APPENDIX K

GEOTECHNICAL ANALYTICAL RESULTS

CATLIN
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Oct 19 ,1999

Mr. Steve Selecman
Science Applications International Corporation
P.O. BOX 2502
800 Oak Ridge Turnpike
Oak Ridge, TN. 37831

Re: Geotechnical Test Results
Load Line 1, Phase II RI
Ravenna Army Ammunition Plant
CATLIN Project No. 99146

Dear Mr. Selecman:

Included herewith please find the completed data package for the geotechnical tests performed on soil samples submitted from the referenced site. CATLIN Engineers and Scientists appreciate the opportunity to provide geotechnical testing services to SAIC. If you should have any questions regarding these results, please contact us at (843) 881-6000 at your convenience.

Very truly yours

John Jones, P.E
Project Engineer

Fouad Bouani
Engineer 1

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Summary Results For Load Line1 , Phase II RI

Test	MW-081	MW-082
%Passing #200 sieve	67.6	81.8
Specific Gravity	2.65	2.65
Moisture Content (%)	12.0	13.6
Atterberg Limits: LL PL PI	 36.9 21.9 15.0	 45.2 29.6 15.6
Fines Classification	CL	ML
Permeability (cm/sec)	1.20E-4	3.40E-4
Bulk Density (pcf)	112.7	96.0
Porosity	0.32	0.42
pH A) in Distilled Water B) in 0.01 Cacl2	 5.2 4.9	 4.9 4.2
Unified Soil Classification	CL	ML

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project: Load Line 1, Phase II RI	Job No.: 99146
Project Location: Ravenna Army Ammo Plant	Sample No.:LL1-MW-081
Sample Description: Brown Gray Sandy Clay	Sample Depth: 1.0'- 2.1'
	Boring No.:
Tested By: FB	Date of Testing: 10/13/99

Mcws	Mcds	Mc : B7	Mw	Ms	w%	Mws	Ms
166.49	153.72	47.25	12.77	106.47	12.0	200.00	178.58

Sieve No.	Diam. (mm)	Wt. retained	% retained	E % retained	% passing
3	76.2	0	0.00	0.00	100.00
2	50.8	0	0.00	0.00	100.00
1 1/2	25.4	0	0.00	0.00	100.00
3/4	19.05	0	0.00	0.00	100.00
3/8	9.51	3	1.68	1.68	98.32
4	4.76	4.74	2.65	4.33	95.67
10	2.00	3.68	2.06	6.39	93.61
20	0.841	3.58	2.00	8.40	91.60
40	0.42	4.69	2.63	11.03	88.97
60	0.25	10.35	5.80	16.82	83.18
140	0.106	25.56	14.31	31.13	68.87
200	0.074	2.31	1.29	32.43	67.57
pan	---	0	0.00	32.43	67.57
total		54.91			

SPECIFIC GRAVITY OF SOIL SOLIDS (Gs) (ASTM D854-92)

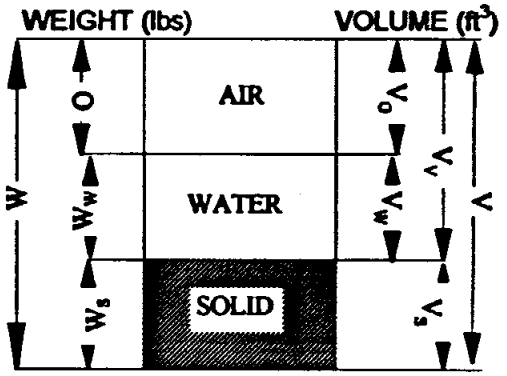
Project: Load Line 1, Phase II RI	Job No.: 99146
Project Location: Ravenna Army Ammo Plant	Sample No.: LL1-MW-081
Sample Description:Brown Gray Sandy Clay	Sample Depth: 1.0'- 2.1'
	Boring No.:
Tested By: FB	Date of Testing: 10/12/99

Test No.:	1			
Wt. of Flask, Mf	163.20			
Mass Flask + H2O @ Ta = Ma @ T a	662.10			
Temperature, Ta, oC	23.0			
Method of air removal	Vacuum	Vacuum	Vacuum	Vacuum
Wt. Flask + H2O+ Soil = Mb (g)	716.0			
Temperature, Tb, oC	23.0			
Wt. Flask + H2Ob = Ma	662.10			
evap dish no.	T4			
wt of evap. dish +dry soil	338.65			
Wt. evap dish	252.20			
Wt. of dry soil = Mo (g)	86.45			
Ww = Mo + Ma - Mb	32.55			
G @ Tb = Mo/Ww	2.66			
K @ Tb	0.9993			
Gs = K * G	2.65			

BULK DENSITY, SPECIFIC GRAVITY AND POROSITY

PROJECT: Load Line 1 ,Phasell RI
LOCATION OF PROJECT: Ravenna Army Ammo Plant
DESCRIPTION OF SOIL: Brown Gray Sandy Clay (CL)
TESTED BY: FB

JOB NO.: 99146
SAMPLE NO.: LL1-MW-081
DEPTH OF SAMPLE: 1.0'- 2.1'
DATE OF TESTING: 10/13/99



W = 0.0899
$W_W = W - W_S$ = 0.0099
$W_S = Y_d * V$ = 0.080

V = 0.00071
$V_W = W_W/Y_W$ = 0.00016
$V_S = W_S/G_S*Y_W$ = 0.00048
$V_G = V - (V_S + V_W)$ = 0.00007
$V_V = V_G + V_W$ = 0.00023

MEASUREMENTS OF TUBE/CAN

HEIGHT= 0 cm
DIAMETER= 0 cm

CALCULATED VOLUME OF TUBE/CAN

V= 20.00 cm^3
0.00071 ft^3

WT. OF TUBE/CAN + WET SOIL= 40.80 g
WEIGHT OF TUBE/CAN= 0 g
WEIGHT OF WET SOIL= 40.80 g
W = 0.0899 lb

MOISTURE CONTENT

M_{CWS} = 166.49 g
M_{CDS} = 153.30 g
M_W = 13.19 g
M_C = 47.25 g
M_S = 106.05 g
w = 12.4 %

Wet Density, $Y_m = W / V$

Dry Density, $Y_d = W_s / V$ or $Y_d = Y_m / (1+ w)$

double check
$Y_d = W_s / V$
Y_d= 112.68 lbs/ft^3

$Y_d = Y_m / (1+ w)$
Y_m= 126.65 lbs/ft^3
Y_d= 112.68 lbs/ft^3

Void Ratio, $e = V_V/V_S$
e = 0.48

Porosity, $n = V_V / V$
n = 0.32

Specific Gravity = 2.65

Degree of Saturation, $S = V_W/V_V$
S = 0.70

PERMEABILITY TEST ANALYSIS (ASTM D5084)

Project : Load Line 1 , Phase II RI

Location of Project : Ravenna Army Ammo Plant

Description of Soil : Brown Gray Sandy Clay

Job # : 99146
Date of Testing: 10/12/99
Tested by: JJ
Boring # :
Sample # : LL1-MW-081
Sample Depth : 1.0'-2.1'

Sample Type (Undisturbed or Remolded)
Standard Proctor:
Maximim Dry Density: _____ pcf
Optimum Moisture Content: _____ %

% Sample Compaction:
Sample Dry Density: 0.0
Sample Moisture Content:
Sample Wet Density: 0.0

Sample Permeation:

De-Aired Water
% Saturation: 100 %
Cell Pressure: 56 psi
Lower Pressure: 51 psi
Upper Pressure: 50 psi
Gradient: 5.86

Sample Dimensions		
	Before	After
Length (cm)	12.00	12.00
Diameter (cm)	7.20	7.25
Water Content (%)	12.40	19.10
Weight (g)	848.6*	911.8*

* Wax on side of sample

Constant Head Calculation:

$$K = [V(t_1,t_2)\, LR_T]/[P_B A t] \text{ (cm/sec)}$$

$V(t_1,t_2)$ = Volume of flow from t_1 to t_2 (cm^3)
L = Length of Sample = 12.00 cm
A = Area of Sample = 40.72 cm^2
$t = t_2 - t_1$ (sec)
P_B = Bias Pressure = 1 psi x 70.37 $cm/psi_{(cm-H2O)}$ 70.37 cm
R_T = Temperature correction = 0.953

t_2 (min)	t_1 (min)	$(t_2 - t_1)*60$ (sec)	V (cm3)	$[LR_T]/[P_B A]$ (cm^{-1})	K (cm/sec)
1.5	1	30	1	3.99E-03	1.33E-04
2	1.5	30	1	3.99E-03	1.33E-04
2.5	2	30	0.7	3.99E-03	9.31E-05
3	2.5	30	0.8	3.99E-03	1.06E-04

K_{avg} = 1.2E-04 cm/sec

Note: Sample was very crumbly. Gravel found in perm sample.

ATTERBERG LIMITS DETEMINATION (ASTM D4318-93)

Project: Load Line 1, Phase II RI
Location of project: Ravenna Army Ammo Plant
Description Of Soil: Brown Gray Sandy Clay
Tested By: FB

Job No.: 99146
Sample No.: LL1-MW-081
Depth of Sample: 1.0'- 2.1'
Date of Testing: 10/12/99

Liquid Limit Dermination

Can No.	A19	A3	A53	A12	A1	
Wt of Soil + can, Mcws	20.50	18.49	23.55	15.86	21.21	
Wt. of dry soil + can,Mcds	19.16	17.45	21.40	14.62	19.58	
Wt. of can, Mc	15.01	15.35	14.94	11.19	15.28	
Wt. of dry soil, Ms	4.15	2.10	6.46	3.43	4.30	0.00
Wt. of moisture	1.34	1.04	2.15	1.24	1.63	0.00
Water content, w%	32.29	49.52	33.28	36.15	37.91	#DIV/0!
No. of blows, N	35	10	29	18	25	

Plastic Limit Determination

Can no.	C3	C19	C22			
Wt. of wet soil + can, Mcws	5.23	2.95	5.26			
Wt. of dry soil +can, Mcds	5.06	2.74	5.10			
Wt. of can, Mc	4.31	1.85	4.27			
Wt. of dry soil, Ms	0.75	0.89	0.83	0	0	0
Wt. of moisture, Mw	0.17	0.21	0.16	0	0	0
Water content, W% = Wp	22.67	23.60	19.28	#DIV/0!	#DIV/0!	#DIV/0!

LIQUID LIMIT =	36.9
PLASTIC LIMIT =	21.90
PLASTICITY INDEX =	15.00
CLASSIFICATION	CL

ATTERBERG LIMITS DETERMINATION (ASTM D4318-93)

Project SAIC Job No. 99146

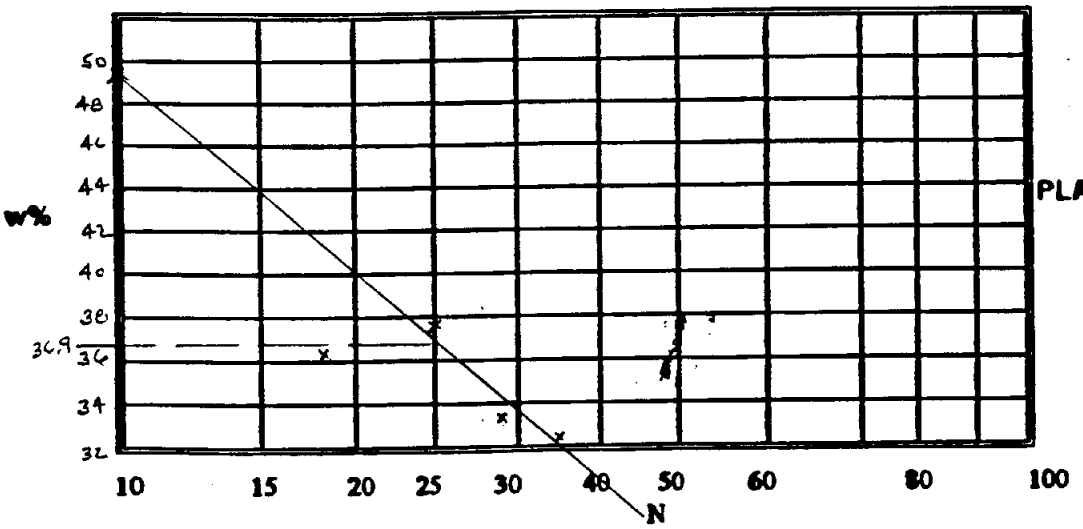
Location of Project RAVENNA ARMY AMMO PLANT Boring No. _____ Sample No. LL1 - MW - 081

Description of Soil BROWN GRAY SANDY CLAY (CL)

Depth of Sample 1.0 - 2.1 Tested By FB Date of Testing 10/12/99

Liquid Limit Determination

Can no.						
Wt. of soil + can, M_{ws}						
Wt. of dry soil + can, M_{ds}						
Wt. of can, M_c						
Wt. of dry soil, M_s						
Wt. of moisture						
Water content, w%						
No. of blows, N						



LIQUID LIMIT = 36.9

PLASTIC LIMIT = 21.9

PLASTICITY INDEX = 15.0

CL

Plastic Limit Determination

Can no.				
Wt. of wet soil + can, M_{ws}				
Wt. of dry soil + can, M_{ds}				
Wt. of can, M_c				
Wt. of dry soil, M_s				
Wt. of moisture, M_w				
Water content, w% = w_p				

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800 Oak Ridge Turnpike, Oak Ridge, TN 37831 (423) 481-4800

CHAIN OF CUSTODY RECORD

COC NO.: 1001

PROJECT NAME: Load Line 1 Phase II RI

DELIVERY ORDER NUMBER: 003

PROJECT MANAGER: Steve Selecman 423-481-8761

Sampler (Signature): Matt Bills (Printed Name): Matthew West

LABORATORY NAME: ~~Quanterra Environmental~~ Catlin.

LABORATORY ADDRESS: ~~4101 Shuffel Drive NW~~ 1051 Johnni Dodds Pd, Suite C
North Canton, Ohio 44720 Mt Pleasant SC
Attn: Becky Smith 29464

PHONE NO: ~~330-966-9789~~ 843-881-6000

REQUESTED PARAMETERS

Sample ID	Date Collected	Time Collected	Matrix	VOCs a2	SVOCs b1	Pesticides c1	PCBs d1	Explosives e1	Propellants f1	Metals, total g3	Metals, filtered g3	Cyanide h4	Geotechnical	No. of Containers	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
LL1-MW-081-0001-ST	08/19/99	1134	Soil										1	1	Shelby Tube
~~LL1-MW-081-0001-ST~~	~~08/27/99~~	~~1120~~	~~Soil~~		MS/MSD 08/14/99								1	1	~~Shelby Tube~~

K-12

08/14/99

RELINQUISHED BY	Date/Time	RECEIVED BY	Date/Time
M. West	08/14/99		
COMPANY NAME: SAIC		COMPANY NAME:	
RECEIVED BY: Fed Ex	Date/Time 08/14/99	RELINQUISHED BY:	Date/Time
COMPANY NAME: Fed Ex		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	

TOTAL NUMBER OF CONTAINERS: 1

Cooler Temperature: N/A

Cooler ID: N/A

FEDEX NUMBER:

METHODS
a SW-846 8260B
b SW-846 8270C
c SW-846 8081A
d SW-846 8082
e SW-846 8330
f SW-846 8330MOD/353.2
g SW-846 6010/7470A
h SW-846 9012A

MS/MSD 08/14/99

1 Cool, 4C 2 HCL, pH < 2 3 HNO3, pH < 2 4 NaOH, pH > 12

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project: Load Line 1, Phase II RI	Job No.: 99146
Project Location: Ravenna Army Ammo Plant	Sample No.: LL1-MW-082
Sample Description: Light Brown Silt With Sand (ML)	Sample Depth: 0'- 1.8'
	Boring No.:
Tested By: FB	Date of Testing: 10/12/99

Mcws	Mcds	Mc : A40	Mw	Ms	w%	Mws	Ms
22.74	21.88	15.00	0.86	6.88	12.5	200.04	177.81

Sieve No.	Diam. (mm)	Wt. retained	% retained	E % retained	% passing
3	76.2	0	0.00	0.00	100.00
2	50.8	0	0.00	0.00	100.00
1 1/2	25.4	0	0.00	0.00	100.00
3/4	19.05	0	0.00	0.00	100.00
3/8	9.51	0	0.00	0.00	100.00
4	4.76	3.81	2.14	2.14	97.86
10	2.00	4.74	2.67	4.81	95.19
20	0.841	3	1.69	6.50	93.50
40	0.42	3.82	2.15	8.64	91.36
60	0.25	6.3	3.54	12.19	87.81
140	0.106	9.84	5.53	17.72	82.28
200	0.074	2.13	1.20	18.92	81.08
pan	—	0	0.00	18.92	81.08
total		33.64			

SPECIFIC GRAVITY OF SOIL SOLIDS (Gs) (ASTM D854-92)

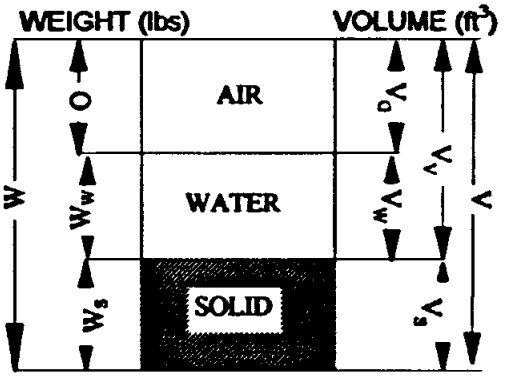
Project: Load Line 1 ,Phase II RI	Job No.: 99146
Project Location: Ravenna Army Ammo Plant	Sample No.: LL1-MW-082
Sample Description: Light Brown Silt With Sand	Sample Depth: 0'- 1.8'
	Boring No.:
Tested By: FB	Date of Testing: 10/13/99

Test No.:	2			
Wt. of Flask, Mf	163.82			
Mass Flask + H2O @ Ta = Ma @ T a	656.80			
Temperature, Ta, oC	24.0			
Method of air removal	Vacuum	Vacuum	Vacuum	Vacuum
Wt. Flask + H2O+ Soil = Mb (g)	711.8			
Temperature, Tb, oC	24.0			
Wt. Flask + H2Ob = Ma	656.8			
evap dish no.	T1			
wt of evap. dish +dry soil	339.25			
Wt. evap dish	250.90			
Wt. of dry soil = Mo (g)	88.35			
Ww = Mo + Ma - Mb	33.35			
G @ Tb = Mo/Ww	2.65			
K @ Tb	0.9991			
Gs = K * G	2.65			

BULK DENSITY, SPECIFIC GRAVITY AND POROSITY

PROJECT: Load Line 1, Phase II RI
LOCATION OF PROJECT: Ravenna Army Ammo Plant
DESCRIPTION OF SOIL: Light Brown Silt With Sand
TESTED BY: FB

JOB NO.: 99146
SAMPLE NO.: LL1-MW-082
DEPTH OF SAMPLE: 0'- 1.8'
DATE OF TESTING: 10/13/99



W = 1.90190
$W_W = W - W_S$ = 0.22823
$W_S = Y_d * V$ = 1.6737

V = 0.01744
$V_W = W_W / Y_W$ = 0.0037
$V_S = W_S / G_S * Y_W$ = 0.0101
$V_G = V - (V_S + V_W)$ = 0.00367
$V_V = V_G + V_W$ = 0.0073

MEASUREMENTS OF TUBE/CAN

HEIGHT= 11.8 cm
DIAMETER= 7.3 cm

CALCULATED VOLUME OF TUBE/CAN

V= 493.88 cm^3
0.01744 ft^3

WT. OF TUBE/CAN + WET SOIL= 1202.50 g
WEIGHT OF TUBE/CAN= 339.8 g
WEIGHT OF WET SOIL= 862.70 g
W = 1.9019 lb

MOISTURE CONTENT

M_{CWS} =	18.70	g	M_C =	11.20	g
M_{CDS} =	17.80	g	M_S =	6.60	g
M_W =	0.90	g	w =	13.6	%

Wet Density, $Y_m = W / V$

Dry Density, $Y_d = W_s / V$ or $Y_d = Y_m / (1+w)$

double check	$Y_d = Y_m / (1+w)$
$Y_d = W_s / V$	Y_m= 109.03 lbs/ft^3
Y_d= 95.95 lbs/ft^3	Y_d= 95.95 lbs/ft^3

Void Ratio, $e = V_V / V_S$
e = 0.7243

Porosity, $n = V_V / V$
n = 0.42

Specific Gravity = 2.65

Degree of Saturation, $S = V_W / V_V$
S = 0.4989

PERMEABILITY TEST ANALYSIS (ASTM D5084)

Project : Load Line 1, Phase II RI

Location of Project : Ravenna Army Ammo Plant

Description of Soil : Light Brown Silt With Sand

Job # : 99146
Date of Testing: 10/13/99
Tested by: JJ
Boring # :
Sample # : LL1-MW-82
Sample Depth : 0'- 1.8'

Sample Type (Undisturbed or Remolded)
Standard Proctor:
Maximim Dry Density: _____ pcf
Optimum Moisture Content: _____ %

% Sample Compaction: _____ %
Sample Dry Density: 0.0 pcf
Sample Moisture Content: _____ %
Sample Wet Density: 0.0 pcf

Sample Permeation:

De-Aired Water
% Saturation: 100 %
Cell Pressure: 81 psi
Lower Pressure: 76 psi
Upper Pressure: 75 psi
Gradient: 6.17

Sample Dimensions		
	Before	After
Length (cm)	11.40	11.54
Diameter (cm)	7.20	7.33
Water Content (%)	14.5	24.0
Weight (g)	799.8	882.7

Constant Head Calculation:

$$K = [V(t_1,t_2)\, LR_T]/[P_B A t] \text{ (cm/sec)}$$

$V(t_1,t_2)$ = Volume of flow from t_1 to t_2 (cm^3)
L = Length of Sample = 11.40 cm
A = Area of Sample = 40.72 cm^2
t = $t_2 - t_1$ (sec)
P_B = Bias Pressure = 1 psi x 70.37 cm/psi $_{(cm - H2O)}$ 70.37 cm
R_T = Temperature correction = 0.953

t_2 (sec)	t_1 (sec)	$(t_2 - t_1)$ (sec)	V (cm3)	$[LR_T]/[P_B A]$ (cm^{-2})	K (cm/sec)
15	0	15	1.7	3.79E-03	4.30E-04
30	15	15	1.3	3.79E-03	3.29E-04
45	30	15	1.3	3.79E-03	3.29E-04
60	45	15	1	3.79E-03	2.53E-04

K_{avg} = 3.35E-04 cm/sec

ATTERBERG LIMITS DETEMINATION (ASTM D4318-93)

Project: Load Line 1, Phase II RI
Location of project: Ravenna Army Ammo Plant
Description Of Soil: Light Brown Silt With Sand (ML)
Tested By: FB

Job No.: 99146
Sample No.: LL1-MW-082
Depth of Sample: 0'- 1.8'
Date of Testing: 10/13/99

Liquid Limit Dermination

Can No.	A43	A45	A12	A33	A18	
Wt of Soil + can, Mcws	25.50	23.00	20.60	23.20	21.20	
Wt. of dry soil + can,Mcds	22.35	20.48	18.94	20.88	18.24	
Wt. of can, Mc	15.30	15.44	15.26	15.30	11.44	
Wt. of dry soil, Ms	7.05	5.04	3.68	5.58	6.80	0.00
Wt. of moisture	3.15	2.52	1.66	2.32	2.96	0.00
Water content, w%	44.68	50.00	45.11	41.58	43.53	#DIV/0!
No. of blows, N	35	13	25	39	30	

Plastic Limit Determination

Can no.	C4	C8	C18			
Wt. of wet soil + can, Mcws	5.20	4.30	3.90			
Wt. of dry soil +can, Mcds	4.60	3.80	3.49			
Wt. of can, Mc	2.37	2.41	1.91			
Wt. of dry soil, Ms	2.23	1.39	1.58	0	0	0
Wt. of moisture, Mw	0.60	0.50	0.41	0	0	0
Water content, W% = Wp	26.91	35.97	25.95	#DIV/0!	#DIV/0!	#DIV/0!

