Klaus W. Flach
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SCS, Washington, DC

United States Department of Agriculture

Soil Conservation Service

Midwest National Technical Center
Soil Mechanics Laboratory
512 South 7th Street
Lincoln, NE 68508-2919

Subject: WEPP - 1987 Cropland Samples - Soil Mechanics Tests

Date: September 7, 1988

To: John M. Laflen, Research Leader
Natl. Soil Erosion Research Laboratory
ARS, West Lafayette, IN

File code: 210-22

Eighteen samples were sent to the SCS Soil Mechanics Laboratory at Lincoln, Nebraska, for soil mechanics tests. The samples were collected during the summer of 1987.

The tests that we were scheduled to make are as follows:

1. Atterberg limits
2. Middleton dispersion ratio (modification)
3. Unconfined compressive strength
4. Direct shear at low confining pressure
5. Consolidation tests with permeability measurements
6. Pinhole test for dispersion/erodibility

The samples tested are listed on the attached form SCS-ENG-354 (Attachment A). The Atterberg limit test data are recorded on the attached forms SCS-ENG-354.

The Middleton dispersion ratio along with the SCS percent dispersion values are recorded on the attached form SCS-ENG-354 (Attachment A).

The Middleton dispersion ratio from USDA Technical Bulletin No. 178, "Properties of Soil Which Influence Soil Erosion" by H. E. Middleton is defined as the ratio, expressed in percentage, of silt and clay to the total silt and clay obtained by mechanical analyses. The gradation data for the samples are recorded on the attached form SCS-ENG-354. The size range finer than the No. 200 sieve (0.074 mm) was determined by hydrometer. The first line entry for each sample represents the total size fraction determined with a standard hydrometer analyses test using a chemical dispersing agent. The second line entry for each sample represents the size fraction by hydrometer analyses without a dispersing agent added. Refer to ASTM D4221 "Dispersive Characteristics of Clay Soil by Double Hydrometer" for the test procedure.

The entries in the percent dispersion column on the attached form SCS-ENG-354 are for the double hydrometer procedure (ASTM D4221). The column labeled

Middleton dispersion ratio is the percent passing 0.05 mm for the second line entry divided by the total percent passing 0.05 mm (first line entry).

The specific gravity of the solid fraction finer than the No. 10 size is recorded for each sample on the attached form SCS-ENG-354.

Prior to making tests for direct shear, unconfined compression, consolidation with permeability, and pinhole tests it was necessary to determine a test density. In discussion with John Laflen we agreed to make the tests at the after rain density listed in Attachment B.

Direct shear tests were made on each of the samples. The test density was the after rain density listed in Attachment B. The test specimens were flooded prior to testing. The tests were made at low normal loads of 2, 4, and 6 lb/in^2, The shear test parameters obtained represent the consolidated drained conditions. The data are reported in attachment C and are summarized in Attachment A.

Unconfined compression tests were made on each of the samples. The test specimens were molded to the after rain density. They were placed in a rubber membrane in a triaxial cell and water was percolated through the specimens for about 16 hours to saturate them. Following the saturation process, the specimens were loaded to failure. The test data are in Attachment D and are summarized as follows:

Unconfined Compression Tests

Sample No.	Soil	Test γ_d g/cm^3	W After Test %	Strain @ Failure %	Shear Strength c, lb/ft^2
88C89	Abilene	1.50	16.5	1.3	190
88C90	Academy	1.61	17.0	1.7	180
88C91	Barnes	1.14	26.6	1.0	190
88C92	Barnes	1.20	31.8	2.0	215
88C93	Heiden	0.99	36.5	5.0	250
88C94	Hirsh	1.43	19.7	1.3	135
88C95	Keith	1.32	28.2	2.0	230
88C96	Los Banos	1.0		11.0	280
88C97	Pierre	1.05	39.6	4.0	350
88C98	Palouse	1.15	31.3	6.0	285
88C99	Portneuf	1.25	31.7	4.0	315
88C100	Sharpsburg	1.14	35.8	4.0	225
88C101	Sverdrup	1.46	20.3	1.5	190
88C102	Walla Walla	1.25	32.6	2.0	280
88C103	Whitney	1.54	15.6	2.0	200
88C104	Williams	1.16	29.0	1.0	190
88C105	Woodward	1.41	25.0	2.0	260
88C106	Zahl	1.25	27.5	3.0	240

Consolidation Tests

Consolidation tests were made on all samples. The test specimens were made to the after rain density in the consolidometer. Prior to loading, the samples were flooded. The first test on each sample was made by loading to 500 lb/ft^2, 1,000 lb/ft^2, 2,000 lb/ft^2, 4,000 lb/ft^2, and 8,000 lb/ft^2. Permeability measurements were made at 2,000 lb/ft^2, 4,000 lb/ft^2, and at 8,000 lb/ft^2 loads. When we looked at the consolidation and permeability test data from these tests, we found that the permeability versus void ratio relationship could not be projected back to estimate the permeability at placement void ratio because too much volume change had occurred on most of the samples. Additional tests were then made in which the loading sequence was 100 lb/ft^2, 500 lb/ft^2, 1,000 lb/ft^2, and 2,000 lb/ft^2 with permeability measurements made at each load. The consolidation test data are reported in Attachment E. The data are reported as void ratio versus consolidating pressure and percent consolidation versus consolidating pressure.

The following is a summary of the percent consolidation versus load. Eleven of the 18 samples were tested twice. The first test was made with the loading sequence started at 0.5 ksf and with doubling load increments thru 8 ksf. The second test was made with the load starting at 0.1 ksf and with load increments thru 2 ksf. For 6 of the 11 samples on which two tests were made, the percent consolidation versus load for the .5, 1.0, and 2.0 ksf loads were very close to the same. On the other 5 of 11 samples where two tests were made there were some fairly large differences in the amount of consolidation under the same load between the two tests. The same procedure was used to prepare the specimens for each test and the test density was very close to the same so the difference is likely due to different size of voids in the two specimens due to slightly different aggregation.

Sample No.	Test γ_d		Percent Consolidation Under These Loads (ksf)						
	lb/ft^3	g/cm^3	.1	.25	.5	1.0	2.0	4.0	8.0
88C89 Abilene	93.6	1.50			6.04	7.55	9.33	10.98	12.47
88C90 Academy	100	1.60			8.55	10.9	12.9	15.1	17.2
88C91 Barnes	71.7	1.15			20.3	24.6	27.9	31.3	34.8
	71.2	1.14	12.4	17.9	21.0	24.5	27.8		
88C92 Barnes	75.0	1.20			8.2	12.5	16.8	19.5	24.5
	74.9	1.20	4.2		14.0	17.9	22.1		
	74.9	1.20	6.2		13.2	18.0	21.7		
88C93 Heiden	61.9	0.99			19.3	25.6	31.2	35.5	39.1
	61.8	0.99	2.0		15.9	22.8	28.5		
88C94 Hirsh	86.7	1.39			12.0	13.6	15.2	16.7	18.1
	86.8	1.39	11.6		15.4	17.6	19.2		
	86.8	1.39	17.0		20.0	21.4	22.7		

Sample No.	Test γ_d		Percent Consolidation Under These Loads (ksf)						
	lb/ft³	g/cm³	.1	.25	.5	1.0	2.0	4.0	8.0
88C95 Keith	82.4	1.32			8.3	12.5	15.9	18.9	22.2
	82.4	1.32	-.5		6.7	10.9	14.7		
88C96 Los Banos	62.4	1.0			22.3	25.7	30.5	34.8	39.0
	62.4	1.0	9.5		22.8	27.4	31.7		
88C97 Pierre	65.6	1.05			12.1	16.4	22.5	28.0	33.1
			-.6		12.0	18.0	23.2		
88C98 Palouse	71.8	1.15	14.8		21.2	24.0	26.8		
88C99 Portneuf	78.0	1.25			4.3	7.8	11.0	14.6	18.3
88C100 Sharpsburg	71.2	1.14			8.9	13.5	17.9	22.1	26.7
	71.2	1.14	-.05		11.5	16.3	21.0		
88C101 Sverdrup	91.1	1.46			10.1	13.4	16.2	18.3	20.7
	91.1	1.46	1.3		10.1	13.5	16.6		
88C102 Walla Walla	78.0	1.25			4.4	7.5	10.5	13.6	17.0
88C103 Whitney	96.1	1.54			13.4	15.1	16.9	18.8	20.9
	96.1	1.54	-.6		12.5	13.8	15.0		
88C104 Williams	72.4	1.16			17.9	21.9	26.2	29.8	33.4
			4.9		17.9	22.0	25.5		
88C105 Woodward	88.0	1.41			5.0	8.8	11.7	14.7	17.6
88C106 Zahl	78	1.25			10.4	15.2	18.6	23.2	27.2
	78	1.25	5.2		14.8	18.6	21.9		

Permeability

Permeability tests were made on the consolidation test specimens during the consolidation test. The consolidation test specimens were placed at or near the after rain density and flooded prior to the test. Following consolidation under a given load, a falling head permeability test was made. The procedure used is similar to that described in the Canadian Geotechnical Journal, Vol. 20, No. 4, November 1983, "The Permeability of Natural Soft Clays. Part I: Methods of Laboratory Measurement.

Permeability measurements made at different void ratios are plotted as void ratio e versus the log of permeability coefficient k. From this plot the permeability at the initial void ratio of the specimen can be determined. Part II: Permeability Characteristics in the above referenced paper states that the e versus log k relationship are linear for volumetric strains of from 0 - 20% and that beyond

20% a more or less curvature occurs indicating a faster reduction in permeability with void ratio. Eleven of the first consolidation test specimens had more than 20% consolidation so additional test with a lesser loading along with permeability measurements were made to provide the basis for estimating permeability at the after rain density. The e versus log k data are in Attachment F.

The estimated permeability at the after rain density for each of the samples are as follows:

Sample No.	After Rain γ_d, g/cm³	Test γ_d g/cm³	k (ft/day)
88C89 Abilene		1.5	15
88C90 Academy	1.61	1.6	0.8
88C91 Barnes, MN		1.15	8
88C92 Barnes, ND	1.20	1.20	3.5
88C93 Heiden	.99	0.99	3
88C94 Hirsh	1.43	1.39	10
88C95 Keith	1.32	1.32	0.6
88C96 Los Banos	1.0	1.0	10
88C97 Pierre	1.05	1.05	1.0
88C98 Palouse	1.15	1.15	1.0
88C99 Portneuf	1.25	1.25	0.3
88C100 Sharpsburg		1.14 (tilled)	6.0
88C101 Sverdrup	1.46	1.46	5.0
88C102 Walla Walla		1.25	0.3
88C103 Whitney	1.54	1.54	0.9
88C104 Williams	1.16	1.16	10.0
88C105 Woodward	1.41	1.41	2.0
88C106 Zahl	1.25	1.25	2.0

Critical Shear Stress

The pinhole test procedure was modified to provide a basis for estimating critical shear. This was done by making flow through quantity measurements starting at a head of ½ inch and then increasing the head slightly in increments. Critical shear stress was assumed to be the point at which erosion of particles started to enlarge the preformed hole. This point was judged by comparing measured rates of flow through under a given head to the computed curve of flow through versus preformed hole diameter.

The first trial for each sample was made at the after rain density and then two more trials were made to determine if we could measure differences in critical shear stress with a change in soil density.

The values of critical shear stress estimated by this method for three different placement densities are as follows:

Sample No.	Soil Series	TRIAL 1		TRIAL 2		TRIAL 3	
		γ_d g/cm³	Crit. Shear N/m²	γ_d g/cm³	Crit. Shear N/m²	γ_d g/cm³	Crit. Shear N/m²
88C89	Abilene	1.50	0.94	1.60	1.29	1.70	1.20
88C90	Academy	1.61	4.19	1.60	1.78	1.70	3.47
88C91	Barnes, MN	1.14	12.03	1.05	3.56	1.07	1.01
88C92	Barnes, ND	1.20	2.08	1.05	0.95	1.25	2.94
88C93	Heiden	0.99	10.76	0.85	10.63	0.75	3.46
88C94	Hirsh	1.43	1.16	1.60	0.66	1.70	0.59
88C95	Keith	1.32	0.73	1.40	2.52	1.50	1.89
88C96	Los Banos	1.00	10.52	0.85	7.78	0.75	6.44
88C97	Pierre	1.05	No erosion	0.90	No erosion	0.75	12.84
88C98	Palouse	1.15	12.93	1.00	0.88	1.07	2.27
88C99	Portneuf	1.25	1.45	1.35	2.46	1.50	2.06
88C100	Sharpsburg	1.14	2.86	1.20	6.81	1.10	8.02
88C101	Sverdrup	1.46	4.94	1.55	4.17	1.40	3.18
88C102	Walla Walla	1.25	1.84	1.40	1.00	1.50	4.36
88C103	Whitney	1.54	1.03	1.65	0.71	1.70	3.08
88C104	Williams	1.16	14.15	1.05	12.73	0.90	4.96
88C105	Woodward	1.41	0.92	1.60	1.29	1.70	1.24
88C106	Zahl	1.25	5.19	1.35	7.56	1.15	3.82

Effect of Conductivity of Eroding Water on Critical Shear Stress

Four samples were selected for testing with water that was made up to approximate the conductivity of the water that was used for the field trial. The samples selected were fine grained soils. Three of the samples selected had low values for critical shear stress as determined by the laboratory method presented in this report and one had a fairly high value for critical shear stress. These tests were made at the after rain density.

The comparison of critical shear stress for the two types of eroding water are as follows:

Sample	Critical Shear Stress N/m² Distilled Water	Critical Shear Stress N/m² Field Trial Water Equivalent
Barnes, ND, 88C92	2.08	5.7
Keith, 88C95	0.73	21.3
Los Banos, 88C96	10.5	13.2
Woodward, 88C105	0.92	No erosion

We didn't check the effect of eroding water on any of the nonplastic sandy samples nor more than one of the fine grained soils that showed good erosion resistance because for each of these groups we thought the effect of water conductivity on erosion in this test might be small.

The tests on the Keith soil and the Woodward soil show a significant effect of conductivity of the eroding water on the susceptibility of erosion by this test.

The data sheets for each trial and the explanation of how the conductivity of field trial water was approximated are included in Appendix G.

Lorn P. Dunnigan

LORN P. DUNNIGAN
Head, Soil Mechanics Laboratory

Enclosure

cc: w/encl.
Walter J. Rawls, Hydrologist, Hydrology Laboratory, Beltsville Agricultural Research Center, Beltsville, MD
John Gilley, ARS, University of Nebraska, East Campus, Lincoln, NE
Leonard Lane, ARS, Tucson, AZ
E. Eugene Alberts, Watershed Research Unit, University of Missouri, Columbia, MO
David L. Schertz, National Agronomist, Ecological Sciences Division, SCS, Washington, DC
Klaus W. Flach, Special Asst. Science & Technology, SCS, Washington, DC
James R. Talbot, Natl. Soil Engineer, Engineering Division, SCS, Washington, DC
C. Steven Holzhey, Asst. Director, Soil Survey Division, SCS, Lincoln, NE

Forms SCS-ENG-354, Soil Mechanics Laboratory Data

Attachment A

SCS-ENG-354
Rev. 3-70
File Code ENG-13-18

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY DATA
Sheet 1 of 3

2/22/88 Laboratory Sample Number	Field Number	Location and Description	Depth	Field Classification	Mechanical Analysis: Grain Size Distribution Expressed as Percent Finer by Dry Weight Fines 0.002 mm	0.005	0.02	0.05	#200 0.074	Sand #140 0.105	#80 0.250	#40 0.42	#20 .84	#10 2.0	#4 4.76	Gravel 3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 25.4	1 1/2" 38.1	3" 76.2 mm	Atterberg Limits LL	PI	Unified Classification	Soluble Salts %	SCS Dispersion %	Moisture - Density Relationships ☐ Standard ☐ Modified Curve No	Max γd pcf	wo %	Undisturbed Sample Data γd g/cc	wn %	Gs	Middleton Dispersion Ratio	Special Tests Direct Shear φ deg	c psf		
88C		WEPP Soil Samples																																			
89		Abilene -- Texas M. Bag		*	7	7	9	22	29	39	81	98	100									Non-Plastic		SM		0						2.63	79	23	50		
						0	3	9	23	34	76	97	100																								
90		Academy -- Fresno, CA M. Bag		*	9	11	21	39	48	56	79	90	74	94	94	96	96	100				Non-Plastic		SM		27						2.75	92	34	0		
					0	3	10	25	41	49	70	81	89	94	94	96	96	100																			
91		Barnes -- Morris, MN M. Bag		*	18	19	31	50	61	67	85	92	97	100								26	9	CL		0						2.61	49	33	0		
						0	3	20	30	39	70	87	97	100																							
92		Barnes -- McClusky, ND M. Bag		*	22	25	37	51	62	70	88	94	98	100								31	12	CL		0						2.55	52	30	0		
						0	1	17	32	42	77	92	98	100																							
93		Heiden -- Waco, TX M. Bag		*	52	69	85	95	100													52	37	CH		0						2.6	13	33	0		
						-	0	5	13	15	23	35	62	100																							
94		Hirsh -- Ord, NE M. Bag		*	6	6	6	16	33	41	74	94	100									Non-Plastic		SM		0						2.63	76	28	0		
							0	4	25	34	69	93	100																								
95		Keith -- Albin, WY M. Bag		*	20	22	28	55	82	96	99	100										32	13	CL		0						2.59	83	31	0		
						0	9	32	68	84	94	97	99	100																							
96		Los Banos -- Fresno, CA M. Bag		*	43	48	62	80	92	96	99	100										46	25	CL		0						2.61	48	30	40		
						0	7	29.	44	56	86	95	98	100																							

* = GRADATION WITH THE USE OF DISPERSING AGENT

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SOIL MECHANICS
LABORATORY DATA
Sheet 2 of 3

2/22/88

Laboratory Sample Number	Field Number	Location and Description	Depth	Field Classification	Fines 0.002 mm	Fines 0.005	Fines 0.02	Fines 0.05	Fines #200 0.074	Sand #140 0.105	Sand #80 0.250	Sand #40 0.42	Sand #20 0.84	Sand #10 2.0	Sand #4 4.76	Gravel 3/8" 9.525	Gravel 1/2" 12.7	Gravel 3/4" 19.05	Gravel 1" 25.4	Gravel 1 1/2" 38.1	Gravel 3" 76.2 mm	Atterberg Limits LL	Atterberg Limits PI	Unified Classification	Soluble Salts %	SCS Dispersion %	Moisture-Density Relationships ☐ Standard ☐ Modified: Curve No.	Max. γ_d pcf	w_o %	Undisturbed Sample Data γ_d g/cc	w_n %	G_s	Special Tests: Middleton Dispersion Ratio	Direct Shear ϕ deg	Direct Shear $\bar{c}$ psf
88C		WEPP Soil Samples																																	
97		Pierre -- Cottonwood, SD M. Bag		*	47	54	66	85	95	96	98	99	100									52	32	CH		0						2.71	13	32	0
							0	11	22	28	55	79	97	100																					
98		Palouse -- Pullman, WA M. Bag		*	23	25	50	86	100													31	13	CL		0						2.64	30	31	25
						0	6	26	51	57	78	95	100																						
99		Portneuf -- Kimberly, ID M. Bag		*	10	12	37	80	99	100												28	4	CL-ML		0						2.66	63	18	100
						0	11	50	72	77	84	88	93	100																					
100		Sharpsburg -- Lincoln, NE M. Bag		*	41	45	63	91	100													49	30	CL		0						2.63	37	34	0
						0	9	34	49	54	75	90	99	100																					
101		Sverdrup -- Morris, MN M. Bag		*	11	11	15	20	25	27	48	72	75	100								25	9	SC		0						2.63	35	27	0
							0	7	17	19	40	65	75	100																					
102		Walla Walla -- Pullman, WA		*	12	17	41	80	98	99	100											28	4	CL-ML		0						2.65	68	30	0
		M. Bag				0	15	54	81	87	96	99	100																						
103		Whitney -- Fresno, CA M. Bag		*	8	9	12	22	30	36	58	75	92	100								Non-Plastic		SM		0						2.67	55	31	0
						0	4	12	27	34	58	76	91	100																					
104		Williams -- McClusky, ND M. Bag		*	25	29	41	55	65	70	84	91	95	97	98	100						37	19	CL		0						2.59	11	31	0
							0	6	24	29	57	81	74	97	98	100																			

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS
LABORATORY DATA
Sheet 3 of 3

Laboratory Sample Number	Field Number	Location and Description	Depth	Field Classification	Mechanical Analysis Grain Size Distribution Expressed as Percent Finer by Dry Weight																	Atterberg Limits		Unified Classification	Soluble Salts %	SCS Dispersion %	Moisture - Density Relationships ☐ Standard ☐ Modified			Undisturbed Sample Data		G_s	Middle Dispersion Ratio	Special Tests			
					Fines					Sand							Gravel																	Direct Shear			
					.002 mm	.005	.02	.05	#200 0.074	#140 0.105	#80 0.250	#40 0.42	#20 0.84	#10 2.0	#4 4.76	3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 25.4	1 1/2" 38.1	3" 76.2 mm	LL	PI				Curve No.	Max. γ_d pcf	w_o %	γ_d g/cc	w_n %			$\bar{\phi}$ deg	$\bar{c}$ psf		
2/22/88 88C		WEPP Soil Samples																																			
105		Woodward -- Oklahoma M. Bag		*	13	14	20	49	79	93	99	100										25	7	CL-ML		0						2.61	69	30	0		
						0	4	34	64	83	98	99	100																								
106		Zahl -- North Dakota M. Bag		*	23	27	35	47	62	68	86	91	93	94	96	97	97	100				31	13	CL								2.58	23	27	50		
						0	1	11	25	28	66	85	92	94	96	97	97	100								0											

Attachment B

Letter to C. S. Holzhey from Walter J. Rawls

Attachment B

United States
Department of
Agriculture

Agricultural
Research
Service

Beltsville Area
Beltsville Agricultural
Research Center

Beltsville, Maryland
20705

March 2, 1988

Dr. C. S. Holzhey, SCS
Federal Bldg, Rm 345
100 Centennial Mall N.
Lincoln, NE 68508-3866

Dear Dr. Holzhey:

Enclosed are the bulk density summaries for the WEPP soils ~~you needed~~ for the SCS Soil Mechanics Lab tests. Because of the variability ~~of the~~ tilled bulk density (standard deviation of ± 0.2 gm/cm^3), I recommend ~~that the~~ beginning bulk density be about 15 percent less than the reported tilled bulk density and the maximum bulk density be about 25 percent more than the reported 1/3 bar bulk density. For the range soils I would set the range at ± 25 percent of the 1/3 bar bulk density. I believe these ranges will cover the expected bulk density changes which can occur in the field.

As we discussed at the WEPP meeting, it would be useful if the same conditions and bulk densities the Soil Mechanics Lab uses to run their hydraulic conductivity tests could be used by your lab to determine the 1/3 bar water retention value. Also, if possible, it would be good if for 3 or 4 of the bulk densities the 0.1 bar water retention value could be determined. The water retention data will be useful in testing Ahuja's hydraulic conductivity concepts and would give us a check as to what the sample preparation does to the hydraulic properties of the soil.

I am very excited about the soil data we are compiling. It should help us to better model soil hydraulic properties.

Sincerely,

Walter

WALTER J. RAWLS
Hydrologist
Hydrology Laboratory

Enclosures

MAR 7 1988

John Laflen · FTS - 284-8673

on 4-4-88 - John Laflen suggested after rain δd for our tests

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WEPP Agricultural Soils

Soil Series	Bulk Density (g/cm³) 1/3 bar	Dry	Tilled	After Rain
8C 100 Sharpsburg	1.28	1.64	1.14	
94 Hersh	1.65	1.70	1.14	1.43
95 Keith	1.48	1.56	.85	1.32
Amarillo	1.69	1.74	.97	1.55
105 Woodward	1.37	1.46	.86	1.41
93 Heiden	1.38	1.80	.66	.99
103 Whitney	1.80	1.82	1.37	1.54
Academy	1.80	1.90	1.35	1.61
96 Los Banos	1.36	1.74	.87	1.00
99 Portneuf	1.33	1 38	.93	1.25
Sagemore	1.40	1 41	.96	1.38
98 Palouse	1.25	1.29	1 00	1.15
106 Zahl	1.50	1.65	1 06	1.25
97 Pierre	1.28	1.51	.88	1.05
104 Williams	1 45	1.62	.90	1.16
92 Barnes ND	1 35	1.50	.93	1.20
101 Sverdrup	1.60	1.67	1.25	1.46
91 Barnes MN	1.45	1.59	1.01	1.14

BULK DENSITY SUMMARY (g/cc3)
1987 19

WEPP Rangeland Soils

		MOISTURE CONDITION											Bulk Density g/cm3	
		BEFORE DRY						AFTER V. WET						
		AREA						AREA						
Soil Series ~~BULKDN~~ ~~MEAN~~	LOCATION	BURN85	BURN87	INTERSPACE AREA	OPEN AREA	SMALL PLOT	UNDER CANOPY	BURN87	LARGE BARE	CHANNEL ON L.B.	SMALL COVERED	SMALL UNCOVERED	1/3 Bar	Oven Dry
Stronghold	A1	.	.	1.48	.	.	1.32	.	1.47	1.65	.	1.75	1.77	1.90
Forrest	A2	.	.	1.35	.	.	.	.	1.46	.	.	.	1.60	1.67
Durorthid	B1	.	.	1.00	.	.	1.25	.	1.50	1.48	1.57	1.48	1.55	1.68
Nat Desa Butte Id	B2	.	.	1.74	- .	.	1.48	.	1.44	1.20	1.89	1.81		
Grant	D1	.	.	.	.	1.40	1.27	.	1.33	.	1.54	1.54	1.41	1.49
Grant Erroded	D2	.	.	.	.	1.42	1.39	.	1.34	.	1.47	1.61	1.48	1.53
Pratt	E1	.	.	.	.	1.38	1.39	.	1.50	1.63	1.52	1.40	1.53	1.53
vinlan	E2	.	.	.	.	1.27	1.42	.	1.39	.	.	1.54	1.38	1.46
Vida	F1	.	.	.	.	1.30	.	.	1.23	.	1.83	1.48	1.29	1.43
Pierre	H1	.	.	.	.	1.19	1.54	.	1.33	.	1.40	.	1.28	1.81
Pierre	H2	.	.	.	.	1.37	.	.	1.17	.	1.52	1.57		
Hackrox	I1	.	.	.	.	1.42	.	.	1.40	.	1.43	1.49	1.39	1.44
Querencia	J1	.	.	.	.	1.55	.	.	1.47	.	.	1.55	1.31	1.39
Jauriga	K1	.	.	.	1.24	1.25	1.03	.	0.93	.	[illegible]	[illegible]	1.25	1.37
Jauriga	K2	0.94	1.05	.	.	.	.	1.35	.	.	.	.		

Attachment C

Direct Shear Test Data

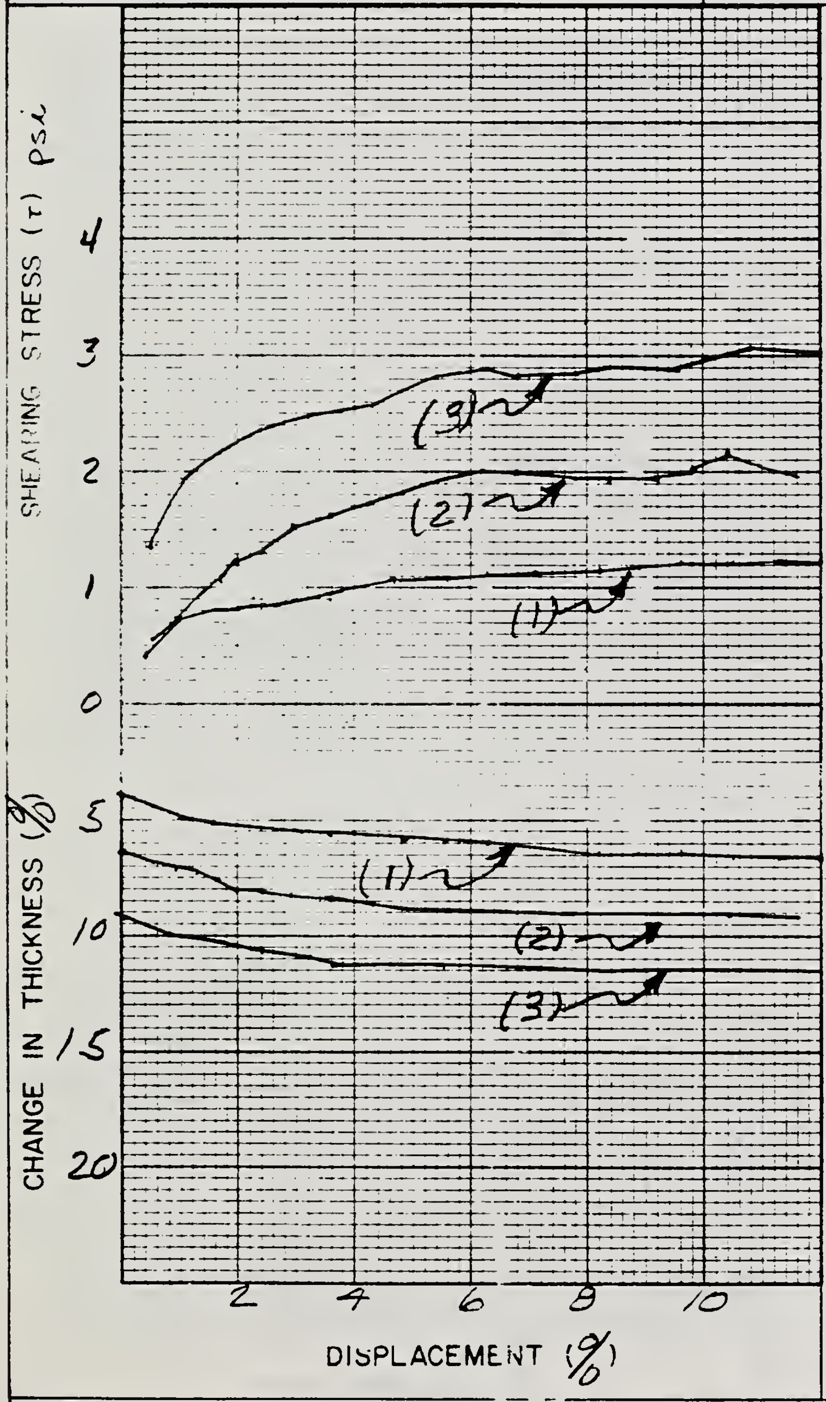
Form SCS 366
9-64

LABORATORY NO 88C89

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	**DIRECT SHEAR TEST**

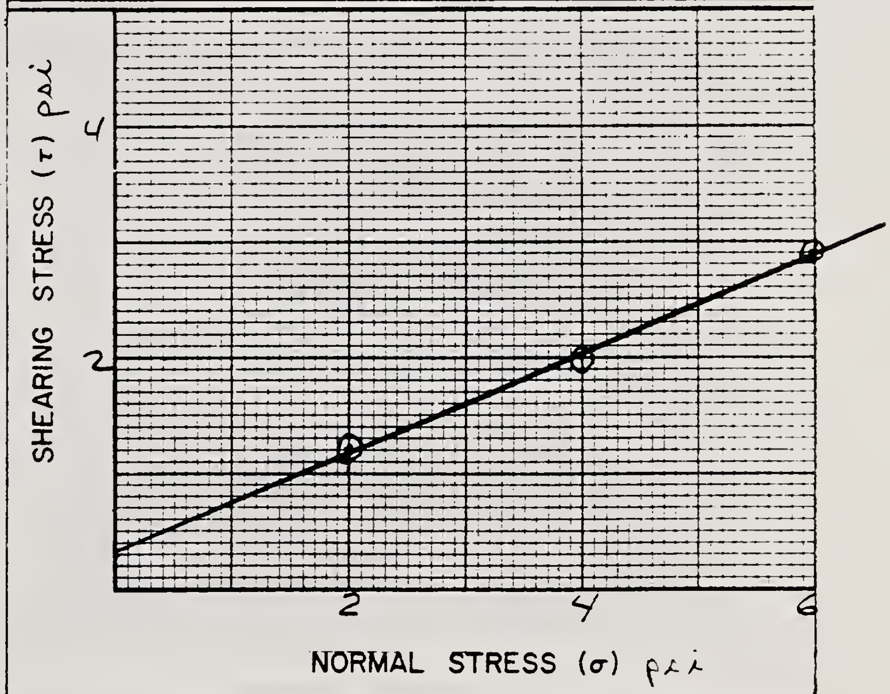
PROJECT and STATE WEPP - Abilene soil		SAMPLE LOCATION Texas
FIELD SAMPLE NO.	DEPTH	GEOLOGIC ORIGIN
TYPE OF SAMPLE COMPACTED	TESTED AT S.M.L., LINCOLN	APPROVED BY	DATE

CLASSIFICATION	LL	PI	SPECIFIC GRAVITY
TYPE OF TEST Consolidated Slow	CONTROL STRAIN	G_s (-) #4	2.63
RATE OF LOADING (in/min.) 0.0006	MOISTURE CONDITION FLOODED	G_s (+) #4	
TYPE OF SPECIMEN ROUND	AREA (sq.in) 4.9 / THICKNESS (in.) 1.0	G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	7.14	7.14	7.14	
DRY DENSITY, ☒ g/cc ☐ pcf	1.50	1.50	1.50	
INIT VOID RATIO	.7533	.7533	.7533	
TEST DURATION, (min)	500	.483	500	
FINAL MOISTURE, %	17.3	17.5	16.35	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.2	2.0	2.9	

SHEAR VALUES	ϕ°	c_{psf}
AT MAXIMUM STRESS	23	50



REMARKS

Form SCS 367
9-64

LABORATORY NO 88C 90

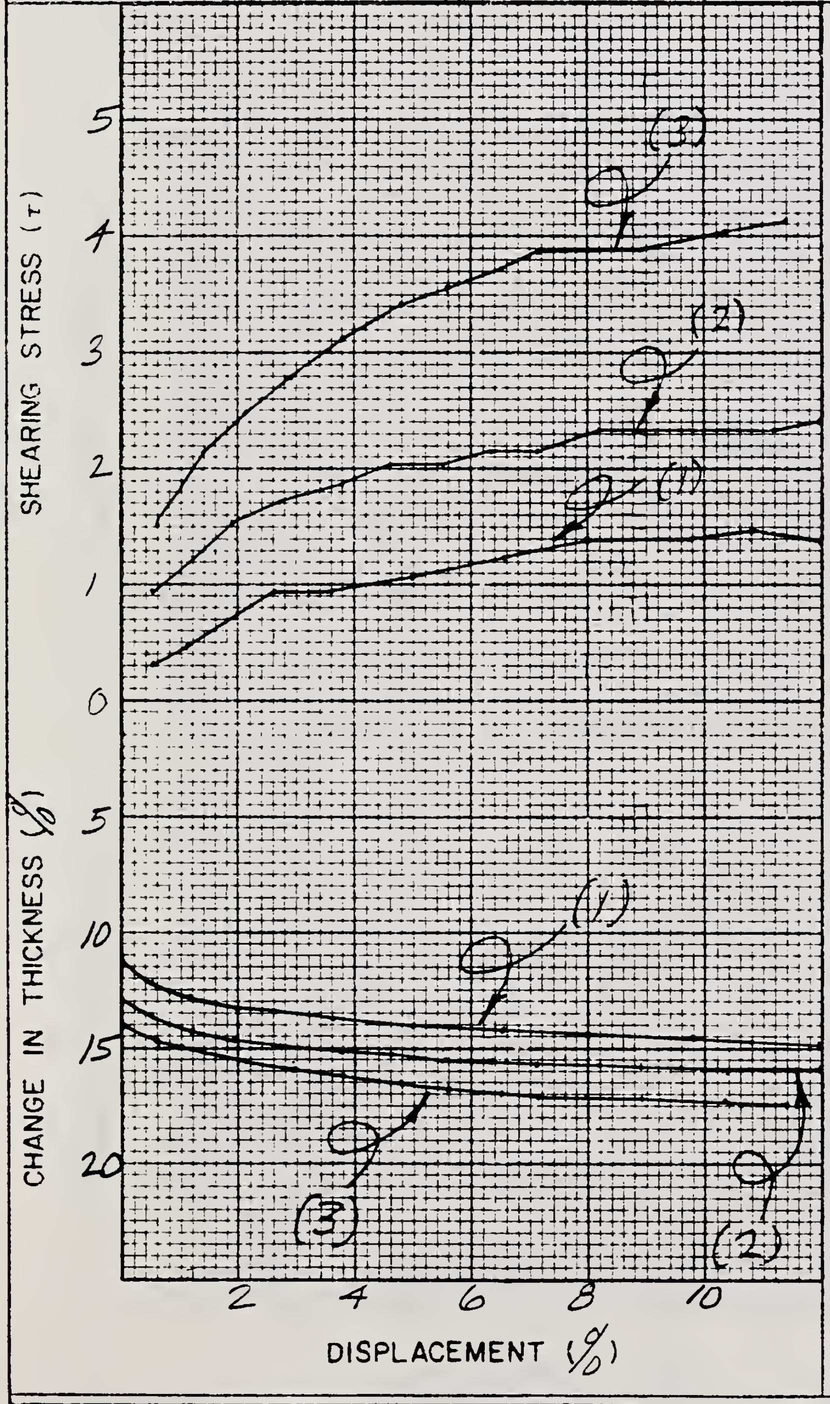
MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE WEPP Academy Soil	SAMPLE LOCATION Fresno CA

FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN

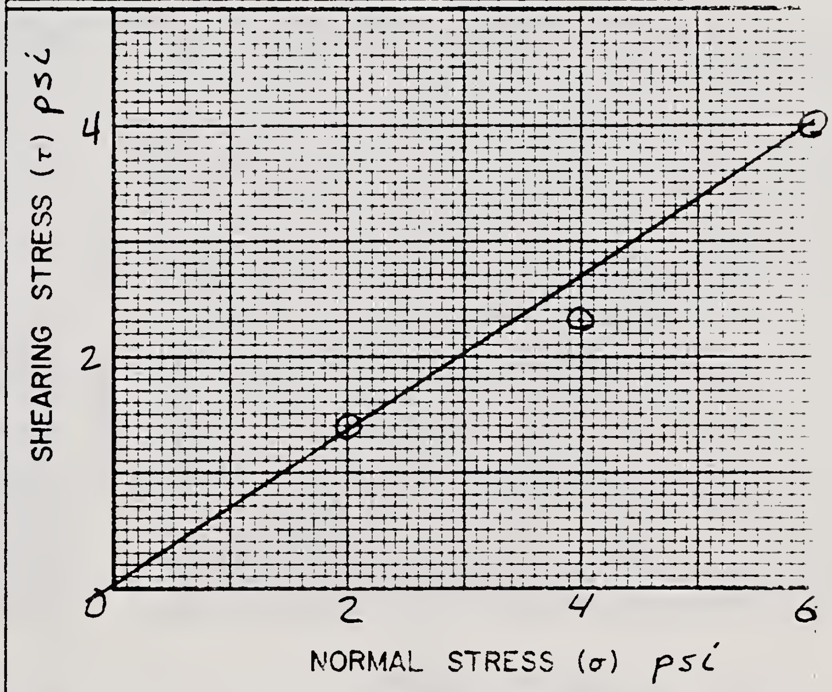
TYPE OF SAMPLE COMPACTED	TESTED AT S.M.L., LINCOLN	APPROVED BY	DATE

CLASSIFICATION Non-plastic SM LL PI		SPECIFIC GRAVITY	
TYPE OF TEST Consolidated Slow	CONTROL STRAIN	G_s (-) #4	2.75
RATE OF LOADING (in/min) 0.00064	MOISTURE CONDITION FLOODED	G_s (+) #4	
TYPE OF SPECIMEN ROUND	AREA (sq in) 4.9 / THICKNESS (in) 1.0	G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	4.6	4.6	5.4	
DRY DENSITY, ☒ g/cc ☐ pcf	1.61	1.61	1.60	
INIT VOID RATIO	.7081	.7081	.7133	
TEST DURATION, (min.)	470	469	492	
FINAL MOISTURE, %	14.5	14.21	13.5	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.4	2.3	40	

SHEAR VALUES	ϕ	C
AT MAXIMUM STRESS	34°	0



REMARKS

Form SCS 366
9-64

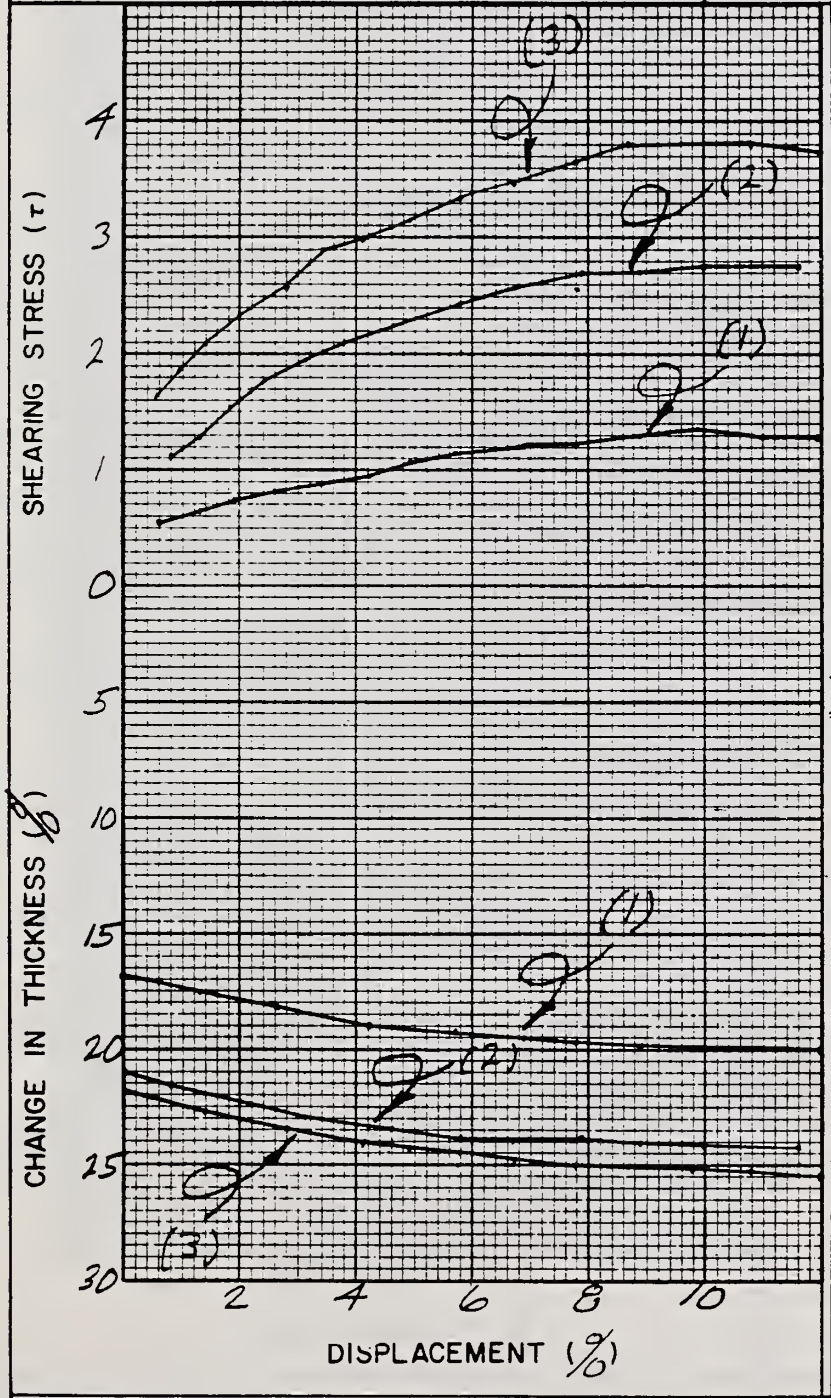
LABORATORY NO. 88C91

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE: WEPP Barnes Soil
SAMPLE LOCATION: Morris MN
FIELD SAMPLE NO.:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: COMPACTED
TESTED AT: S.M.L., LINCOLN
APPROVED BY:
DATE:

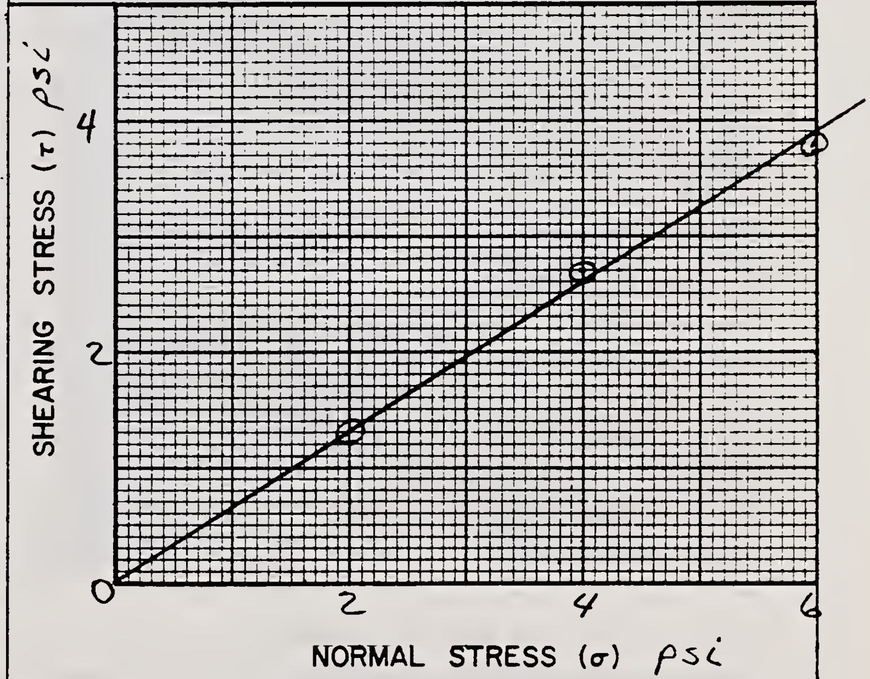
CLASSIFICATION: CL
LL: 26
PI: 9
TYPE OF TEST: Consolidated Slow
CONTROL: STRAIN
RATE OF LOADING (in/min.): 0.0006
MOISTURE CONDITION: FLOODED
TYPE OF SPECIMEN: ROUND
AREA (sq.in.): 4.9
THICKNESS (in.): 1.0

SPECIFIC GRAVITY	
$G_s(-)$ #4	2.61
$G_s(+)$ #4	
G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	11.5	11.5	11.5	
DRY DENSITY, ☒ g/cc ☐ pcf	1.14	1.14	1.14	
INIT. VOID RATIO	1.2895	1.2895	1.2895	
TEST DURATION, (min.)	500	483	500	
FINAL MOISTURE, %	25.9	24.7	22.3	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.3	2.7	3.8	

SHEAR VALUES	φ	C
AT MAXIMUM STRESS	33°	0



REMARKS

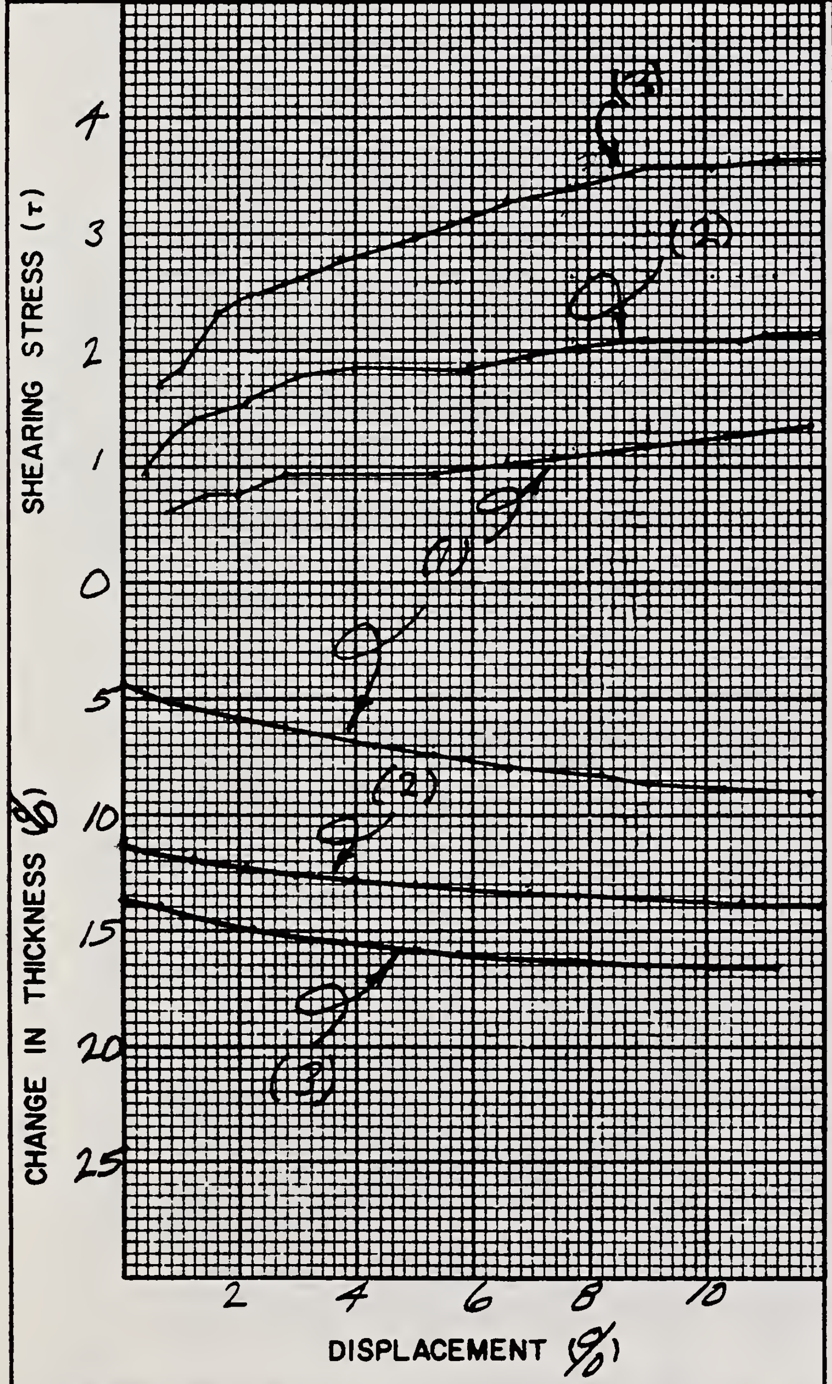
Form SCS 366
9-64

LABORATORY NO. 88C 92

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

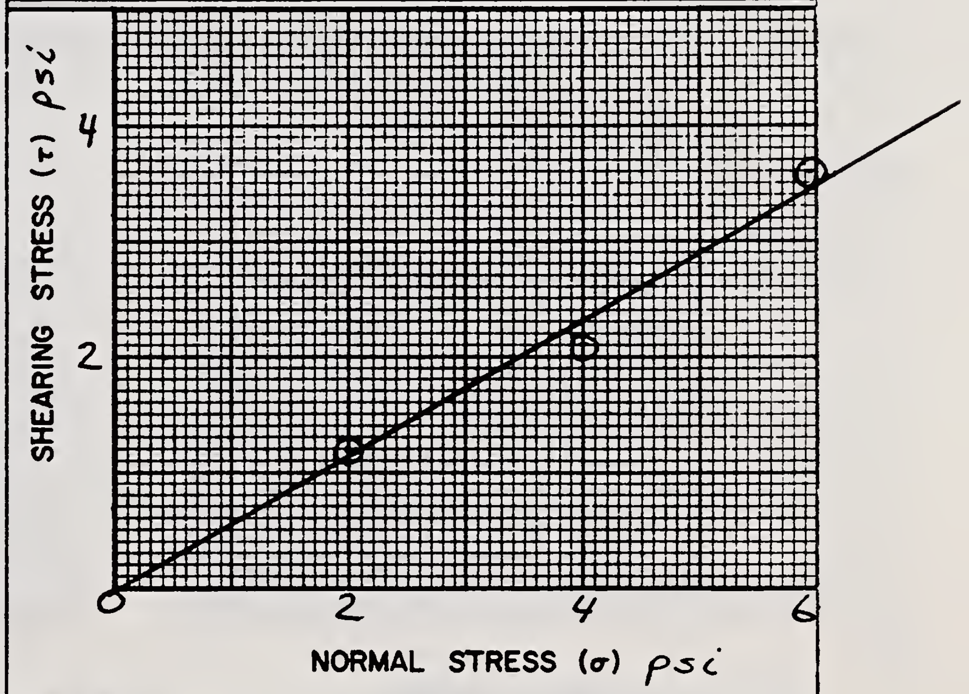
PROJECT and STATE: WEPP Barnes Soil
SAMPLE LOCATION: -McClusky, ND
FIELD SAMPLE NO.:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: COMPACTED
TESTED AT: S.M.L., LINCOLN
APPROVED BY:
DATE:
CLASSIFICATION: CL
LL: 31
PI: 12
TYPE OF TEST: Consolidated Slow
CONTROL: STRAIN
RATE OF LOADING (in/min.): 0.00064
MOISTURE CONDITION: FLOODED
TYPE OF SPECIMEN: ROUND
AREA (sq.in.): 4.9
THICKNESS (in.): 1.0

SPECIFIC GRAVITY	
G_s(-) #4	2.55
G_s(+) #4	
G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	13.6	13.6	13.6	
DRY DENSITY, ☒ g/cc ☐ pcf	1.20	1.20	1.20	
INIT. VOID RATIO	1.1250	1.1250	1.1250	
TEST DURATION, (min.)	478	469	481	
FINAL MOISTURE, %	33.1	30.4	30.3	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.2	2.1	3.6	

SHEAR VALUES	φ	c
AT MAXIMUM STRESS	30°	0



REMARKS

Form SCS 366
9-64

LABORATORY NO. 88C93

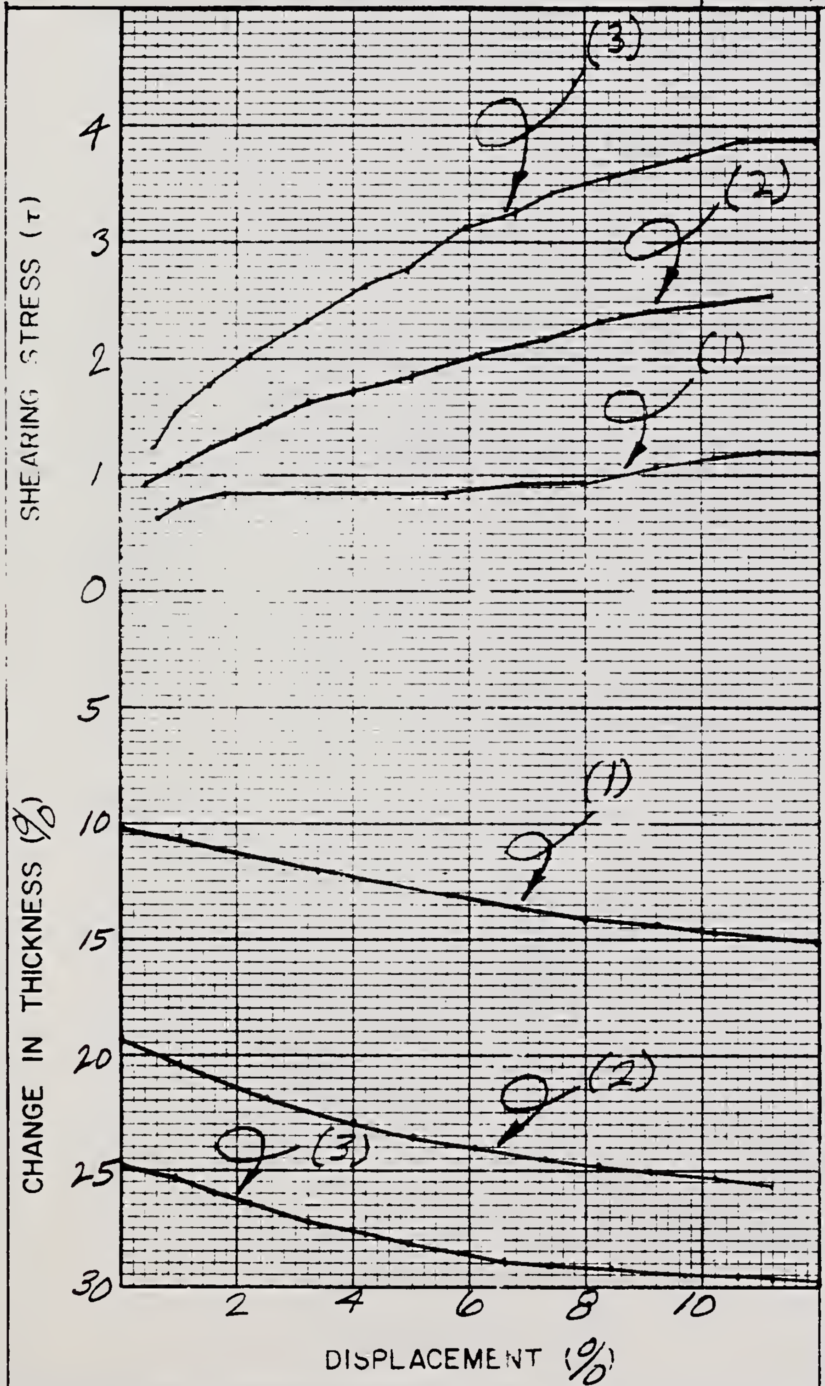
MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE: WEPP Heiden Soil
SAMPLE LOCATION: Waco, TX
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: COMPACTED
TESTED AT: S.M.L., LINCOLN
APPROVED BY:
DATE:

CLASSIFICATION: CH
LL 52 PI 37

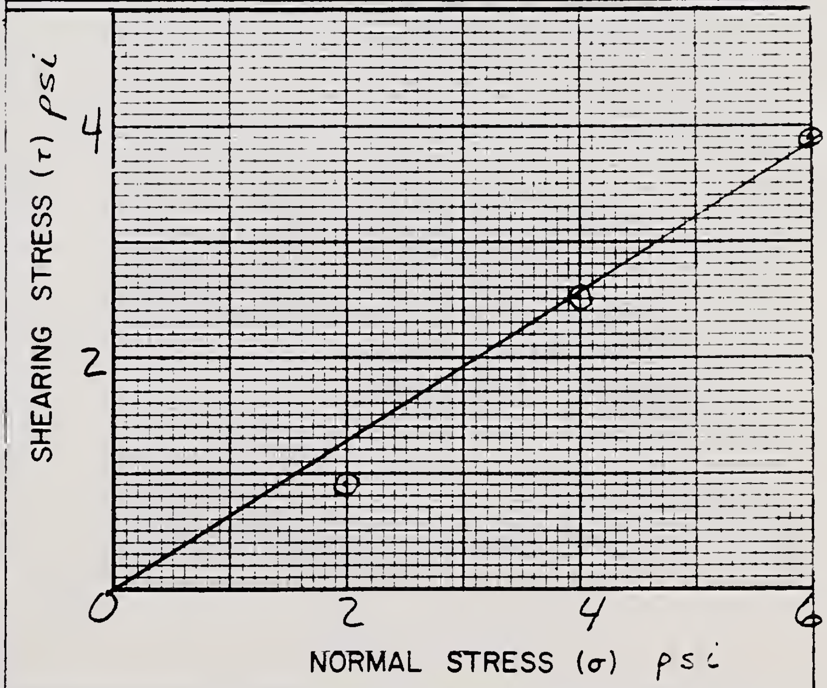
SPECIFIC GRAVITY
G_s (−) #4: 2.67
G_s (+) #4:
G_m(bulk)(+) #4:

TYPE OF TEST:
CONTROL: STRAIN
RATE OF LOADING (in/min.): 0.00064
MOISTURE CONDITION: FLOODED
TYPE OF SPECIMEN: ROUND
AREA (sq.in.): 4.9
THICKNESS (in.): 1.0



TEST NO	1	2	3	4
INIT MOISTURE, %	20.1	20.1	20.1	
DRY DENSITY, ☒ g/cc ☐ pcf	0.99	0.99	0.99	
INIT VOID RATIO	1.6970	1.6970	1.6970	
TEST DURATION, (min)	469	472	469	
FINAL MOISTURE, %	40.8	33.3	32.0	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	0.9	2.5	3.9	

SHEAR VALUES	φ	c
AT MAXIMUM STRESS	33°	0



REMARKS

Form SCS 366
9-64

LABORATORY NO 38C94

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE WEPP Hirsh Soil

SAMPLE LOCATION Ord, NE

FIELD SAMPLE NO

DEPTH

GEOLOGIC ORIGIN

TYPE OF SAMPLE COMPACTED

TESTED AT S.M.L., LINCOLN

APPROVED BY

DATE

CLASSIFICATION Non-plastic SM LL ____ PI ____

TYPE OF TEST Consolidated Slow

CONTROL STRAIN

RATE OF LOADING (in/min.) 0.0006

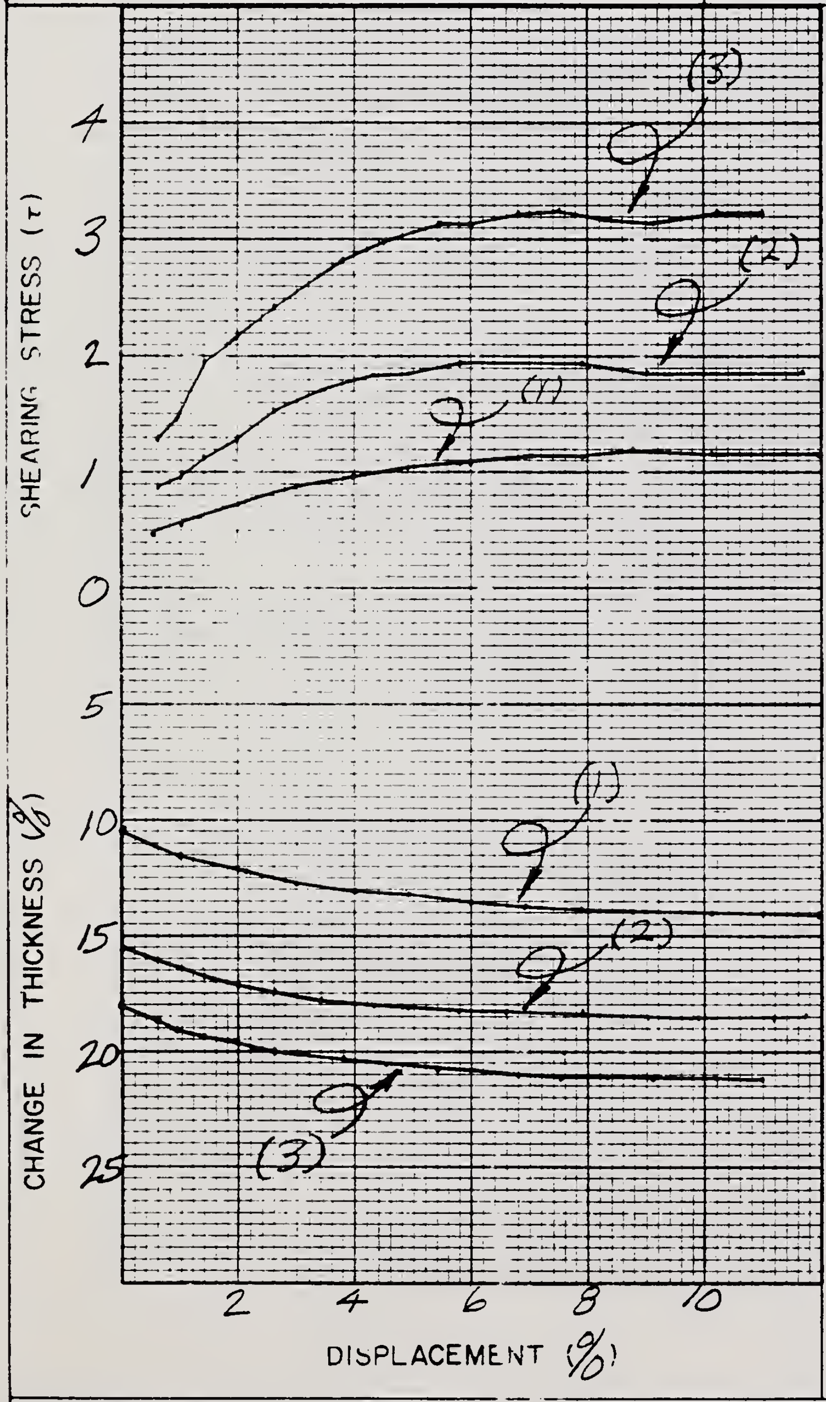
MOISTURE CONDITION FLOODED

TYPE OF SPECIMEN ROUND

AREA (sq.in.) 4.9

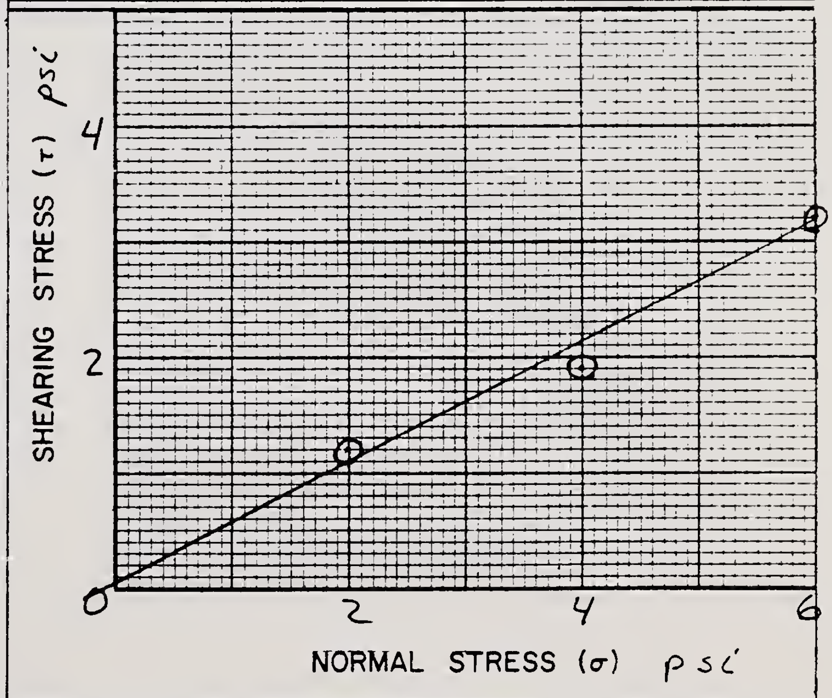
THICKNESS (in.) 1.0

SPECIFIC GRAVITY	
$G_s(-)$ #4	2.63
$G_s(+)$ #4	
G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	2.65	2.65	2.65	
DRY DENSITY, ☒ g/cc ☐ pcf	1.43	1.43	1.43	
INIT VOID RATIO	.8392	.8392	.8392	
TEST DURATION, (min)	500	488	458	
FINAL MOISTURE, %	18.6	18.0	16.6	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	1.2	1.9	3.2	

SHEAR VALUES	Ø	C
AT MAXIMUM STRESS	28°	0



REMARKS

Form SCS 366
9-64

LABORATORY NO. 88C95

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE WEPP Keith Soil

SAMPLE LOCATION Albin, Wy

FIELD SAMPLE NO

DEPTH

GEOLOGIC ORIGIN

TYPE OF SAMPLE COMPACTED

TESTED AT S.M.L., LINCOLN

APPROVED BY

DATE

CLASSIFICATION CL

LL 32 PI 13

TYPE OF TEST Consolidated Slow

CONTROL STRAIN

RATE OF LOADING (in/min.) 0.00064

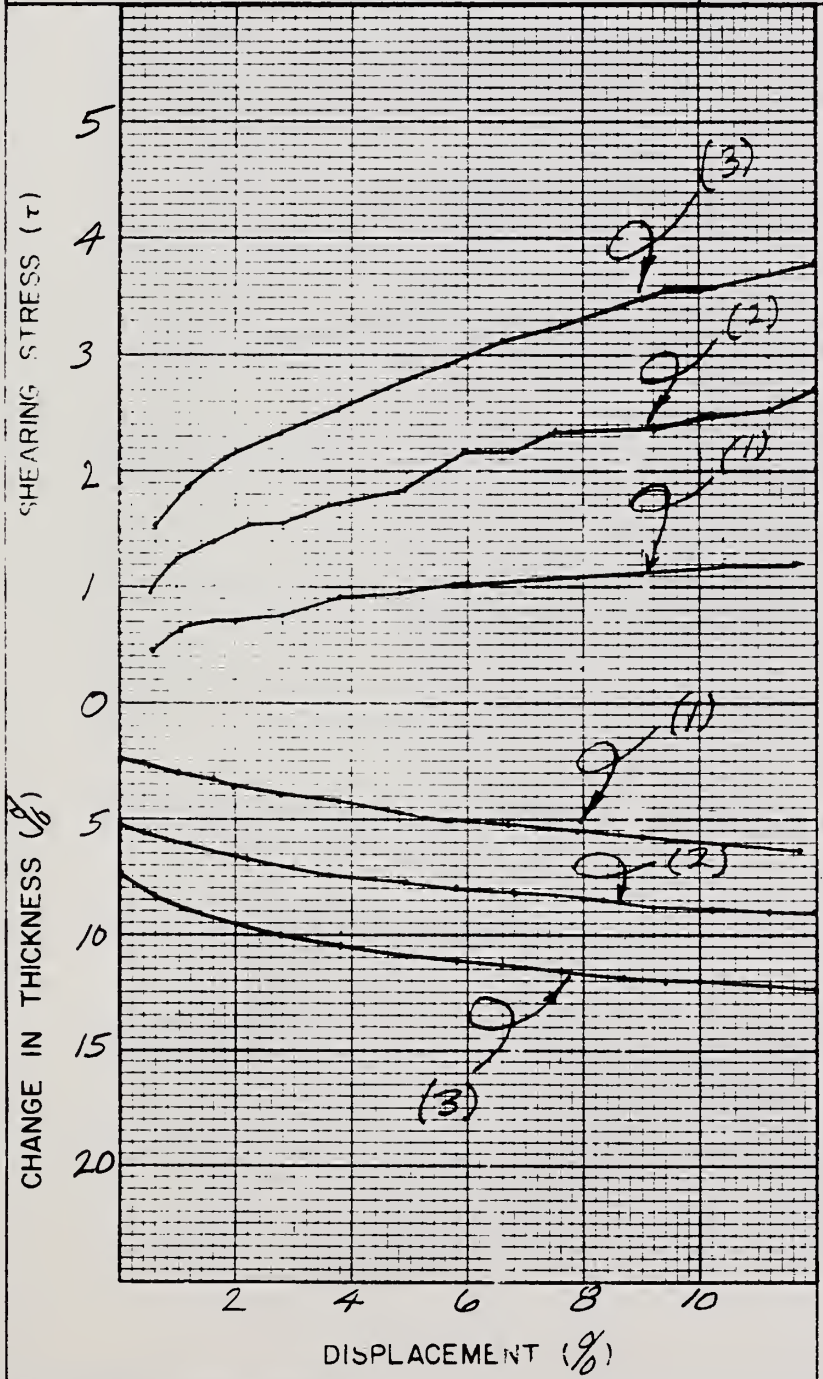
MOISTURE CONDITION FLOODED

TYPE OF SPECIMEN ROUND

AREA (sq.in.) 4.9

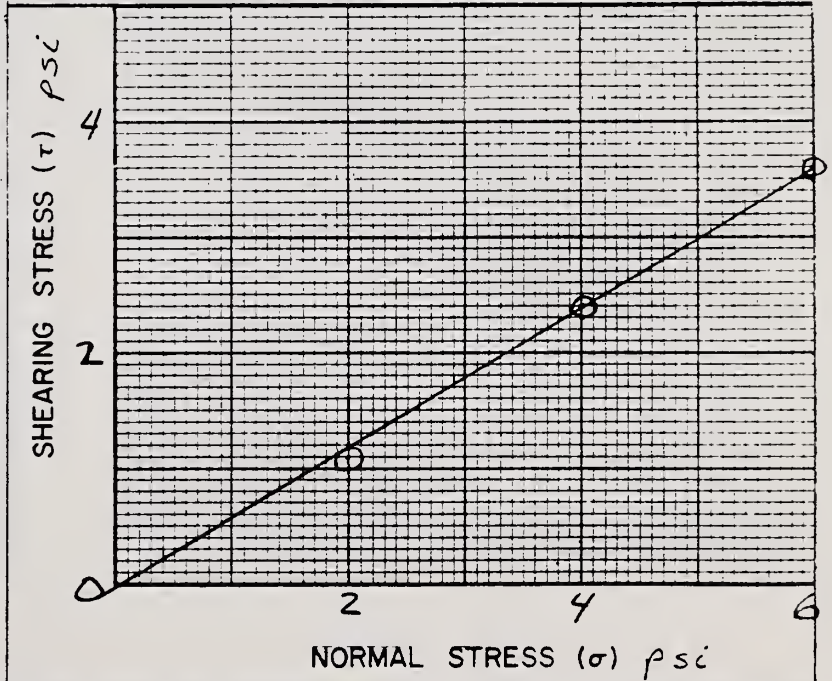
THICKNESS (in.) 1.0

SPECIFIC GRAVITY	
$G_s(-)$ #4	2.50
$G_s(+)$ #4	
G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	14.4	14.4	14.4	
DRY DENSITY, ☒ g/cc ☐ pcf	1.32	1.32	1.32	
INIT. VOID RATIO	.9621	.9621	.9621	
TEST DURATION, (min)	456	469	469	
FINAL MOISTURE, %	29.8	26.5	25.0	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	1.1	2.4	3.6	

SHEAR VALUES	φ	c
AT MAXIMUM STRESS	31°	0



REMARKS

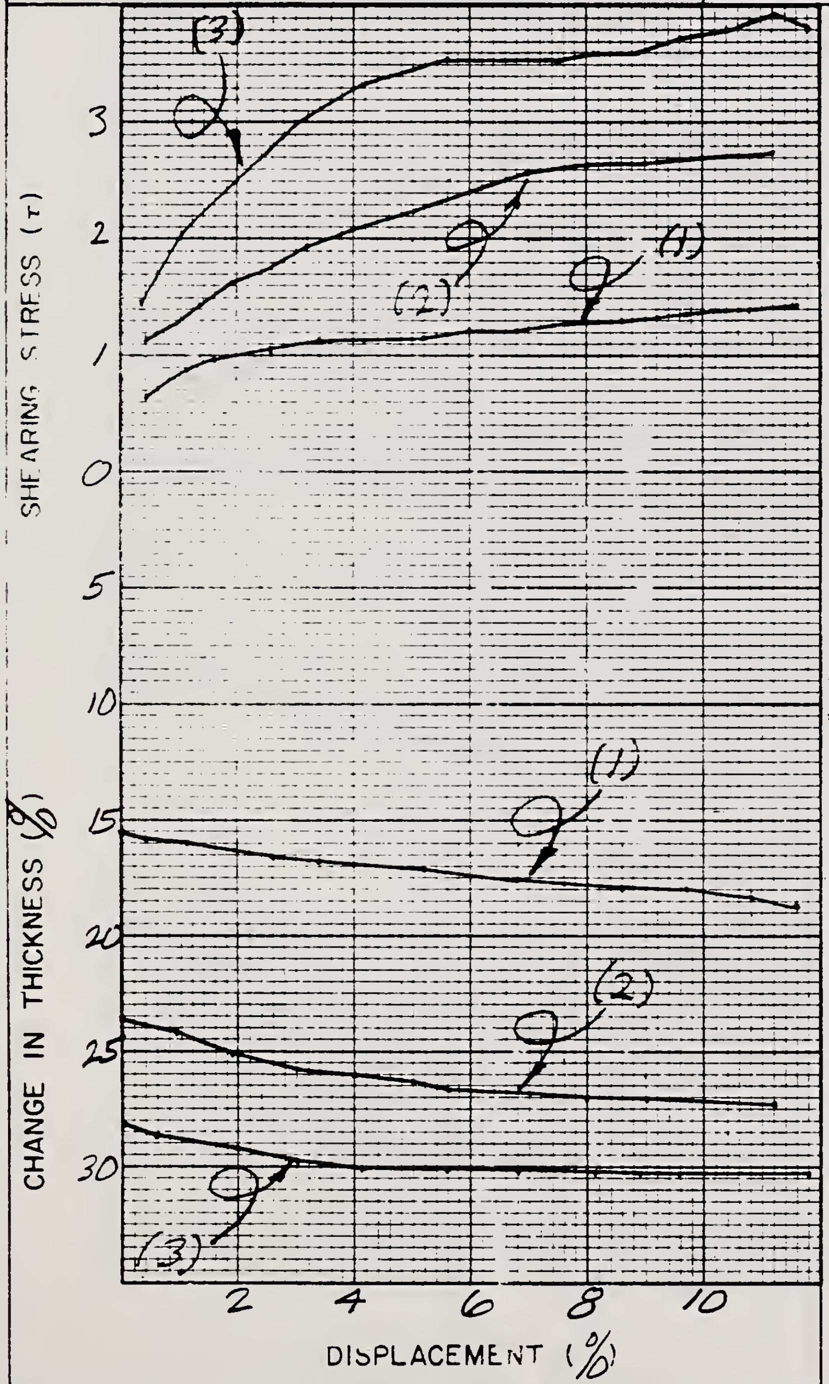
Form SCS 366
9-64

LABORATORY NO 88C36

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DIRECT SHEAR TEST

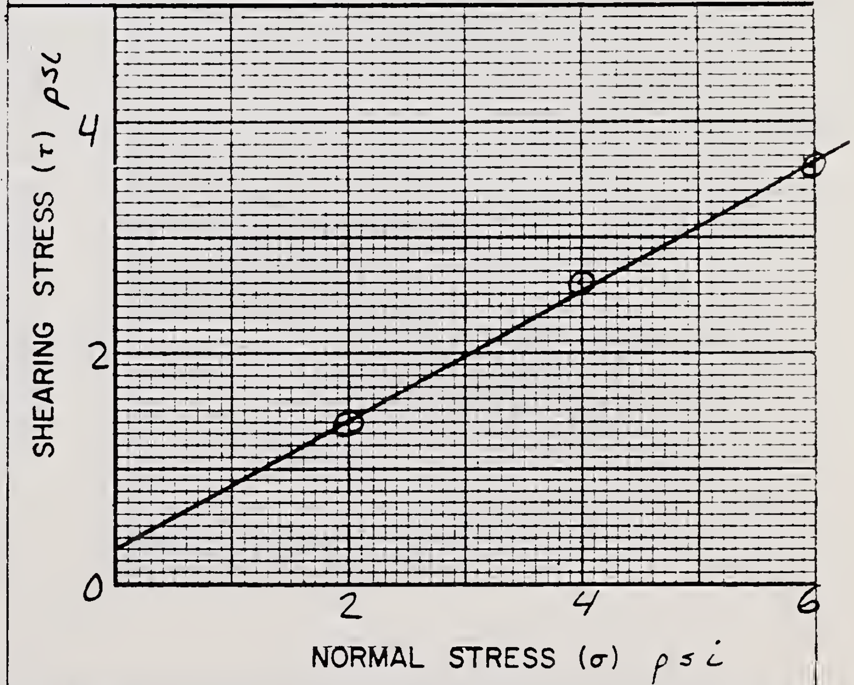
PROJECT and STATE: WEPP Los Banos Soil
SAMPLE LOCATION: Fresno, CA
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: COMPACTED
TESTED AT: S.M.L., LINCOLN
APPROVED BY:
DATE:
CLASSIFICATION: CL
LL: 46
PI: 25
TYPE OF TEST: Consolidated Slow
CONTROL: STRAIN
RATE OF LOADING (in/min.): 0.0006
MOISTURE CONDITION: FLOODED
TYPE OF SPECIMEN: ROUND
AREA (sq.in.): 4.9
THICKNESS (in.): 1.0

SPECIFIC GRAVITY	
G_s (-) #4	2.61
G_s (+) #4	
G_m (bulk) (+) #4	



TEST NO.	1	2	3	4
INIT. MOISTURE, %	15.9	15.9	15.9	
DRY DENSITY, ☒ g/cc ☐ pcf	1.01	1.01	1.01	
INIT. VOID RATIO	1.5842	1.5842	1.5842	
TEST DURATION, (min.)	483	467	490	
FINAL MOISTURE, %	38.4	35.1	32.0	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.4	2.6	3.6	

SHEAR VALUES	∅	C
AT MAXIMUM STRESS	30°	40 psf



REMARKS

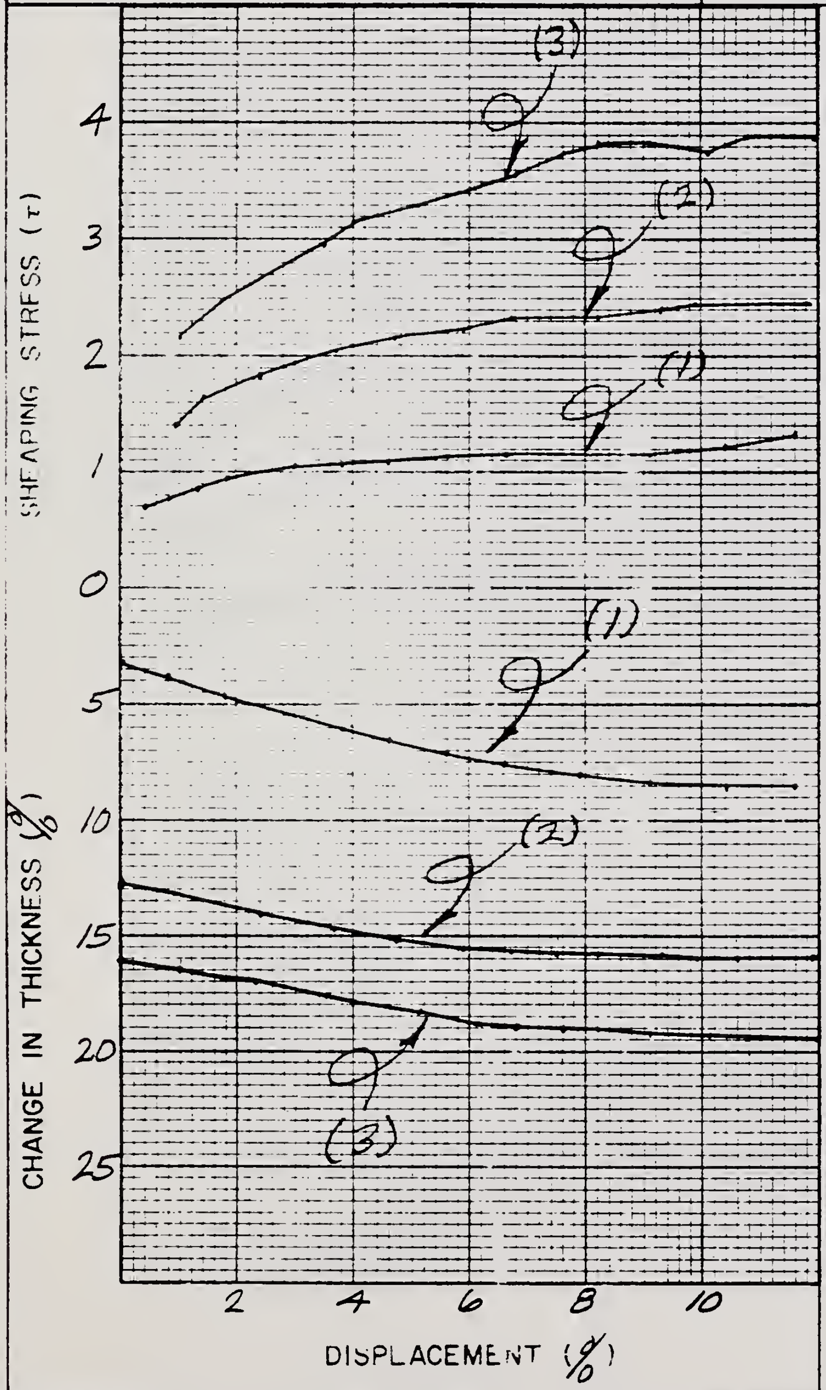
Form SCS 366
9-64

LABORATORY NO. 88C 97

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	DIRECT SHEAR TEST

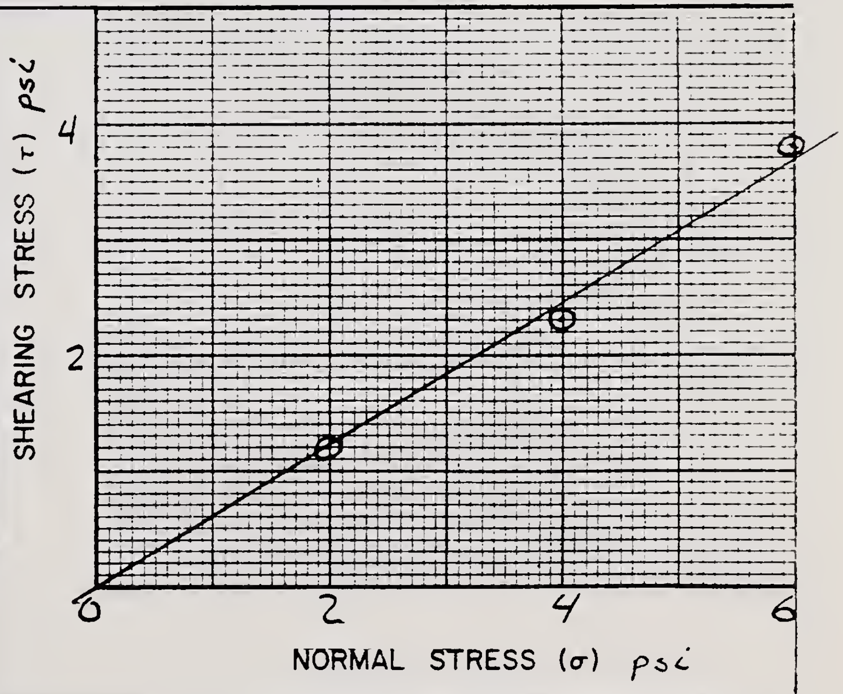
PROJECT and STATE: WEPP Pierre Soil
SAMPLE LOCATION: Cottonwood SC
FIELD SAMPLE NO
DEPTH
GEOLOGIC ORIGIN
TYPE OF SAMPLE: COMPACTED
TESTED AT: S.M.L., LINCOLN
APPROVED BY
DATE
CLASSIFICATION: CH
LL 52
PI 32
TYPE OF TEST: Consolidated Slow
CONTROL: STRAIN
RATE OF LOADING (in/min.): 0.00064
MOISTURE CONDITION: FLOODED
TYPE OF SPECIMEN: ROUND
AREA (sq.in): 4.9
THICKNESS (in.): 1.0

SPECIFIC GRAVITY	
G_s (-) #4	2.71
G_s (+) #4	
G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	16.4	16.4	16.4	
DRY DENSITY, ☒ g/cc ☐ pcf	1.05	1.05	1.05	
INIT VOID RATIO	1.5810	1.5810	1.5810	
TEST DURATION, (min)	453	464	469	
FINAL MOISTURE, %	42.2	38.1	35.6	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.2	2.3	3.8	

SHEAR VALUES	∅	C
AT MAXIMUM STRESS	32°	0



REMARKS

Form SCS 366
9-64

LABORATORY NO 88C 98

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE: WEPP Palouse Soil

SAMPLE LOCATION: Pullman, WA

FIELD SAMPLE NO.:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: COMPACTED

TESTED AT: S.M.L., LINCOLN

APPROVED BY:

DATE:

CLASSIFICATION: CL

LL 31 PI 13

TYPE OF TEST: Consolidated Slow

CONTROL: STRAIN

RATE OF LOADING (in/min.): 0.00064

MOISTURE CONDITION: FLOODED

TYPE OF SPECIMEN: ROUND

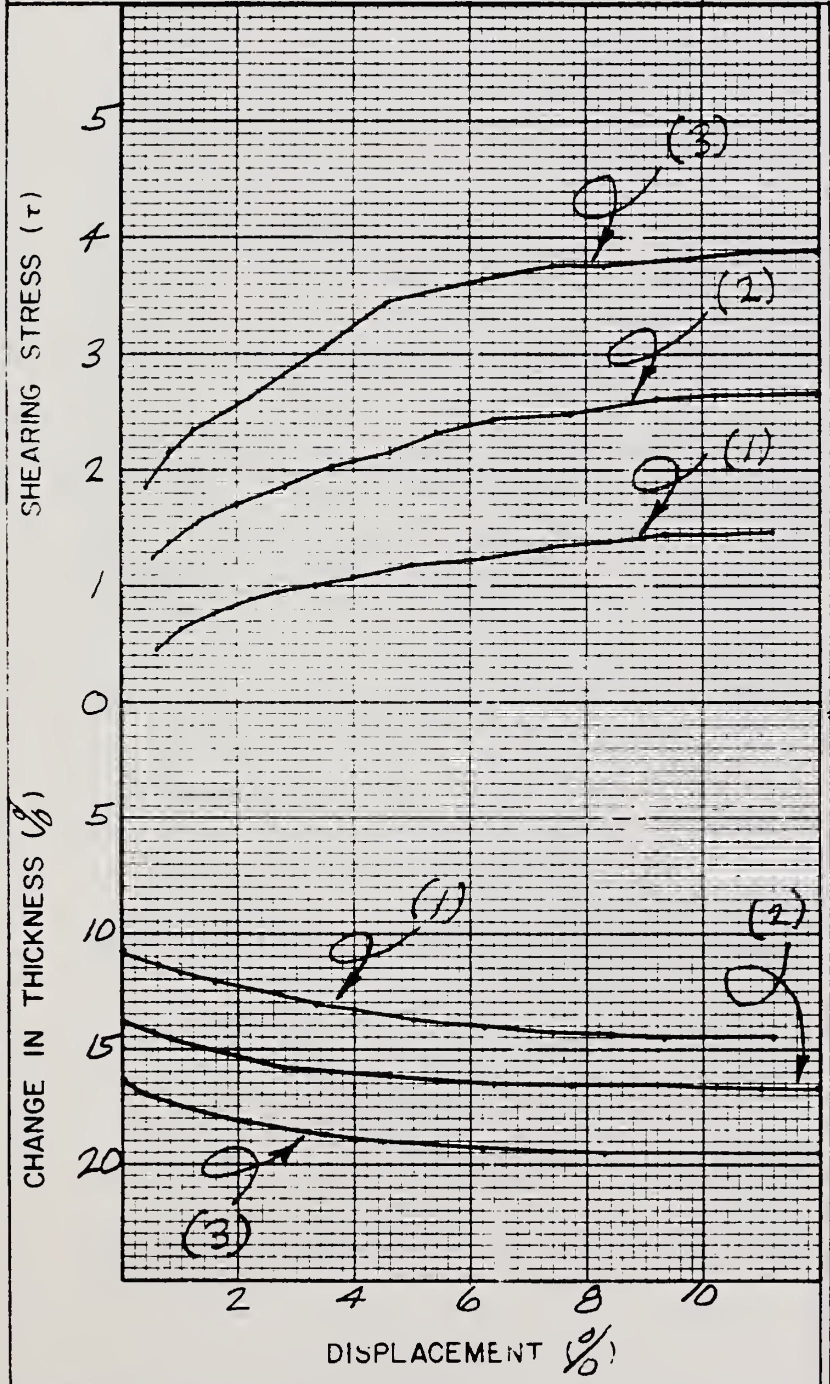
AREA (sq.in): 4.9

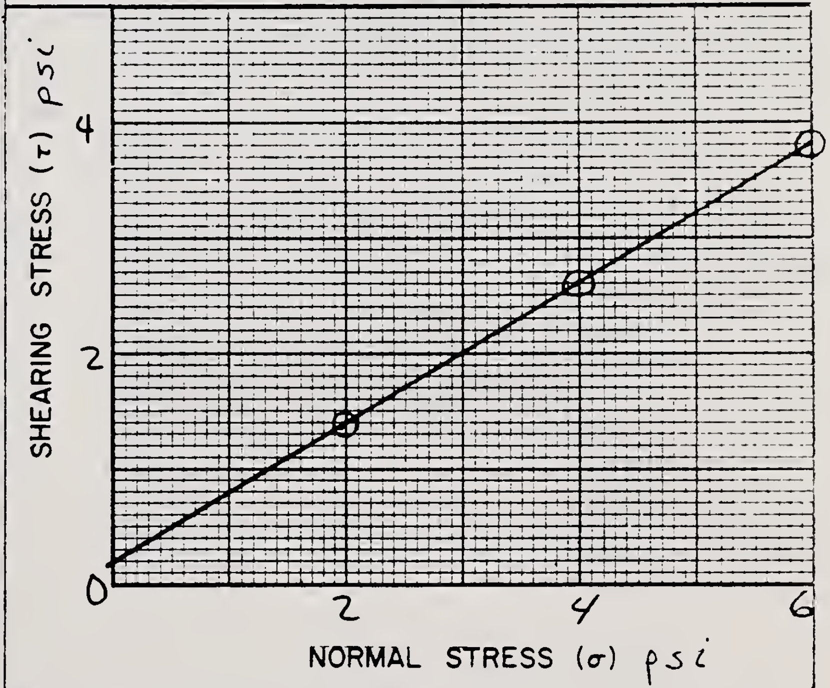
THICKNESS (in.): 1.0

SPECIFIC GRAVITY	
G_s (-) #4	2.64
G_s (+) #4	
G_m (bulk) (+) #4	

TEST NO.	1	2	3	4
INIT. MOISTURE, %	14.2	14.2	14.2	
DRY DENSITY, ☒ g/cc ☐ pcf	1.15	1.15	1.15	
INIT. VOID RATIO	1.2956	1.2956	1.2956	
TEST DURATION, (min)	438	469	469	
FINAL MOISTURE, %	30.8	29.8	28.6	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.4	2.6	3.8	

SHEAR VALUES	φ	C
AT MAXIMUM STRESS	31°	25 psf





REMARKS

Form SCS 366
9-64

LABORATORY NO. 88C99

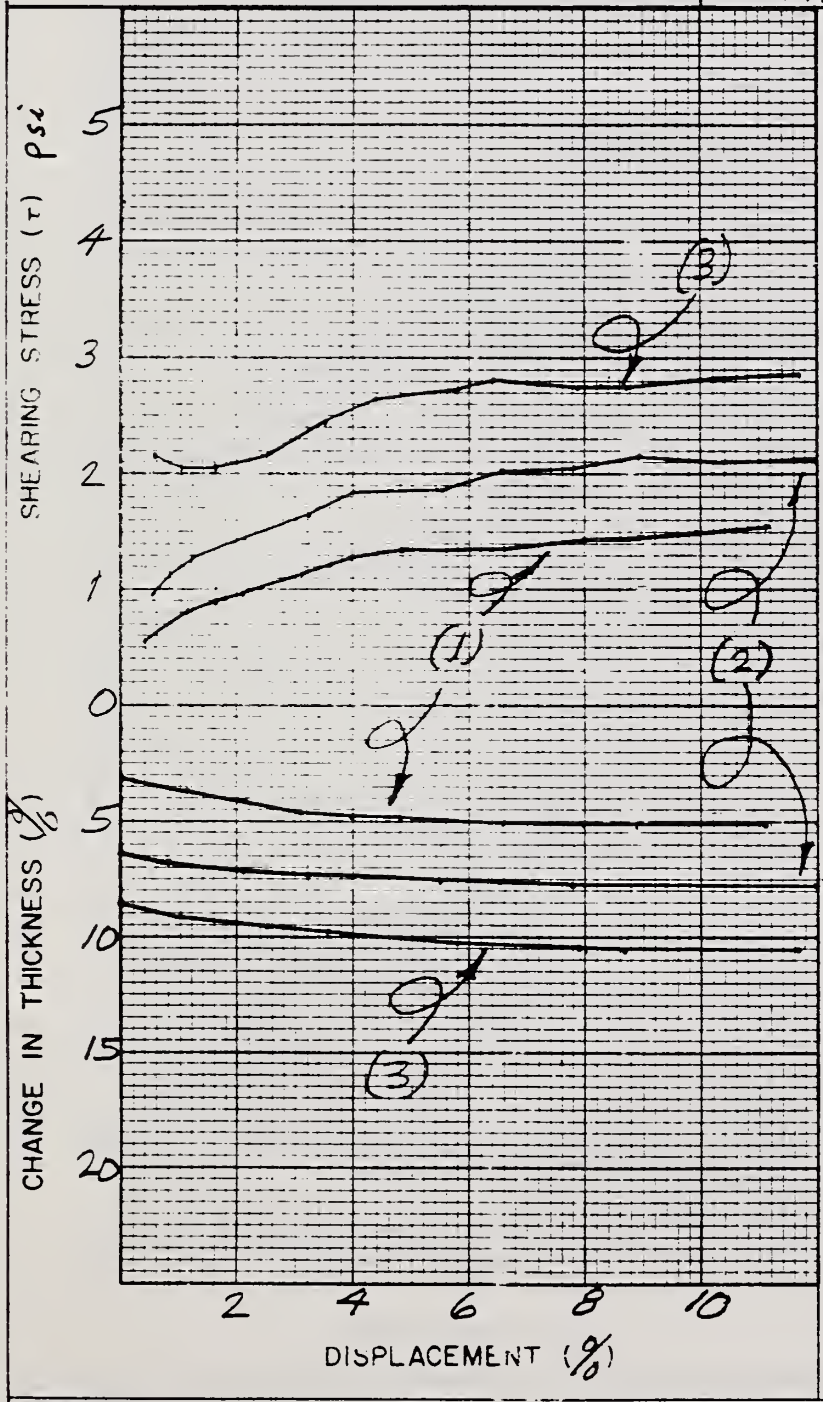
MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE WEPP Portneuf Soil	SAMPLE LOCATION Kimberly, ID

FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN

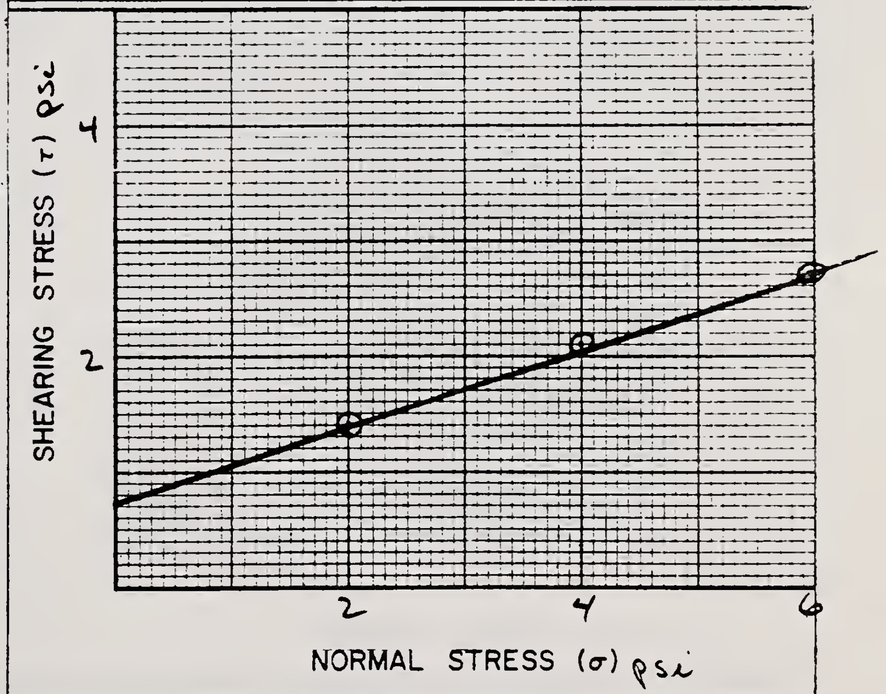
TYPE OF SAMPLE COMPACTED	TESTED AT S.M.L., LINCOLN	APPROVED BY	DATE

CLASSIFICATION CL-ML	LL 28 PI 4	SPECIFIC GRAVITY	
TYPE OF TEST Consolidated Slow	CONTROL STRAIN	$G_s (-)$ #4	2.66
RATE OF LOADING (in/min.) 0.0006	MOISTURE CONDITION FLOODED	$G_s (+)$ #4	
TYPE OF SPECIMEN ROUND	AREA (sq.in.) 4.9 THICKNESS (in.) 1.0	G_m(bulk)(+) #4	



TEST NO.	1	2	3	4
INIT MOISTURE, %	15.8	15.8	15.8	
DRY DENSITY, ☒ g/cc ☐ pcf	1.25	1.25	1.25	
INIT VOID RATIO	1.1280	1.1280	1.1280	
TEST DURATION, (min)	463	500	488	
FINAL MOISTURE, %	34.0	31.3	33.4	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	1.4	2.1	2.7	

SHEAR VALUES	ϕ	c
AT MAXIMUM STRESS	18°	100



REMARKS

Form SCS 366
9-64

LABORATORY NO [illegible]

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE WEPP Sharpsburg Soil

SAMPLE LOCATION Lincoln NE

FIELD SAMPLE NO

DEPTH

GEOLOGIC ORIGIN

TYPE OF SAMPLE Compacted

TESTED AT S.M.L., Lincoln

APPROVED BY

DATE

CLASSIFICATION CL LL 49 PI 30

TYPE OF TEST Consolidated Slow

CONTROL Strain

RATE OF LOADING (in/min) 0.00064

MOISTURE CONDITION Flooded

TYPE OF SPECIMEN Round

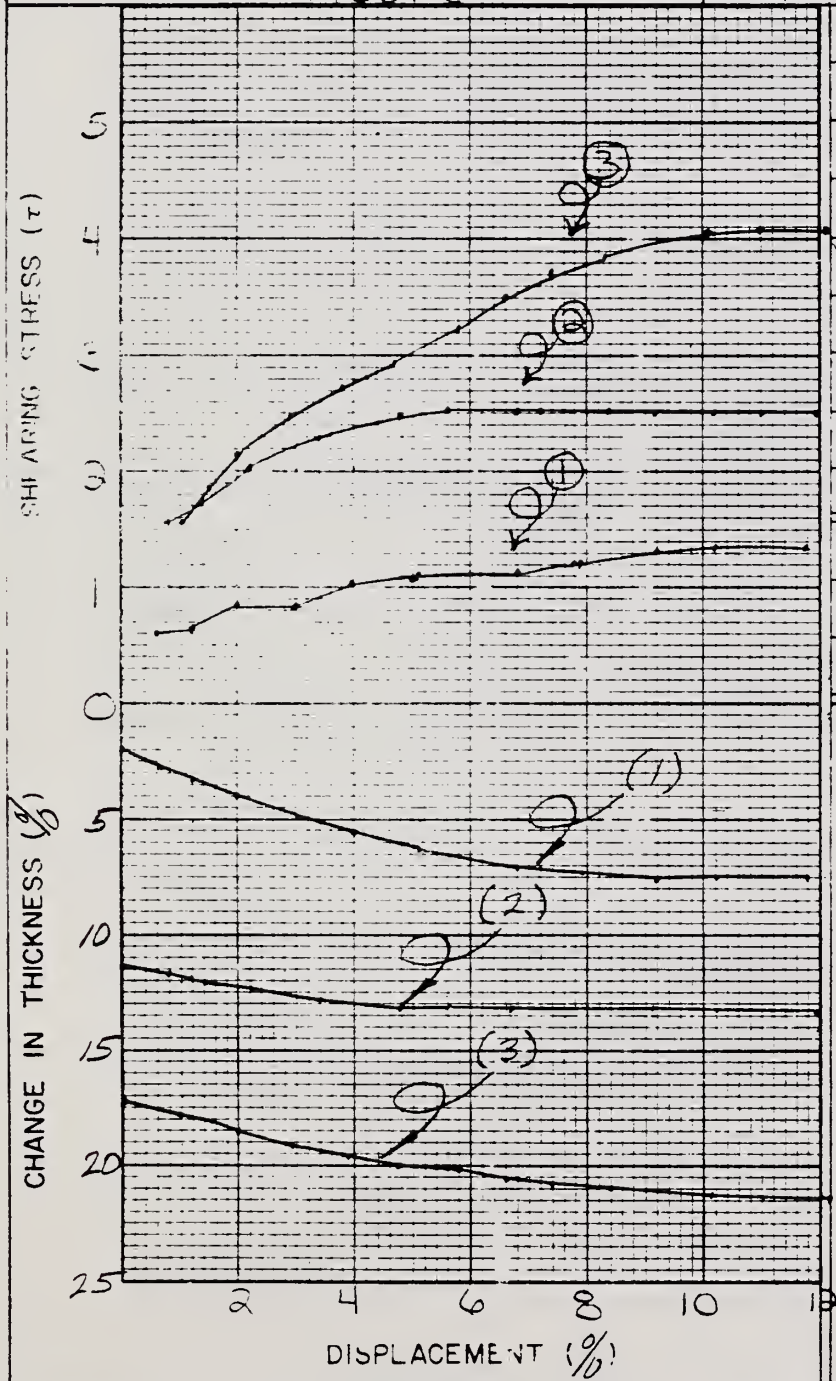
AREA (sq.in) 4.9

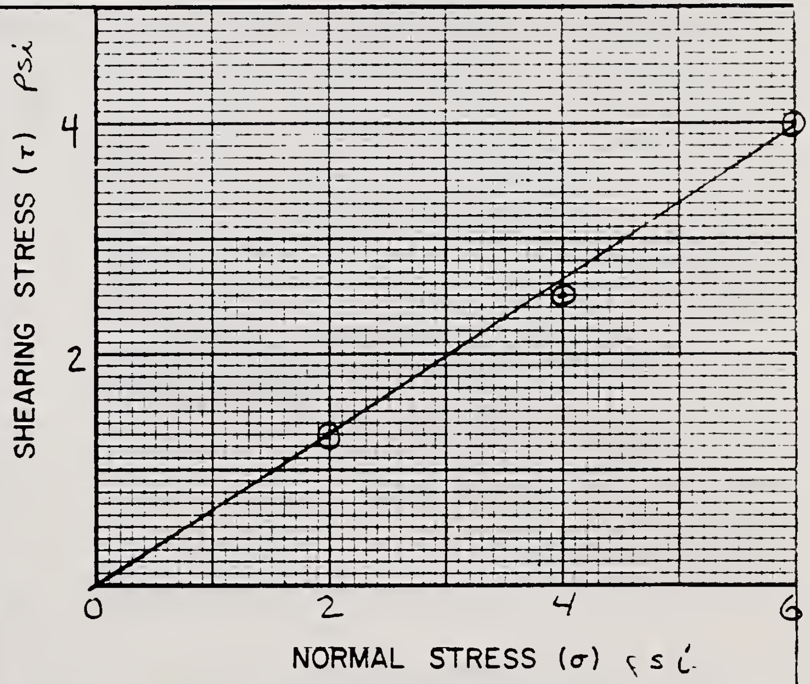
THICKNESS (in) 1.0

SPECIFIC GRAVITY	
$G_s(-)$ #4	263
$G_s(+)$ #4	
G_m(bulk)(+) #4	

TEST NO	1	2	3	4
INIT MOISTURE, %	19.?3 [illegible]	[illegible]	19.93	
DRY DENSITY, ☒ g/cc ☐ pcf	1.14	1.14	1.14	
INIT VOID RATIO	1.3070	1.3070	1.3070	
TEST DURATION, (min)	462	469	477	
FINAL MOISTURE, %	35.26	32.02	[illegible]	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	1.3	2.5	4.0	

SHEAR VALUES	Ø	C
AT MAXIMUM STRESS	34°	0





REMARKS

Form SCS 366
9-64

LABORATORY NO 88 C-101

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	**DIRECT SHEAR TEST**

PROJECT and STATE: WEPP Sverdrup Soil

SAMPLE LOCATION: Morris, MN

FIELD SAMPLE NO.:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: Compacted

TESTED AT: SN L, Lincoln

APPROVED BY:

DATE:

CLASSIFICATION: SC

LL: 25

PI: 9

SPECIFIC GRAVITY

TYPE OF TEST: Consolidated Slow

CONTROL: Strain

G_s (−) #4: 2.63

RATE OF LOADING (in/min.): 0.0006

MOISTURE CONDITION: Flooded

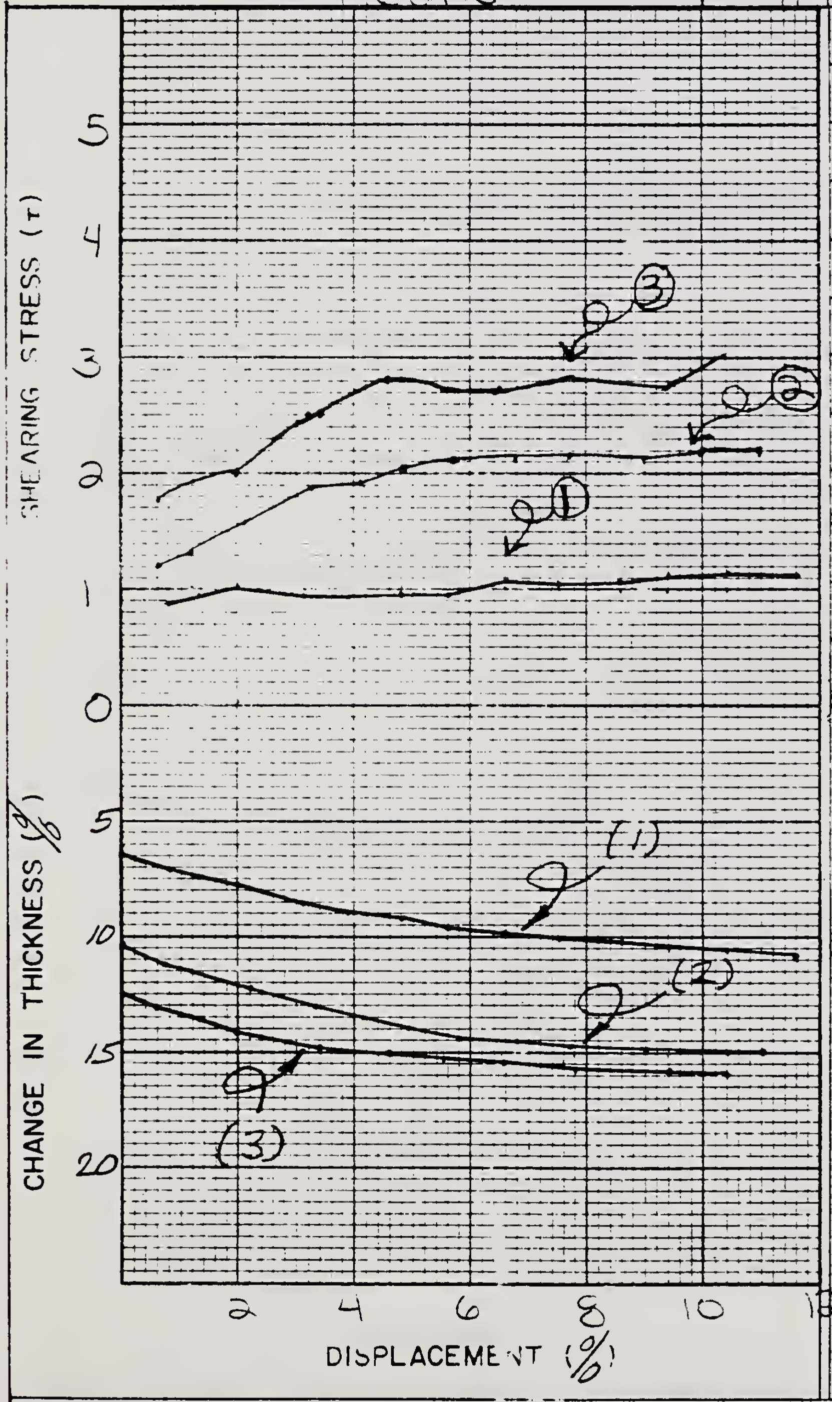
G_s (+) #4:

TYPE OF SPECIMEN: Round

AREA (sq.in): 4.9

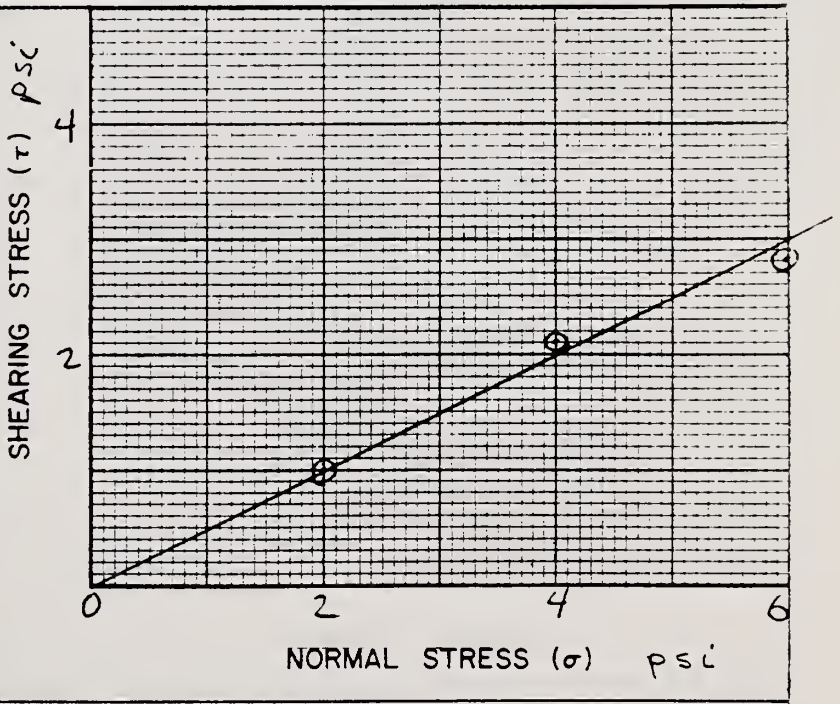
THICKNESS (in.): 1.0

G_m(bulk)(+) #4:



TEST NO	1	2	3	4
INIT MOISTURE, %	10.21	10.21	10.21	
DRY DENSITY, ☒ g/cc ☐ pcf	1.46	[illegible]	[illegible]	
INIT VOID RATIO	.8014	.8014	.8014	
TEST DURATION, (min)	483	459	433	
FINAL MOISTURE, %	[illegible]	[illegible]	18.21	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	1.0	2.1	2.8	

SHEAR VALUES	∅	C
AT MAXIMUM STRESS	27°	0



REMARKS

Form SCS 366
9-64

LABORATORY NO 88-C102

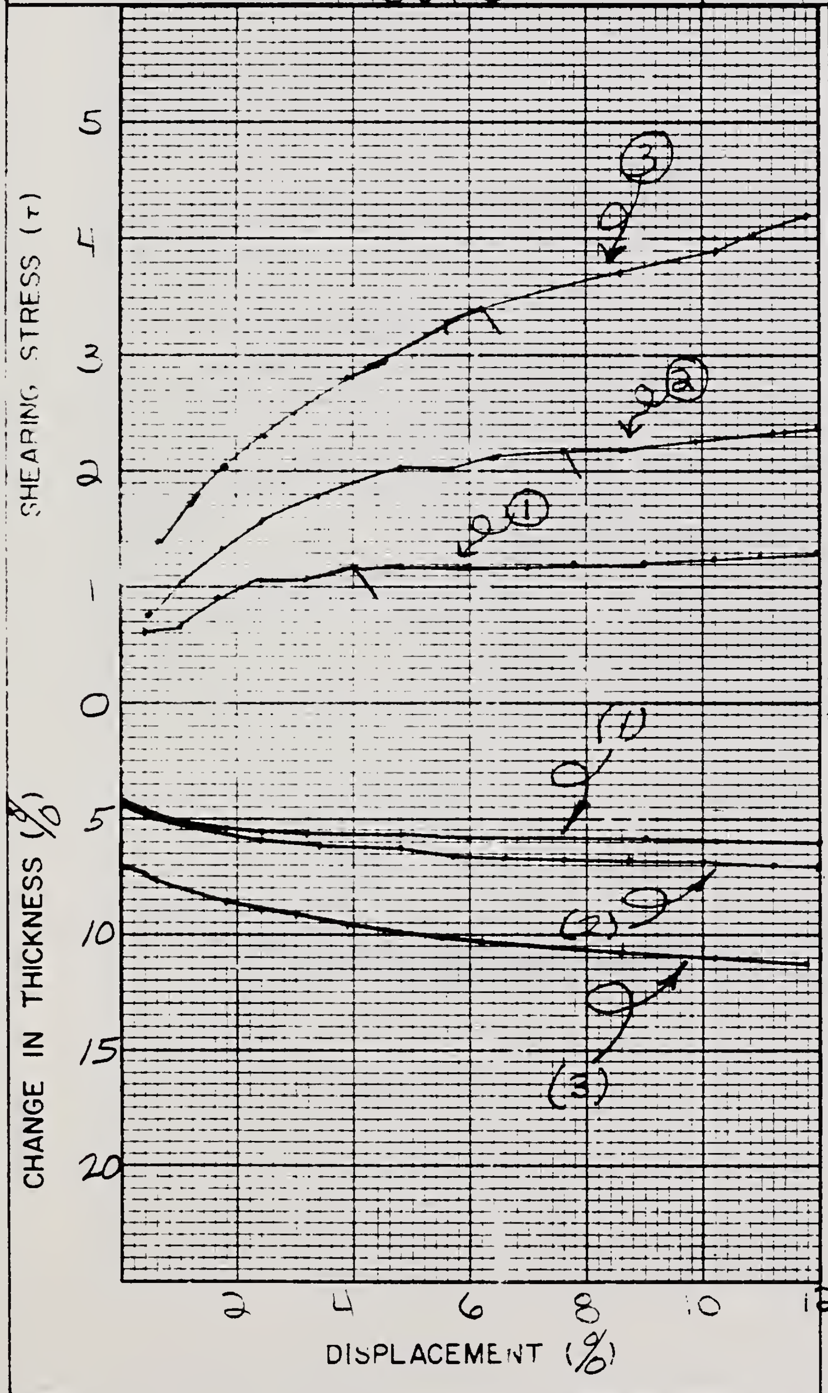
MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

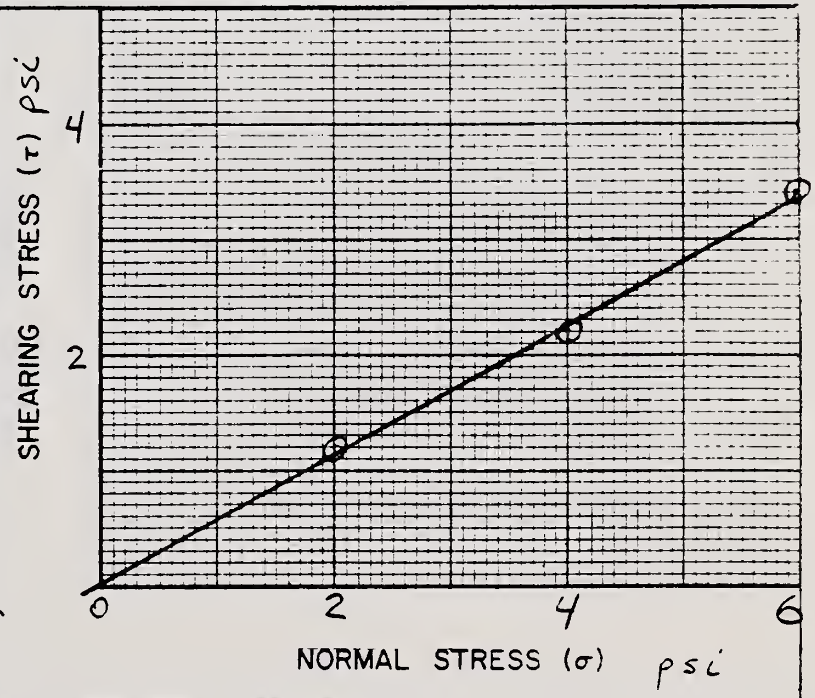
PROJECT and STATE: WEPP Walla Walla Soil
SAMPLE LOCATION: Pullman WA
FIELD SAMPLE NO.:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: S[illegible], Lincoln
APPROVED BY:
DATE:
CLASSIFICATION: CL-ML
LL 28
PI 4
TYPE OF TEST: Consolidated Slow
CONTROL: Strain
RATE OF LOADING (in/min.): 0.00064
MOISTURE CONDITION: Flooded
TYPE OF SPECIMEN: Round
AREA (sq.in.): 4.9
THICKNESS (in.): 1.0

SPECIFIC GRAVITY	
$G_s(-)$ #4	2.65
$G_s(+)$ #4	
G_m(bulk)(+) #4	

TEST NO	1	2	3	4
INIT MOISTURE, %	13.61	13.61	13.61	
DRY DENSITY, ☒ g/cc ☐ pcf	1.25	1.25	1.25	
INIT VOID RATIO	1.1200	1.1200	1.1200	
TEST DURATION, (min)	469	469	461	
FINAL MOISTURE, %	34.01	32.85	3[illegible].95	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.2	2.2	3.0	

SHEAR VALUES	ø	c
AT MAXIMUM STRESS	30°	0





REMARKS

Form SCS 366
9-64

LABORATORY NO. 88-C-103

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

PROJECT and STATE WEPP Whitney Soil

SAMPLE LOCATION Fresno, CA

FIELD SAMPLE NO

DEPTH

GEOLOGIC ORIGIN

TYPE OF SAMPLE Compacted

TESTED AT S.M.L. Lincoln

APPROVED BY

DATE

CLASSIFICATION Non-plastic SM LL ____ PI ____

TYPE OF TEST Consolidated Slow

CONTROL Strain

RATE OF LOADING (in/min.) 0.00064

MOISTURE CONDITION Flooded

TYPE OF SPECIMEN Round

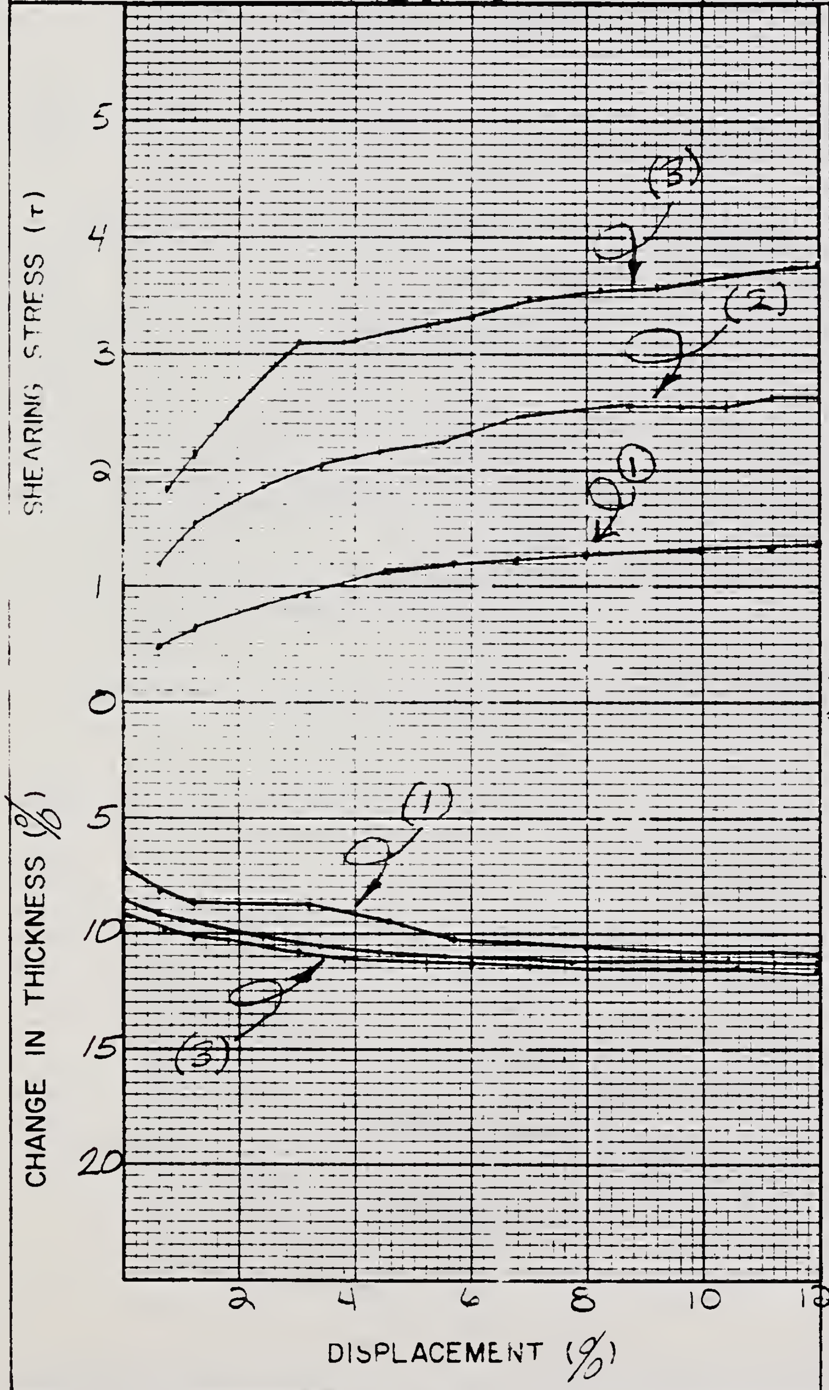
AREA (sq.in) 4.9

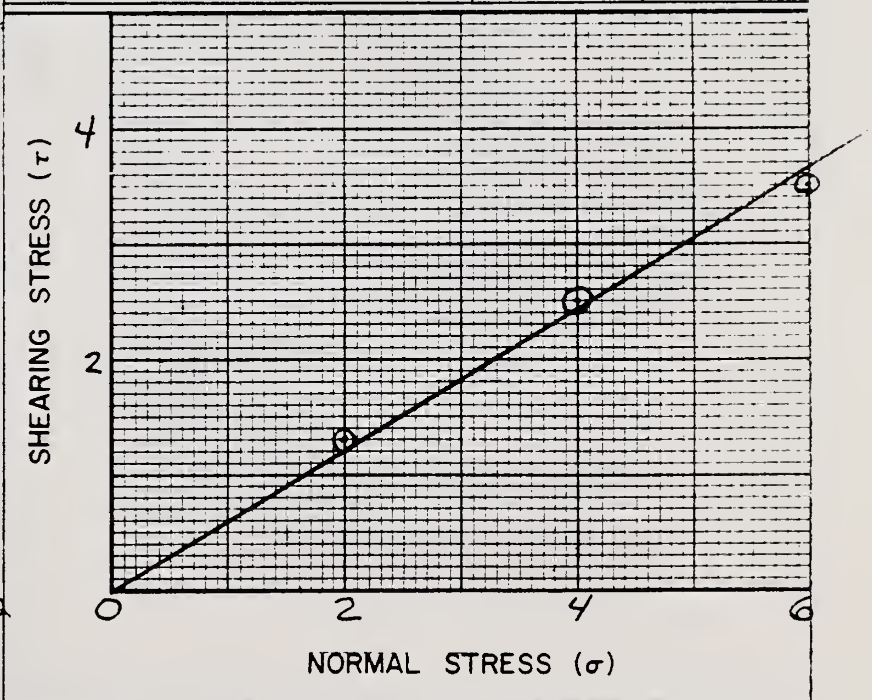
THICKNESS (in.) 1.0

SPECIFIC GRAVITY	
$G_s(-)$ #4	2.67
$G_s(+)$ #4	
G_m(bulk)(+) #4	

TEST NO.	1	2	3	4
INIT MOISTURE, %	7.34	7.34	7.34	
DRY DENSITY, ☒ g/cc ☐ pcf	1.54	1.54	1.54	
INIT VOID RATIO	.7338	.7338	.7338	
TEST DURATION, (min)	469	469	469	
FINAL MOISTURE, %	15.2	16.3	15.5	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	1.3	2.5	3.5	

SHEAR VALUES	∅	C
AT MAXIMUM STRESS	31°	0





REMARKS

Form SCS 366
9-64

LABORATORY NO 88C 104

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	# DIRECT SHEAR TEST

PROJECT and STATE: WEPP Williams Soil

SAMPLE LOCATION: McClusky ND

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: COMPACTED

TESTED AT: S.M.L., LINCOLN

APPROVED BY:

DATE:

CLASSIFICATION ______ LL ______ PI ______

TYPE OF TEST: Consolidated Slow

CONTROL: STRAIN

RATE OF LOADING (in/min.): 0.00064

MOISTURE CONDITION: FLOODED

TYPE OF SPECIMEN: ROUND

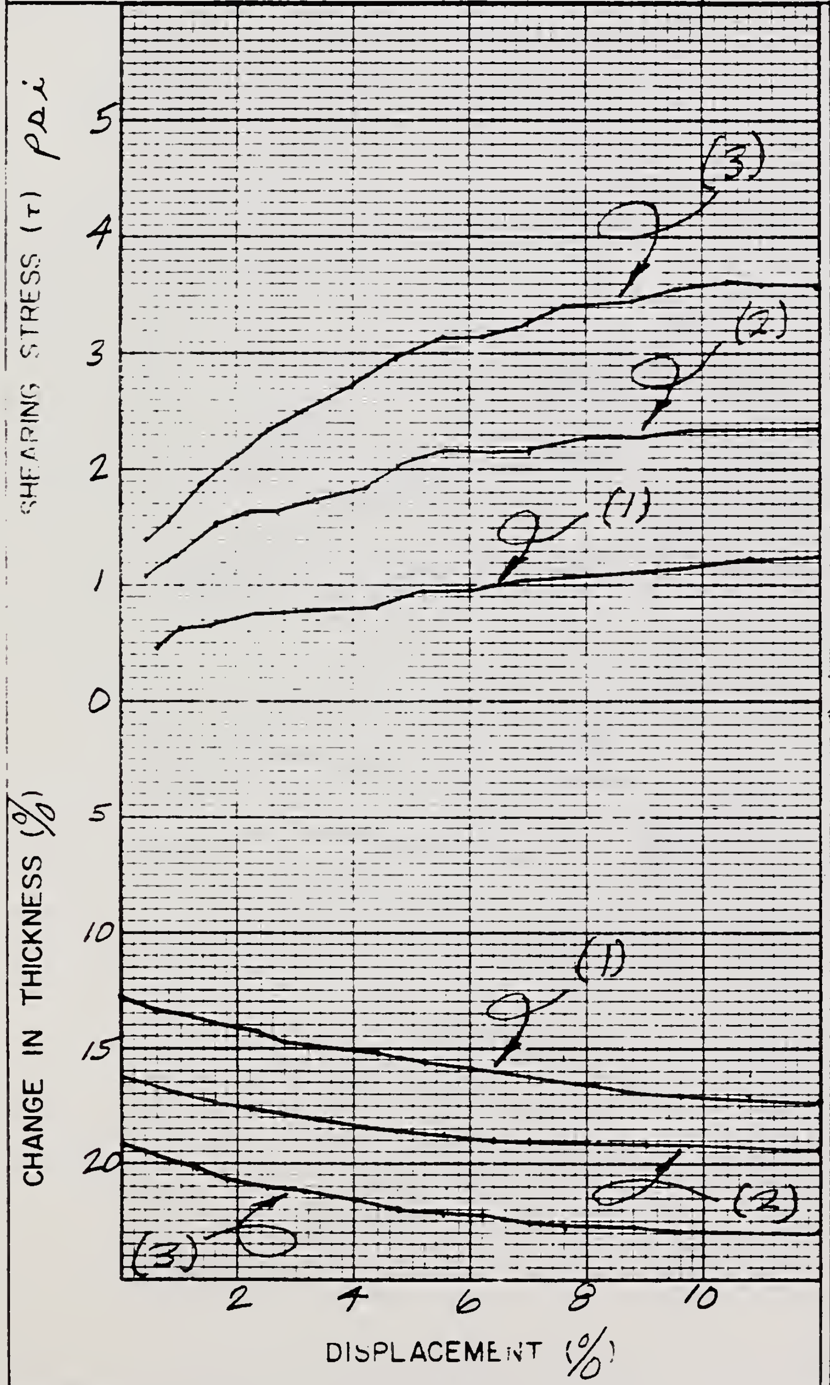
AREA (sq.in.): 4.9

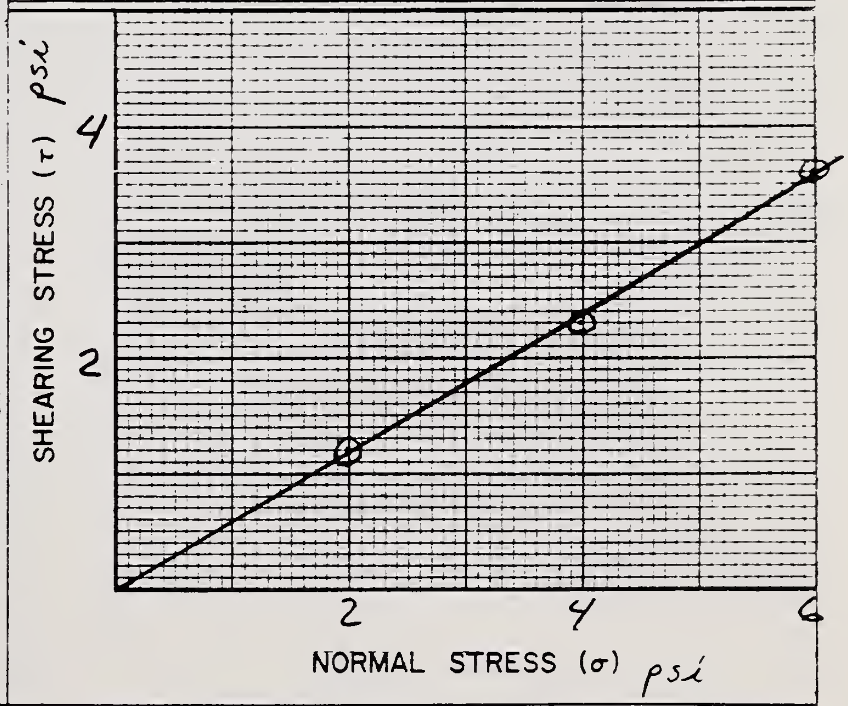
THICKNESS (in.): 1.0

SPECIFIC GRAVITY	
G_s (–) #4	2.59
G_s (+) #4	
G_m(bulk)(+) #4	

TEST NO.	1	2	3	4
INIT MOISTURE, %	16.78	16.78	16.78	
DRY DENSITY, ☒ g/cc ☐ pcf	1.16	1.16	1.16	
INIT VOID RATIO	1.2328	1.2328	1.2328	
TEST DURATION, (min)	469	469	469	
FINAL MOISTURE, %	28.97	27.27	24.88	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.2	2.3	3.6	

SHEAR VALUES	ø°	c psf
AT MAXIMUM STRESS	31°	0





REMARKS

Form SCS 366
9-64

LABORATORY NO 38C 105

MATERIALS TESTING REPORT | **U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**

DIRECT SHEAR TEST

PROJECT and STATE: WEPP Woodward Soil

SAMPLE LOCATION: Oklahoma

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: COMPACTED

TESTED AT: S.M.L., LINCOLN

APPROVED BY:

DATE:

CLASSIFICATION CL-ML LL 25 PI 7

SPECIFIC GRAVITY		
G_s (−) #4	2.61	
G_s (+) #4		
G_m (bulk) (+) #4		

TYPE OF TEST: Consolidated Slow

CONTROL: STRAIN

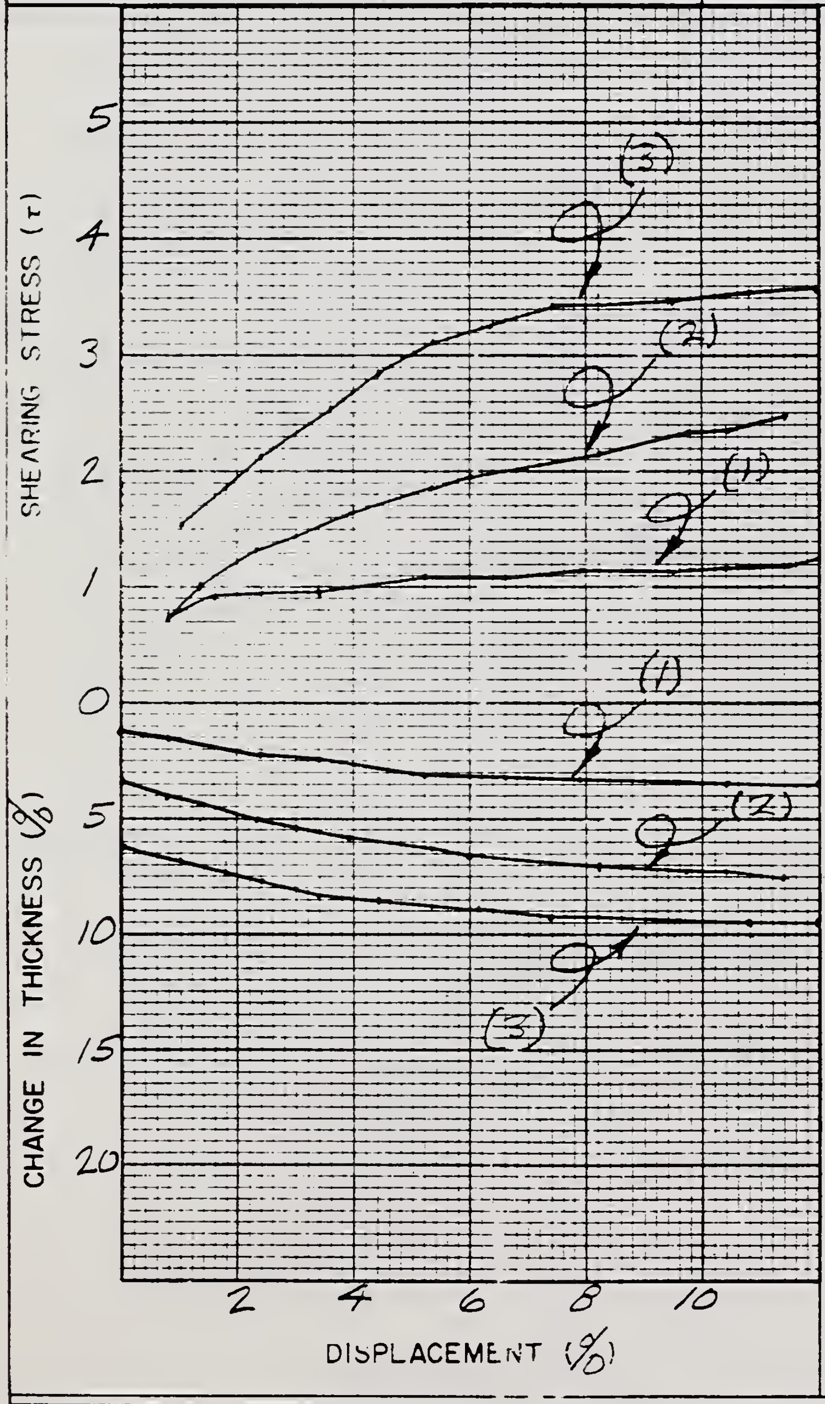
RATE OF LOADING (in/min.): 0.00064

MOISTURE CONDITION: FLOODED

TYPE OF SPECIMEN: ROUND

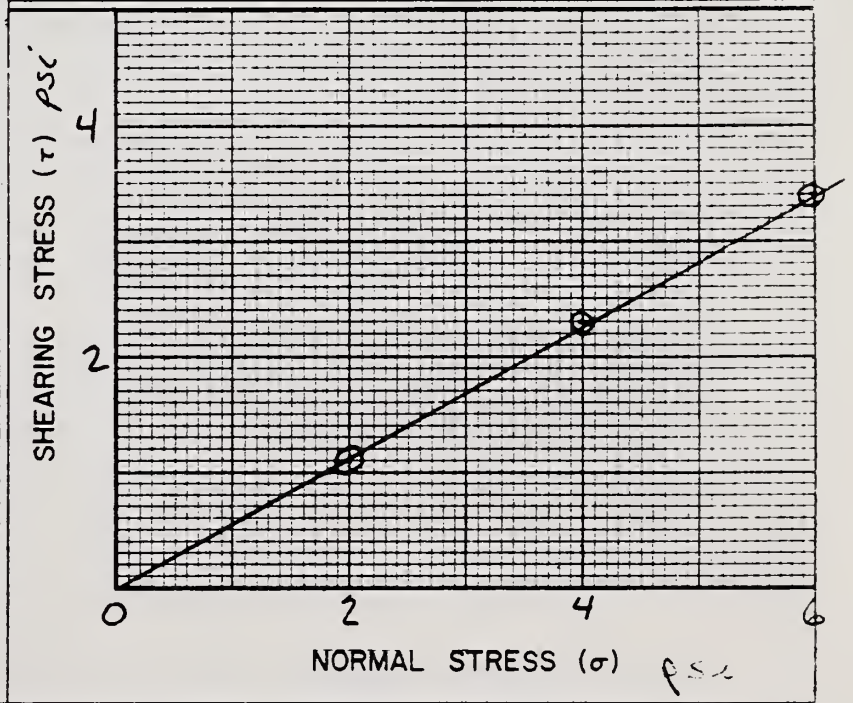
AREA (sq.in): 4.9

THICKNESS (in.): 1.0



TEST NO.	1	2	3	4
INIT MOISTURE, %	8.39	8.39	8.39	
DRY DENSITY, ☒ g/cc ☐ pcf	1.41	1.41	1.41	
INIT VOID RATIO	.8511	.8511	.8511	
TEST DURATION, (min)	469	444	469	
FINAL MOISTURE, %	24.8	23.5	22.3	
NORMAL STRESS psi	2	4	6	
MAX SHEAR STRESS psi	1.1	2.3	3.4	

SHEAR VALUES	Ø	C
AT MAXIMUM STRESS	30°	0



REMARKS

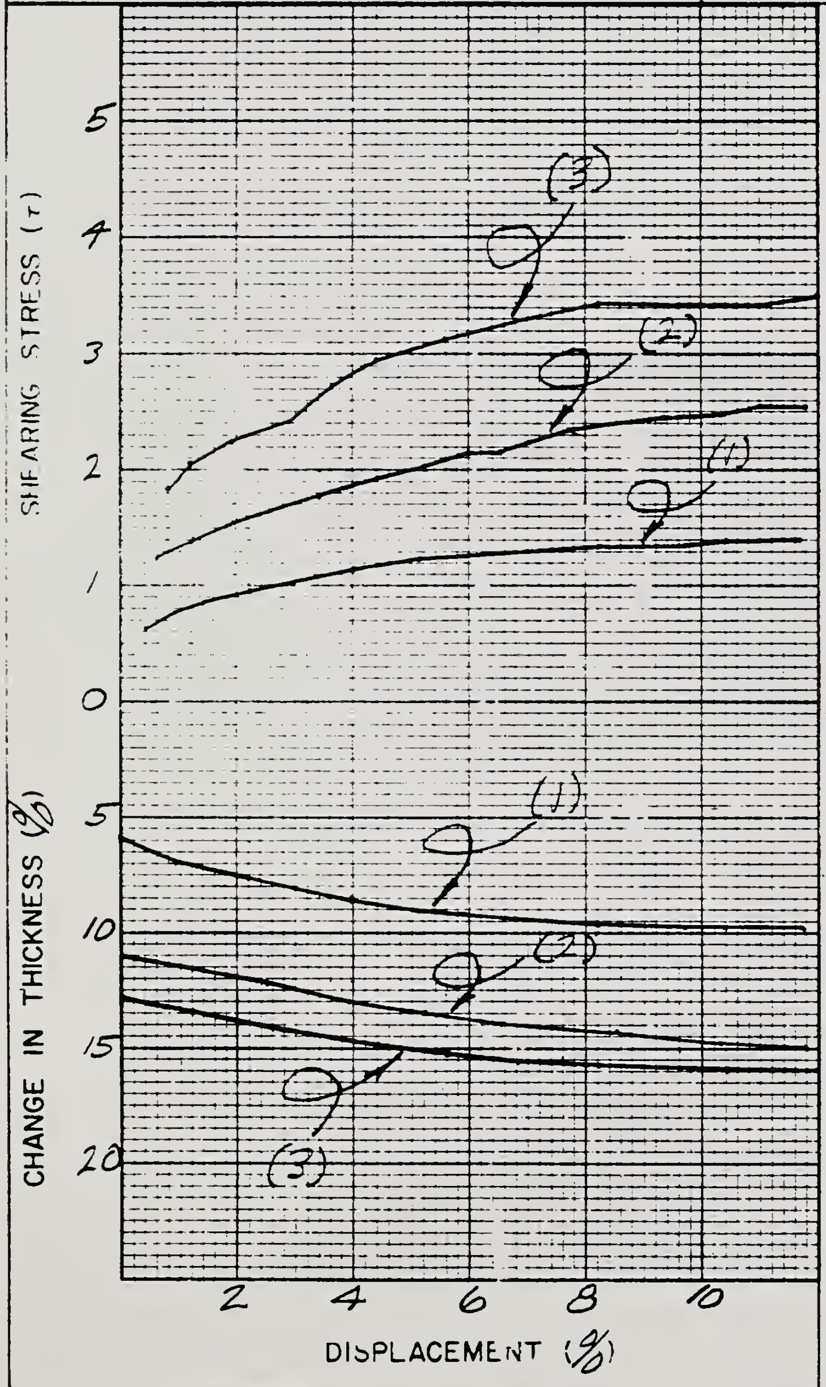
Form SCS 366
9-64

LABORATORY NO 88C 106

MATERIALS TESTING REPORT	**U.S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**DIRECT SHEAR TEST**

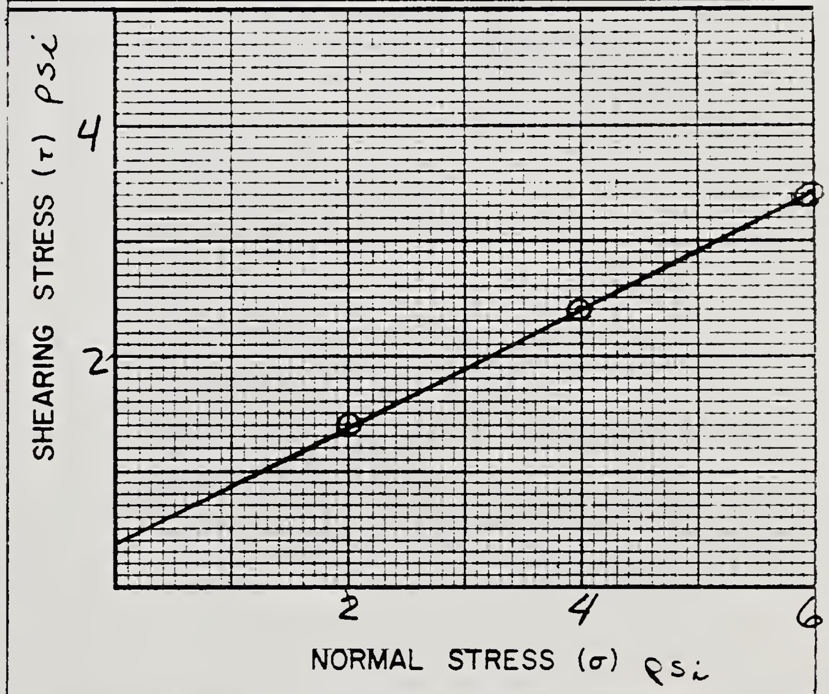
PROJECT and STATE WEPP Zahl Soil		SAMPLE LOCATION ND	
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE COMPACTED	TESTED AT S.M.L., LINCOLN	APPROVED BY	DATE

CLASSIFICATION	LL	PI	SPECIFIC GRAVITY
TYPE OF TEST Consolidated Slow	CONTROL STRAIN	G_s(-) #4	
RATE OF LOADING (in/min) 0.00064	MOISTURE CONDITION FLOODED	G_s(+) #4	
TYPE OF SPECIMEN ROUND	AREA (sq.in.) 4.9	THICKNESS (in) 1.0	G_m(bulk)(+) #4



TEST NO.	1	2	3	4
INIT MOISTURE, %	16.7	16.7	16.7	
DRY DENSITY, ☒ g/cc ☐ pcf	1.25	1.25	1.25	
INIT VOID RATIO				
TEST DURATION, (min)	456	459	469	
FINAL MOISTURE, %	30.2	25.1	26.2	
NORMAL STRESS psi	2	4	6	
MAX. SHEAR STRESS psi	1.4	2.4	3.4	

SHEAR VALUES	ø	c
AT MAXIMUM STRESS	27°	50 psf



REMARKS

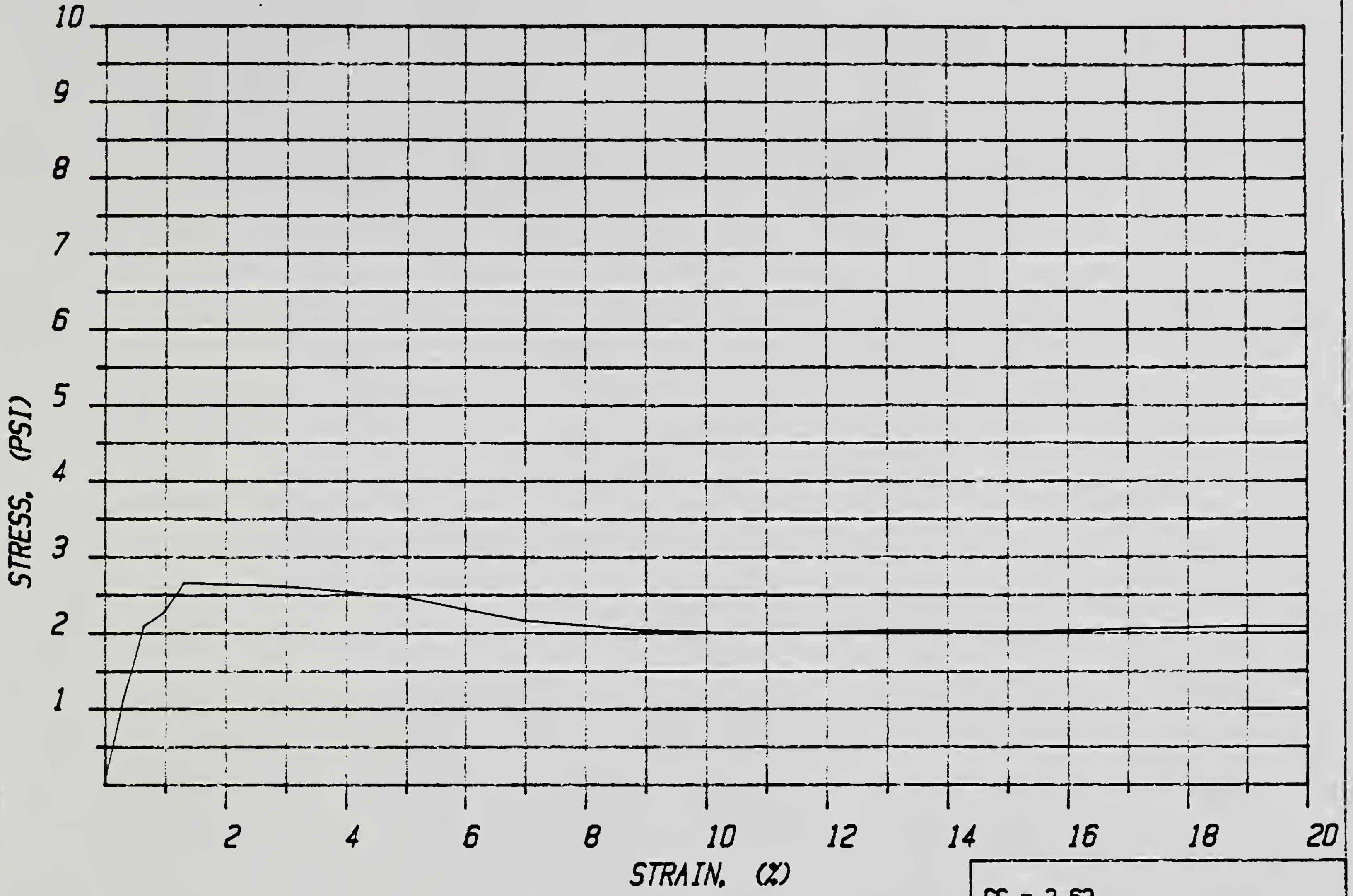
Unconfined Compression Test Data

UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.

SAMPLE NO. 88C 89

PROJECT: WEPP - ABILENE SOIL - TEXAS

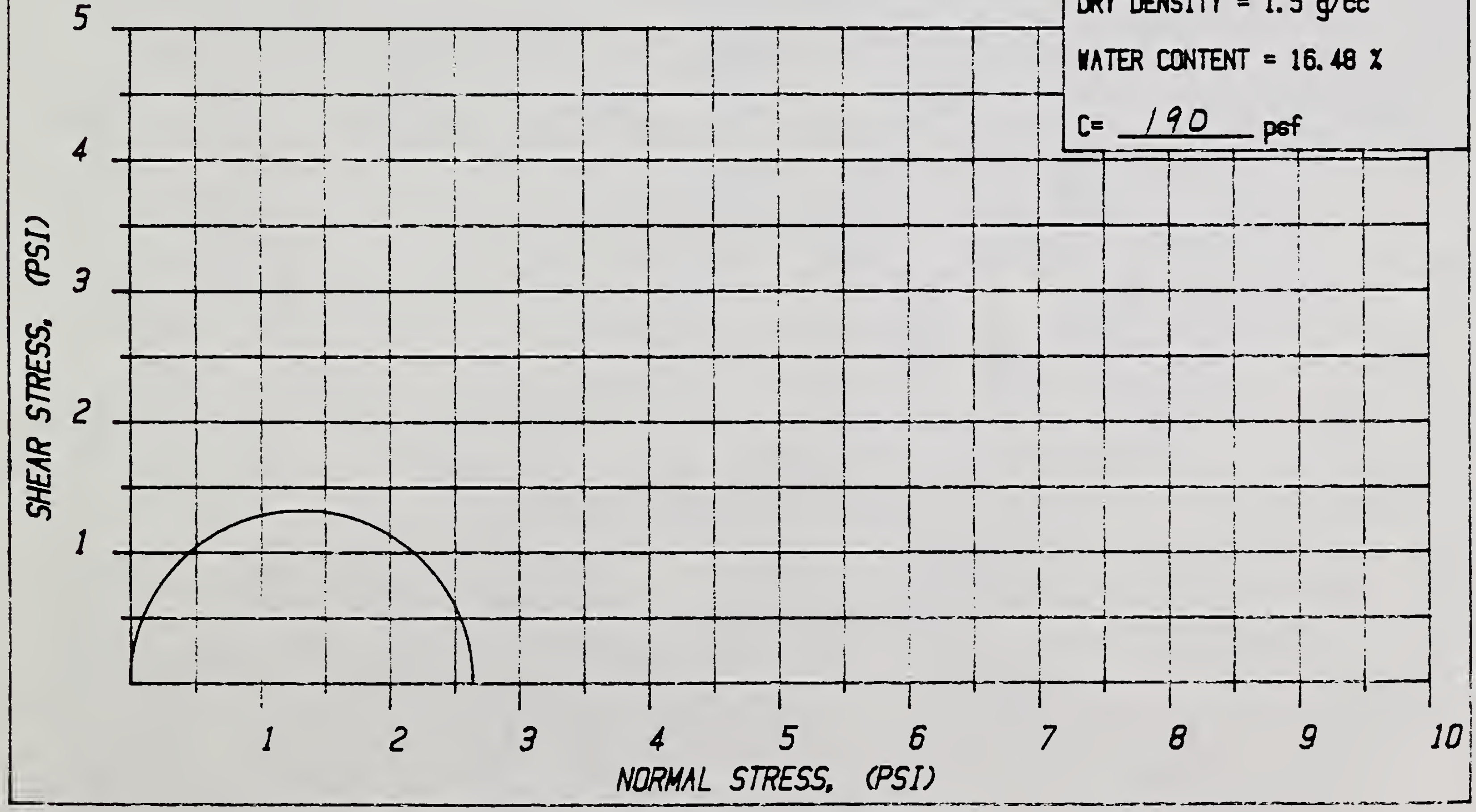


GS = 2.63

DRY DENSITY = 1.5 g/cc

WATER CONTENT = 16.48 %

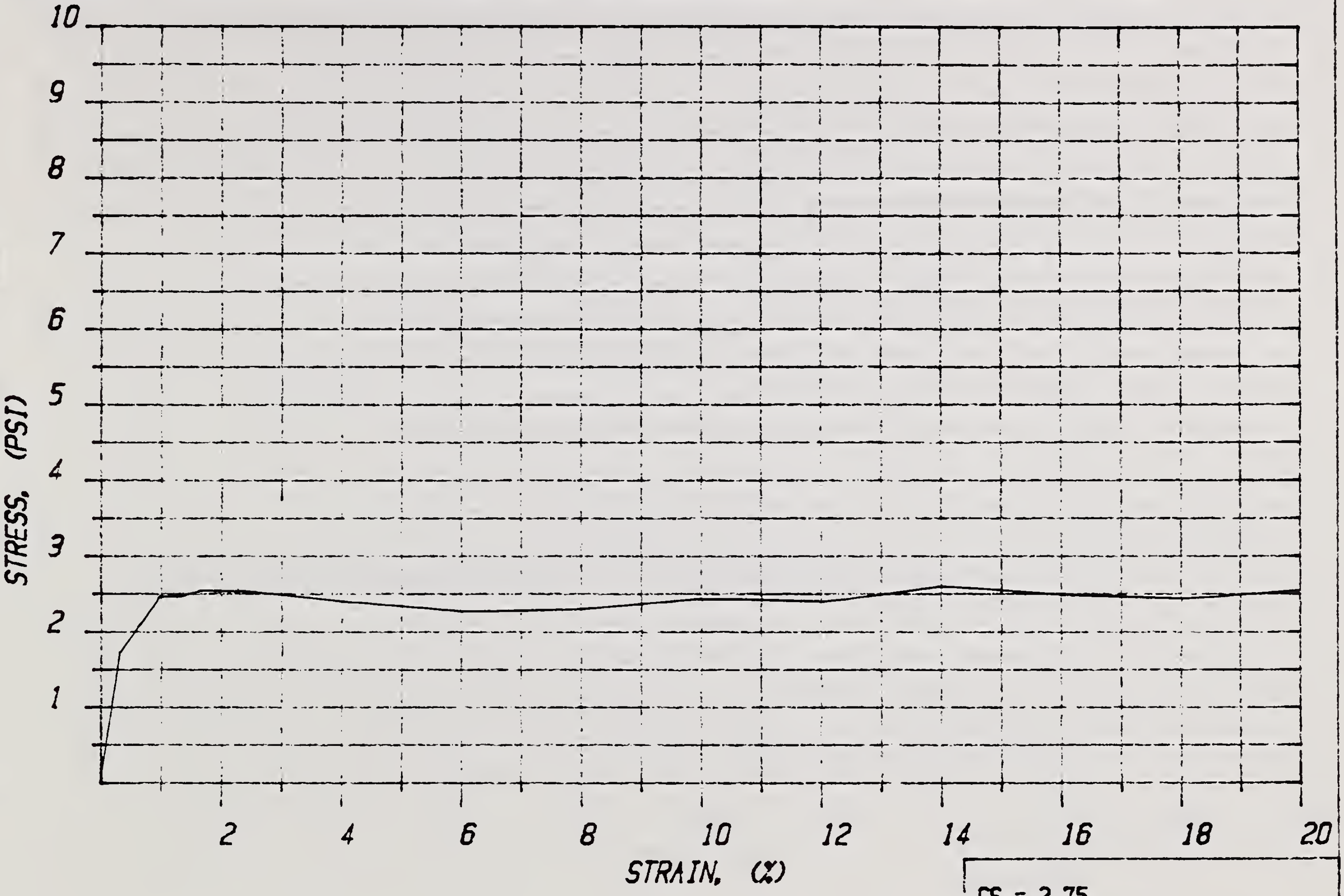
C= 190 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 90

PROJECT: WEPP - ACADEMY SOIL - FRESNO CA.

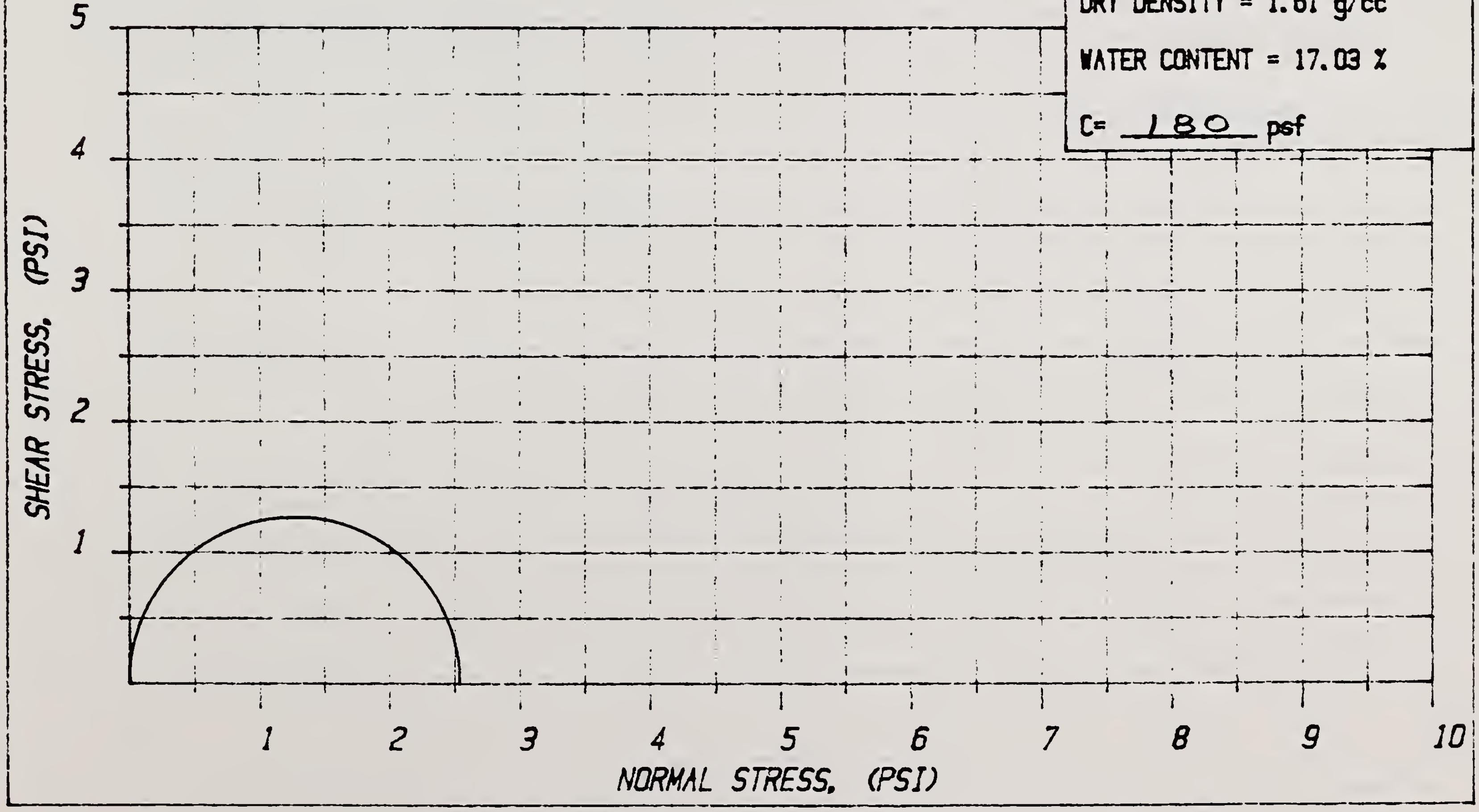


GS = 2.75

DRY DENSITY = 1.61 g/cc

WATER CONTENT = 17.03 %

C= 180 psf

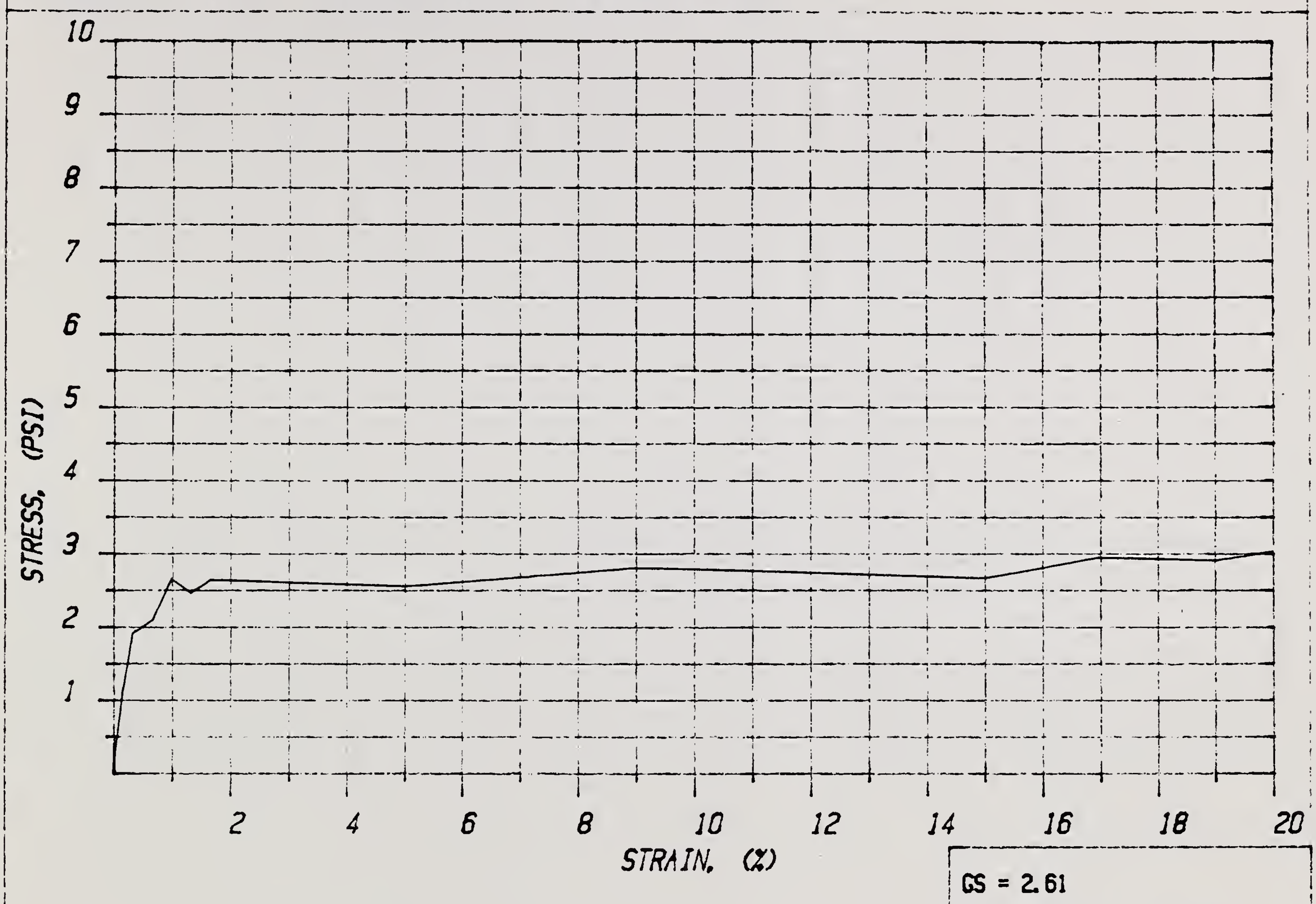


UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.

SAMPLE NO. 88C 91

PROJECT: WEPP - BARNES SOIL - MORRIS MN.

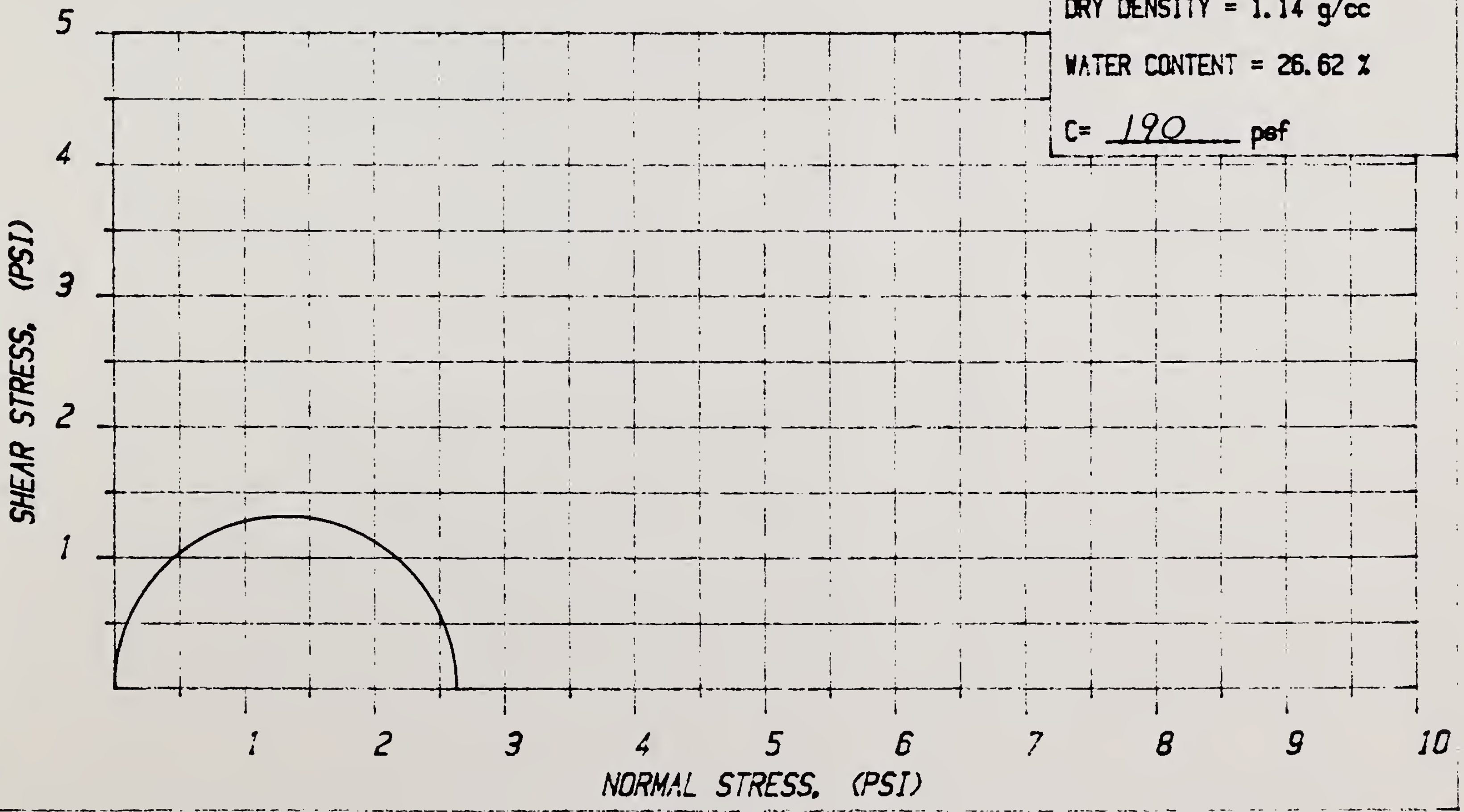


GS = 2.61

DRY DENSITY = 1.14 g/cc

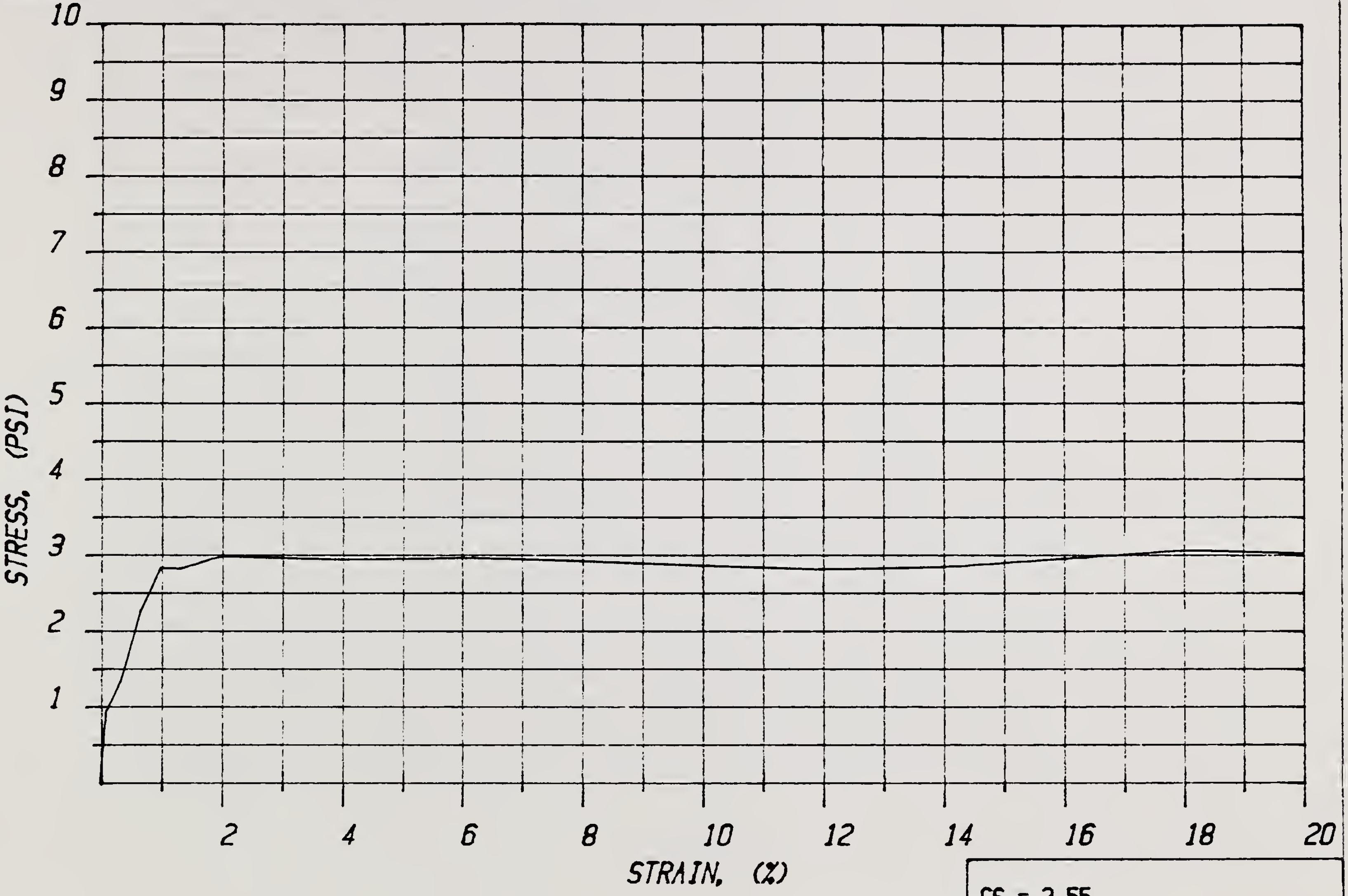
WATER CONTENT = 26.62 %

C= 190 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 92
PROJECT: WEPP - BARNES SOIL - McCLUSKY ND.	