LIQUID LIMIT =	45.2
PLASTIC LIMIT =	29.6
PLASTICITY INDEX =	15.6
CLASSIFICATION	ML

ATTERBERG LIMITS DETERMINATION (ASTM D4318-93)

Project SAIC Job No. 99146

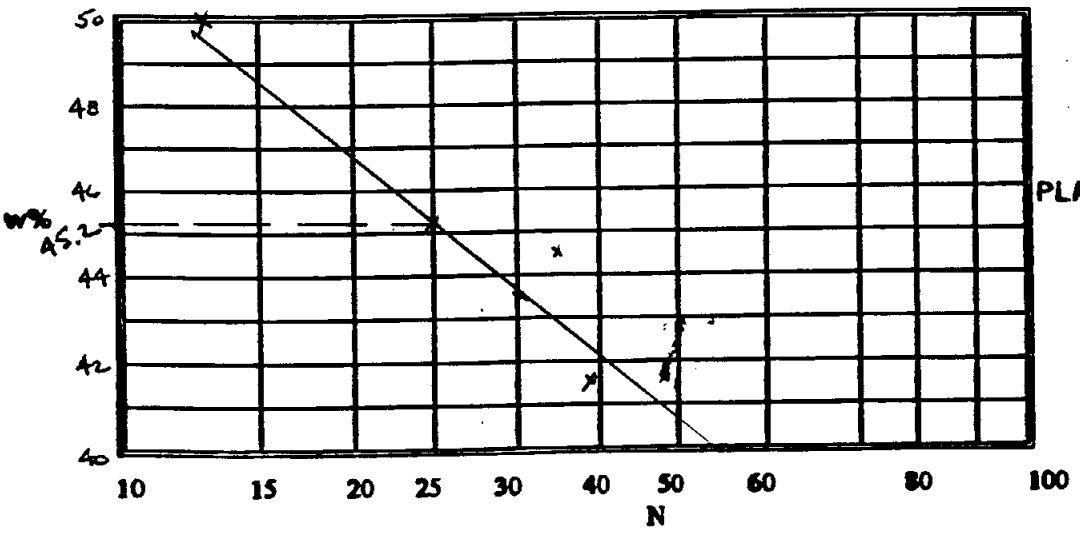
Location of Project RAVENNA ARMY AMMO PLANT Boring No. _____ Sample No. LL1-MW-082

Description of Soil LIGHT BROWN SILT WITH SAND (ML)

Depth of Sample 0' - 1.8' Tested By FB Date of Testing _____

Liquid Limit Determination

Can no.						
Wt. of soil + can, M_{wc}						
Wt. of dry soil + can, M_{dc}						
Wt. of can, M_c						
Wt. of dry soil, M_s						
Wt. of moisture						
Water content, w%						
No. of blows, N						



LIQUID LIMIT = 45.2

PLASTIC LIMIT = 29.6

PLASTICITY INDEX = 15.6

ML

Plastic Limit Determination

Can no.				
Wt. of wet soil + can, M_{wc}				
Wt. of dry soil + can, M_{dc}				
Wt. of can, M_c				
Wt. of dry soil, M_s				
Wt. of moisture, M_w				
Water content, w% = w_p				

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300 Oak Ridge Turnpike, Oak Ridge, TN 37831 (423) 481-4000

CHAIN OF CUSTODY RECORD

COC NO.: 1000

PROJECT NAME: Load Line 1, Phase II

DELIVERY ORDER NO: 003

PROJECT MANAGER: Steve Salerman 423-481-8761

Sampler (Signature): Matthew Vest (Printed Name): Matthew Vest

REQUESTED PARAMETERS: Geotechnical

Sample ID	Date Collected	Time Collected	Matrix	No. of Bottles/ Vials	OBSERVATIONS, COMMENTS,
LLI-MW082-0001-ST	08/27/99	1120	SOIL	1	Shelby Tube

K-19

09/14/99

LABORATORY NAME: Cutlm.

LABORATORY ADDRESS: 1051 Johnnie Dodds Rd Suite C, Mt. Pleasant SC 29464

PHONE NO: 843-881-6000

RELINQUISHED BY: M. Vest	Date/Time 09/14/99	RECEIVED BY:	Date/Time	TOTAL NUMBER OF CONTAINERS: 1	Cooler Temperature: N/A
COMPANY NAME: SAIC		COMPANY NAME:		Cooler ID: N/A	FEDEX NUMBER:
RECEIVED BY: Fed Ex	Date/Time 09/14/99	RELINQUISHED BY:	Date/Time		
COMPANY NAME: Fed Ex		COMPANY NAME:			
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			

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CATLIN
ENGINEERS and SCIENTISTS

1051 Johnnie Dodds Boulevard, Suite C
Mt. Pleasant, South Carolina 29464
Telephone: (803) 881-6000
Fax: (803) 881-2619

October 9 , 2000

Mrs. Vicki Brumback
Science Applications International Corporation
P.O. BOX 2502
800 Oak Ridge Turnpike
Oak Ridge, TN. 37831

Re: Geotechnical Test Results
Load Line 1 Phase II RI
CATLIN Project No: 199-146
Subcontract No: 4400031227

Dear Mrs. Brumback :

Included herewith please find the completed data package for the geotechnical tests performed on soil samples submitted from the referenced site. CATLIN Engineers and Scientists appreciate the opportunity to provide geotechnical testing services to SAIC.

If you should have any questions regarding these results, please feel to contact us at your convenience at (800) 762-7004.

Sincerely,

Fouad Bouani
Laboratory Manager

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CATLIN ENGINEERS AND SCIENTISTS
GEOTECHNICAL LABORATORIES

GEOTECHNICAL TEST RESULTS FOR LOAD LINE 1 PHASE II RI

CATLIN PROJECT NUMBER : 199-146
SUBCONTRACT NUMBER : 4400031227

AS REQUESTED BY
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

OCTOBER 9, 2000

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TABLE OF CONTENTS

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1.0 CASE NARRATIVE

1.1 Sample Check-in

When a sample shipment is received at the lab, a receiving technician inspects the shipment and fills out the required documentation before any sample preparation is done. The required documents are as follows: Chain-of-Custody (COC) - signed and dated and Sample Receipt Record - sample receiving checklist.

1.2 Sample Preparation/Extraction

Samples that cannot be worked on at the time of receipt shall be stored in designated areas. For samples not contained in 5.0-gallon buckets, storage will be in the clean lab.

If more than one analysis is required for a sample, an order of analyses is determined from the requested analyses for each sample shown on the chain-of-custody. This is to insure integrity of each analysis.

The analyses order for Load Line 1 Phase II RI samples that were bagged was moisture content and grain size analysis-sieve.
Sample preparation procedures are determined according to corresponding ASTM standards for the requested analyses.

1.3 Sample Analyses

This section identifies the specification/methods that are followed during the analyses of each sample.

1.3.1. Moisture Content

Natural moisture content of soil samples are determined according to ASTM D2216.

1.3.2. Grain Size (Sieve)

Before analysis, each sample is prepared following procedures in ASTM D421 and D2217. Grain size (sieve) procedures that are followed are outlined in ASTM D422.
As specified by the client, dry sieve analyses were performed on all soil samples. The following sieve sizes were used: 3-in.,2-in., 11/2-in., 3/4 in., 3/8 in., No. 4, No. 10, No.20, No. 40, No. 60, No. 140, and No. 200.

1.4. Sample Disposal/Storage

Worked samples with final analyses results are disposed of as directed on the chain-of-custody. Unless specified otherwise, spare or remaining samples are stored in the dirty lab for thirty days. After such time, kept samples are then properly disposed of.

2.0 TEST RESULTS

Test results are summarized on the attached table.

Appendix A contains Moisture Content.

Appendix B Grain Size Analysis-Sieve.

3.0 QUALITY ASSURANCE

As specified by the client, copies of all COCs, signed and dated, and Sample Receipt Records, filled out by a receiving technician in the lab are contained in appendix C.

TABLES

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Summary Table For Load Line 1 Phase II RI

SAMPLE NO.	SIEVE ANALYSIS (% PASSING)											
	3"	2"	1 1/2"	3/4"	3/8"	#4	#10	#20	#40	#60	#140	#200
LL11270	100	100	100	96.07	78.04	68.13	57.21	47.59	33.69	17.53	7.23	6.74
LL11272	100	100	100	100	100	98.97	91.66	89.31	82.74	50.38	26.91	25.16
LL11273	100	100	86.88	82.78	73.17	64.07	55.77	48.07	35.39	21.14	12.28	11.37
LL10980	100	100	100	100	100	90.01	80.36	74.29	68.86	65.07	62.84	62.65

SAMPLE NO.	MOISTURE CONTENT %
LL10773	12.32
LL10936	9.86
LL10764	9.72
LL10734	9.32
LL11104	17.39
LL10838	23.76
LL10840	7.21
LL10981	40.30
LL10753	14.65

Fouad Bouani
Laboratory Manager

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APPENDIX A

MOISTURE CONTENT

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LABORATORY DETERMINATION OF WATER (MOISTURE) CONTENT OF SOIL & ROCK (ASTM D2216-92)

Project Load Line 1 Phase II RI Job No. 199-146

Location of Project Ravenna, Ohio Sample No. _____

Description of Soil _____ Depth of Sample _____

Tested By FB Date of Testing 10/2/00

	Sample #	M_{cws}	M_{cds}	M_c	M_w	M_s	w
A4	LL11104	23.99	22.71	15.35	1.28	7.36	17.39
A10	LL10838	30.76	27.74	15.03	3.02	12.71	23.76
A19	LL10840	28.57	27.66	15.03	0.91	12.63	7.21
A35	LL10981	25.08	21.11	11.26	3.97	9.85	40.30
A3	LL10753	27.41	25.87	15.36	1.54	10.51	14.65

$w = [(M_{cws} - M_{cds})/(M_{cds} - M_c)] \cdot 100 = M_w \div M_s \cdot 100$

Where:

w = Water content, %,
M_{cws} = Mass of container and wet specimen, g,
M_{cds} = Mass of container and oven dry specimen, g,
M_c = Mass of container, g,
M_w = Mass of water ($M_w = M_{cws} - M_{cds}$), g, and
M_s = Mass of solid particles ($M_s = M_{cds} - M_c$), g

Maximum particle size (100% passing)	Standard Sieve Size	Recommended minimum mass of moist test specimen for water content reported to ± 0.1%	Recommended minimum mass of moist test specimen for water content reported to ± 1%
2 mm or less	No. 10	20 g	20 g*
4.75 mm	No. 4	100 g	20 g*
9.5 mm	3/8-in.	500 g	50 g
19.0 mm	3/4-in.	2.5 kg	250 g
37.5 mm	11/2-in.	10 kg	1 kg
75.0 mm	3-in.	50 kg	5 kg

NOTE: *To be representative not less than 20 g shall be used.

LABORATORY DETERMINATION OF WATER (MOISTURE) CONTENT OF SOIL & ROCK (ASTM D2216-92)

Project Load Line 1 Phase II R1 Job No. 199-146

Location of Project Ravenna, Ohio Sample No. _____

Description of Soil _____ Depth of Sample _____

Tested By FB Date of Testing 10/2/00

	Sample #	M_{cws}	M_{cds}	M_c	M_w	M_s	w
A32	LL10773	24.44	22.95	10.86	1.49	12.09	12.32
A18	LL10936	27.71	26.25	11.44	1.46	14.81	9.86
A12	LL10764	25.98	24.67	11.19	1.31	13.48	9.72
A42	LL10734	20.92	20.07	10.95	0.85	9.12	9.32

$w = [(M_{cws} - M_{cds})/(M_{cds} - M_c)] \cdot 100 = M_w \div M_s \cdot 100$

Where:

w = Water content, %,
M_{cws} = Mass of container and wet specimen, g,
M_{cds} = Mass of container and oven dry specimen, g,
M_c = Mass of container, g,
M_w = Mass of water ($M_w = M_{cws} - M_{cds}$), g, and
M_s = Mass of solid particles ($M_s = M_{cds} - M_c$), g

Maximum particle size (100% passing)	Standard Sieve Size	Recommended minimum mass of moist test specimen for water content reported to ± 0.1%	Recommended minimum mass of moist test specimen for water content reported to ± 1%
2 mm or less	No. 10	20 g	20 g*
4.75 mm	No. 4	100 g	20 g*
9.5 mm	3/8-in.	500 g	50 g
19.0 mm	3/4-in.	2.5 kg	250 g
37.5 mm	11/2-in.	10 kg	1 kg
75.0 mm	3-in.	50 kg	5 kg

NOTE: *To be representative not less than 20 g shall be used.

APPENDIX B

GRAIN SIZE ANALYSIS-SIEVE

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GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project Load Line 1 Phase II RI Job No. 199-146

Location of Project Mislocated LL1-047 Sample No. LL11270

Description of Soil Brown Sand Depth of Sample / Boring No. /

Tested By FB Date of Testing 10/05/00

Sample preparation procedures outlined in ASTM D421 and D2217.

Nominal diameter of largest particle	Approximate minimum Wt. of sample, g
No. 10 sieve	200
No. 4 sieve	500
3/4 in.	1500

Weight of sample used, M_{ws}= 426.90 g

M_{cws}	M_{cds}	M_c A19	M_w	M_s	w %	M_{ws}	M_s
40.86	34.83	15.03	6.03	19.80	30.45	426.90	327.24

Sieve analysis and grain shape

Sieve no.	Diam. (mm)	Wt. retained	% retained	Σ % retained	% passing
3	76.2	0	0	0	100
2	50.8	0	0	0	100
1 1/2	25.4	0	0	0	100
3/4	19.05	12.87	3.93	3.93	96.07
3/8	9.51	59.01	18.03	21.96	78.04
4	4.76	32.43	9.91	31.87	68.13
10	2.00	35.74	10.92	42.79	57.21
20	0.841	31.48	9.62	52.41	47.59
40	0.42	45.47	13.89	66.31	33.69
60	0.25	52.90	16.17	82.47	17.53
140	0.106	33.70	10.30	92.77	7.23
200	0.074	1.58	0.48	93.26	6.74

% retained = (Wt. retained/W_s) · 100 % passing = 100 - Σ % retained.

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project: Load Line 1 Phase II RI	Job No.: 199-146
Project Location: Mislocated LL1-047	Sample No.: LL11270
Sample Description: Brown Sand	Sample Depth:
	Boring No.:
Tested By: FB	Date of Testing: 10/5/00

Mcws	Mcds	Mc : A19	Mw	Ms	w%	Mws	Ms
40.86	34.83	15.03	6.03	19.80	30.45	426.90	327.24

Sieve No.	Diam. (mm)	Wt. retained	% retained	E % retained	% passing
3	76.2	0	0.00	0.00	100.00
2	50.8	0	0.00	0.00	100.00
1 1/2	25.4	0	0.00	0.00	100.00
3/4	19.05	12.87	3.93	3.93	96.07
3/8	9.51	59.01	18.03	21.96	78.04
4	4.76	32.43	9.91	31.87	68.13
10	2.00	35.74	10.92	42.79	57.21
20	0.841	31.48	9.62	52.41	47.59
40	0.42	45.47	13.89	66.31	33.69
60	0.25	52.90	16.17	82.47	17.53
140	0.106	33.70	10.30	92.77	7.23
200	0.074	1.58	0.48	93.26	6.74

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project Load Line 1 Phase II RI Job No. 199-146

Location of Project 100' DS of LL1-322 Sample No. LL11272

Description of Soil Dark Clayey Sand Depth of Sample 0'-0.5' Boring No.

Tested By FB Date of Testing 10/3/00

Sample preparation procedures outlined in ASTM D421 and D2217.

Nominal diameter of largest particle	Approximate minimum Wt. of sample, g
No. 10 sieve	200
No. 4 sieve	500
3/4 in.	1500

Weight of sample used, M_{ws}= 244.40 g

M_{cws}	M_{cds}	M_c ASD	M_w	M_s	w %	M_{ws}	M_s
25.35	22.12	14.95	3.23	7.17	45.05	244.40	168.50

Sieve analysis and grain shape

Sieve no.	Diam. (mm)	Wt. retained	% retained	Σ % retained	% passing
3	76.2	0	0	0	100
2	50.8	0	0	0	100
1 1/2	25.4	0	0	0	100
3/4	19.05	0	0	0	100
3/8	9.51	0	0	0	100
4	4.76	1.73	1.03	1.03	98.97
10	2.00	12.33	7.32	8.34	91.66
20	0.841	3.95	2.34	10.69	89.31
40	0.42	11.08	6.58	17.26	82.74
60	0.25	54.52	32.36	49.62	50.38
140	0.106	39.55	23.47	73.09	26.91
200	0.074	2.95	1.75	74.84	25.16

% retained = (Wt. retained/W_s) · 100

% passing = 100 - Σ % retained.

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project: Load Line 1 Phase II RI	Job No.: 199-146
Project Location: 100'DS of LL1-322	Sample No.: LL11272
Sample Description: Dark Clayey Sand	Sample Depth: 0'-0.5'
	Boring No.:
Tested By: FB	Date of Testing: 10/3/00

Mcws	Mcds	Mc : A50	Mw	Ms	w%	Mws	Ms
25.35	22.12	14.95	3.23	7.17	45.05	244.40	168.50

Sieve No.	Diam. (mm)	Wt. retained	% retained	E % retained	% passing
3	76.2	0	0.00	0.00	100.00
2	50.8	0	0.00	0.00	100.00
1 1/2	25.4	0	0.00	0.00	100.00
3/4	19.05	0	0.00	0.00	100.00
3/8	9.51	0	0.00	0.00	100.00
4	4.76	1.73	1.03	1.03	98.97
10	2.00	12.33	7.32	8.34	91.66
20	0.841	3.95	2.34	10.69	89.31
40	0.42	11.08	6.58	17.26	82.74
60	0.25	54.52	32.36	49.62	50.38
140	0.106	39.55	23.47	73.09	26.91
200	0.074	2.95	1.75	74.84	25.16

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project Load Line 1 Phase II R1 Job No. 199-146

Location of Project 100' US of LL1-322 Sample No. LL11273

Description of Soil Brown Sand Depth of Sample 0'-0.5' Boring No.

Tested By FB Date of Testing 10/5/00

Sample preparation procedures outlined in ASTM D421 and D2217.

Nominal diameter of largest particle	Approximate minimum Wt. of sample, g
No. 10 sieve	200 400
No. 4 sieve	500
3/4 in.	1500

Weight of sample used, M_{ws}= 400 g

M_{cws}	M_{cds}	M_c A31	M_w	M_s	w %	M_{ws}	M_s
27.10	25.21	15.25	1.89	9.96	18.98	400.0	336.20

Sieve analysis and grain shape

Sieve no	Diam. (mm)	Wt. retained	% retained	Σ % retained	% passing
3	76.2	0	0	0	100
2	50.8	0	0	0	100
1 1/2	25.4	44.12	13.12	13.12	86.88
3/4	19.05	13.79	4.10	17.22	82.78
3/8	9.51	32.28	9.60	26.83	73.17
4	4.76	30.60	9.10	35.93	64.07
10	2.00	27.92	8.30	44.23	55.77
20	0.841	25.88	7.70	51.93	48.07
40	0.42	42.63	12.68	64.61	35.39
60	0.25	47.90	14.25	78.86	21.14
140	0.106	29.80	8.86	87.72	12.28
200	0.074	3.04	0.90	88.63	11.37

% retained = (Wt. retained/W_s) · 100

% passing = 100 - Σ % retained.

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project: Load Line 1 Phase II RI	Job No.: 199-146
Project Location: 100' US of LL1-322	Sample No.: LL11273
Sample Description: Brown Sand	Sample Depth:0'-0.5'
	Boring No.:
Tested By: FB	Date of Testing: 10/5/00

Mcws	Mcds	Mc : A31	Mw	Ms	w%	Mws	Ms
27.10	25.21	15.25	1.89	9.96	18.98	400.00	336.20

Sieve No.	Diam. (mm)	Wt. retained	% retained	E % retained	% passing
3	76.2	0	0.00	0.00	100.00
2	50.8	0	0.00	0.00	100.00
1 1/2	25.4	44.12	13.12	13.12	86.88
3/4	19.05	13.79	4.10	17.22	82.78
3/8	9.51	32.28	9.60	26.83	73.17
4	4.76	30.60	9.10	35.93	64.07
10	2.00	27.92	8.30	44.23	55.77
20	0.841	25.88	7.70	51.93	48.07
40	0.42	42.63	12.68	64.61	35.39
60	0.25	47.90	14.25	78.86	21.14
140	0.106	29.80	8.86	87.72	12.28
200	0.074	3.04	0.90	88.63	11.37

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project Load Line 1 Phase II RI Job No. 199-146

Location of Project Ditchet at Inlet A4(LL253) Sample No. LL10980

Description of Soil Dark Sand with High Organic Contents. Depth of Sample 0'-0.5' Boring No.

Tested By FB Date of Testing 10/3/00

Sample preparation procedures outlined in ASTM D421 and D2217.

Nominal diameter of largest particle	Approximate minimum Wt. of sample, g
No. 10 sieve	200
No. 4 sieve	500
3/4 in.	1500

Weight of sample used, M_{ws}= 200 g

M_{cws}	M_{cds}	M_c A48	M_w	M_s	w %	M_{ws}	M_s
21.49	19.65	15.32	1.84	4.33	42.49	200.0	140.36

Sieve analysis and grain shape

Sieve no.	Diam. (mm)	Wt. retained	% retained	Σ % retained	% passing
3	76.2	0	0	0	100
2	50.8	0	0	0	100
1 1/2	25.4	0	0	0	100
3/4	19.05	0	0	0	100
3/8	9.51	0	0	0	100
4	4.76	14.02	9.99	9.99	90.01
10	2.00	13.54	9.65	19.64	80.36
20	0.841	8.53	6.08	25.71	74.29
40	0.42	7.62	5.43	31.14	68.86
60	0.25	5.32	3.79	34.93	65.07
140	0.106	3.12	2.22	37.16	62.84
200	0.074	0.27	0.19	37.35	62.65

% retained = (Wt. retained/W_s) · 100

% passing = 100 - Σ % retained.

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project: Load Line 1 Phase II RI	Job No.: 199-146
Project Location: Ditchet at Inlet A4 (LL1-253)	Sample No.: LL10980
Sample Description: Dark Sand With Organic Contents	Sample Depth: 0'-0.5'
	Boring No.:
Tested By: FB	Date of Testing: 10/3/00

Mcws	Mcds	Mc : A48	Mw	Ms	w%	Mws	Ms
21.49	19.65	15.32	1.84	4.33	42.49	200.00	140.36

Sieve No.	Diam. (mm)	Wt. retained	% retained	E % retained	% passing
3	76.2	0	0.00	0.00	100.00
2	50.8	0	0.00	0.00	100.00
1 1/2	25.4	0	0.00	0.00	100.00
3/4	19.05	0	0.00	0.00	100.00
3/8	9.51	0	0.00	0.00	100.00
4	4.76	14.02	9.99	9.99	90.01
10	2.00	13.54	9.65	19.64	80.36
20	0.841	8.53	6.08	25.71	74.29
40	0.42	7.62	5.43	31.14	68.86
60	0.25	5.32	3.79	34.93	65.07
140	0.106	3.12	2.22	37.16	62.84
200	0.074	0.27	0.19	37.35	62.65

APPENDIX C

CHAIN-OF-CUSTODY AND RECEIVING REPORTS

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FedEx. USA Airbill

FedEx Tracking Number 810254671317

Form I.D. No. 0200

Recipient's Copy

1 From

Date 9-28-04

Sender's Name Vicki Brumback Phone (330) 358-1340

Company SAIC

Address EVAAP, 8451 State Route 5 Bldg 1036 Dept/Floor/Suite/Room

City Ravenna State OH ZIP 44266

2 Your Internal Billing Reference Information 01-1622-44-9551-300

3 To

Recipient's Name Bob Locke Phone (803) 881-6000

Company Catlin Engineers

Address 10151 Johnnie Dodds Blvd. Suite C Dept./Floor/Suite/Room

(To "HOLD" at FedEx location, print FedEx address here)

Check here if residence (Extra charge applies for FedEx Express Saver)

City Mt. Pleasant State SC ZIP 29464

For HOLD at FedEx Location check here

- Hold Weekday (Not available with FedEx First Overnight)
- Hold Saturday (Not available at all locations) (Available for FedEx Priority Overnight and FedEx 2Day only)

For WEEKEND Delivery check here (Extra Charge. Not available at all locations)

- Saturday Delivery (Available for FedEx Priority Overnight and FedEx 2Day only)
- NEW Sunday Delivery (Available for FedEx Priority Overnight only)

8 1 0 2 5 4 6 7 1 3 1 7

4a Express Package Service *Packages under 150 lbs.* Delivery commitment may be later in some areas

- [x] FedEx Priority Overnight (Next business morning)
- [ ] FedEx Standard Overnight (Next business afternoon)
- [ ] FedEx First Overnight (Earliest next business morning delivery to select locations) (Higher rates apply)
- [ ] FedEx 2Day (Second business day)
- [ ] FedEx Express Saver (Third business day)

FedEx Letter Rate not available. Minimum charge: One pound rate.

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some areas.

- [ ] FedEx Overnight Freight (Next business day)
- [ ] FedEx 2Day Freight (Second business day)
- [ ] FedEx Express Saver Freight (Up to 3 business days)

(Call for delivery schedule. See back for detailed descriptions of freight services.)

5 Packaging

- [ ] FedEx Letter
- [ ] FedEx Pak
- [ ] FedEx Box
- [ ] FedEx Tube
- [x] Other Pkg.

Declared value limit $500.

6 Special Handling (One box must be checked)

Does this shipment contain dangerous goods?*

- [x] No
- [ ] Yes (As per attached Shipper's Declaration)
- [ ] Yes (Shipper's Declaration not required)

- [ ] Dry Ice (Dry Ice, 9, UN 1845) ____ x ____ kg.
- [ ] Cargo Aircraft Only

*Dangerous Goods cannot be shipped in FedEx packaging.

7 Payment

- [ ] Obtain Recipient FedEx Account No.

Bill to:

- [x] Sender (Account No. in Section 1 will be billed)
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

(Enter FedEx Account No. or Credit Card No. below)

Total Packages	Total Weight	Total Declared Value*	Total Charges
1	25#	$ .00	$

* When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE, AND LIMIT OF LIABILITY section for further information.

Credit Card Auth.

8 Release Signature

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

321

Questions?
Call 1·800·Go·FedEx® (800)463-3339

SAIC® An Employee-Owned Company
Science Applications International Corporation
800 Oak Ridge Turnpike, Oak Ridge, TN 37831 (423) 481-4600

COC NO.: LL1CE- 1
page 1 of 1

CHAIN OF CUSTODY RECORD

PROJECT NAME: Load Line 1 Phase II RI

DELIVERY ORDER NO: 0003

PROJECT MANAGER: Steve Selecman 423-481-8761

Sampler (Signature): Vicki Brumback (Printed Name): Vicki Brumback

LABORATORY NAME: Catlin Engineers

LABORATORY ADDRESS: 1051 Johnnie Dodds Blvd. Suite C Mt. Pleasant, SC 29464

PHONE NO: 803-881-6000

Sample ID	Date Collected	Time Collected	Matrix	Grain Size	Moisture	Atterberg Limits	USCS Classification	Bulk Density	Porosity	Hydraulic Conductivity	Specific Gravity	pH	No. of Bottles/ Vials:	OBSERVATIONS, COMMENTS,
LL1Φ84Φ	9-17-ΦΦ	1Φ1Φ	Sb. soil		✓								1	
LL1Φ936	9-26-ΦΦ	Φ825	S. soil		✓								1	
LL1114	9-27-ΦΦ	11ΦΦ	S. soil		✓								1	
LL1272	9-27-ΦΦ	1Φ36	Sediment	✓									1	
LL1273	9-27-ΦΦ	1117	Sediment	✓									1	
LL1Φ764	9-27-ΦΦ	Φ84Φ	S. Soil		✓								1	
LL1127Φ	9-26-ΦΦ	1441	Sediment	✓									1	
LL1Φ753	9-26-ΦΦ	1ΦΦΦ	S. Soil		✓								1	
LL1Φ773	9-27-ΦΦ	1Φ35	S. soil		✓								1	
LL1Φ951	9-26-ΦΦ	Φ955	S. Soil		✓								1	
LL1Φ838	9-19-ΦΦ	Φ9ΦΦ	Sb. soil		✓								1	
LL1Φ734	9-25-ΦΦ	1515	SS		✓								1	
LL1Φ95Φ	9-2Φ-ΦΦ	Φ819	Sediment	✓									1	

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
Vicki Brumback	9-28-ΦΦ 17ΦΦ	F	
COMPANY NAME: SAIC		COMPANY NAME:	
RECEIVED BY: Tonya Bonany	Date/Time 9/29/00 11:00am	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	

TOTAL NUMBER OF CONTAINERS: 13

Cooler ID: Lined box NA-

Cooler Temperature: NA

FEDEX NUMBER: 816254671317

Sb = Subsurface soil
S = Surface soil

K-50

CATLIN
ENGINEERS and SCIENTISTS

220 Old Dairy Road • P.O. Box 10279
Wilmington, North Carolina 28405
Telephone: (910) 452-5861
Fax: (910) 452-7563

1622.20010129.006

January 10, 2001

SAIC
Attn: Mr. Steve Selecman
800 Oak Ridge Turnpike
Oak Ridge, Tennessee 37831

Re: Laboratory Results
Load Line 1 Phase II R1
Delivery Order No. 0003
CATLIN Project No. 199-146

Dear Mr. Selecman:

CATLIN Engineers and Scientists is pleased to present you with the results of the geotechnical laboratory testing for the above referenced project. A total of 49 soil samples were tested for particle size analysis via the American Society for Testing and Materials (ASTM) D-422 "Standard Test Method for Particle Size Analysis of Soils", ASTM D-2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)", ASTM D-2216 "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock", and ASTM D-4318 "Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils". Each soil sample was tested for the required analyses per the chain-of-custody. Tables 1 and 2 summarize laboratory testing results. A gradation curve has also been provided for each soil sample that required grain size analysis. Also attached are the chain-of-custody forms and sample receipt records.

CATLIN appreciates the opportunity to provide you with geotechnical laboratory testing. If you have any questions or concerns, please contact us at your convenience.

Sincerely,

Michael D. Mason
Laboratory Manager

Michael D. Mason for
Greg Djoboulian, P.G.
Project Manager

MDM/GD/ss/hab

Enclosures

9146mdm01_ltr

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TABLE 1
SUMMARY OF LABORATORY TESTING RESULTS FOR MOISTURE CONTENT, ATTERBERG LIMITS, AND VISUAL CLASSIFICATION

SAIC - LOAD LINE 1 PHASE II RI
CONTRACT NO. 4400031227
CATLIN PROJECT NO. 199-146

SAMPLE ID	LABORATORY ANALYSIS		
	MOISTURE CONTENT (%)	ATTERBERG LIMITS (LL/PL)	VISUAL CLASSIFICATION
LL10722	4.0	NA	NA
LL10800	15.0	NA	NA
LL10804	14.0	NP	Silty Sand, SM
LL10834	11.0	NA	NA
LL10853	6.0	NA	NA
LL10862	19.0	NA	NA
LL10872	6.0	NP	Silty Sand, SM
LL10882	12.0	NA	NA
LL10893	14.0	NA	NA
LL10895	20.0	NA	NA
LL10912	14.0	36/8	Sandy Silt, ML
LL10942	NA	NP	Silty Sand, SM
LL10950	NA	NP	Silty Sand, SM
LL10984	NA	34/9	Sandy Silt, ML
LL11002	17.0	NA	NA
LL11229	16.0	25/8	Elastic Silt, MH

NA = Not Analyzed
LL = Liquid Limit
PL = Plastic Limit

TABLE 2 (Page 1 of 3)
SUMMARY OF LABORATORY TESTING RESULTS
FOR GRAIN SIZE ANALYSIS

SAIC - LOAD LINE 1 PHASE II RI
CONTRACT NO. 4400031227
CATLIN PROJECT NO. 199-146

Sieve No.	LL10979 % Passing	LL11015 % Passing	LL11016 % Passing	LL11017 % Passing	LL11018 % Passing
3/8	96.5	99.7	90.2	86.8	97.5
#4	91.5	95.8	87.5	85.0	97.0
#10	97.4	91.1	86.4	84.1	95.6
#20	82.5	87.3	84.5	82.8	94.0
#40	77.5	82.9	79.8	79.0	92.0
#60	72.8	76.1	74.5	74.0	89.3
#100	65.0	66.7	57.5	56.7	86.0
#200	58.4	61.7	53.1	48.5	83.6

Sieve No.	LL11019 % Passing	LL11048 % Passing	LL11049 % Passing	LL11050 % Passing	LL11051 % Passing
3/8	25.0	100.0	89.7	87.3	21.3
#4	24.3	99.5	84.6	84.4	14.4
#10	23.5	98.2	73.7	79.8	12.9
#20	22.2	96.7	65.4	73.7	11.1
#40	20.5	93.4	56.2	61.8	9.1
#60	18.6	90.8	44.3	51.1	7.1
#100	9.2	88.0	34.2	36.7	3.3
#200	4.8	86.4	30.3	30.9	2.2

Sieve No.	LL11052 % Passing	LL11053 % Passing	LL11054 % Passing	LL11055 % Passing	LL11056 % Passing
3/8	99.5	100.0	99.9	99.2	72.0
#4	98.7	99.3	97.1	97.1	66.3
#10	96.8	98.4	93.1	95.6	61.1
#20	93.5	96.7	88.9	94.4	57.1
#40	89.9	90.0	81.6	93.0	52.7
#60	87.6	80.3	70.1	91.4	48.1
#100	83.3	69.4	58.2	89.0	44.0
#200	80.9	63.8	52.7	86.8	41.4

TABLE 2 (Page 2 of 3)
SUMMARY OF LABORATORY TESTING RESULTS
FOR GRAIN SIZE ANALYSIS

SAIC - LOAD LINE 1 PHASE II RI
CONTRACT NO. 4400031227
CATLIN PROJECT NO. 199-146

Sieve No.	LL11057 % Passing	LL11058 % Passing	LL11059 % Passing	LL11060 % Passing	LL11061 % Passing
3/8	98.9	82.9	51.3	93.3	99.4
#4	96.0	66.0	40.3	90.1	98.9
#10	93.1	54.0	30.9	86.7	97.7
#20	90.6	48.3	25.2	84.7	97.2
#40	86.6	40.4	20.9	83.2	96.4
#60	81.2	25.2	17.2	81.1	92.9
#100	72.5	16.0	13.5	75.7	81.6
#200	65.0	12.9	11.7	70.9	71.4

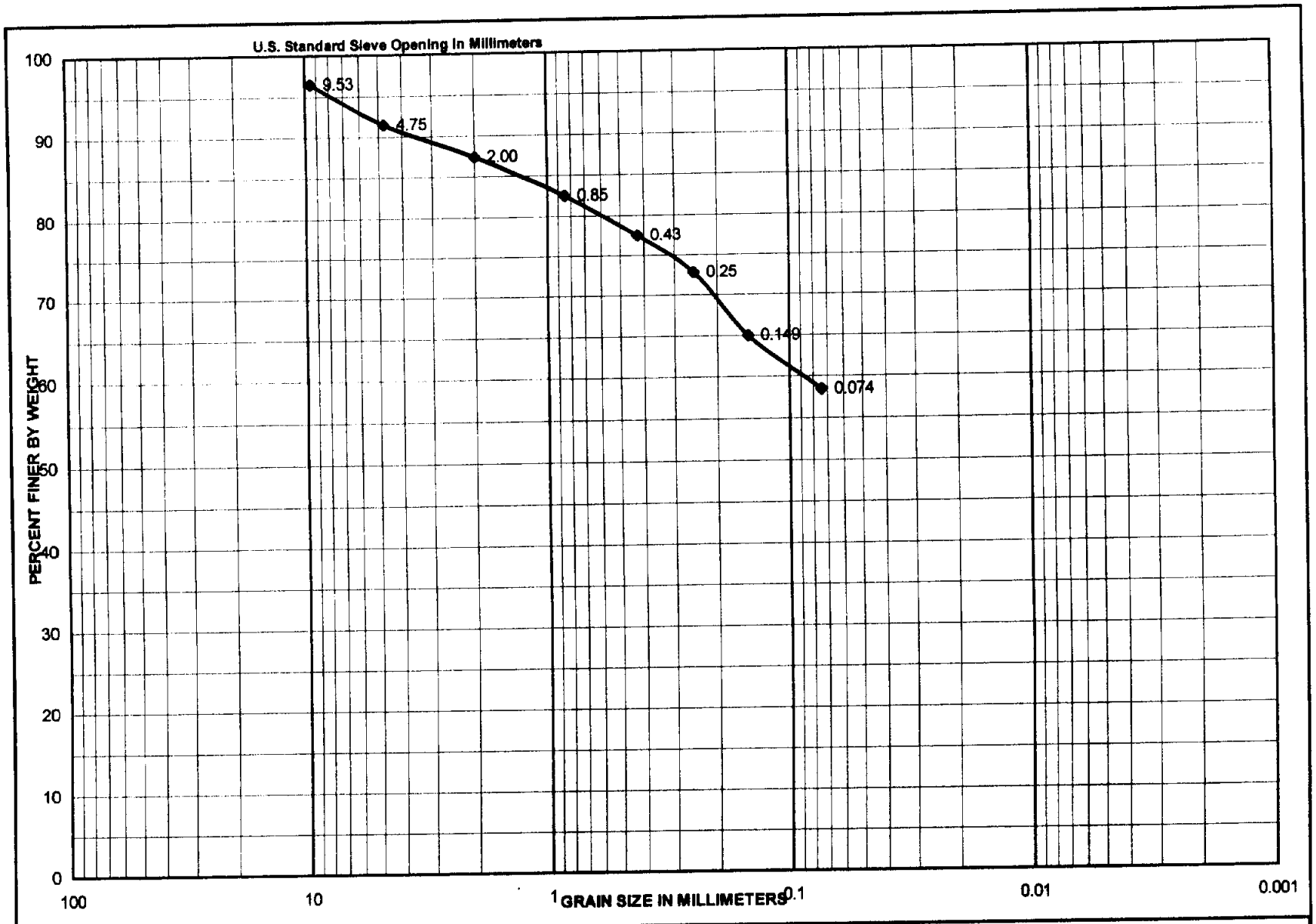
Sieve No.	LL11062 % Passing	LL11098 % Passing	LL11099 % Passing	LL11260 % Passing	LL11269 % Passing
3/8	100.0	100.0	85.3	81.8	91.1
#4	94.8	99.3	77.5	79.7	86.0
#10	73.2	97.5	66.9	78.1	82.9
#20	65.7	96.1	59.8	75.4	79.7
#40	59.8	92.9	46.4	70.1	73.9
#60	47.0	89.1	22.1	64.8	69.0
#100	32.2	84.3	11.7	56.3	59.7
#200	26.3	79.3	9.5	50.2	55.7

Sieve No.	LL11274 % Passing	LL11275 % Passing	LL11276 % Passing	LL11277 % Passing	LL11100 % Passing
3/8	98.0	94.5	99.2	86.3	95.2
#4	97.3	91.5	98.2	82.5	86.3
#10	96.3	88.5	95.3	80.4	79.2
#20	92.8	86.7	92.0	78.6	75.3
#40	84.2	83.5	88.5	74.4	72.2
#60	76.2	78.2	84.1	67.4	69.1
#100	62.8	64.9	79.4	53.3	66.0
#200	57.4	61.4	76.7	49.3	64.2

TABLE 2 (Page 3 of 3)
SUMMARY OF LABORATORY TESTING RESULTS
FOR GRAIN SIZE ANALYSIS

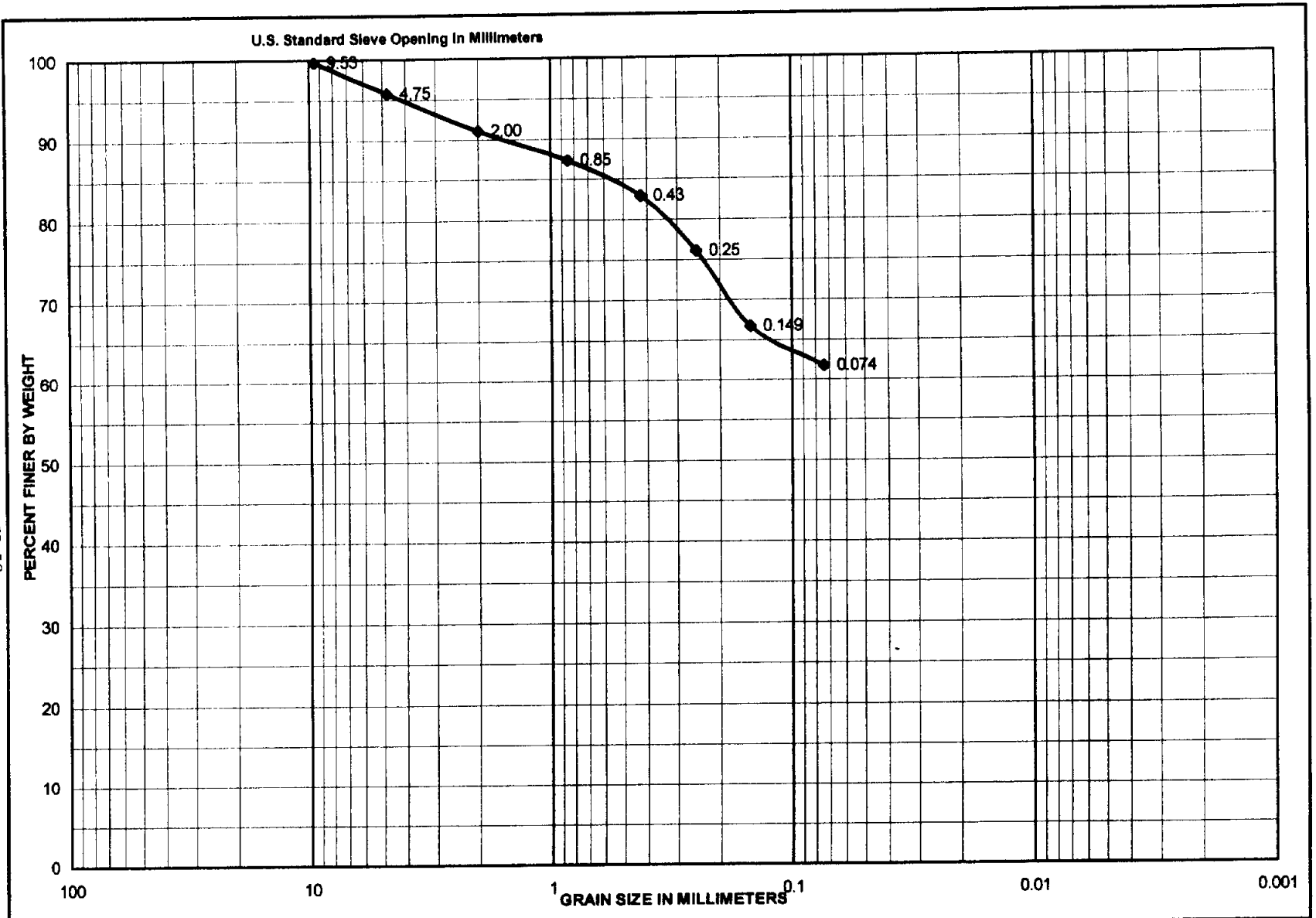
SAIC - LOAD LINE 1 PHASE II RI
CONTRACT NO. 4400031227
CATLIN PROJECT NO. 199-146

Sieve No.	LL11101 % Passing	LL11102 % Passing	LL11103 % Passing
3/8	92.1	99.9	99.5
#4	88.3	99.5	82.7
#10	85.7	98.4	63.1
#20	84.4	97.2	58.4
#40	83.2	95.3	53.4
#60	81.7	88.0	42.4
#100	78.1	68.1	28.1
#200	74.3	55.4	20.7



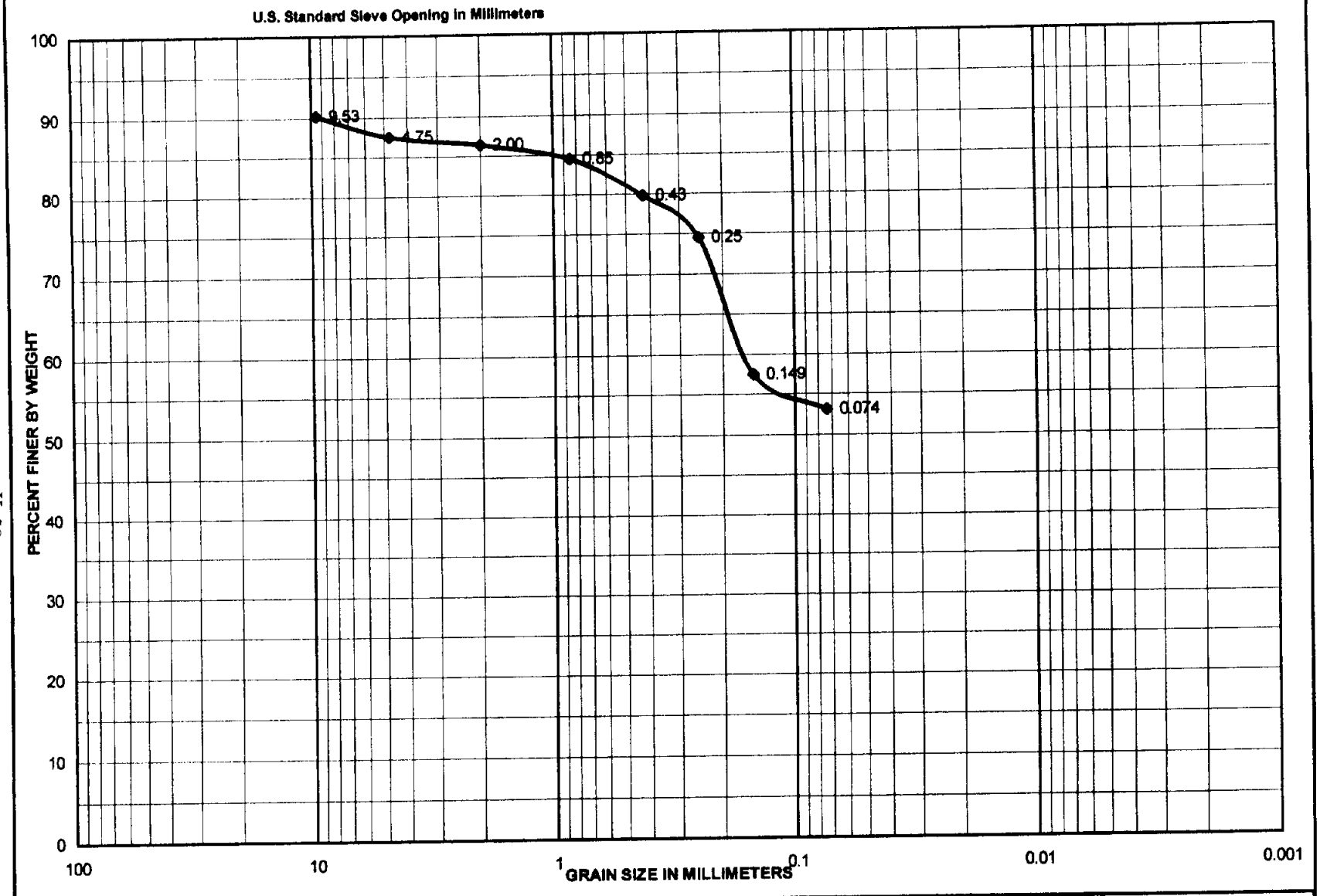
Sample No.	Depth (ft)	Classification
LL10979		

Project SAIC
Area Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory
Boring No.
Date 12/13/2000



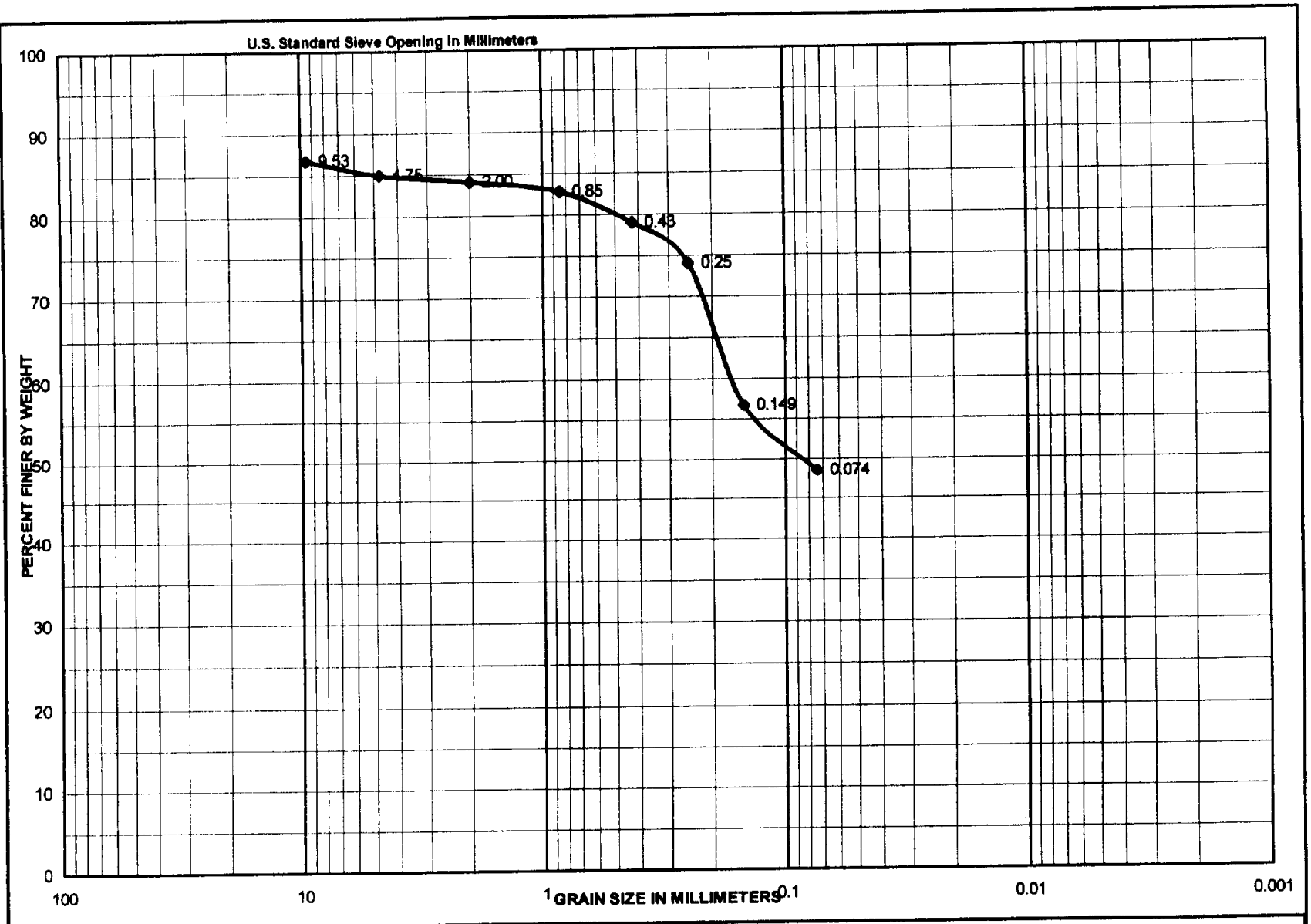
Sample No.	Depth (ft)	Classification
LL11015		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