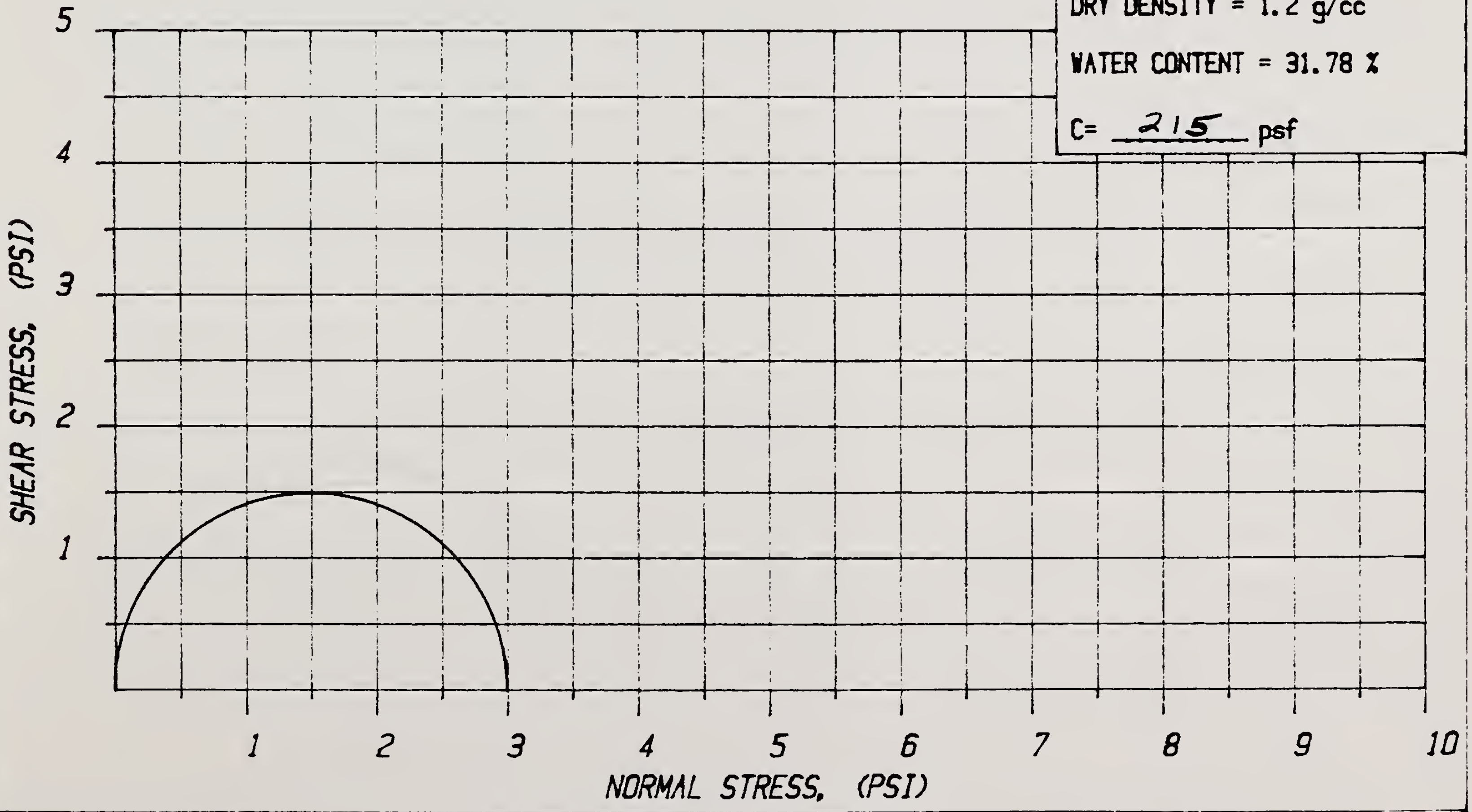


GS = 2.55

DRY DENSITY = 1.2 g/cc

WATER CONTENT = 31.78 %

C= 215 psf

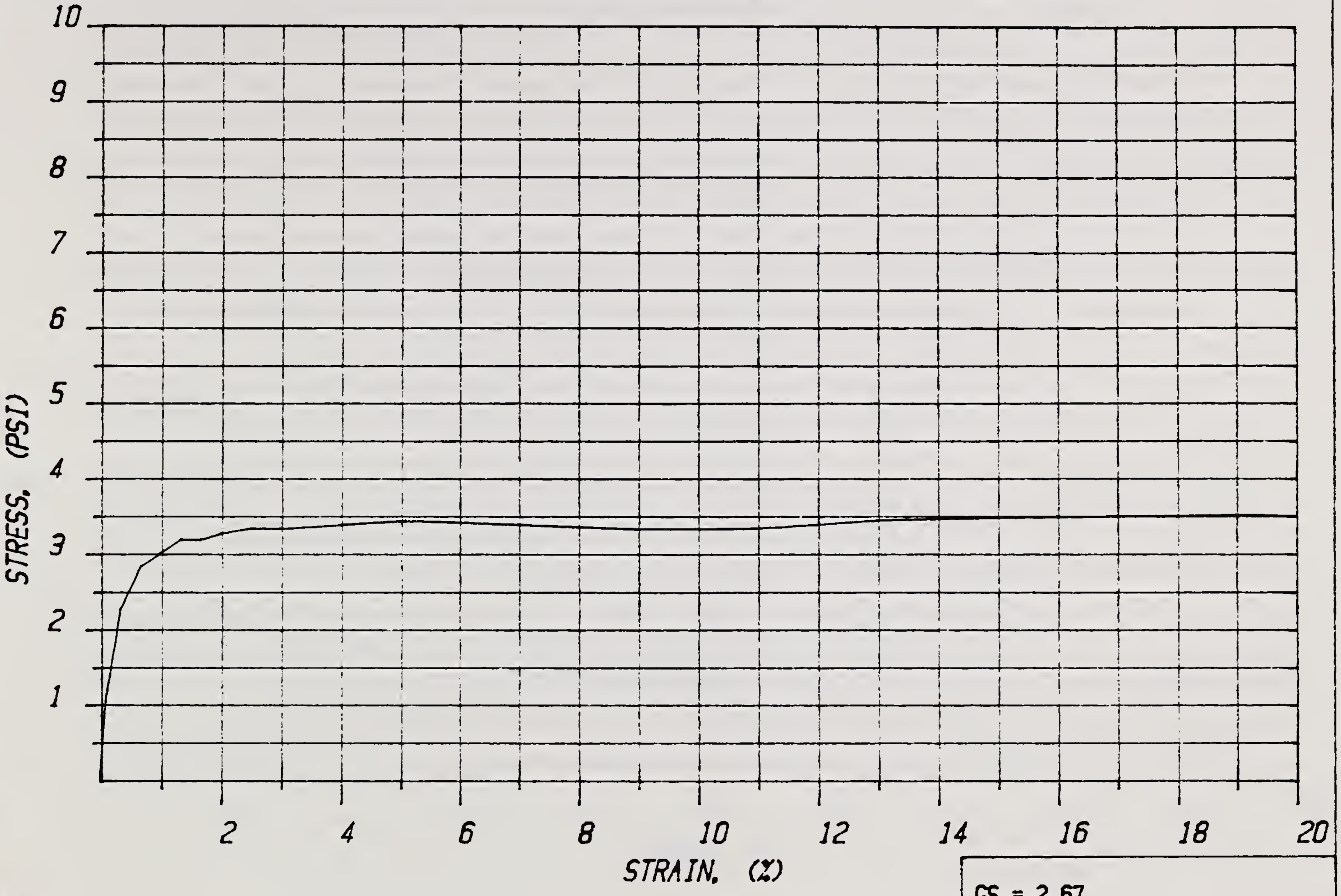


UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.

SAMPLE NO. 88C 93

PROJECT: WEPP - HEIDEN SOIL - WACO TX.

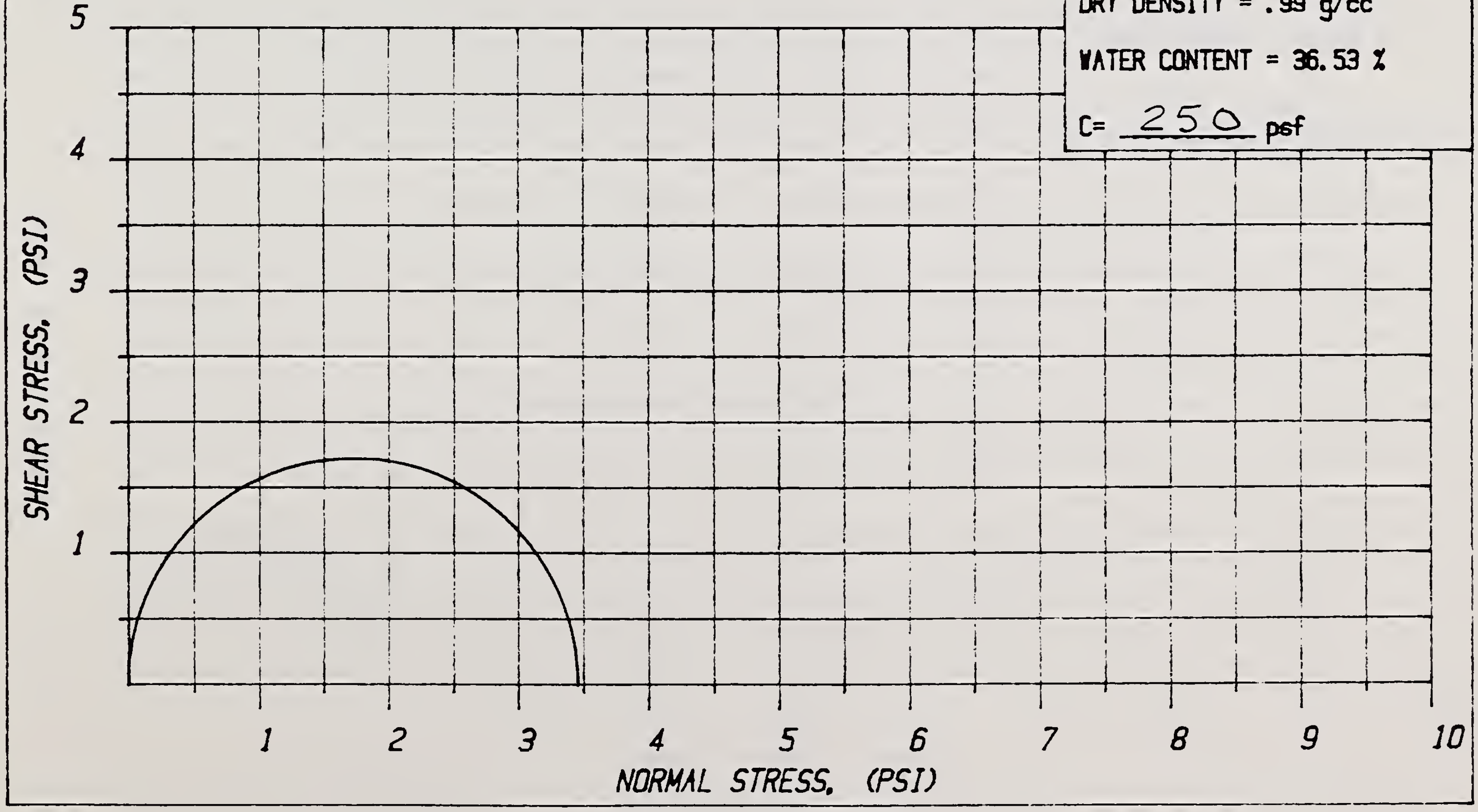


GS = 2.67

DRY DENSITY = .99 g/cc

WATER CONTENT = 36.53 %

C= 250 psf

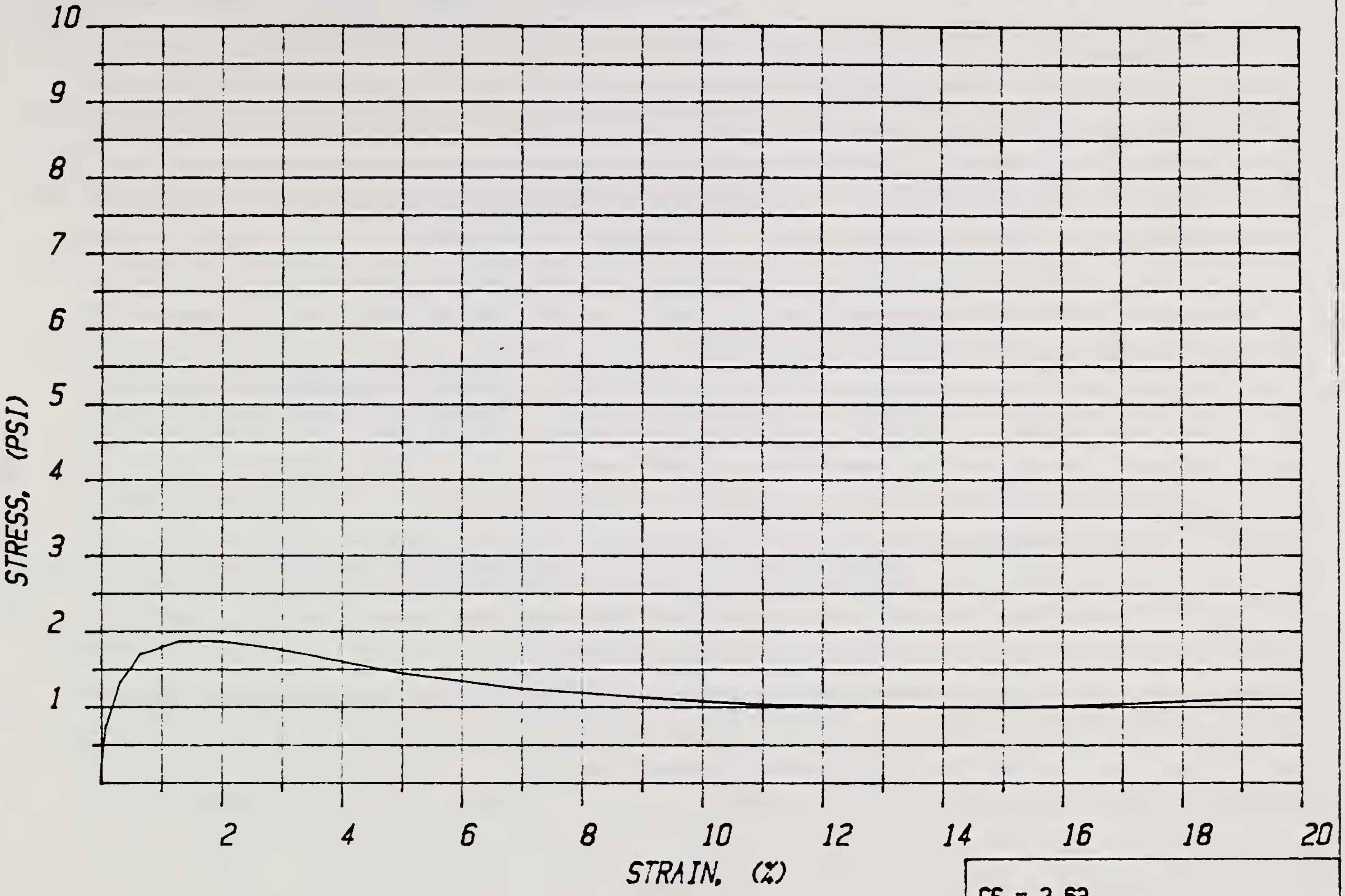


UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.

SAMPLE NO. 88C 94

PROJECT: WEPP - HIRSH SOIL - ORD NE.

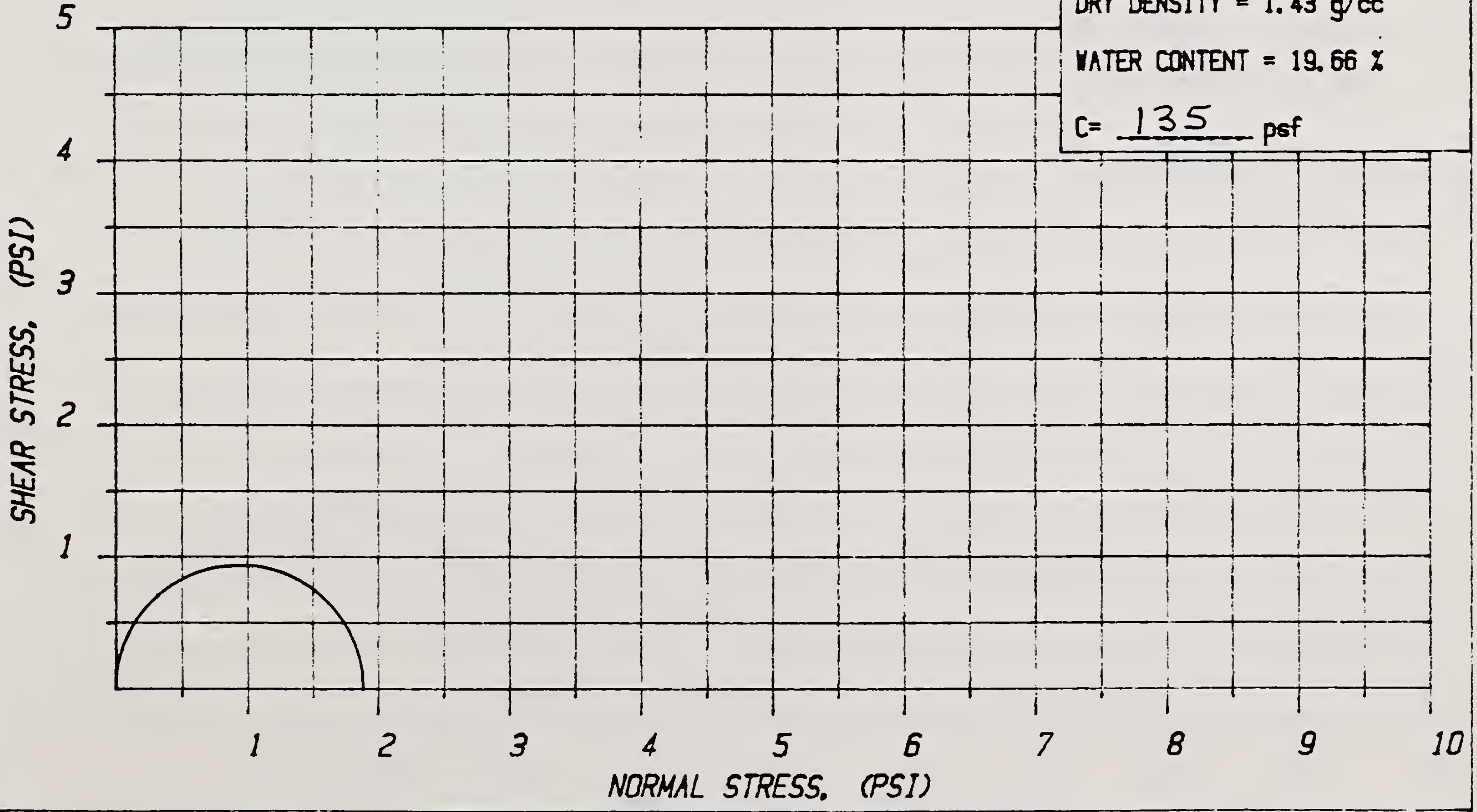


GS = 2.63

DRY DENSITY = 1.43 g/cc

WATER CONTENT = 19.66 %

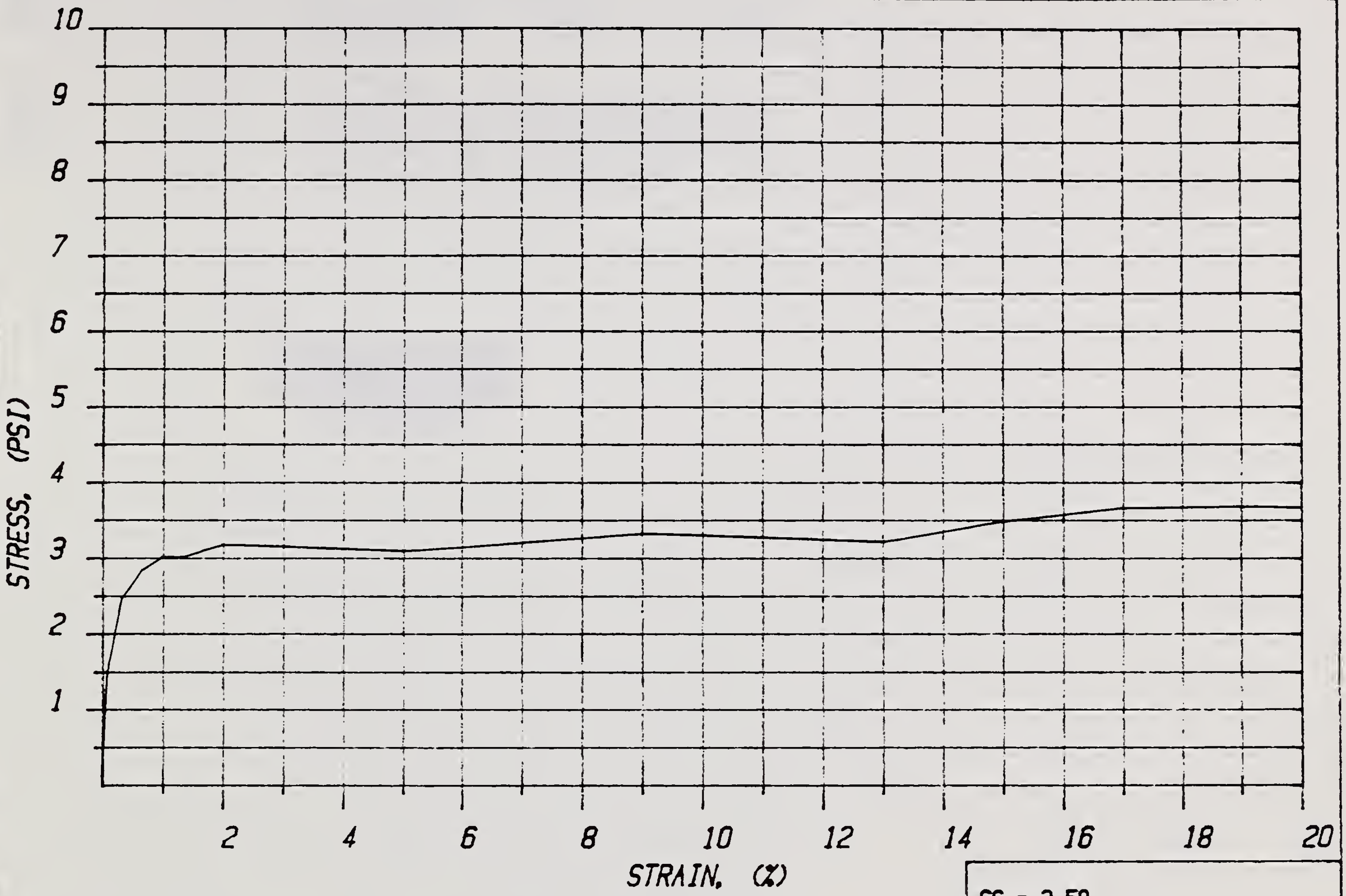
C= 135 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 95

PROJECT: WEPP - KEITH SOIL - ALBIN WY.

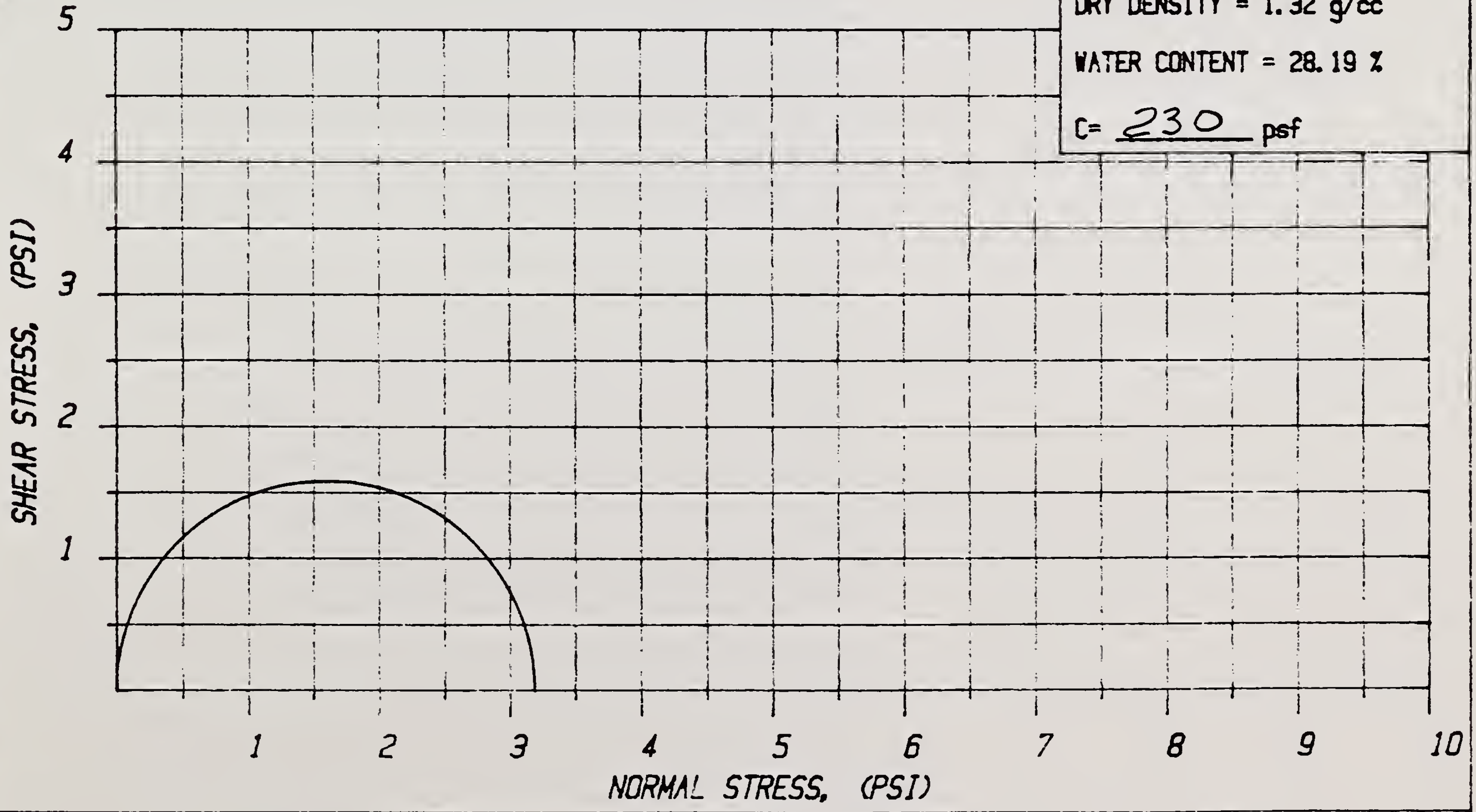


GS = 2.59

DRY DENSITY = 1.32 g/cc

WATER CONTENT = 28.19 %

C= 230 psf



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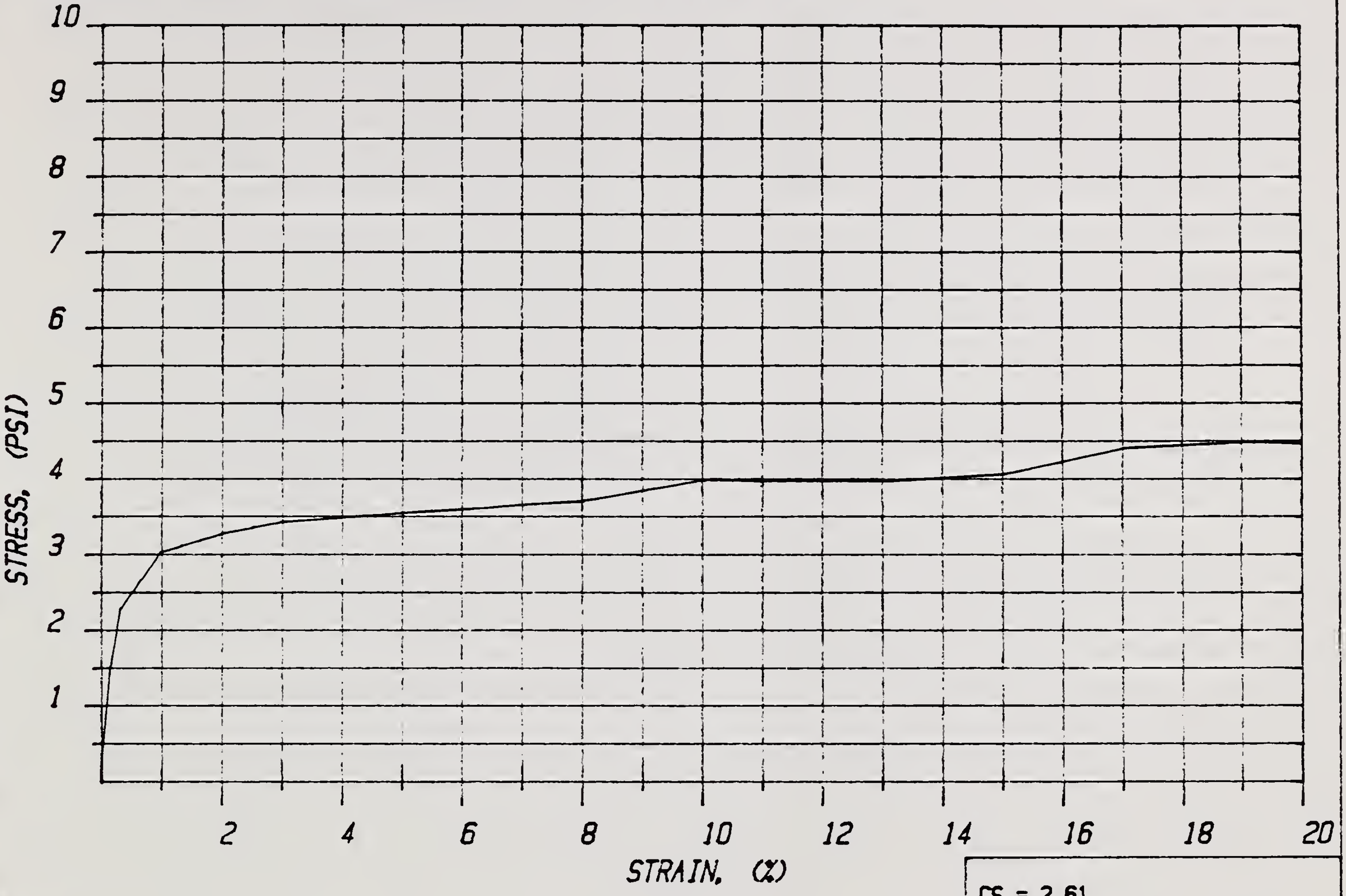
040			‡a AGLG
245	1		‡a WEPP 1987 cropland samples : ‡b soil mechanics tests.
260			‡a Lincoln, NE : ‡b USDA, Soil Conservation Service, Midwest National Technical Center, Soil Mechanics Laboratory, ‡c 1987.

UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 96

PROJECT: WEPP - LOS BANOS SOIL - FRESNO CA.

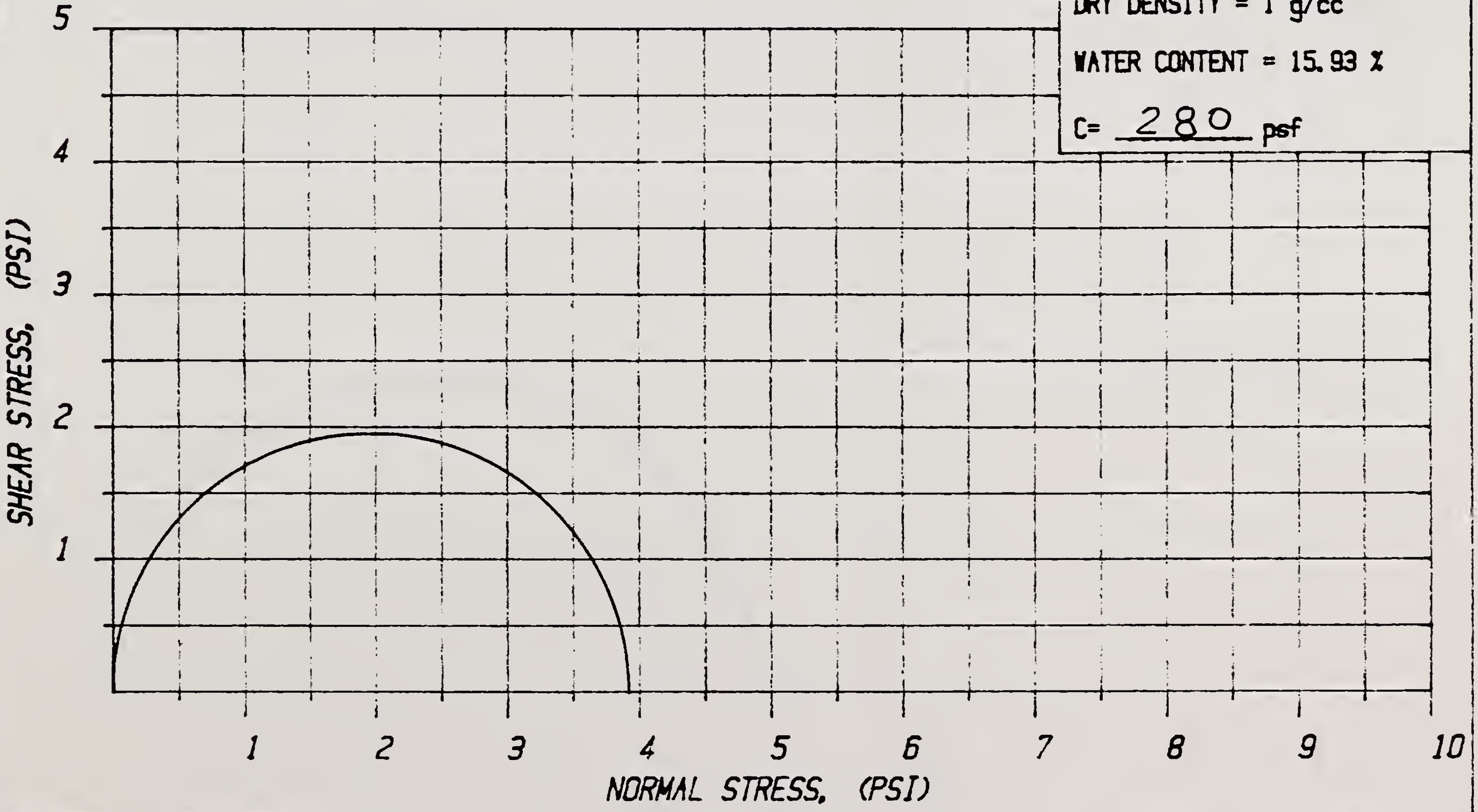


GS = 2.61

DRY DENSITY = 1 g/cc

WATER CONTENT = 15.93 %

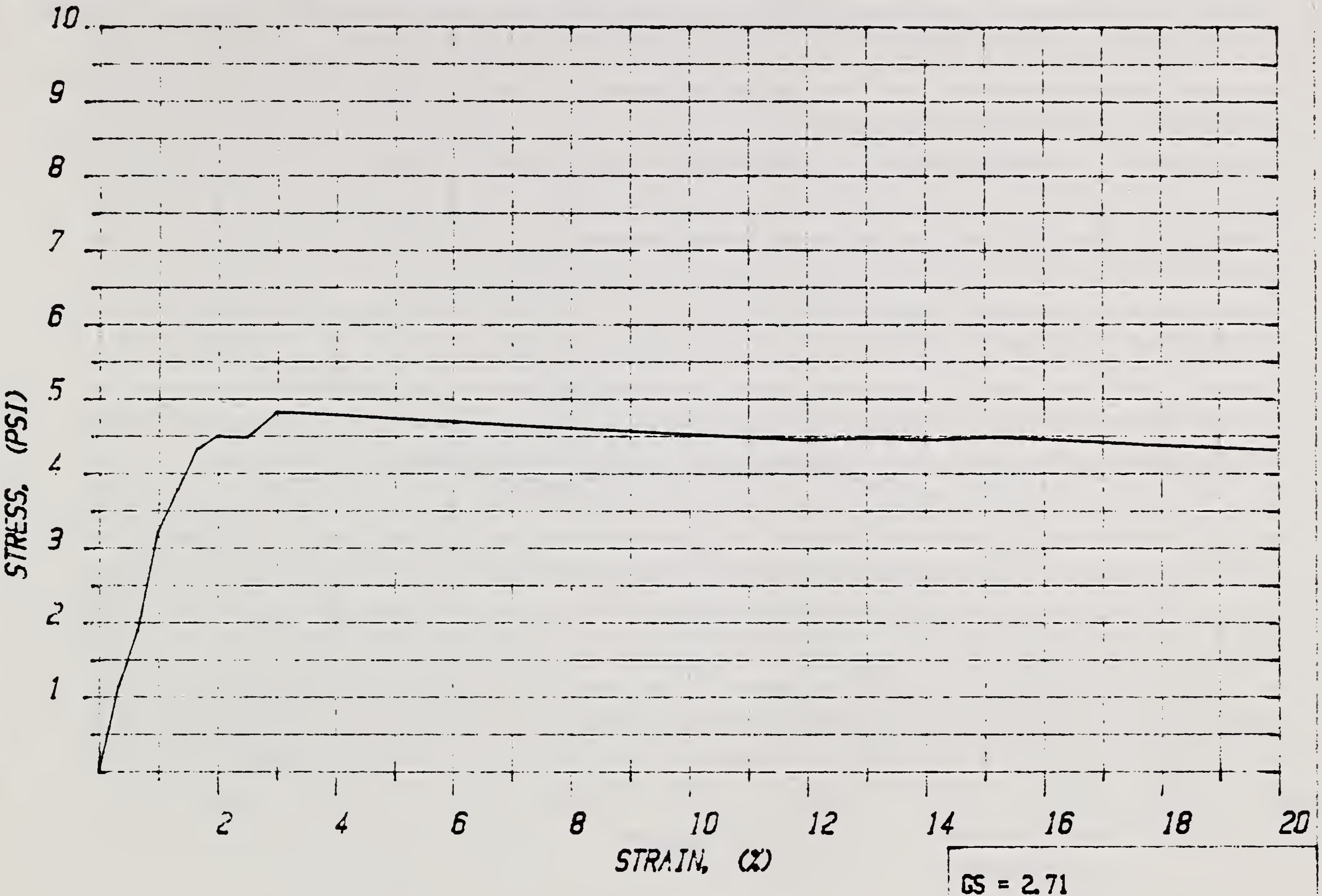
C= 280 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE. | SAMPLE NO. 88C97

PROJECT: WEPP - PIERRE SOIL - COTTONWOOD SD.

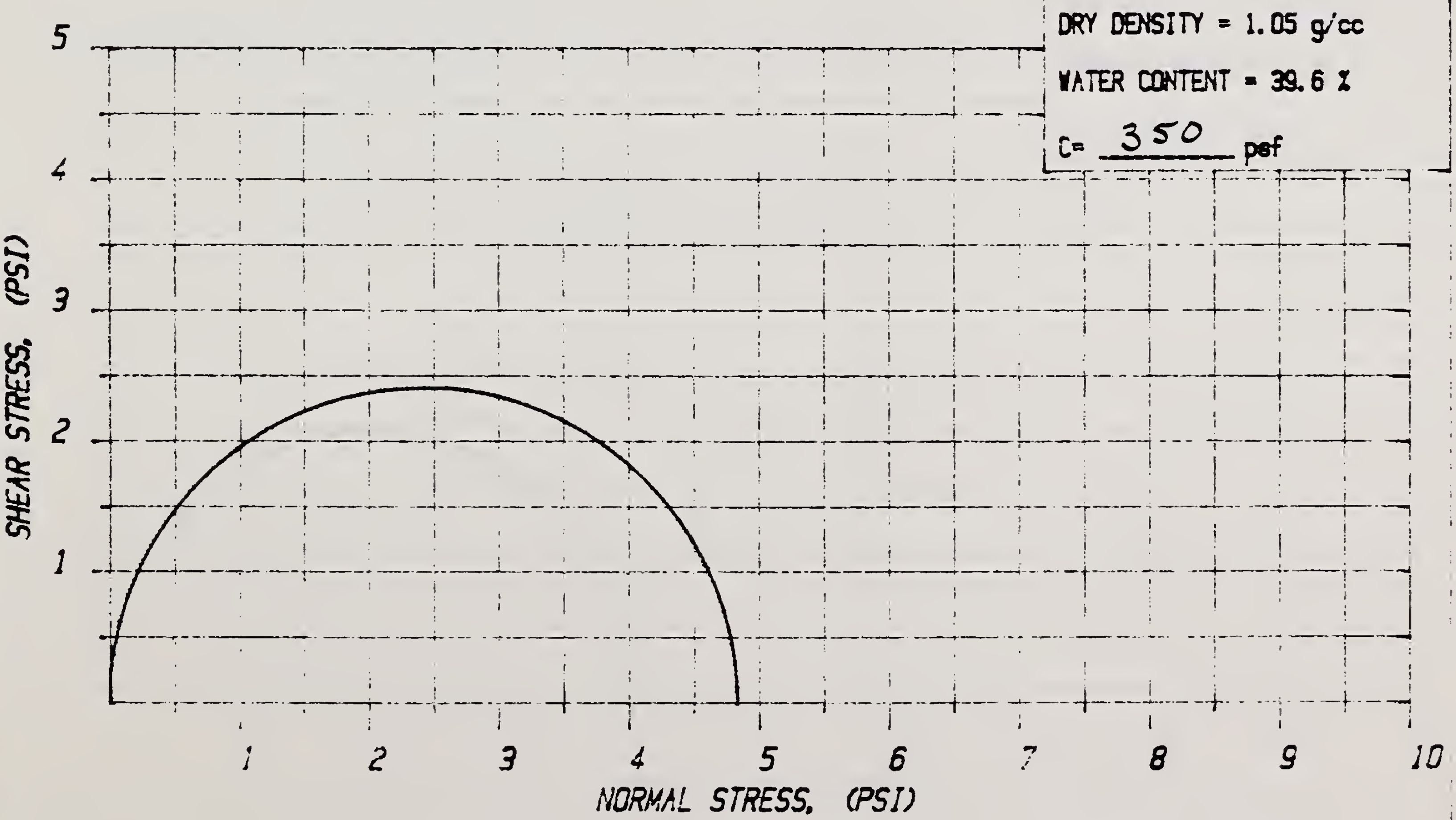


GS = 2.71

DRY DENSITY = 1.05 g/cc

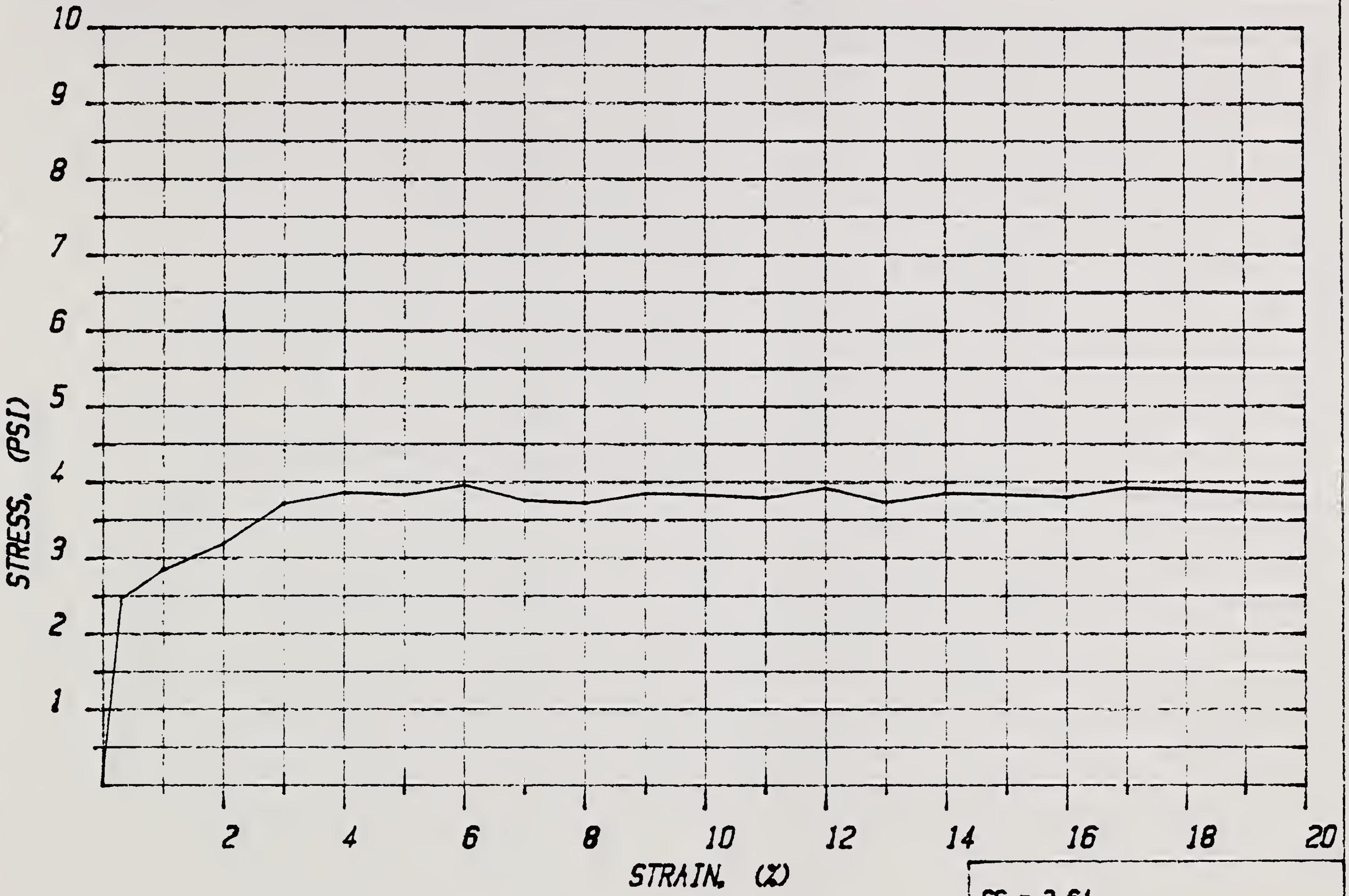
WATER CONTENT = 39.6 %

C= 350 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 99C98
PROJECT: WEPP - PALOUSE SOIL - PULLMAN WA.	

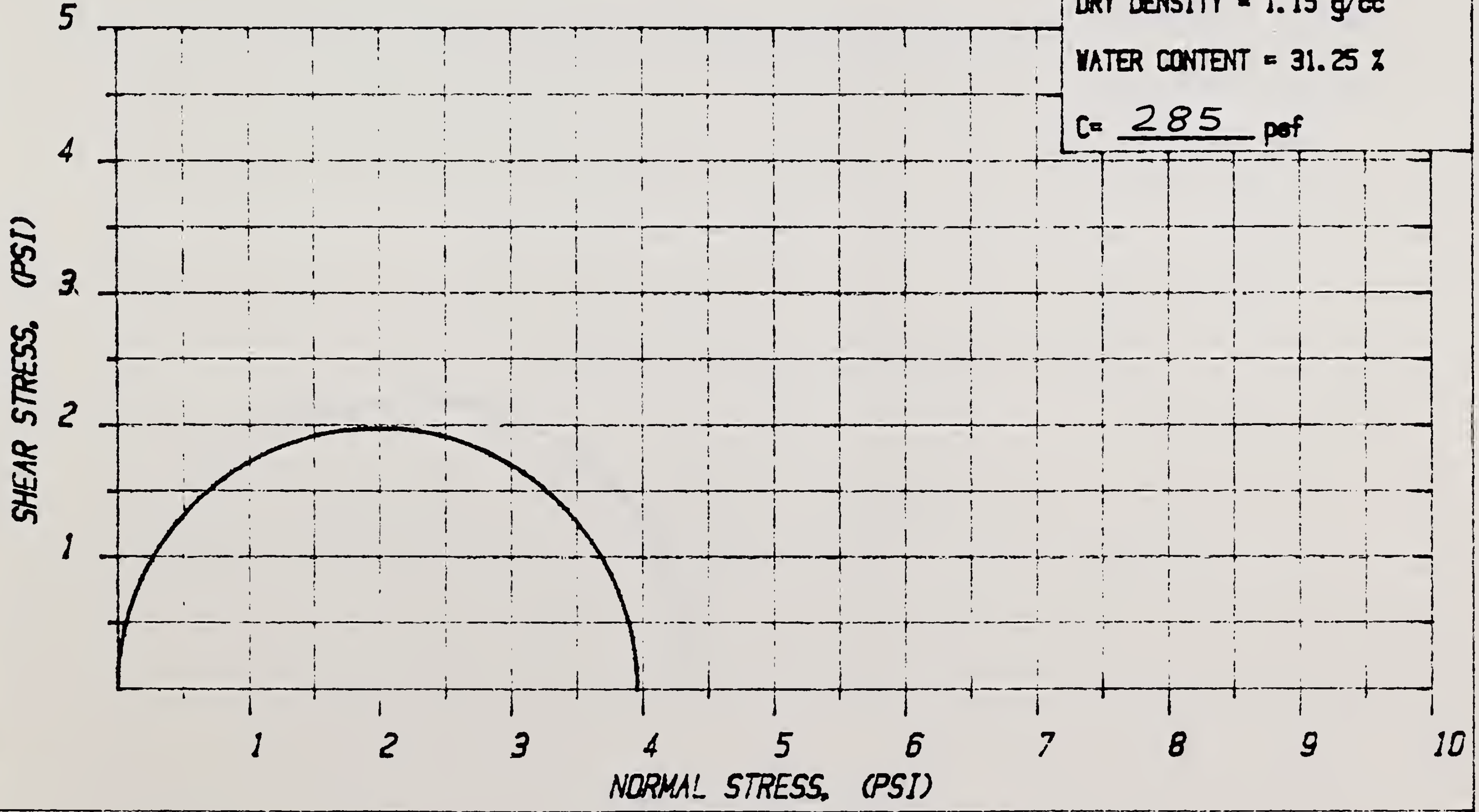


GS = 2.64

DRY DENSITY = 1.15 g/cc

WATER CONTENT = 31.25 %

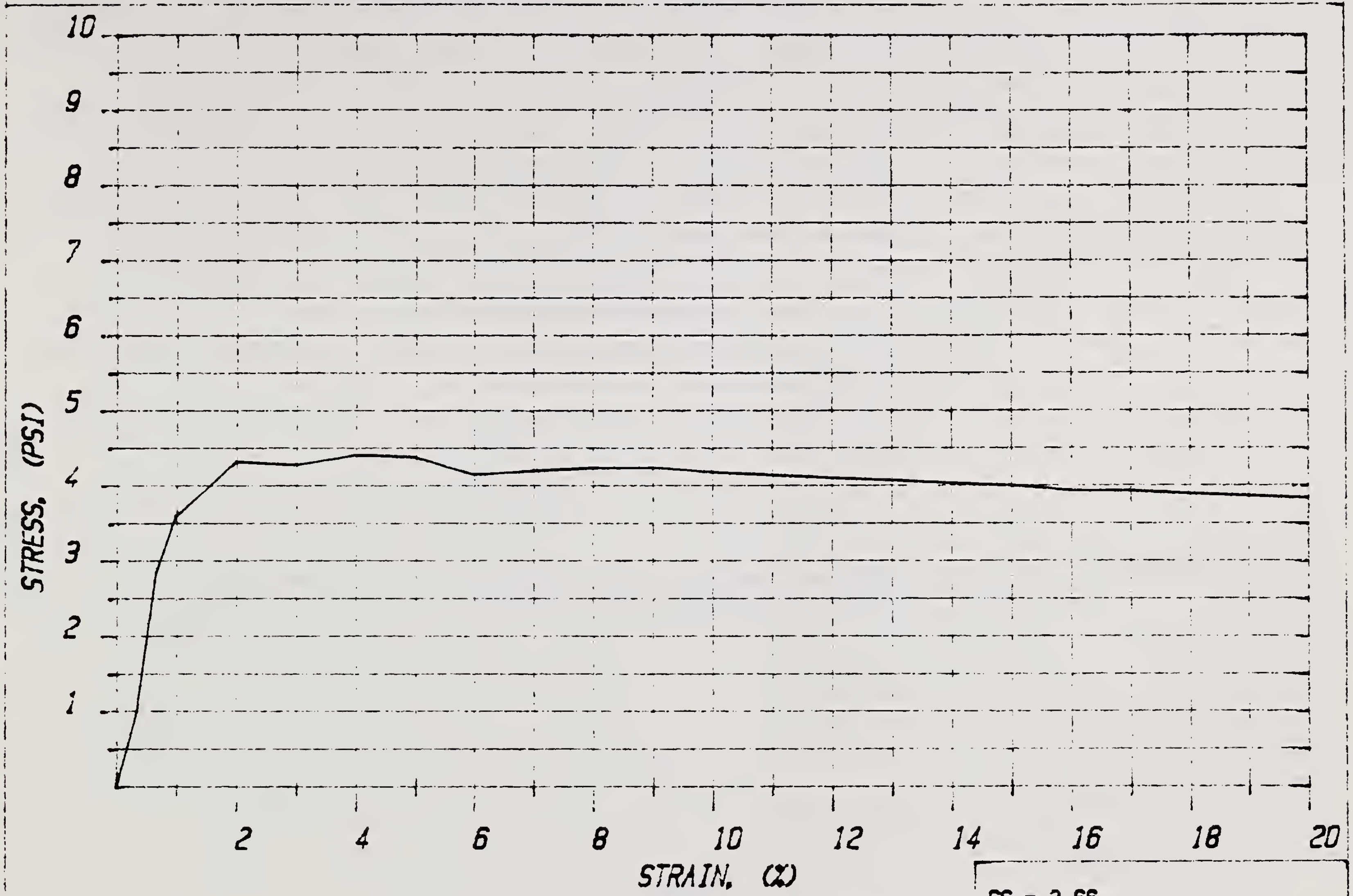
C= 285 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE. SAMPLE NO. 88C99

PROJECT: WEPP - PORTNEUF SOIL - KIMBERLY ID.

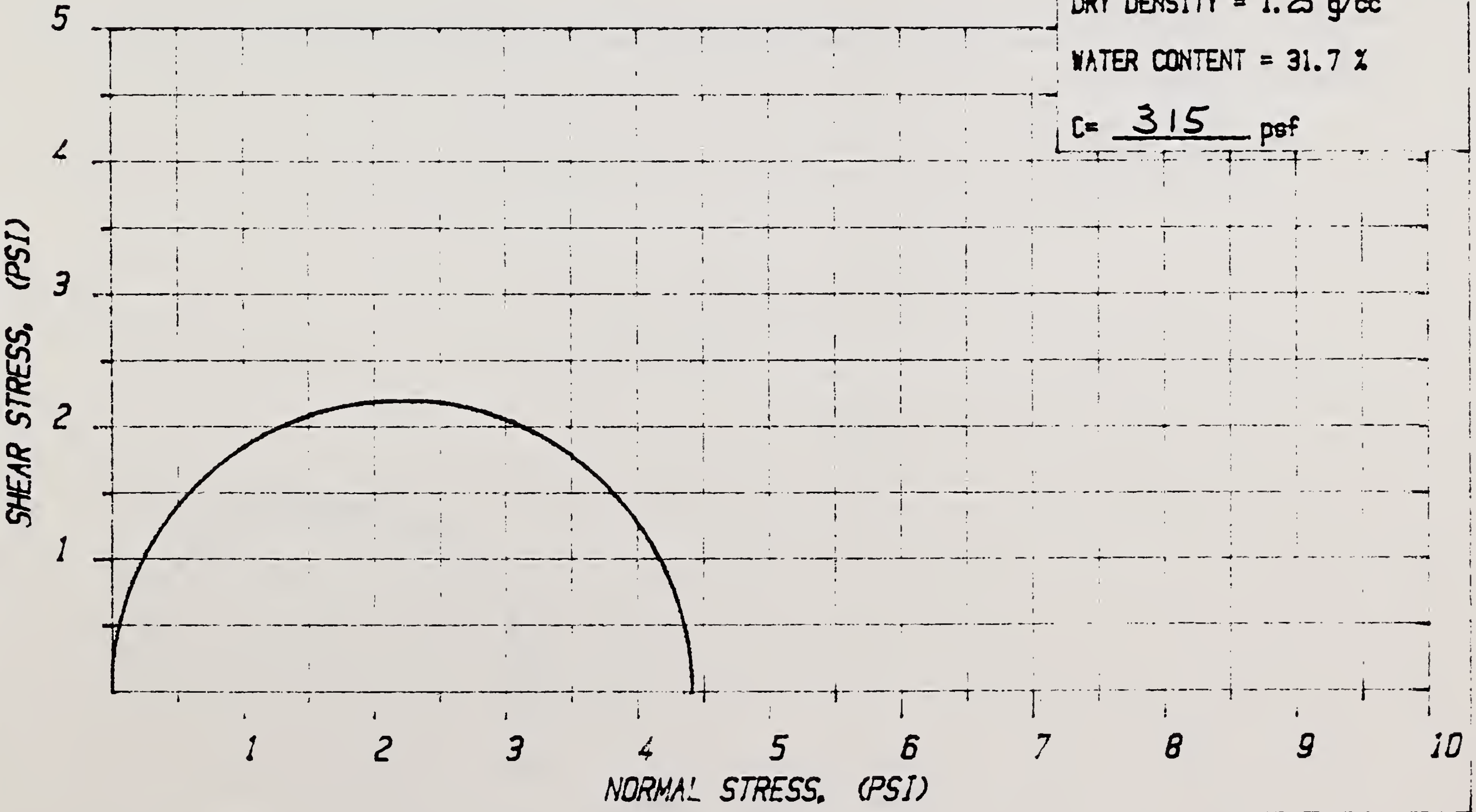


GS = 2.66

DRY DENSITY = 1.25 g/cc

WATER CONTENT = 31.7 %

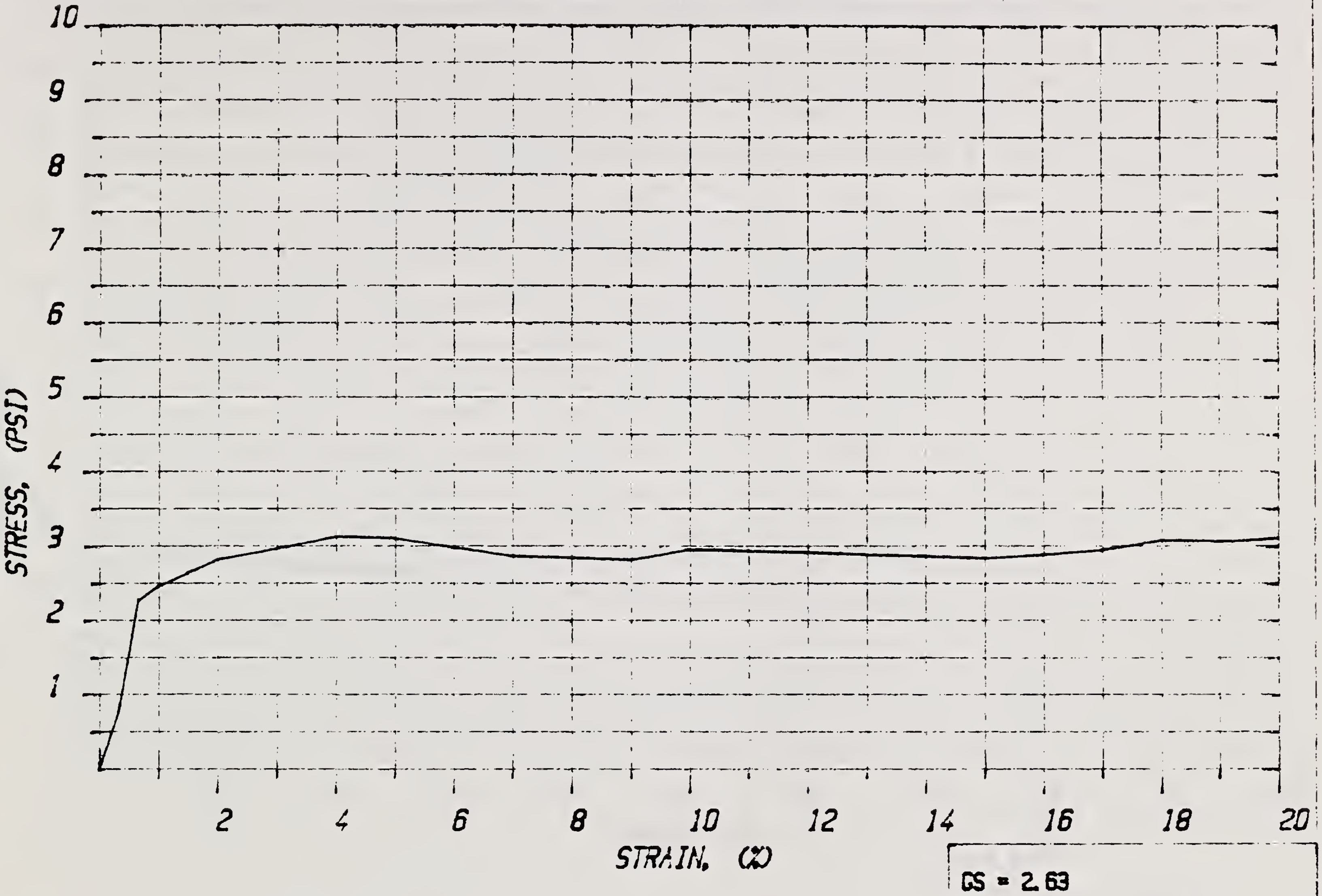
C= 315 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C100

PROJECT: WEPP - SHARPSBURG SOIL - LINCOLN NE.

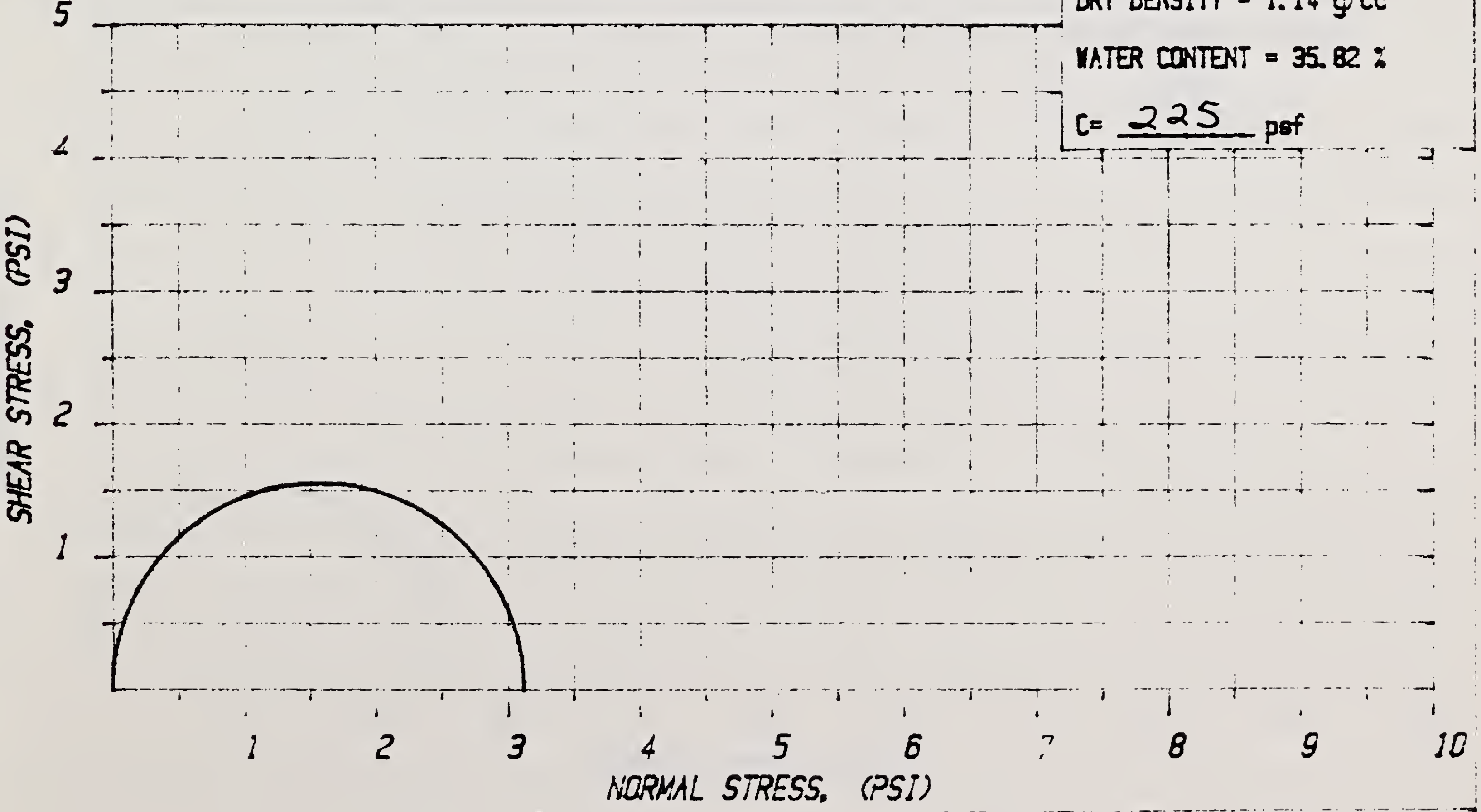


GS = 2.63

DRY DENSITY = 1.14 g/cc

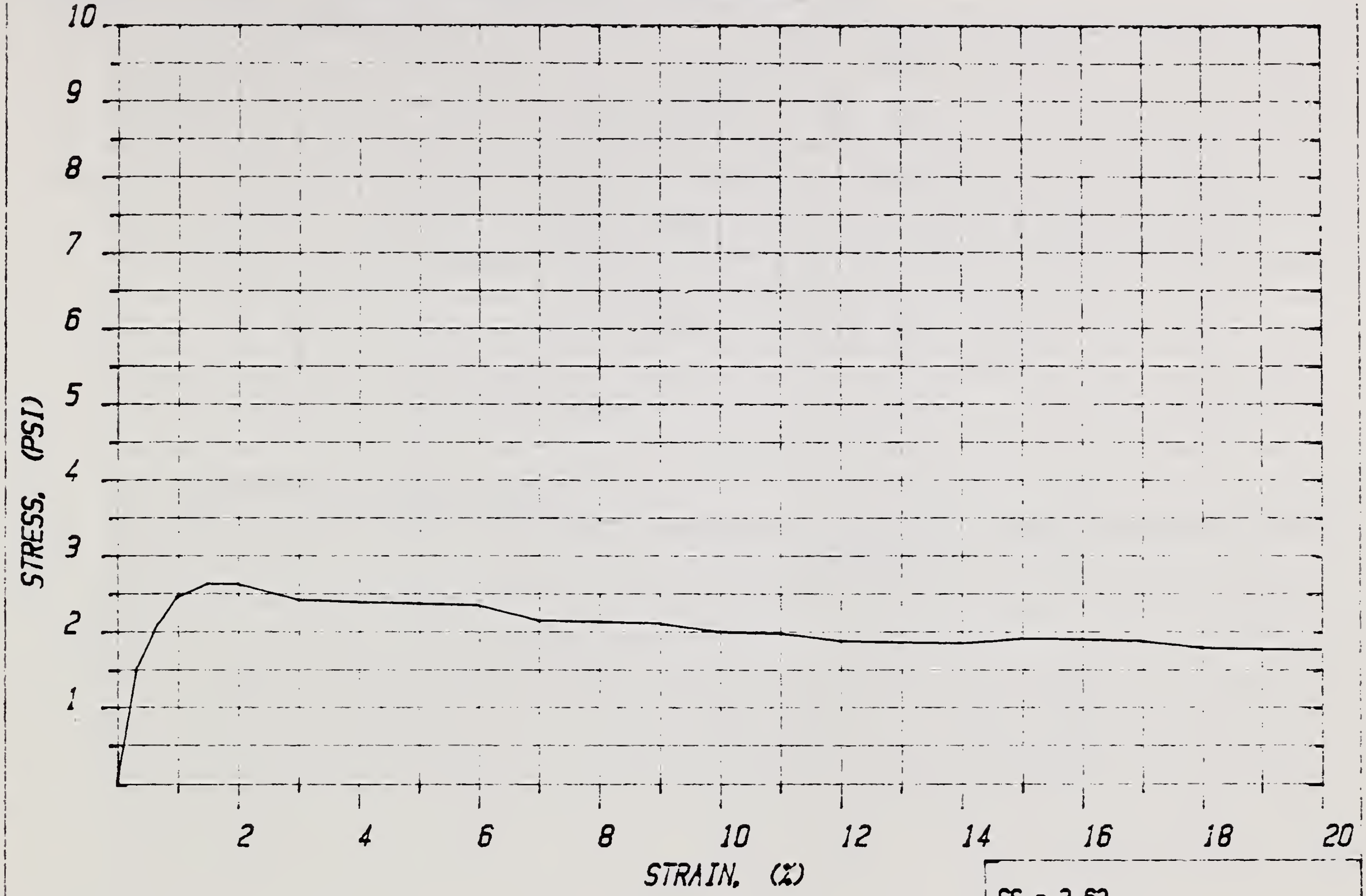
WATER CONTENT = 35.82 %

C= 225 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C101
PROJECT: WEPP - SVERDRUP SOIL - MORRIS MN.	

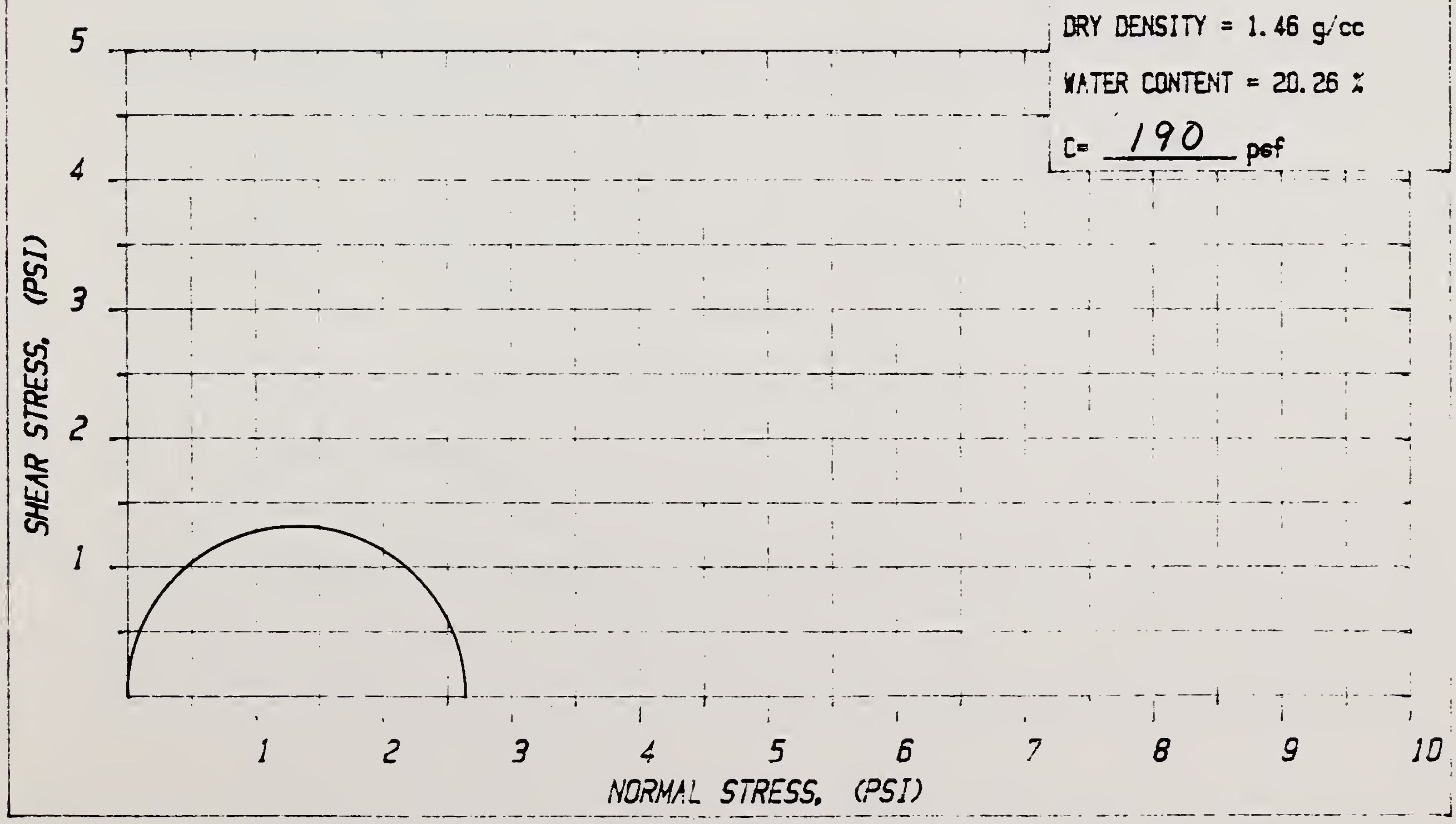


GS = 2.63

DRY DENSITY = 1.46 g/cc

WATER CONTENT = 20.26 %

C= 190 psf

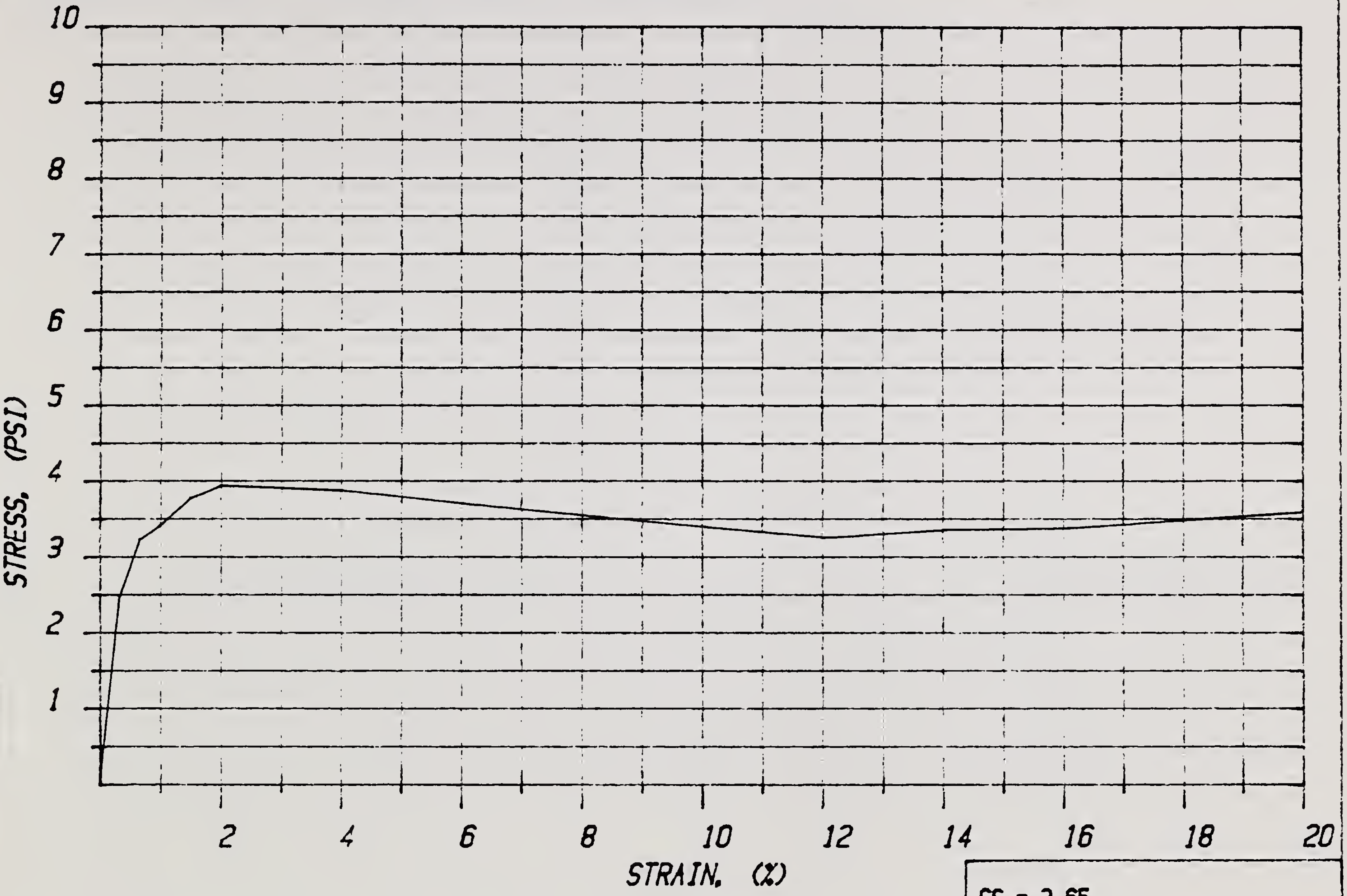


UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.

SAMPLE NO. 88C 102

PROJECT: WEPP - WALLA WALLA SOIL - PULLMAN WA.

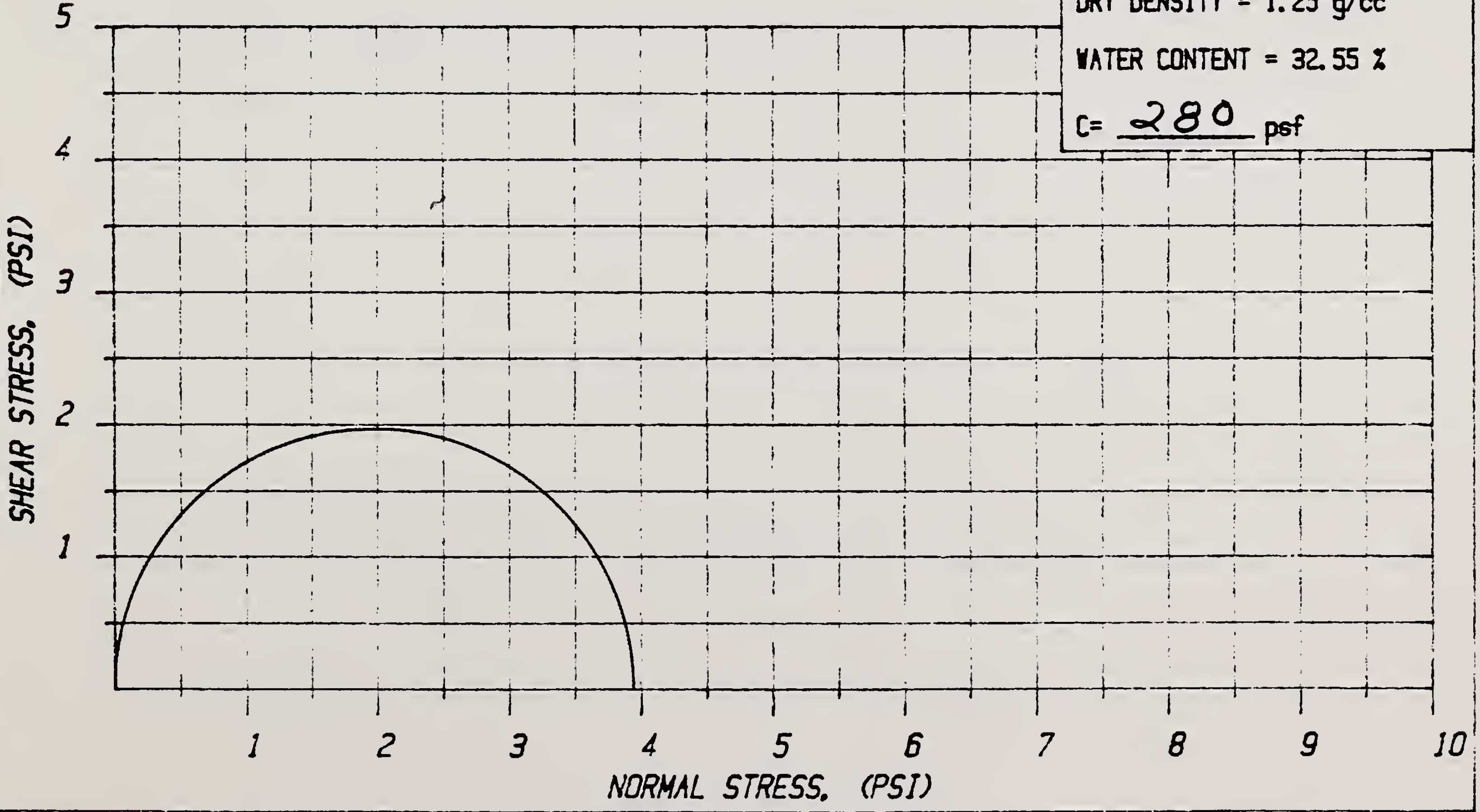


GS = 2.65

DRY DENSITY = 1.25 g/cc

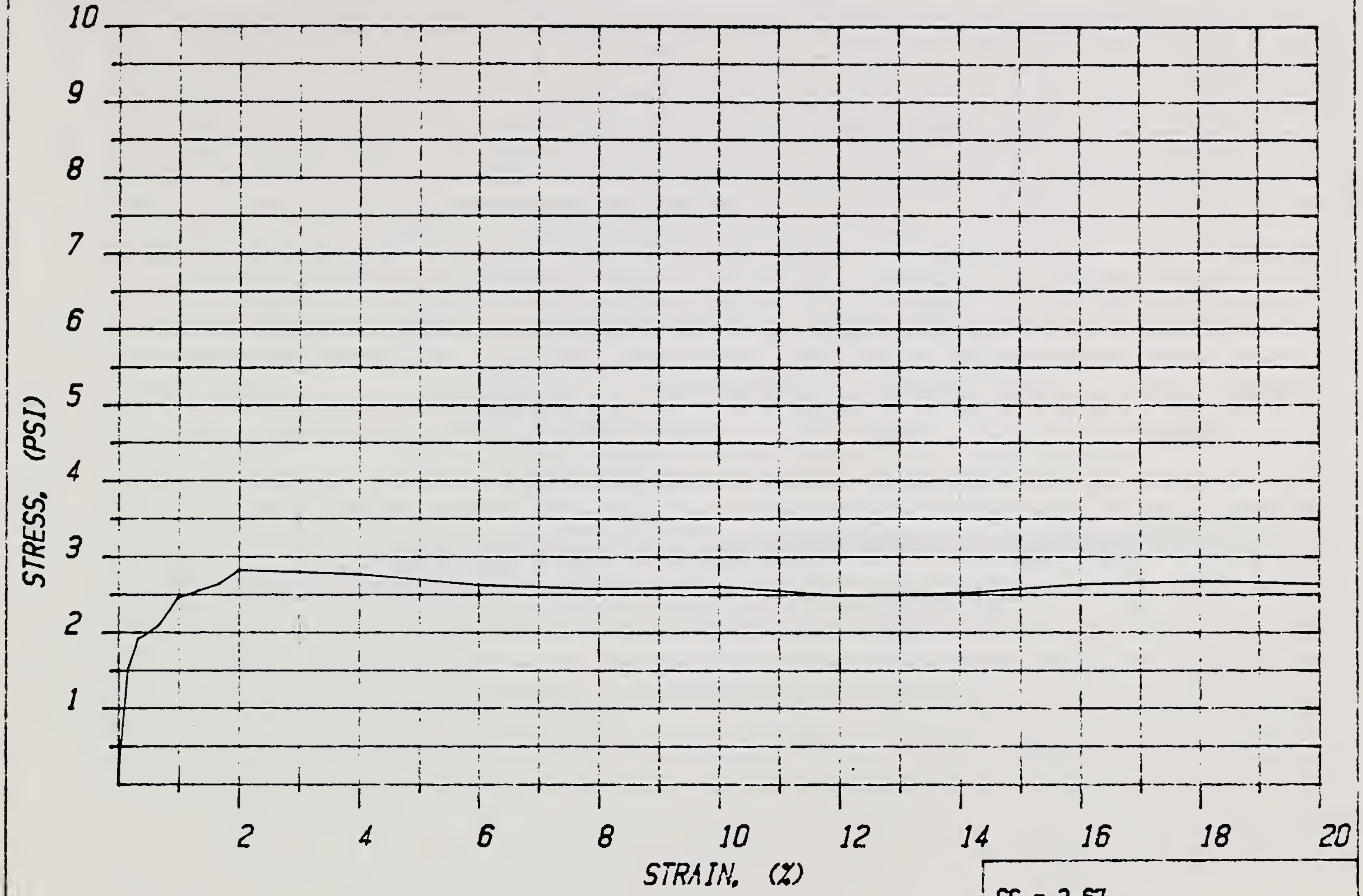
WATER CONTENT = 32.55 %

C= 280 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 103
PROJECT: WEPP - WHITNEY SOIL - FRESNO CA.	

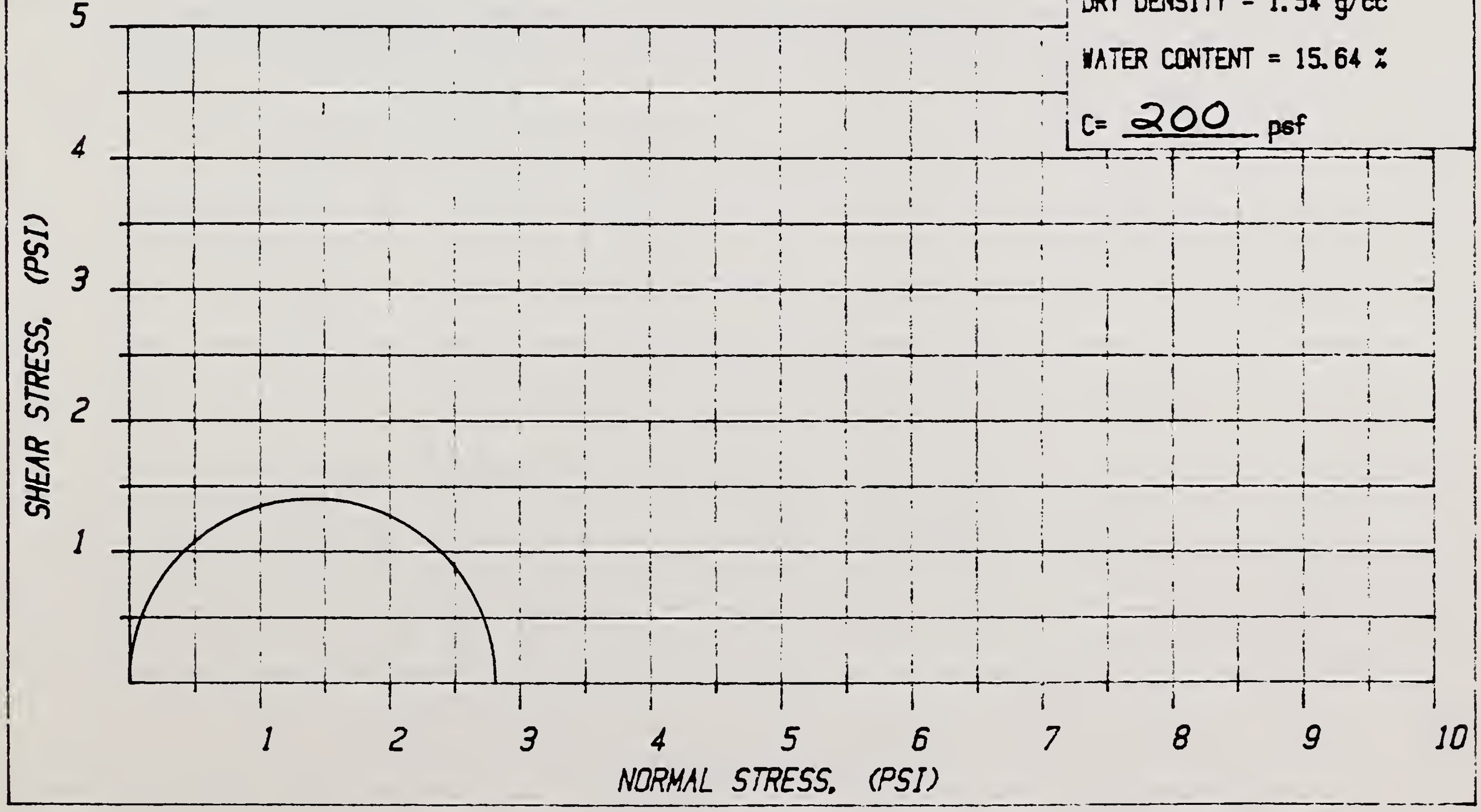


GS = 2.67

DRY DENSITY = 1.54 g/cc

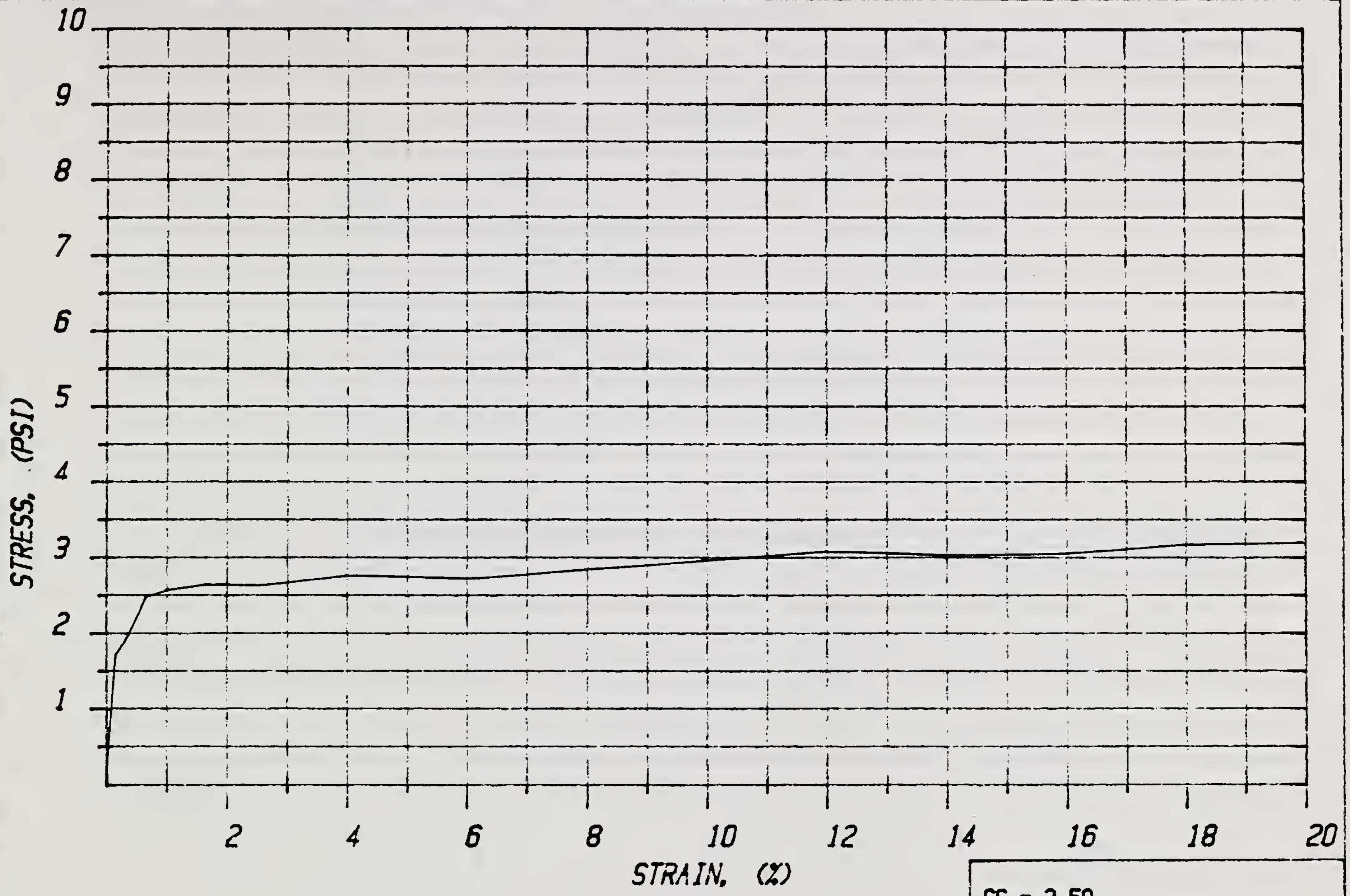
WATER CONTENT = 15.64 %

C= 200 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 104
PROJECT: WEPP - WILLIAMS SOIL - McCLUSKY ND.	

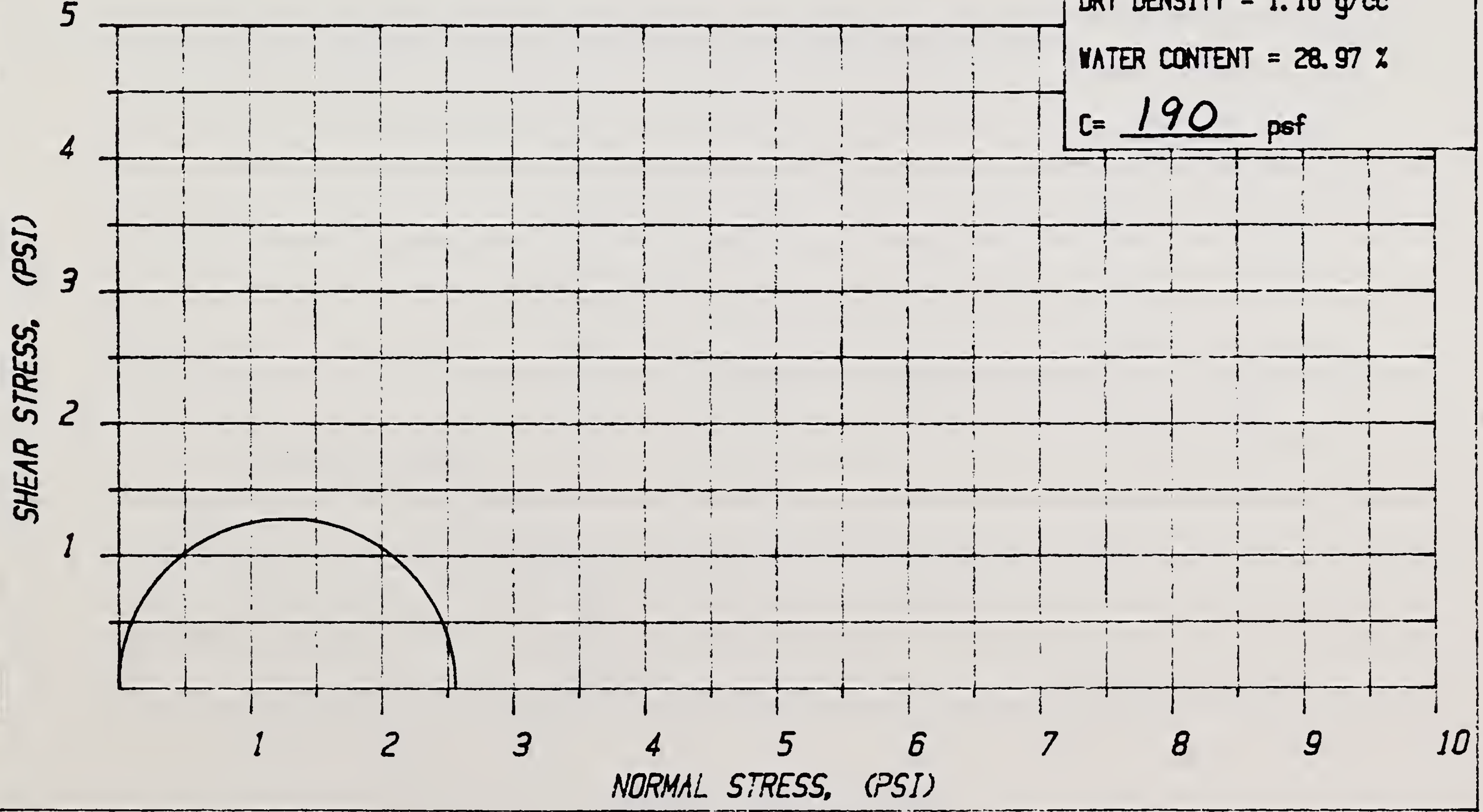


GS = 2.59

DRY DENSITY = 1.16 g/cc

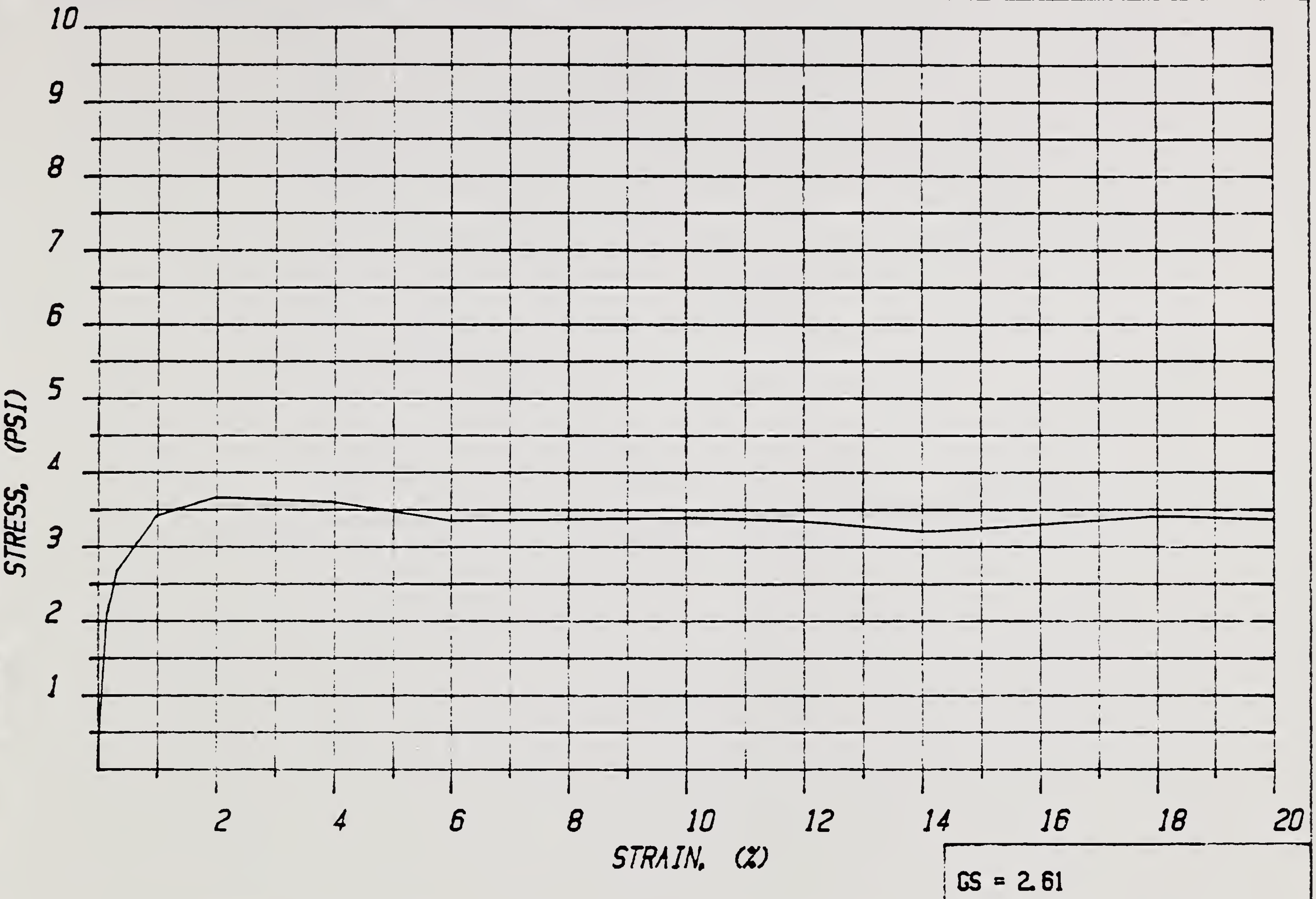
WATER CONTENT = 28.97 %

C= 190 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 105
PROJECT: WEPP - WOODWARD SOIL - OKLAHOMA	

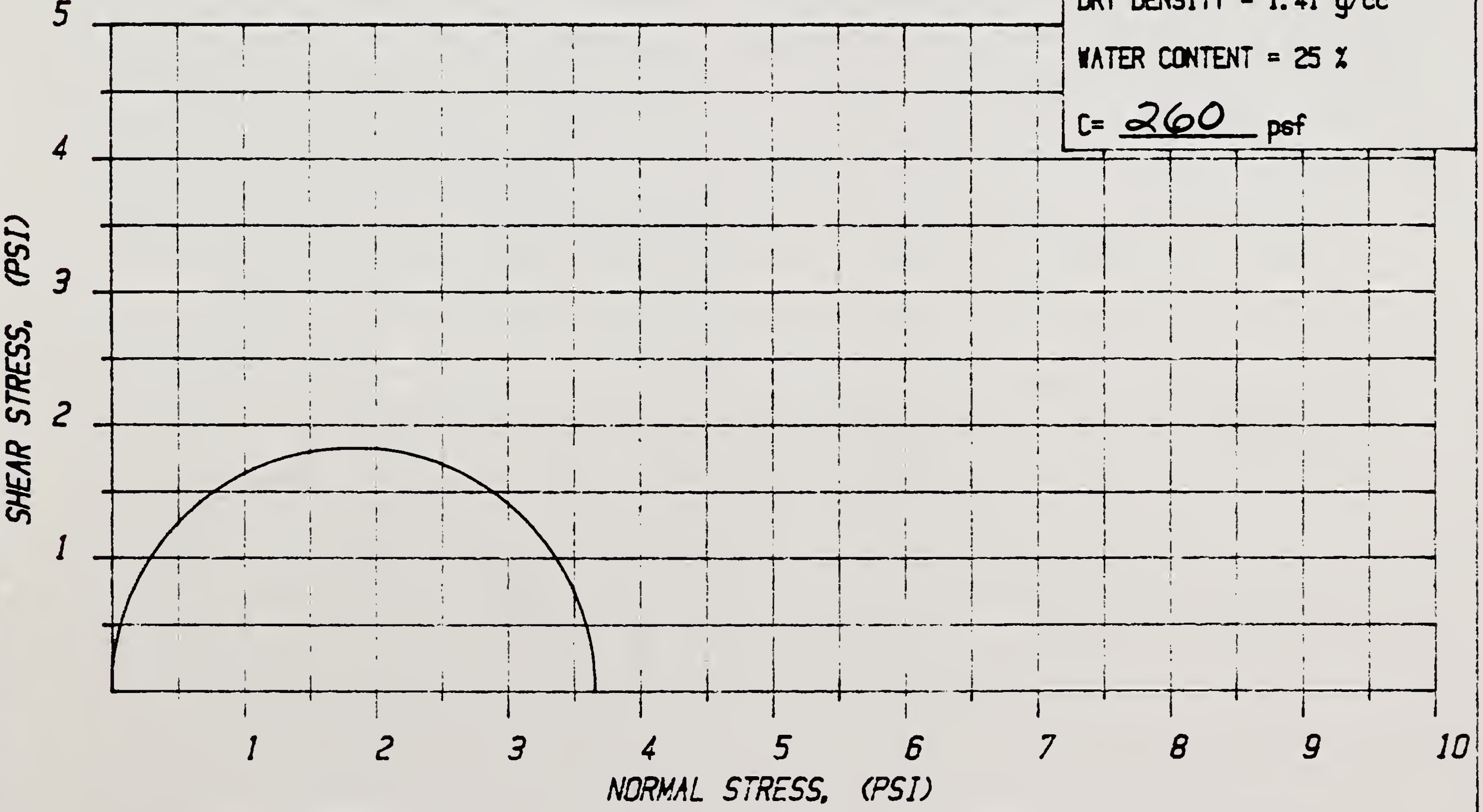


GS = 2.61

DRY DENSITY = 1.41 g/cc

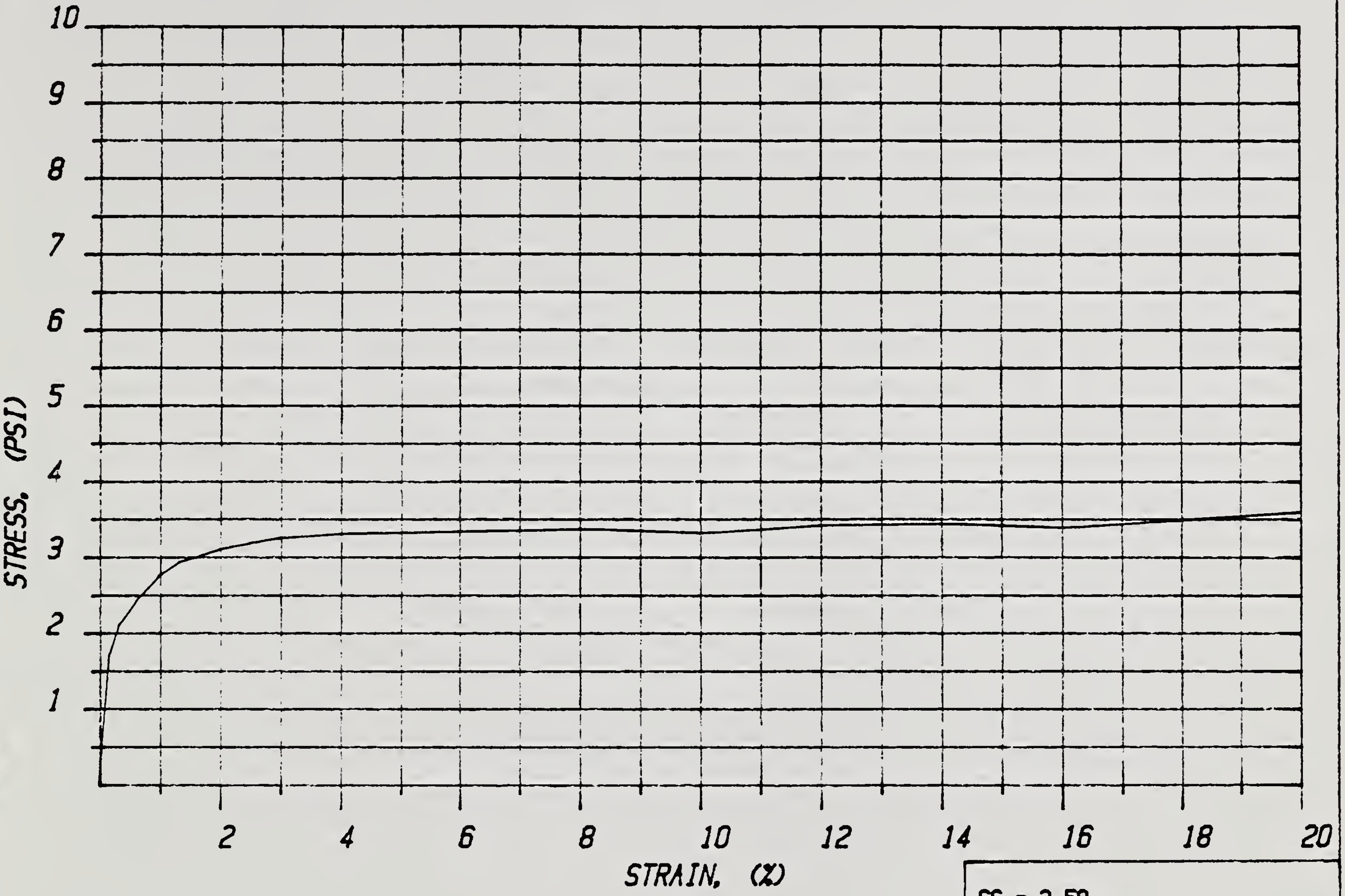
WATER CONTENT = 25 %

C= 260 psf



UNCONFINED COMPRESSION TEST

SOIL MECHANICS LABORATORY, LINCOLN NE.	SAMPLE NO. 88C 106
PROJECT: WEPP - ZAHL SOIL - NORTH DAKOTA	

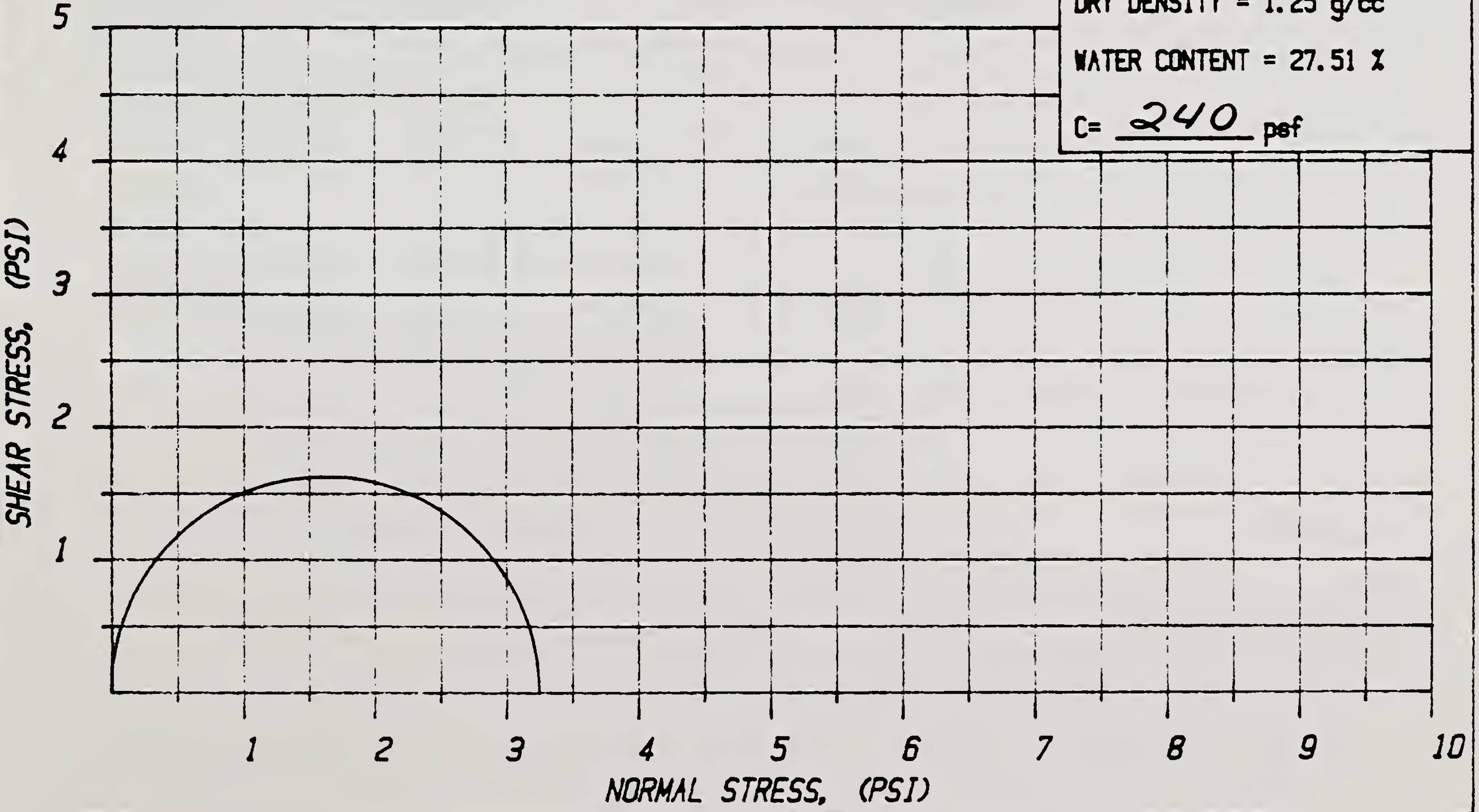


GS = 2.58

DRY DENSITY = 1.25 g/cc

WATER CONTENT = 27.51 %

C= 240 psf



Attachment E

Consolidation Test Data

RESULTS OF CONSOLIDATION TEST

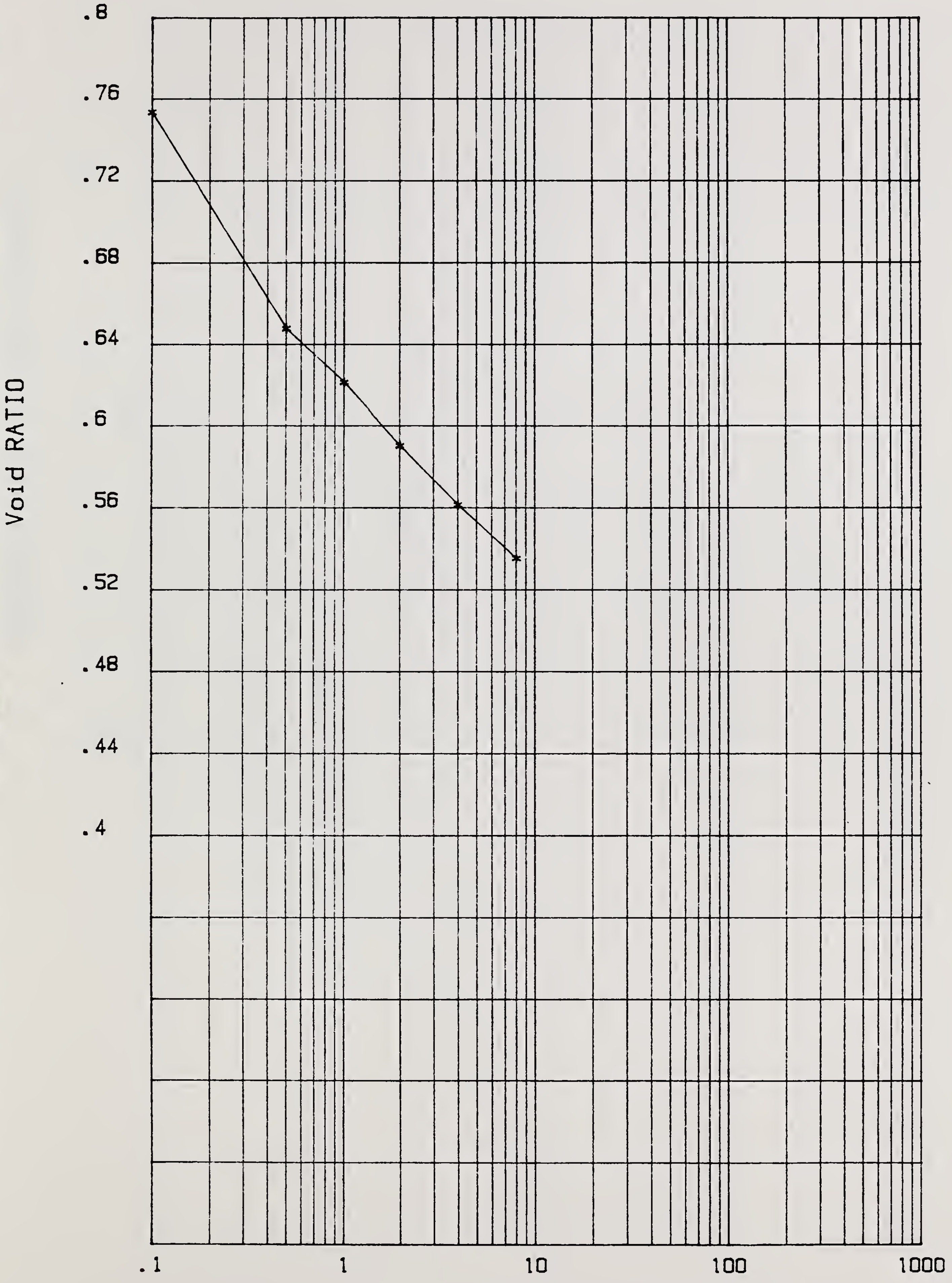
WEPP-Sample

Project: ABILENE-TEXAS
Field number:
LAB.NUMBER 88C89
Sample depth: Feet
Sample description: REMOLDED TO 1.50 GMS/CC NON-PLASTIC SM SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	129.27 g
INITIAL DRY WEIGHT:	120.66 g
INITIAL WATER CONTENT:	7.1 %
INITIAL WET DENSITY:	100.327 PCF
INITIAL DRY DENSITY:	93.645 PCF
SPECIFIC GRAVITY:	2.63
INITIAL VOID RATIO:	.753

FINAL WET WEIGHT:	140.12 g
FINAL WATER CONTENT:	16.1 %

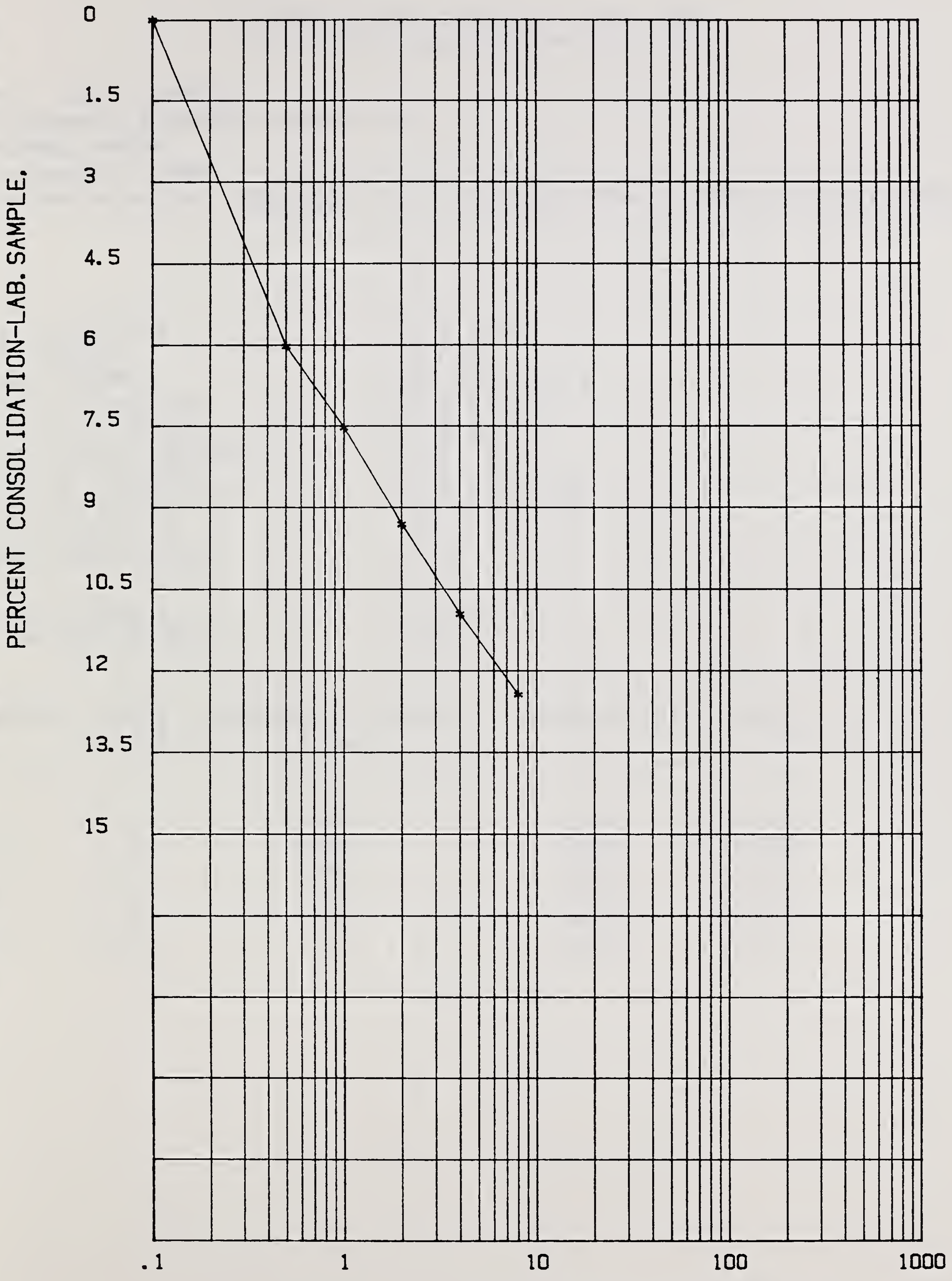
I EMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	.7530	0.00
2.0	.50	.0604	.6470	6.04
3.0	1.00	.0755	.6200	7.55
4.0	2.00	.0933	.5890	9.33
5.0	4.00	.1098	.5600	10.98
6.0	8.00	.1247	.5340	12.47



Project: ABILENE-TEXAS LAB. NUMBER 88C89

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: ABILENE-TEXAS
LAB. NUMBER 88C89
Field number:
Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

```
                         RESULTS OF CONSOLIDATION TEST
                         =============================

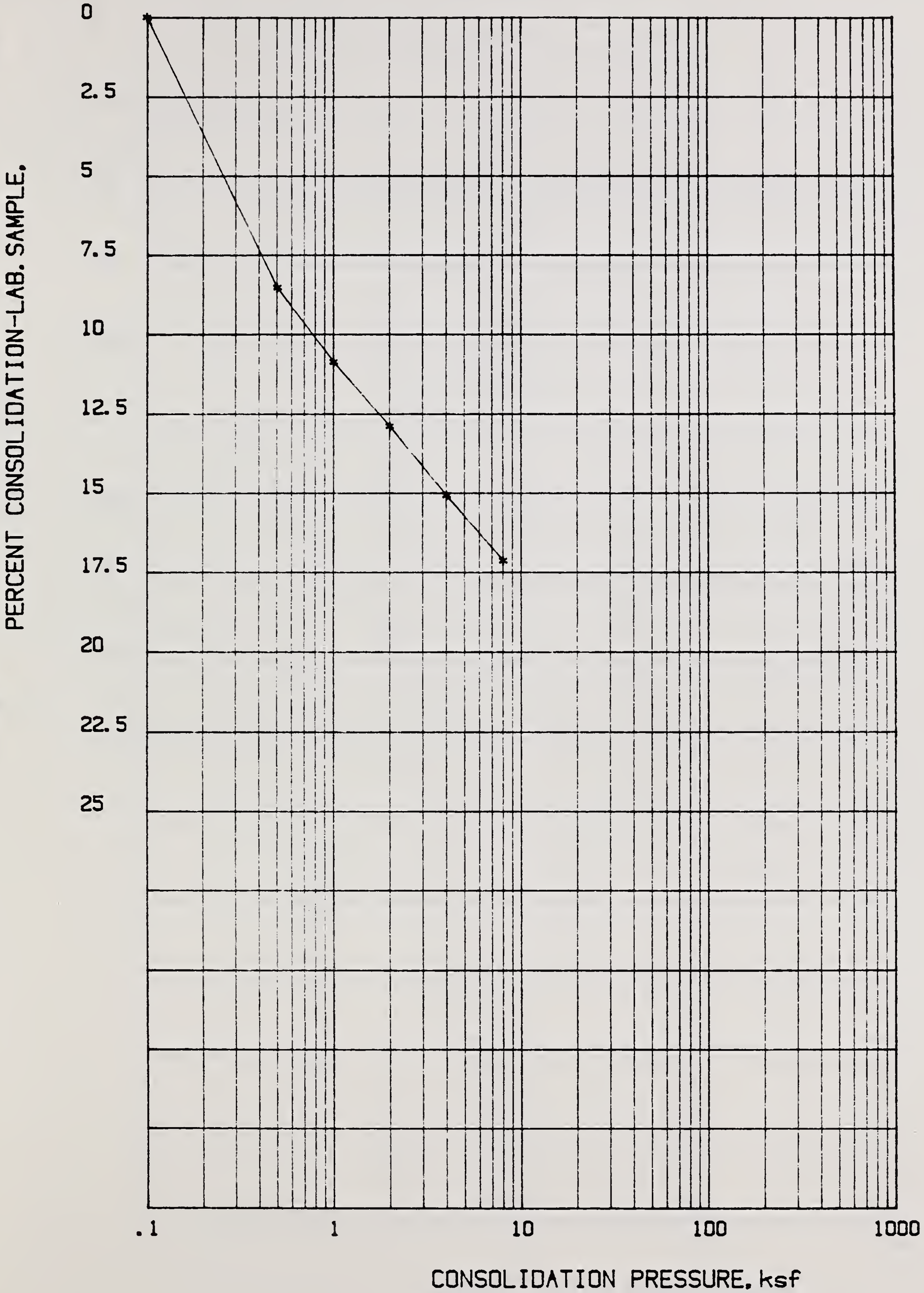
Project: WEPP SAMPLE
Field number: ACADEMY-FRESNO CA.
LAB.NUMBER 88C90
Sample depth:  Feet
Sample description: REMOLDED TO 1.61 GM/CC NON-PLASTIC SM SATURATED AT START OF
TEST


SAMPLE DIAMETER:                  2.5 ins
SAMPLE HEIGHT:                    1 ins
INITIAL VOLUME:                   80.439  cm^3
INITIAL WET WEIGHT:               133.44  g
INITIAL DRY WEIGHT:               128.88  g
INITIAL WATER CONTENT:            3.5  %
INITIAL WET DENSITY:              103.563  PCF
INITIAL DRY DENSITY:              100.024  PCF
SPECIFIC GRAVITY:                 2.75
INITIAL VOID RATIO:               .716

FINAL WET WEIGHT:                 146.86  g
FINAL WATER CONTENT:              13.9  %


I   EMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )       (ins)
---------   ----   ----------------   -----------    ---

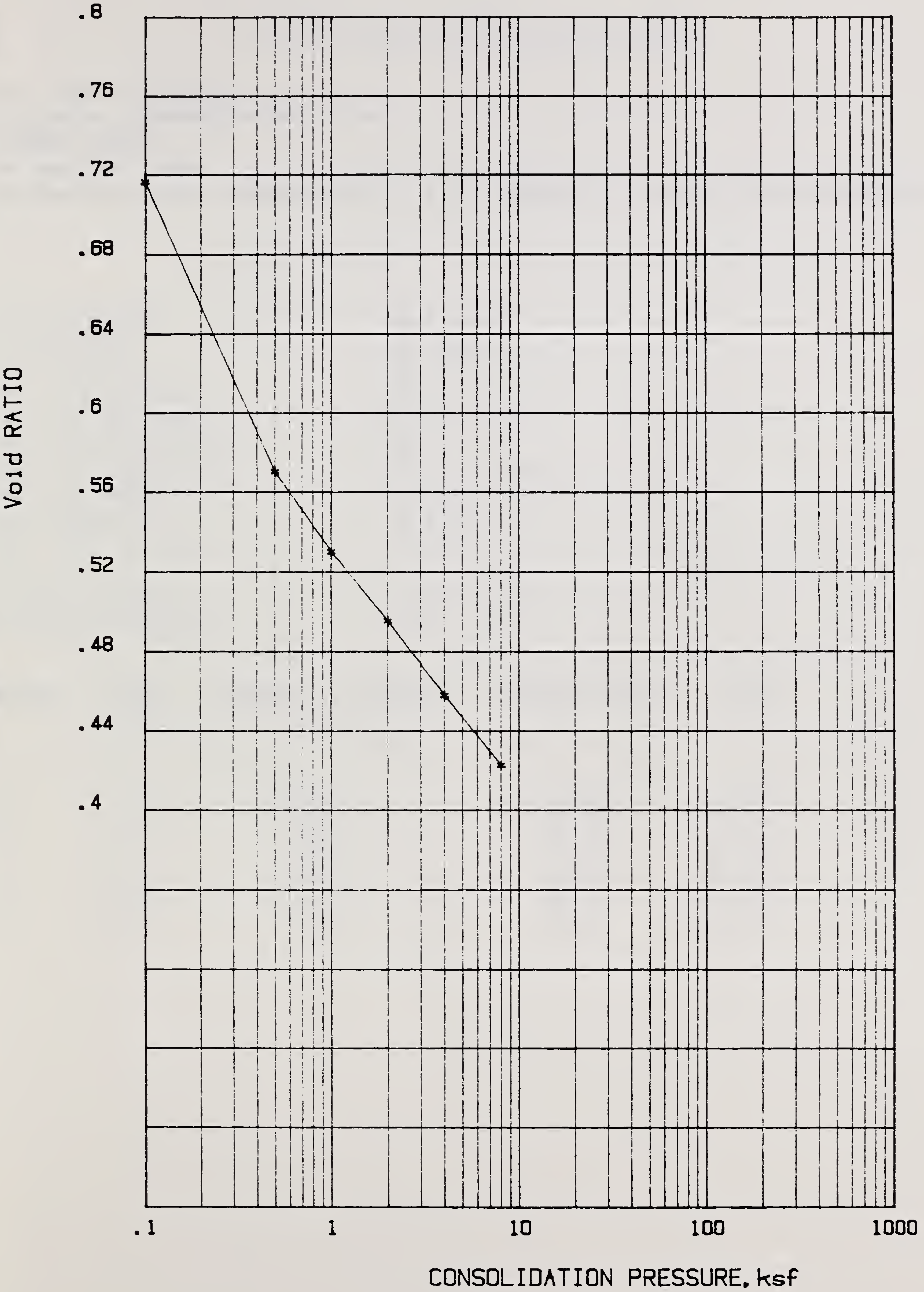
   1.0       .10       0.0000            .7160       0.00
   2.0       .50        .0855            .5690       8.55
   3.0      1.00        .1090            .5290      10.90
   4.0      2.00        .1292            .4940      12.92
   5.0      4.00        .1511            .4570      15.11
   6.0      8.00        .1717            .4210      17.17
```



Project: WEPP SAMPLE LAB. NUMBER 88C90

Field number: ACADEMY-FRESNO CA. Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.



Project: WEPP SAMPLE LAB. NUMBER 88C90

Field number: ACADEMY-FRESNO CA. Sample depth: Feet

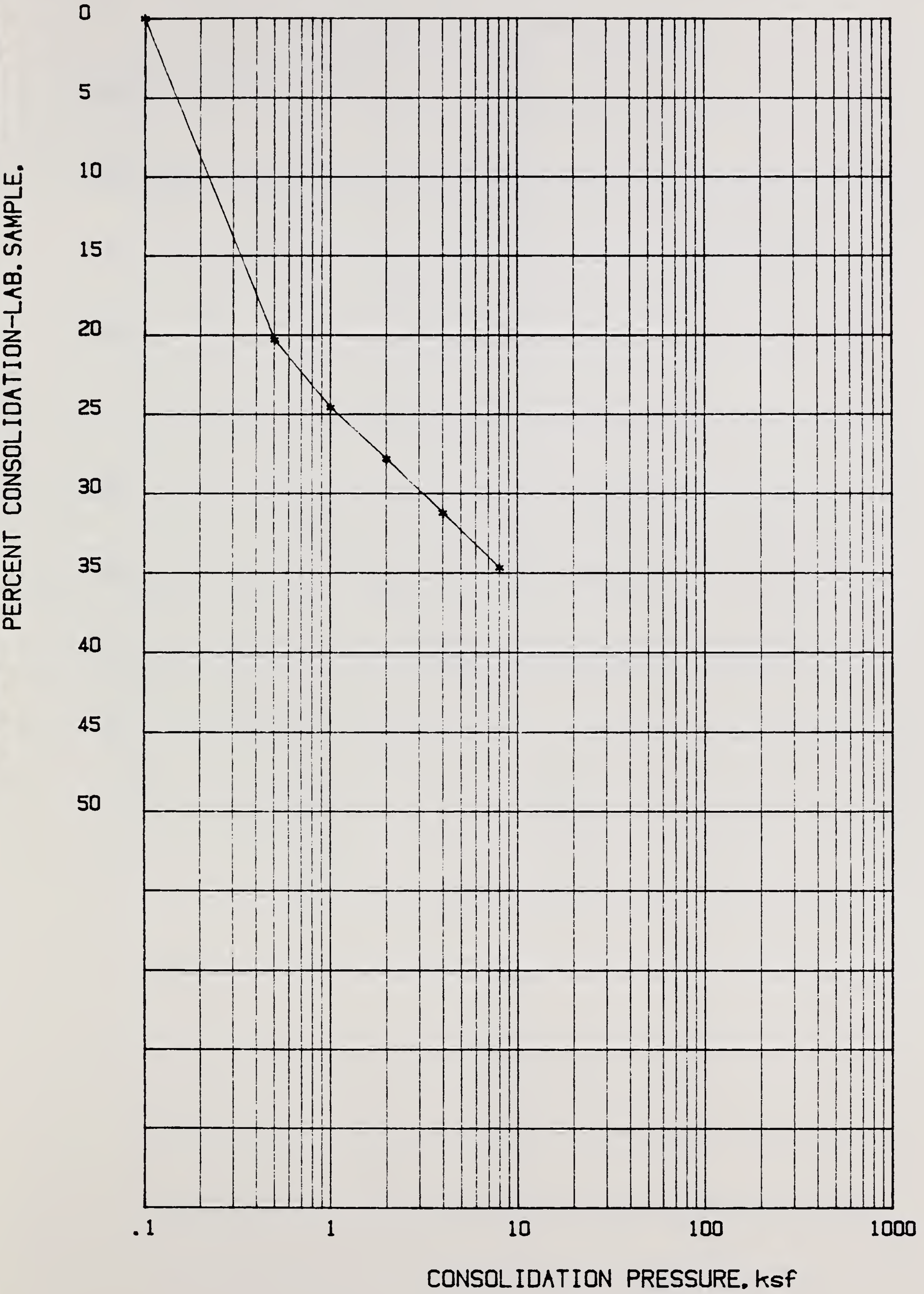
USDA-SCS S. M. L. LINCOLN NE.

RESULTS OF CONSOLIDATION TEST

Project: WEPP SAMPLE
Field number: BARNES-MORRIS MN.
LAB.NUMBER 88C91
Sample depth: Feet
Sample description: COMPACTED TO 1.14 GM/CC CL LL=26 PI=9 SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	100 g
INITIAL DRY WEIGHT:	92.34 g
INITIAL WATER CONTENT:	8.2 %
INITIAL WET DENSITY:	77.61 PCF
INITIAL DRY DENSITY:	71.665 PCF
SPECIFIC GRAVITY:	2.61
INITIAL VOID RATIO:	1.273
FINAL WET WEIGHT:	109.66 g
FINAL WATER CONTENT:	18.7 %

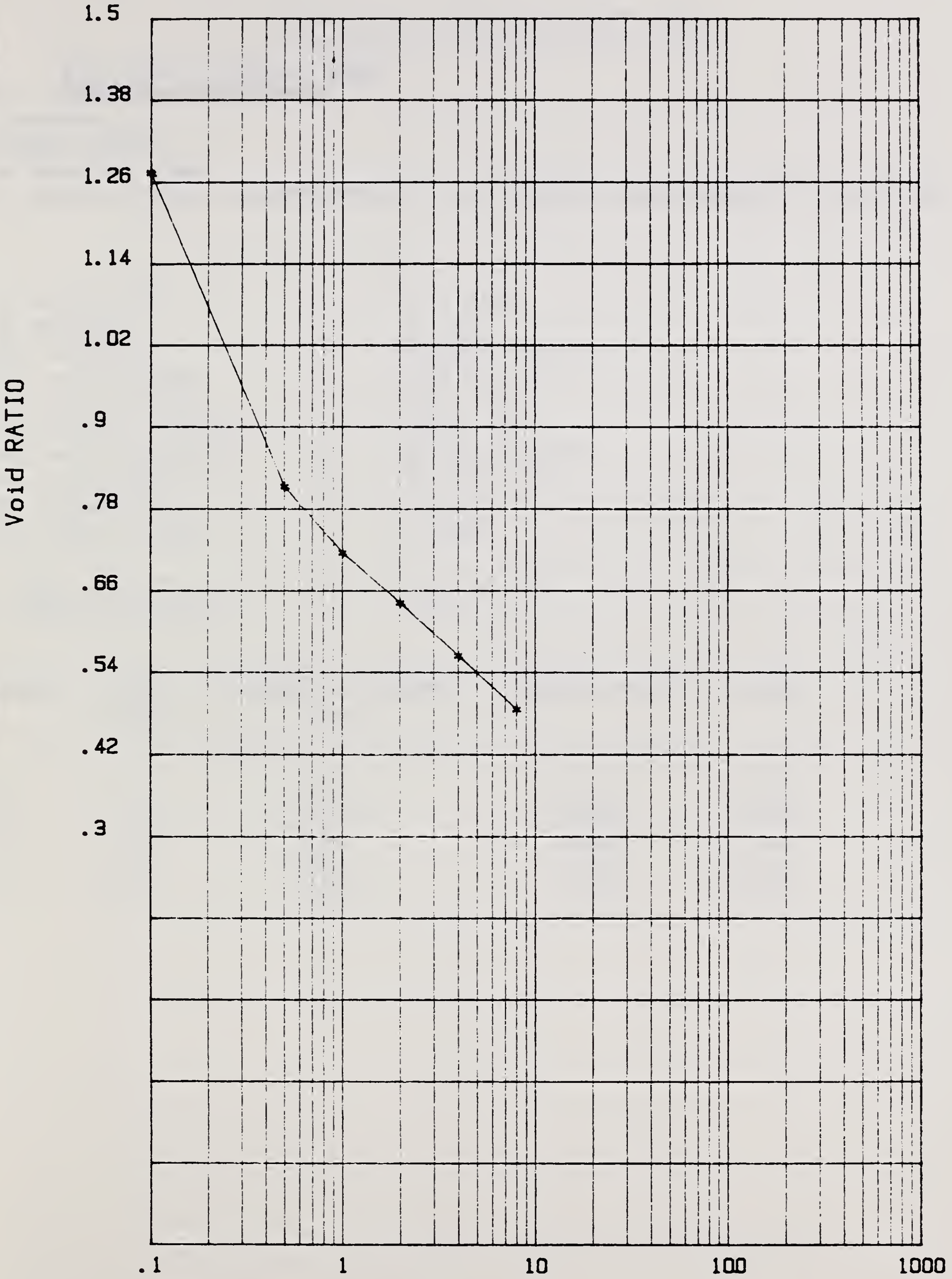
I[illegible]EMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	1.2730	0.00
2.0	.50	.2034	.8110	20.34
3.0	1.00	.2463	.7130	24.63
4.0	2.00	.2787	.6390	27.87
5.0	4.00	.3130	.5610	31.30
6.0	8.00	.3477	.4830	34.77



Project: WEPP SAMPLE LAB. NUMBER 88C91

Field number: BARNES-MORRIS MN. Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: WEPP SAMPLE LAB. NUMBER 88C91

Field number: BARNES-MORRIS MN. Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2

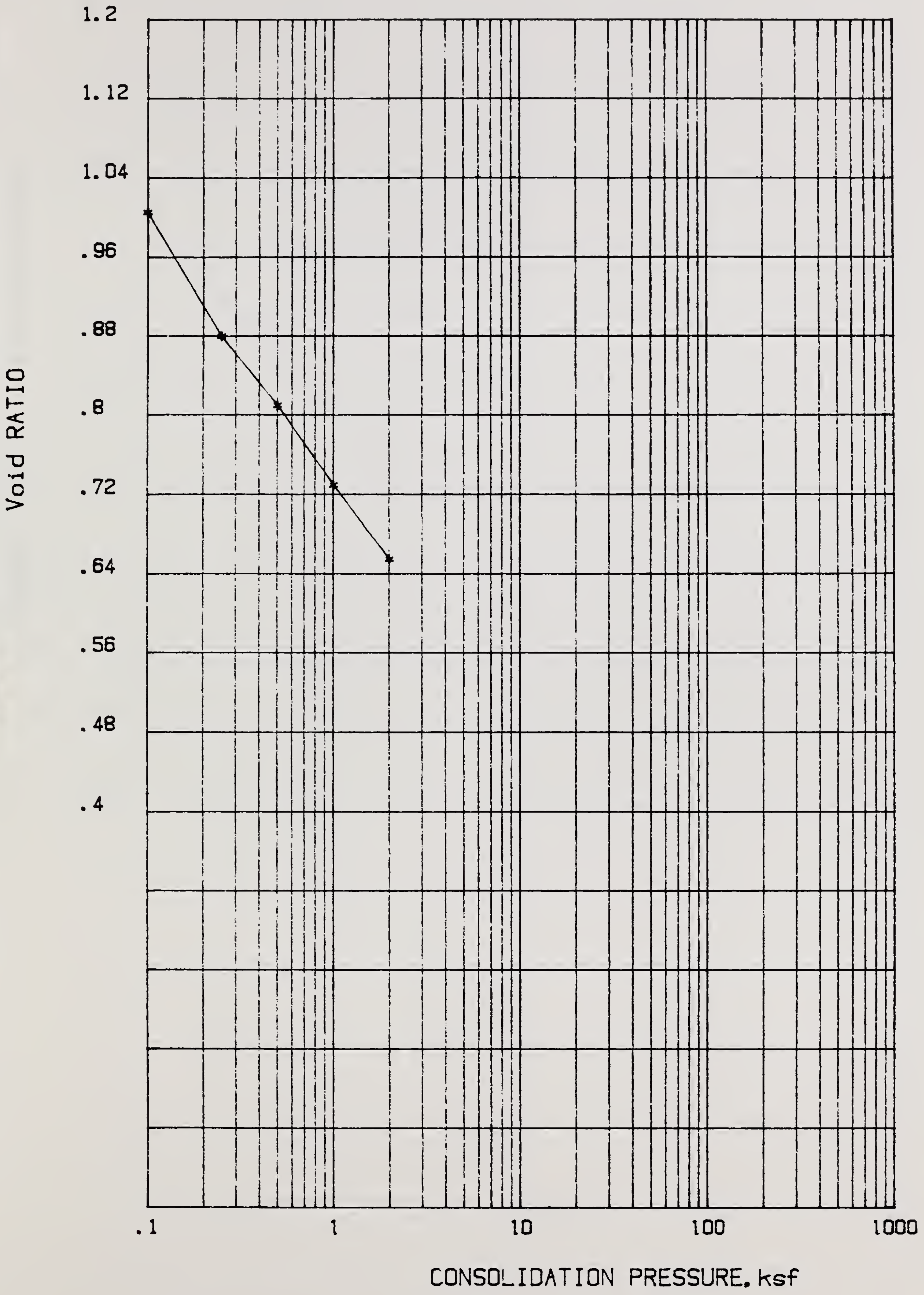
RESULTS OF CONSOLIDATION TEST

Project: Barnes, Morris MN. [redacted]
Field number:
LAB.NUMBER 88C91
Sample depth: Feet
Sample description: COMPACTED TO 1.14 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	104.25 g
INITIAL DRY WEIGHT:	91.7 g
INITIAL WATER CONTENT:	13.6 %
INITIAL WET DENSITY:	80.909 PCF
INITIAL DRY DENSITY:	71.169 PCF
SPECIFIC GRAVITY:	2.61
INITIAL VOID RATIO:	1.289
FINAL WET WEIGHT:	113.66 g
FINAL WATER CONTENT:	23.9 %

I[illegible]EMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.1243	1.0040	12.43
2.0	.25	.1794	.8780	17.94
3.0	.50	.2101	.8080	21.01
4.0	1.00	.2451	.7280	24.51
5.0	2.00	.2779	.6530	27.79

Test 2



Project: [redacted] Barnes Soil MN.

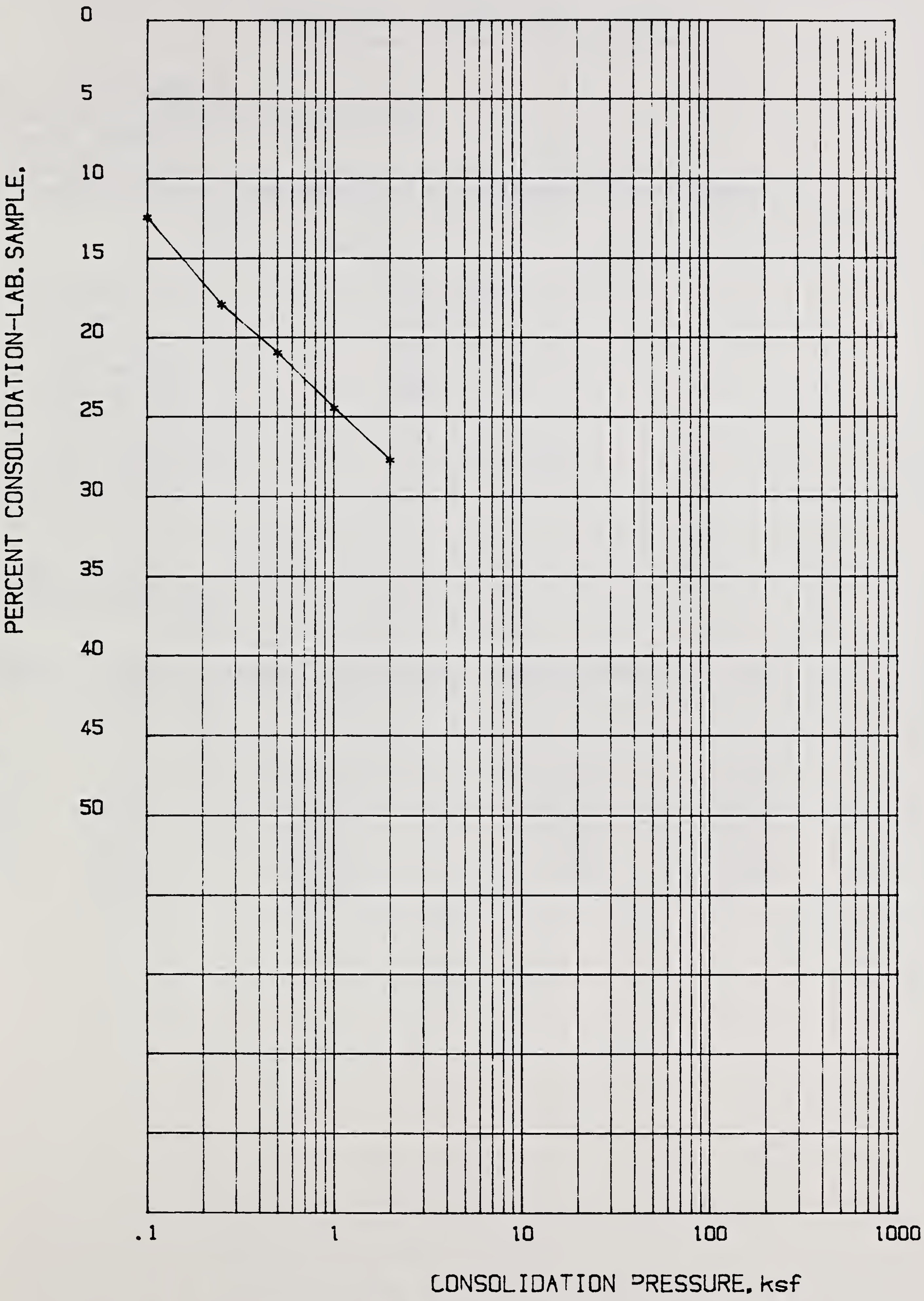
LAB. NUMBER 88C91

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2



Project: Barnes Soil MN. [redacted]

LAB. NUMBER 88C91

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

```
                         RESULTS OF CONSOLIDATION TEST
                         =============================

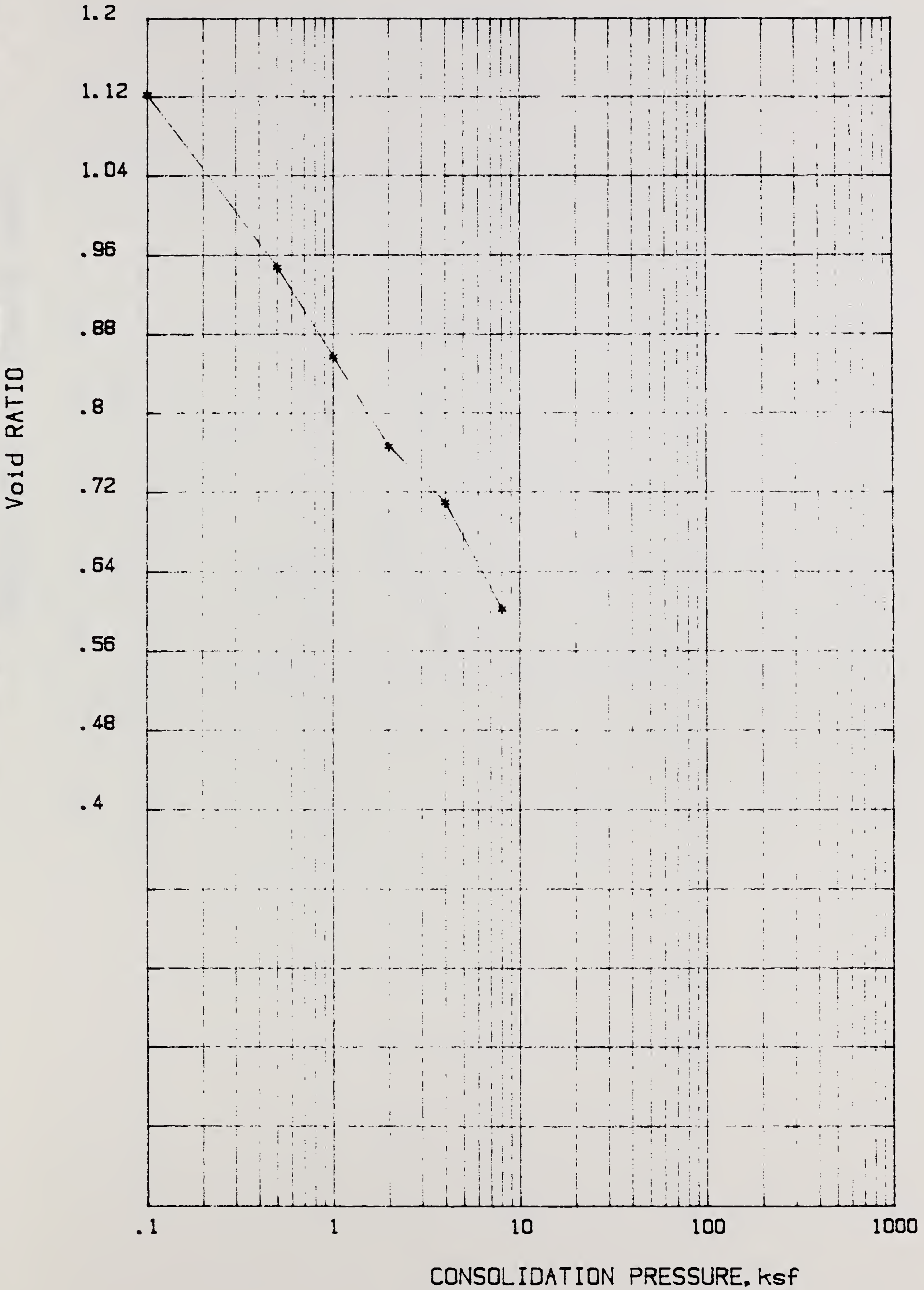
Project: WEPP SAMPLE
Field number: BARNES-McCLUSKY ND.
LAB.NUMBER 88C92
Sample depth:  Feet
Sample description: COMPACTED TO 1.20 GM/CC LL=31 PI=12


SAMPLE DIAMETER:                 2.5 ins
SAMPLE HEIGHT:                   1 ins
INITIAL VOLUME:                  80.439  cm^3
INITIAL WET WEIGHT:              104.23  g
INITIAL DRY WEIGHT:              96.67  g
INITIAL WATER CONTENT:           7.8  %
INITIAL WET DENSITY:             80.893  PCF
INITIAL DRY DENSITY:             75.026  PCF
SPECIFIC GRAVITY:                2.55
INITIAL VOID RATIO:              1.121

FINAL WET WEIGHT:                108.14  g
FINAL WATER CONTENT:             11.8  %

INCREMENT   LOAD    CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )       (ins)
---------   ----    ----------------   -----------    ---

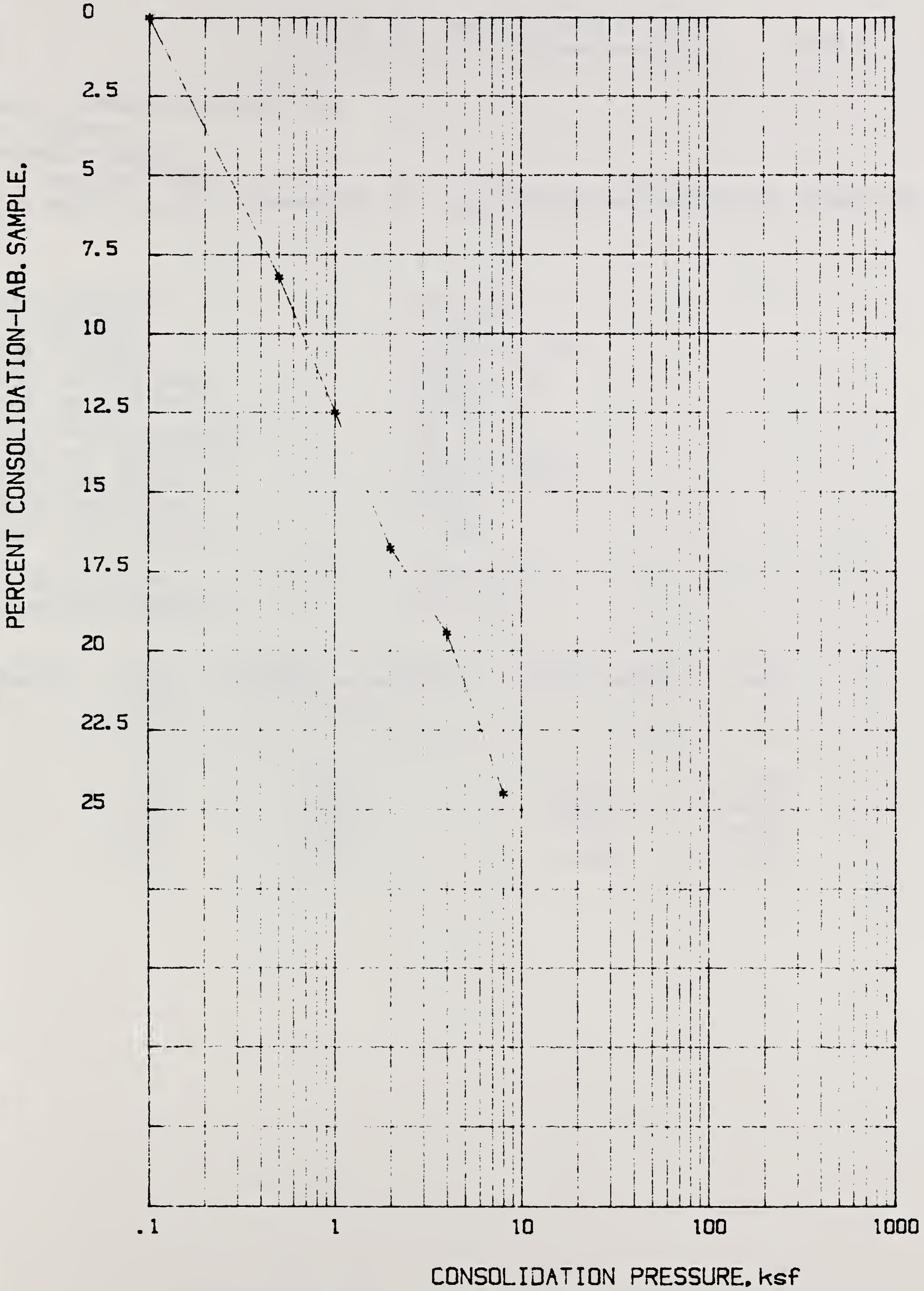
   1.0       .10      0.0000             1.1210       0.00
   2.0       .50       .0823              .9470       8.23
   3.0      1.00       .1252              .8560      12.52
   4.0      2.00       .1681              .7650      16.81
   5.0      4.00       .1948              .7080      19.48
   6.0      8.00       .2454              .6010      24.54
```



Project: WEPP SAMPLE LAB. NUMBER 88C92

Field number: BARNES-McCLUSKY ND. Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.



Project: WEPP SAMPLE LAB. NUMBER 88C92

Field number: BARNES-McCLUSKY ND. Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

RESULTS OF CONSOLIDATION TEST

Test #2

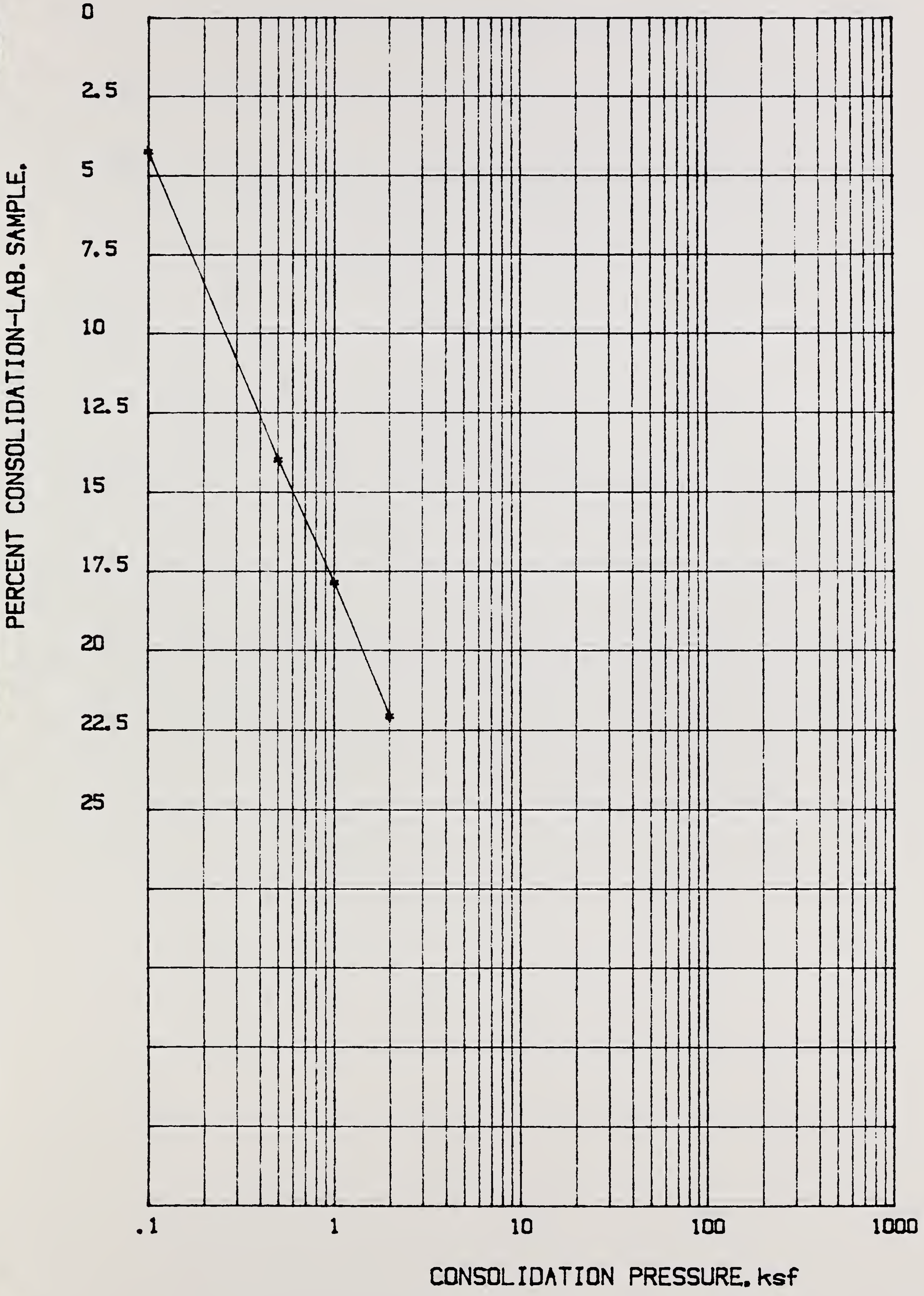
Project: BARNES-McCLUSKY ND.
Field number:
LAB.NUMBER 88C92
Sample depth: Feet
Sample description: COMPACTED TO 1.20 GM/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	108.16 g
INITIAL DRY WEIGHT:	96.52 g
INITIAL WATER CONTENT:	12 %
INITIAL WET DENSITY:	83.943 PCF
INITIAL DRY DENSITY:	74.909 PCF
SPECIFIC GRAVITY:	2.55
INITIAL VOID RATIO:	1.125

FINAL WET WEIGHT:	122.96 g
FINAL WATER CONTENT:	27.3 %

EMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.0425	1.0340	4.25
2.0	.50	.1400	.8270	14.00
3.0	1.00	.1789	.7440	17.89
4.0	2.00	.2210	.6550	22.10

Test No. 2

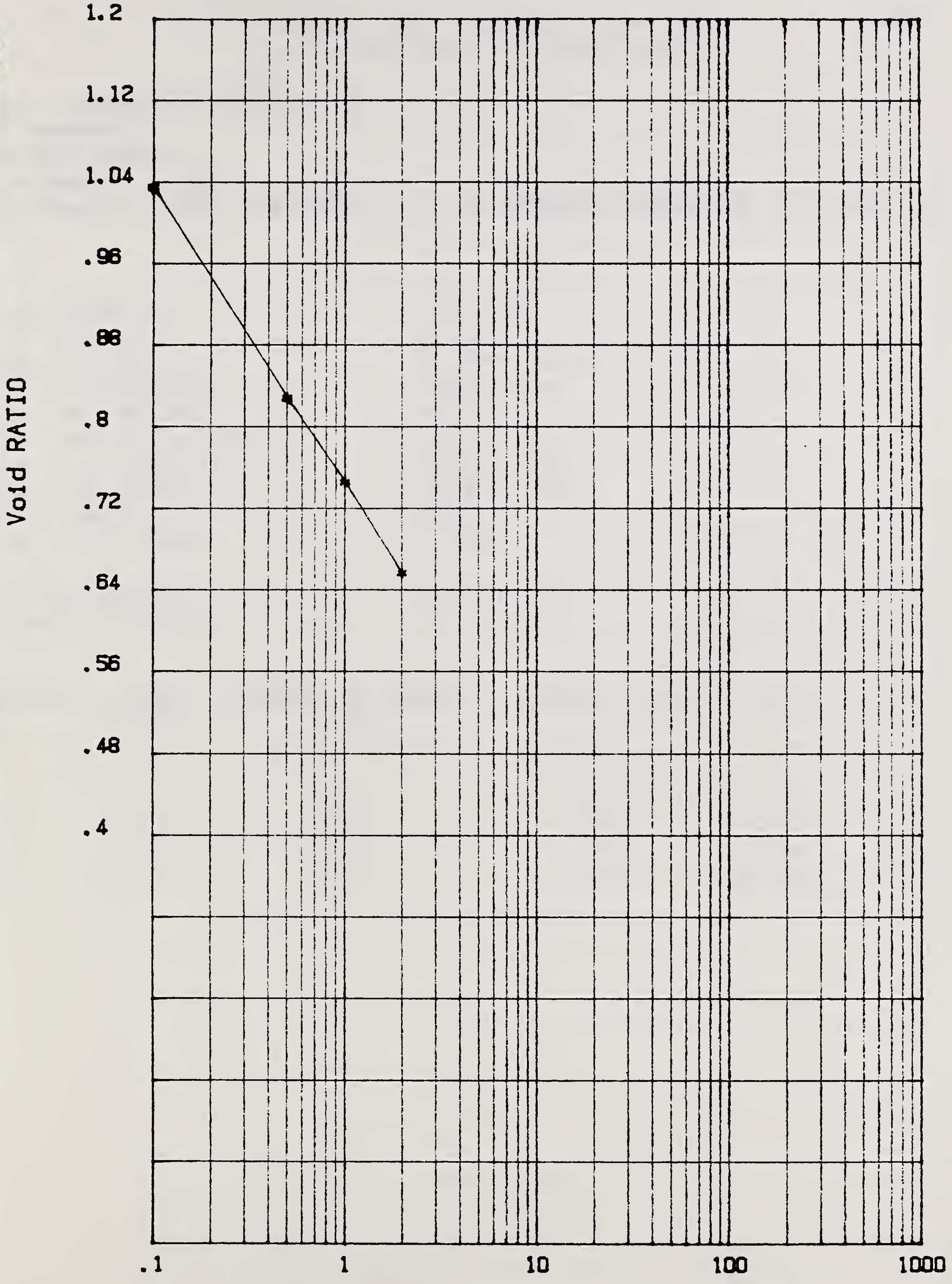


Project: BARNES-McCLUSKY ND. LAB. NUMBER 88C92

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test No. 2



CONSOLIDATION PRESSURE, ksf

Project: BARNES-McCLUSKY ND. LAB. NUMBER 88C92

Field number: Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.

Test #3

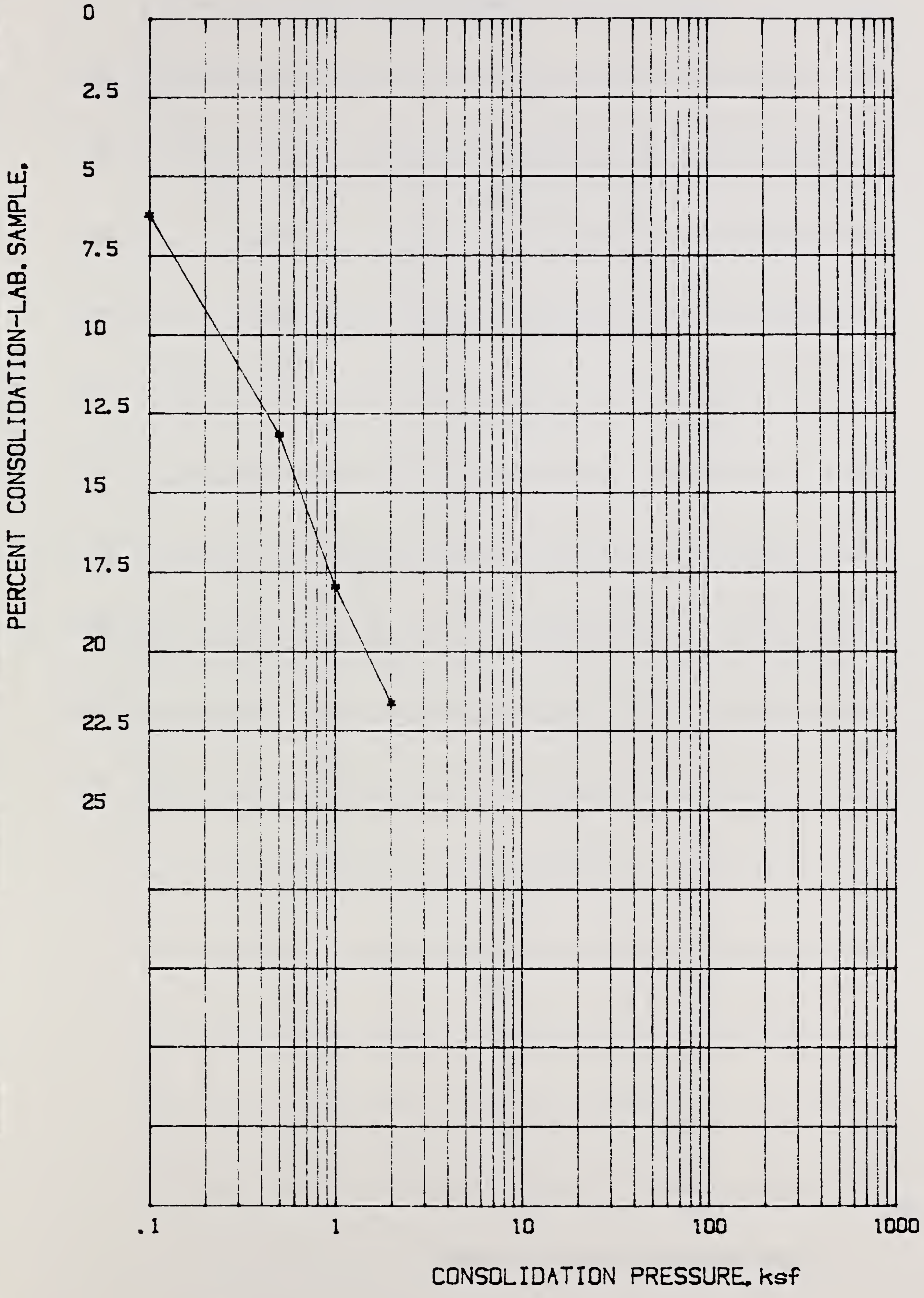
RESULTS OF CONSOLIDATION TEST

Project: BARNES--McCLUSKY ND
Field number:
LAB.NUMBER 88C92
Sample depth: Feet
Sample description: COMPATED TO 1.20 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	108.04 g
INITIAL DRY WEIGHT:	96.52 g
INITIAL WATER CONTENT:	11.9 %
INITIAL WET DENSITY:	83.85 PCF
INITIAL DRY DENSITY:	74.909 PCF
SPECIFIC GRAVITY:	2.55
INITIAL VOID RATIO:	1.125
FINAL WET WEIGHT:	122.11 g
FINAL WATER CONTENT:	26.5 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.0622	.9920	6.22
2.0	.50	.1320	.8440	13.20
3.0	1.00	.1799	.7420	17.99
4.0	2.00	.2168	.6640	21.68

Test No. 3



Project: BARNES---McCLUSKY ND

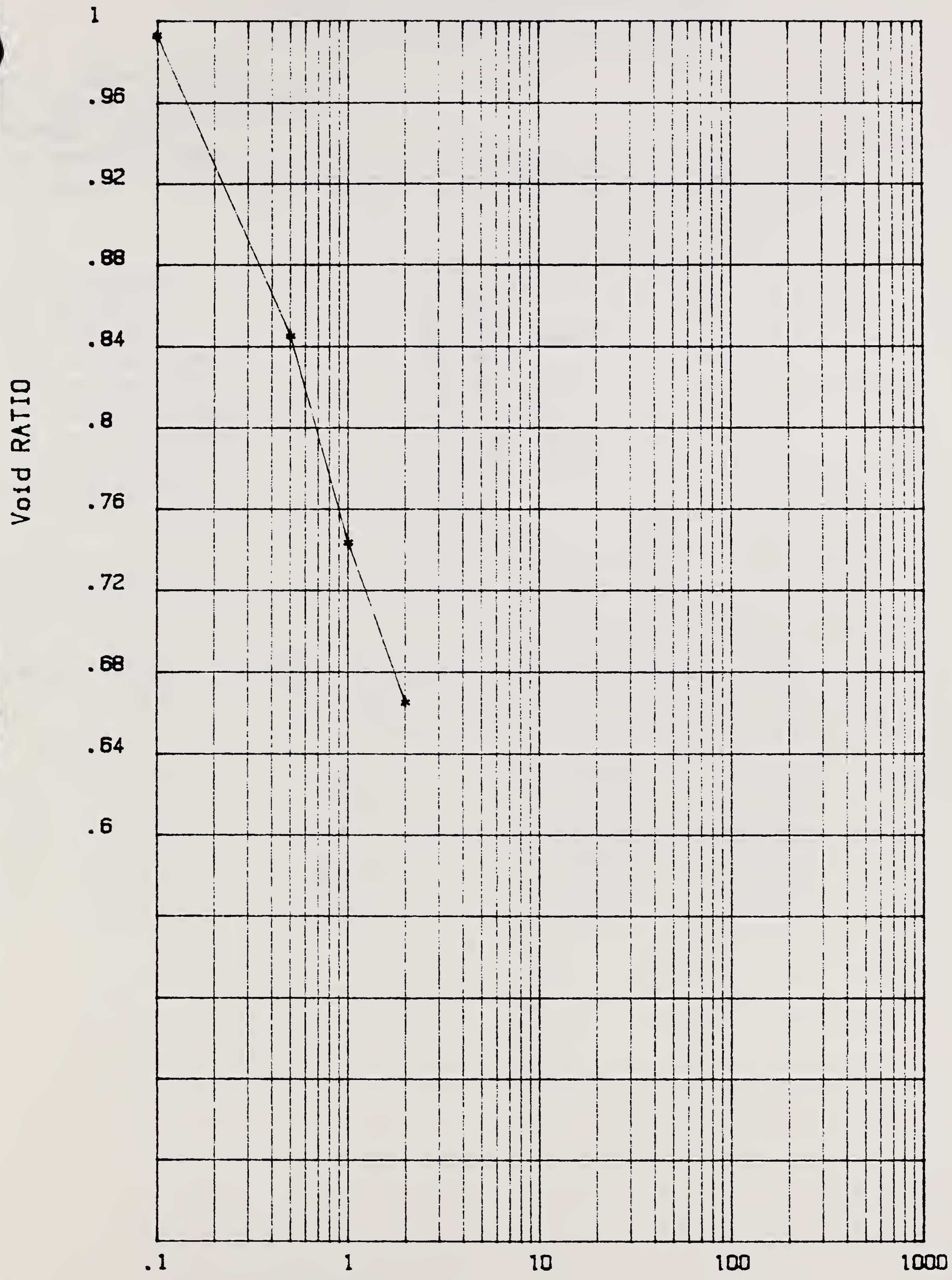
LAB. NUMBER 88C92

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test No. 3



Project: BARNES--McCLUSKY ND _AB. NUMBER 88C92

Field number: Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.