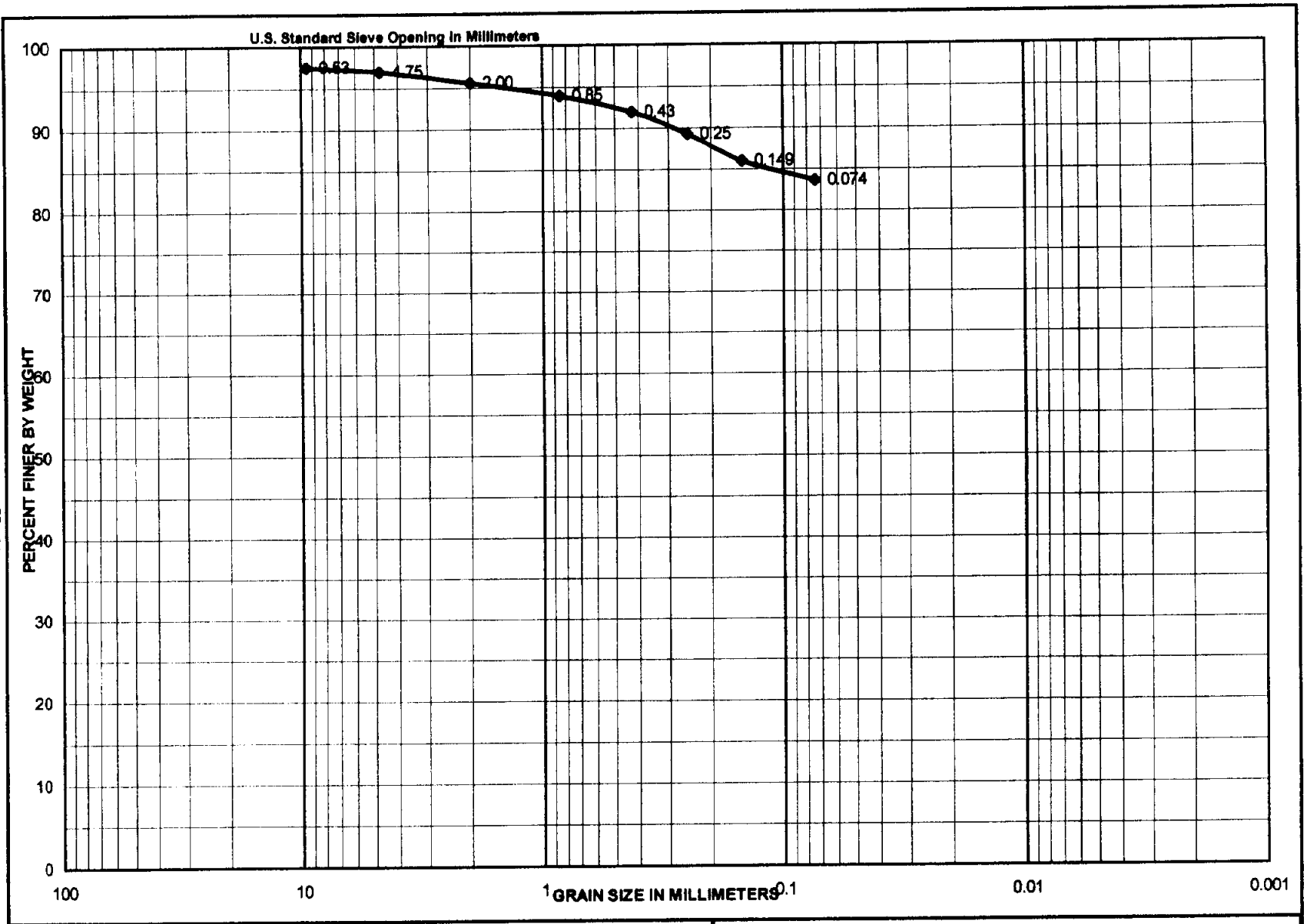
Sample No.	Depth (ft)	Classification
LL11016		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



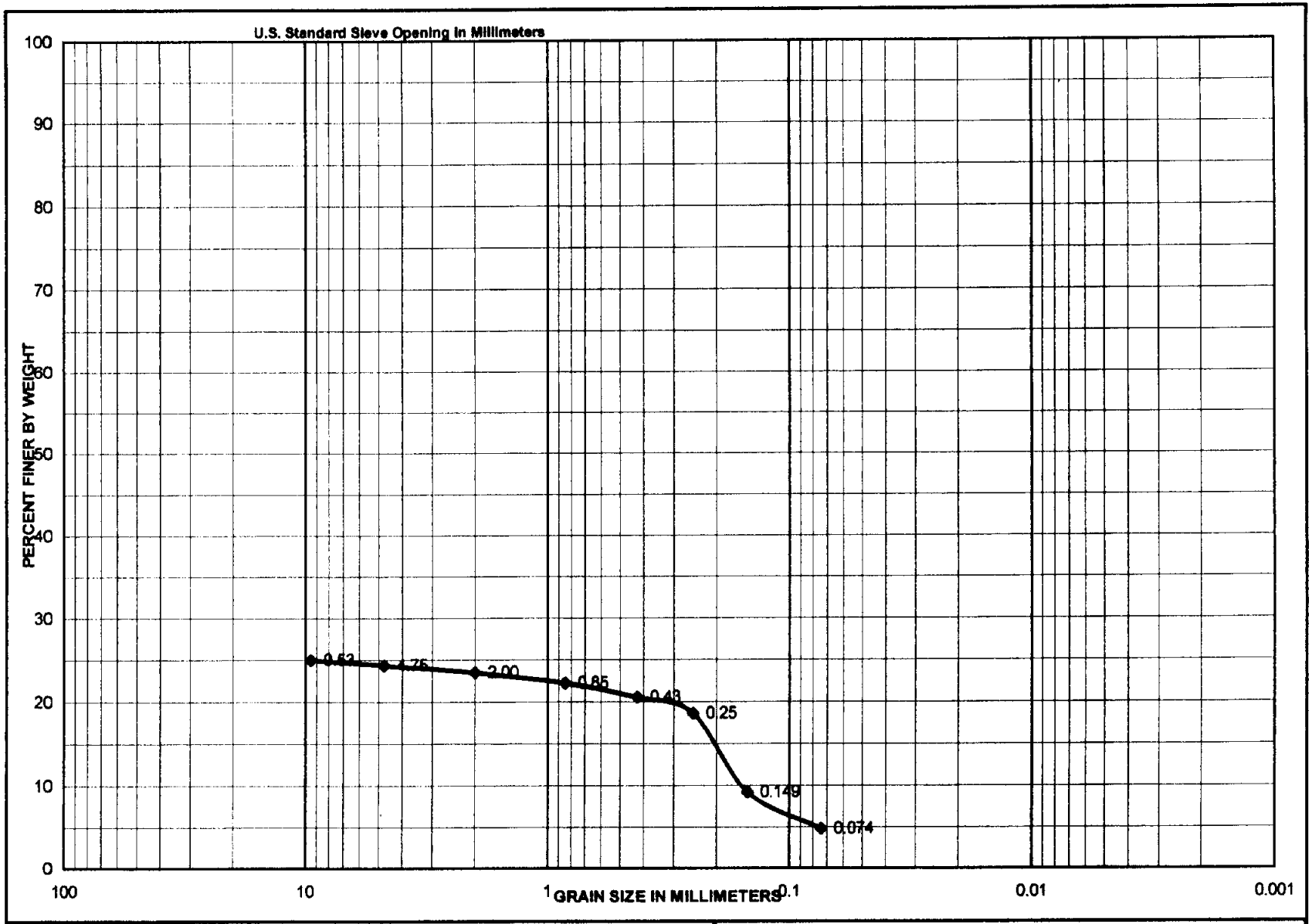
Sample No.	Depth (ft)	Classification
LL11017		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



Sample No.	Depth (ft)	Classification
LL11018		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



Sample No.	Depth (ft)	Classification	
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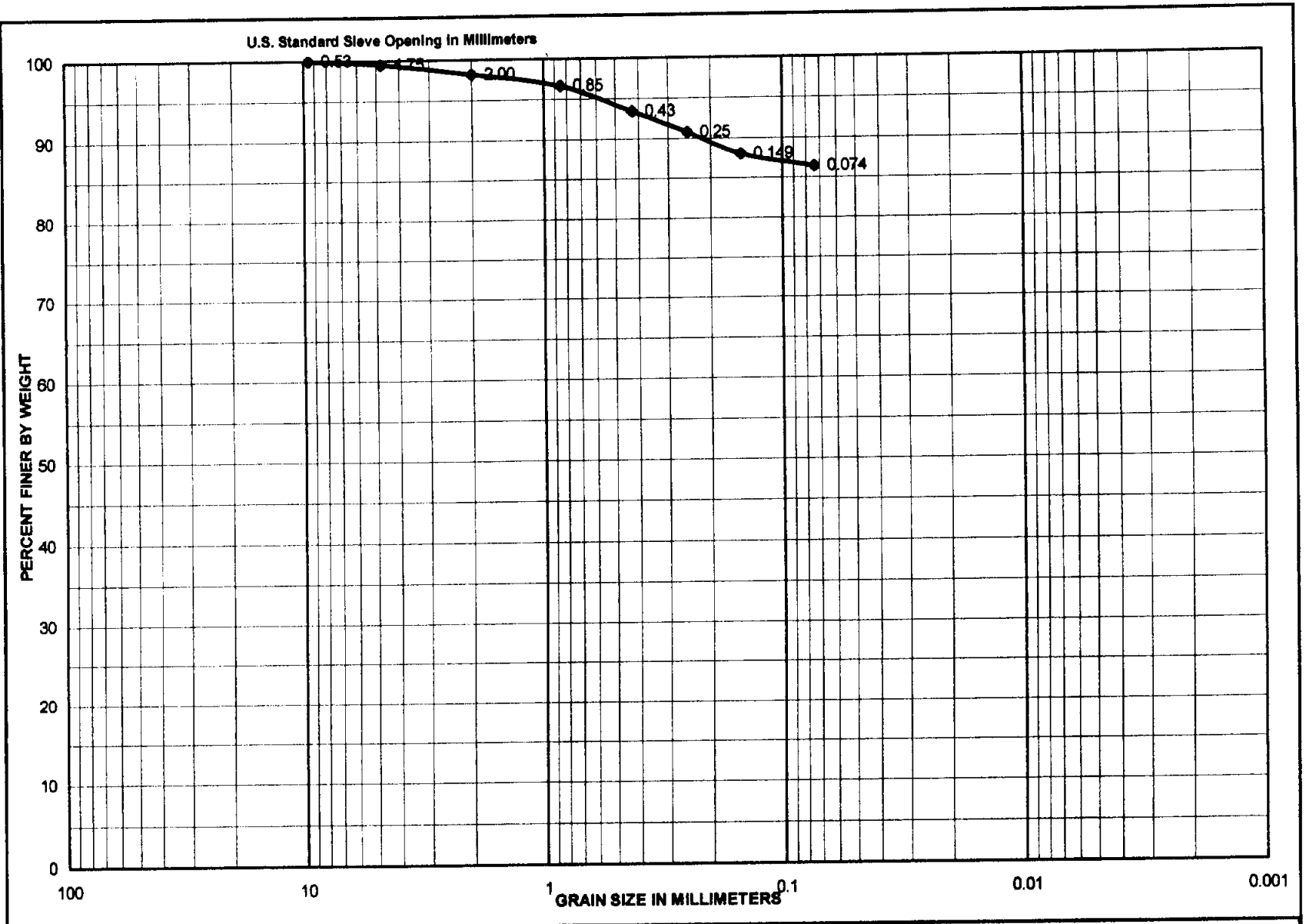
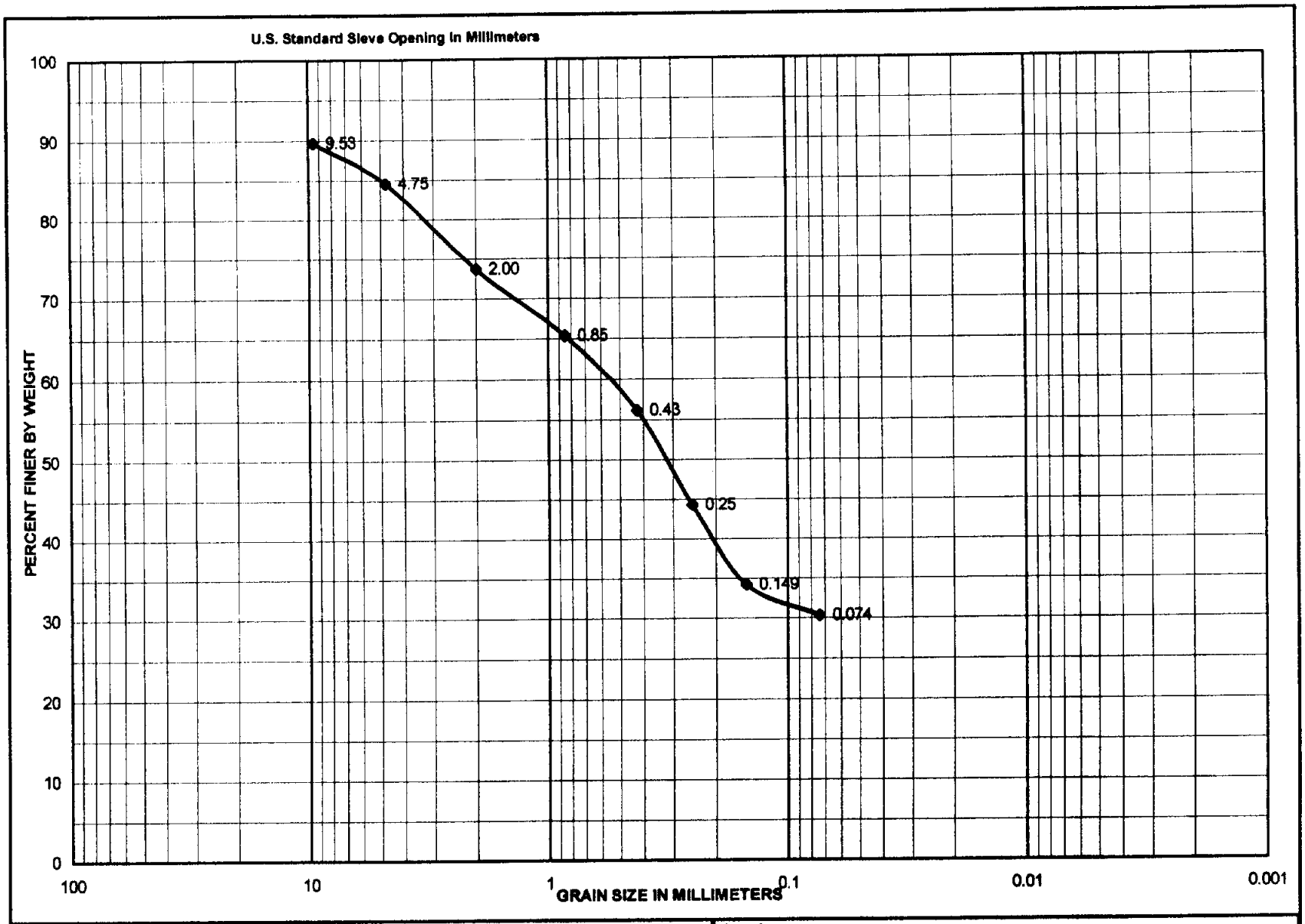
			Area Load Line 1 Phase II RI
			CATLIN Geotechnical Laboratory
			Boring No.
			Date 12/13/2000



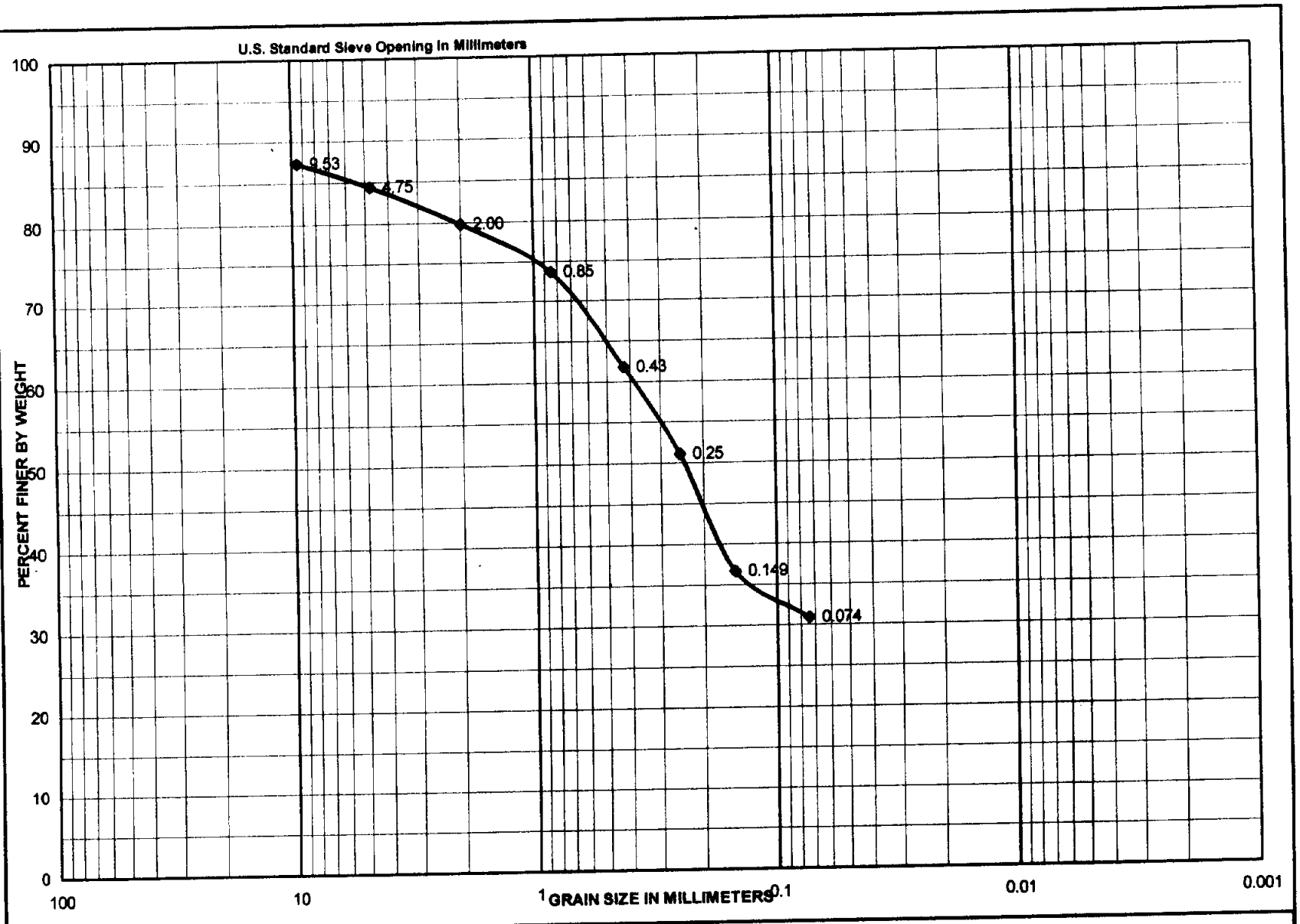
Sample No.	Depth (ft)	Classification
LL11048		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



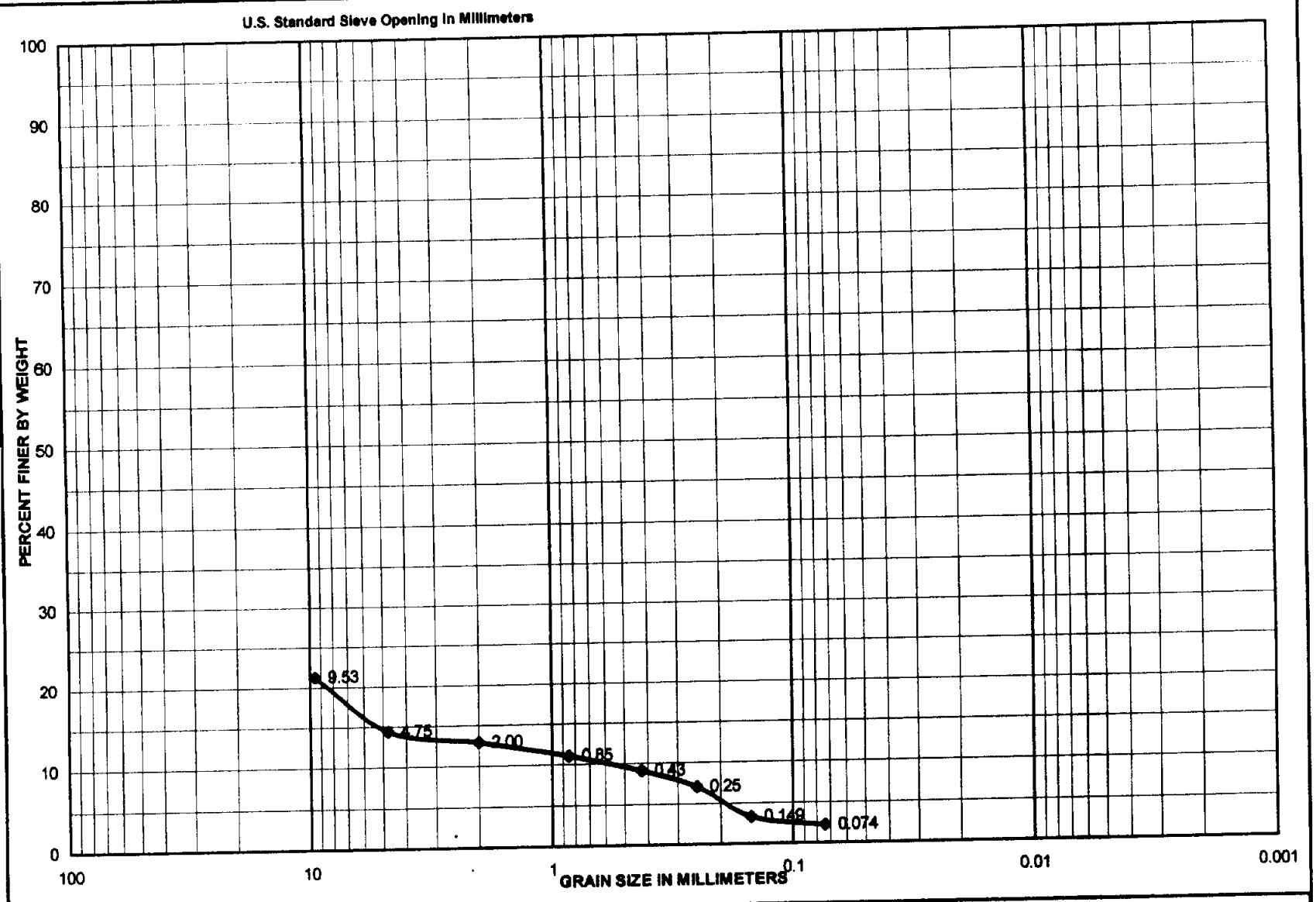
Sample No.	Depth (ft)	Classification
LL11049		

Project SAIC
Area Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory
Boring No.
Date 12/18/2000



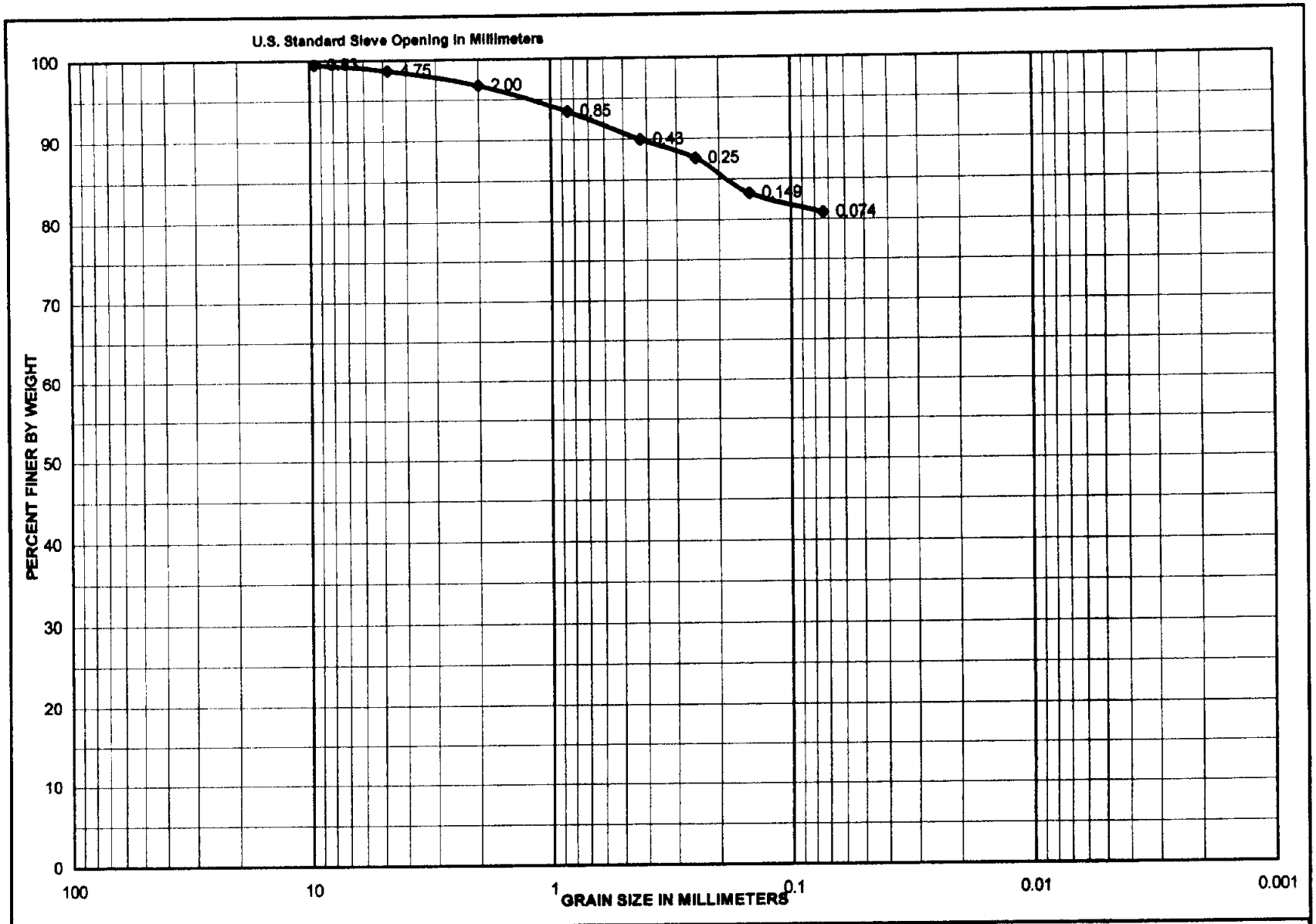
Sample No.	Depth (ft)	Classification
LL11050		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



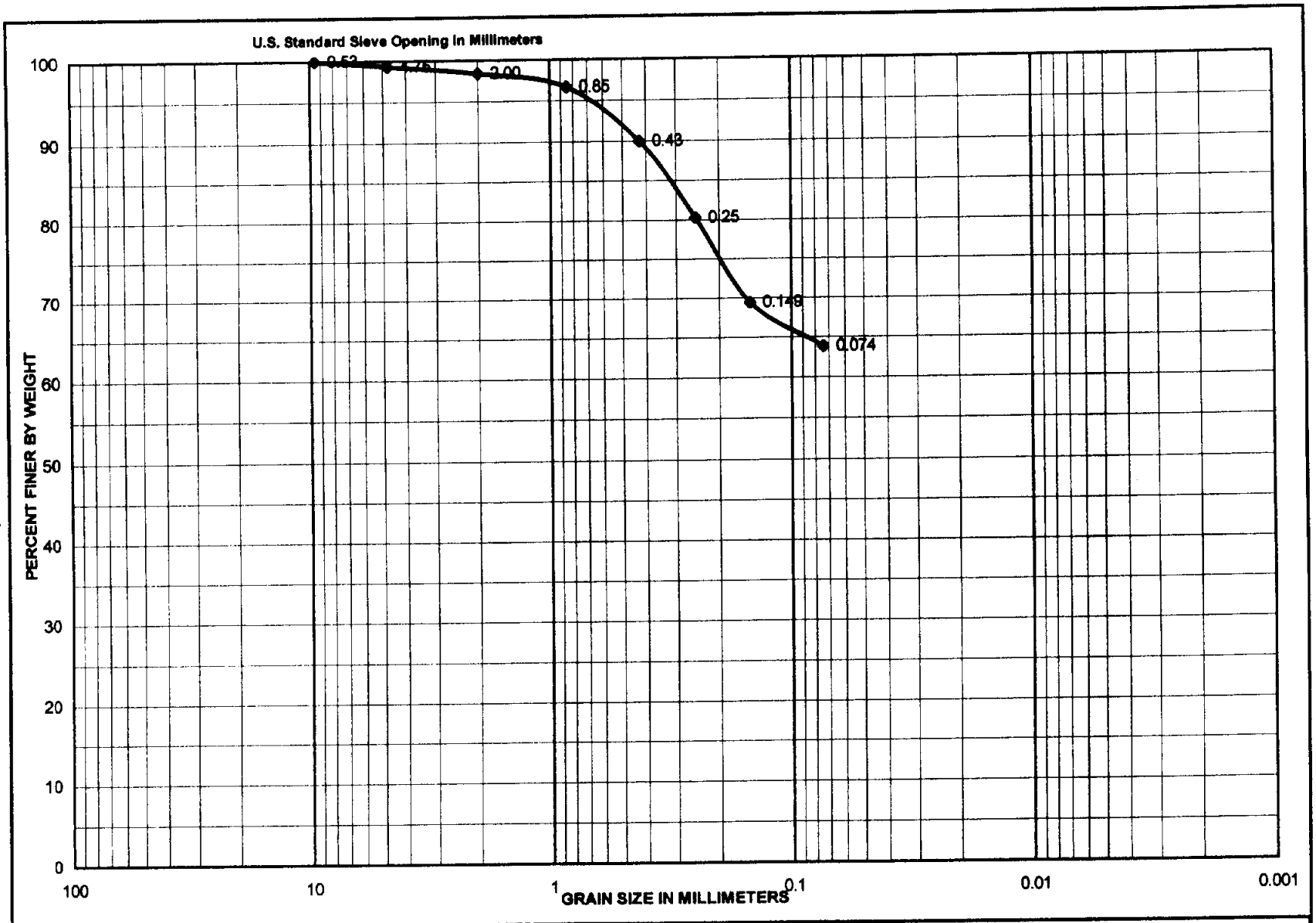
Sample No.	Depth (ft)	Classification
LL11051		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



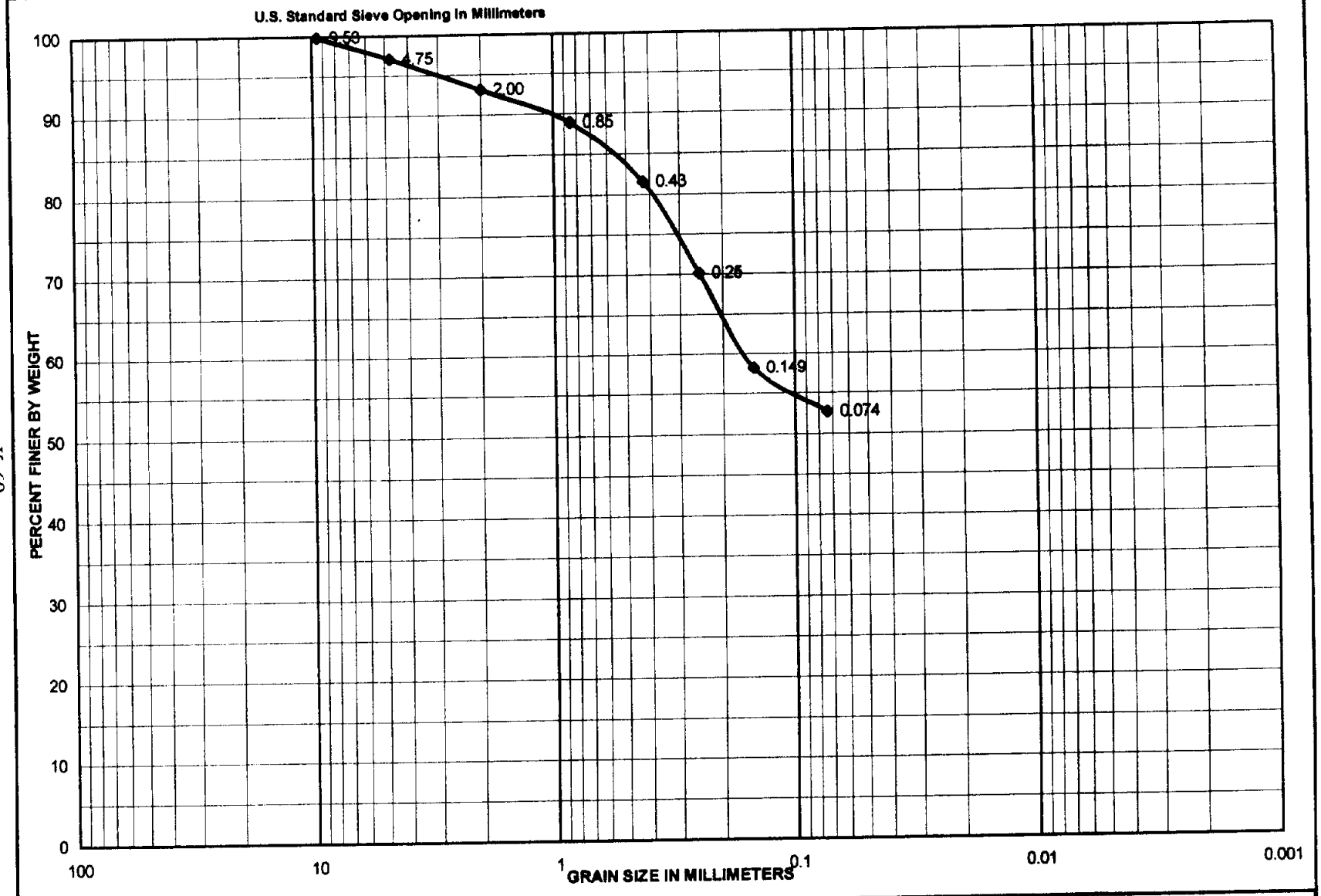
Sample No.	Depth (ft)	Classification
LL11052		

Project	SAIC
Area	Load Line1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



Sample No.	Depth (ft)	Classification
LL11053		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



Sample No.	Depth (ft)	Classification
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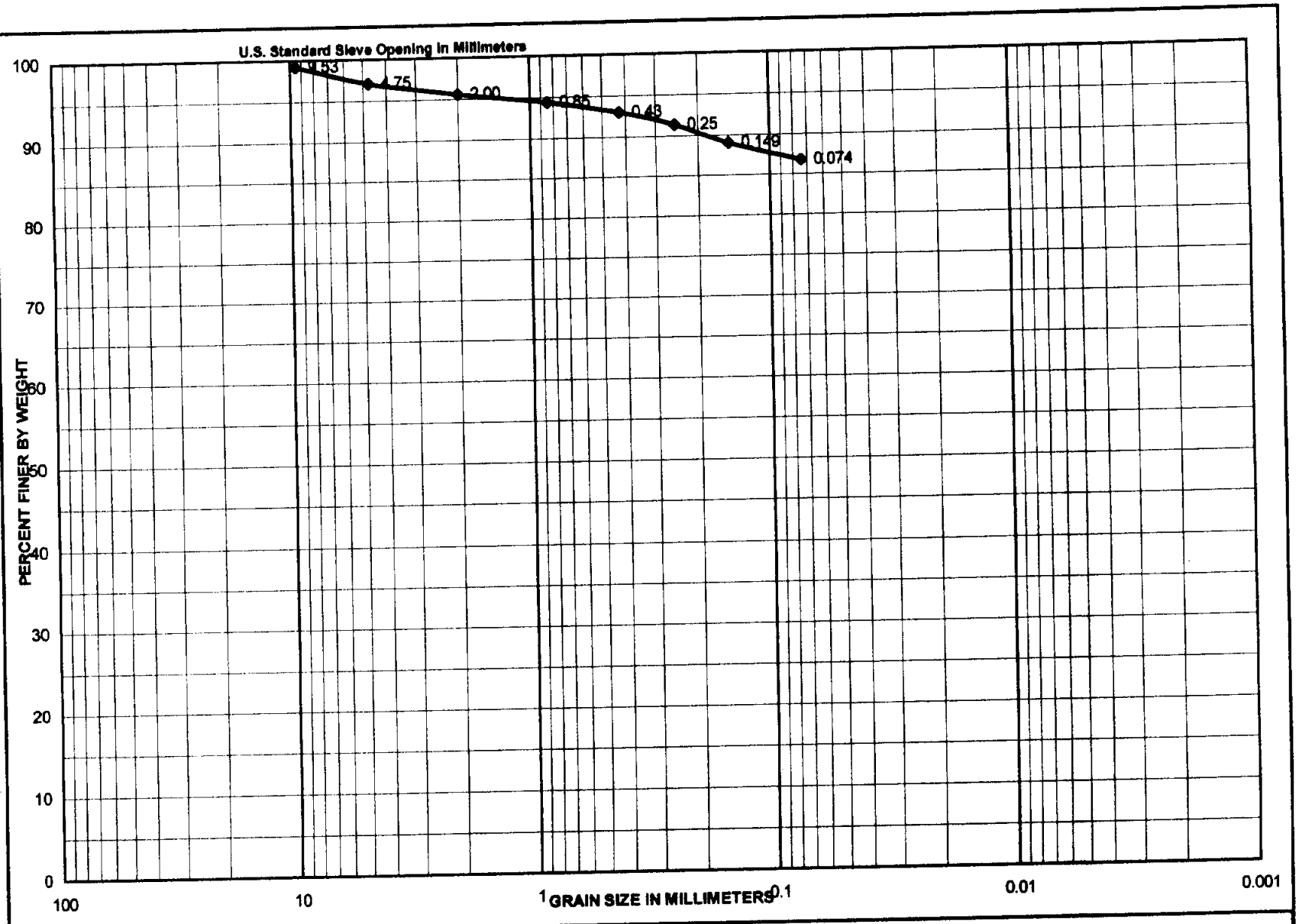
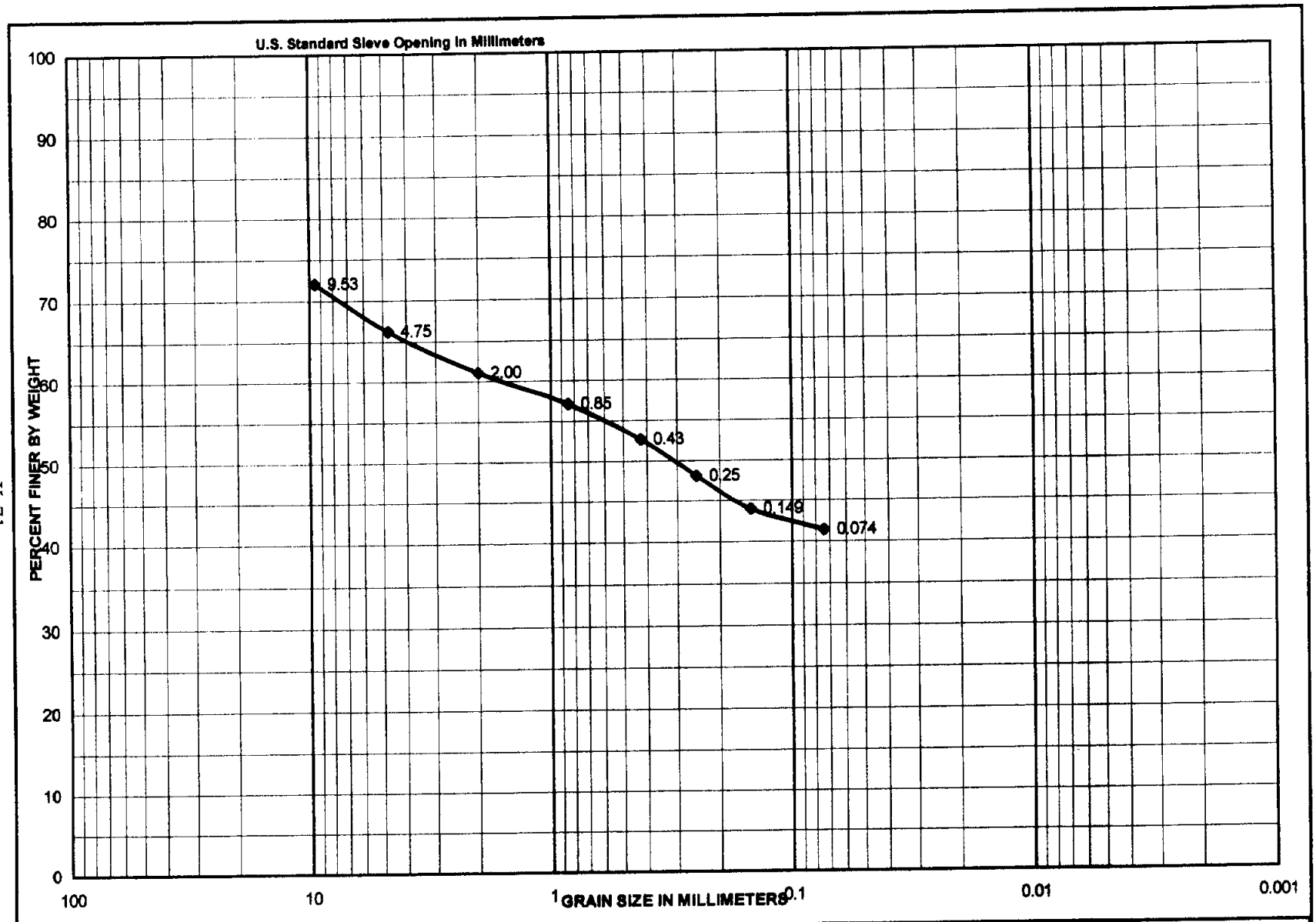
Project SAIC
Area Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory
Boring No.
Date 12/18/2000



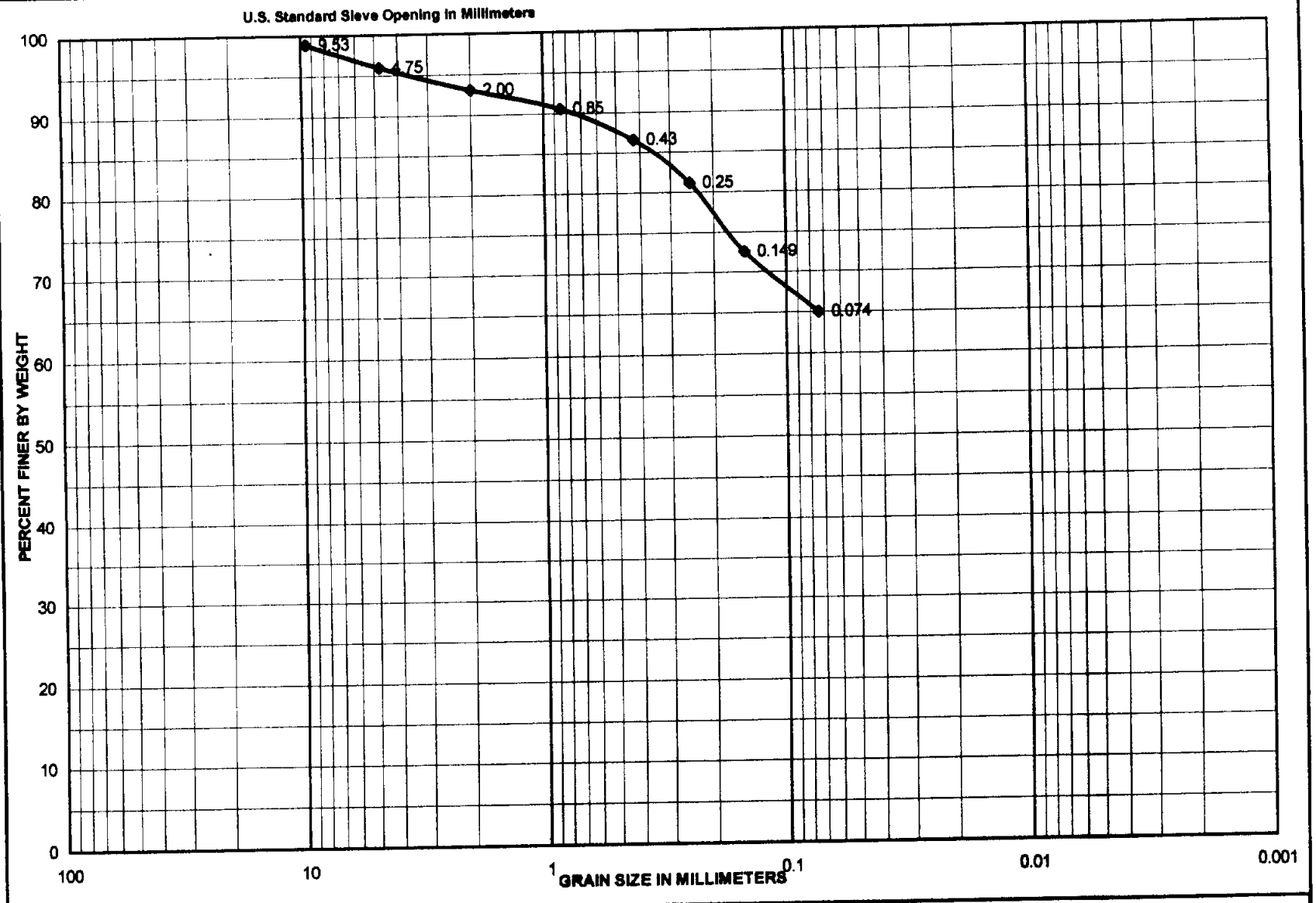
Sample No.	Depth (ft)	Classification
LL11055		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



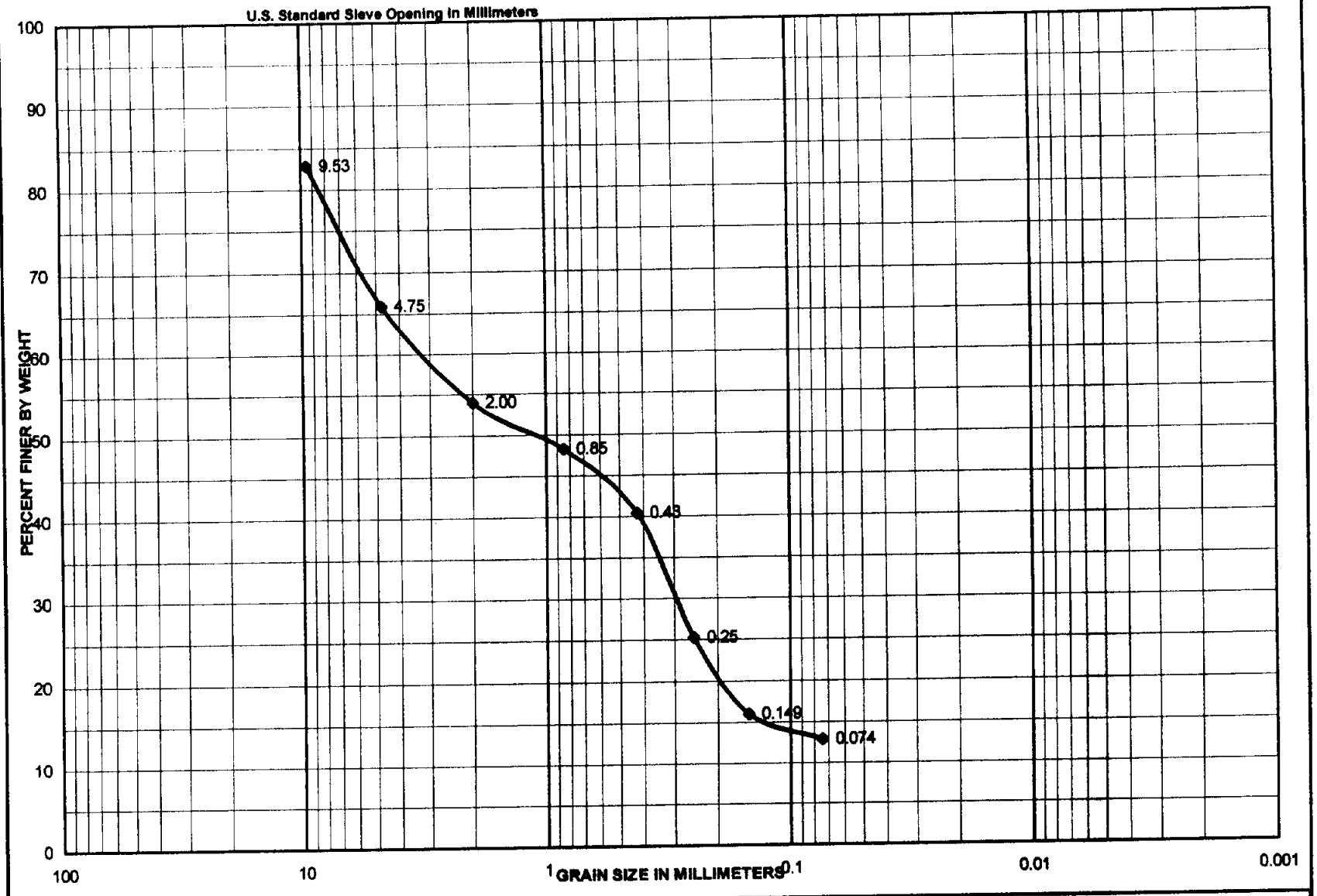
Sample No.	Depth (ft)	Classification
LL11056		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



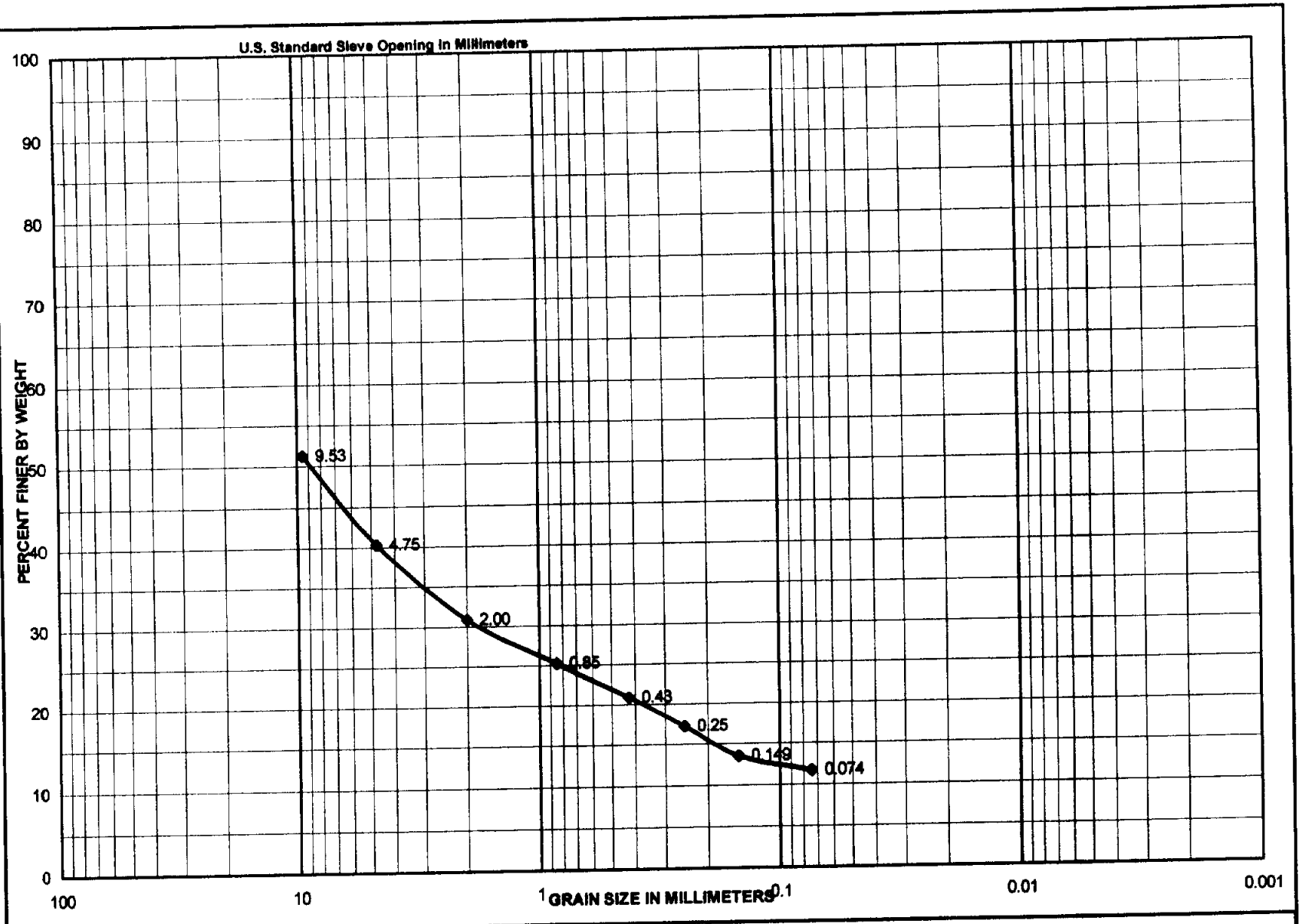
Sample No.	Depth (ft)	Classification
LL11057		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