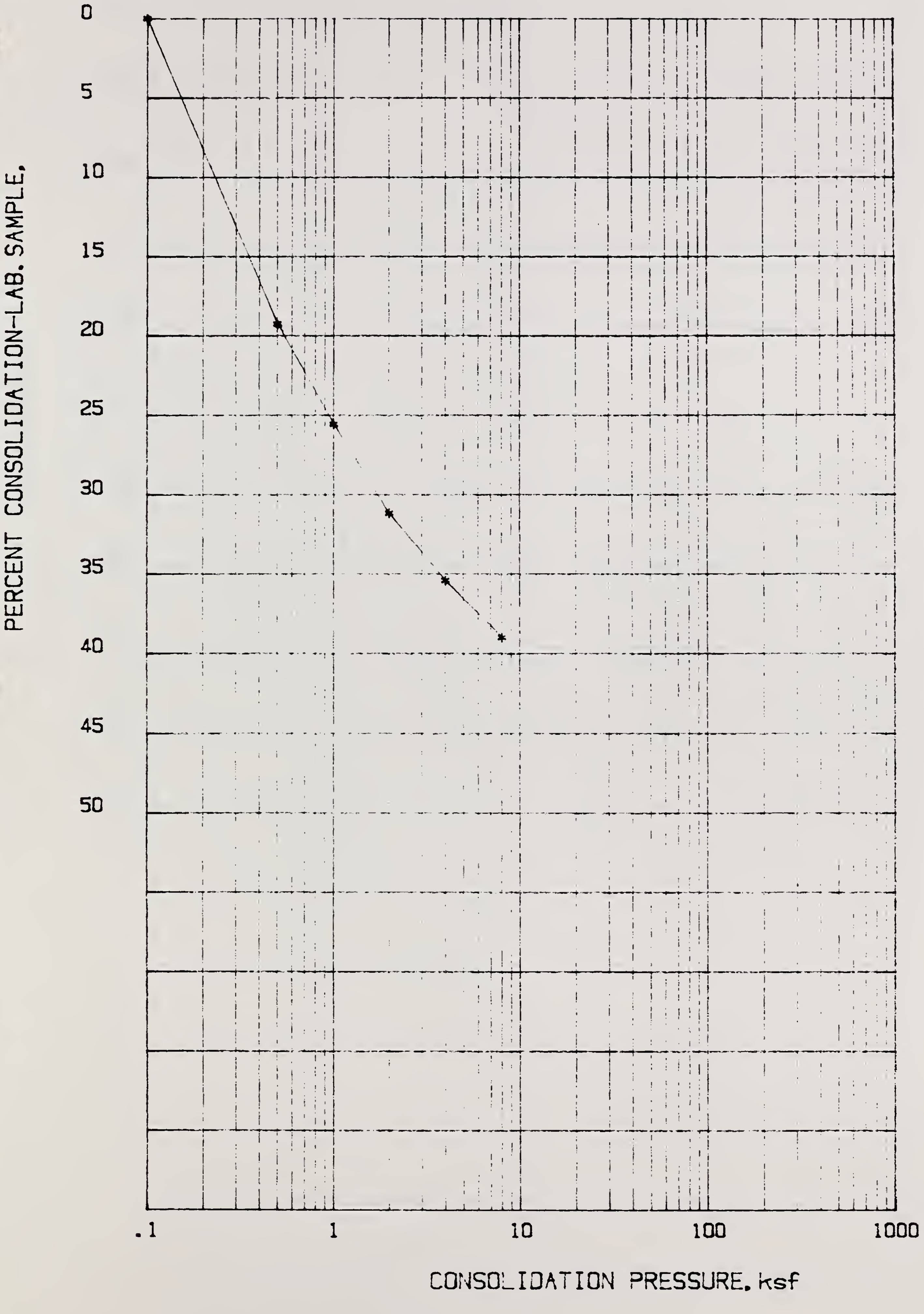
RESULTS OF CONSOLIDATION TEST

Project: WEPP SAMPLE
Field number: HEIDEN-WACO TX.
LAB.NUMBER 88C93
Sample depth: Feet
Sample description: COMPACTED TO .99 GMS/CC CH LL=52 PI=37

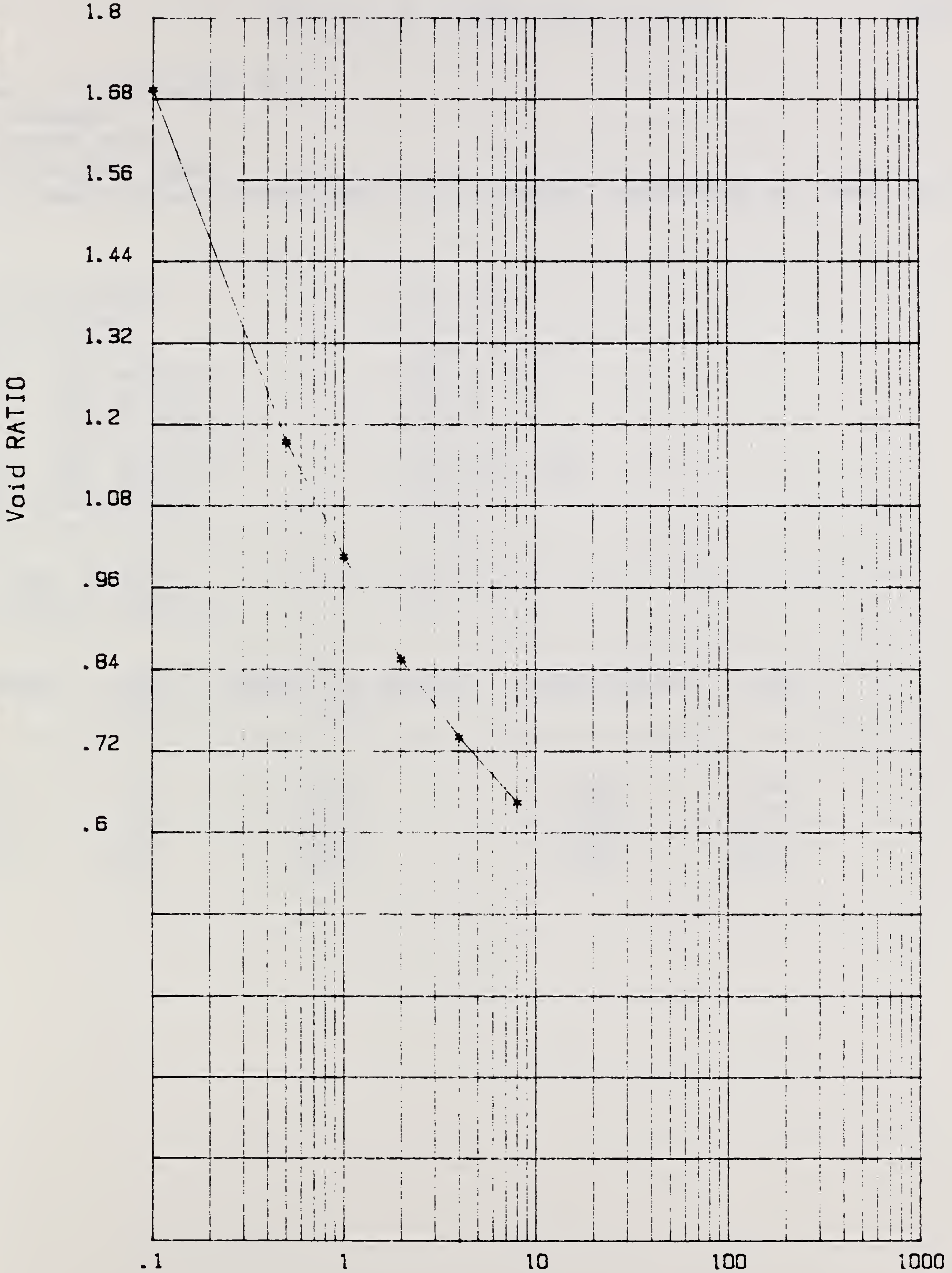
SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	95.78 g
INITIAL DRY WEIGHT:	79.73 g
INITIAL WATER CONTENT:	20.1 %
INITIAL WET DENSITY:	74.335 PCF
INITIAL DRY DENSITY:	61.879 PCF
SPECIFIC GRAVITY:	2.67
INITIAL VOID RATIO:	1.693

FINAL WET WEIGHT:	91.67 g
FINAL WATER CONTENT:	14.9 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	1.6930	0.00
2.0	.50	.1931	1.1730	19.31
3.0	1.00	.2561	1.0030	25.61
4.0	2.00	.3123	.8520	31.23
5.0	4.00	.3548	.7380	35.48
6.0	8.00	.3907	.6410	39.07



Project: WEPP SAMPLE LAB. NUMBER 88C93
Field number: HEIDEN-WACO TX. Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.



CONSOLIDATION PRESSURE, ksf

Project: WEPP SAMPLE LAB. NUMBER 88C93

Field number: HEIDEN-WACO TX. Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test #2

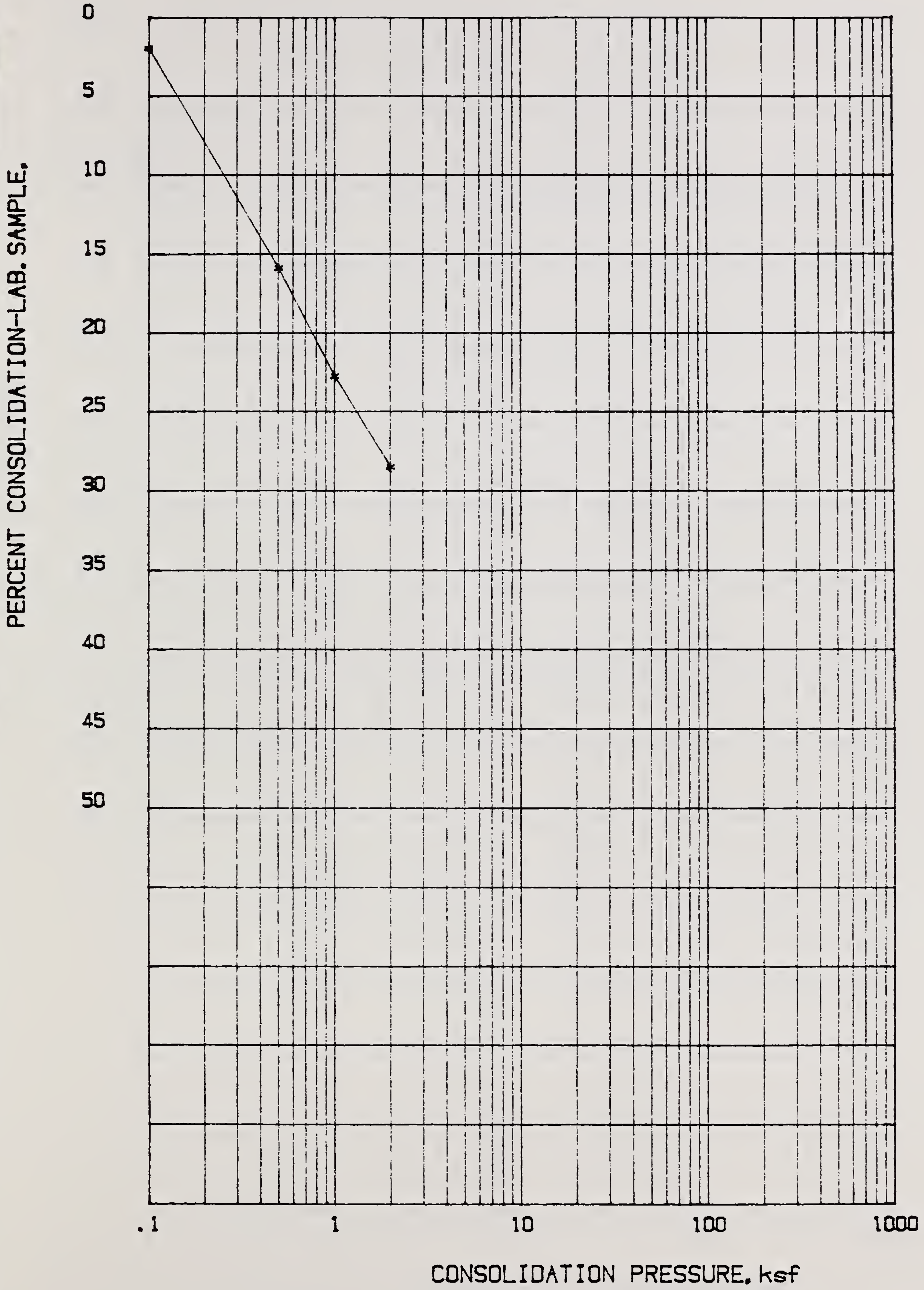
RESULTS OF CONSOLIDATION TEST

Project: HEIDEN-WACO TX.
Field number:
LAB.NUMBER 88C93
Sample depth: Feet
Sample description: COMPACTED TO .99 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	89.98 g
INITIAL DRY WEIGHT:	79.62 g
INITIAL WATER CONTENT:	13 %
INITIAL WET DENSITY:	69.834 PCF
INITIAL DRY DENSITY:	61.793 PCF
SPECIFIC GRAVITY:	2.67
INITIAL VOID RATIO:	1.697
FINAL WET WEIGHT:	104.36 g
FINAL WATER CONTENT:	31 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.0196	1.6440	1.96
2.0	.50	.1592	1.2680	15.92
3.0	1.00	.2279	1.0820	22.79
4.0	2.00	.2854	.9270	28.54

Test 2



Project: HEIDEN-WACO TX.

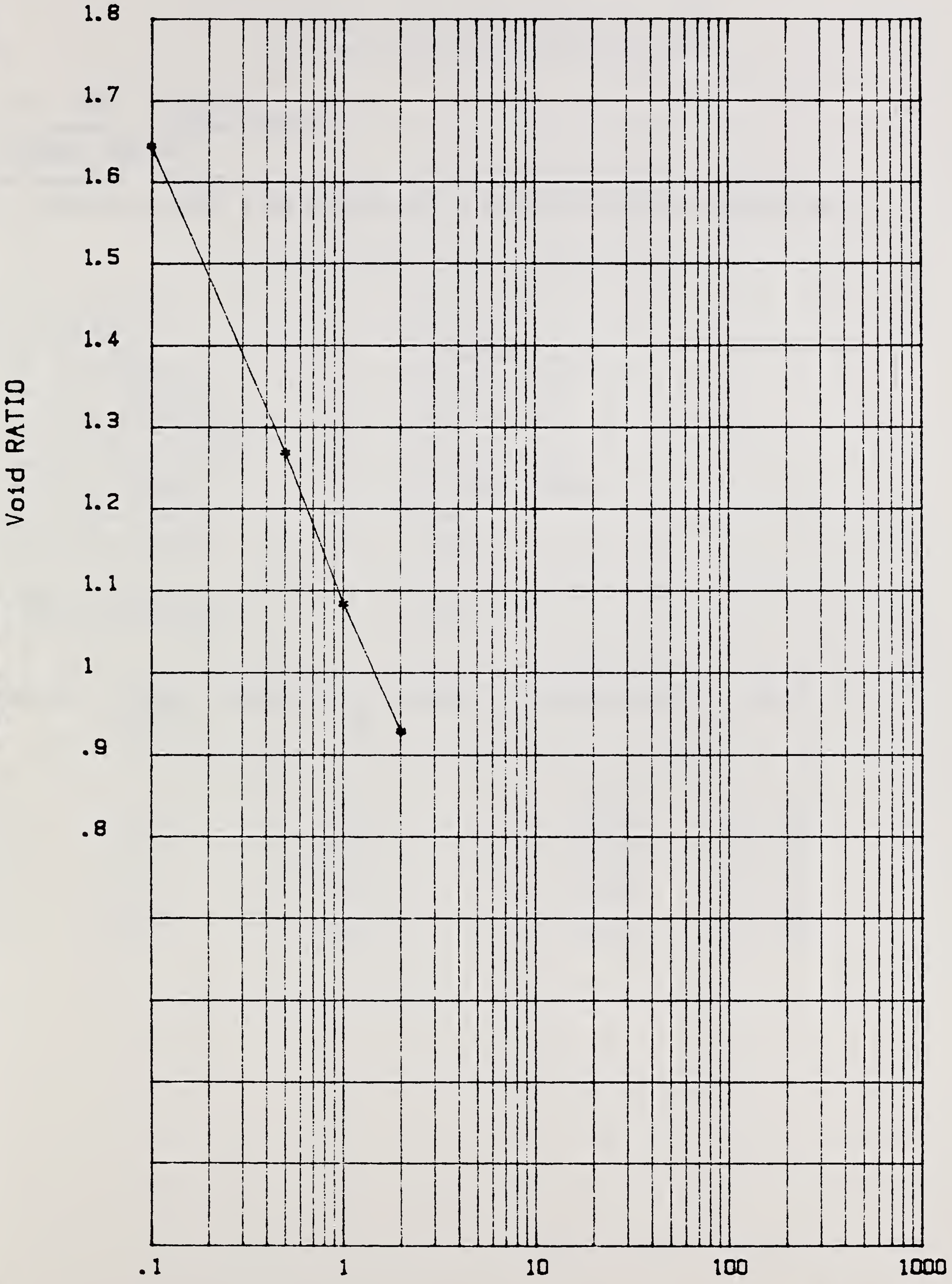
LAB. NUMBER 88C93

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 3



CONSOLIDATION PRESSURE, ksf

Project: HEIDEN-WACO TX.
Field number:

LAB. NUMBER 88C93
Sample depth: Feet

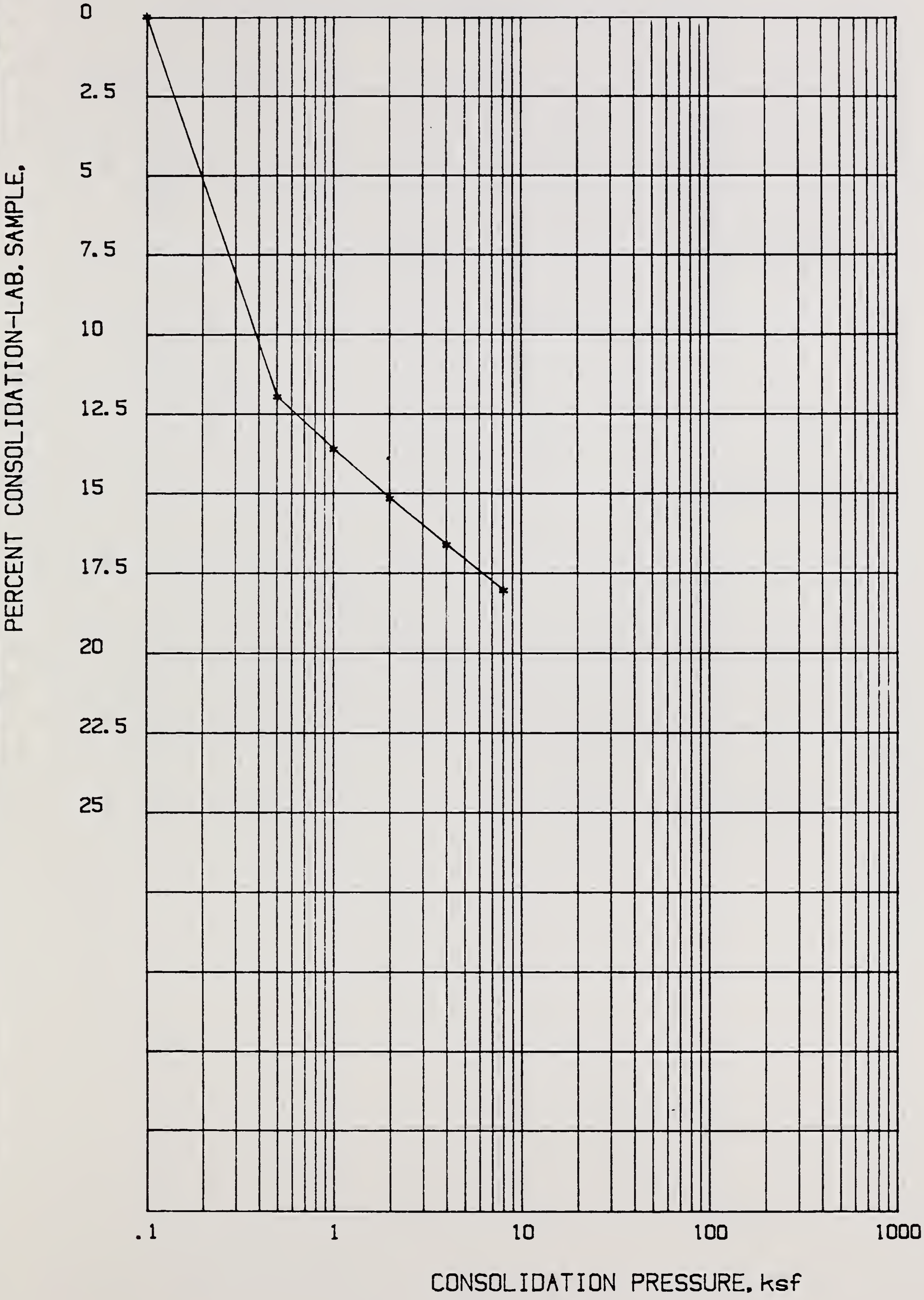
USDA-SCS S. M. L. LINCOLN NE.

RESULTS OF CONSOLIDATION TEST

Project: WEPP SAMPLE
Field number: HIRSH-ORD NE.
LAB.NUMBER 88C94
Sample depth: Feet
Sample description: COMPACTED TO 1.43 GM/CC NON-PLASTIC SM

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	118.08 g
INITIAL DRY WEIGHT:	111.69 g
INITIAL WATER CONTENT:	5.7 %
INITIAL WET DENSITY:	91.642 PCF
INITIAL DRY DENSITY:	86.683 PCF
SPECIFIC GRAVITY:	2.63
INITIAL VOID RATIO:	.894
FINAL WET WEIGHT:	132.44 g
FINAL WATER CONTENT:	18.5 %

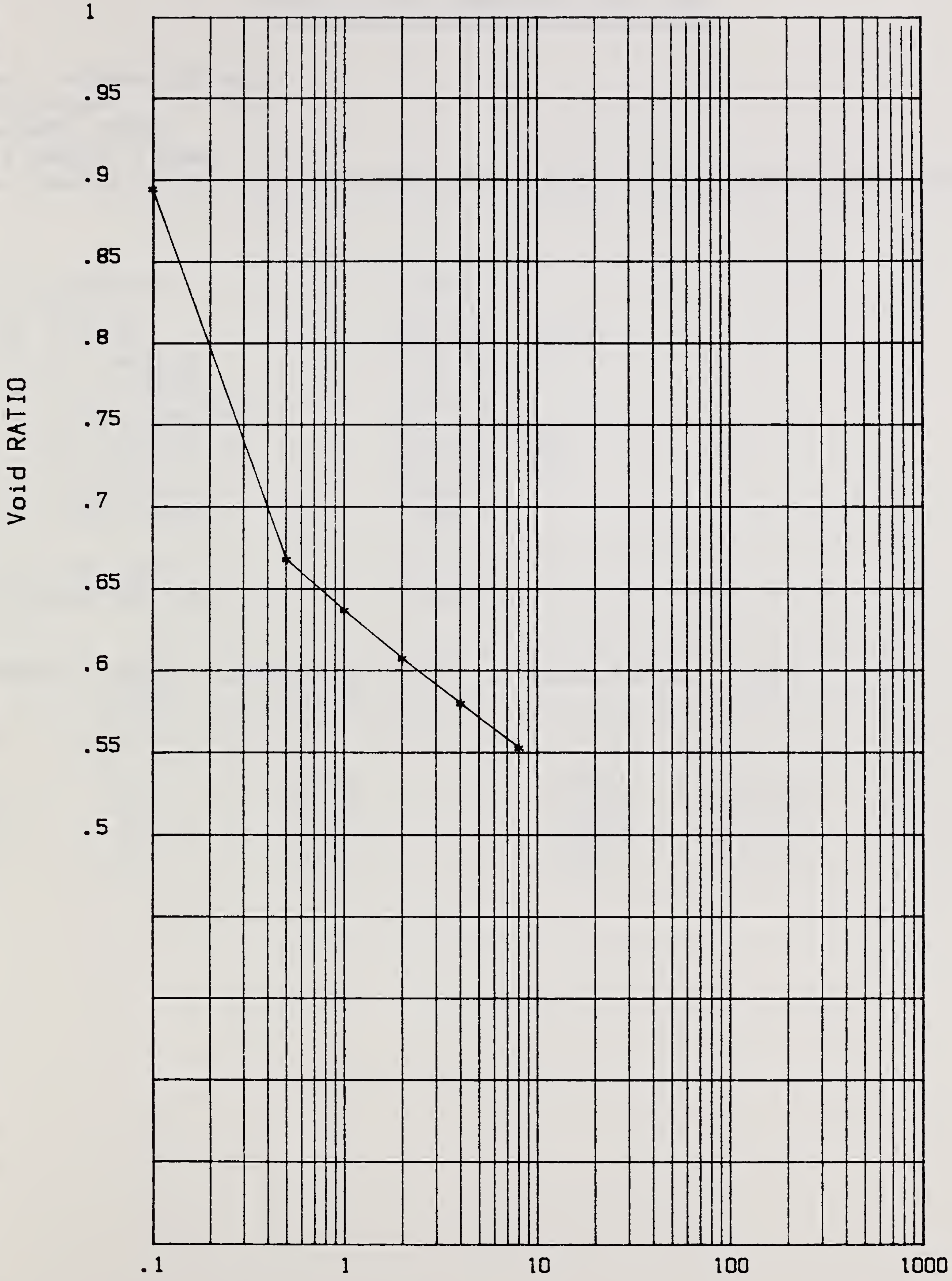
I[illegible]REMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	.8940	0.00
2.0	.50	.1198	.6670	11.98
3.0	1.00	.1363	.6350	13.63
4.0	2.00	.1519	.6060	15.19
5.0	4.00	.1665	.5780	16.65
6.0	8.00	.1808	.5510	18.08



Project: WEPP SAMPLE　　LAB. NUMBER 88C94

Field number: HIRSH-ORD NE.　　Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



CONSOLIDATION PRESSURE, ksf

Project: WEPP SAMPLE

LAB. NUMBER 88C94

Field number: HIRSH-ORD NE.

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test #2

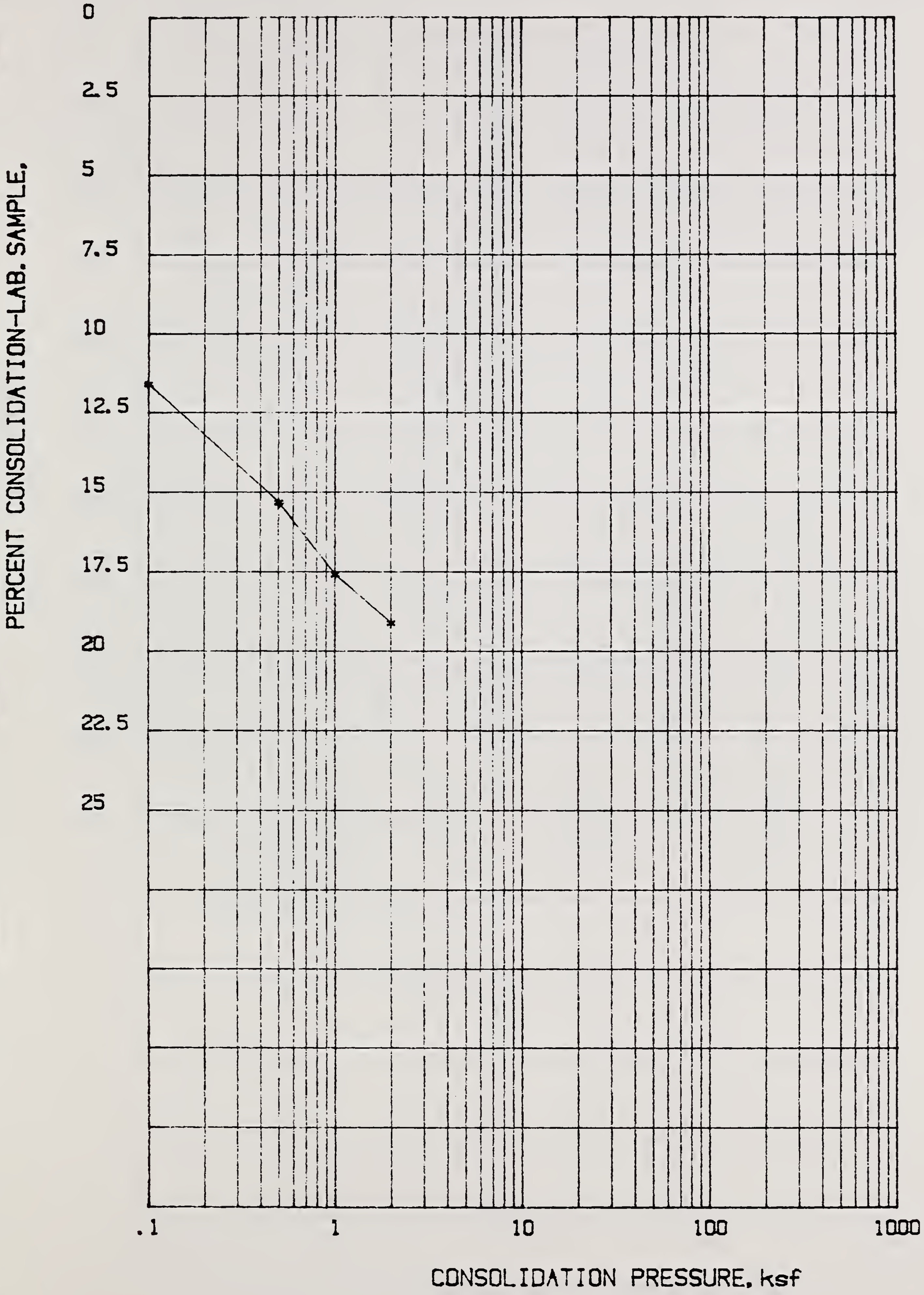
RESULTS OF CONSOLIDATION TEST

Project: HIRSH-ORD NE
Field number:
LAB.NUMBER 88C94
Sample depth: Feet
Sample description: COMPACTED TO 1.39 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	117.6 g
INITIAL DRY WEIGHT:	111.8 g
INITIAL WATER CONTENT:	5.1 %
INITIAL WET DENSITY:	91.27 PCF
INITIAL DRY DENSITY:	86.768 PCF
SPECIFIC GRAVITY:	2.63
INITIAL VOID RATIO:	.892
FINAL WET WEIGHT:	132.61 g
FINAL WATER CONTENT:	18.6 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.1163	.6720	11.63
2.0	.50	.1536	.6010	15.36
3.0	1.00	.1763	.5580	17.63
4.0	2.00	.1916	.5290	19.16

Test No. 2



Project: HIRSH-ORD NE

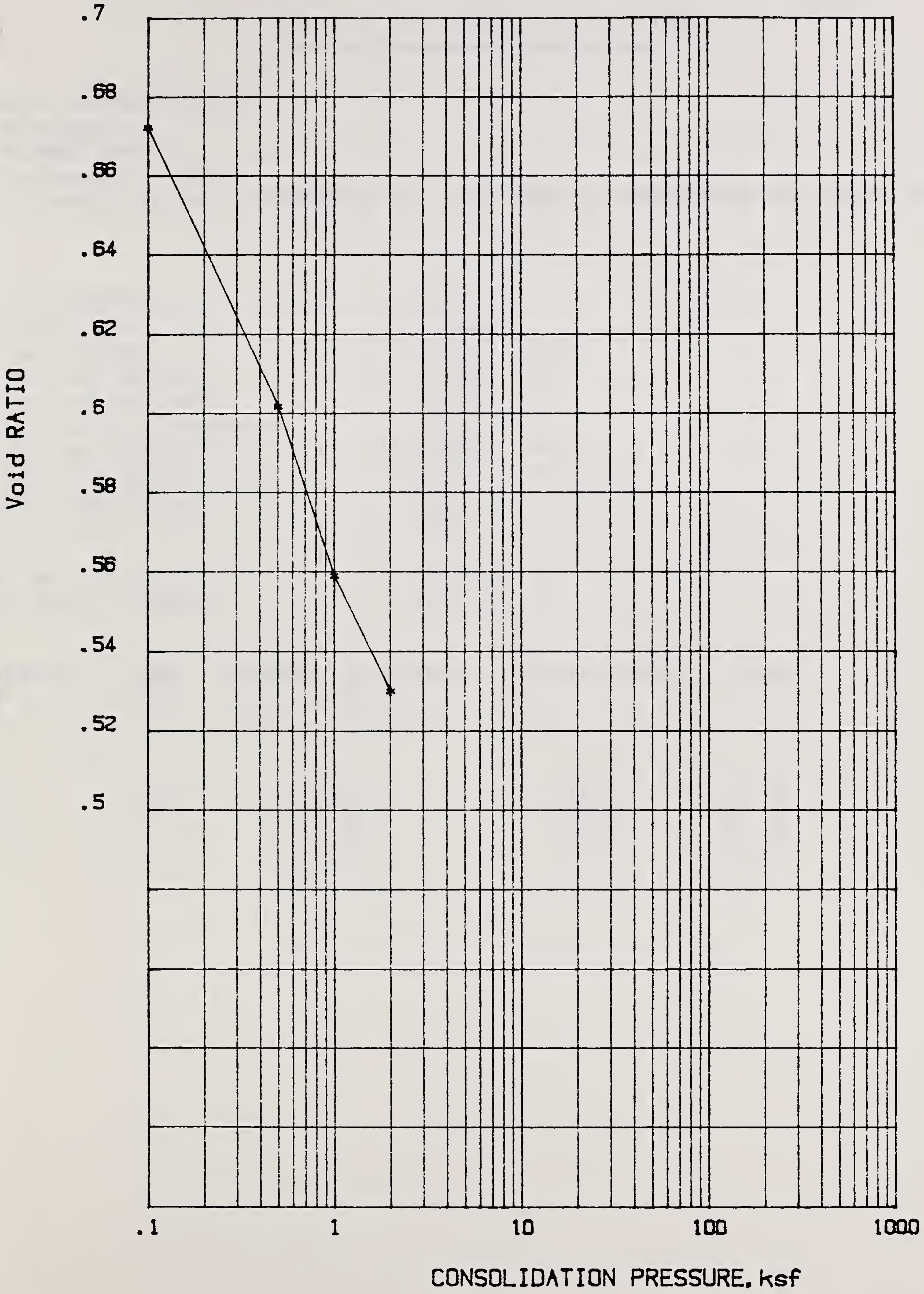
LAB. NUMBER 88C94

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test No. 2



Project: HIRSH-ORD NE _AB. NUMBER 88C94

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test #3

RESULTS OF CONSOLIDATION TEST

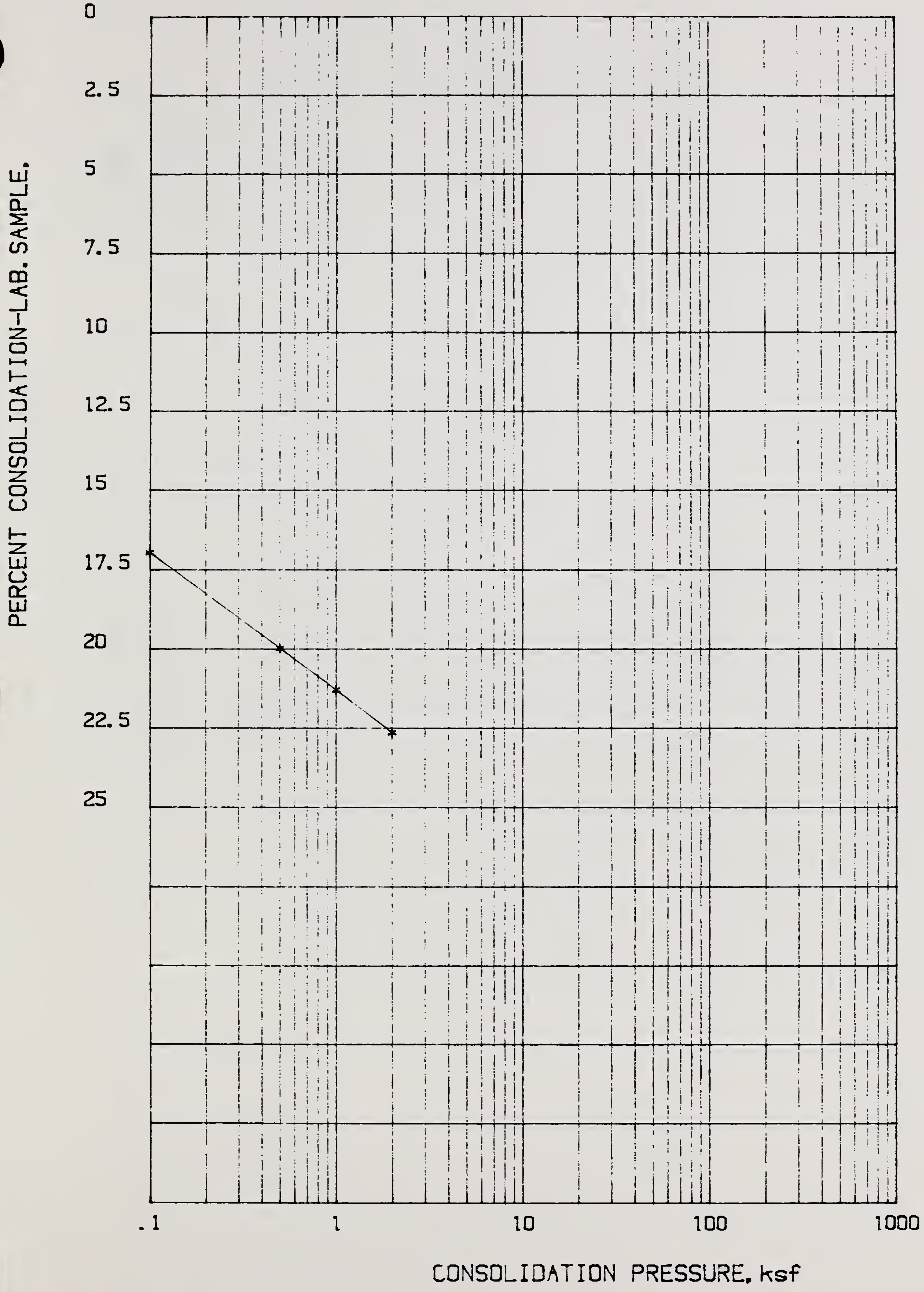
Project: HIRSH-ORD NE.
Field number:
LAB.NUMBER 88C94
Sample depth: Feet
Sample description: COMPACTED TO 1.39 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER: 2.5 ins
SAMPLE HEIGHT: 1 ins
INITIAL VOLUME: 80.439 cm^3
INITIAL WET WEIGHT: 115.88 g
INITIAL DRY WEIGHT: 111.81 g
INITIAL WATER CONTENT: 3.6 %
INITIAL WET DENSITY: 89.935 PCF
INITIAL DRY DENSITY: 86.776 PCF
SPECIFIC GRAVITY: 2.63
INITIAL VOID RATIO: .892

FINAL WET WEIGHT: 135.16 g
FINAL WATER CONTENT: 20.8 %

REMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.1700	.5700	17.00
2.0	.50	.2003	.5130	20.03
3.0	1.00	.2135	.4880	21.35
4.0	2.00	.2270	.4620	22.70

Test No. 3



Project: HIRSH-ORD NE.

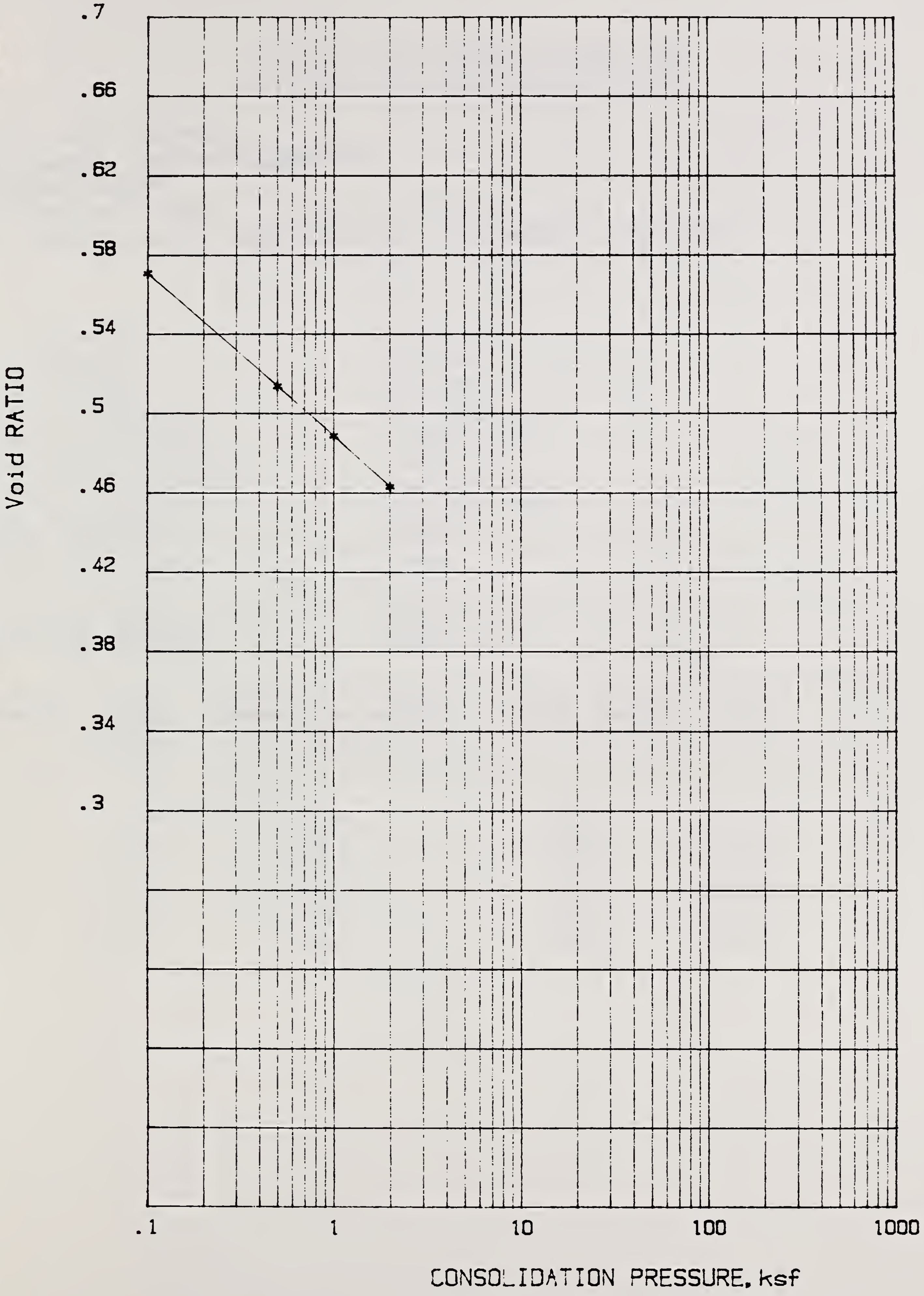
LAB. NUMBER 88C94

Field number:

Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.

Test No. 3



Project: HIRSH-ORD NE.
LAB. NUMBER 88C94

Field number:
Sample depth: Feet

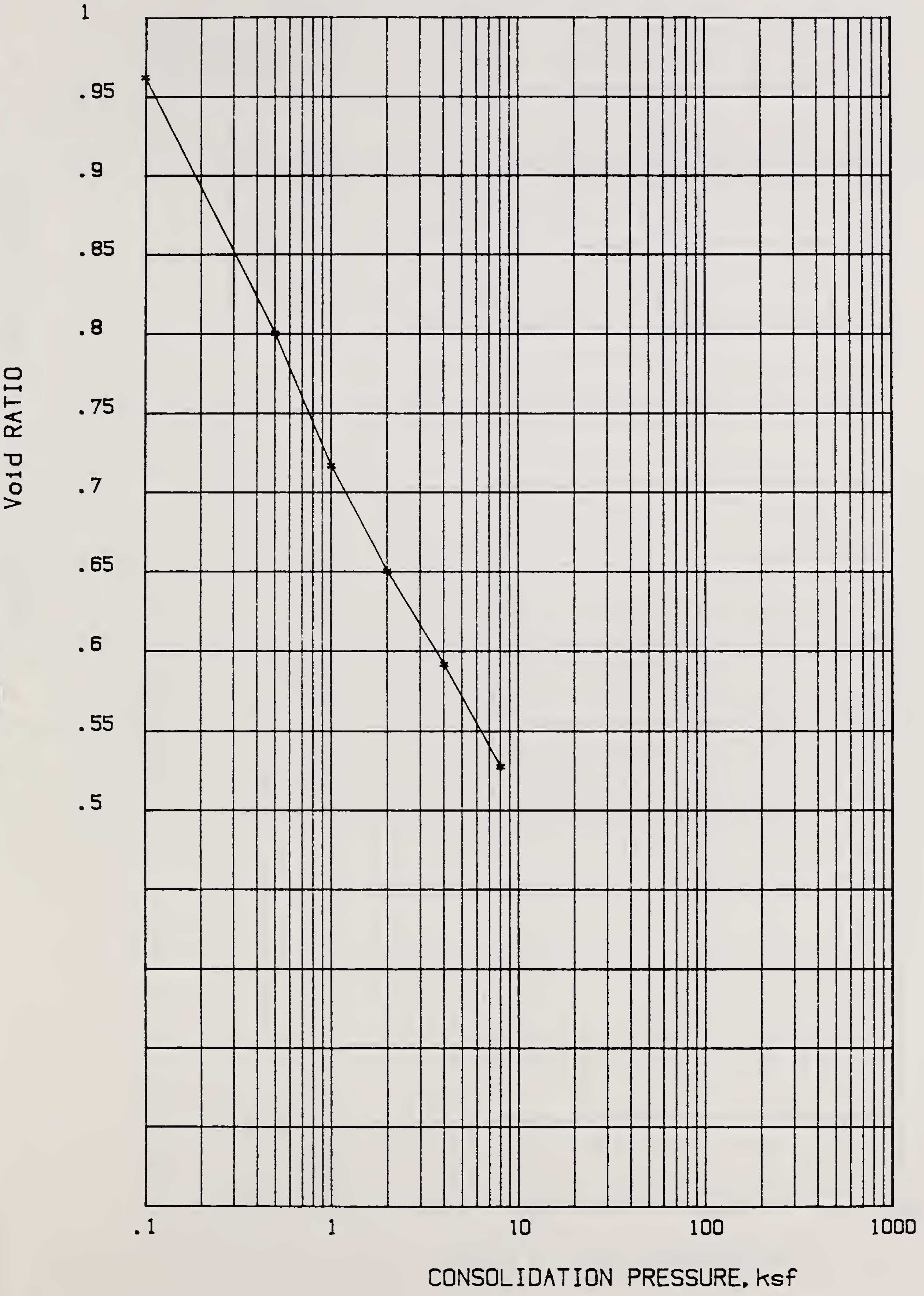
USDA-SCS S. M. L. LINCOLN NE.

RESULTS OF CONSOLIDATION TEST

Project: WEPP SAMPLE
Field number: KEITH-ALBI0N WY.
LAB.NUMBER 88C95
Sample depth: Feet
Sample description: COMPACTED TO 1.32 GM/CC LL=32 PI=13

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	121.43 g
INITIAL DRY WEIGHT:	106.18 g
INITIAL WATER CONTENT:	14.3 %
INITIAL WET DENSITY:	94.242 PCF
INITIAL DRY DENSITY:	82.407 PCF
SPECIFIC GRAVITY:	2.59
INITIAL VOID RATIO:	.962
FINAL WET WEIGHT:	128.11 g
FINAL WATER CONTENT:	20.6 %

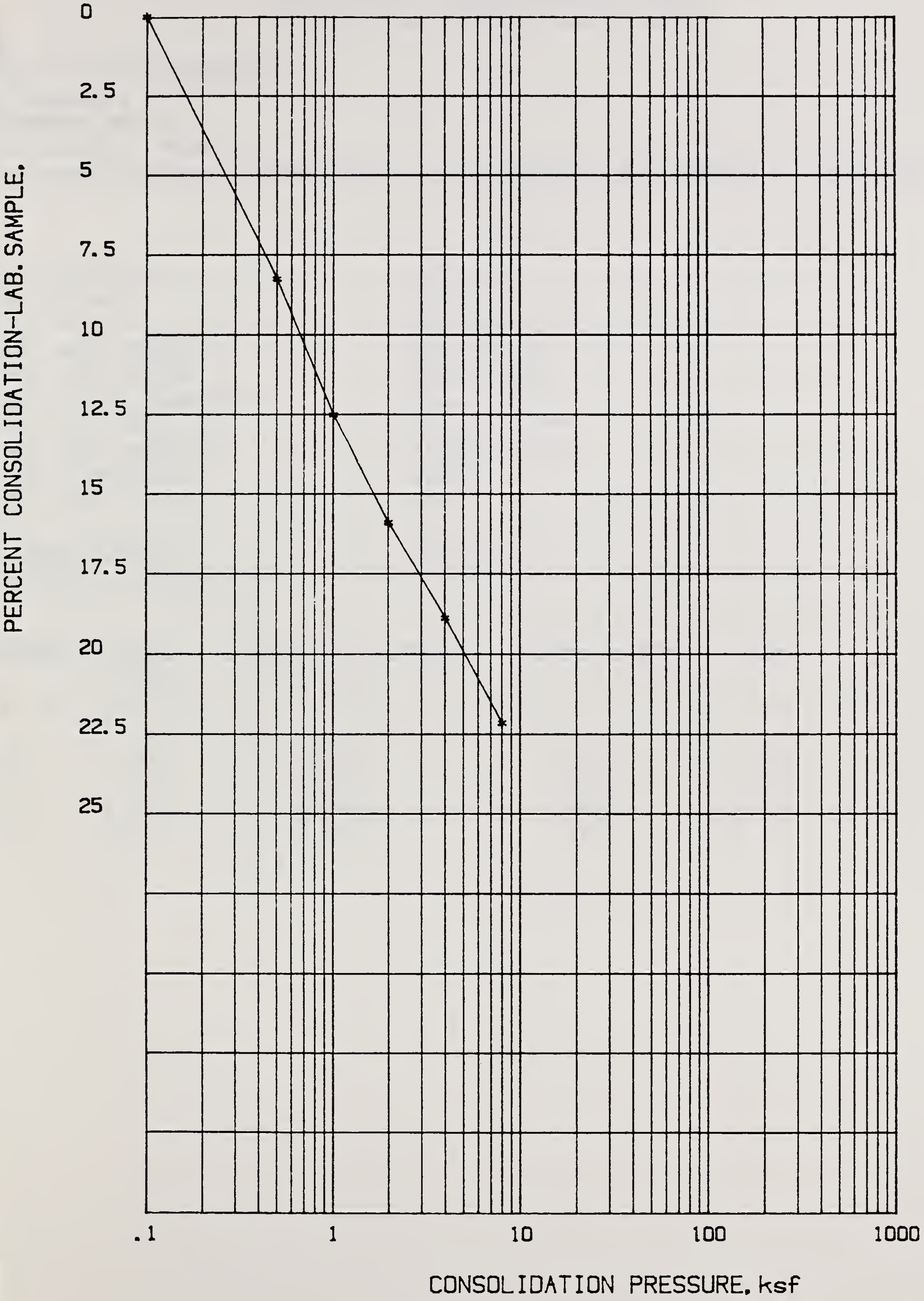
INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	.9620	0.00
2.0	.50	.0827	.7990	8.27
3.0	1.00	.1253	.7160	12.53
4.0	2.00	.1593	.6490	15.93
5.0	4.00	.1891	.5910	18.91
6.0	8.00	.2220	.5260	22.20



Project: WEPP SAMPLE LAB. NUMBER 88C95

Field number: KEITH-ALBION WY. Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.



Project: WEPP SAMPLE LAB. NUMBER 88C95
Field number: KEITH-ALBION WY. Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

Test 2

RESULTS OF CONSOLIDATION TEST

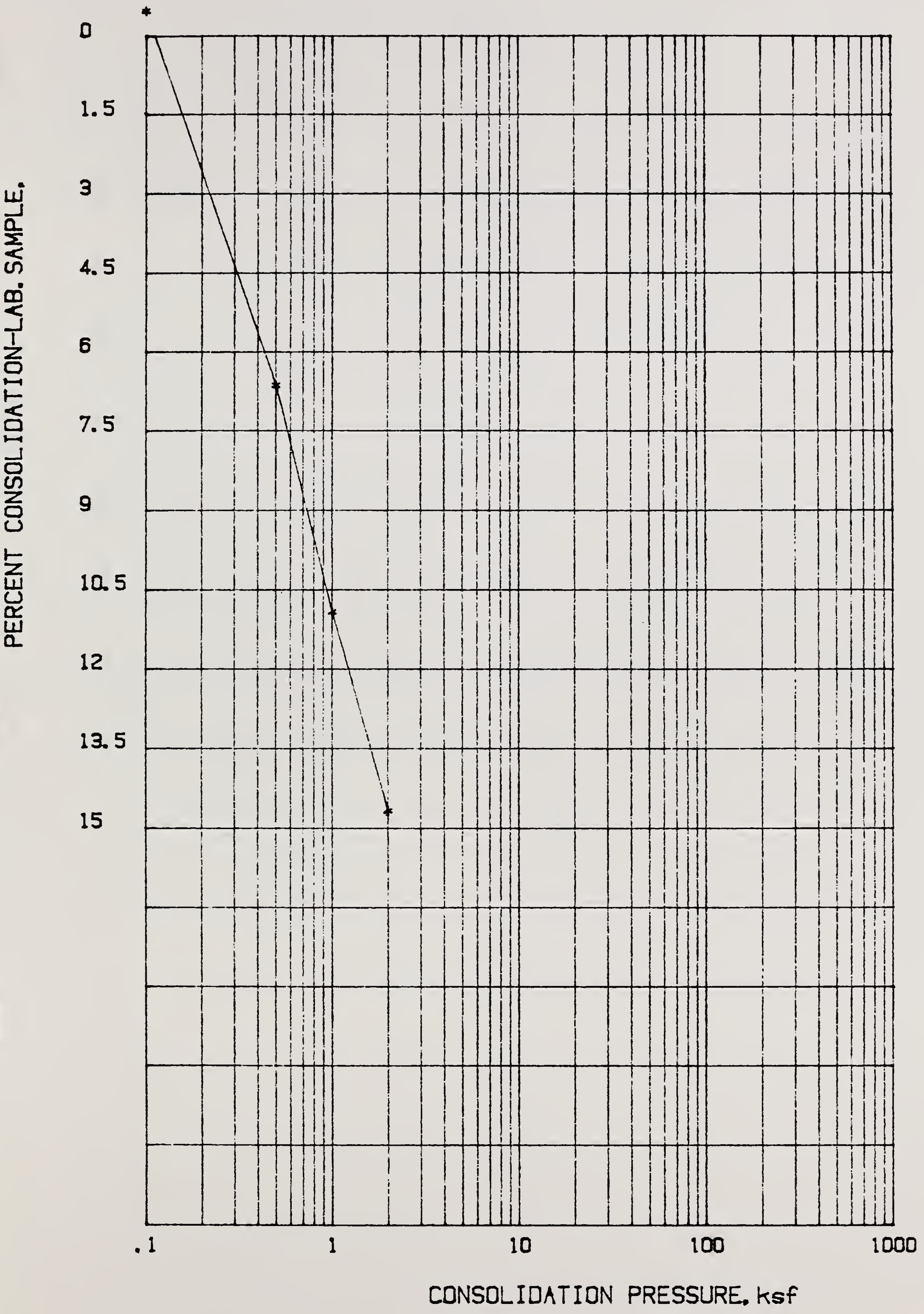
Project: KIETH-ALBIN WY
Field number:
LAB.NUMBER 88C95
Sample depth: Feet
Sample description: COMPACTED TO 1.32 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER: 2.5 ins
SAMPLE HEIGHT: 1 ins
INITIAL VOLUME: 80.439 cm^3
INITIAL WET WEIGHT: 125.78 g
INITIAL DRY WEIGHT: 106.17 g
INITIAL WATER CONTENT: 18.4 %
INITIAL WET DENSITY: 97.618 PCF
INITIAL DRY DENSITY: 82.399 PCF
SPECIFIC GRAVITY: 2.59
INITIAL VOID RATIO: .962

FINAL WET WEIGHT: 135.88 g
FINAL WATER CONTENT: 27.9 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	-.0048	.9710	-.48
2.0	.50	.0665	.8310	6.65
3.0	1.00	.1094	.7470	10.94
4.0	2.00	.1470	.6730	14.70

Test 2



Project: KIETH-ALBIN WY

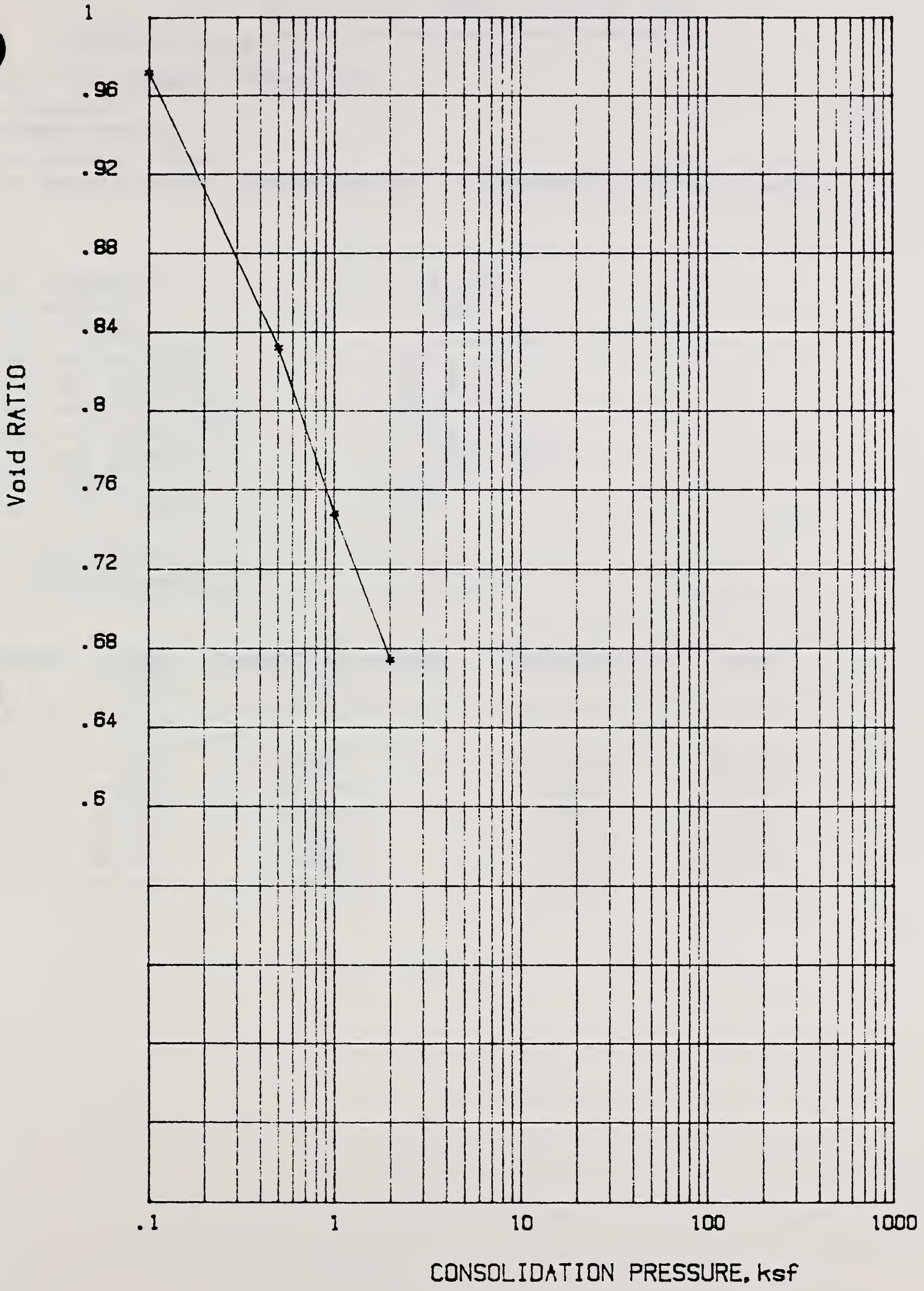
_AB. NUMBER 88C95

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2



Project: KIETH-ALBIN WY

_AB. NUMBER 88C95

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

```
                         RESULTS OF CONSOLIDATION TEST
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WEPP Sample

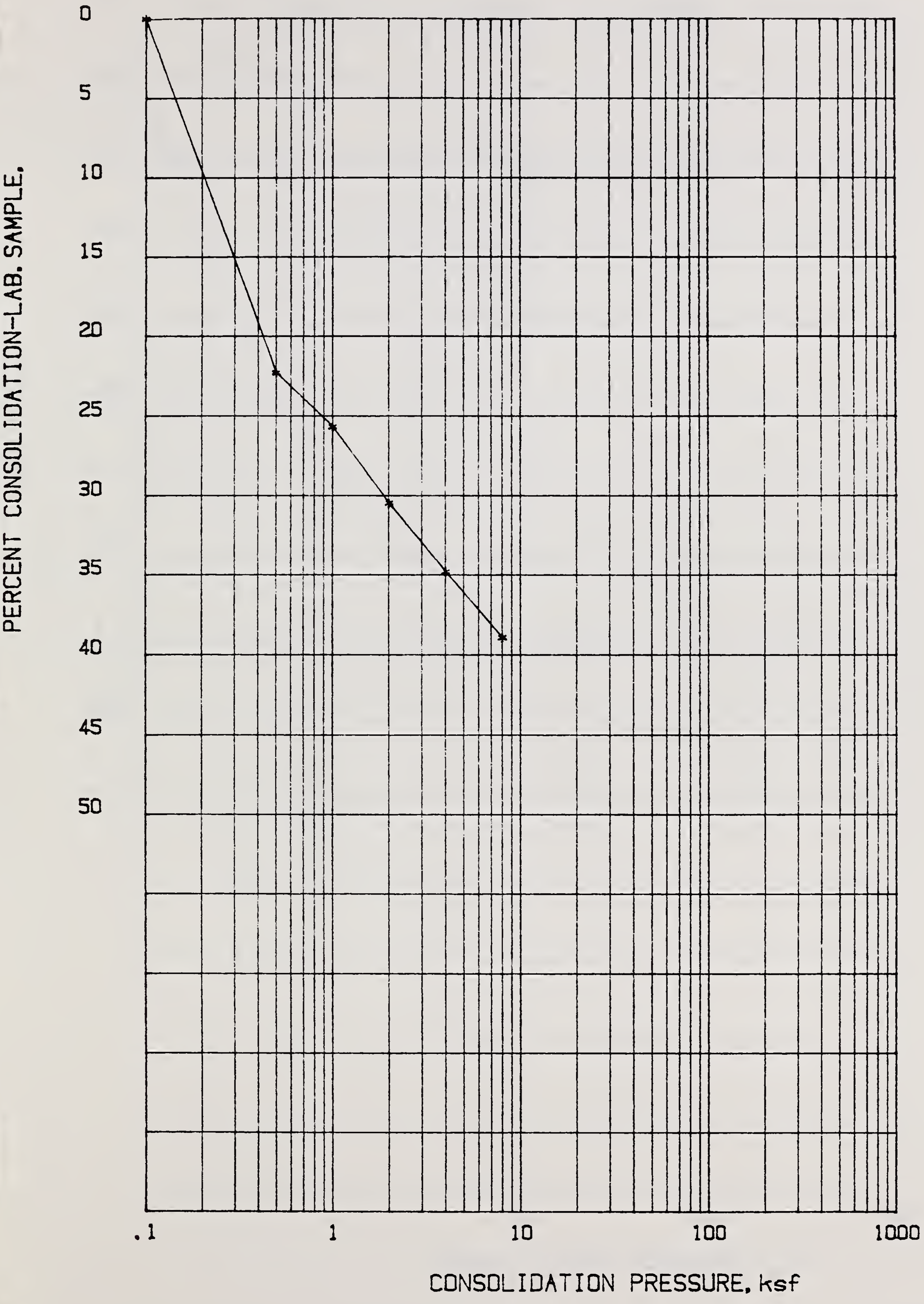
```
Project: LOS BANOS--FRESNO CA.
Field number:
LAB.NUMBER 88C96
Sample depth:  Feet
Sample description: COMPACTED TO 1.0 GMS/CC CL LL=46 PI=25


SAMPLE DIAMETER:                  2.5 ins
SAMPLE HEIGHT:                    1 ins
INITIAL VOLUME:                   80.439  cm^3
INITIAL WET WEIGHT:               92.1  g
INITIAL DRY WEIGHT:               80.43  g
INITIAL WATER CONTENT:            14.5  %
INITIAL WET DENSITY:              71.479  PCF
INITIAL DRY DENSITY:              62.422  PCF
SPECIFIC GRAVITY:                 2.61
INITIAL VOID RATIO:               1.61

FINAL WET WEIGHT:                 102.46  g
FINAL WATER CONTENT:              27.3  %

INCREMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )      (ins)
---------   ----   ----------------   -----------    ---

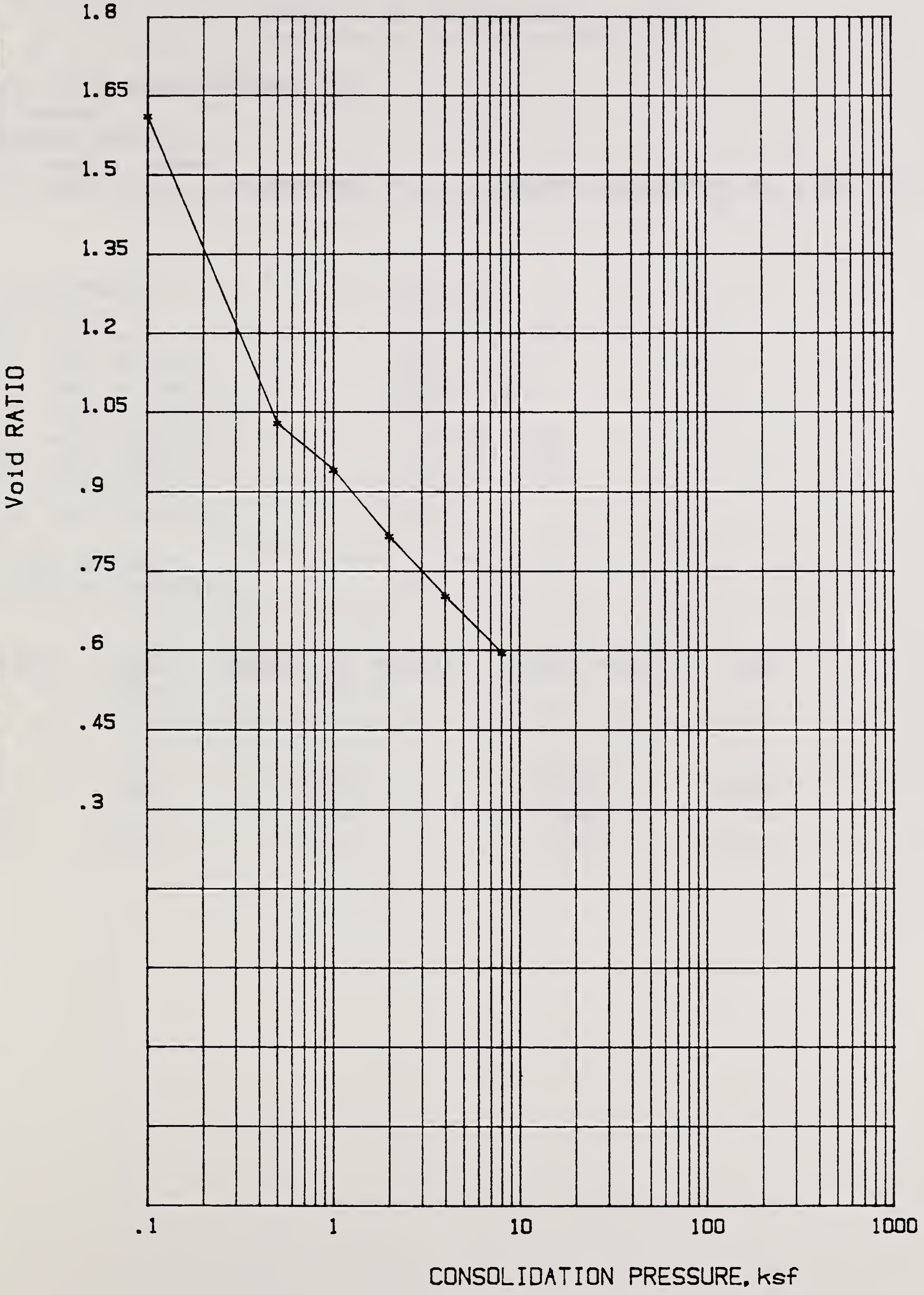
   1.0       .10       0.0000           1.6100       0.00
   2.0       .50        .2234           1.0270      22.34
   3.0      1.00        .2571            .9390      25.71
   4.0      2.00        .3053            .8130      30.53
   5.0      4.00        .3486            .7000      34.86
   6.0      8.00        .3900            .5920      39.00
```



Project: LOS BANOS--FRESNO CA. LAB. NUMBER 88C96

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: LOS BANOS--FRESNO CA. LAB. NUMBER 88C96

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2

RESULTS OF CONSOLIDATION TEST

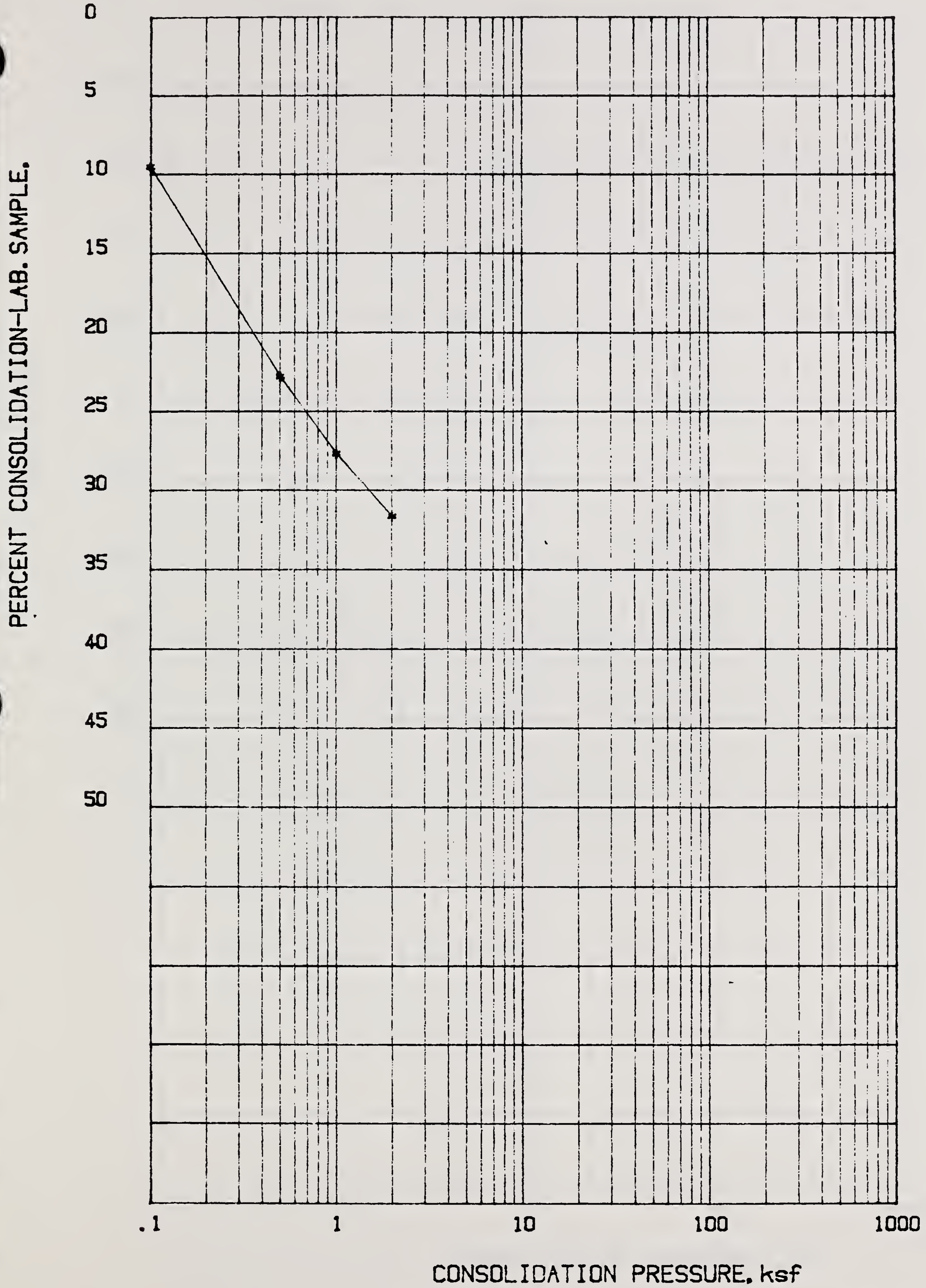
Project: LOS BANOS-FRESNO CA
Field number:
LAB.NUMBER 88C96
Sample depth: Feet
Sample description: COMPACTED TO 1.0 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER: 2.5 ins
SAMPLE HEIGHT: 1 ins
INITIAL VOLUME: 80.439 cm^3
INITIAL WET WEIGHT: 92.57 g
INITIAL DRY WEIGHT: 80.43 g
INITIAL WATER CONTENT: 15 %
INITIAL WET DENSITY: 71.844 PCF
INITIAL DRY DENSITY: 62.422 PCF
SPECIFIC GRAVITY: 2.61
INITIAL VOID RATIO: 1.61

FINAL WET WEIGHT: 106.24 g
FINAL WATER CONTENT: 32 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.0953	1.3610	9.53
2.0	.50	.2282	1.0140	22.82
3.0	1.00	.2774	.8860	27.74
4.0	2.00	.3172	.7820	31.72

Test 2

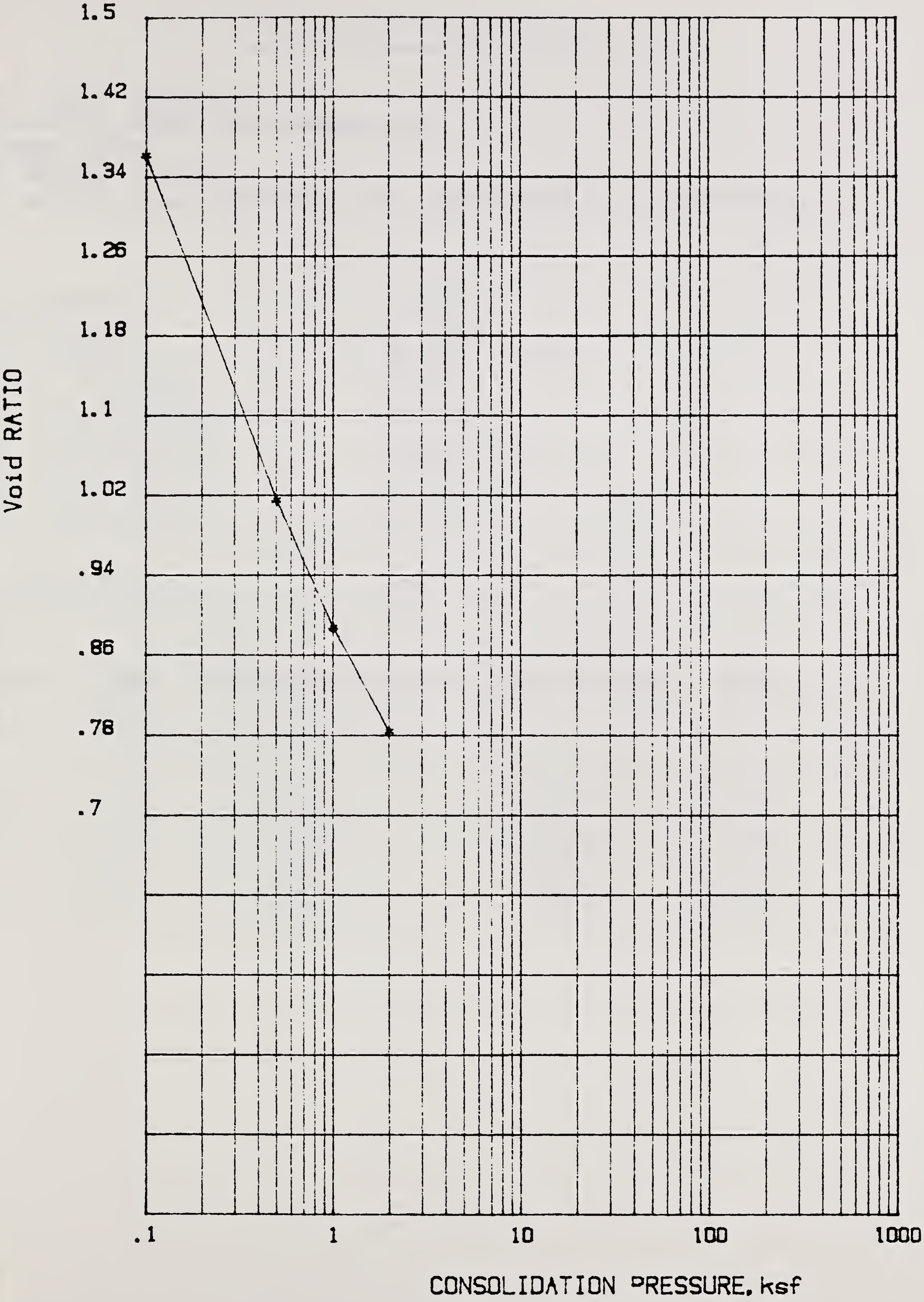


Project: LOS BANOS-FRESNO CA LAB. NUMBER 88C96

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2



Project: LOS BANOS-FRESNO CA

LAB. NUMBER 88C96

Field number:

Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.