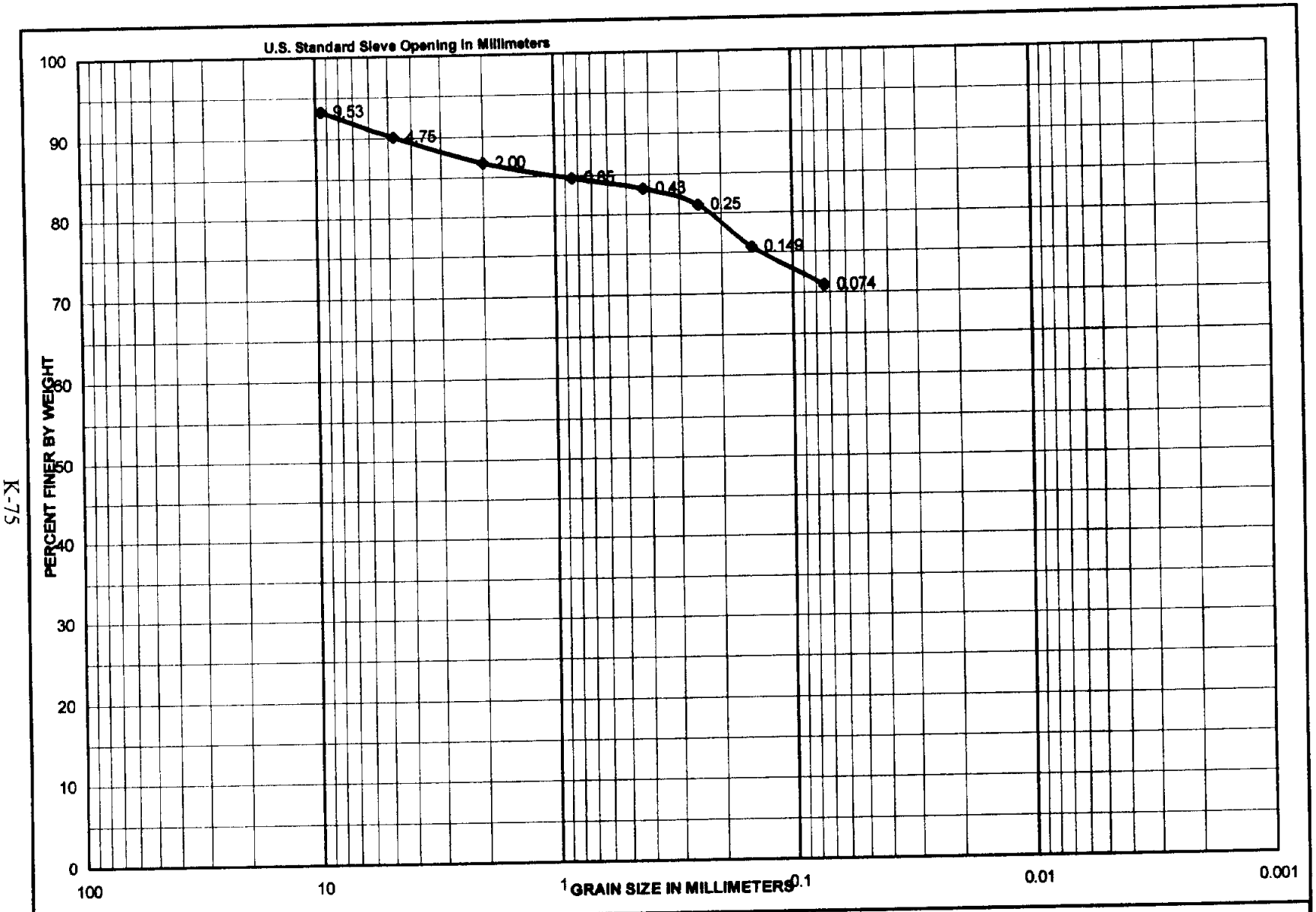
Sample No.	Depth (ft)	Classification
LL11058		

Project	SAIC
Area	Load Line 1 Phase II RI
	CATLIN Geotechnical Laboratory
	Boring No.
Date	12/13/2000



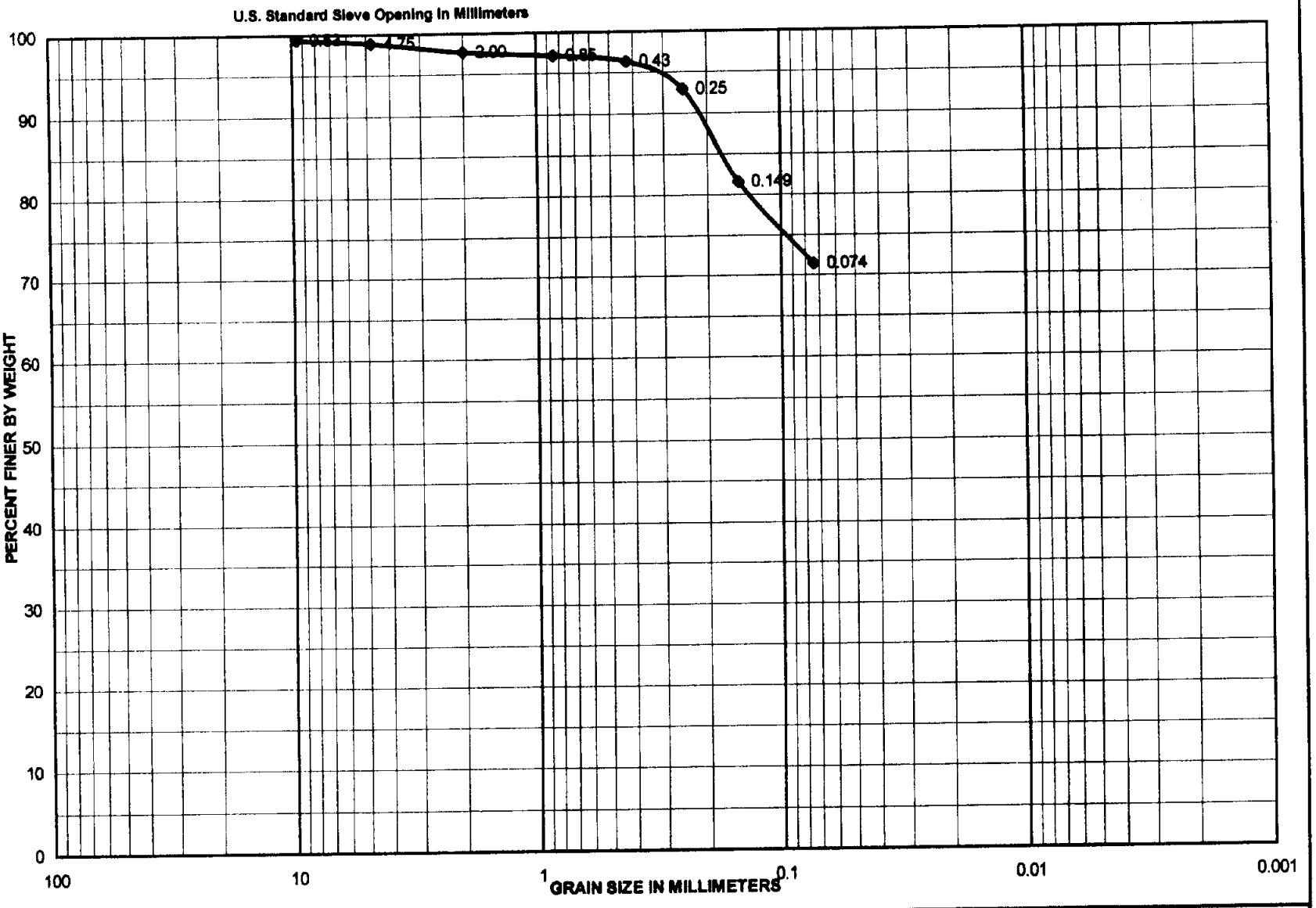
Sample No.	Depth (ft)	Classification
LL11059		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



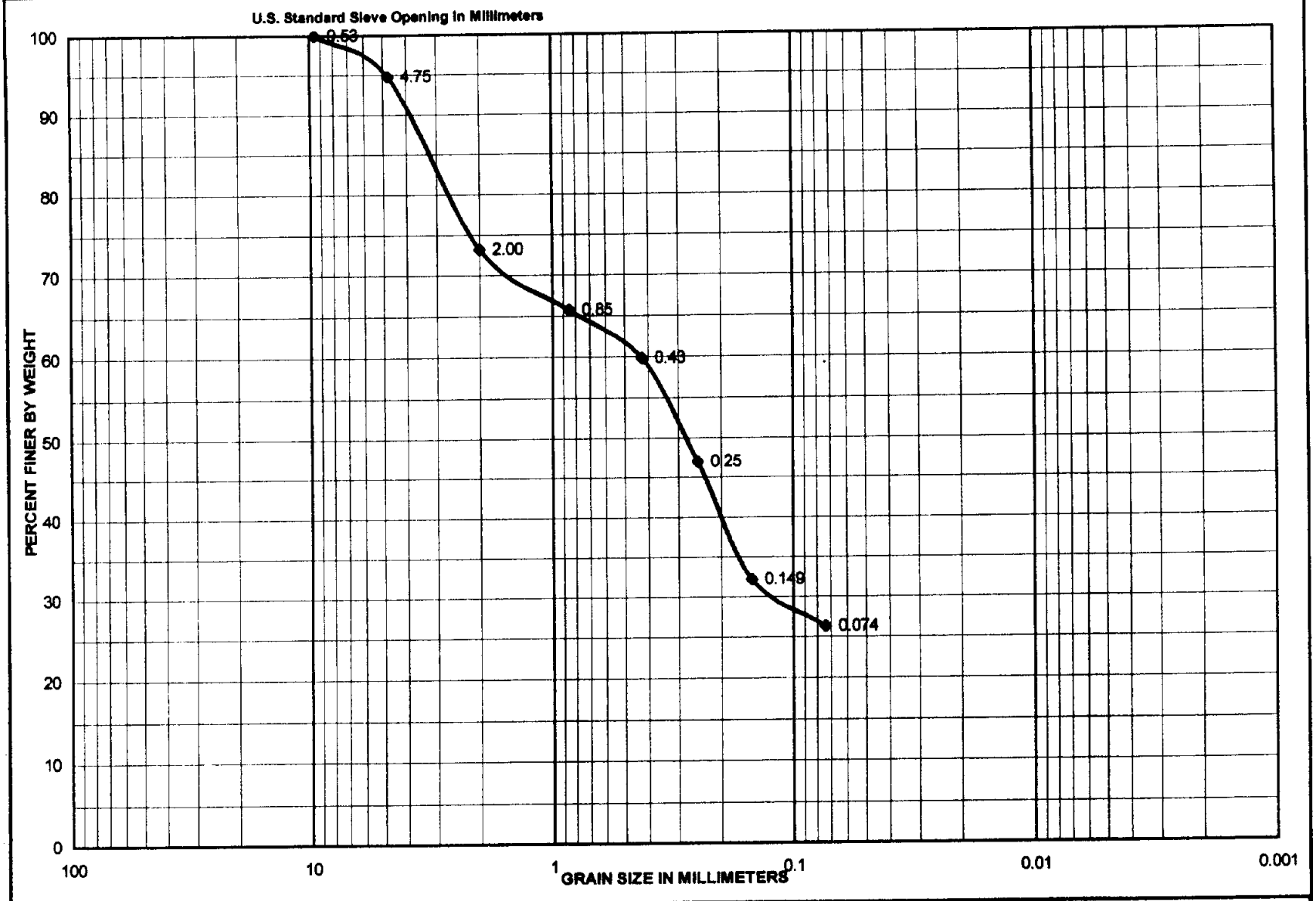
Sample No.	Depth (ft)	Classification
LL11060		

Project SAIC
Area Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory
Boring No.
Date 12/13/2000



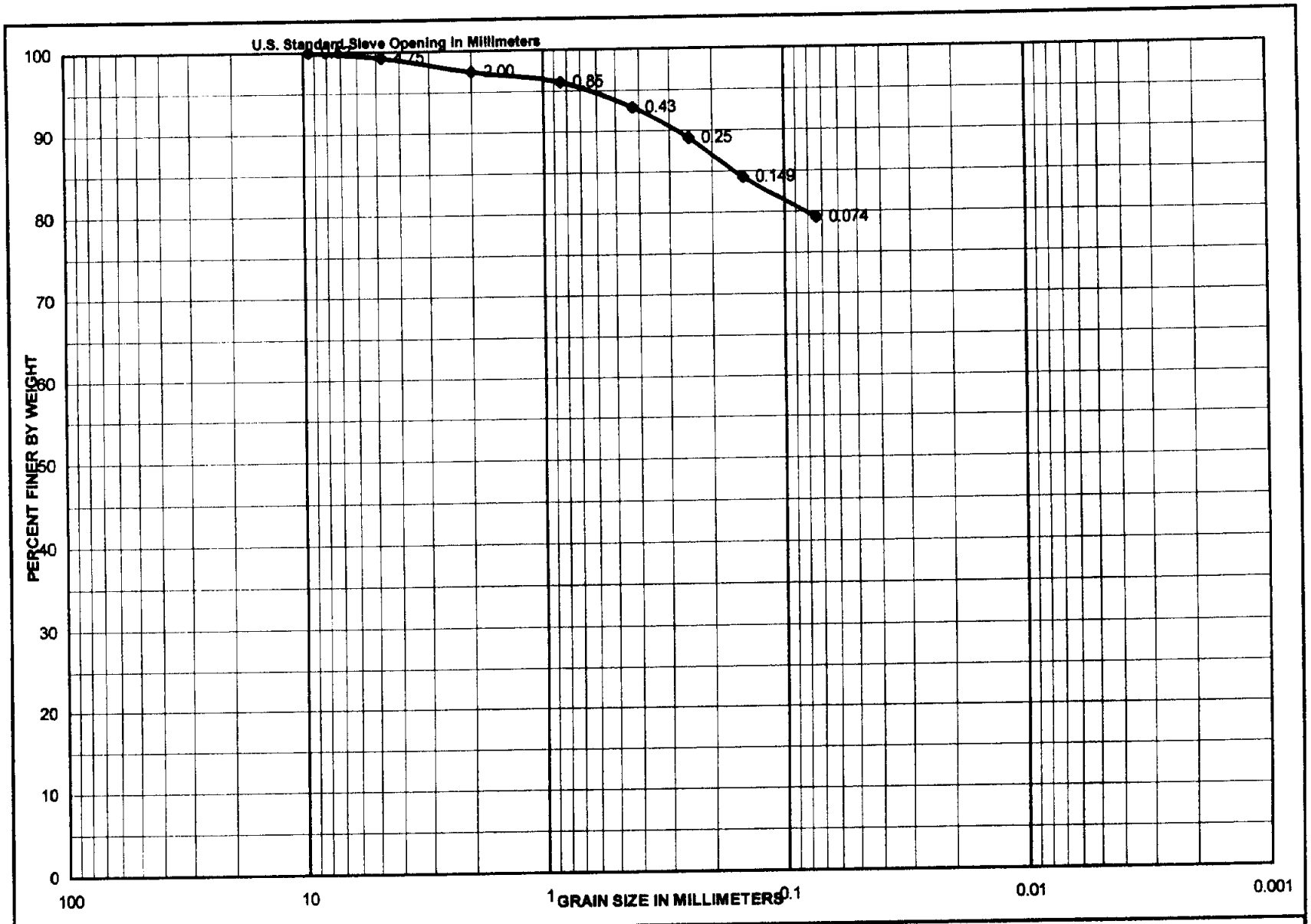
Sample No.	Depth (ft)	Classification
LL11061		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



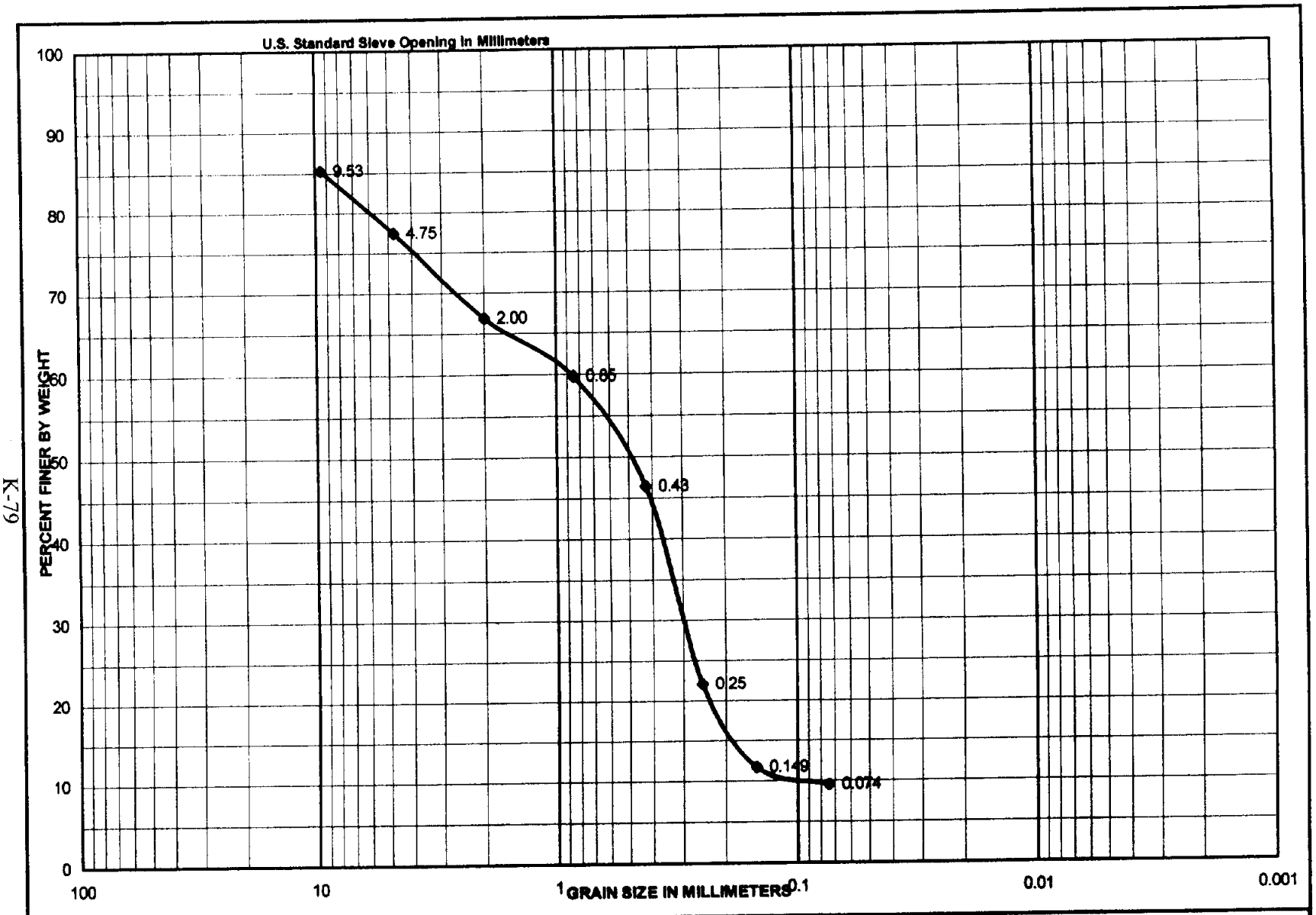
Sample No.	Depth (ft)	Classification
LL11062		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



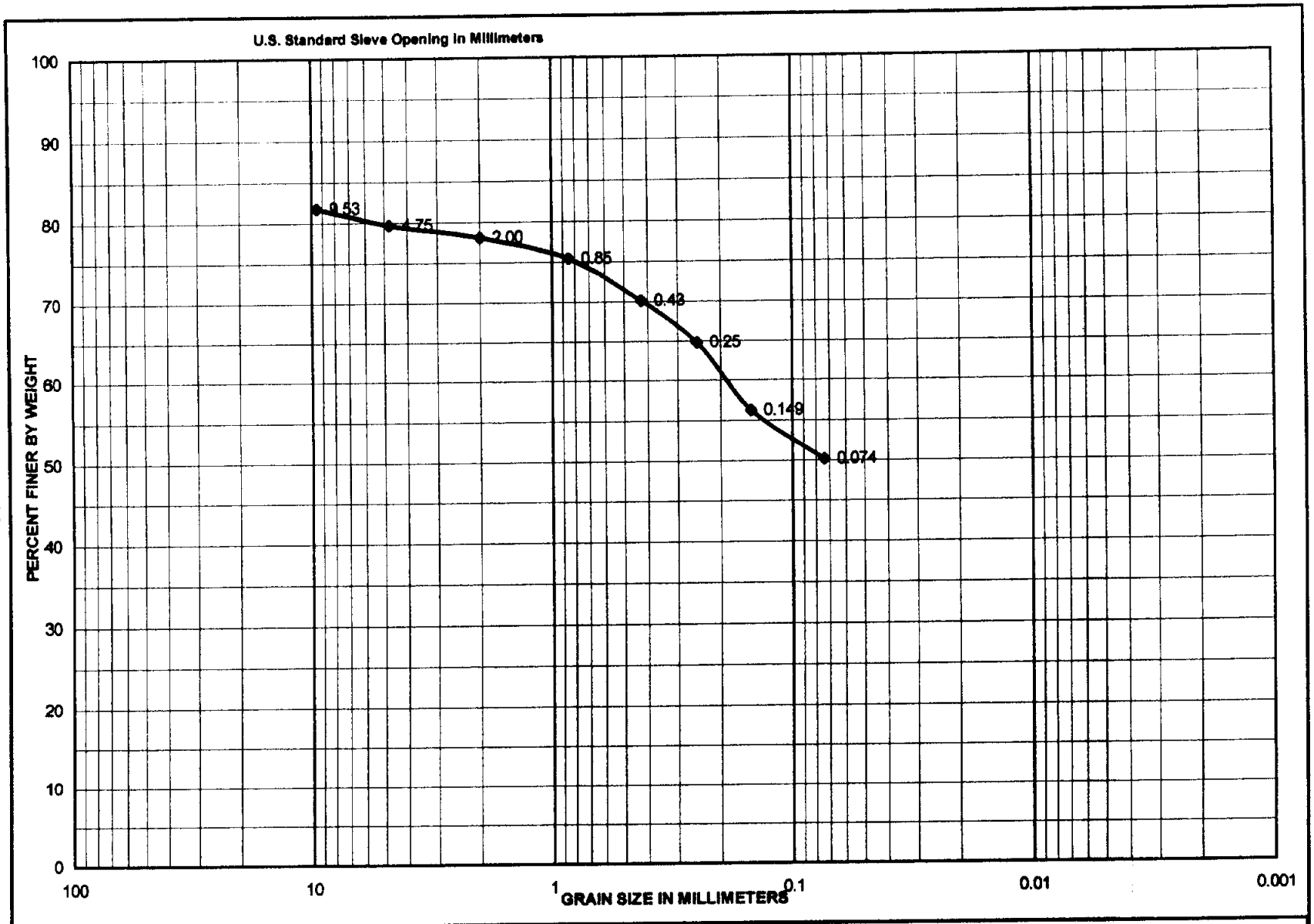
Sample No.	Depth (ft)	Classification
LL11098		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



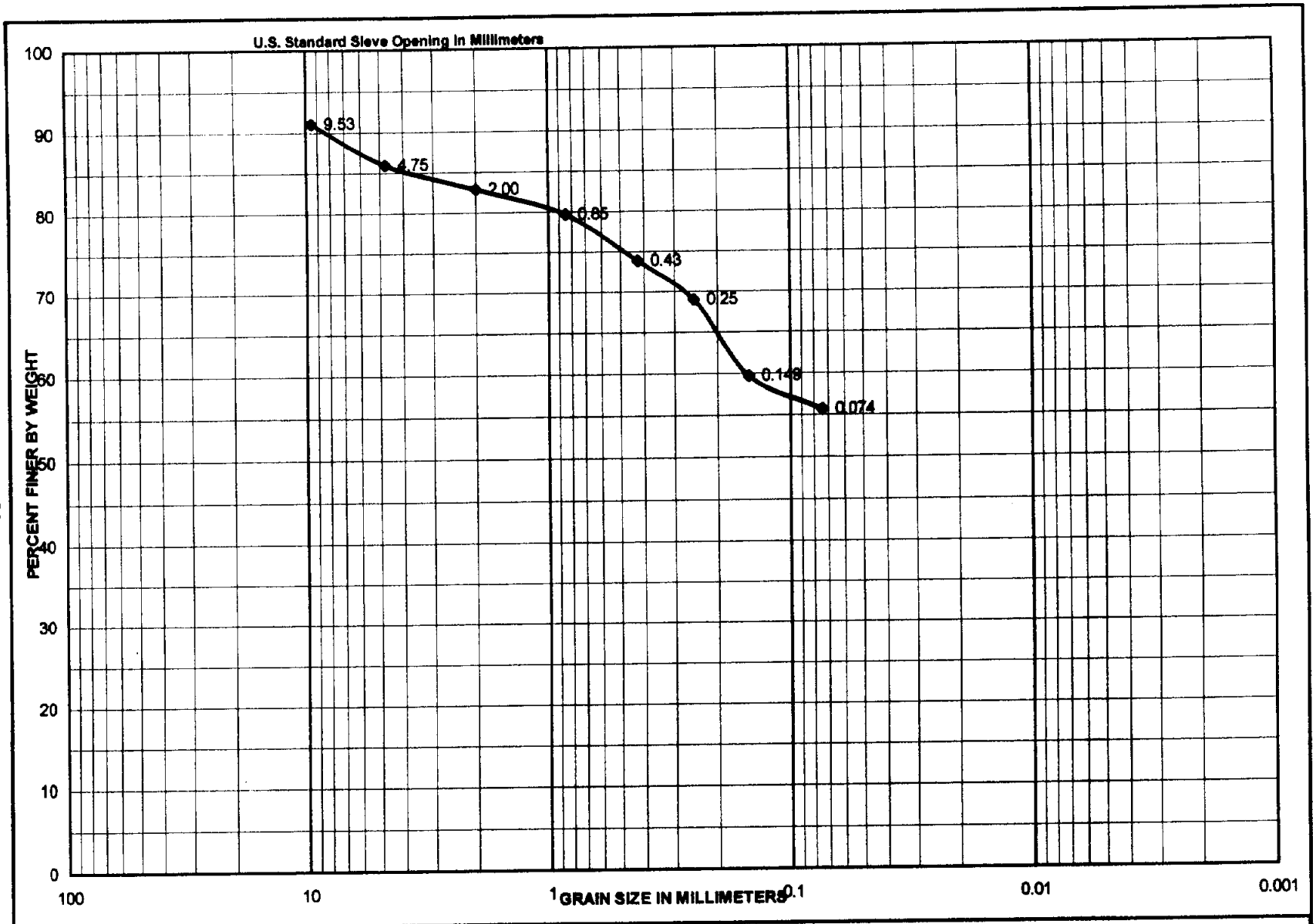
Sample No.	Depth (ft)	Classification
LL11099		