```
                         RESULTS OF CONSOLIDATION TEST
                         =============================

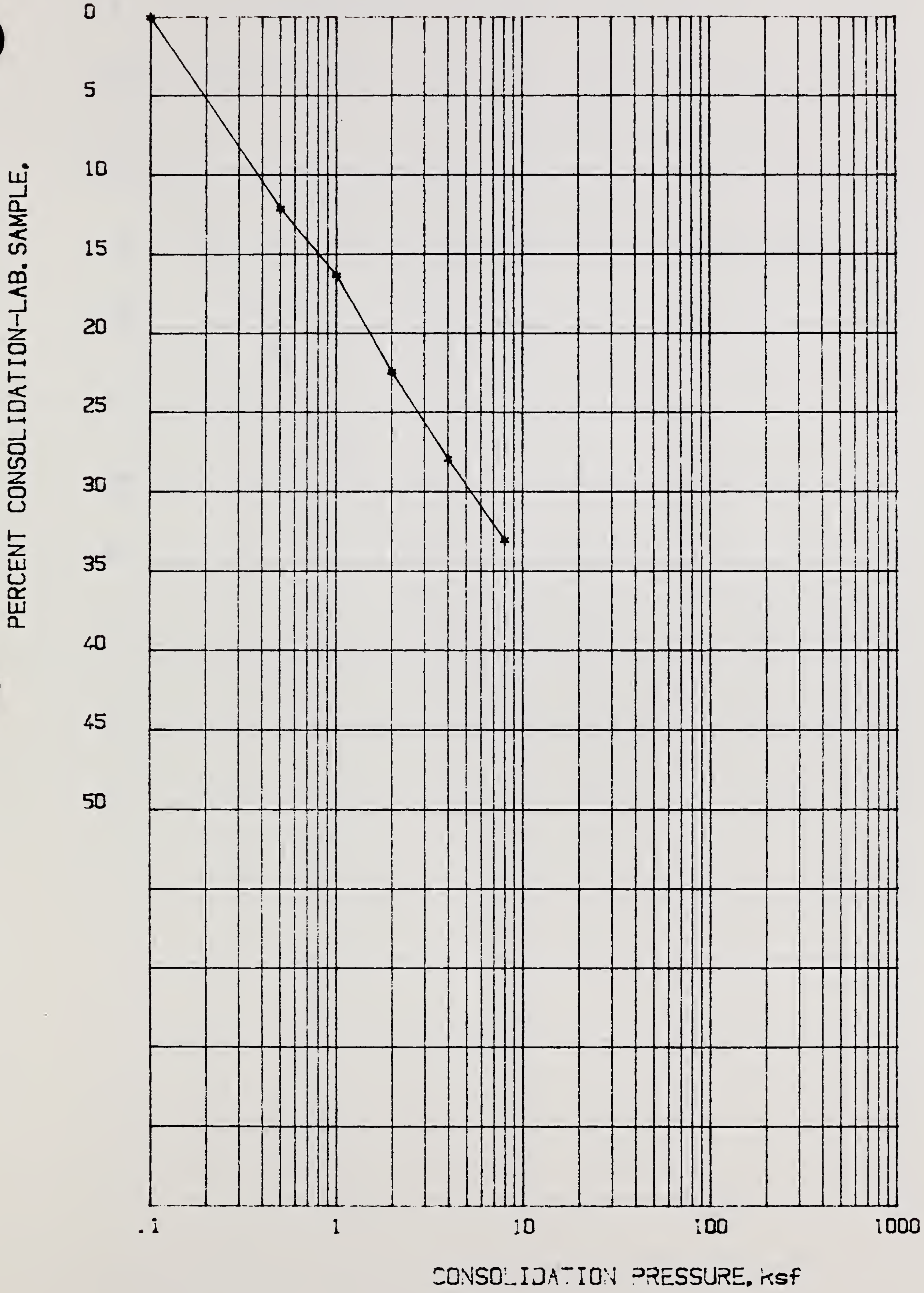
Project: WEPP SAMPLE
Field number: PIERE-COTTONWOOD SD.
LAB.NUMBER 88C97
Sample depth: - Feet
Sample description: REMOLDED TO 1.05 GMS/CC CH LL=52 PI=32


SAMPLE DIAMETER:               2.5 ins
SAMPLE HEIGHT:                 1 ins
INITIAL VOLUME:                80.439  cm^3
INITIAL WET WEIGHT:            98.35   g
INITIAL DRY WEIGHT:            84.46   g
INITIAL WATER CONTENT:         16.4    %
INITIAL WET DENSITY:           76.33   PCF
INITIAL DRY DENSITY:           65.55   PCF
SPECIFIC GRAVITY:              2.71
INITIAL VOID RATIO:            1.581

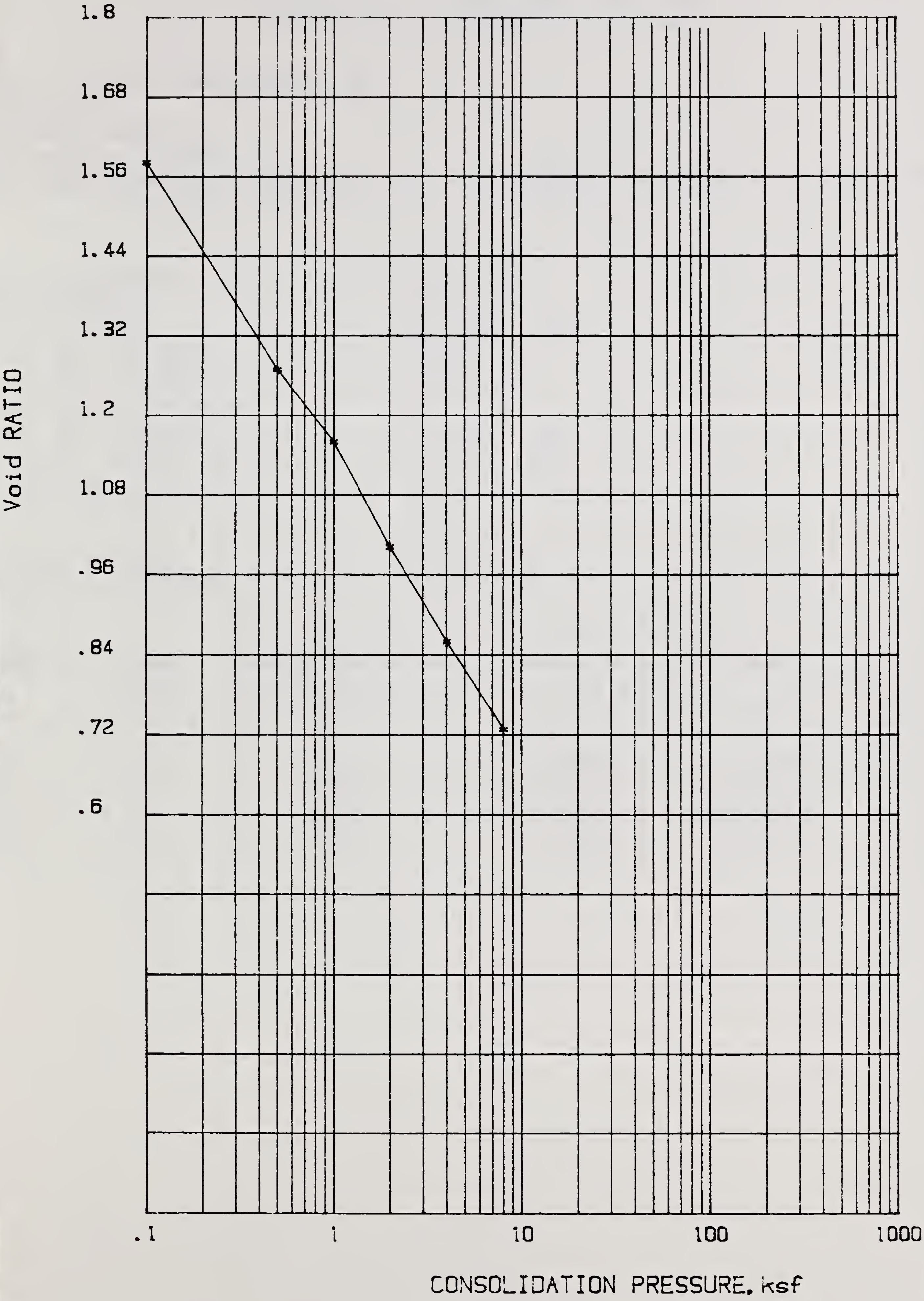
FINAL WET WEIGHT:              108.92   g
FINAL WATER CONTENT:           28.9    %

INCREMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )      (ins)
---------   ----   ----------------   -----------    ---

   1.0       .10        0.0000           1.5810       0.00
   2.0       .50         .1214           1.2670      12.14
   3.0      1.00         .1638           1.1580      16.38
   4.0      2.00         .2251           1.0000      22.51
   5.0      4.00         .2802            .8570      28.02
   6.0      8.00         .3313            .7250      33.13
```



Project: WEPP SAMPLE LAB. NUMBER 88C97
Field number: PIERE-COTTONWOOD SD.Sample depth: - Feet
USDA-SCS S.M.L. LINCOLN NE.



Project: WEPP SAMPLE _AB. NUMBER 88C97
Field number: PIERE-COTTONWOOD SD.Sample depth: - Feet
USDA-SCS S. M. L. LINCOLN NE.

Test 2

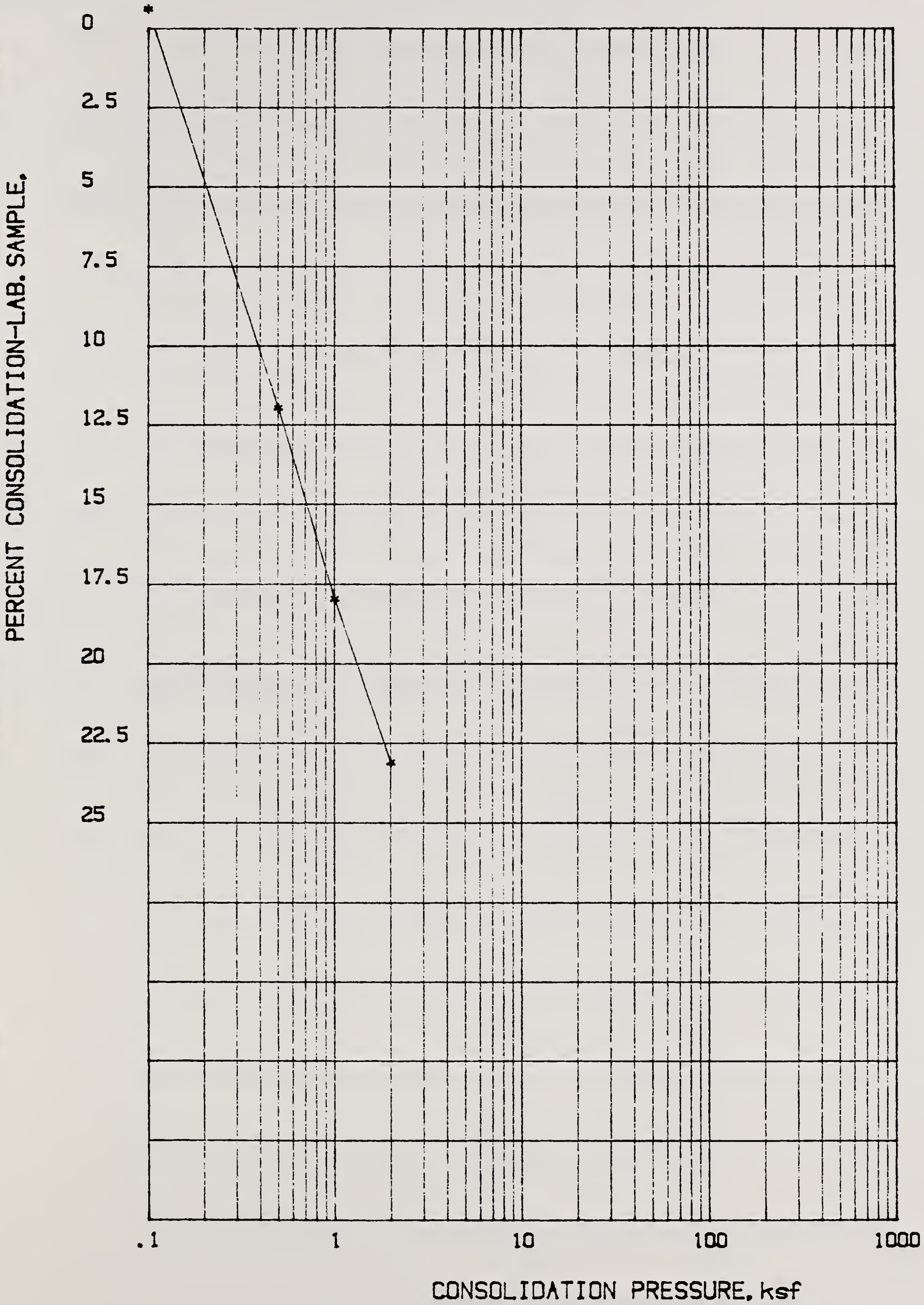
RESULTS OF CONSOLIDATION TEST

Project: PIERRE-COTTONWOOD SD
Field number:
LAB.NUMBER 88C97
Sample depth: Feet
Sample description: COMPACTED TO 1.05 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	100.7 g
INITIAL DRY WEIGHT:	84.45 g
INITIAL WATER CONTENT:	19.2 %
INITIAL WET DENSITY:	78.154 PCF
INITIAL DRY DENSITY:	65.542 PCF
SPECIFIC GRAVITY:	2.71
INITIAL VOID RATIO:	1.581
FINAL WET WEIGHT:	113.08 g
FINAL WATER CONTENT:	33.9 %

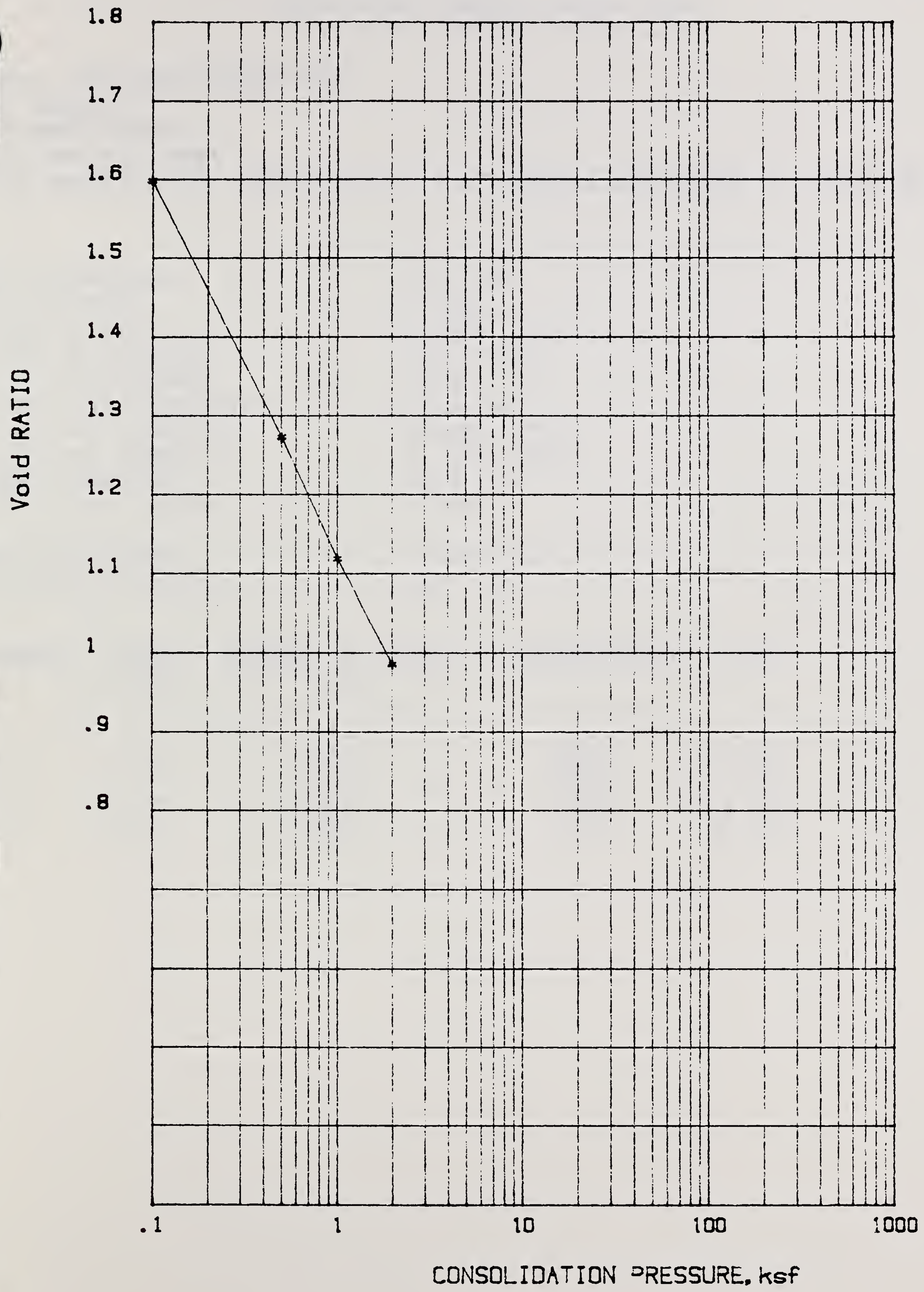
INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	-.0064	1.5970	-.64
2.0	.50	.1198	1.2720	11.98
3.0	1.00	.1799	1.1160	17.99
4.0	2.00	.2315	.9830	23.15

Test 2



Project: PIERRE-COTTONWOOD SD LAB. NUMBER 88C97
Field number: Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

Test 2



Project: PIERRE-COTTONWOOD SD
LAB. NUMBER 88C97

Field number:
Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

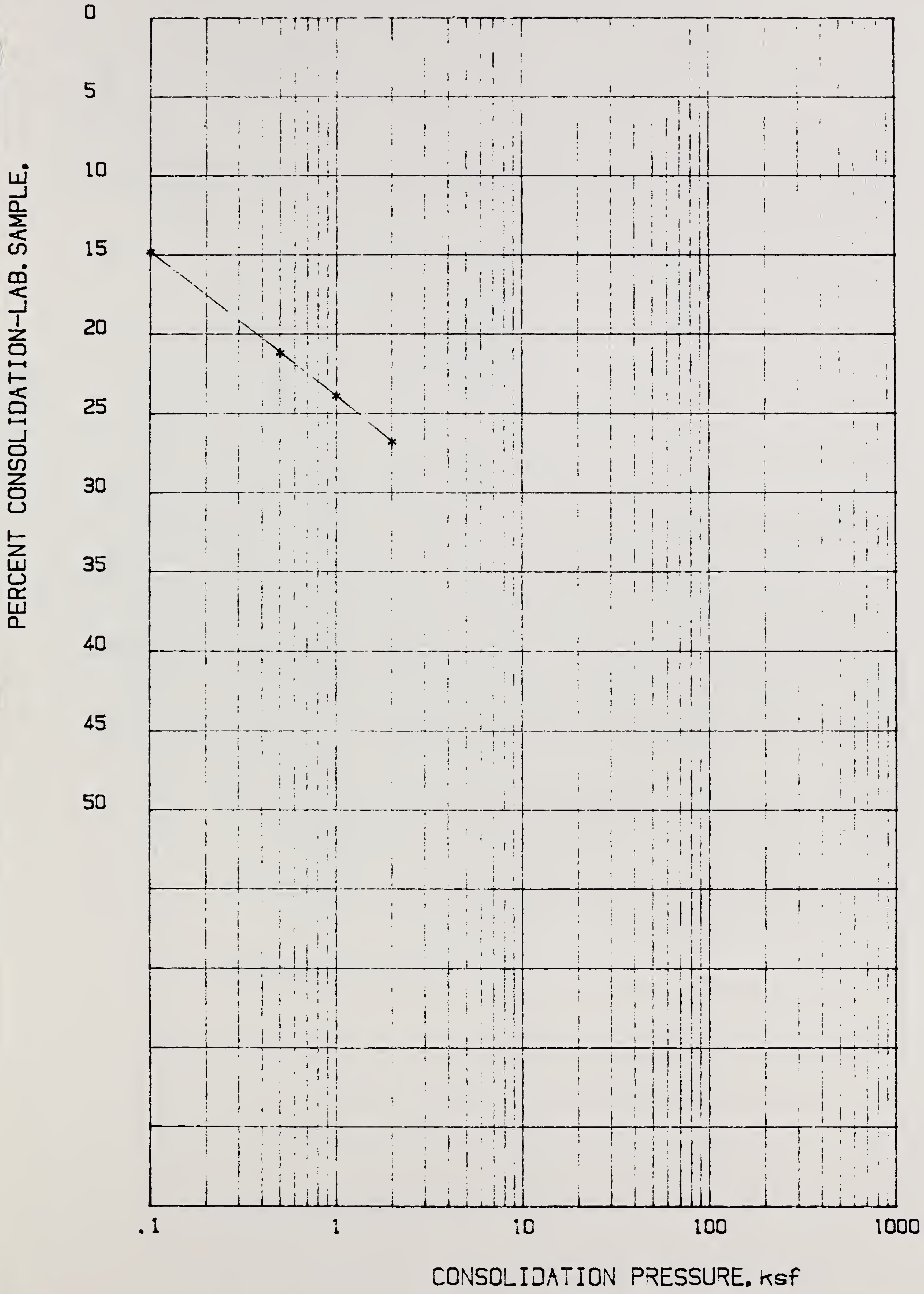
RESULTS OF CONSOLIDATION TEST

Project: PALOUSE-PULLMAN WA.
Field number:
LAB.NUMBER 88C98
Sample depth: Feet
Sample description: COMPACTED TO 1.15 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	104.17 g
INITIAL DRY WEIGHT:	92.51 g
INITIAL WATER CONTENT:	12.6 %
INITIAL WET DENSITY:	80.847 PCF
INITIAL DRY DENSITY:	71.797 PCF
SPECIFIC GRAVITY:	2.64
INITIAL VOID RATIO:	1.295

FINAL WET WEIGHT:	119.29 g
FINAL WATER CONTENT:	28.9 %

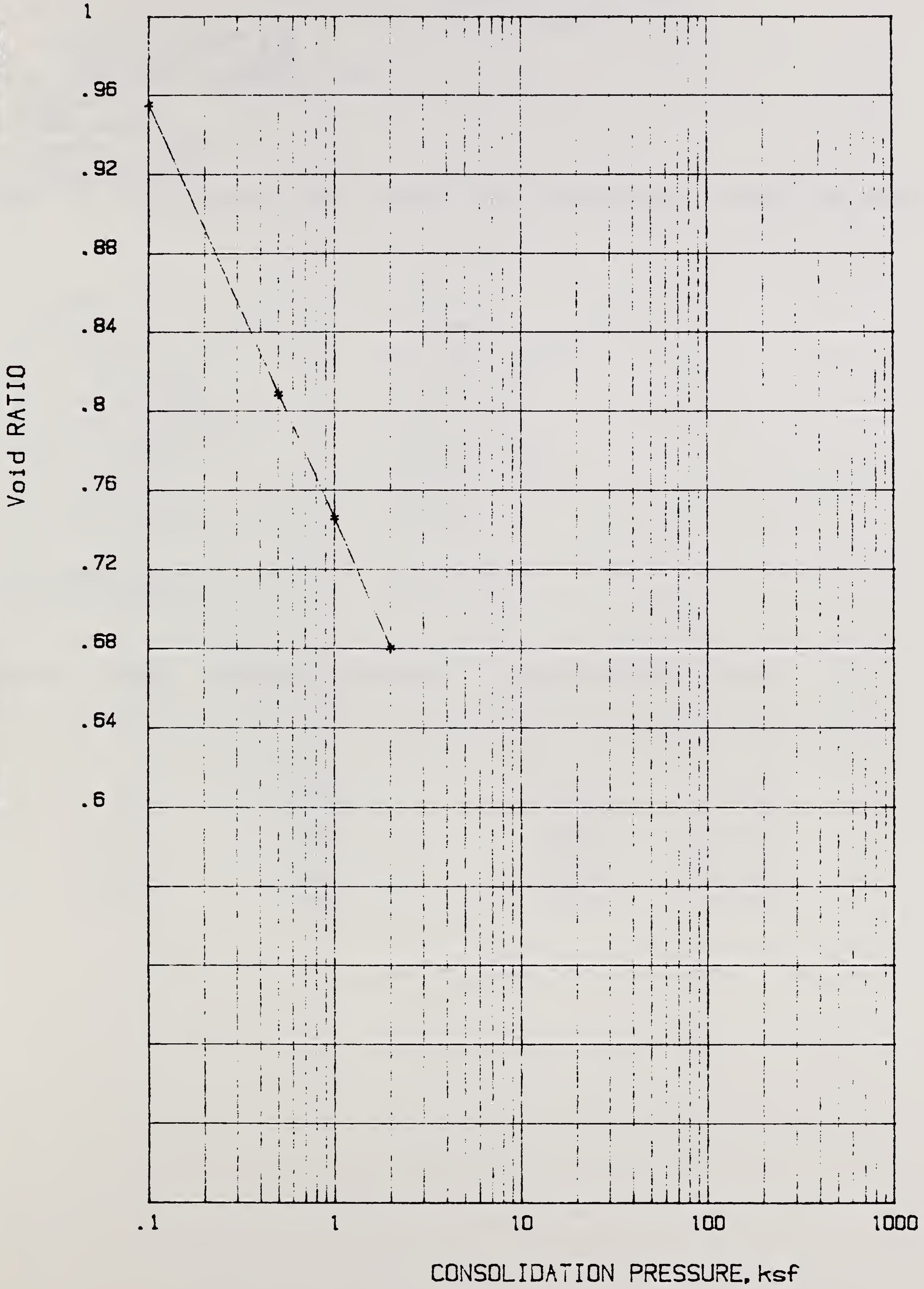
INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.1483	.9550	14.83
2.0	.50	.2123	.8080	21.23
3.0	1.00	.2395	.7450	23.95
4.0	2.00	.2683	.6790	26.83



Project: PALOUSE-PULLMAN WA. LAB. NUMBER 88C98

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: PALOUSE-PULLMAN WA. LAB. NUMBER 88C98

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

RESULTS OF CONSOLIDATION TEST

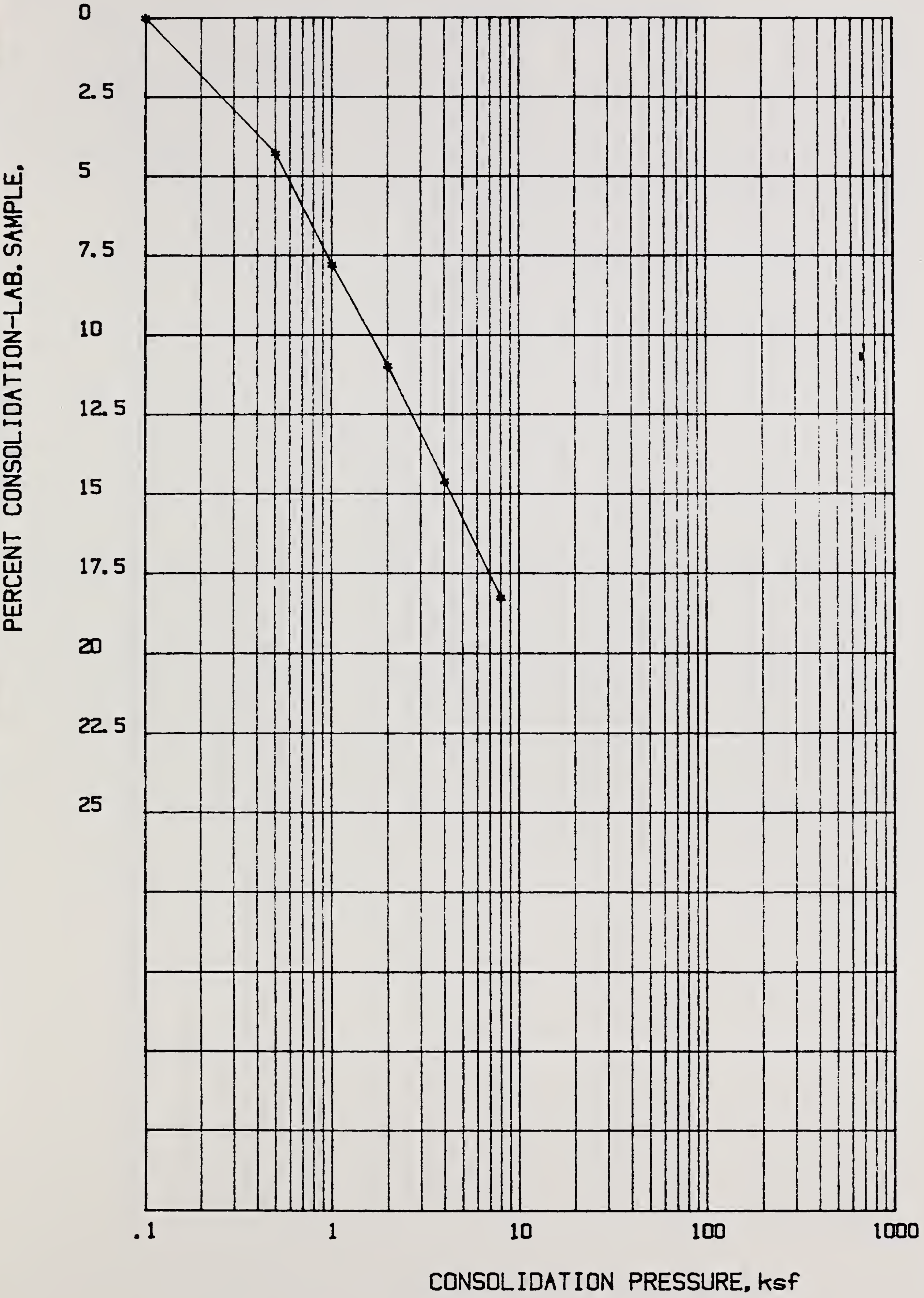
WEPP Sample

Project: PORTNEUF-KIMBERLY ID.
Field number:
LAB.NUMBER 88C99
Sample depth: Feet
Sample description:
REMOLDED TO 1.25 GM/CC CL-ML LL=28 PI=4 SATURATED AT START OF TEST

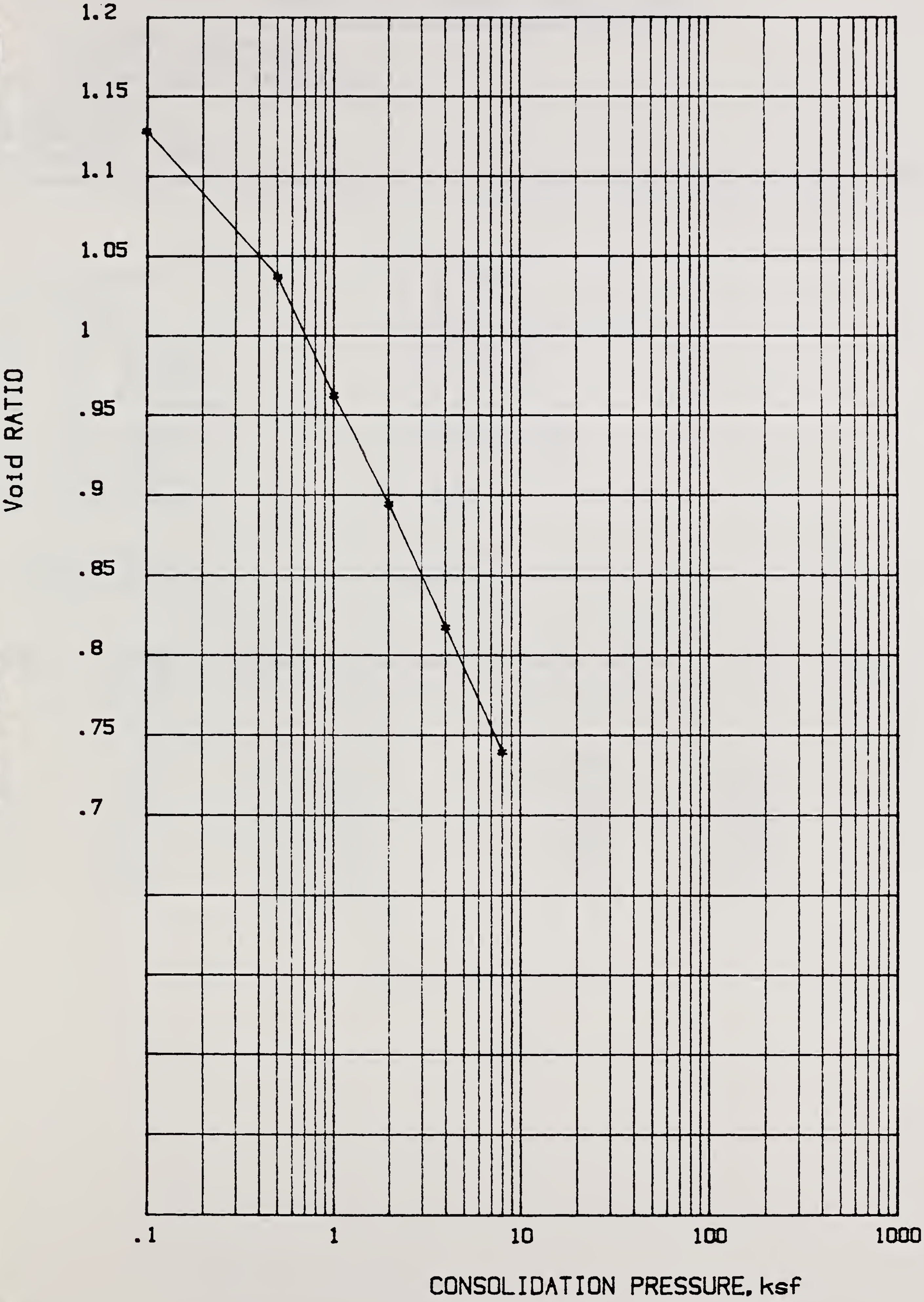
SAMPLE DIAMETER: 2.5 ins
SAMPLE HEIGHT: 1 ins
INITIAL VOLUME: 80.439 cm^3
INITIAL WET WEIGHT: 116.42 g
INITIAL DRY WEIGHT: 100.55 g
INITIAL WATER CONTENT: 15.7 %
INITIAL WET DENSITY: 90.354 PCF
INITIAL DRY DENSITY: 78.037 PCF
SPECIFIC GRAVITY: 2.66
INITIAL VOID RATIO: 1.127

FINAL WET WEIGHT: 129.37 g
FINAL WATER CONTENT: 28.6 %

I[illegible]EMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	1.1270	0.00
2.0	.50	.0429	1.0360	4.29
3.0	1.00	.0781	.9610	7.81
4.0	2.00	.1100	.8930	11.00
5.0	4.00	.1463	.8160	14.63
6.0	8.00	.1830	.7380	18.30



Project: PORTNEUF-KIMBERLY ID. LAB. NUMBER 88C99
Field number: Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.



Project: PORTNEUF-KIMBERLY ID.   LAB. NUMBER 88C99
Field number: Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

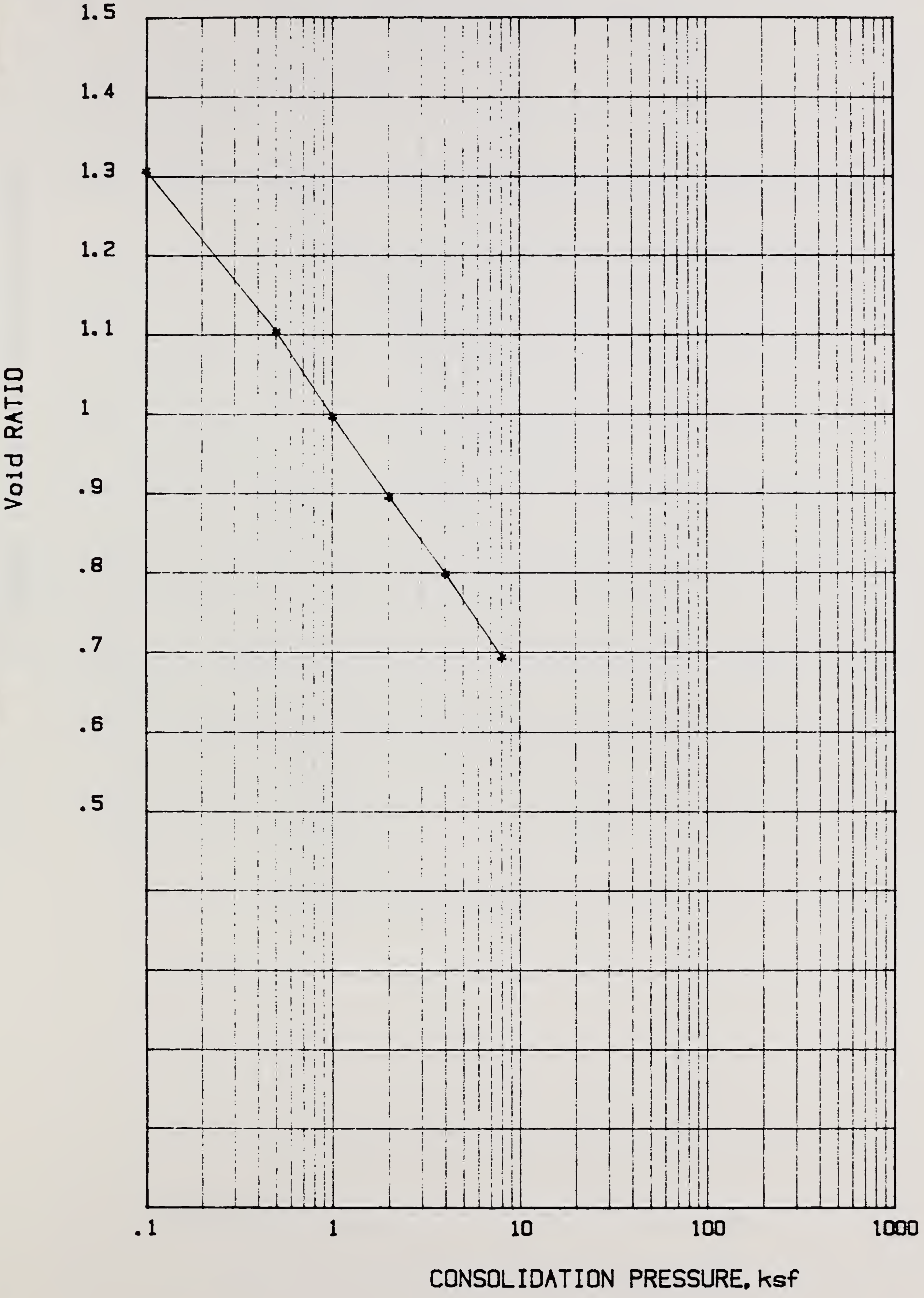
RESULTS OF CONSOLIDATION TEST

WEPP Sample

Project: SHARPSBURG LINCON NE.
Field number:
LAB.NUMBER 88C100
Sample depth: Feet
Sample description: COMPACTED TO 1.14 GM/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5	ins
SAMPLE HEIGHT:	1	ins
INITIAL VOLUME:	80.439	cm^3
INITIAL WET WEIGHT:	109.98	g
INITIAL DRY WEIGHT:	91.7	g
INITIAL WATER CONTENT:	19.9	%
INITIAL WET DENSITY:	85.356	PCF
INITIAL DRY DENSITY:	71.169	PCF
SPECIFIC GRAVITY:	2.63	
INITIAL VOID RATIO:	1.307	
FINAL WET WEIGHT:	115.95	g
FINAL WATER CONTENT:	26.4	%

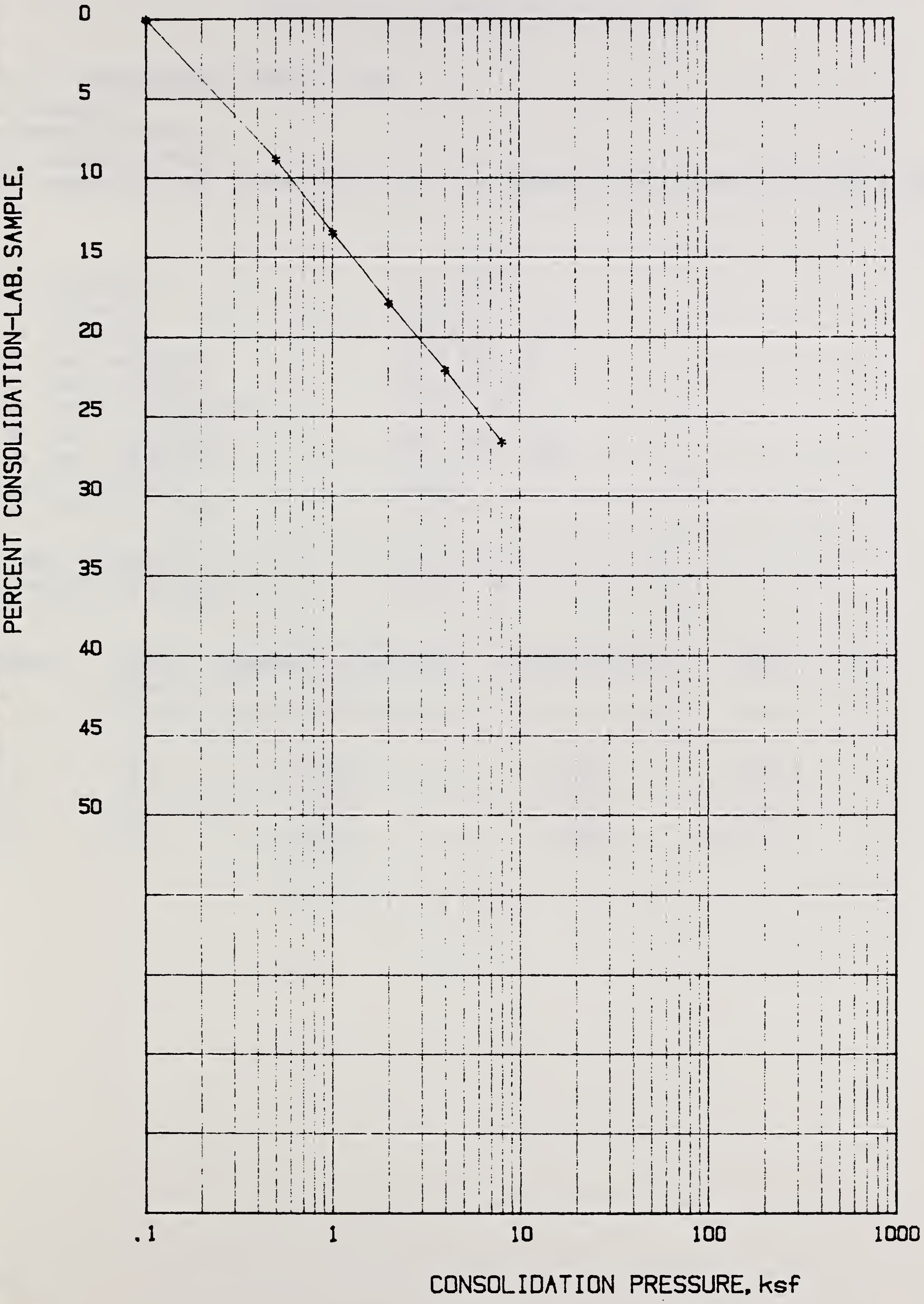
INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	1.3070	0.00
2.0	.50	.0886	1.1020	8.86
3.0	1.00	.1350	.9950	13.50
4.0	2.00	.1789	.8940	17.89
5.0	4.00	.2209	.7970	22.09
6.0	8.00	.2666	.6910	26.66



Project: SHARPSBURG LINCON NE. LAB. NUMBER 88C100

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: SHARPSBURG LINCON NE.

LAB. NUMBER 88C100

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2

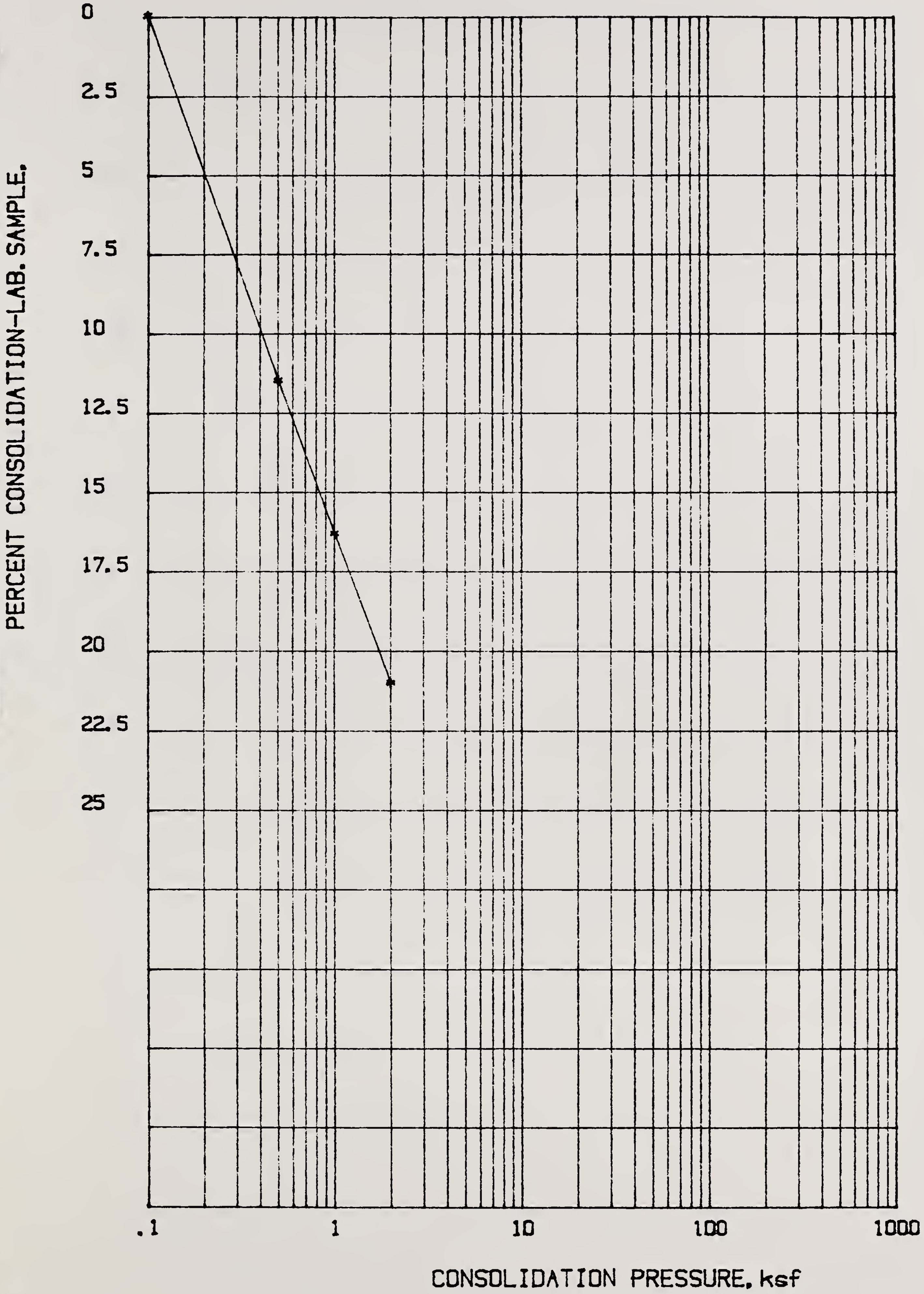
RESULTS OF CONSOLIDATION TEST

Project: SHARPSBURG-LINCOLN NE
Field number:
LAB.NUMBER 88C100
Sample depth: Feet
Sample description: COMPACTED TO 1.14 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	107.87 g
INITIAL DRY WEIGHT:	91.69 g
INITIAL WATER CONTENT:	17.6 %
INITIAL WET DENSITY:	83.718 PCF
INITIAL DRY DENSITY:	71.161 PCF
SPECIFIC GRAVITY:	2.63
INITIAL VOID RATIO:	1.307
FINAL WET WEIGHT:	121.47 g
FINAL WATER CONTENT:	32.4 %

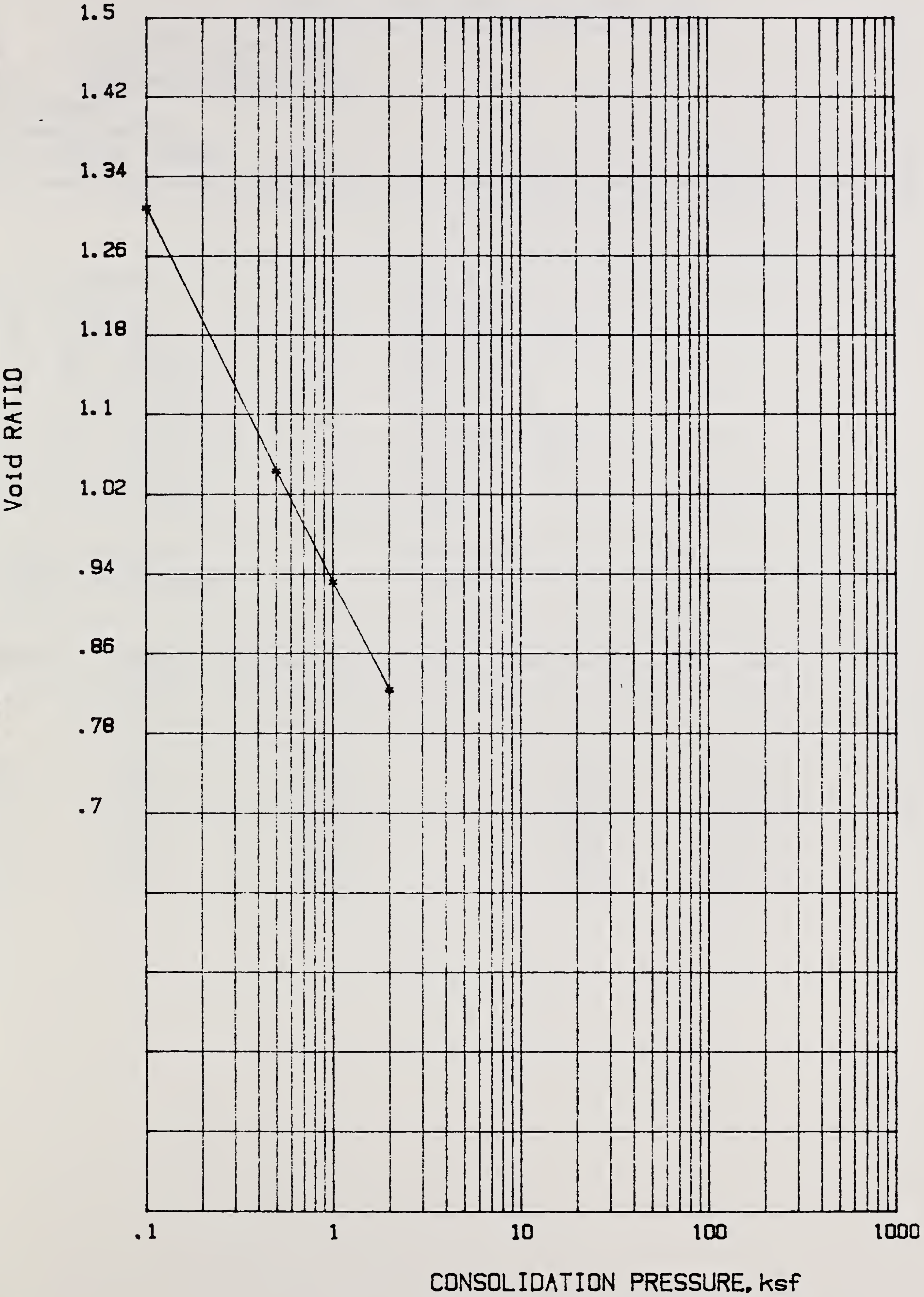
INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	-.0005	1.3080	-.05
2.0	.50	.1148	1.0420	11.48
3.0	1.00	.1632	.9300	16.32
4.0	2.00	.2102	.8220	21.02

Test 2



Project: SHARPSBURG-LINCOLN NE
LAB. NUMBER 88C100
Field number:
Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

Test 2



Project: SHARPSBURG-LINCOLN NE LAB. NUMBER 88C100

Field number: Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.

RESULTS OF CONSOLIDATION TEST

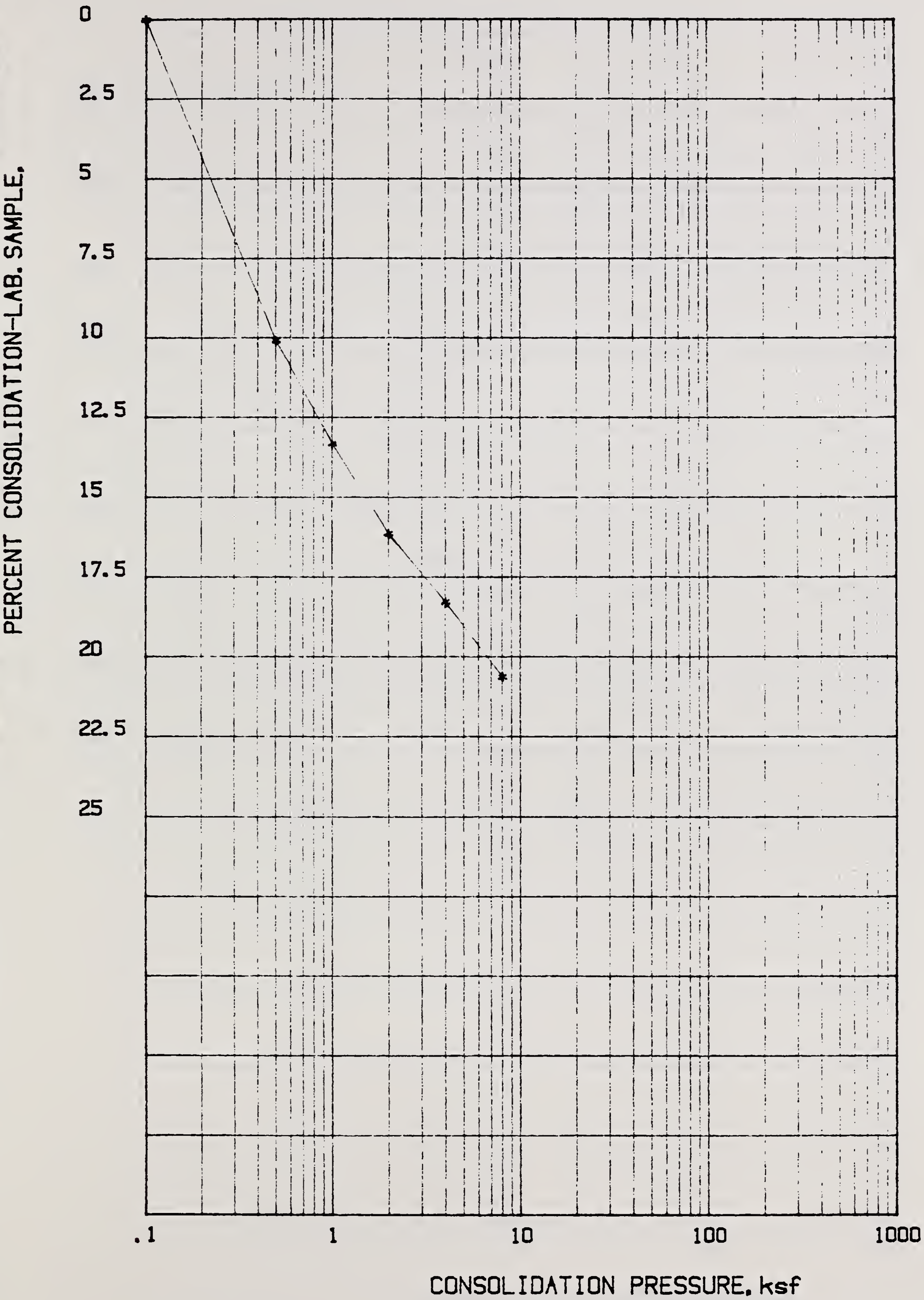
WEPP Sample

Project: SVERDRUP-MORRIS MN.
Field number:
LAB.NUMBER 88C101
Sample depth: Feet
Sample description: COMPACTED TO 1.46 GM/CC SATURATED AT START OF TEST

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	129.4 g
INITIAL DRY WEIGHT:	117.41 g
INITIAL WATER CONTENT:	10.2 %
INITIAL WET DENSITY:	100.428 PCF
INITIAL DRY DENSITY:	91.122 PCF
SPECIFIC GRAVITY:	2.63
INITIAL VOID RATIO:	.801

FINAL WET WEIGHT:	137.53 g
FINAL WATER CONTENT:	17.1 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	.8010	0.00
2.0	.50	.1011	.6190	10.11
3.0	1.00	.1336	.5610	13.36
4.0	2.00	.1617	.5100	16.17
5.0	4.00	.1833	.4710	18.33
6.0	8.00	.2068	.4290	20.68



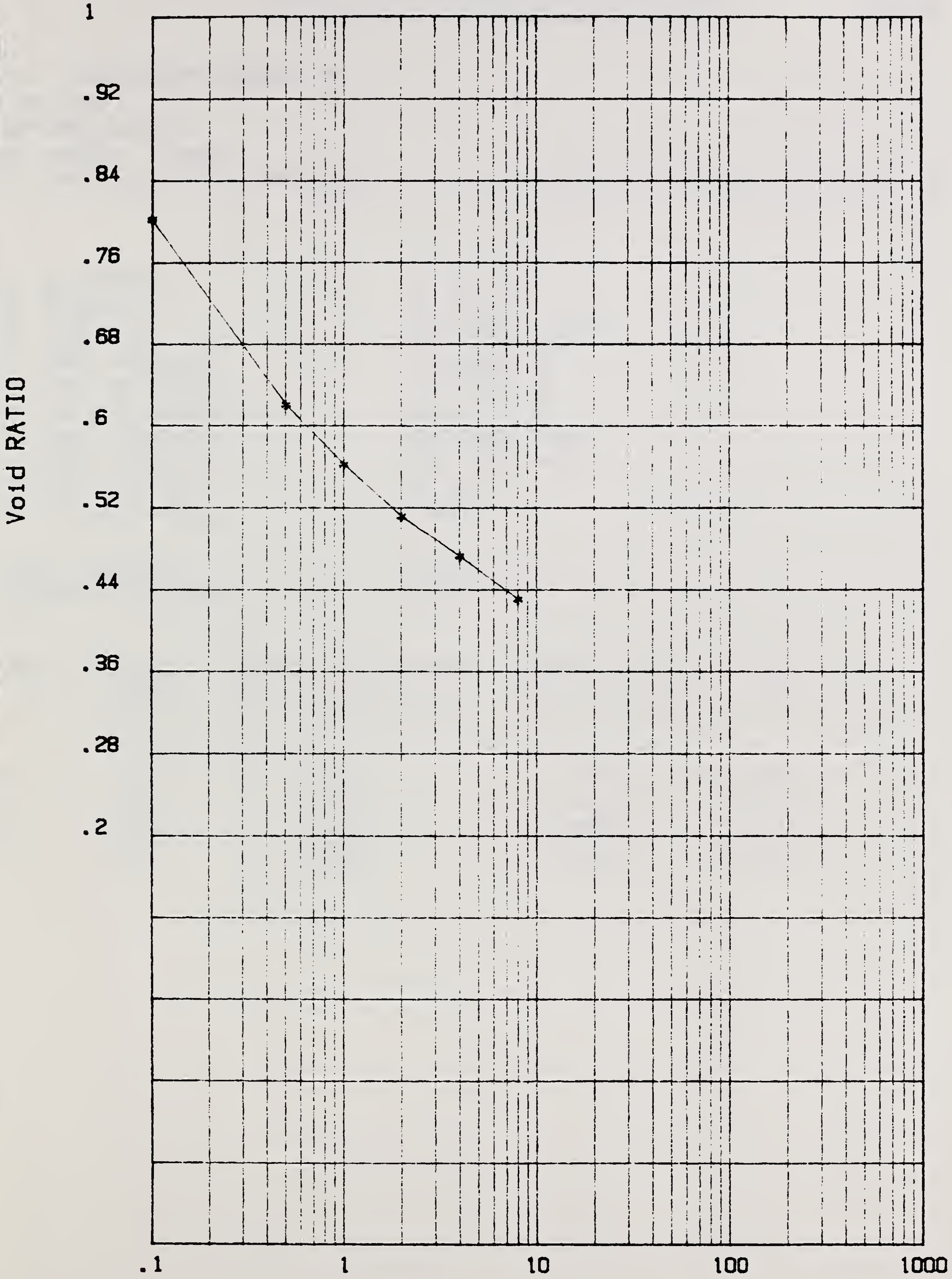
Project: SVERDRUP-MORRIS MN.

LAB. NUMBER 88C101

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: SVERDRUP-MORRIS MN. LAB. NUMBER 88C101

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2

```
                         RESULTS OF CONSOLIDATION TEST
                         =============================

Project: SVERDROP-MORRIS MN
Field number:
LAB.NUMBER 88C101
Sample depth:   Feet
Sample description: COMPACTED TO 1.46 GMS/CC SATURATED AT START OF TEST

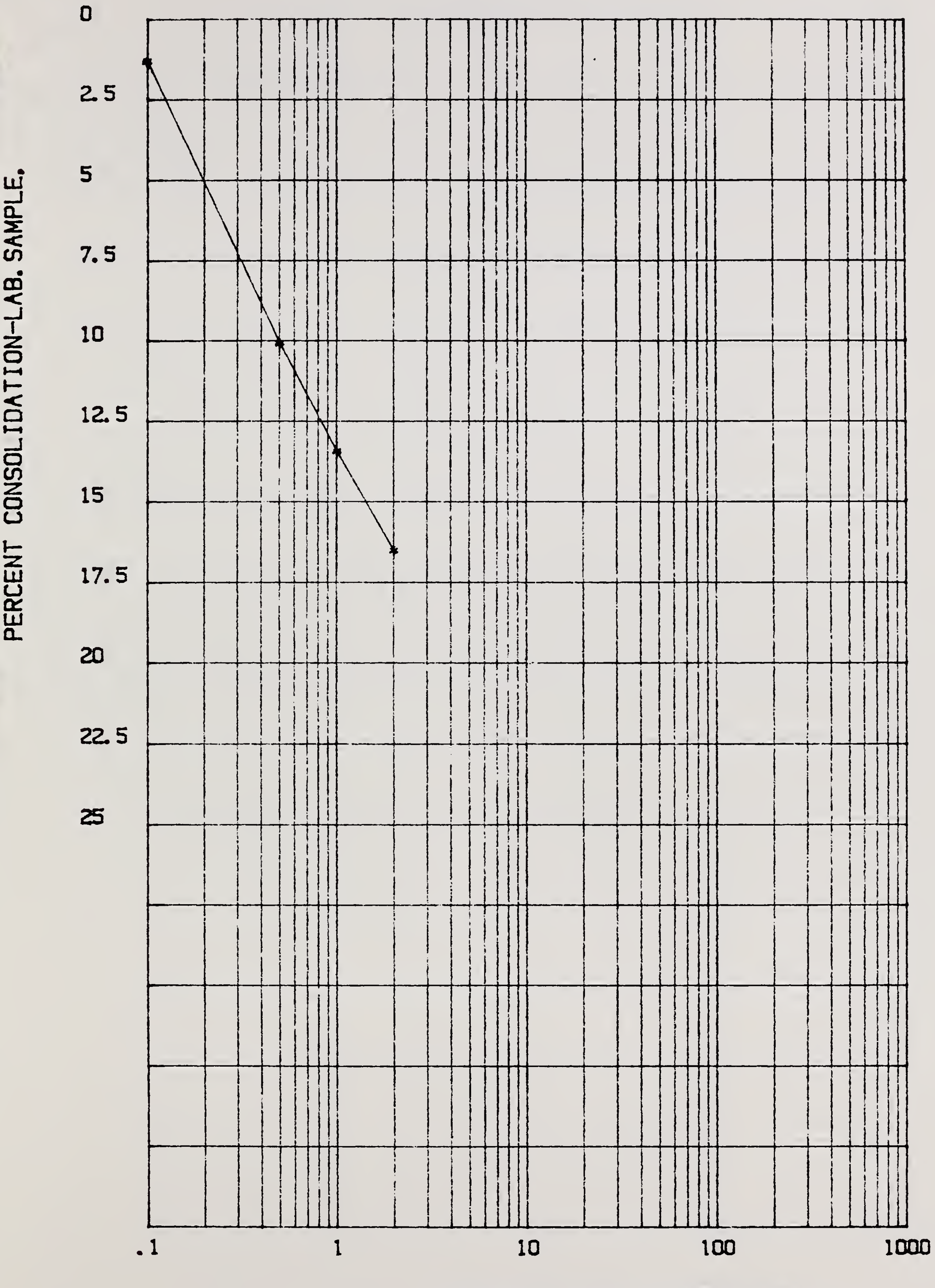

SAMPLE DIAMETER:                2.5 ins
SAMPLE HEIGHT:                  1 ins
INITIAL VOLUME:                 80.439  cm^3
INITIAL WET WEIGHT:             123.55  g
INITIAL DRY WEIGHT:             117.44  g
INITIAL WATER CONTENT:          5.2  %
INITIAL WET DENSITY:            95.888  PCF
INITIAL DRY DENSITY:            91.146  PCF
SPECIFIC GRAVITY:               2.63
INITIAL VOID RATIO:             .801

FINAL WET WEIGHT:               139.69  g
FINAL WATER CONTENT:            18.9  %

INCREMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )       (ins)
---------   ----   ----------------   -----------    ---

   1.0       .10         .0131           .7770       1.31
   2.0       .50         .1009           .6190      10.09
   3.0      1.00         .1346           .5580      13.46
   4.0      2.00         .1655           .5030      16.55
```

Test 2

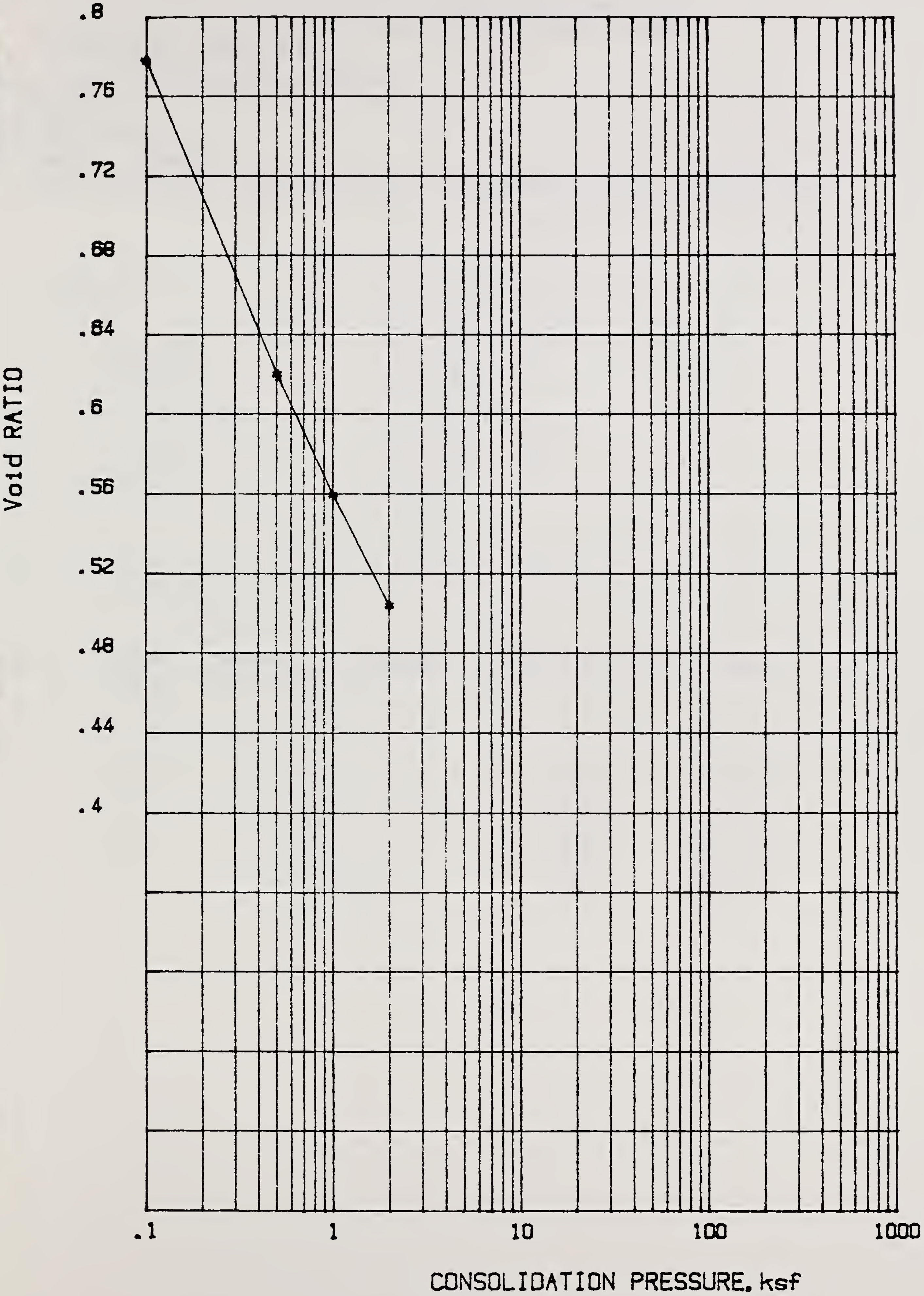


Project: SVERDROP-MORRIS MN LAB. NUMBER 88C101

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 3



Project: SVERDROP-MORRIS MN
LAB. NUMBER 88C101
Field number:
Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

RESULTS OF CONSOLIDATION TEST

WEPP Sample

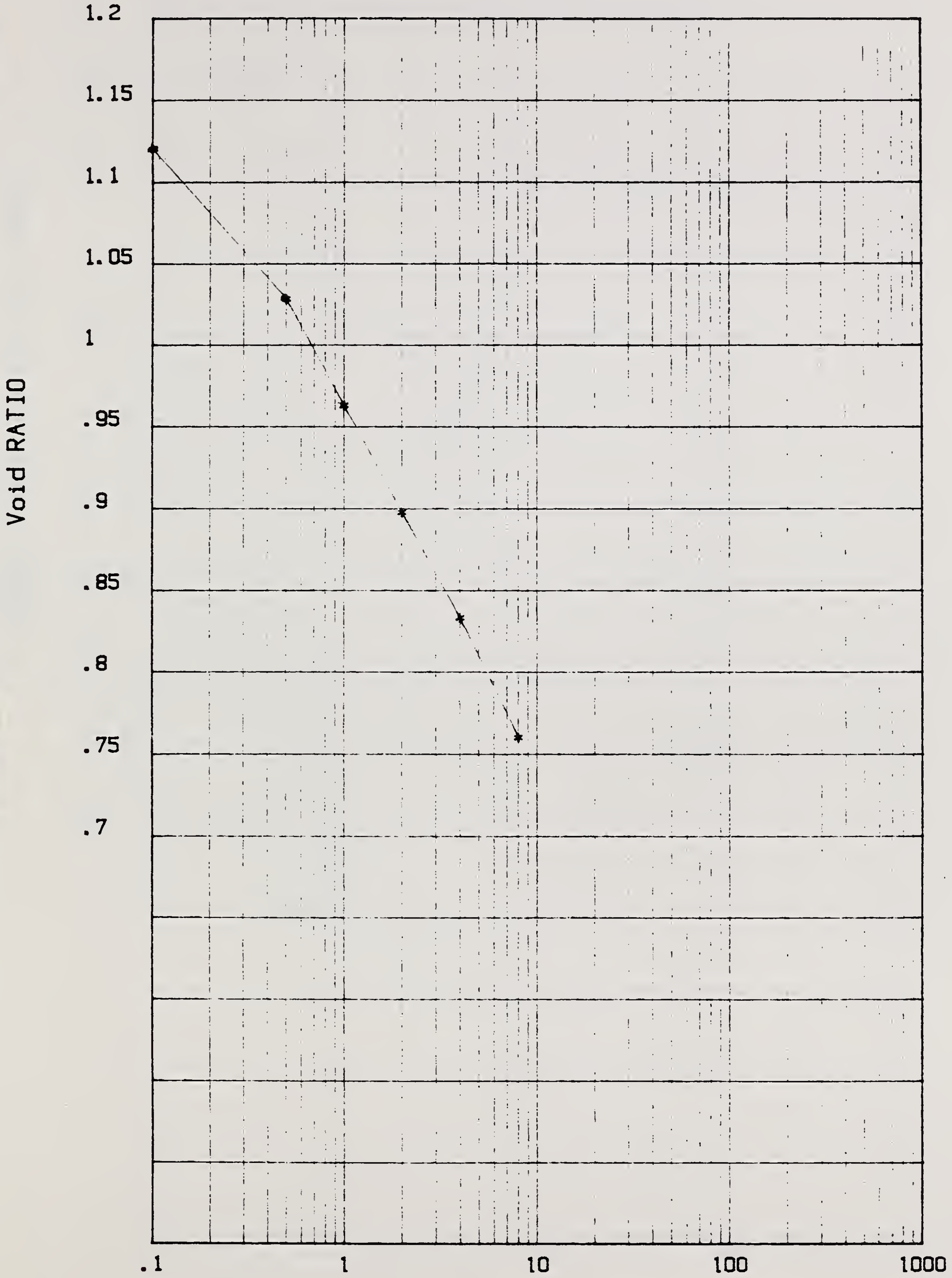
```
Project: WALLA WALLA-PULLMAN WA.
Field number:
LAB.NUMBER 88C102
Sample depth:  Feet
Sample description: COMPACTED TO 1.25 GM/CC CL/ML LL=38 PI=4


SAMPLE DIAMETER:                2.5 ins
SAMPLE HEIGHT:                  1 ins
INITIAL VOLUME:                 80.439  cm^3
INITIAL WET WEIGHT:             114.22  g
INITIAL DRY WEIGHT:             100.53  g
INITIAL WATER CONTENT:          13.6  %
INITIAL WET DENSITY:            88.647  PCF
INITIAL DRY DENSITY:            78.022  PCF
SPECIFIC GRAVITY:               2.65
INITIAL VOID RATIO:             1.12

FINAL WET WEIGHT:               131.72  g
FINAL WATER CONTENT:            31  %


INCREMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )      (ins)
---------   -----  ----------------   -----------    ---

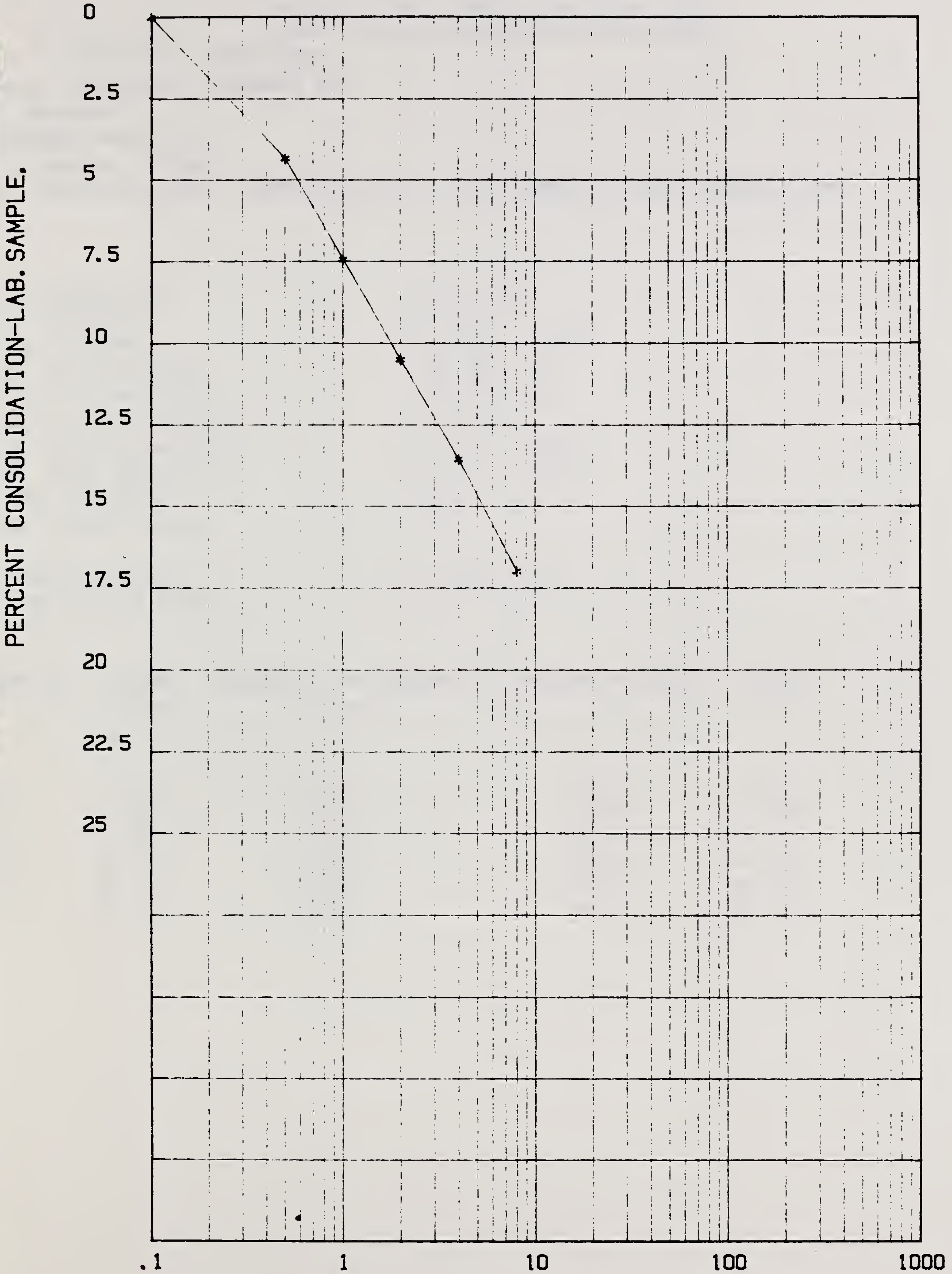
   1.0       .10       0.0000           1.1200       0.00
   2.0       .50        .0435           1.0280       4.35
   3.0      1.00        .0746            .9620       7.46
   4.0      2.00        .1053            .8970      10.53
   5.0      4.00        .1359            .8320      13.59
   6.0      8.00        .1704            .7590      17.04
```



Project: WALLA WALLA-PULLMAN WA. LAB. NUMBER 88C102

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



CONSOLIDATION PRESSURE, ksf

Project: WALLA WALLA-PULLMAN WA. _AB. NUMBER 88C102

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

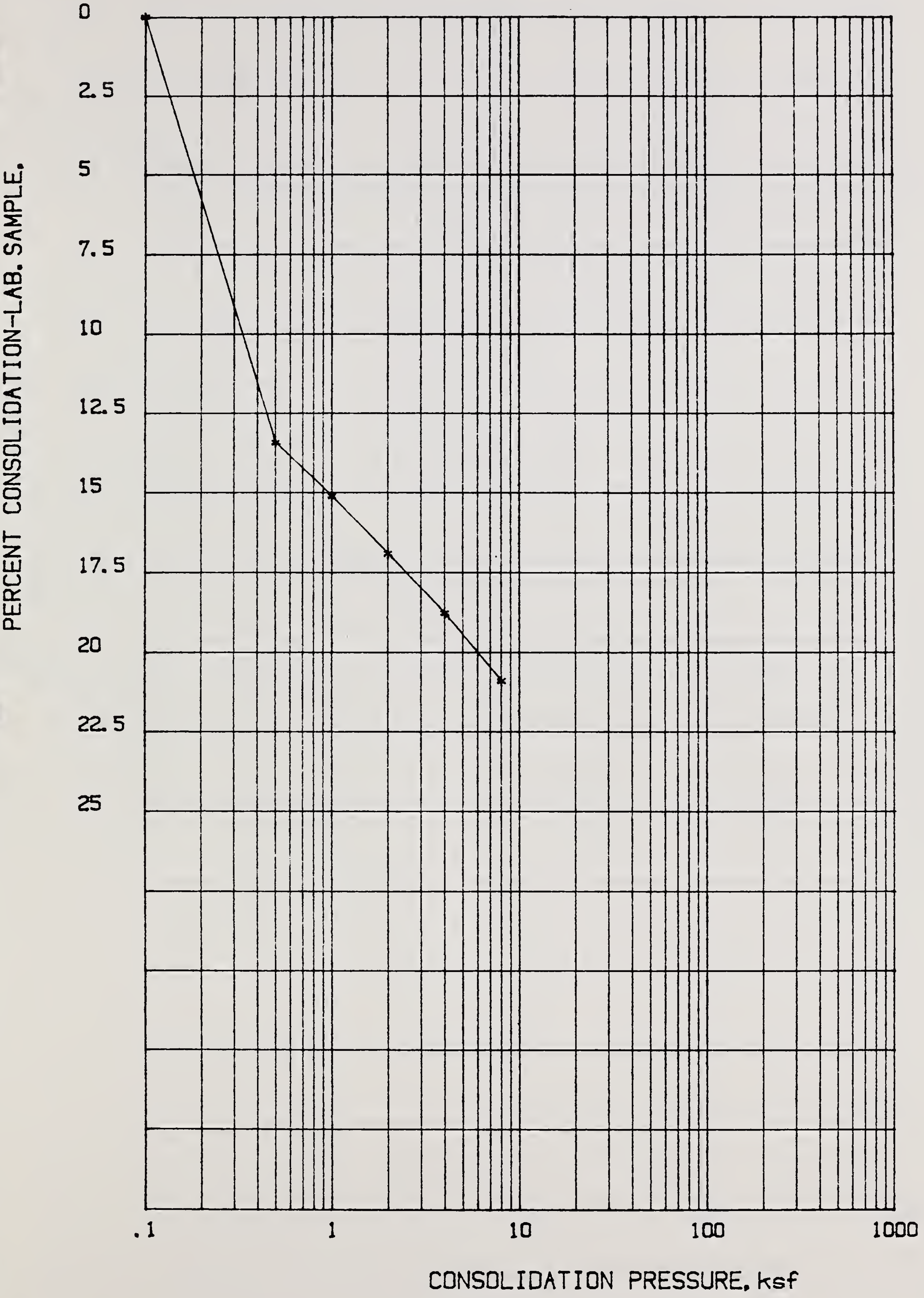
RESULTS OF CONSOLIDATION TEST

WEPP Sample

Project: WHITNEY--FRESNO CA.
Field number:
LAB.NUMBER 88C103
Sample depth: Feet
Sample description: COMPACTED TO 1.54 GMW/CC NON-PLASTIC SM

SAMPLE DIAMETER:	2.5 ins	
SAMPLE HEIGHT:	1 ins	
INITIAL VOLUME:	80.439	cm^3
INITIAL WET WEIGHT:	130.82	g
INITIAL DRY WEIGHT:	123.85	g
INITIAL WATER CONTENT:	5.6	%
INITIAL WET DENSITY:	101.53	PCF
INITIAL DRY DENSITY:	96.121	PCF
SPECIFIC GRAVITY:	2.67	
INITIAL VOID RATIO:	.734	
FINAL WET WEIGHT:	141.59	g
FINAL WATER CONTENT:	14.3	%

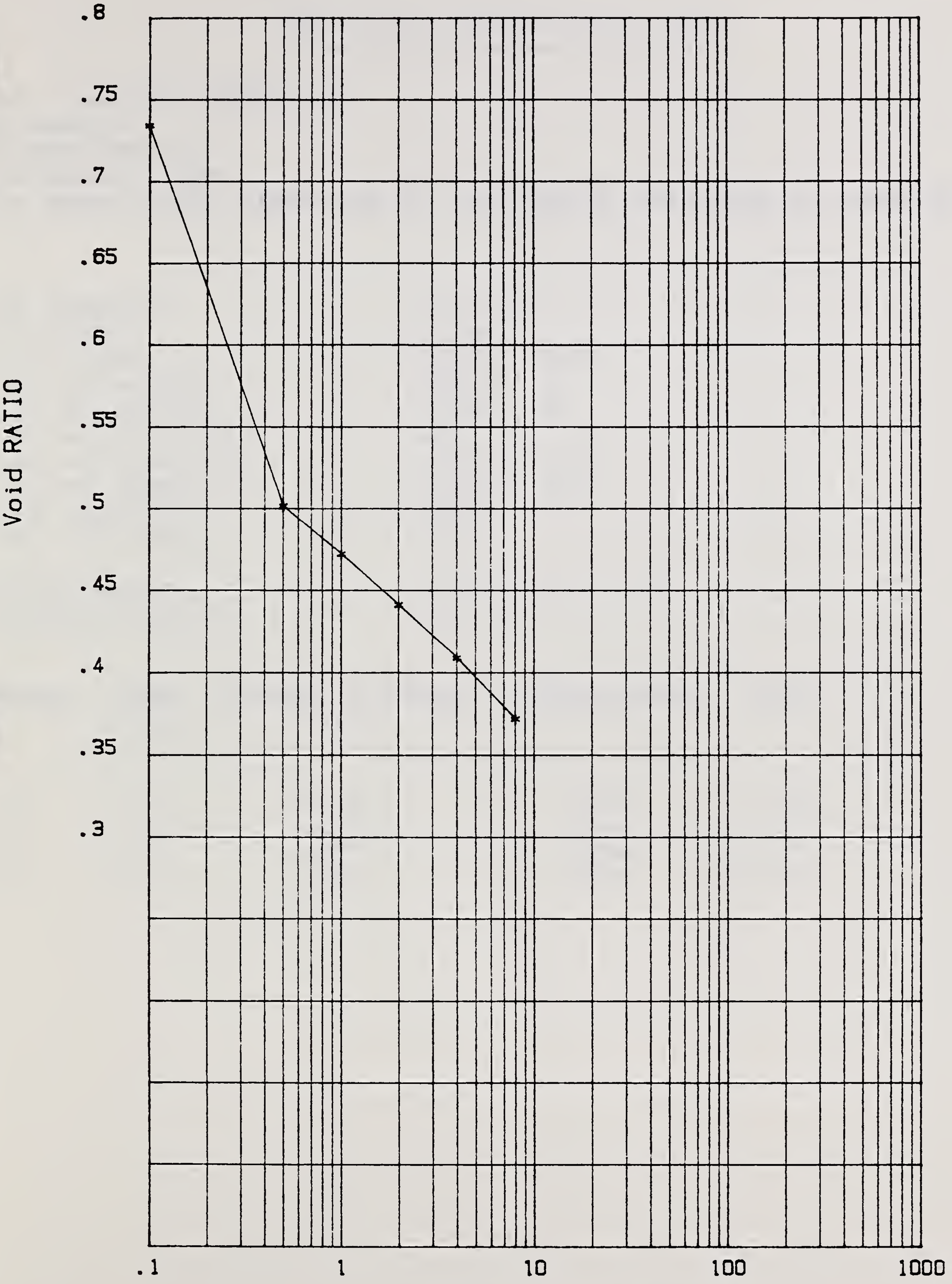
INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	0.0000	.7340	0.00
2.0	.50	.1345	.5000	13.45
3.0	1.00	.1514	.4710	15.14
4.0	2.00	.1694	.4400	16.94
5.0	4.00	.1880	.4080	18.80
6.0	8.00	.2094	.3710	20.94



Project: WHITNEY--FRESNO CA. LAB. NUMBER 88C103

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: WHITNEY--FRESNO CA. LAB. NUMBER 88C103

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2

```
                         RESULTS OF CONSOLIDATION TEST
                         =============================

Project: WHITNEY-FRESNO CA
Field number:
LAB.NUMBER 88C103
Sample depth:   Feet
Sample description: COMPACTED TO 1.54 GMS/CC SATURATED AT START OF TEST

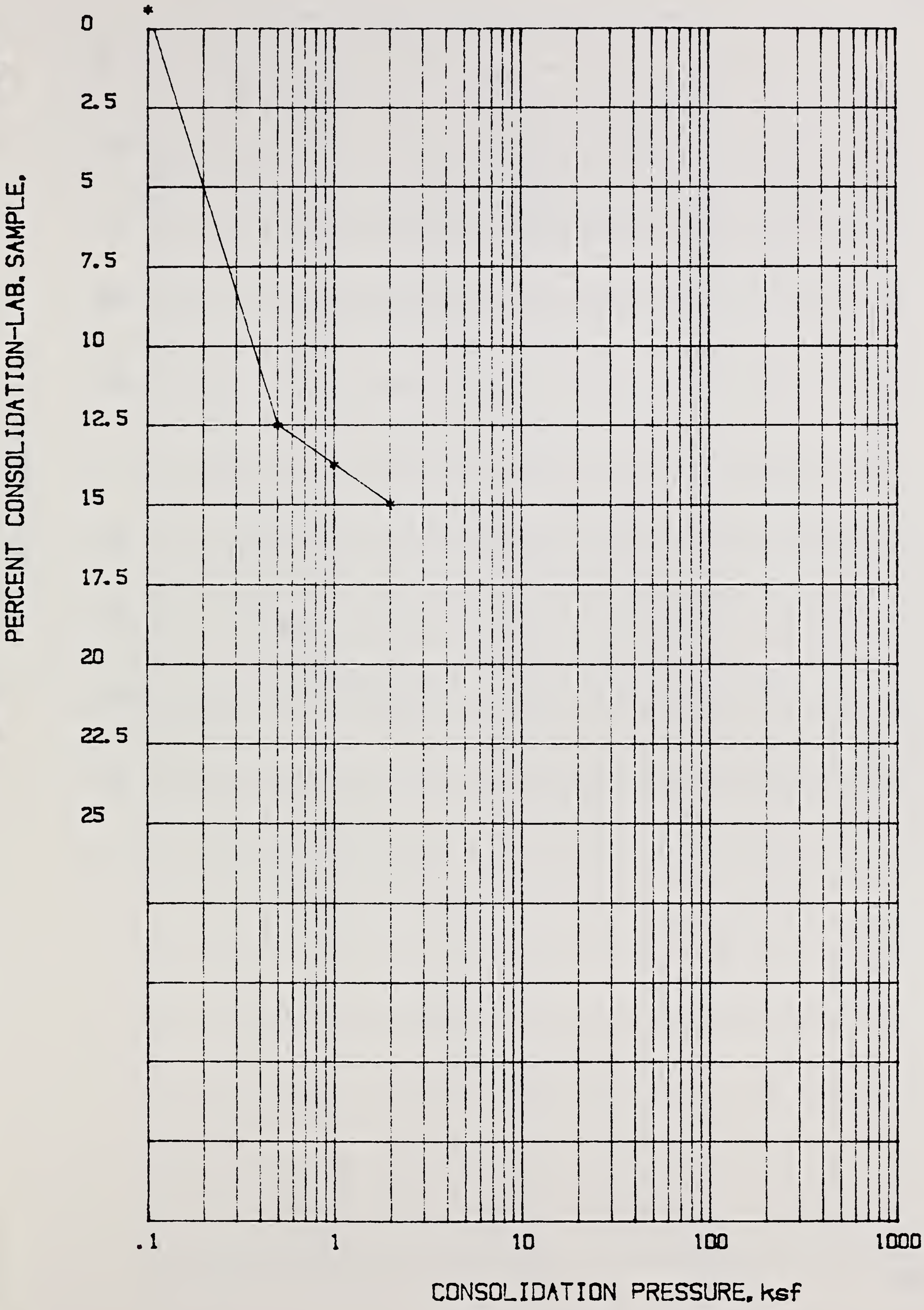

SAMPLE DIAMETER:              2.5 ins
SAMPLE HEIGHT:                1 ins
INITIAL VOLUME:               80.439  cm^3
INITIAL WET WEIGHT:           134.07  g
INITIAL DRY WEIGHT:           123.87  g
INITIAL WATER CONTENT:        8.2   %
INITIAL WET DENSITY:          104.052  PCF
INITIAL DRY DENSITY:          96.136   PCF
SPECIFIC GRAVITY:             2.67
INITIAL VOID RATIO:           .733

FINAL WET WEIGHT:             142.73  g
FINAL WATER CONTENT:          15.2  %

INCREMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )       (ins)
---------   ----   ----------------   -----------    ---

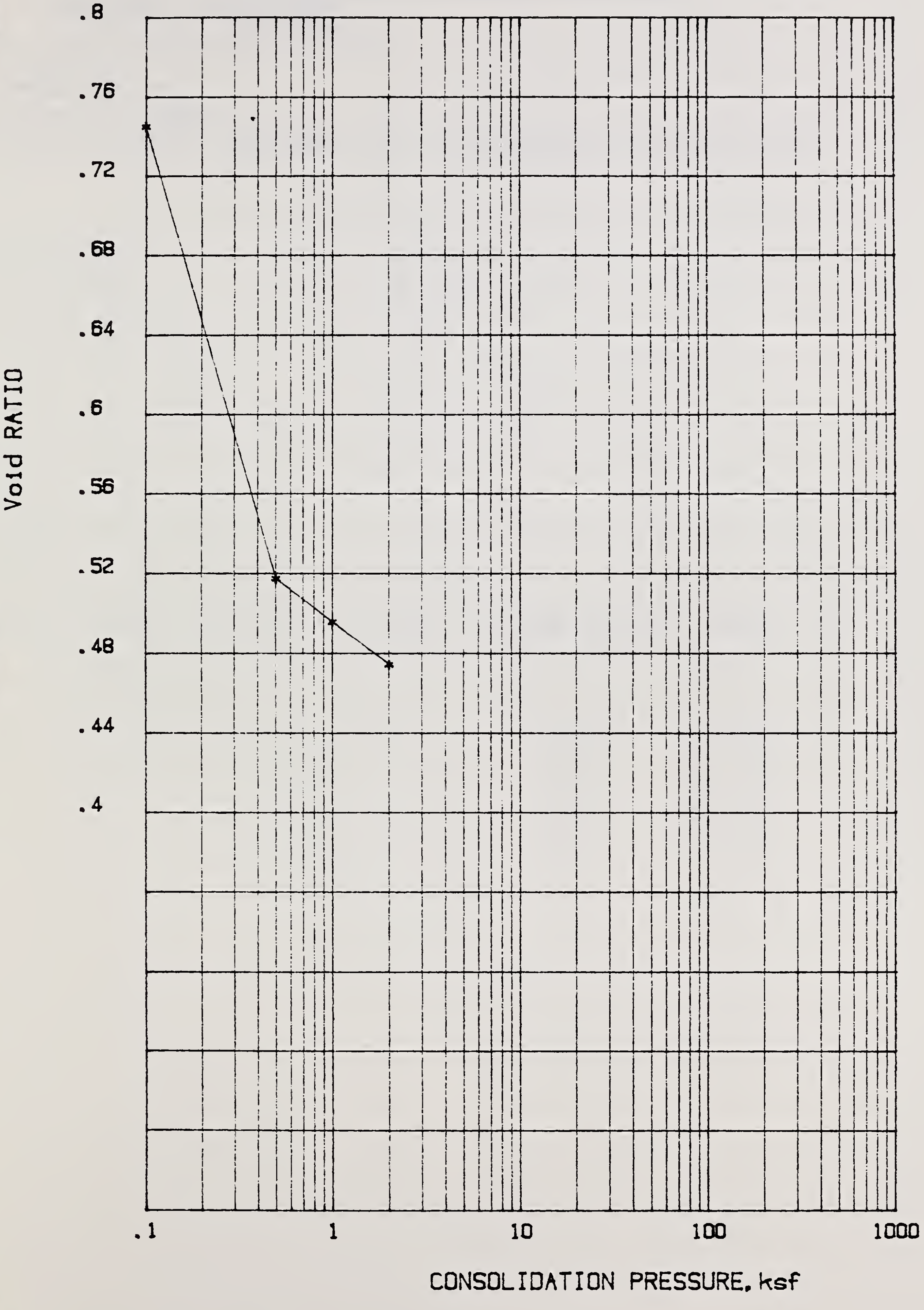
   1.0       .10         -.0063           .7440      -.63
   2.0       .50          .1252           .5160     12.52
   3.0      1.00          .1377           .4950     13.77
   4.0      2.00          .1500           .4730     15.00
```

Test 2



Project: WHITNEY-FRESNO CA _AB. NUMBER 88C103
Field number: Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

Test 2



Project: WHITNEY-FRESNO CA
LAB. NUMBER 88C103
Field number:
Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

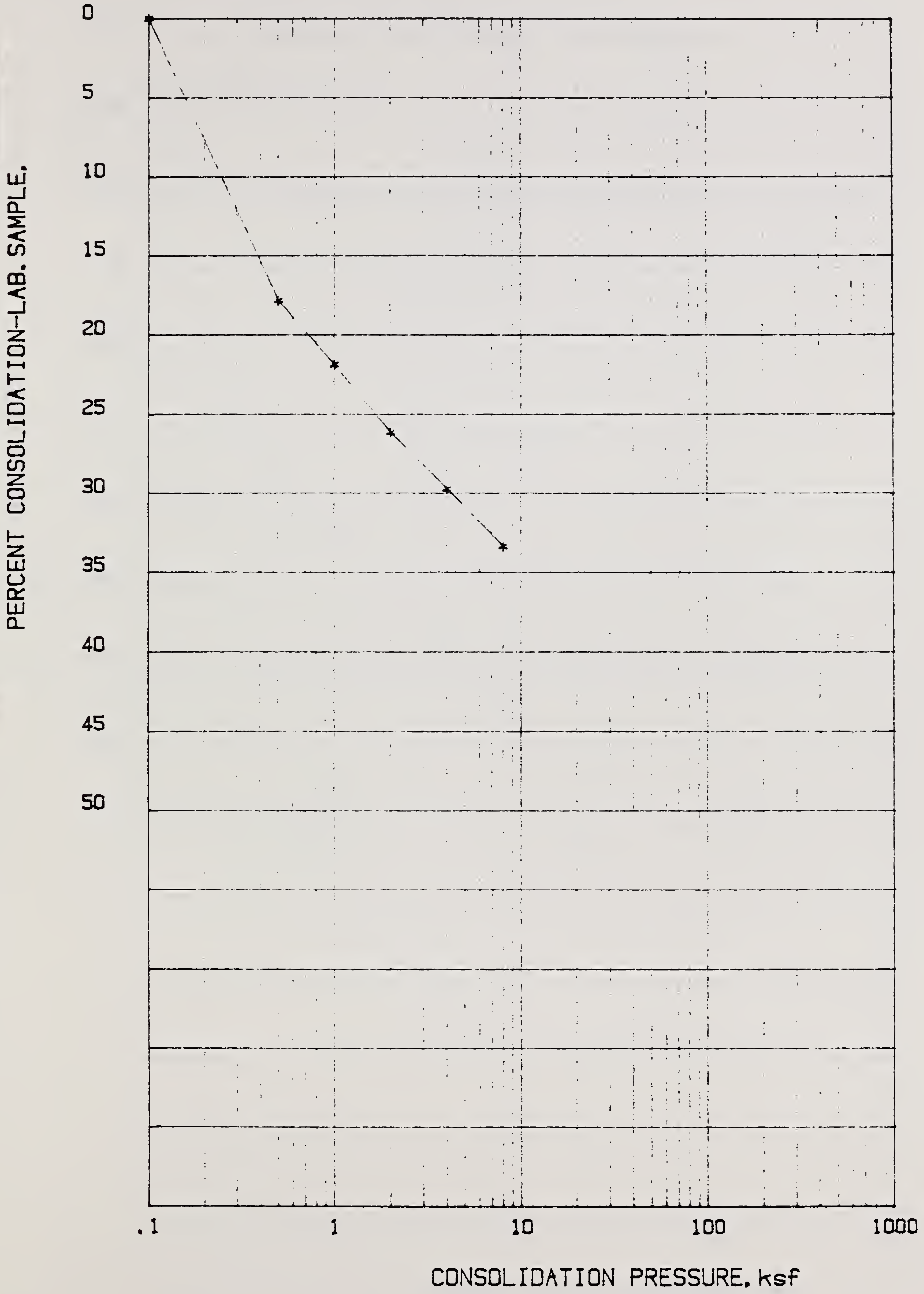
RESULTS OF CONSOLIDATION TEST

WEPP - sample

Project: WILLIAMS- McCLUSKY ND.
Field number:
LAB.NUMBER 88C104
Sample depth: Feet
Sample description: REMOLDED TO 1.16 GMS/CC CL LL=37 PI=19

SAMPLE DIAMETER:	2.5 ins
SAMPLE HEIGHT:	1 ins
INITIAL VOLUME:	80.439 cm^3
INITIAL WET WEIGHT:	106.99 g
INITIAL DRY WEIGHT:	93.3 g
INITIAL WATER CONTENT:	14.6 %
INITIAL WET DENSITY:	83.035 PCF
INITIAL DRY DENSITY:	72.41 PCF
APPARENT S.G.:	2.59
INITIAL VOIDS RATIO:	1.233
FINAL WET WT:	111.9 g
FINAL WATER CONTENT:	19.9 %

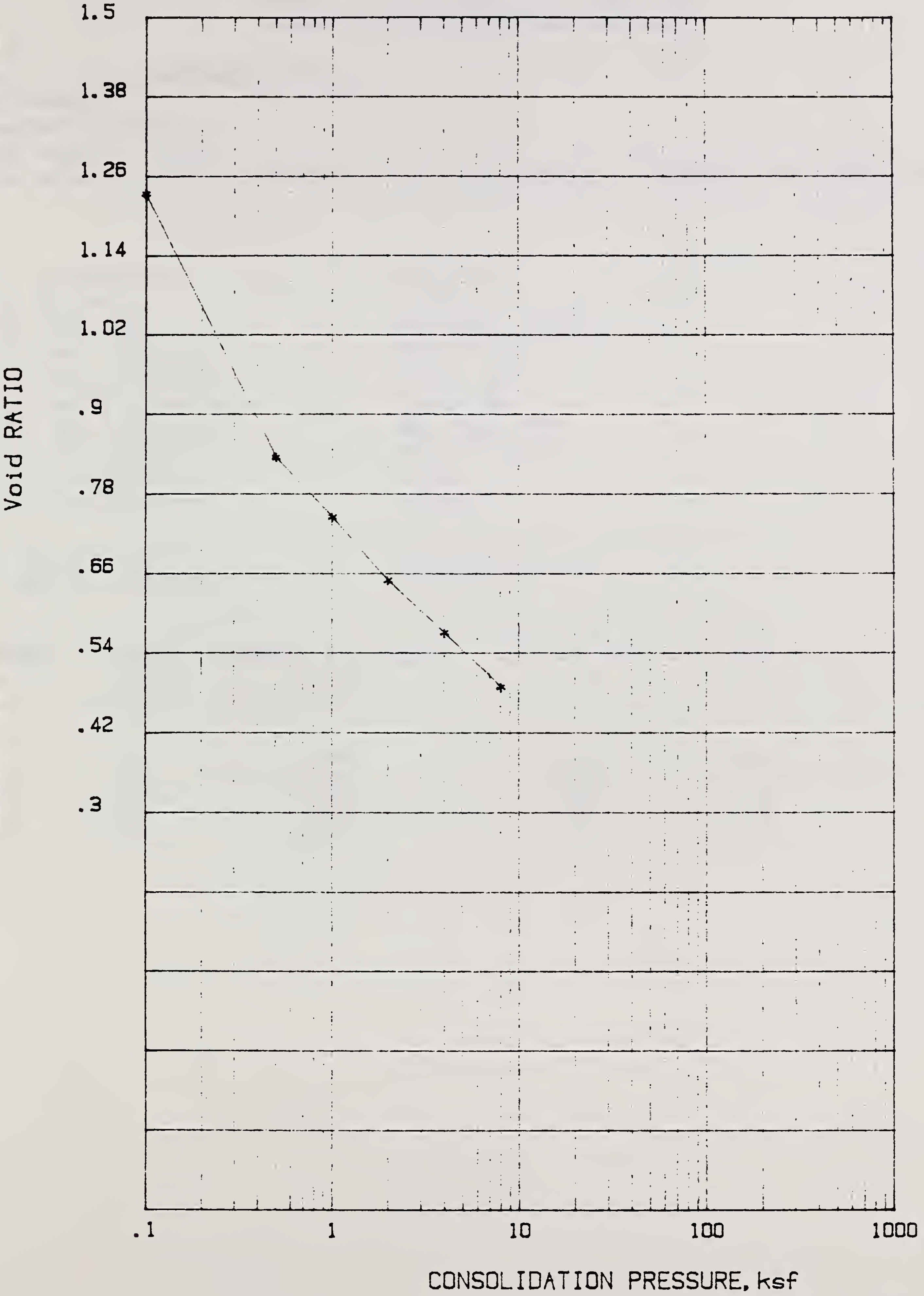
INCREMENT	LOAD	CHANGE IN HEIGHT	VOIDS RATIO	Su%
	[illegible]	[illegible]		
[illegible]	[illegible]		1.2330	0.00
[illegible]	[illegible]	[illegible]	.8330	17.86
3	[illegible]	[illegible]	.7430	21.93
4	[illegible]	[illegible]	.6470	26.20
5	[illegible]	[illegible]	.5480	29.76
6	[illegible]	[illegible]	.4860	33.43



Project: WILLIAMS- McCLUSKY ND. LAB. NUMBER 88C104

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: WILLIAMS- McCLUSKY ND. LAB. NUMBER 88C104
Field number: Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

Test 2

```
                    RESULTS OF CONSOLIDATION TEST
                    =============================

Project: WILLIAMS-McCLUSKY ND
Field number:
LAB.NUMBER 88C104
Sample depth:  Feet
Sample description: COMPACTED TO 1.16 GMS/CC SATURATED AT START OF TEST

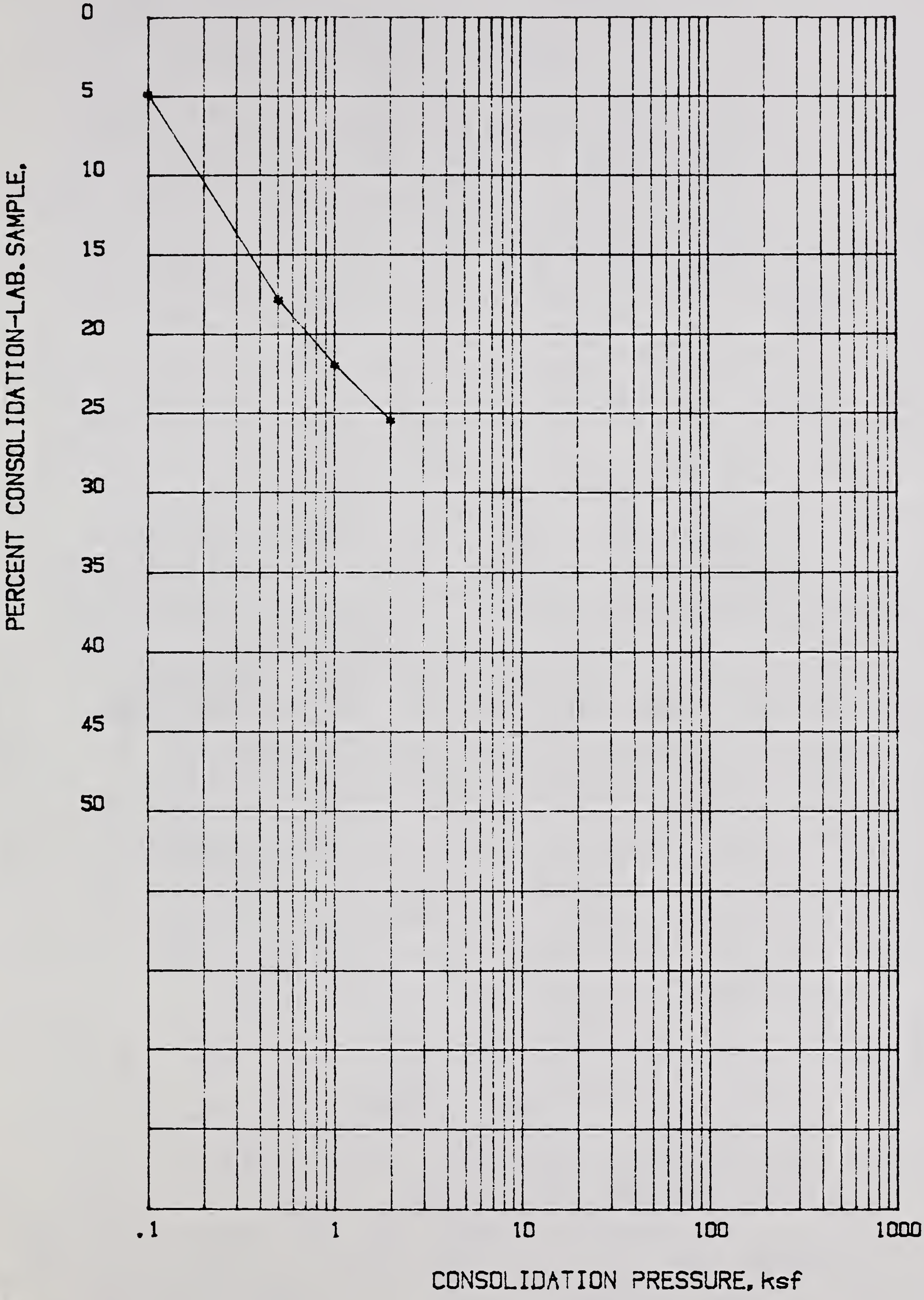

SAMPLE DIAMETER:                2.5 ins
SAMPLE HEIGHT:                  1 ins
INITIAL VOLUME:                 80.439  cm^3
INITIAL WET WEIGHT:             111.8  g
INITIAL DRY WEIGHT:             93.3  g
INITIAL WATER CONTENT:          19.8  %
INITIAL WET DENSITY:            86.768  PCF
INITIAL DRY DENSITY:            72.41  PCF
SPECIFIC GRAVITY:               2.59
INITIAL VOID RATIO:             1.233

FINAL WET WEIGHT:               117.42  g
FINAL WATER CONTENT:            25.8  %


INCREMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
           ( ksf )      (ins)
  ------   ----   ----------------   -----------    ---

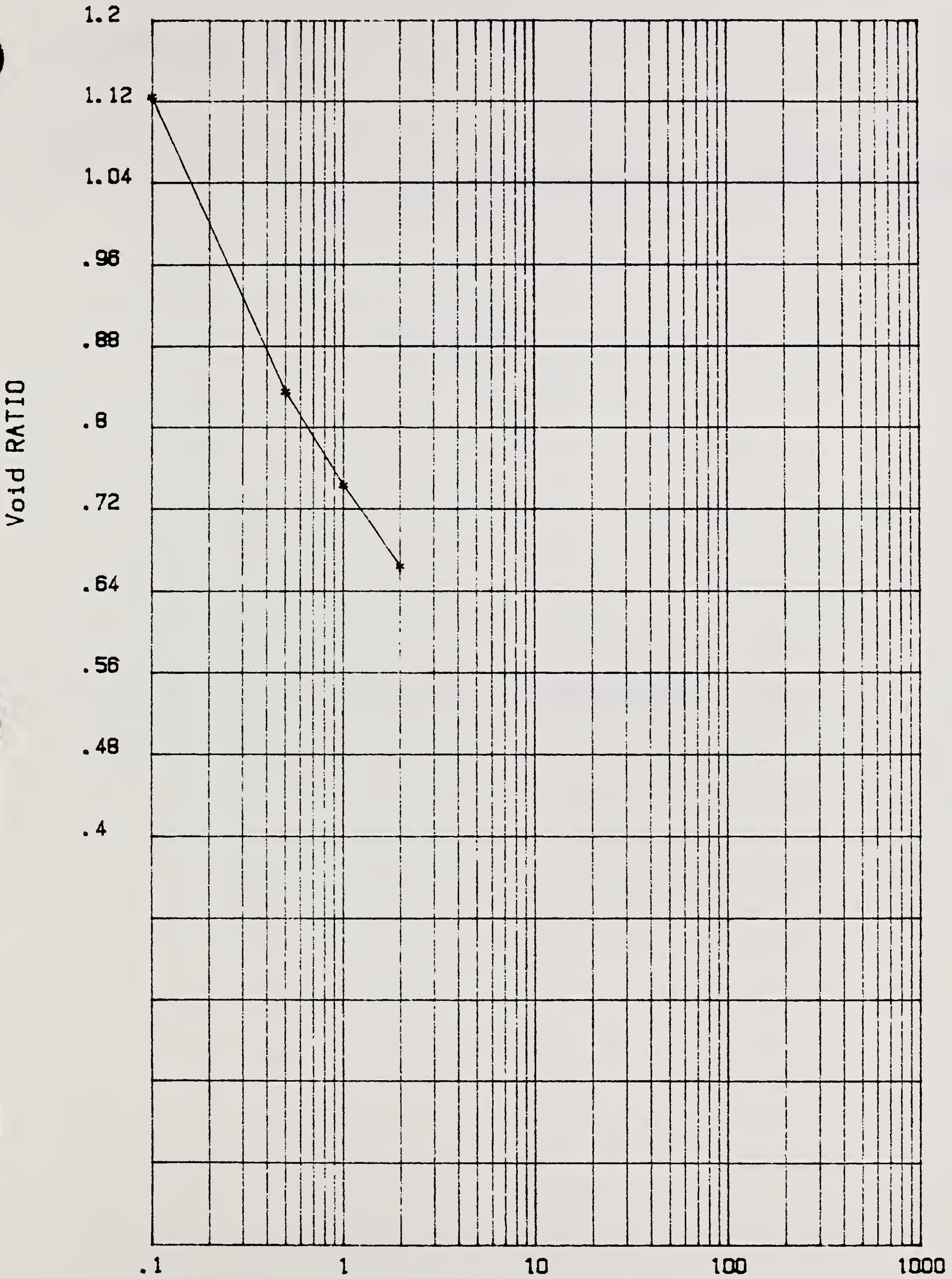
   1.0      .10        .0486           1.1240       4.86
   2.0      .50        .1785            .8340      17.85
   3.0     1.00        .2198            .7420      21.98
   4.0     2.00        .2551            .6630      25.51
```

Test 2



Project: WILLIAMS-McCLUSKY ND
LAB. NUMBER 88C104
Field number:
Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

Test 2



Project: WILLIAMS-McCLUSKY ND

LAB. NUMBER 88C104

Field number:

Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.

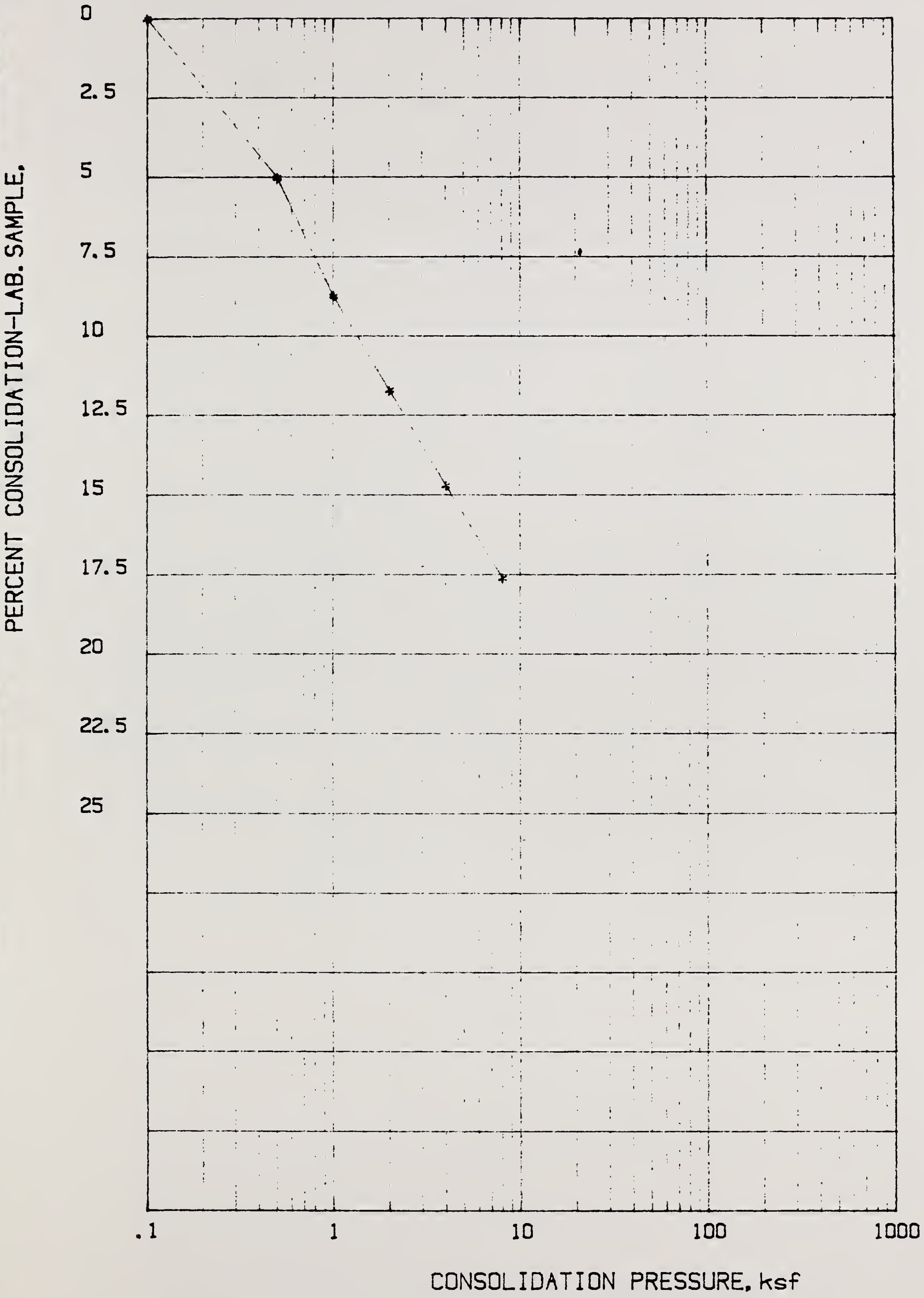
CONSOLIDATION TEST

WEPP Sample

Project: WOODWARD-OKLAHOMA
Field number:
LAB.NUMBER 830105
Sample depth: Feet
Sample description: COMPACTED TO 1.41GMS/CC CL-ML LL=25 PI=7 SATURATED AT START OF TEST

DIAMETER	2.5 ins
HEIGHT	1 ins
[illegible]	80.439 cm^3
[illegible]	122.92 g
[illegible]	[illegible] 4 g
[illegible]	[illegible] %
[illegible]	[illegible]
[illegible]	[illegible]

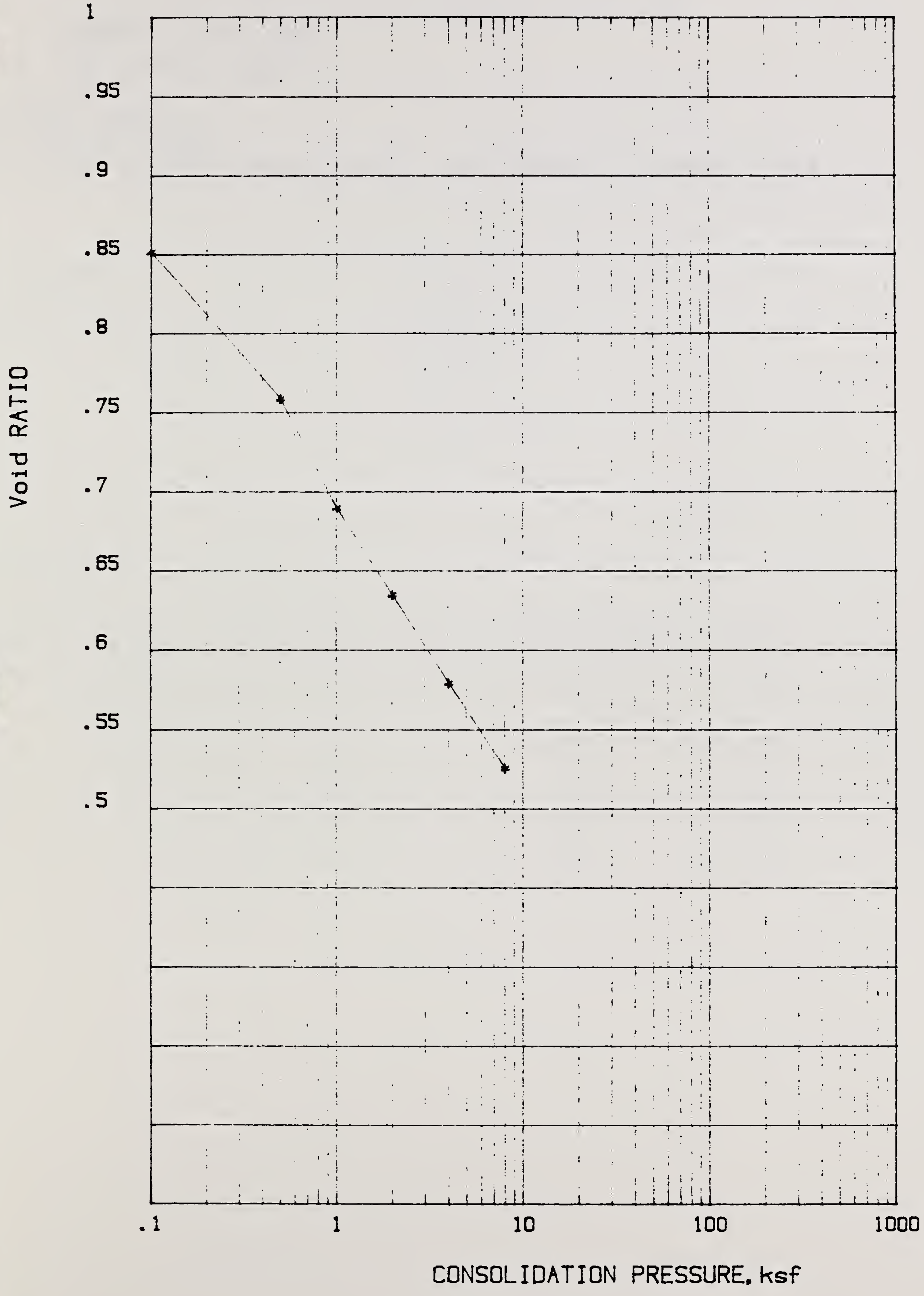
INCREMENT	LOAD	CHANGE IN HEIGHT	VOIDS RATIO	Su%
			.8510	0.00
			.7580	5.03
			.6890	8.76
			.6340	11.74
			.5780	14.74
			.5240	17.65



Project: WOODWARD-OKLAHOMA
LAB. NUMBER 88C105

Field number:
Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: WOODWARD-OKLAHOMA LAB. NUMBER 88C105
Field number: Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

```
              RESULTS OF CONSOLIDATION TEST
              =============================
```

WEPP Sample

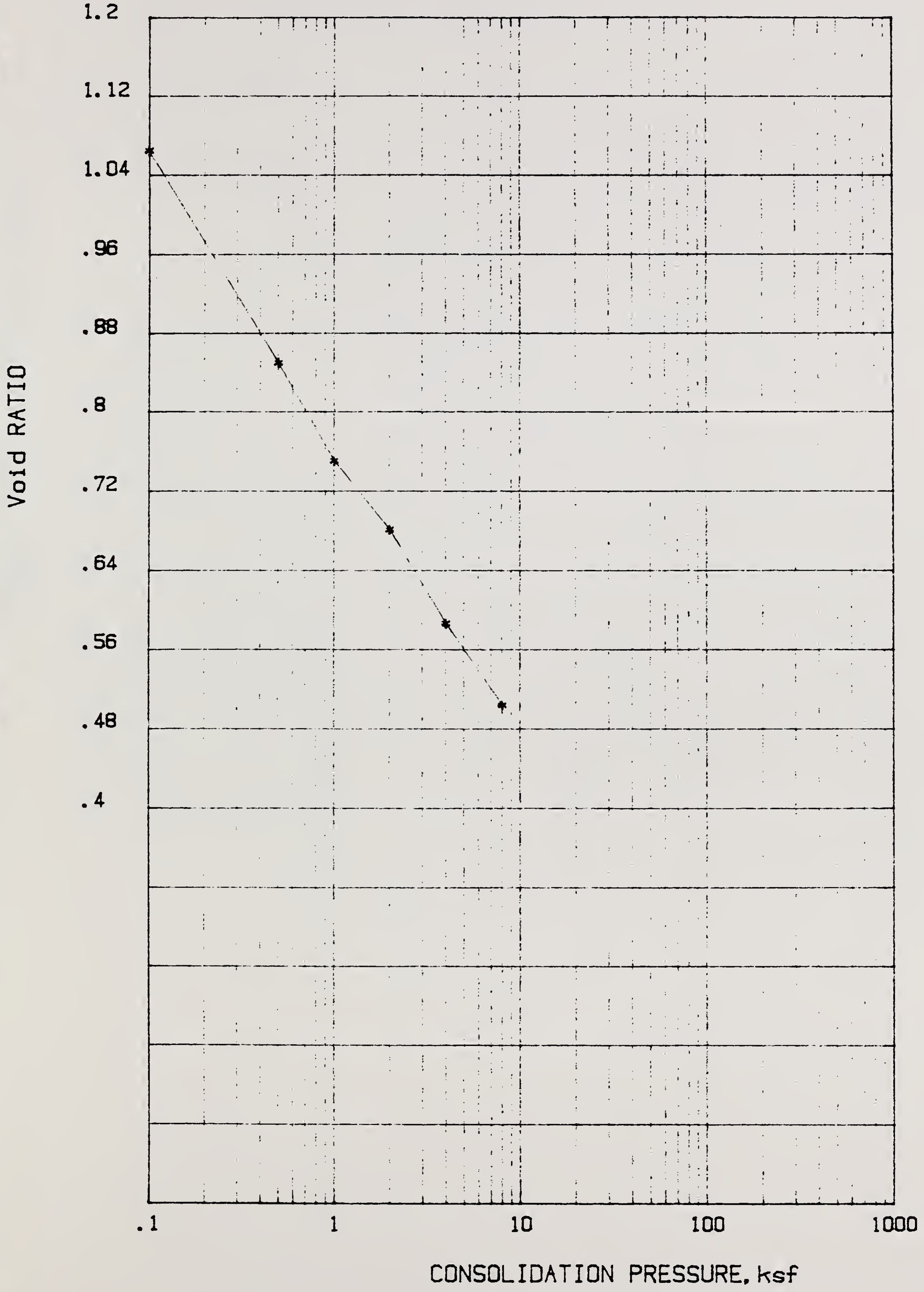
```
Project: ZAHL-NORTH DAKOTA
Field number:
LAB.NUMBER 88C106
Sample depth:   Feet
Sample description: COMPACTED TO 1.25 GMS/CC CL LL=31 PI=13


SAMPLE DIAMETER:                  2.5 ins
SAMPLE HEIGHT:                    1 ins
INITIAL VOLUME:                   80.439  cm^3
INITIAL WET WEIGHT:               108.02  g
INITIAL DRY WEIGHT:               100.53  g
[illegible]                       7.4 %
[illegible]                       [illegible]  PCF
[illegible]                       [illegible]  PCF
[illegible]                       [illegible]
[illegible]                       [illegible]

[illegible]                       [illegible]
[illegible]                       [illegible]