Project SAIC
Area Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory
Boring No.
Date 12/13/2000



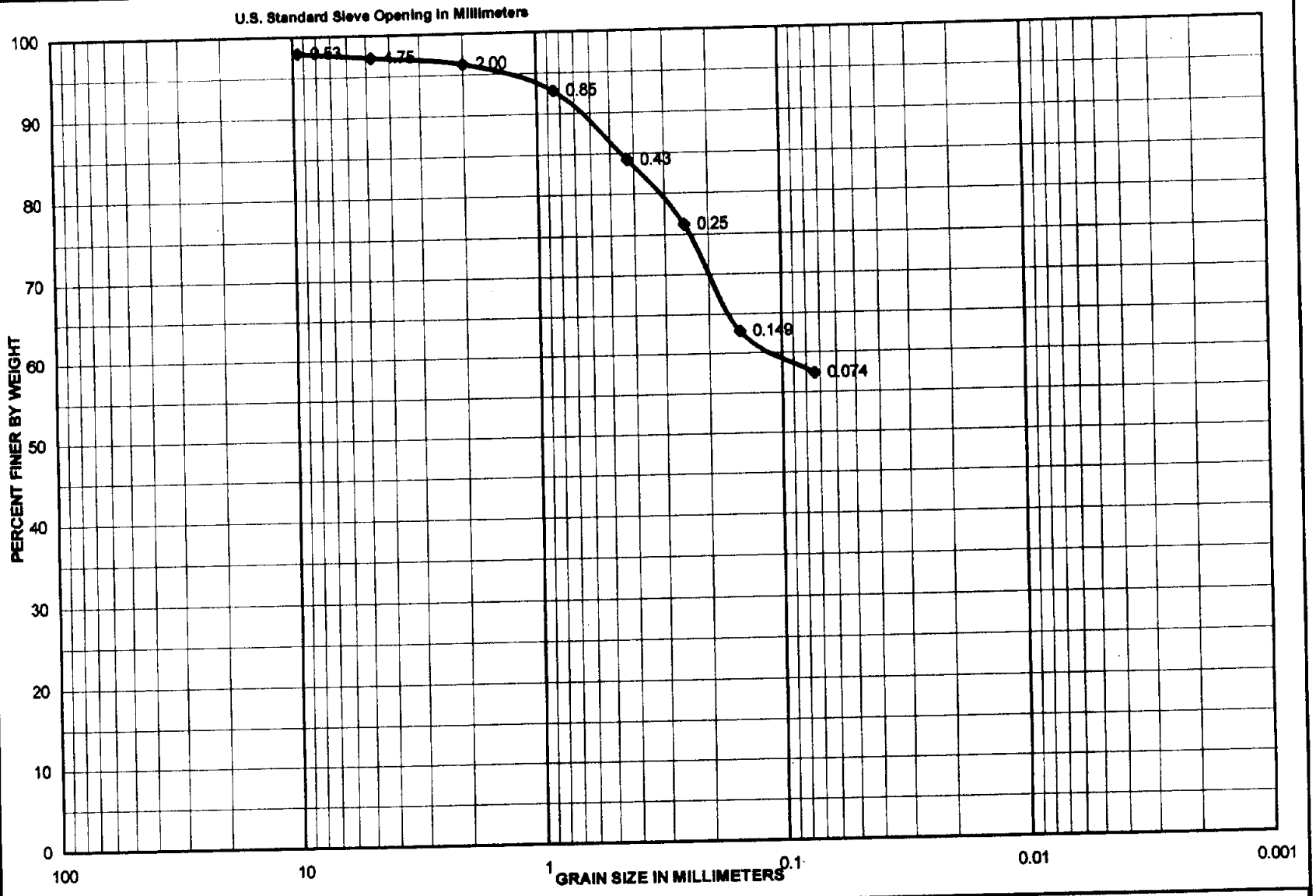
Sample No.	Depth (ft)	Classification
LL11260		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



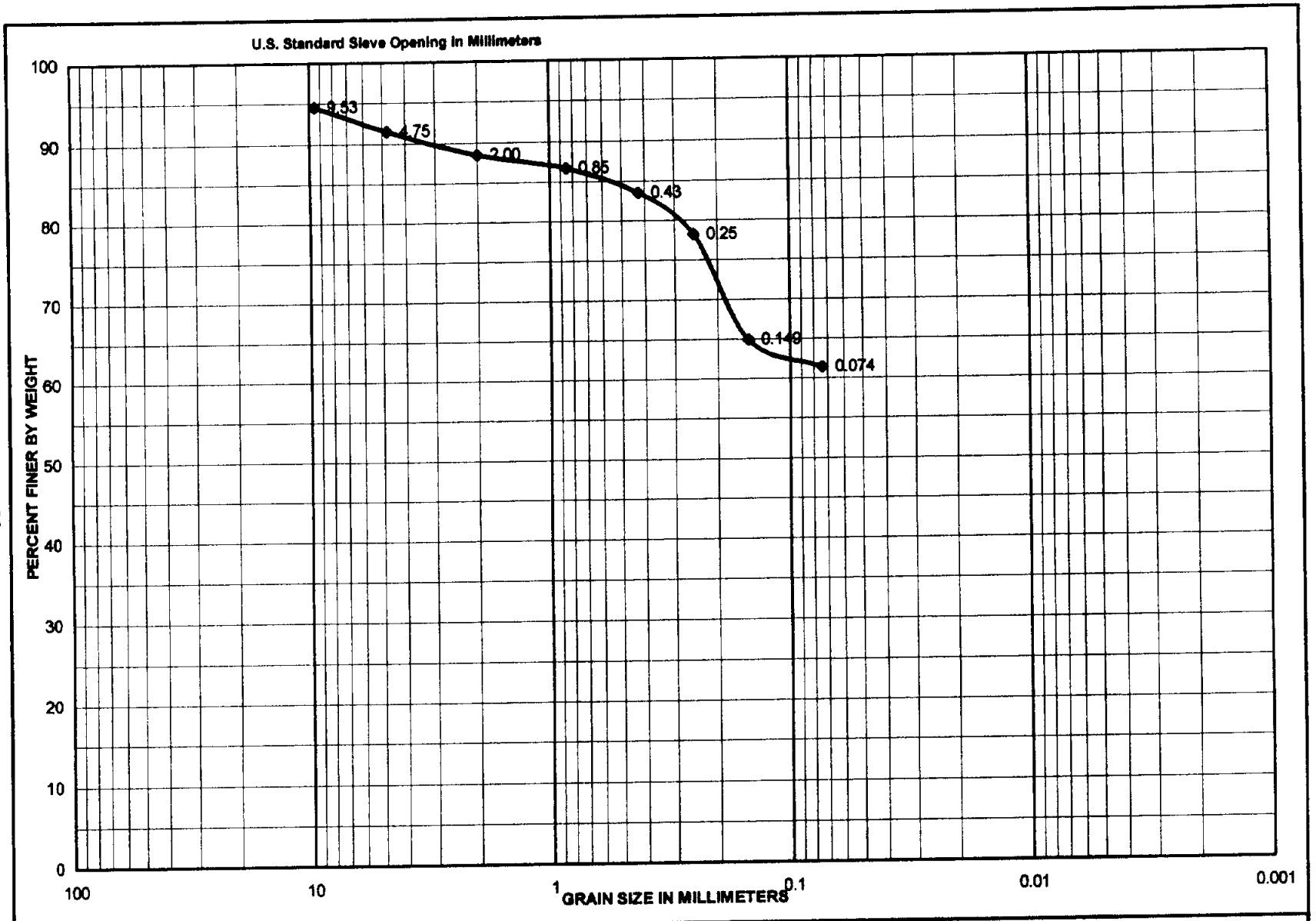
Sample No.	Depth (ft)	Classification
LL11269		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000



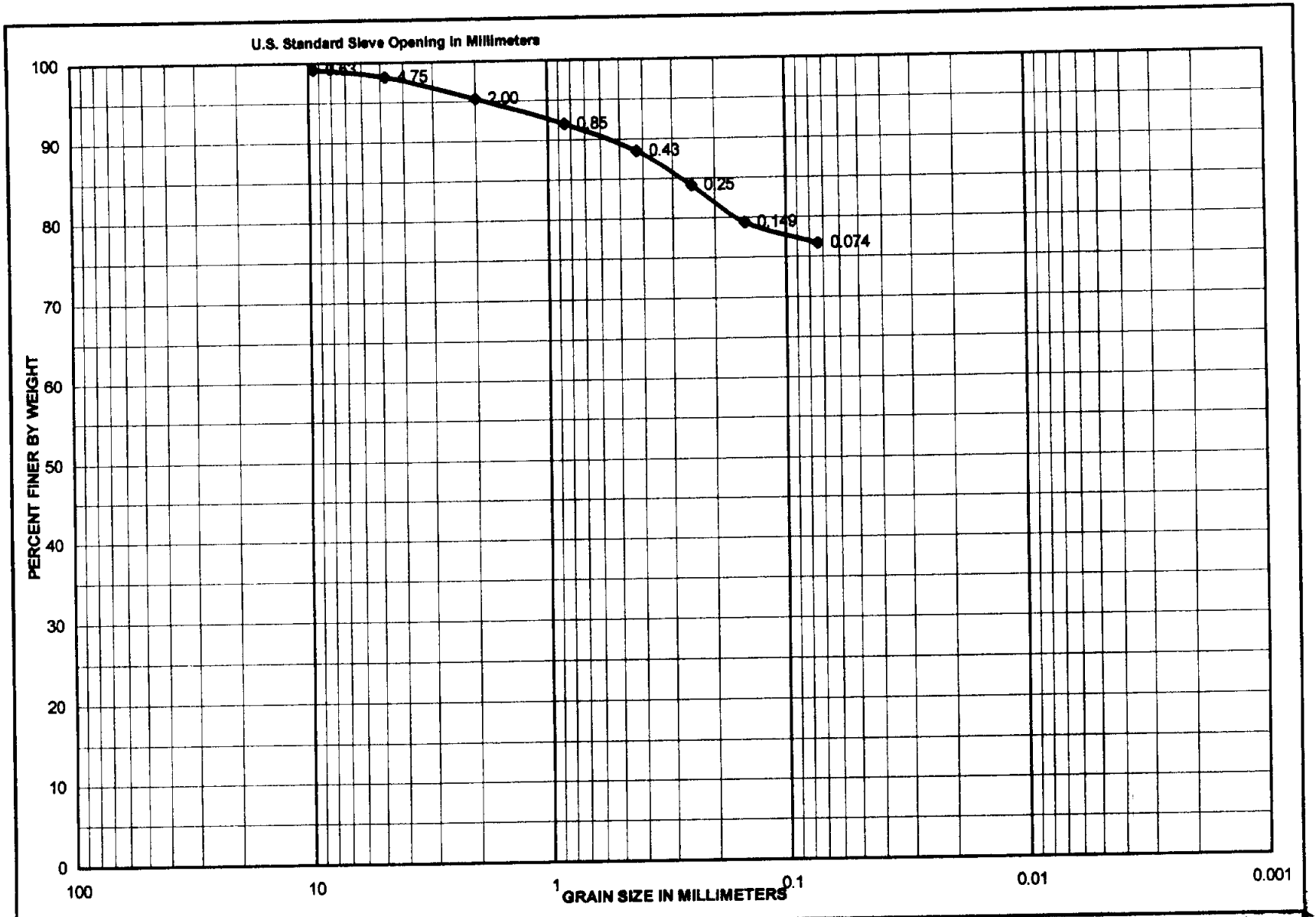
Sample No.	Depth (ft)	Classification
LL11274		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



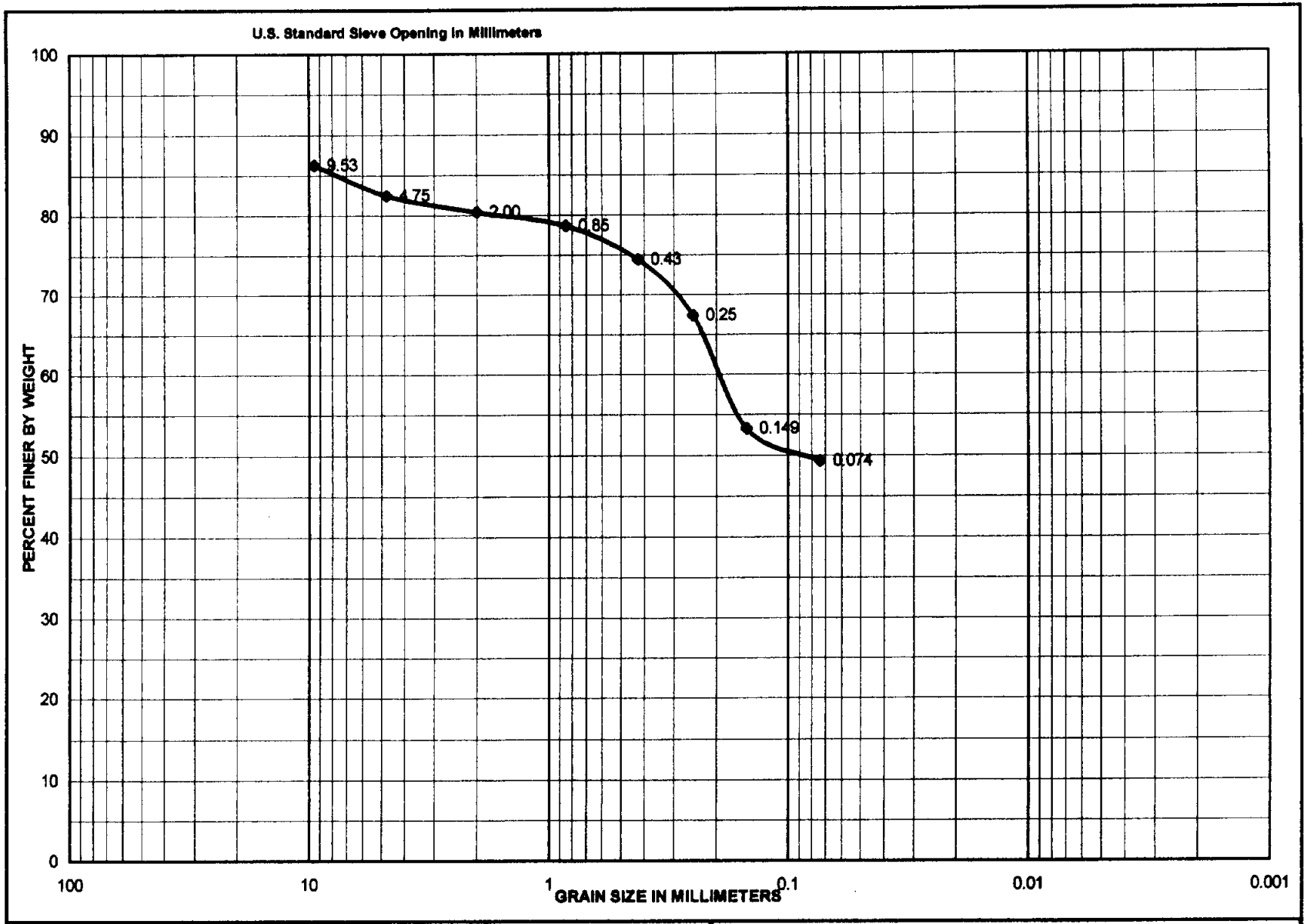
Sample No.	Depth (ft)	Classification
LL11275		

Project	SAIC
Area	Load Line 1 Phase II RI
	CATLIN Geotechnical Laboratory
	Boring No.
Date	12/18/2000

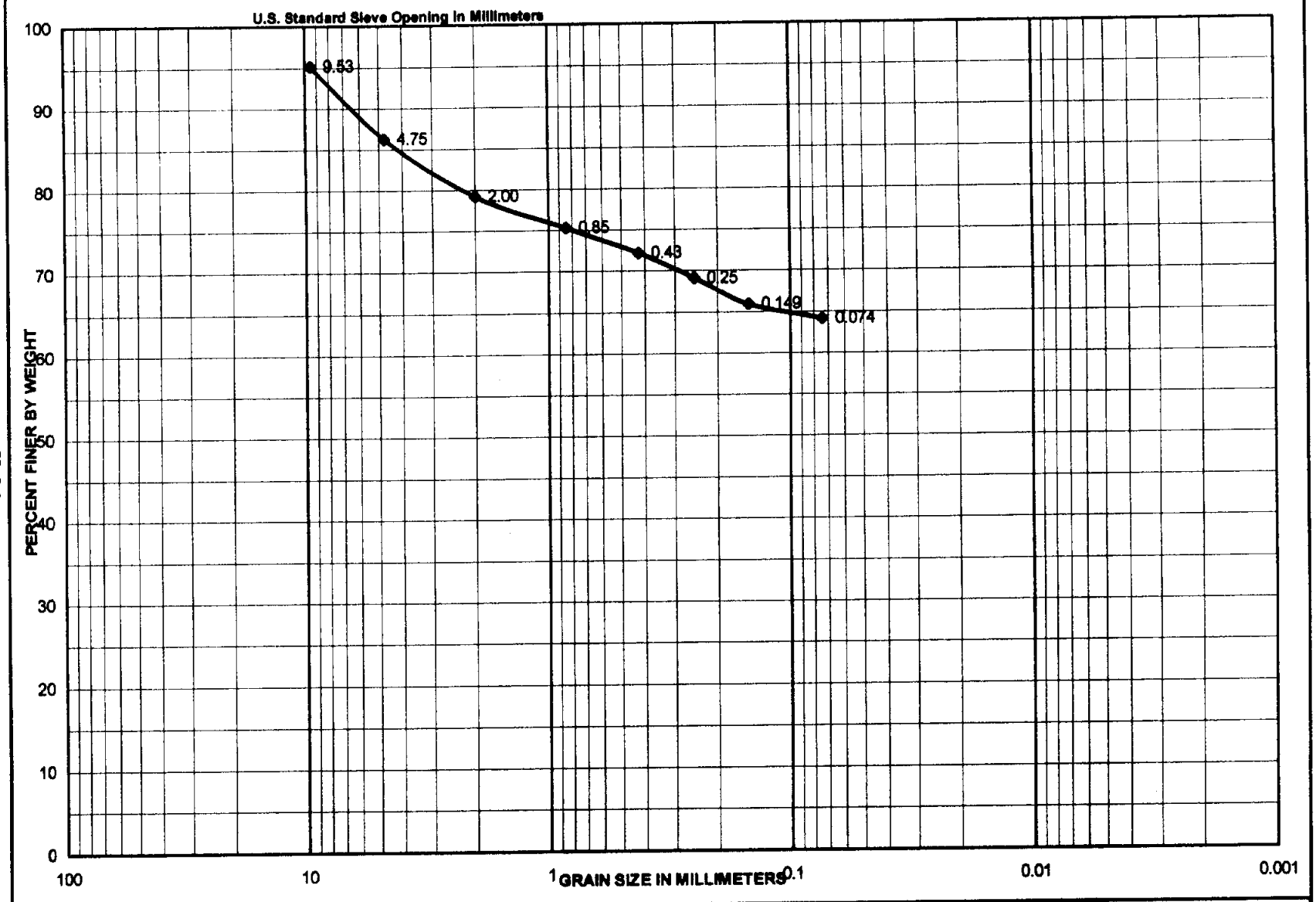


Sample No.	Depth (ft)	Classification
LL11276		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/18/2000

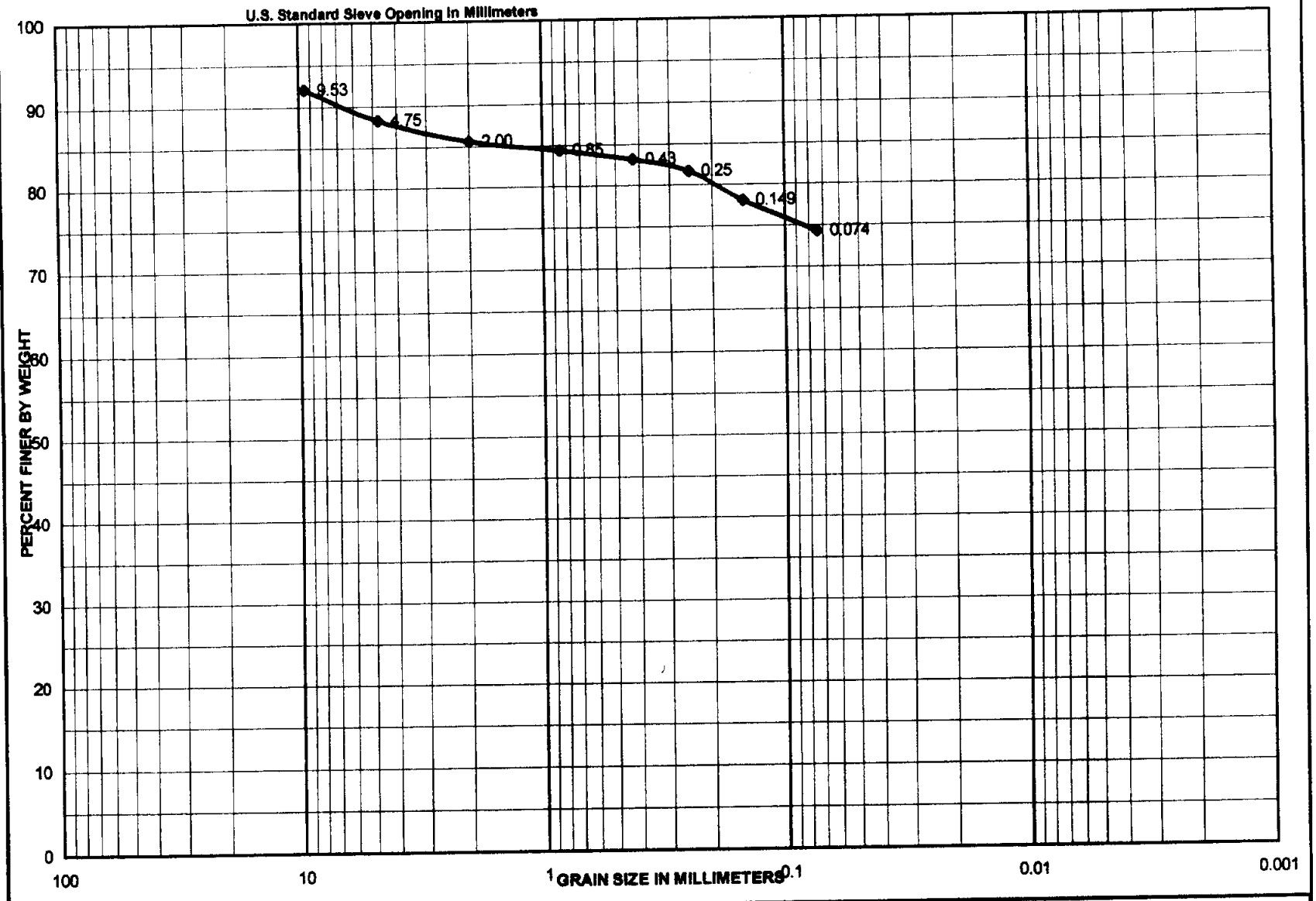


Sample No.	Depth (ft)	Classification	Project SAIC
LL11277			Area Load Line 1 Phase II RI
			CATLIN Geotechnical Laboratory
			Boring No.
			Date 12/18/2000



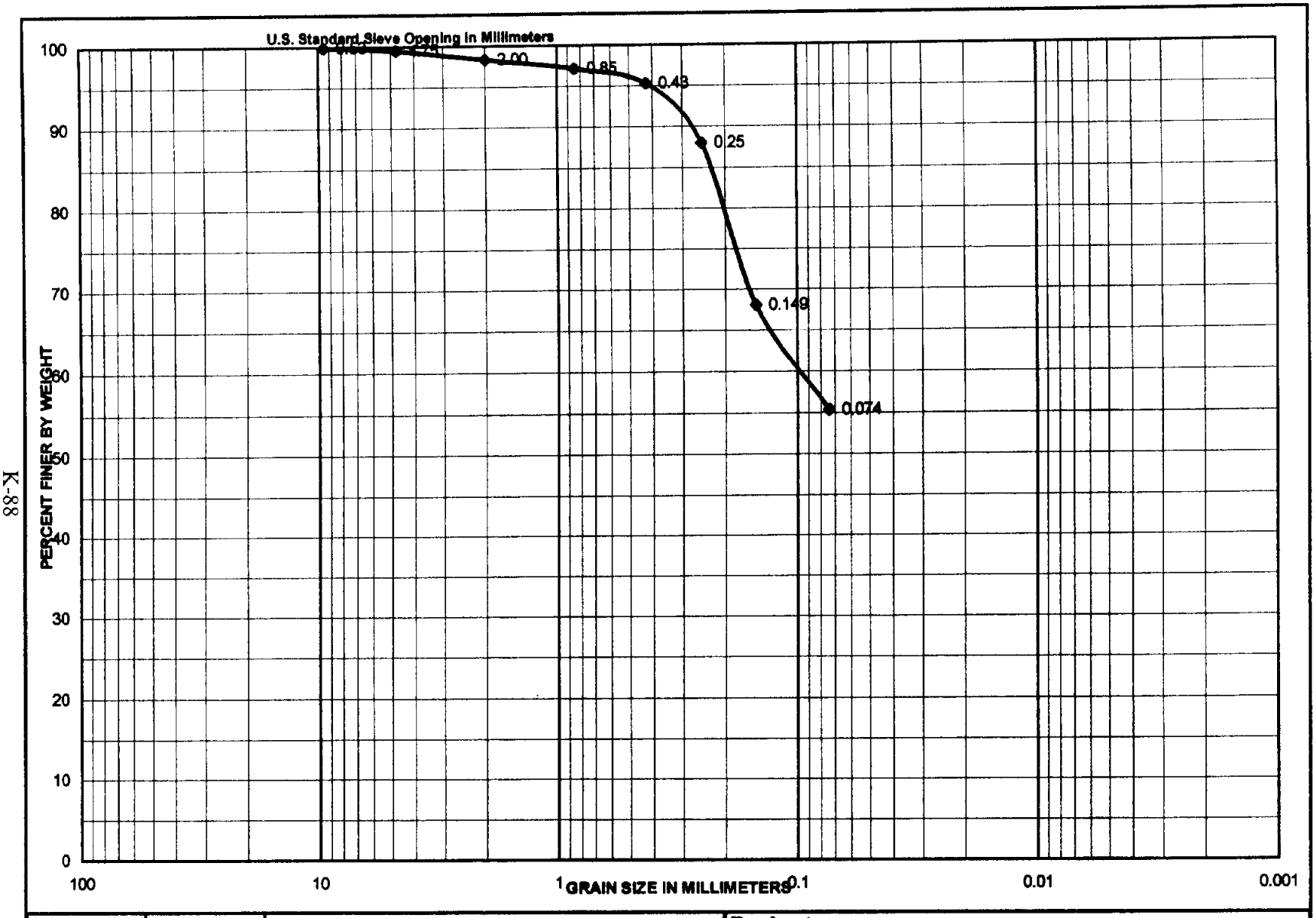
Sample No.	Depth (ft)	Classification
LL11100		

Project SAIC
Area Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory
Boring No.
Date 12/13/2000

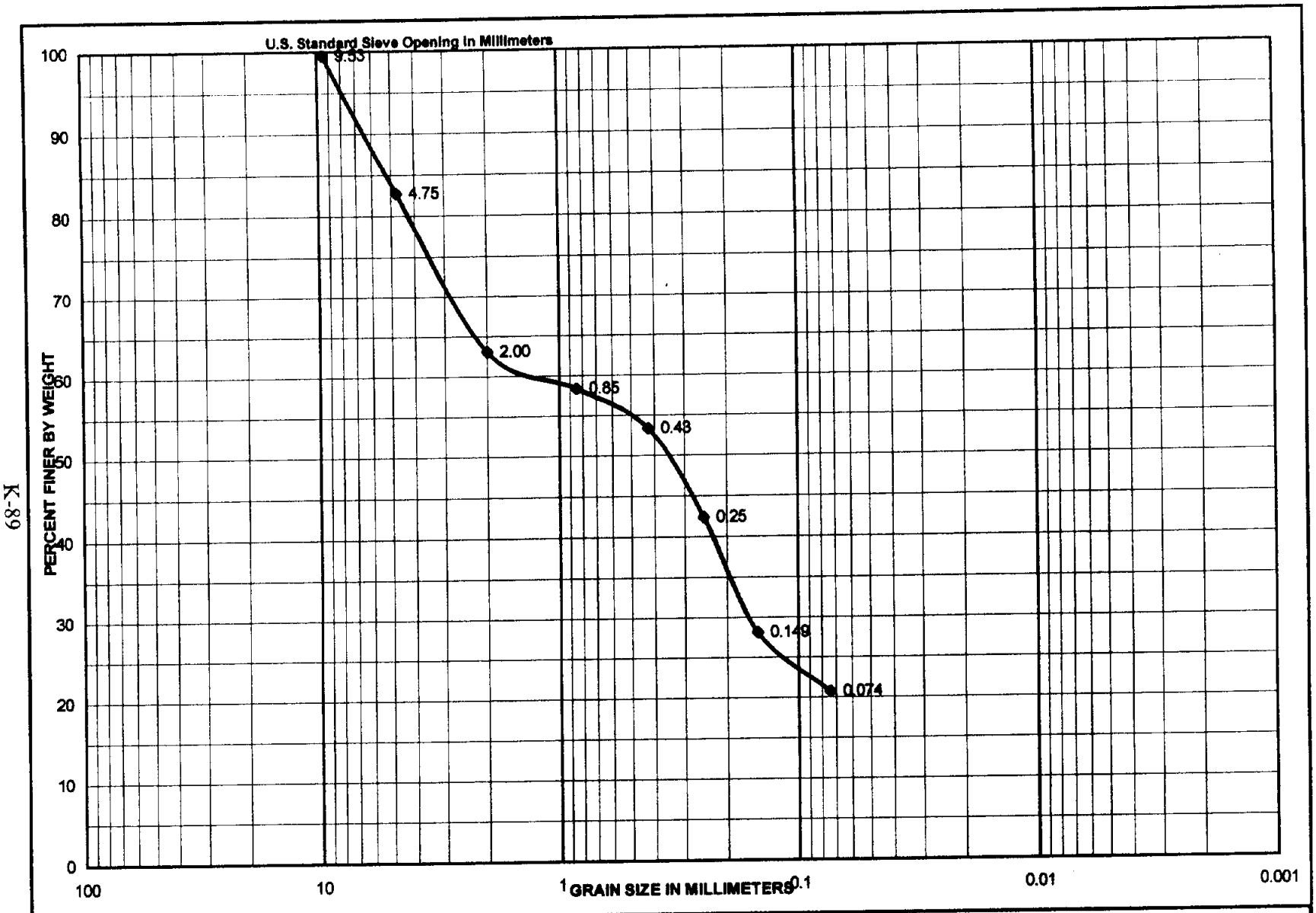


Sample No.	Depth (ft)	Classification
LL11101		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000



Sample No.	Depth (ft)	Classification	Project SAIC
LL11102			Area Load Line 1 Phase II RI
			CATLIN Geotechnical Laboratory
			Boring No.
			Date 12/13/2000



Sample No.	Depth (ft)	Classification
LL11103		

Project	SAIC
Area	Load Line 1 Phase II RI
CATLIN Geotechnical Laboratory	
Boring No.	
Date	12/13/2000

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COC NO.: LL1CE- 2
page 1 of 1

CHAIN OF CUSTODY RECORD

PROJECT NAME: Load Line 1 Phase II RI

DELIVERY ORDER NO: 0003

PROJECT MANAGER: Steve Selecman 423-481-8761

Sampler (Signature): Vicki Brumback (Printed Name): Vicki Brumback

LABORATORY NAME: Catlin Engineers

LABORATORY ADDRESS: 1051 Johnnie Dodds Blvd. Suite C Mt. Pleasant, SC 29464

PHONE NO: 803-881-6000

REQUESTED PARAMETERS

Sample ID	Date Collected	Time Collected	Matrix	Grain Size	Moisture	Atterberg Limits	USCS Classification	Bulk Density	Porosity	Hydraulic Conductivity	Specific Gravity	pH	No. of Bottles/ Vials:	OBSERVATIONS, COMMENTS,
LL11053	9-16-00	1305	~~Sediment~~ Soil	✓									1	LL1-051
LL11277	9-28-00	1311	sediment	✓									1	77' Downstream of LL1-050
LL11054	9-17-00	1600	sediment	✓									1	LL1-070
LL11276	9-28-00	1045	sediment	✓									1	70' Downstream of LL1-109
LL11049	9-17-00	0947	sediment	✓									1	LL1-047
LL11275	9-28-00	0925	sediment	✓									1	Contingency btw 050 and 049
LL11015	9-15-00	1635	sediment	✓									1	LL1-077
LL11061	9-13-00	1450	sediment	✓									1	LL1-322
LL11057	9-15-00	1041	sediment	✓									1	LL1-318
LL11052	9-16-00	1628	sediment	✓									1	LL1-050
LL11051	9-16-00	1808	sediment	✓									1	LL1-049
LL11048	9-17-00	1118	Sediment	✓									1	LL1-046
LL11016	9-16-00	1052	sediment	✓									1	LL1-286

RELINQUISHED BY: Vicki Brumback	Date/Time 10-18-00 1700	RECEIVED BY:	Date/Time	TOTAL NUMBER OF CONTAINERS: 13	Cooler Temperature:
COMPANY NAME: SAIC		COMPANY NAME:		~~Cooler ID~~: Double-lined cardboard box	FEDEX NUMBER: Airbill #: 810254671383
RECEIVED BY:	Date/Time	RELINQUISHED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time		
COMPANY NAME:		COMPANY NAME:			

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CHAIN OF CUSTODY RECORD

COC NO.: LL1CE-3
page 1 of 2

PROJECT NAME: Load Line 1 Phase II RI

DELIVERY ORDER NO: 0003

PROJECT MANAGER: Steve Selecman 423-481-8761

Sampler (Signature) (Printed Name)
Vicki Brumback Vicki Brumback

LABORATORY NAME: Catlin Engineers

LABORATORY ADDRESS: 1051 Johnnie Dodds Blvd. Suite C Mt. Pleasent, SC 29464

PHONE NO: 803-881-6000

Sample ID	Date Collected	Time Collected	Matrix	Grain Size	Moisture	Atterberg Limits	USCS Classification	Bulk Density	Porosity	Hydraulic Conductivity	Specific Gravity	pH	REQUESTED PARAMETERS	No. of Bottles/ Vials:	OBSERVATIONS, COMMENTS,
LL1 1059	9-14-00	1345	Sediment	✓										1	LL1-320
LL1 1060	9-14-00	1057	Sediment	✓										1	LL1-321
LL1 1058	9-14-00	1525	Sediment	✓										1	LL1-319
LL1 1050	9-17-00	1420	Sediment	✓										1	LL1-048
LL1 1274	9-27-00	1438	Sediment	✓										1	~37' Downstream of LL1-050
LL1 1017	9-16-00	1118	Sediment	✓										1	LL1-287
LL1 1055	9-15-00	1415	Sediment	✓										1	LL1-060
LL1 1019	9-16-00	1015	Sediment	✓										1	LL1-289
LL1 0979	9-17-00	1645	Sediment	✓										1	LL1-252
LL1 1056	9-15-00	1335	Sediment	✓										1	LL1-061
LL1 1088	9-16-00	1148	Sediment	✓										1	LL1-288
LL1 1062	9-13-00	0955	Sediment	✓										1	LL1-323
LL1 1260	9-28-00	1005	Sediment	✓										1	Contingency NE of CA-6

OBSERVATIONS, COMMENTS,

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
Vicki Brumback	10-18-00	[redacted]	[redacted]
COMPANY NAME: SAIC	1700	COMPANY NAME: [redacted]	
RECEIVED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	

TOTAL NUMBER OF CONTAINERS: See p 2 of 2

Cooler Temperature: NA

~~Cooler ID:~~ double-lined cardboard box

FEDEX NUMBER:
Airbill #: 810254671383

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COC NO.: LL1CE- 3
page 2 of 2

CHAIN OF CUSTODY RECORD

PROJECT NAME: Load Line 1 Phase II RI

DELIVERY ORDER NO: 0003

PROJECT MANAGER: Steve Selecman 423-481-8761

Sampler (Signature): Vicki Brumback (Printed Name): Vicki Brumback

REQUESTED PARAMETERS

Sample ID	Date Collected	Time Collected	Matrix	Grain Size	Moisture	Atterberg Limits	USCS Classification	Bulk Density	Porosity	Hydraulic Conductivity	Specific Gravity	pH	No. of Bottles/ Vials:	OBSERVATIONS, COMMENTS,
LL11002	9-15-00	1125	soil		✓								1	LL1-274
LL10800	9-12-00	1230	soil		✓								1	LL1-061
LL11269	9-26-00	1615	sediment	✓									1	Downstream of LL1-048
LL10862	9-13-00	0845	soil		✓								1	LL1-168

K-92

Via Ice 10-18-00

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
Vicki Brumback	10-18-00 1700		
COMPANY NAME: SAIC		COMPANY NAME:	
RECEIVED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	

TOTAL NUMBER OF CONTAINERS: 17

~~Cooler ID~~: double-lined cardboard box

LABORATORY NAME: Catlin Engineers

LABORATORY ADDRESS: 1051 Johnnie Dodds Blvd. Suite C Mt. Pleasant, SC 29464

PHONE NO: 803-881-6000

Cooler Temperature: NA

FEDEX NUMBER: Airbill #: 810254671383

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COC NO.: LL1CE- 4
page 1 of 1

CHAIN OF CUSTODY RECORD

PROJECT NAME: Load Line 1 Phase II RI

DELIVERY ORDER NO: 0003

PROJECT MANAGER: Steve Selecman 423-481-8761

Sampler (Signature): Vicki Brumback (Printed Name): Vicki Brumback

LABORATORY NAME: Catlin Engineers

LABORATORY ADDRESS: 1051 Johnnie Dodds Blvd. Suite C Mt. Pleasant, SC 29464

PHONE NO: 803-881-6000

Sample ID	Date Collected	Time Collected	Matrix	Grain Size	Moisture	Atterberg Limits	USCS Classification	Bulk Density	Porosity	Hydraulic Conductivity	Specific Gravity	pH	No. of Bottles/ Vials:	OBSERVATIONS, COMMENTS.
LL10722	9-25-00	0945	surface soil		✓								1	LL1-086
LL10895	9-29-00	1000	surface soil		✓								1	LL1-188
LL10853	9-12-00	1046	surface soil		✓								1	LL1-163
LL10893	9-11-00	1516	surface soil		✓								1	LL1-186
LL10834	9-15-00	1050	surface soil		✓								1	LL1-013
LL10882	9-17-00	1416	surface soil		✓								1	LL1-027
LL10872	9-18-00	1040	surface soil		✓	✓	✓						1	LL1-171
LL10912	9-14-00	0910	surface soil		✓	✓	✓						1	LL1-202
LL10804	9-19-00	0935	subsurface soil		✓	✓	✓						1	LL1-002
LL11229	9-29-00	1105	subsurface soil		✓	✓							1	LL1-145
LL10950	9-14-00	1315	surface soil			✓							1	LL1-231
LL10984	9-17-00	1600	surface soil			✓							1	LL1-256
LL10942	9-17-00	1545	surface soil			✓							1	LL1-226

K-63

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
Vicki Brumback	10-18-00	[redacted]	[redacted]
COMPANY NAME: SAIC	1700	COMPANY NAME: [redacted]	
RECEIVED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME: Parsons	11/30/00 1340	COMPANY NAME:	

TOTAL NUMBER OF CONTAINERS: 13

Cooler Temperature: NA

~~Cooler ID:~~ double-lined cardboard box

FEDEX NUMBER: Airbill # 810254671383

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LL1
COC NO.: CE - 5
page 1 of 1

CHAIN OF CUSTODY RECORD

PROJECT NAME: LOAD LINE I PHASE II RI

DELIVERY ORDER NO: 0003

PROJECT MANAGER: Steve Selecman 865 - 481 - 8761

Sampler (Signature): Vicki Brumback (Printed Name): Vicki Brumback

REQUESTED PARAMETERS

Sample ID	Date Collected	Time Collected	Matrix	GRAIN SIZE	No. of Containers:	OBSERVATIONS, COMMENTS.
LL1 1099	11-6-00	1619	sediment	1	1	LL1-319
LL1 1101	11-6-00	1449	sediment	1	1	LL1-321
LL1 1098	11-6-00	1721	sediment	1	1	LL1-318
LL1 1103	11-6-00	1044	sediment	1	P	LL1-323
LL1 1102	11-6-00	1229	sediment	1	1	LL1-322
LL1 1100	11-6-00	1535	sediment	1	1	LL1-320

K-94

vb 11-7-00

LABORATORY NAME: Cathlin Engineers

LABORATORY ADDRESS: 1051 Johnnie Dodds Blvd. Suite C Mt Pleasent, SC 29464

PHONE NO: 803 - 881-6000

RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
Vicki Brumback	11-7-00 1700		
COMPANY NAME: SAIC		COMPANY NAME:	
RECEIVED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:	

TOTAL NUMBER OF CONTAINERS: 6

Cooler ID: Lined cardboard box

Cooler Temperature:

FEDEX NUMBER: Airbill # 822527889058

ATTERBERG LIMITS DETERMINATION (ASTM D4318-93)

Project: Load Line 1, Phase II RI
Location of project: Ravenna Army Ammunition Plant
Description Of Soil: Brown Gray Sandy Clay
Tested By: FB

Job No.: 99146
Sample No.: LL1-MW-081
Depth of Sample: 1.0'- 2.1'
Date of Testing: 10/12/99

Liquid Limit Determination

Can No.	A19	A3	A53	A12	A1	
Wt of Soil + can, Mcws	20.50	18.49	23.55	15.86	21.21	
Wt. of dry soil + can,Mcds	19.16	17.45	21.40	14.62	19.58	
Wt. of can, Mc	15.01	15.35	14.94	11.19	15.28	
Wt. of dry soil, Ms	4.15	2.10	6.46	3.43	4.30	
Wt. of moisture	1.34	1.04	2.15	1.24	1.63	
Water content, w%	32.29	49.52	33.28	36.15	37.91	
No. of blows, N	35	10	29	18	25	

Plastic Limit Determination

Can no.	C3	C19	C22			
Wt. of wet soil + can, Mcws	5.23	2.95	5.26			
Wt. of dry soil +can, Mcds	5.06	2.74	5.10			
Wt. of can, Mc	4.31	1.85	4.27			
Wt. of dry soil, Ms	0.75	0.89	0.83			
Wt. of moisture, Mw	0.17	0.21	0.16			
Water content, W% = Wp	22.67	23.60	19.28			

LIQUID LIMIT =	36.9
PLASTIC LIMIT =	21.90
PLASTICITY INDEX =	15.00
CLASSIFICATION	CL

GRAIN SIZE ANALYSIS-SIEVE (ASTM D422)

Project: Load Line 1, Phase II RI	Job No.: 99146
Project Location: Ravenna Army Ammunition Plant	Sample No.:LL1-MW-081
Sample Description: Brown Gray Sandy Clay	Sample Depth: 1.0'- 2.1'
	Boring No.: LL1-MW-081
Tested By: FB	Date of Testing: 10/13/99

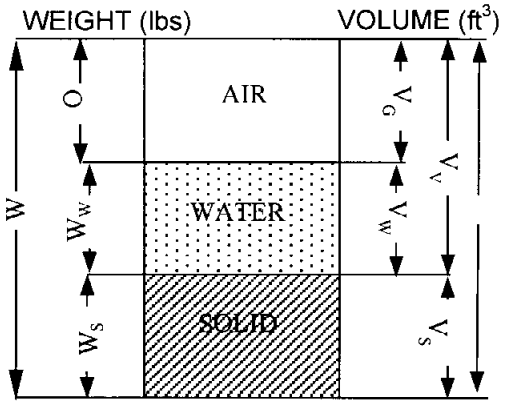
Mcws	Mcds	Mc : B7	Mw	Ms	w%	Mws	Ms
166.49	153.72	47.25	12.77	106.47	12.0	200.00	178.58

Sieve No.	Diam. (mm)	Wt. retained	% retained	E % retained	% passing
3	76.2	0	0.00	0.00	100.00
2	50.8	0	0.00	0.00	100.00
1 1/2	25.4	0	0.00	0.00	100.00
3/4	19.05	0	0.00	0.00	100.00
3/8	9.51	3	1.68	1.68	98.32
4	4.76	4.74	2.65	4.33	95.67
10	2.00	3.68	2.06	6.39	93.61
20	0.841	3.58	2.00	8.40	91.60
40	0.42	4.69	2.63	11.03	88.97
60	0.25	10.35	5.80	16.82	83.18
140	0.106	25.56	14.31	31.13	68.87
200	0.074	2.31	1.29	32.43	67.57
pan	---	0	0.00	32.43	67.57
total		54.91			

BULK DENSITY, SPECIFIC GRAVITY AND POROSITY

PROJECT: Load Line 1, Phase II RI
LOCATION OF PROJECT: Ravenna Army Ammunition Plant
DESCRIPTION OF SOIL: Brown Gray Sandy Clay (CL)
TESTED BY: FB

JOB NO.: 99146
SAMPLE NO.: LL1-MW-081
DEPTH OF SAMPLE: 1.0'- 2.1'
DATE OF TESTING: 10/13/99



W = 0.0899
$W_W = W - W_S$ = 0.0099
$W_S = Y_d * V$ = 0.080

V = 0.00071
$V_W = W_W/Y_W$ = 0.00016
$V_S = W_S/G_S*Y_W$ = 0.00048
$V_G = V - (V_S + V_W)$ = 0.00007
$V_V = V_G + V_W$ = 0.00023

MEASUREMENTS OF TUBE/CAN

HEIGHT= 0 cm
DIAMETER= 0 cm

CALCULATED VOLUME OF TUBE/CAN

V= 20.00 cm^3
0.00071 ft^3

WT. OF TUBE/CAN + WET SOIL= 40.80 g
WEIGHT OF TUBE/CAN= 0 g
WEIGHT OF WET SOIL= 40.80 g
W = 0.0899 lb

MOISTURE CONTENT

M_{CWS} = 166.49 g
M_{CDS} = 153.30 g
M_W = 13.19 g
M_C = 47.25 g
M_S = 106.05 g
w = 12.4 %

Wet Density, $Y_m = W / V$

Dry Density, $Y_d = W_s / V$ or $Y_d = Y_m / (1+ w)$

double check
$Y_d = W_s / V$
Y_d= 112.68 lbs/ft^3

$Y_d = Y_m / (1+ w)$
Y_m= 126.65 lbs/ft^3
Y_d= 112.68 lbs/ft^3

Void Ratio, $e = V_V/V_S$
e = 0.48

Porosity, $n = V_V / V$
n = 0.32

Specific Gravity = 2.65

Degree of Saturation, $S = V_W/V_V$
S = 0.70

BD81.xls

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PERMEABILITY TEST ANALYSIS (ASTM D5084)

Project : Load Line 1 , Phase II RI

Location of Project : Ravenna Army Ammo Plant

Description of Soil : Brown Gray Sandy Clay

Job # : 99146
Date of Testing: 10/12/99
Tested by: JJ
Boring # : LL1-MW-081
Sample # : LL1-MW-081
Sample Depth : 1.0'-2.1'

Sample Type (**Undisturbed** or Remolded)
Standard Proctor:
Maximim Dry Density: _____ *pcf*
Optimum Moisture Content: _____ %

% Sample Compaction: _____ %
Sample Dry Density: 0.0 *pcf*
Sample Moisture Content: _____ %
Sample Wet Density: 0.0 *pcf*

Sample Permeation:

	De-Aired Water	
% Saturation:	100	%
Cell Pressure:	56	*psi*
Lower Pressure:	51	*psi*
Upper Pressure:	50	*psi*
Gradient:	5.86	

Sample Dimensions		
	Before	After
Length (cm)	12.00	12.00
Diameter (cm)	7.20	7.25
Water Content (%)	12.40	19.10
Weight (g)	848.6*	911.8*

*** Wax on side of sample**

Constant Head Calculation:

$$K = [V(t_1,t_2)\, LR_T]/[P_B A t] \text{ (cm/sec)}$$

V(t_1,t_2) = Volume of flow from t_1 to t_2 (cm^2)
L = Length of Sample = 12.00 cm
A = Area of Sample = 40.72 cm^2
t = $t_2 - t_1$ (sec)
P_B = Bias Pressure = 1 psi x 70.37 cm/psi $_{(cm - H2O)}$ 70.37 cm
R_T = Temperature correction = 0.953

t_2 (min)	t_1 (min)	$(t_2 - t_1)*60$ (sec)	V (cm3)	$[LR_T]/[P_B A]$ (cm^{-2})	K (cm/sec)
1.5	1	30	1	3.99E-03	1.33E-04
2	1.5	30	1	3.99E-03	1.33E-04
2.5	2	30	0.7	3.99E-03	9.31E-05
3	2.5	30	0.8	3.99E-03	1.06E-04

K_{avg} = 1.2E-04 cm/sec

Note: Sample was very crumbly. Gravel found in perm sample.

P81.xls

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SPECIFIC GRAVITY OF SOIL SOLIDS (Gs) (ASTM D854-92)

Project: Load Line 1, Phase II RI	Job No.: 99146
Project Location: Ravenna Army Ammunition Plant	Sample No.: LL1-MW-081
Sample Description:Brown Gray Sandy Clay	Sample Depth: 1.0'- 2.1'
	Boring No.: LL1-MW-081
Tested By: FB	Date of Testing: 10/12/99

Test No.:	1			
Wt. of Flask, Mf	163.20			
Mass Flask + H2O @ Ta = Ma @ T a	662.10			
Temperature, Ta, oC	23.0			
Method of air removal	Vacuum			
Wt. Flask + H2O+ Soil = Mb (g)	716.0			
Temperature, Tb, oC	23.0			
Wt. Flask + H2Ob = Ma	662.10			
evap dish no.	T4			
wt of evap. dish +dry soil	338.65			
Wt. evap dish	252.20			
Wt. of dry soil = Mo (g)	86.45			
Ww = Mo + Ma - Mb	32.55			
G @ Tb = Mo/Ww	2.66			
K @ Tb	0.9993			
Gs = K * G	2.65			

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