INCREMENT   LOAD   CHANGE IN HEIGHT   VOIDS RATIO    Su%
                   ----------------   -----------    ---

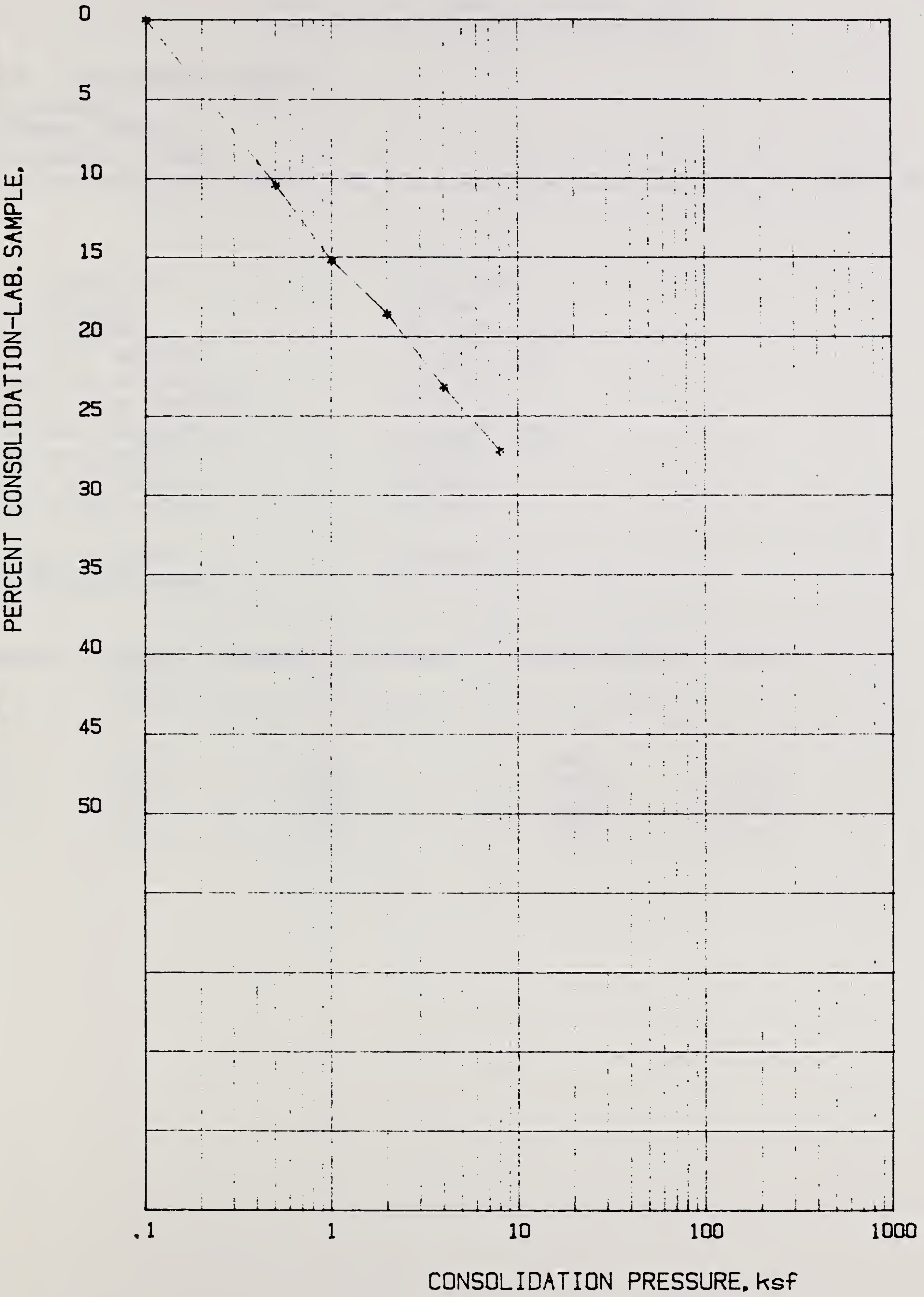
                                        1.0640       0.00
                                         .9490      10.43
                                         .7490      15.24
                                         .6800      18.60
                                         .5850      23.20
                                         .5020      27.22
```



Project: ZAHL-NORTH DAKOTA LAB. NUMBER 88C106

Field number: Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.



Project: ZAHL-NORTH DAKOTA

LAB. NUMBER 88C106

Field number:

Sample depth: Feet

USDA-SCS S. M. L. LINCOLN NE.

Test 2

RESULTS OF CONSOLIDATION TEST

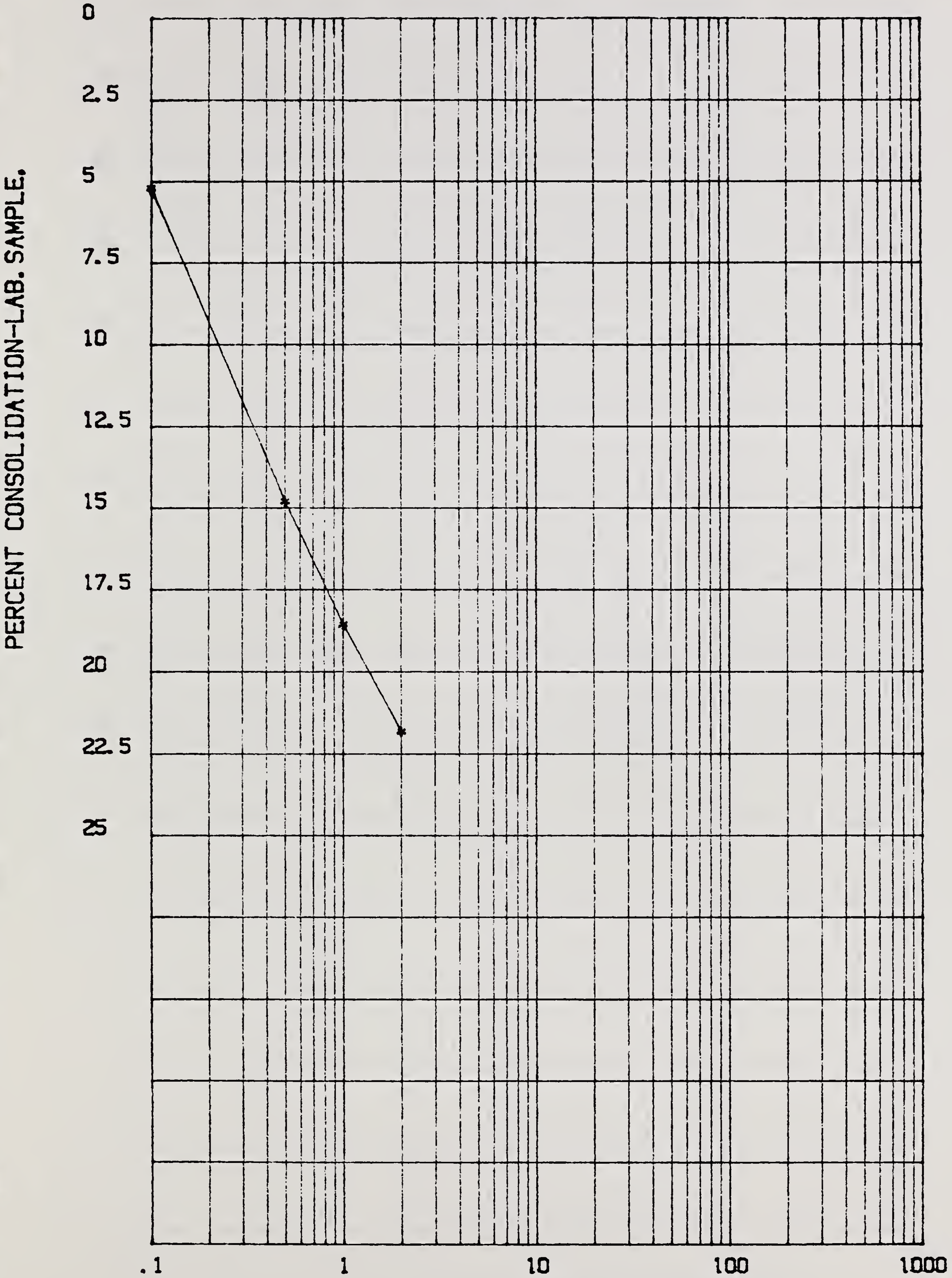
Project: ZAHL-NORTH DAKOTA
Field number:
LAB.NUMBER 88C106
Sample depth: Feet
Sample description: COMPACTED TO 1.25 GMS/CC SATURATED AT START OF TEST

SAMPLE DIAMETER: 2.5 ins
SAMPLE HEIGHT: 1 ins
INITIAL VOLUME: 80.439 cm^3
INITIAL WET WEIGHT: 117.23 g
INITIAL DRY WEIGHT: 100.54 g
INITIAL WATER CONTENT: 16.6 %
INITIAL WET DENSITY: 90.983 PCF
INITIAL DRY DENSITY: 78.029 PCF
SPECIFIC GRAVITY: 2.58
INITIAL VOID RATIO: 1.064

FINAL WET WEIGHT: 123.67 g
FINAL WATER CONTENT: 23 %

INCREMENT	LOAD (ksf)	CHANGE IN HEIGHT (ins)	VOIDS RATIO	Su%
1.0	.10	.0520	.9560	5.20
2.0	.50	.1482	.7580	14.82
3.0	1.00	.1860	.6800	18.60
4.0	2.00	.2186	.6120	21.86

Test 2



Project: ZAHL-NORTH DAKOTA

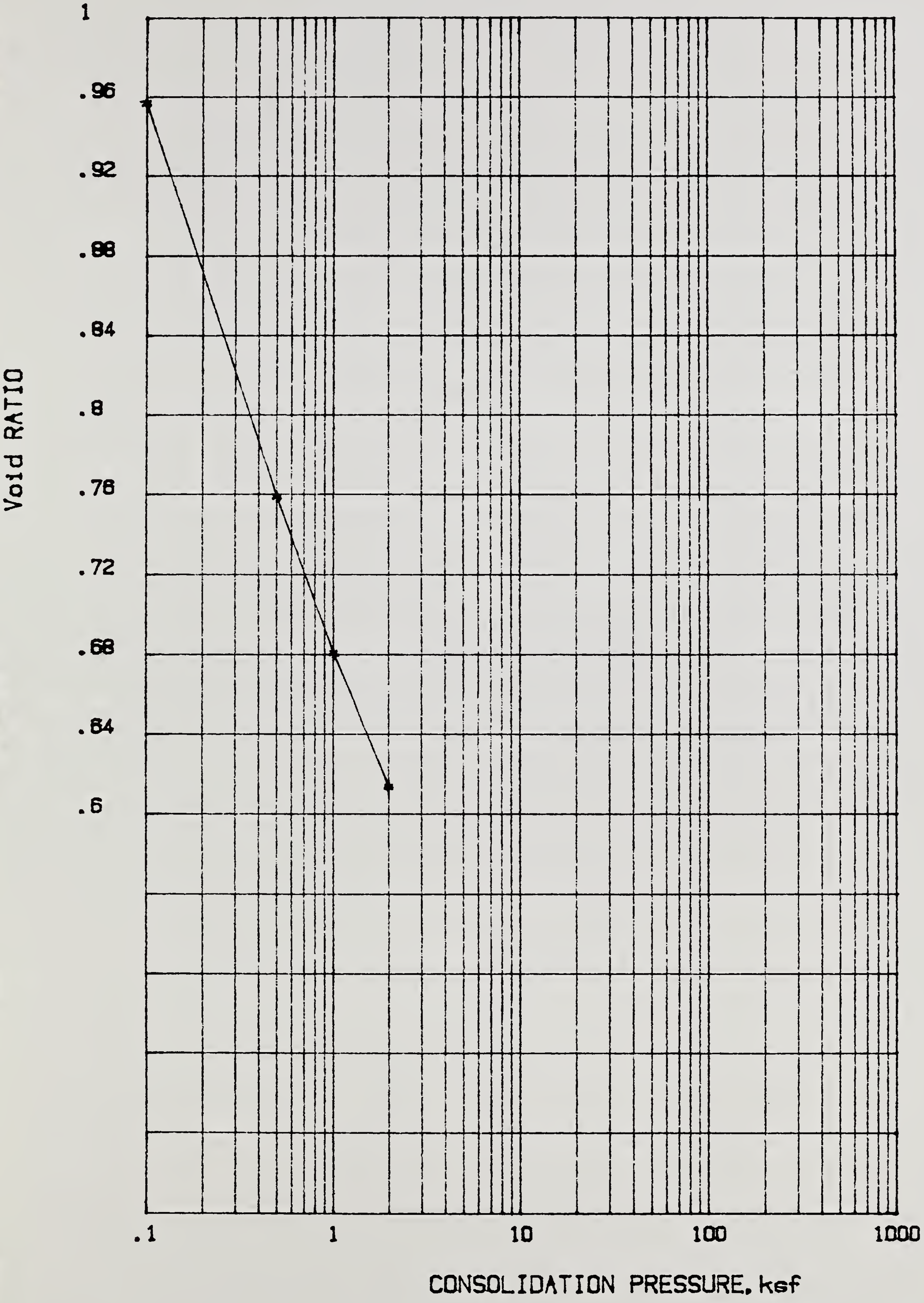
LAB. NUMBER 88C106

Field number:

Sample depth: Feet

USDA-SCS S.M.L. LINCOLN NE.

Test 2



Project: ZAHL-NORTH DAKOTA
LAB. NUMBER 88C106
Field number:
Sample depth: Feet
USDA-SCS S. M. L. LINCOLN NE.

Attachment F

Permeability Data

SCS-ENG-127
REV. 8-72

LABORATORY NO. 88C 89

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

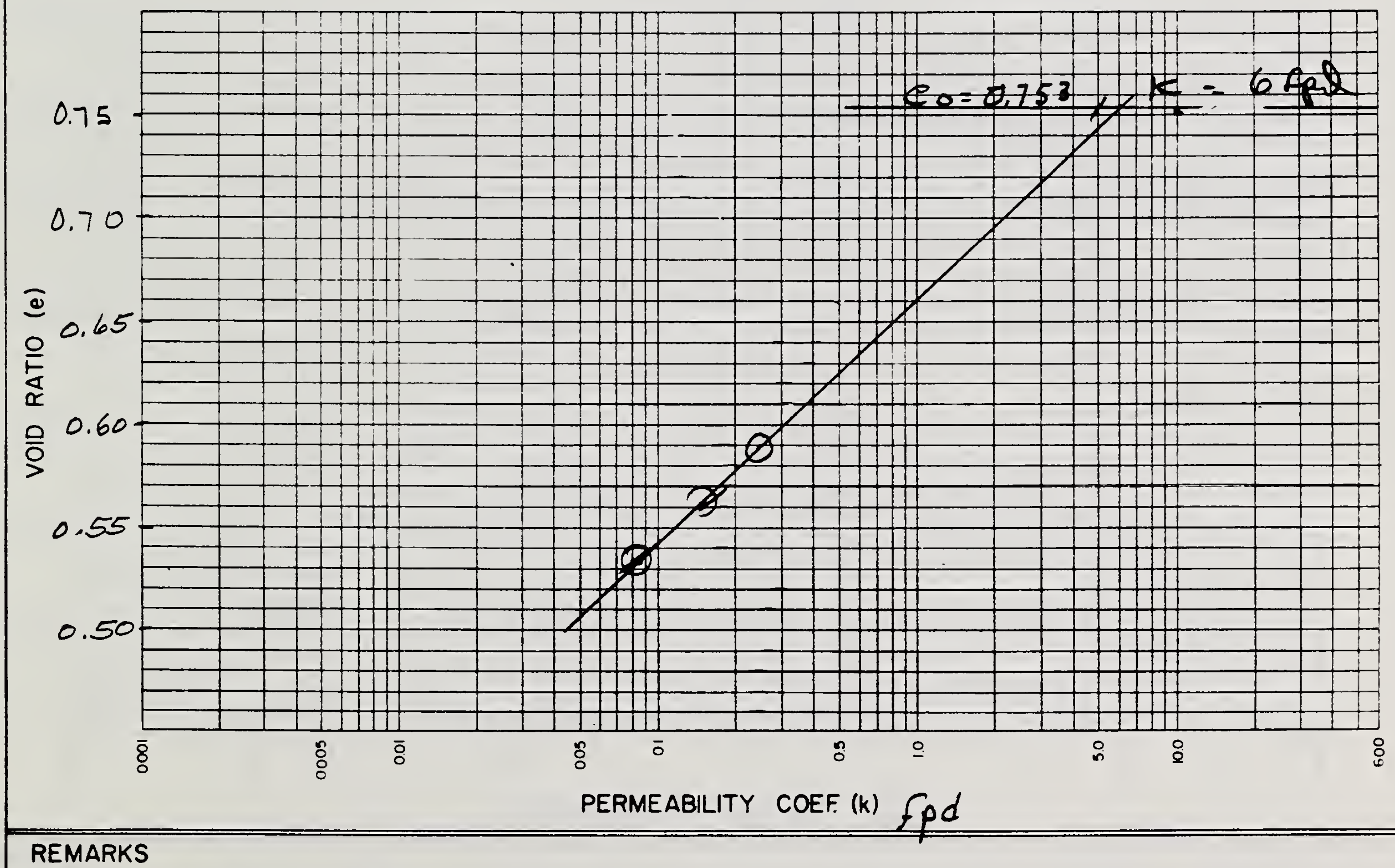
PROJECT and STATE: ABiLENE - TEXAS
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

CLASSIFICATION: NoN-Plastic SM LL ___ PI ___

TEST NO.	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.65	1.69	1.71	
VOID RATIO	.5898	.5608	.5347	
PERMEABILITY COEF. FPD.	.25018	.16597	.08778	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY	
G_s (-)#4	2.63
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS
FAlling Head Perm.



REMARKS

e_0 = 0.753

Volume Change = 12.5%

K at e_0 = 15 fpd

SCS-ENG-127
REV. 6-72

88C90

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE: WEPP - Acadamy - Fresno CA

SAMPLE LOCATION:

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: Remold

TESTED AT: SML - Lincoln

APPROVED BY:

DATE:

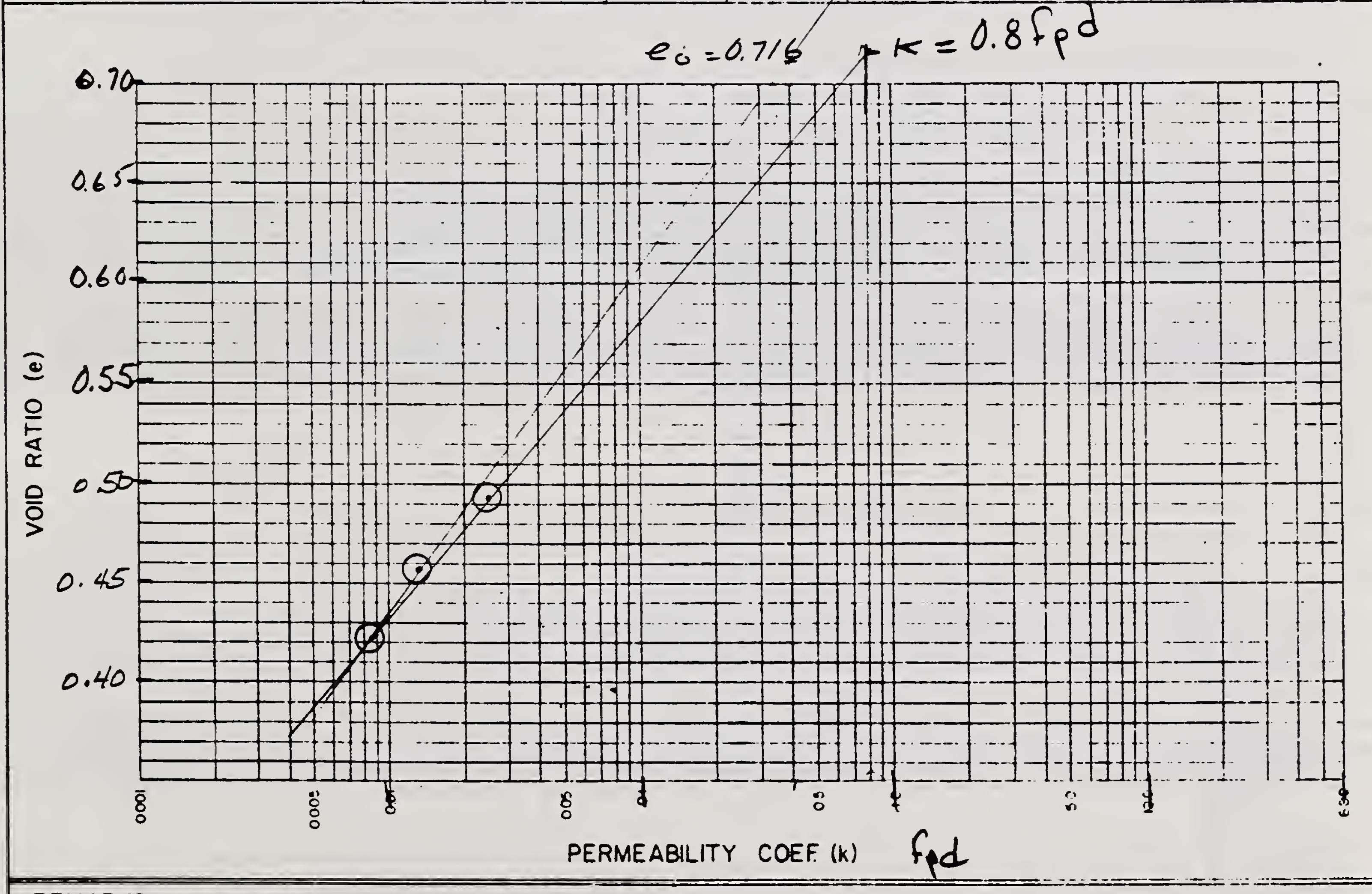
CLASSIFICATION: NON-Plastic SM LL ___ PI ___

SPECIFIC GRAVITY

TEST NO.	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf				
VOID RATIO	.4947	.4571	.4217	
PERMEABILITY COEF F.P.D.	.02646	.01458	.00878	
PERCOLATION COEF				
H/L DURING TEST				

G_s (-) #4	2.75
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS: Falling Head Perms

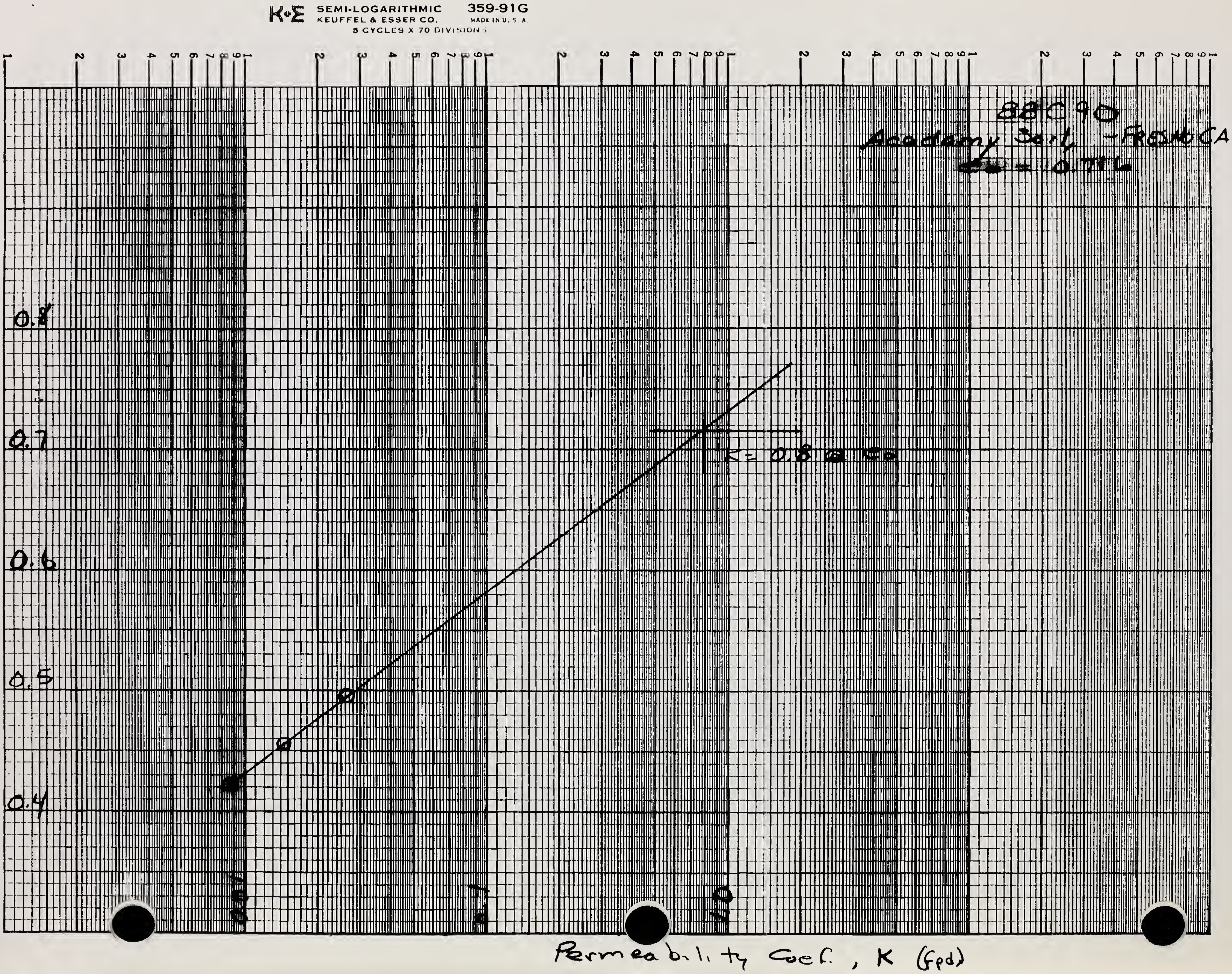


REMARKS

$e_o = 0.716$

Volume Change = 17.2%

K at e_o = 0.8 fpd


K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS
88C90
Academy Soil - FRESNO CA
= 0.71L
0.8
0.7
0.6
0.5
0.4
K = 0.8
.01
.1
1.0
Permeability Coef., K (fpd)

Test 1

SCS-ENG-127
REV 6-72

LABORATORY No. 88C 9-1

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE: WePP Barnes - Morris MN.

SAMPLE LOCATION:

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: Remold

TESTED AT: SML, Lincoln

APPROVED BY:

DATE:

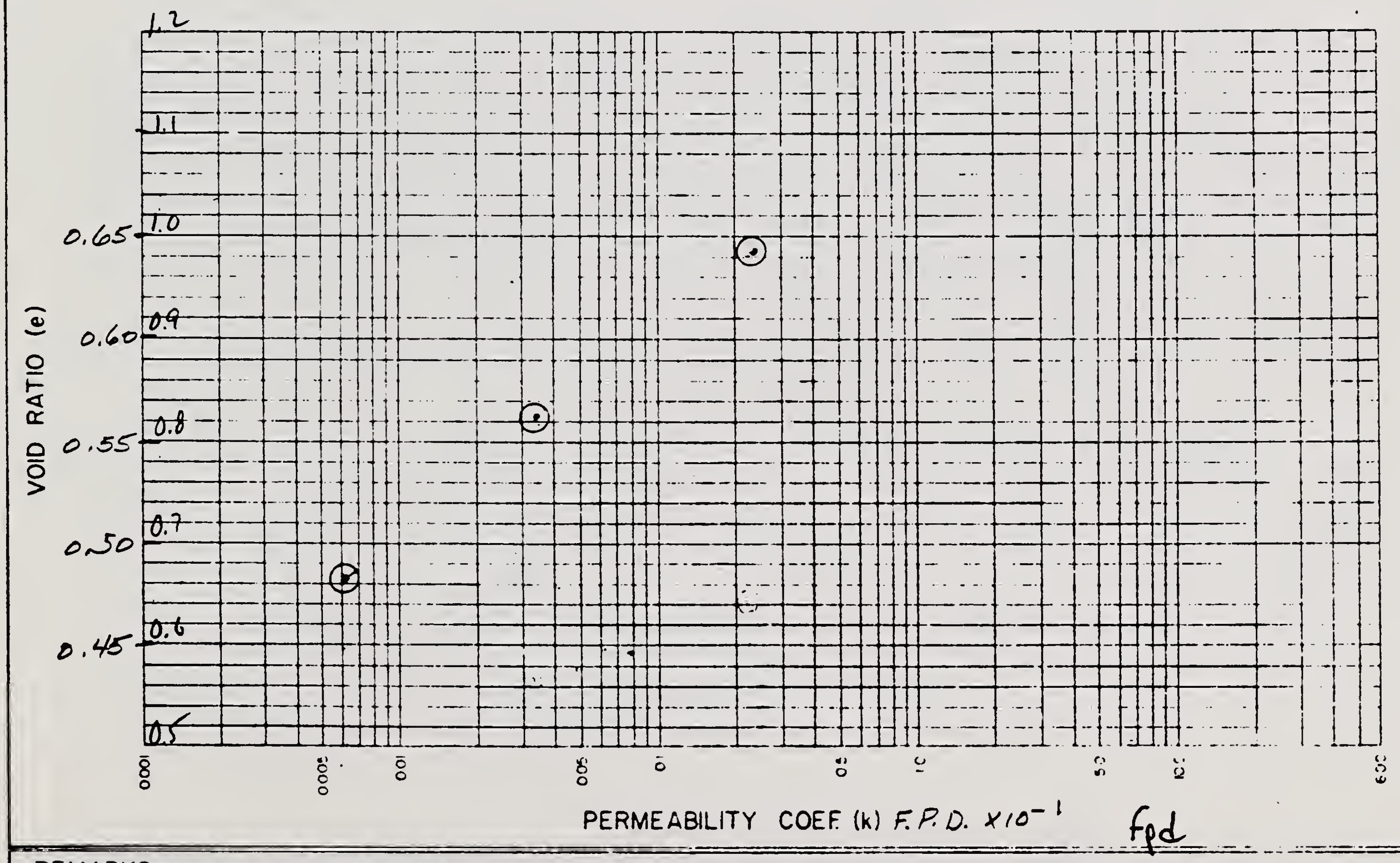
CLASSIFICATION: CL LL 26 PI 9

TEST NO	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf				
VOID RATIO	.6401	.5621	.4832	
PERMEABILITY COEF F.P.D.	.02300	.00349	.00061	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-) #4	2.61
G_s (+) #4	
G_m (Bulk)(+) #4	

TEST SPECIFICATIONS
Falling Head Perm



REMARKS

$e_0 = 1.273$

Test C

SCS-ENG-127
REV. 6-72

88C 91.

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	**SOIL PERMEABILITY**

PROJECT and STATE Wepp - Barnes Soil Morris MN			SAMPLE LOCATION
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

CLASSIFICATION CL LL 26 PI 9

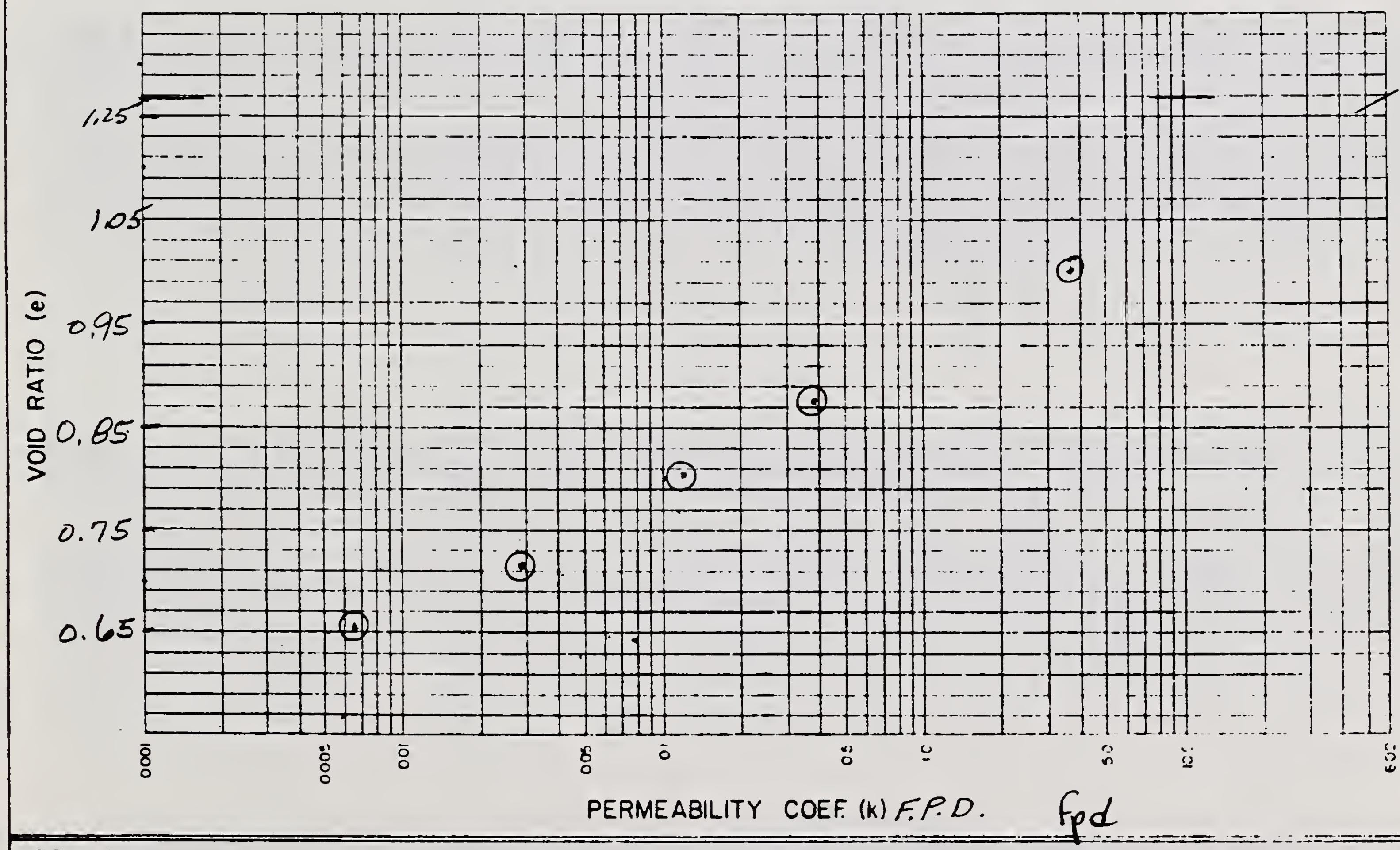
TEST NO.	1 100	2 250	3 500	4 1000	5 2000
INITIAL MOISTURE %					
DRY DENSITY ☐ g/cc ☐ pcf	1.30	1.39	1.44	1.51	1.58
VOID RATIO	1.0050	.8788	.8085	.7284	.6533
PERMEABILITY COEF F.P.D.	1.3900	.39238	.12577	.02924	.00665
PERCOLATION COEF					
H/L DURING TEST					

SPECIFIC GRAVITY

G_s (-) #4		2.61
G_s (+) #4		
G_m (Bulk) (+) #4		

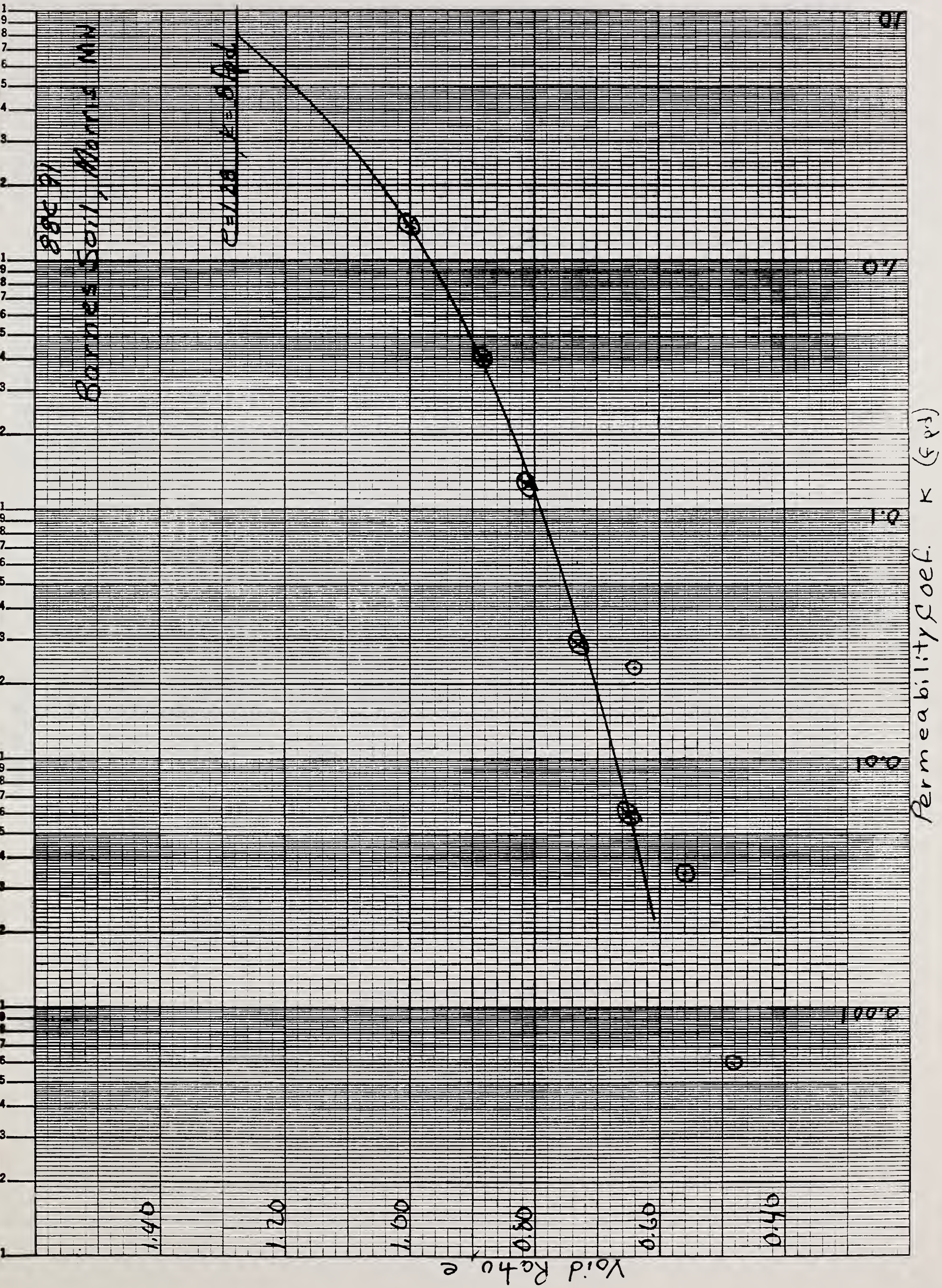
TEST SPECIFICATIONS

Falling Head Perm.



REMARKS

e = 1.289


886 91
Barnes Soil, Morris MN
e=1.18, k=6 fpd
10
1.0
0.1
0.01
0.001
1.40
1.20
1.00
0.80
0.60
0.40
Void Ratio, e
Permeability Coef. K (fpd)
K+E SEMI-LOGARITHMIC 358-91
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS

Test 1

SCS-ENG-127
REV. 6-72

Laboratory No. 88C 92

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE WEPP Barnes McClusky ND.			SAMPLE LOCATION
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Remolded	TESTED AT SML, Lincoln	APPROVED BY	DATE

CLASSIFICATION

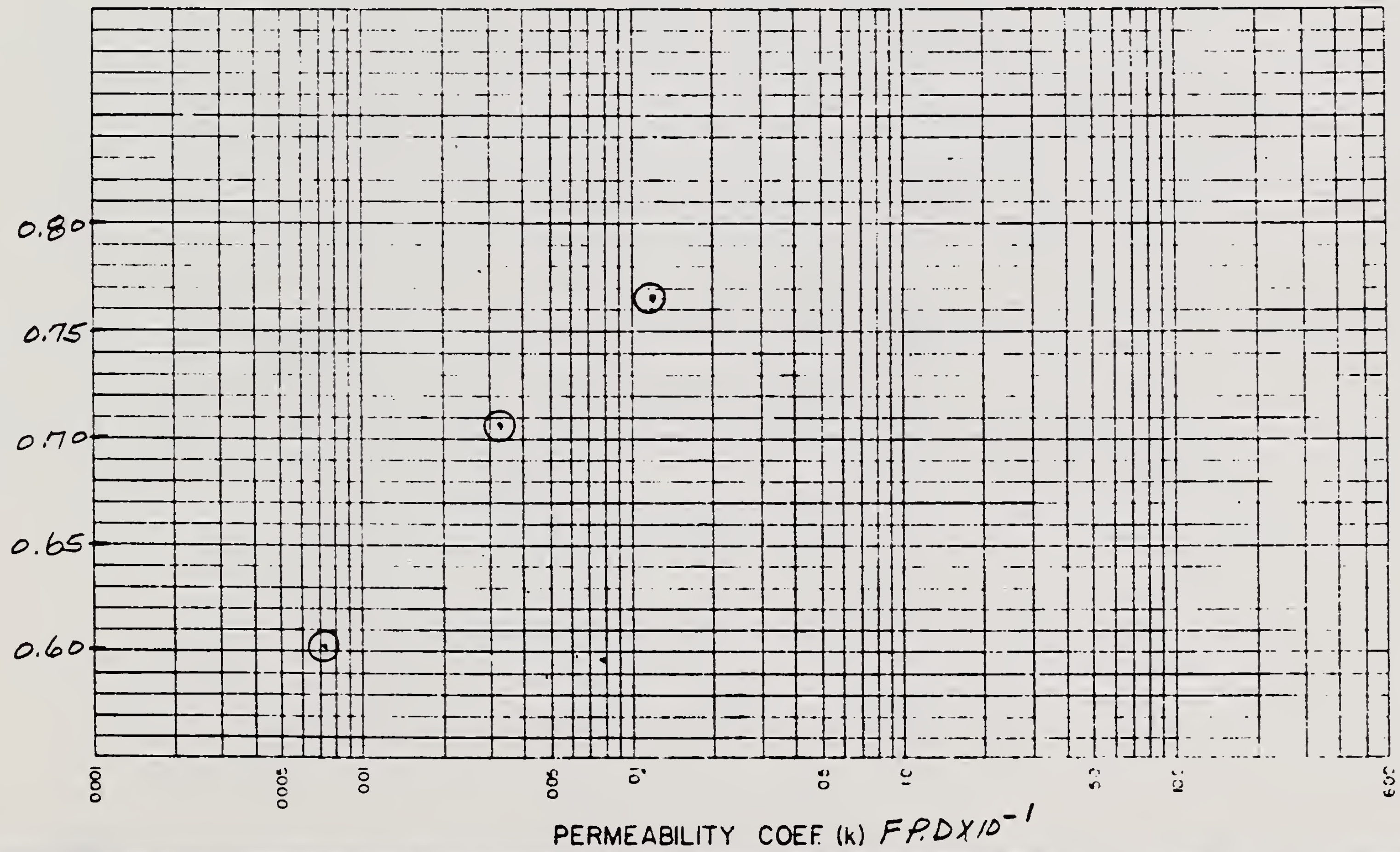
LL ___ PI ___

SPECIFIC GRAVITY

TEST NO	1 2000	2 4800	3 8800	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.44	1.49	1.59	
VOID RATIO	.7652	.7086	.6012	
PERMEABILITY COEF F.P.D.	.01224	.00330	.00073	
PERCOLATION COEF				
H/L DURING TEST				

G_s (-)#4	2.55
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS
Falling Head Perm.



REMARKS

$e_0 = 1.121$

Test 2

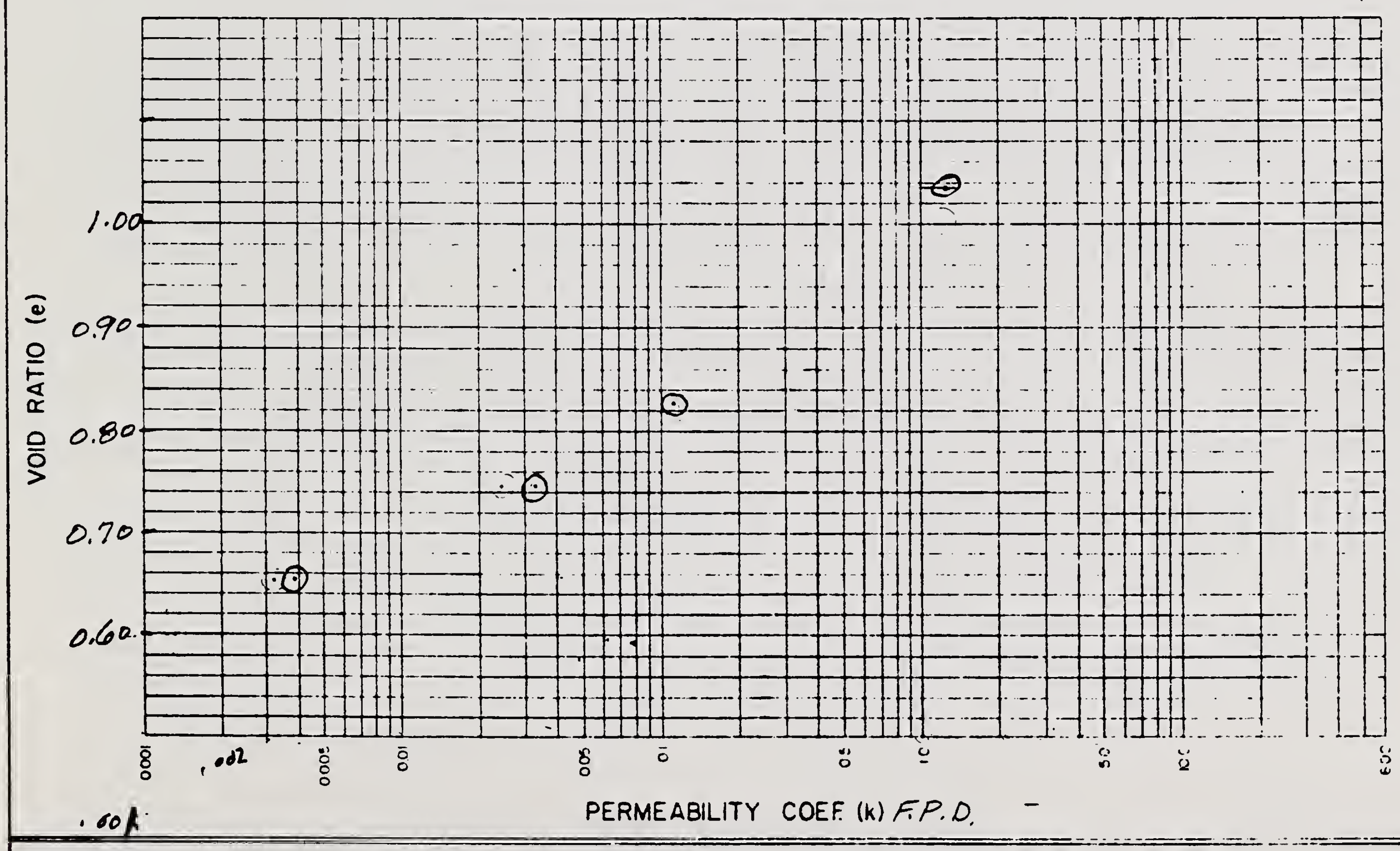
SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C92

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE WePP Barnes - McClusky, N.D.		SAMPLE LOCATION	
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

CLASSIFICATION	CL LL 31 PI 12				SPECIFIC GRAVITY	
TEST NO.	1 100	2 500	3 1000	4 2000	G_s (-) #4	2.55
INITIAL MOISTURE %					G_s (+) #4	
DRY DENSITY ☐ g/cc ☐ pcf	1.25	1.40	1.46	1.54	G_m(Bulk)(+) #4	
VOID RATIO	1.0347	.8275	.7449	.6554	TEST SPECIFICATIONS Falling Head Perm.	
PERMEABILITY COEF F.P.D.	1.3362	.12863	.03330	.00394		
PERCOLATION COEF						
H/L DURING TEST						



REMARKS

$e_o = 1.125$

Test 3

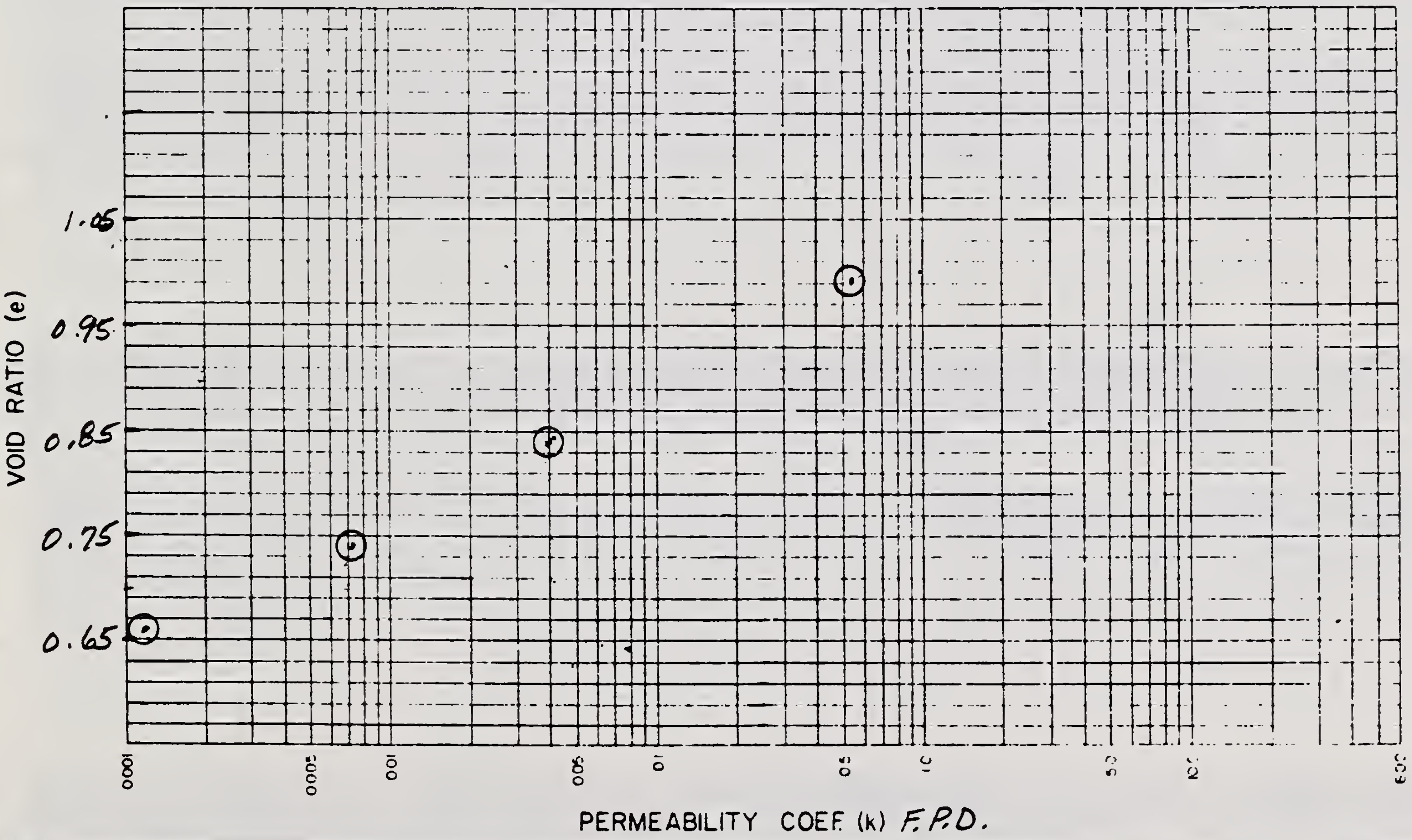
SCS-E-16-127
REV. 6-72

Laboratory No. 88C92

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

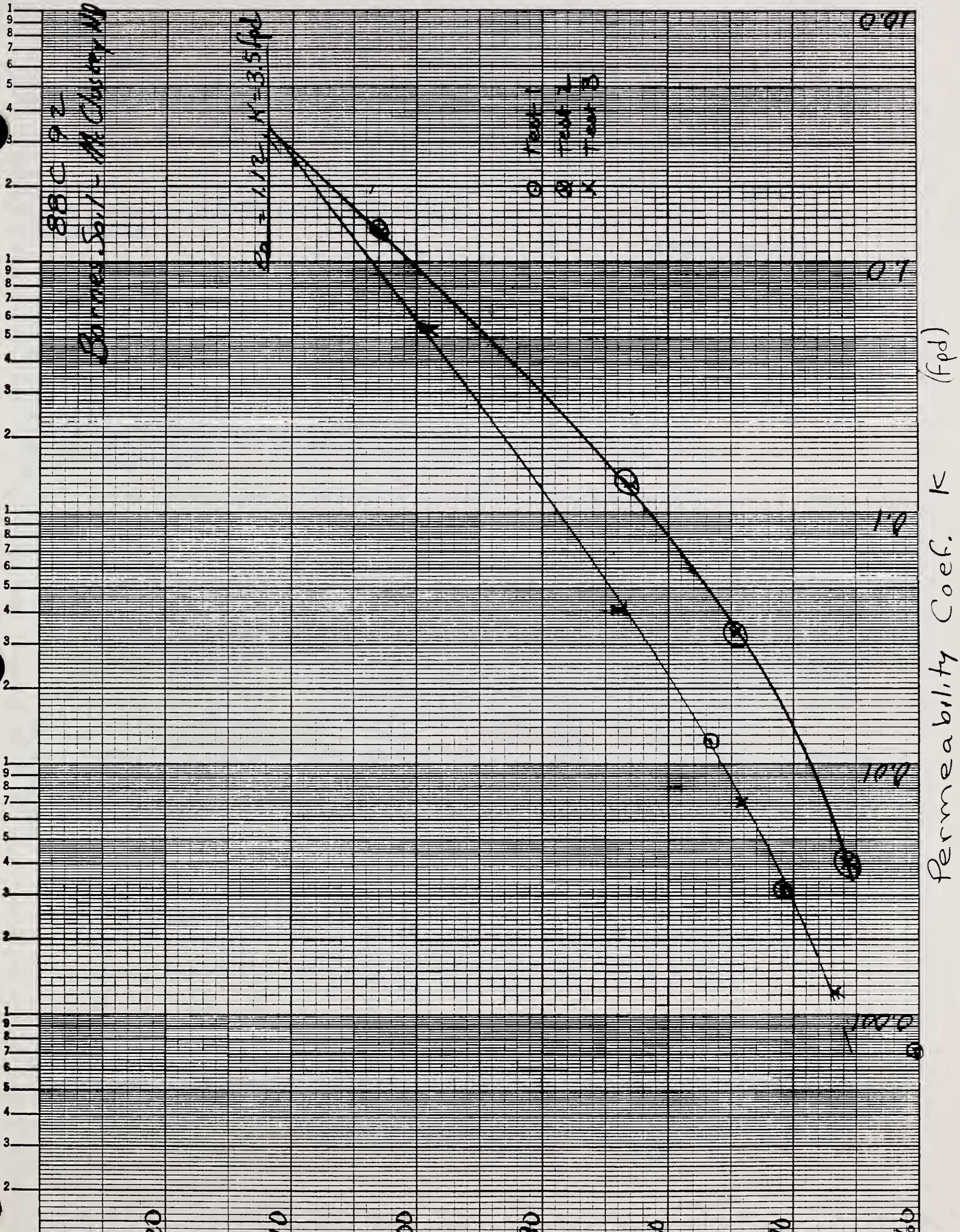
PROJECT and STATE: WePP - Barnes - McClusky, ND.		SAMPLE LOCATION:	
FIELD SAMPLE NO:	DEPTH:	GEOLOGIC ORIGIN:	
TYPE OF SAMPLE: Compacted	TESTED AT: SML - Lincoln	APPROVED BY:	DATE:

CLASSIFICATION CL LL 31 PI 12					SPECIFIC GRAVITY	
TEST NO.	1 100	2 580	3 1080	4 2000	G_s (-) #4	2.55
INITIAL MOISTURE %					G_s (+) #4	
DRY DENSITY ☐ g/cc ☐ pcf	1.28	1.38	1.46	1.53	G_m (Bulk)(+) #4	
VOID RATIO	.9928	.8445	.7427	.6643	TEST SPECIFICATIONS FAlling Head Perm.	
PERMEABILITY COEF F.P.D.	.53575	.04086	.00726	.00125		
PERCOLATION COEF						
H/L DURING TEST						



REMARKS

$e_0 = 1.125$


88C 92

Barnes Soil - Mt Clusby Hd

Test 1

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C93

MATERIALS TESTING REPORT | **U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE** | **SOIL PERMEABILITY**

PROJECT and STATE: WEPP Heiden Waco TX.

SAMPLE LOCATION:

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE:

TESTED AT: SML, Lincoln

APPROVED BY:

DATE:

CLASSIFICATION

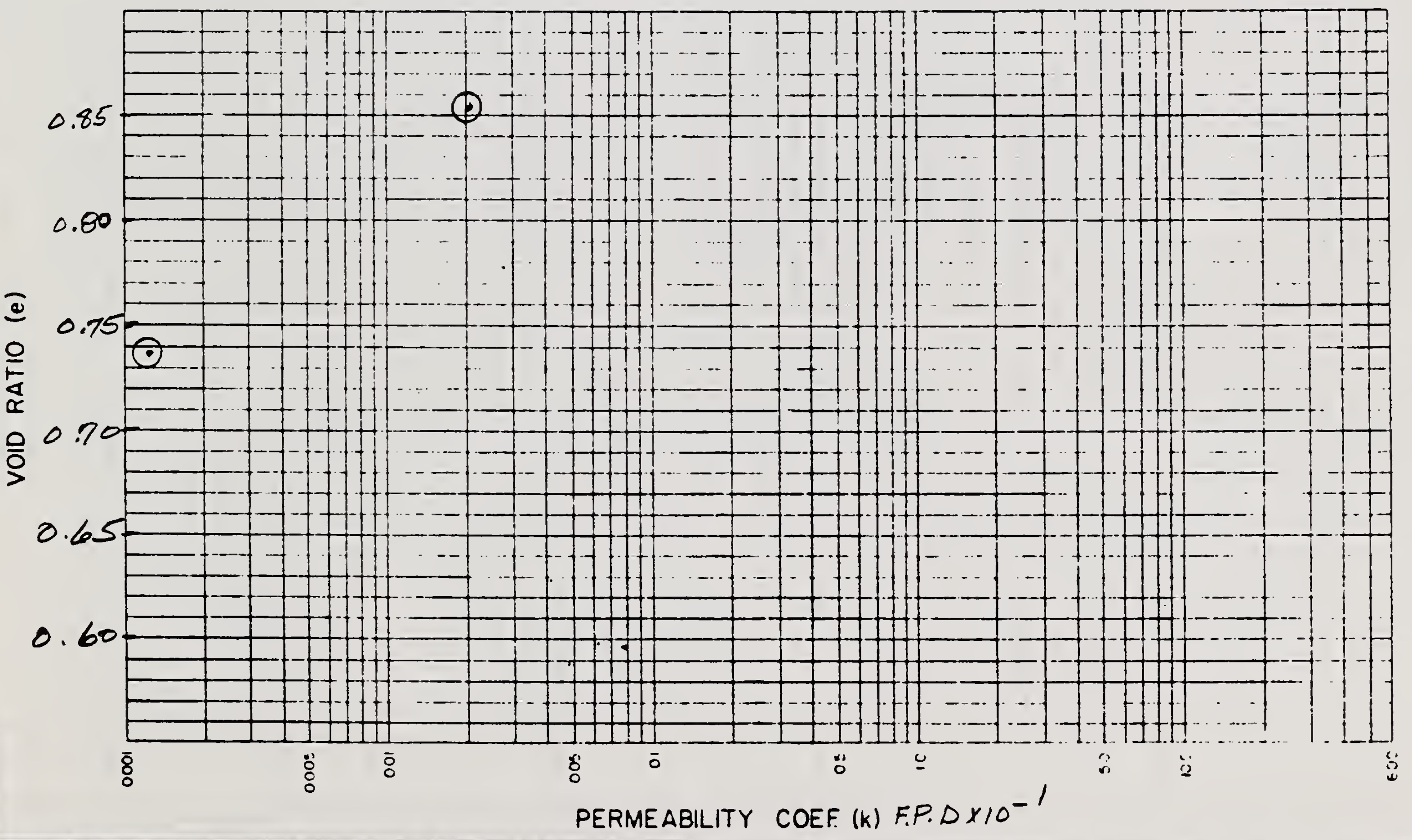
LL ___ PI ___

TEST NO	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.44	1.54	1.63	
VOID RATIO	.8523	.7378	.6411	
PERMEABILITY COEF F.P.D.	.00216	.00012	.00000	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-) #4	2.67
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS
Falling Head Perm.



REMARKS

$e_o = 1.693$

Test 2

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 93.

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

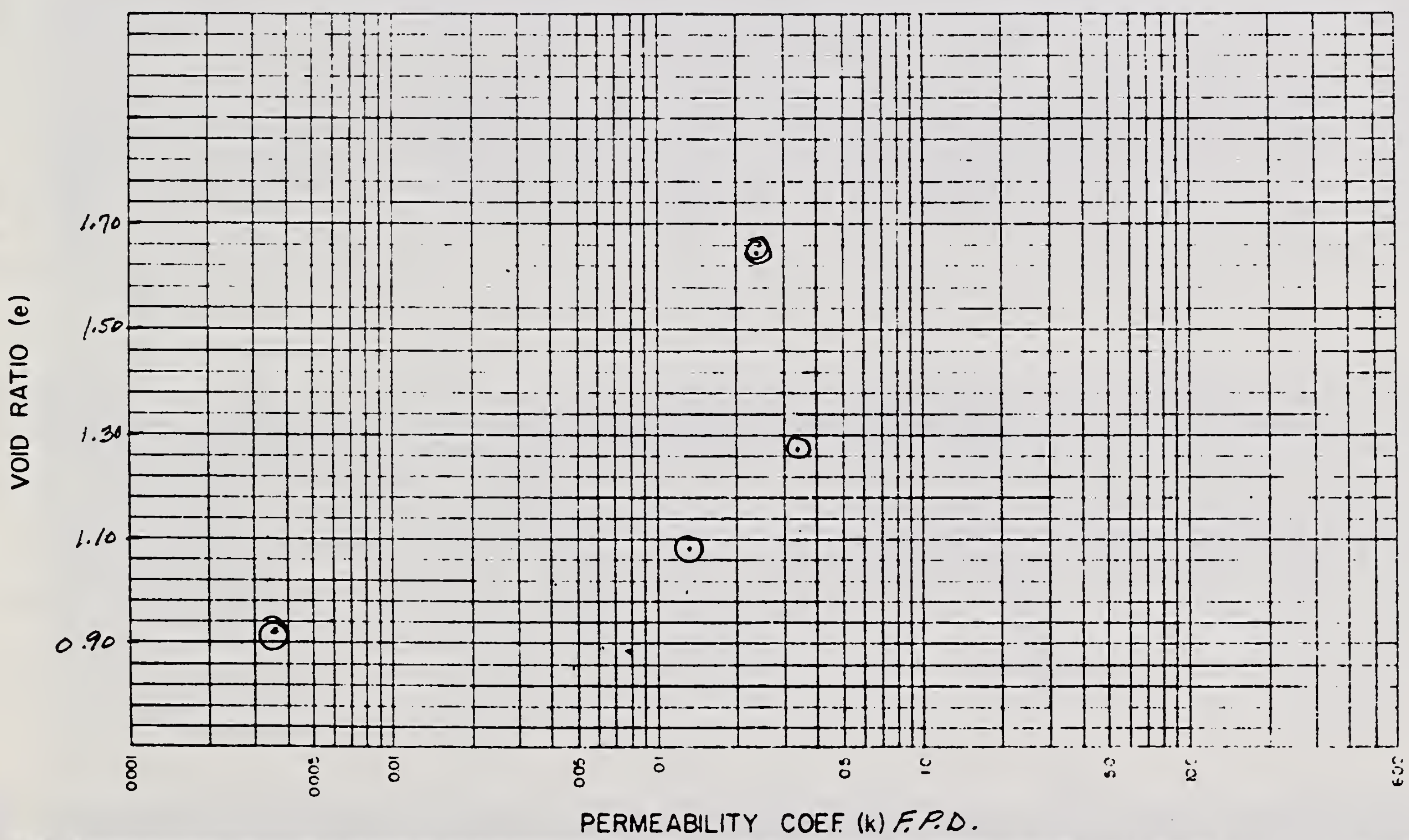
PROJECT and STATE: WePP- Heiden - Waco, Tx.
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

CLASSIFICATION: CH LL 52 PI 37

TEST NO	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.01	1.18	1.28	1.39
VOID RATIO	1.6444	1.2679	1.0826	.9275
PERMEABILITY COEF F.P.D.	2.4032	3.4354	.1460T	.00366
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY	
G_s (-)#4	2.67
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS
Falling Head Perm

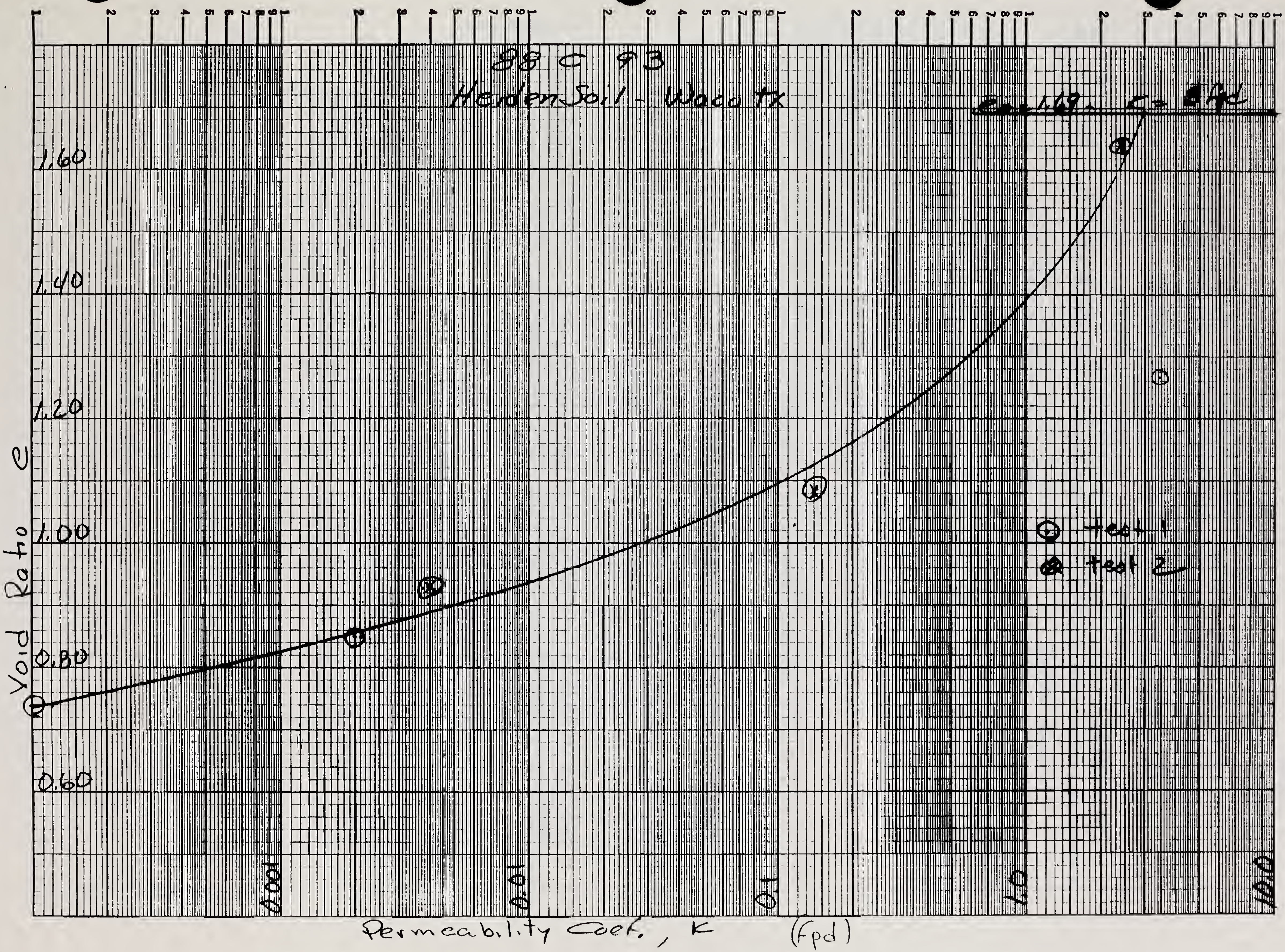


REMARKS

$e_0 = 1.697$

K+E SEMI-LOGARITHMIC 358-91
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS

SS C 93
Heiden Soil - Waco TX



Test 1

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 94

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE: WePP HIRSH ORD NE.

SAMPLE LOCATION: Hirsh - Ord, Ne.

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: Compacted

TESTED AT: SML, Lincoln

APPROVED BY:

DATE:

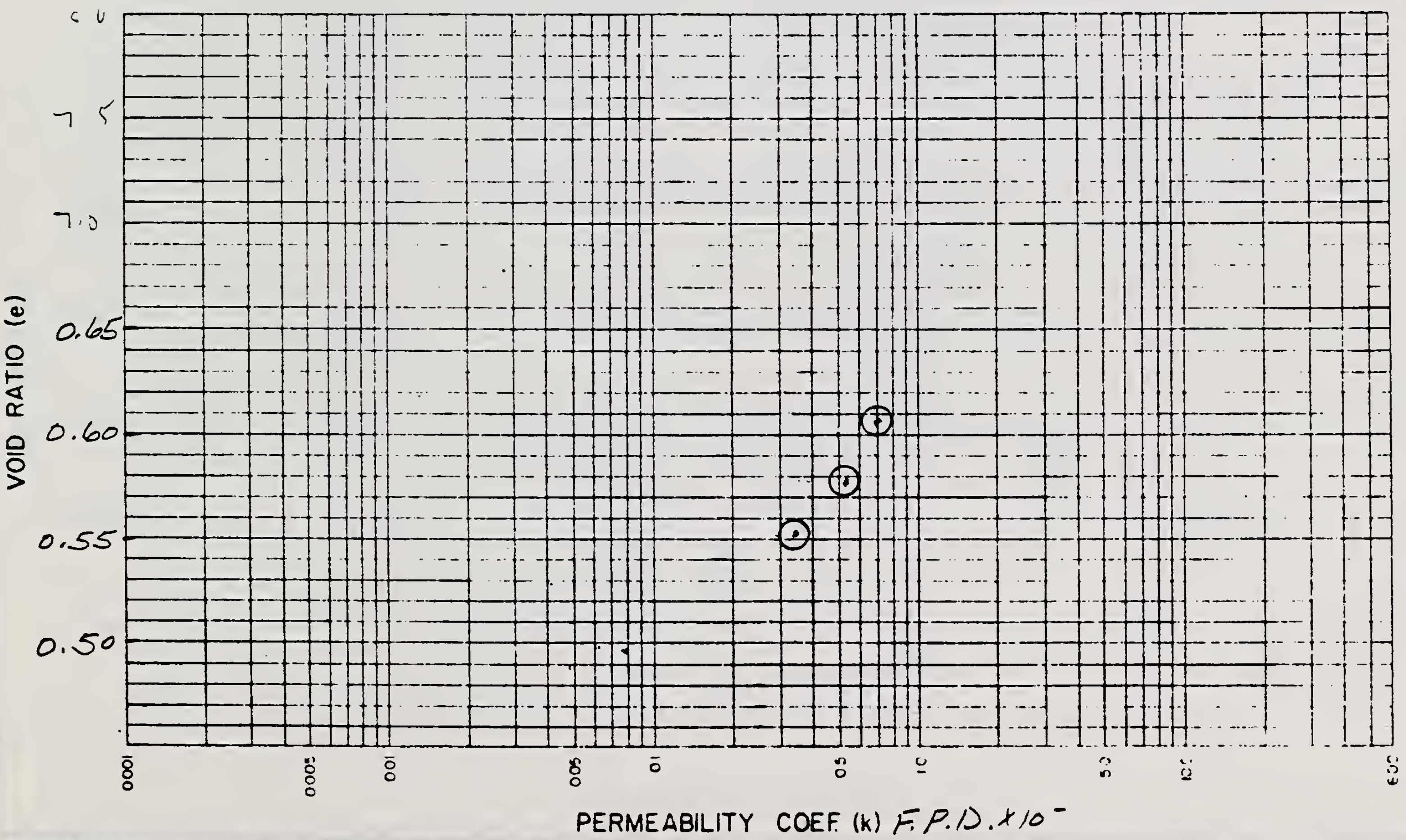
CLASSIFICATION: NoN-Plastic SM LL ___ PI ___

TEST NO	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.65	1.67	1.69	
VOID RATIO	.6065	.5788	.5517	
PERMEABILITY COEF F.P.D.	.7022	.5217	.3549	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (−) #4	2.63
G_s (+) #4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS: FAlling Head Perm.



REMARKS

e_0 = 0.894

Volume Change = 18%

K at eo ~ 40 fpd

Test 2

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 94.

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

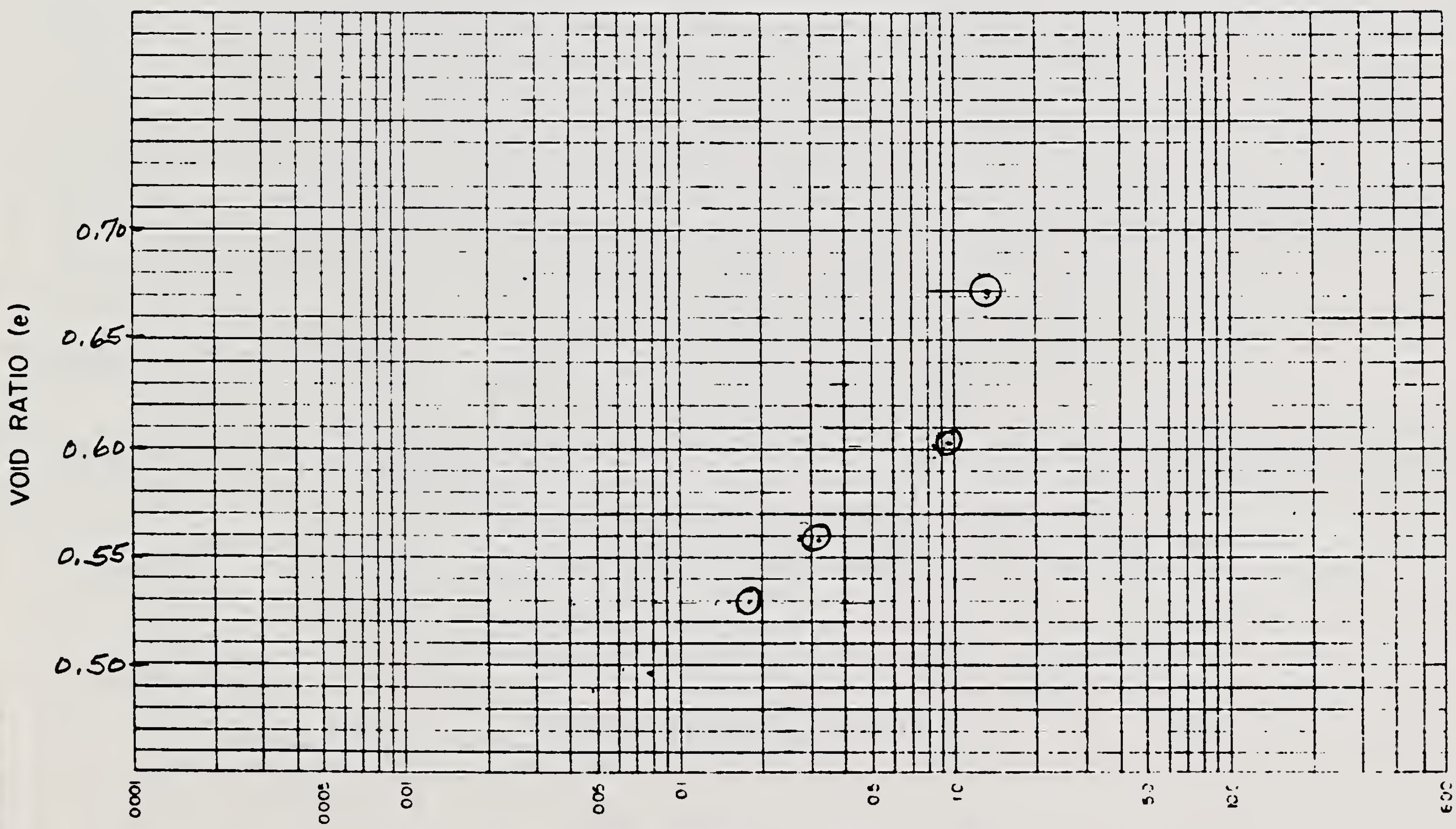
PROJECT and STATE: WePP- HirsH - Ord, Ne
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

CLASSIFICATION: NoN - Plastic SM LL ___ PI ___

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.57	1.64	1.69	1.72
VOID RATIO	.6720	.6014	.5585	.5295
PERMEABILITY COEF F.P.D	1.4394	.9671	.31716	.18705
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY	
G_s (−) #4	2.63
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS: Falling Head Perm



REMARKS

$e_0 = 0.892$

Test 3

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 94

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

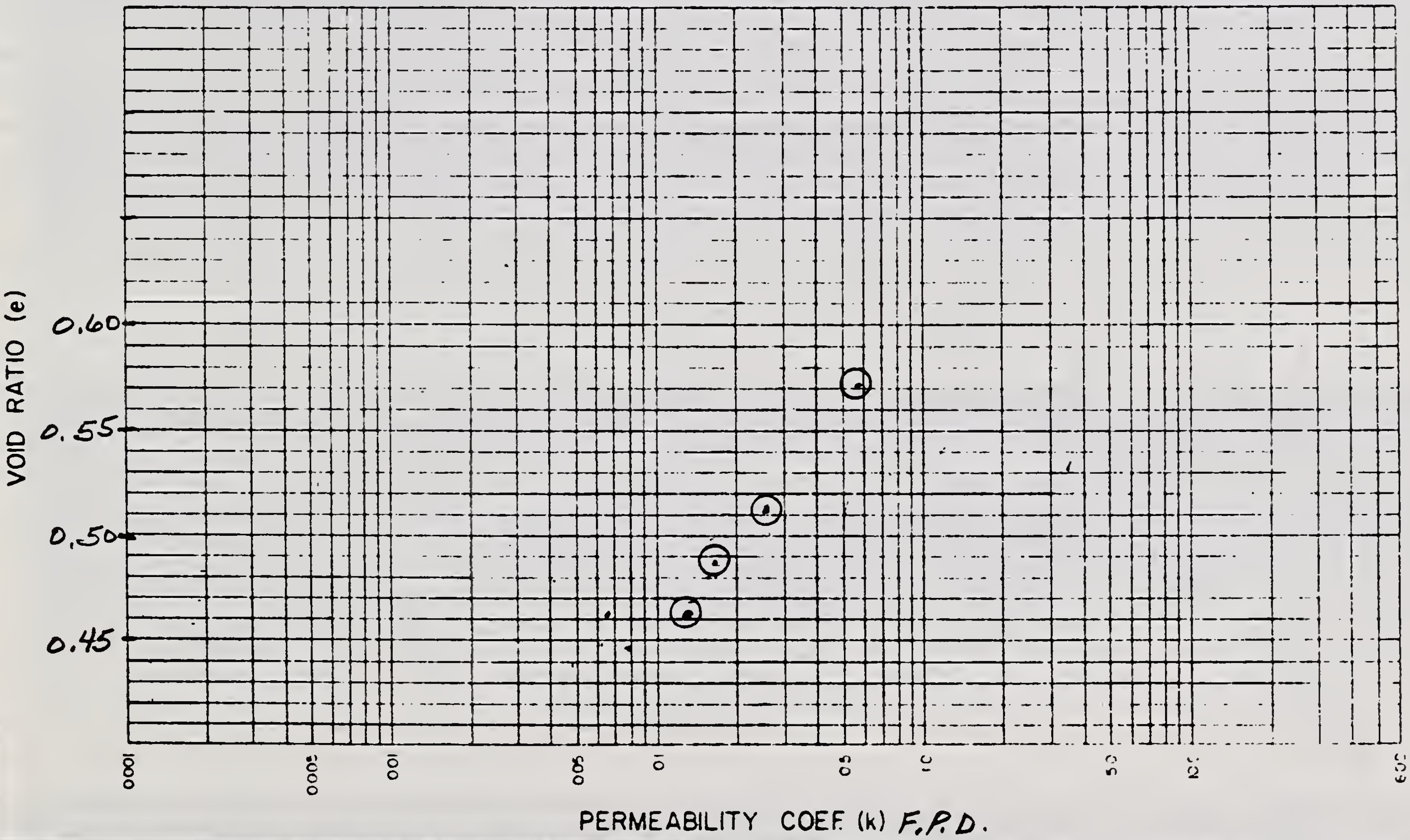
PROJECT and STATE: WePP HirsH - Ord, Ne.
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

CLASSIFICATION: NON-Plastic SM LL___ PI___

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.67	1.74	1.77	1.80
VOID RATIO	.5704	.5131	.4881	.4626
PERMEABILITY COEF F.P.D.	.58296	.26331	.17082	.14340
PERCOLATION COEF				
H/L DURING TEST				

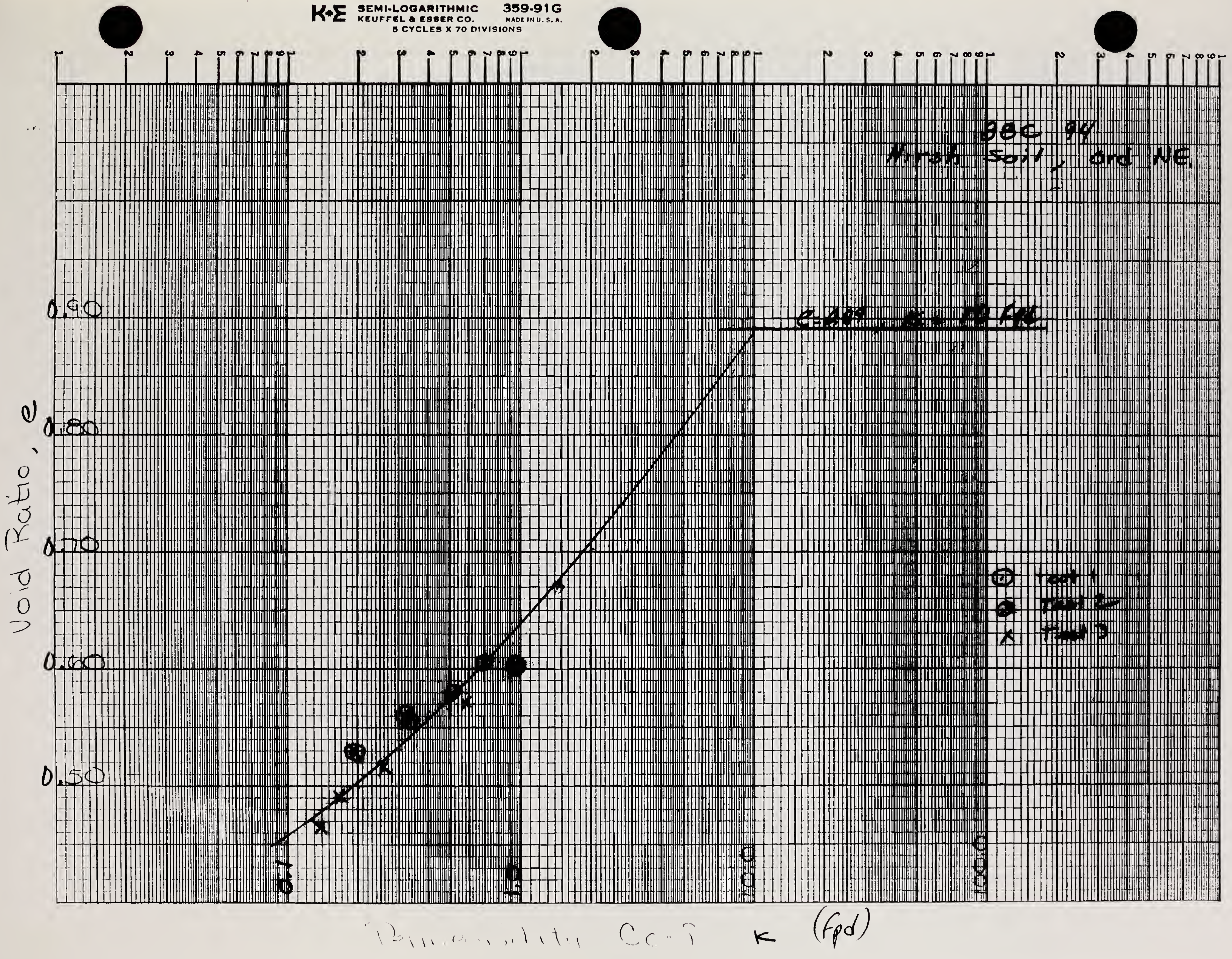
SPECIFIC GRAVITY	
G_s (-) #4	2.63
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS: Falling Head Perm



REMARKS

e_0 = 0.892

K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS
BBC 94
Marsh Soil, and NE.
e=.889, k=10 fpd
Test 1
Test 2
Test 3
Void Ratio, e
0.90
0.80
0.70
0.60
0.50
0.1
1.0
10.0
100.0
1000.0
Permeability Coef. k (fpd)

Test 1

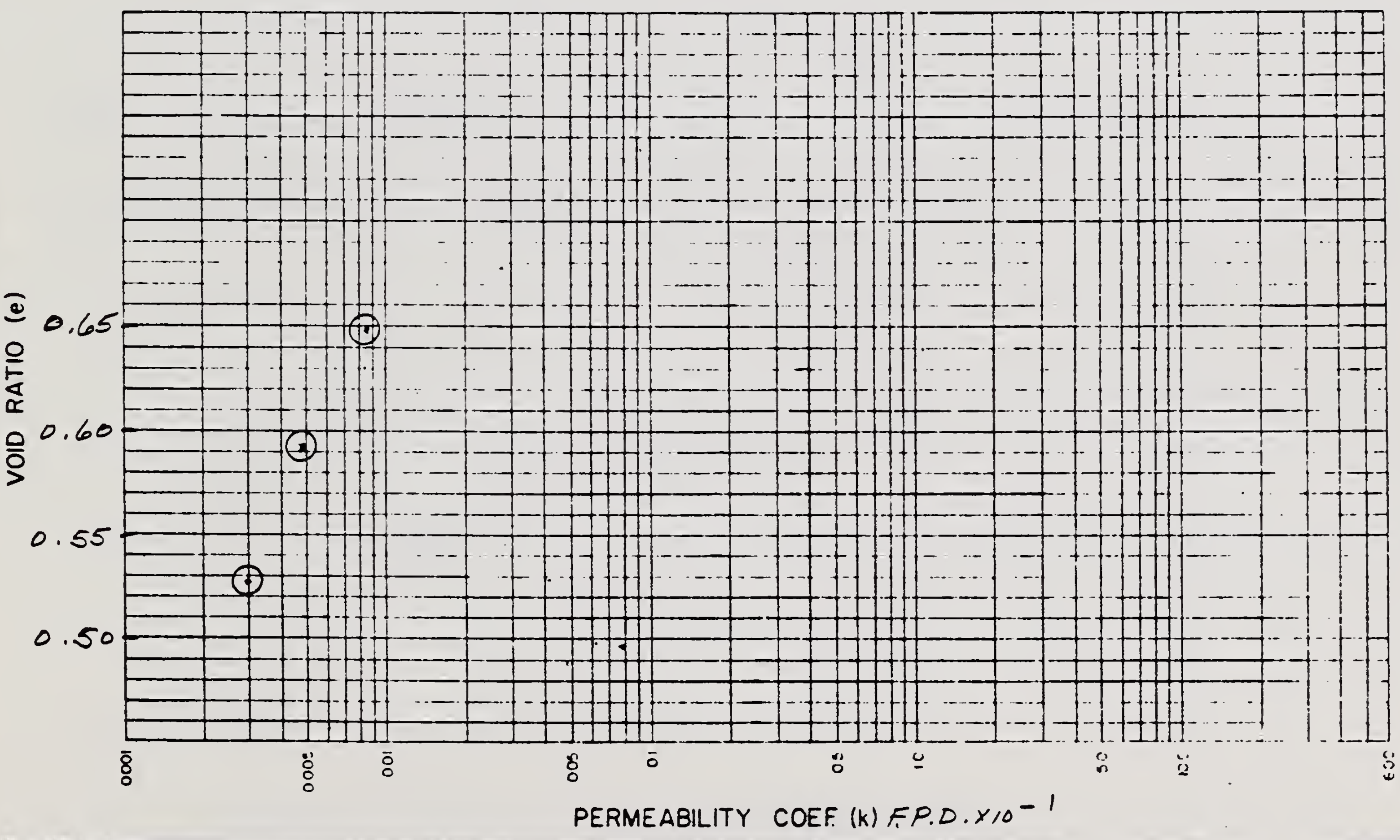
SCS-ENG-127
REV 6-72

Laboratory No. 88C 95

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE WEPP KEITH ALBION WY.		SAMPLE LOCATION Keith - Albin, Wy.
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

CLASSIFICATION CL LL 32 PI 13					SPECIFIC GRAVITY	
TEST NO.	1 2000	2 4000	3 8000	4	G_s (-)#4	2.59
INITIAL MOISTURE %					G_s (+)#4	
DRY DENSITY ☐ g/cc ☐ pcf	1.57	1.63	1.70		G_m(Bulk)(+) #4	
VOID RATIO	.6496	.5911	.5265		TEST SPECIFICATIONS Falling Head Perm	
PERMEABILITY COEF F.P.D.	.00085	.00049	.00030			
PERCOLATION COEF						
H/L DURING TEST						



REMARKS

e_o = 0.962

Volume Change = 22.2%

Test 2

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88 e 95

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE: WePP Keith Albin, Wy.

SAMPLE LOCATION:

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: Compacted

TESTED AT: SML, Lincoln

APPROVED BY:

DATE:

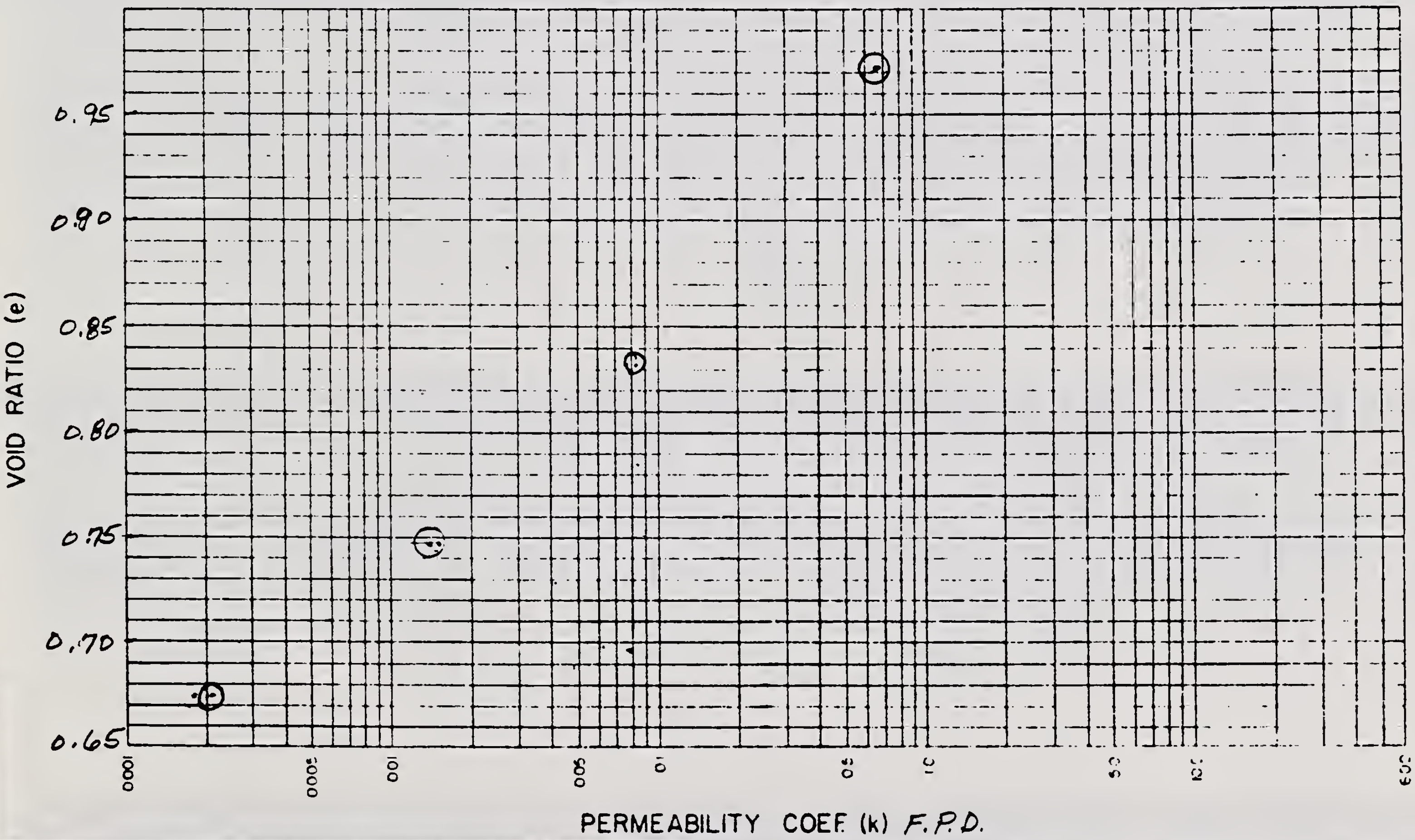
CLASSIFICATION: CL LL 32 PI 13

SPECIFIC GRAVITY

TEST NO.	1 100	2 500	3 1080	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.31	1.41	1.48	1.55
VOID RATIO	.9715	.8316	.7475	.6737
PERMEABILITY COEF F.P.D.	.68500	.08395	.01575	.00209
PERCOLATION COEF				
H/L DURING TEST				

G_s (-) #4	
G_s (+) #4	
G_m(Bulk)(+) #4	

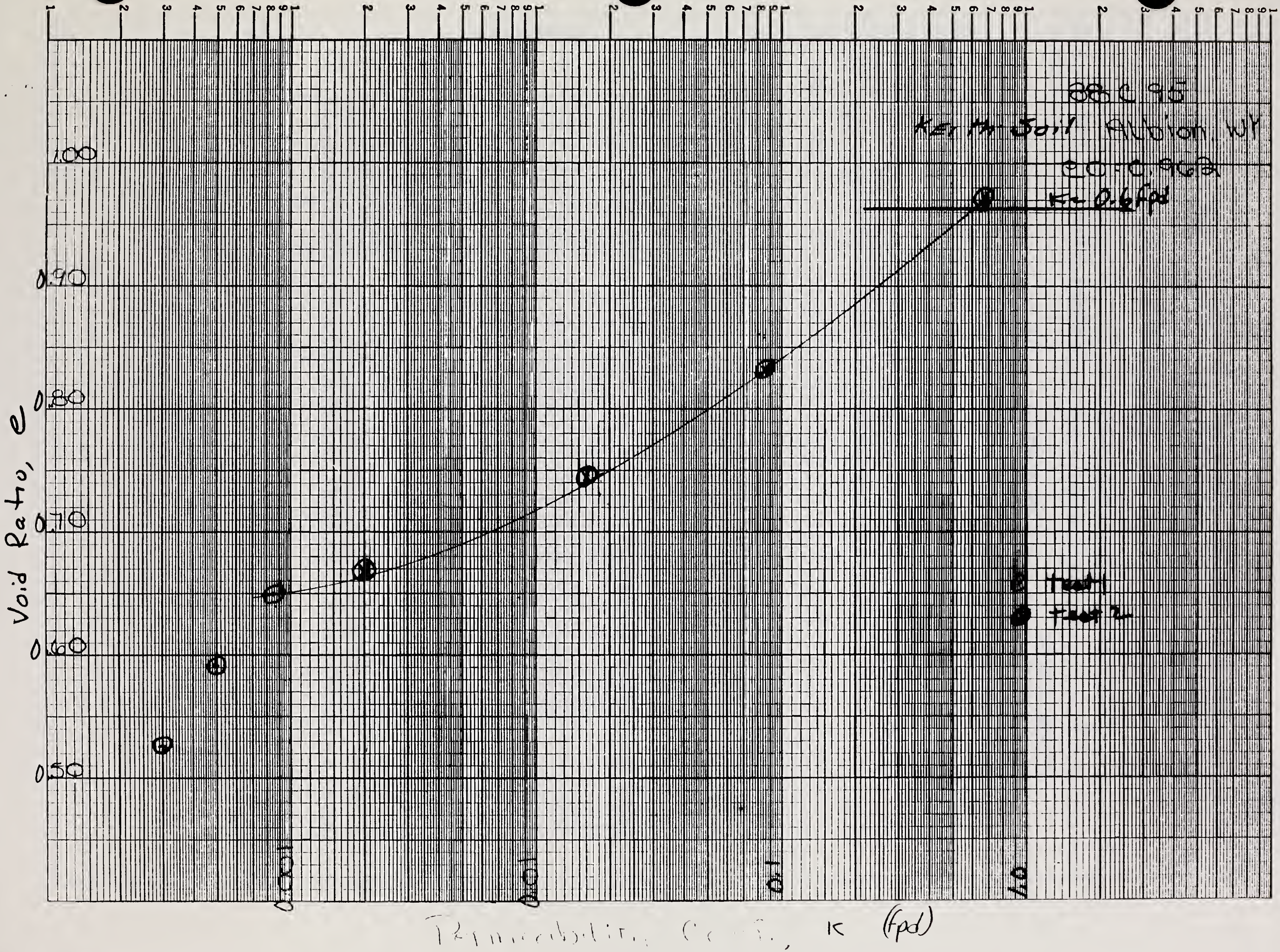
TEST SPECIFICATIONS: Falling Head Perm.



REMARKS

$e_0 = 0.962$

K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS



Test 1

SCS-ENG-127
REV. 6-72

Laboratory No. 88C 96

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE WePP- Los Banos - Fresno, CA.			SAMPLE LOCATION
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

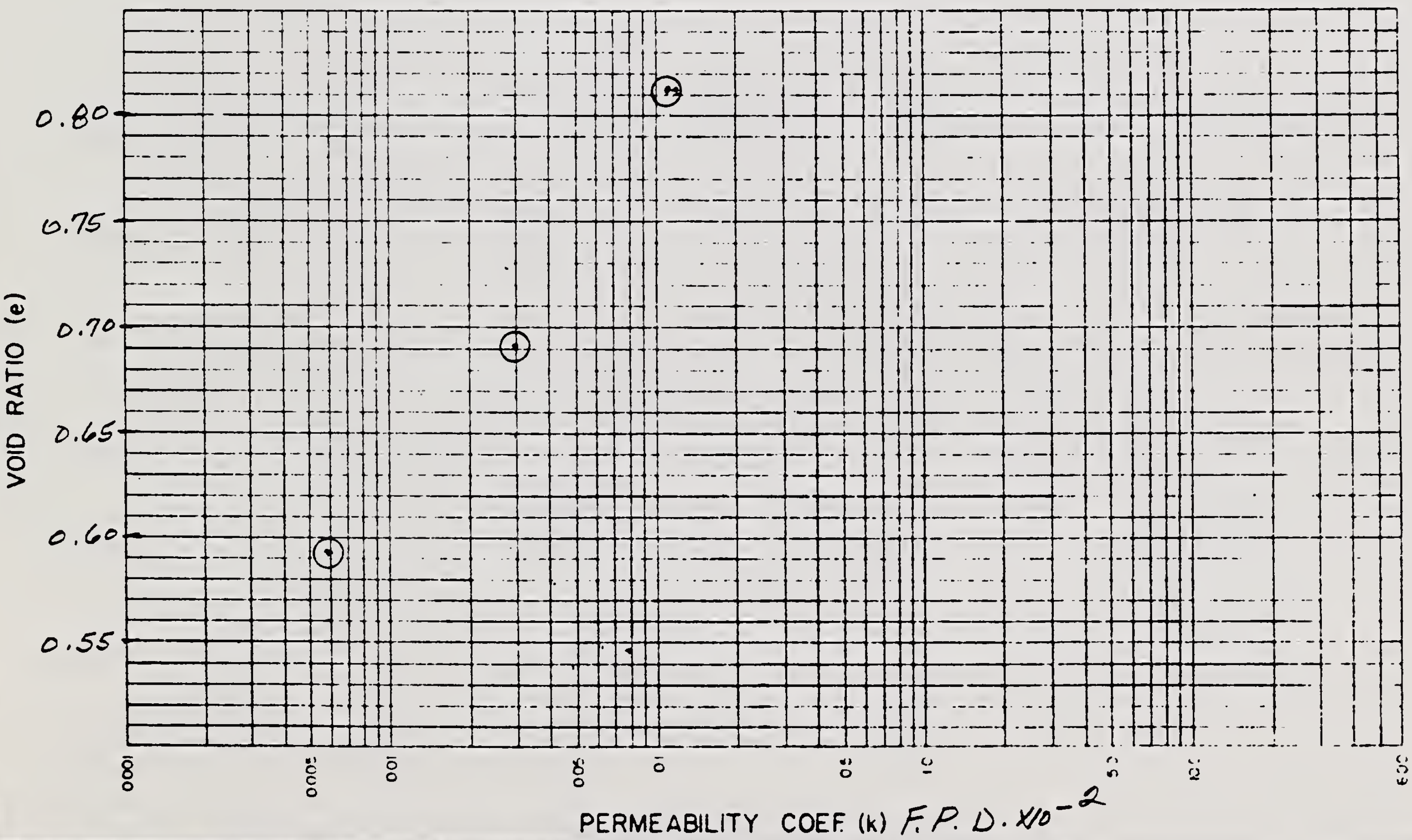
CLASSIFICATION CL LL 46 PI 25

SPECIFIC GRAVITY

TEST NO	1 2060	2 4080	3 8080	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.44	1.54	1.64	
VOID RATIO	.8133	.7003	.5922	
PERMEABILITY COEF F.P.D.	.00122	.00030	.00006	
PERCOLATION COEF				
H/L DURING TEST				

G_s (-)#4	2.61
G_s (+)#4	
G_m(Bulk)(+)#4	

TEST SPECIFICATIONS
Falling Head Perm



REMARKS

e_o = 1.61

Volume Change = 39%

Test2

SCS-ENG-127
REV. 6-72

88C 96.

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE** **SOIL CONSERVATION SERVICE**	# SOIL PERMEABILITY

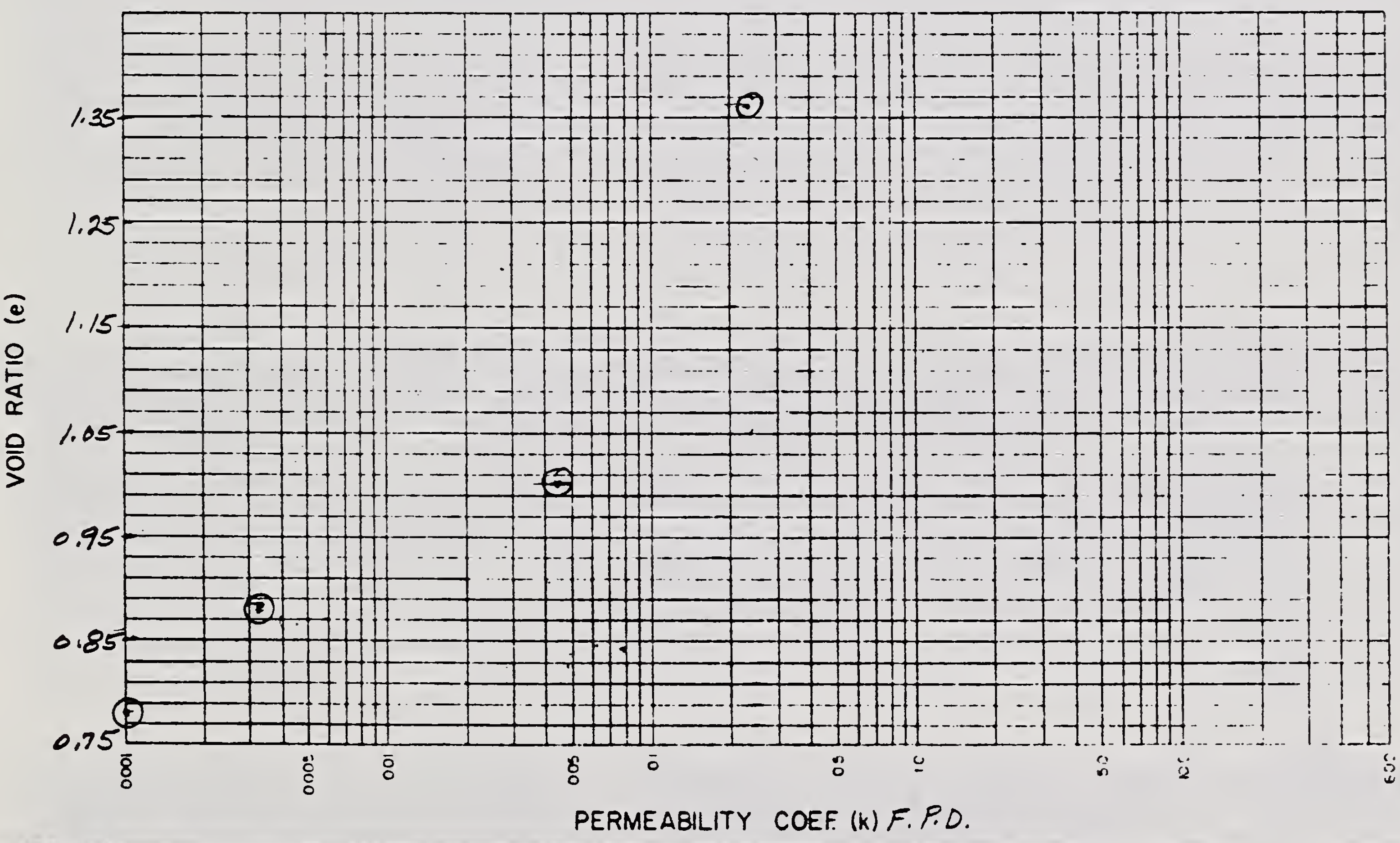
PROJECT and STATE WePP - Los Banos - Fresno, CA.		SAMPLE LOCATION
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY / DATE

CLASSIFICATION CL LL 46 PI 25

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.10	1.30	1.38	1.46
VOID RATIO	1.3613	1.0145	.8860	.7822
PERMEABILITY COEF F.P.D	.23222	.04591	.00327	.00100
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY	
G_s (-) #4	2.61
G_s (+) #4	
G_m (Bulk)(+) #4	

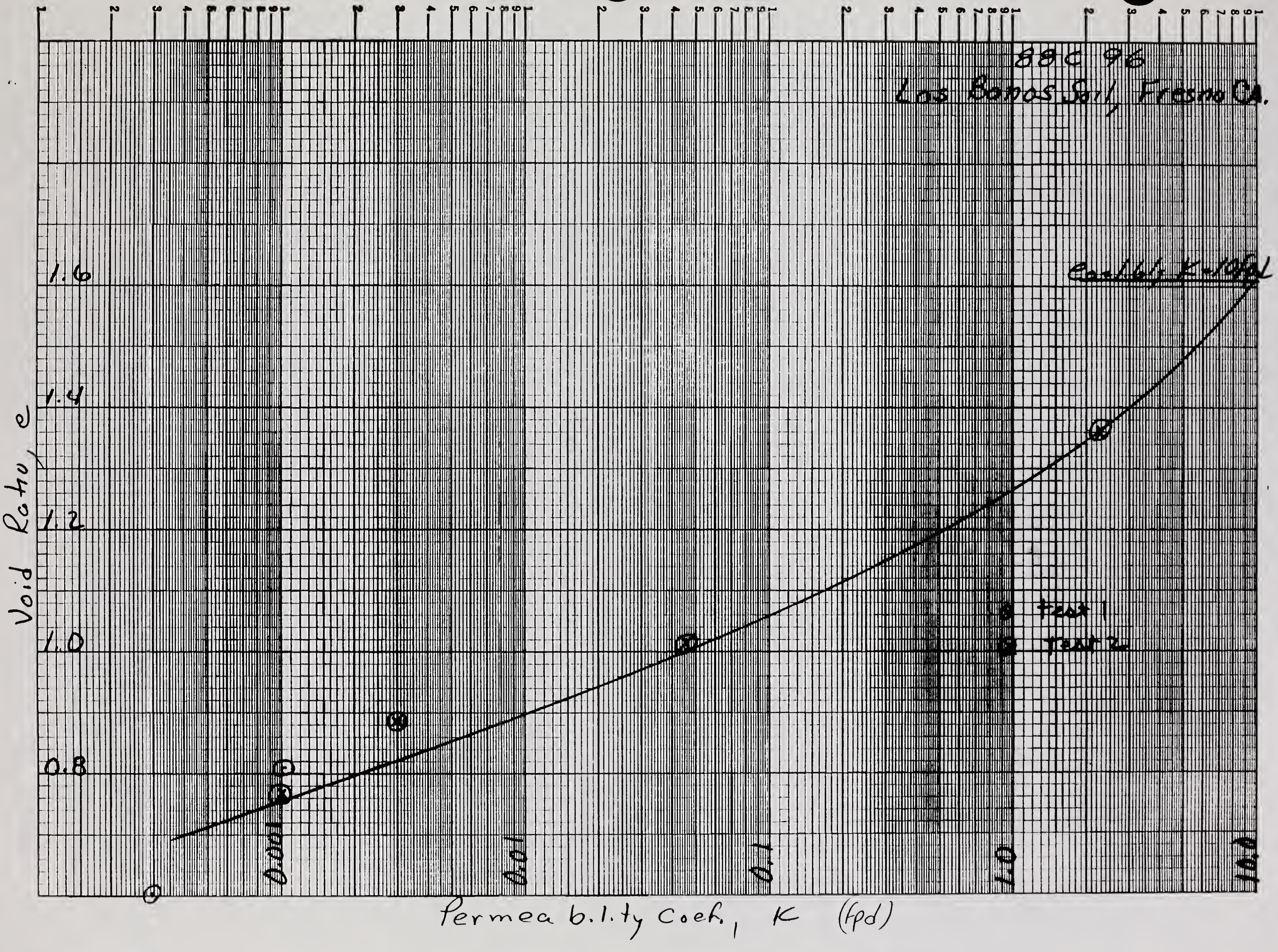
TEST SPECIFICATIONS
Falling Head Perm



REMARKS

$e_o = 1.61$

K+E SEMI-LOGARITHMIC 358-91
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS



Test 1

SCS-ENG-127
REV. 6-72

Laboratory No. 88C 97

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	# SOIL PERMEABILITY

PROJECT and STATE: WEPP - Pierre - Cottonwood, S.D.

SAMPLE LOCATION:

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: Compacted

TESTED AT: SML, Lincoln

APPROVED BY:

DATE:

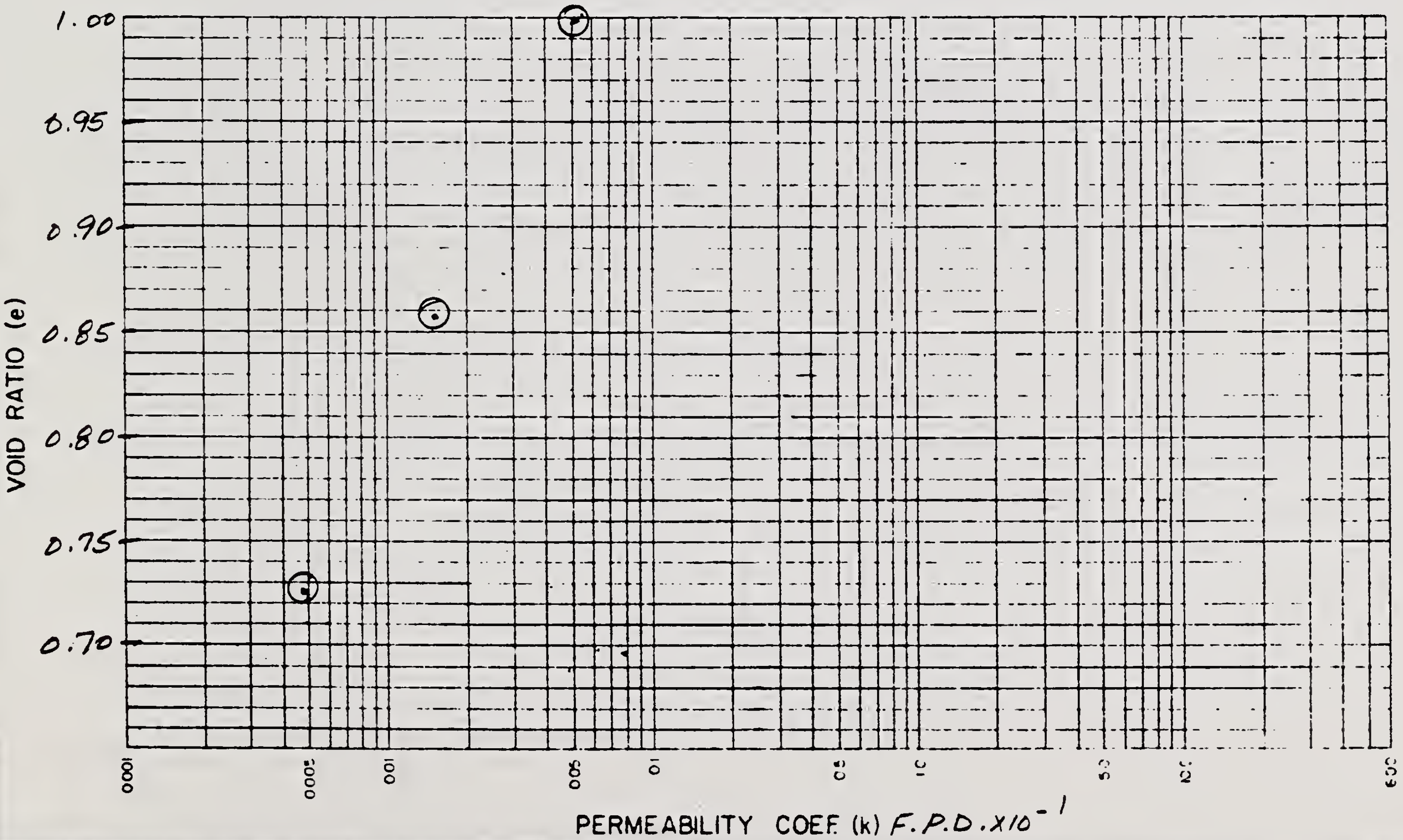
CLASSIFICATION: CH LL 52 PI 32

TEST NO.	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.36	1.46	1.57	
VOID RATIO	.9999	.8577	.7258	
PERMEABILITY COEF F.P.D.	.00518	.00160	.00049	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-) #4	2.71
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS: Falling Head Perm.



REMARKS

$e_0 = 1.581$

Test 2

SCS-ENG-127
REV. 1-72

LAB. NO. 88C97

MATERIALS TESTING REPORT | **U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE** | **SOIL PERMEABILITY**

PROJECT and STATE: Wepp- Pierre - Cottonwood, SD.
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

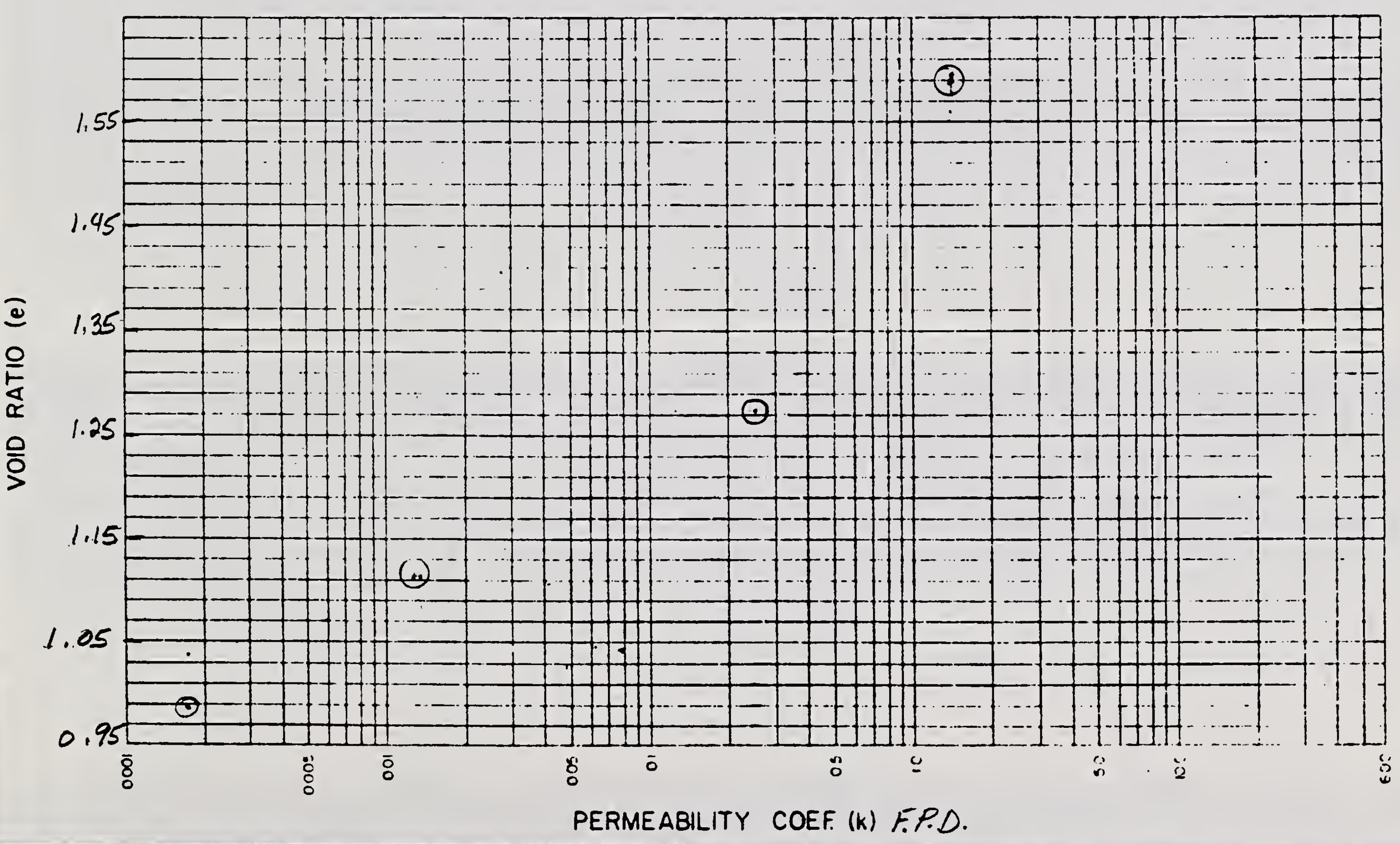
CLASSIFICATION: CH LL 52 PI 32

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.04	1.19	1.28	1.37
VOID RATIO	1.5976	1.2719	1.1168	.9836
PERMEABILITY COEF F.P.D.	1.5267	.25252	.01389	.00175
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

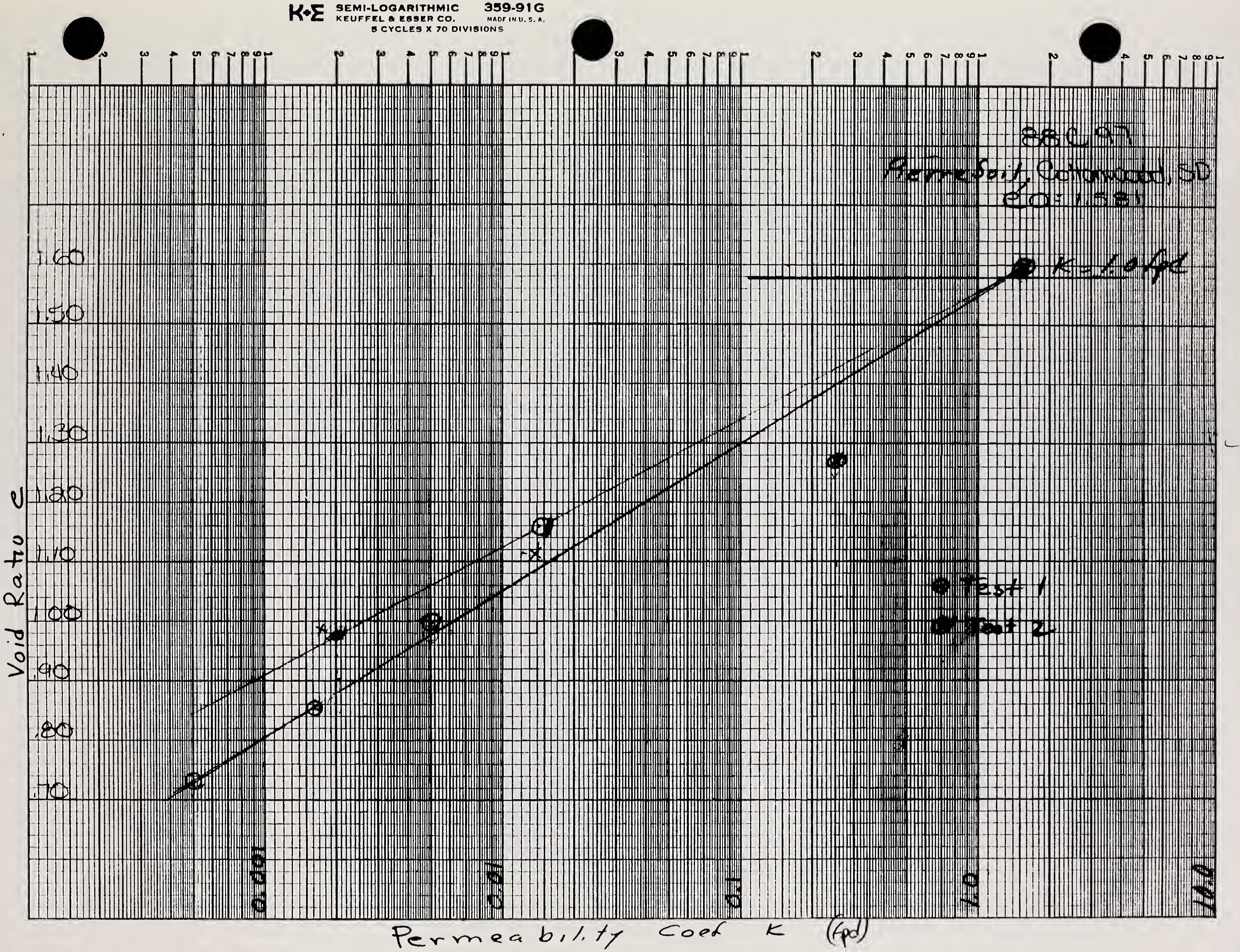
G_s (-)#4	2.71
G_s (+)#4	
G_m(Bulk)(+)#4	

TEST SPECIFICATIONS
Falling Head Perm.



REMARKS

$e_0 = 1.581$

K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS
88C97
Pierre Soil, Cottonwood, SD
e_0 = 1.581
K = 1.0 fpd
Test 1
Test 2
Void Ratio e
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
0.001
0.01
0.1
1.0
10.0
Permeability Coef K (fpd)

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C9B

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE: WePP - PaLouse - Pullman, Wa.
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

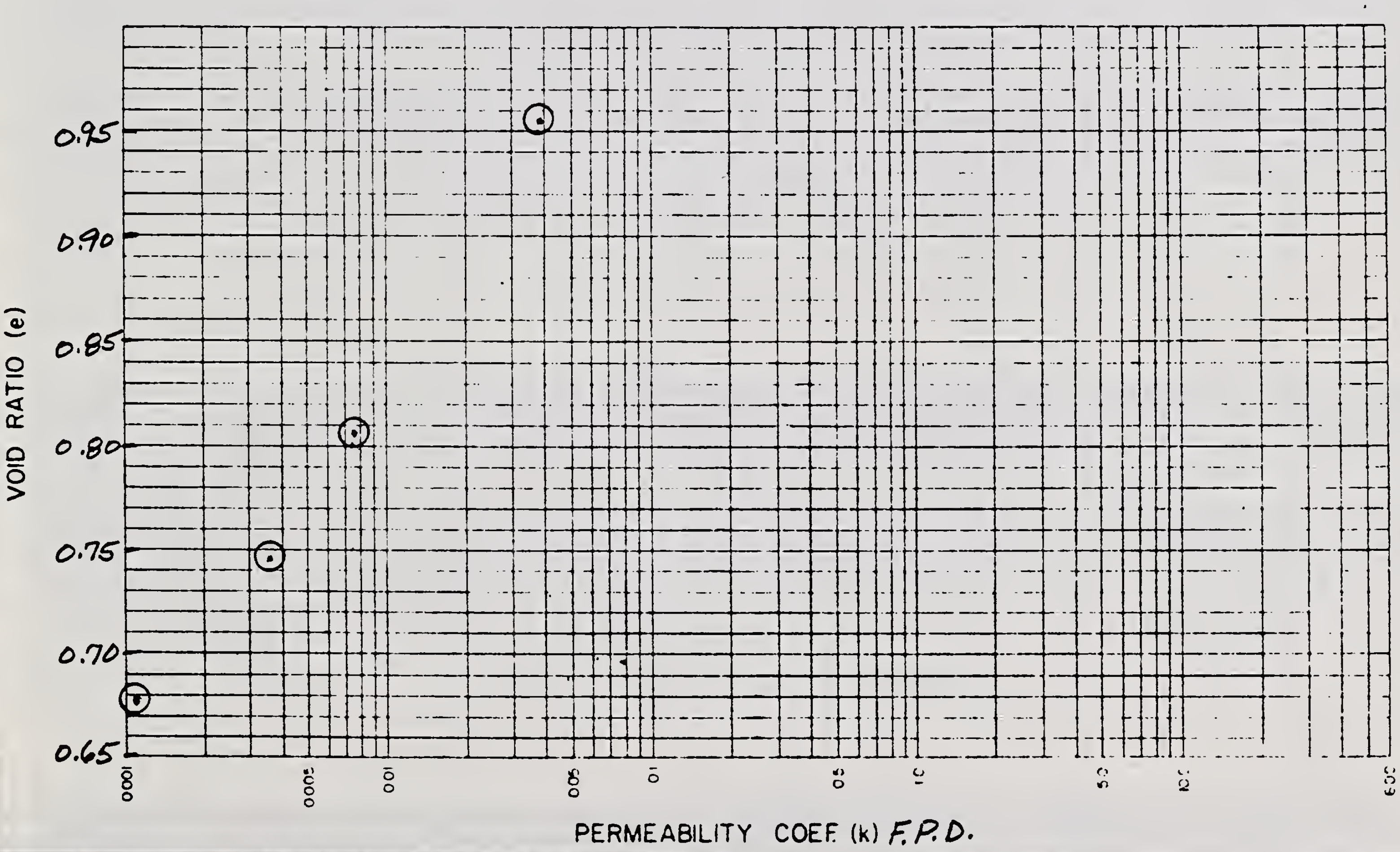
CLASSIFICATION: CL LL 31 PI 13

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.35	1.46	1.51	1.57
VOID RATIO	.9552	.8083	.7459	.6797
PERMEABILITY COEF F.P.D.	.03979	.00753	.00364	.00118
PERCOLATION COEF				
H/L DURING TEST				

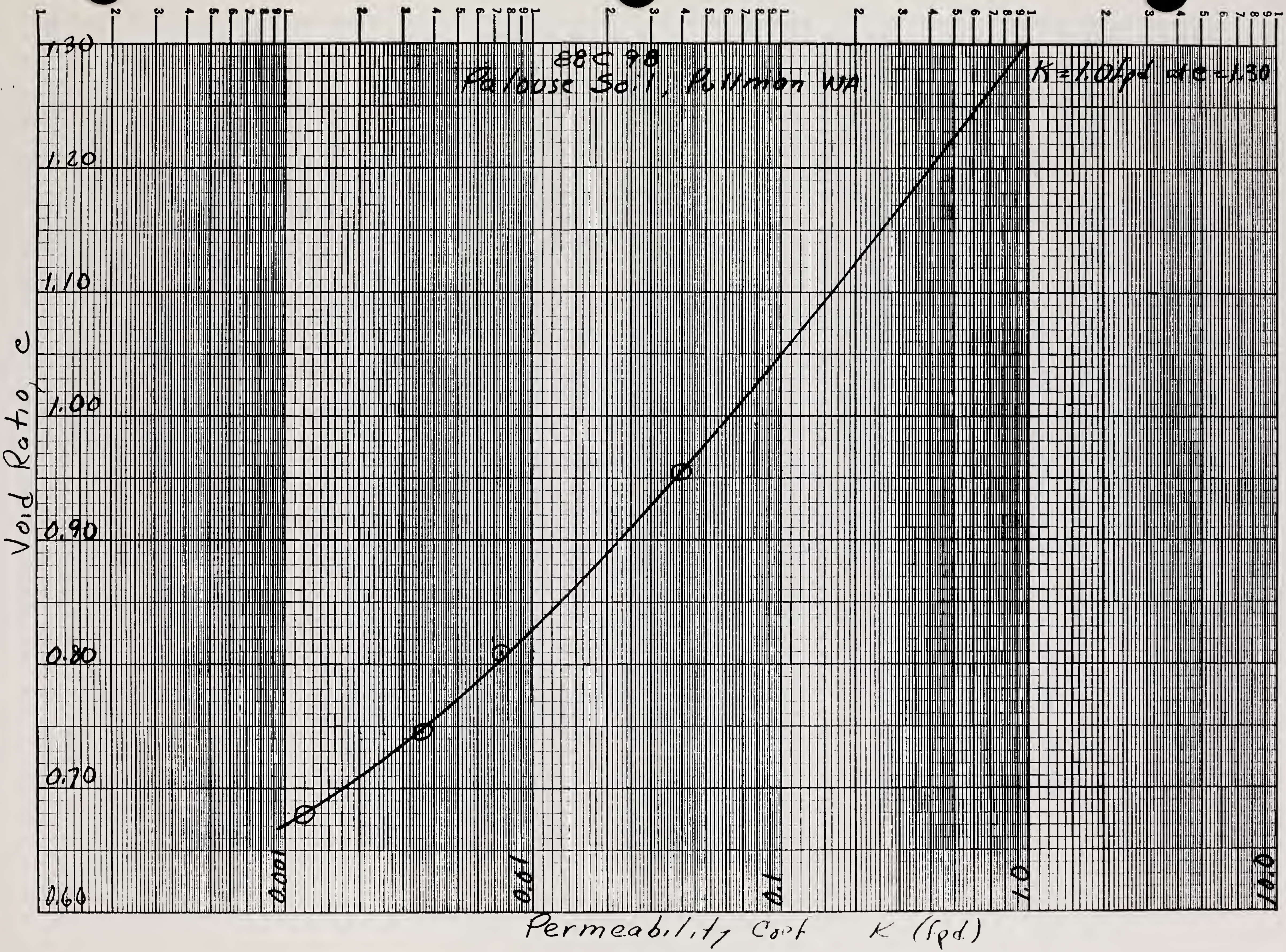
SPECIFIC GRAVITY

G_s (-) #4	2.64
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS
Falling Head Perm.



REMARKS


88C98
Palouse Soil, Pullman WA.
K=1.0fpd at e=1.30
Void Ratio, e
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.001
0.01
0.1
1.0
10.0
Permeability Coef K (fpd)

SCS-ENG-127
REV. 6-72

Laboratory No. 88C 9.9

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE WEPP Portneuf Kimberly ID.			SAMPLE LOCATION Portneuf - Kimberly, ID.
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

CLASSIFICATION

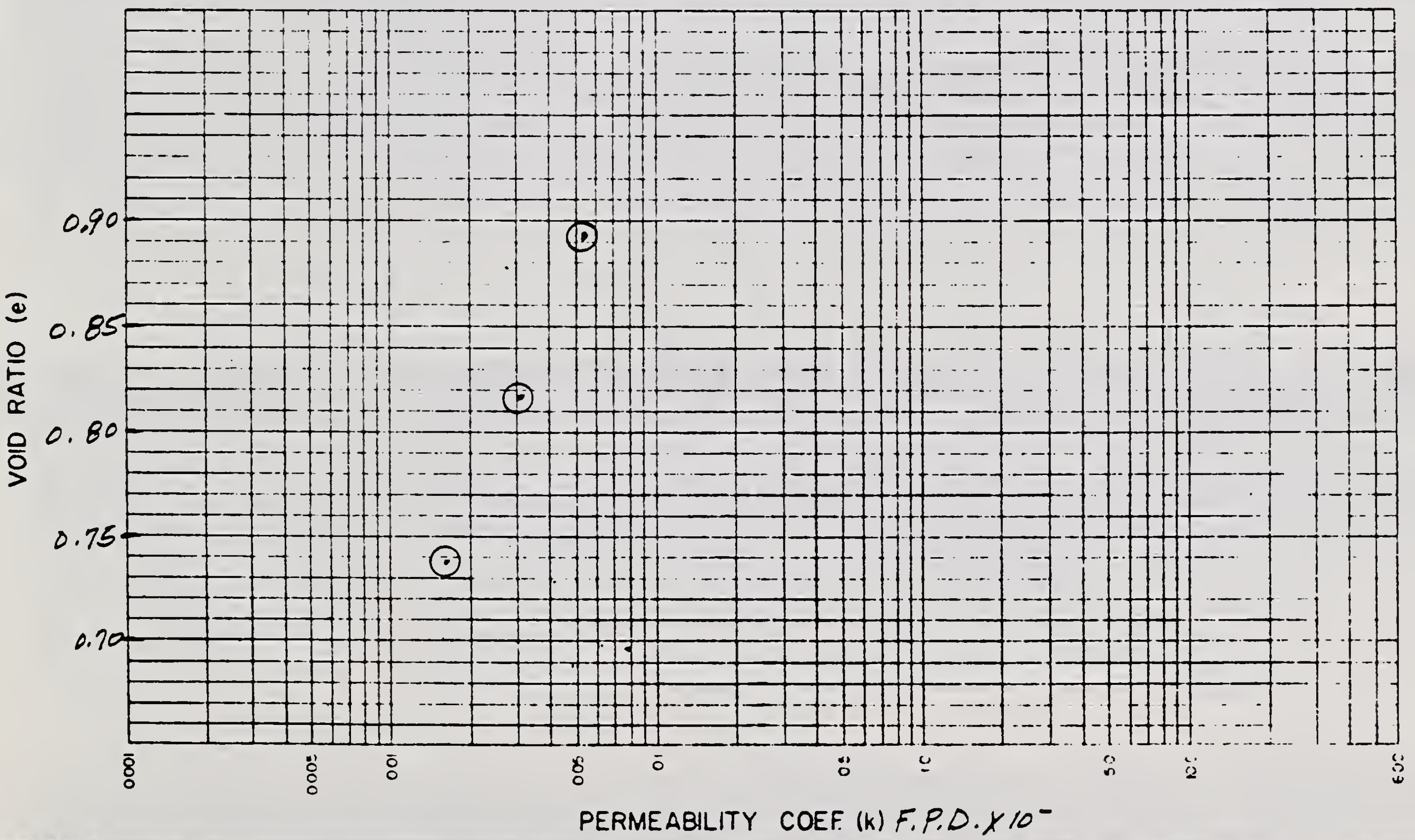
CL-ML LL 28 PI 4

TEST NO.	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.40	1.46	1.53	
VOID RATIO	.8939	.8167	.7386	
PERMEABILITY COEF F.P.D.	.05286	.03103	.01742	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-)#4	2.66
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS
Falling Head Perm.

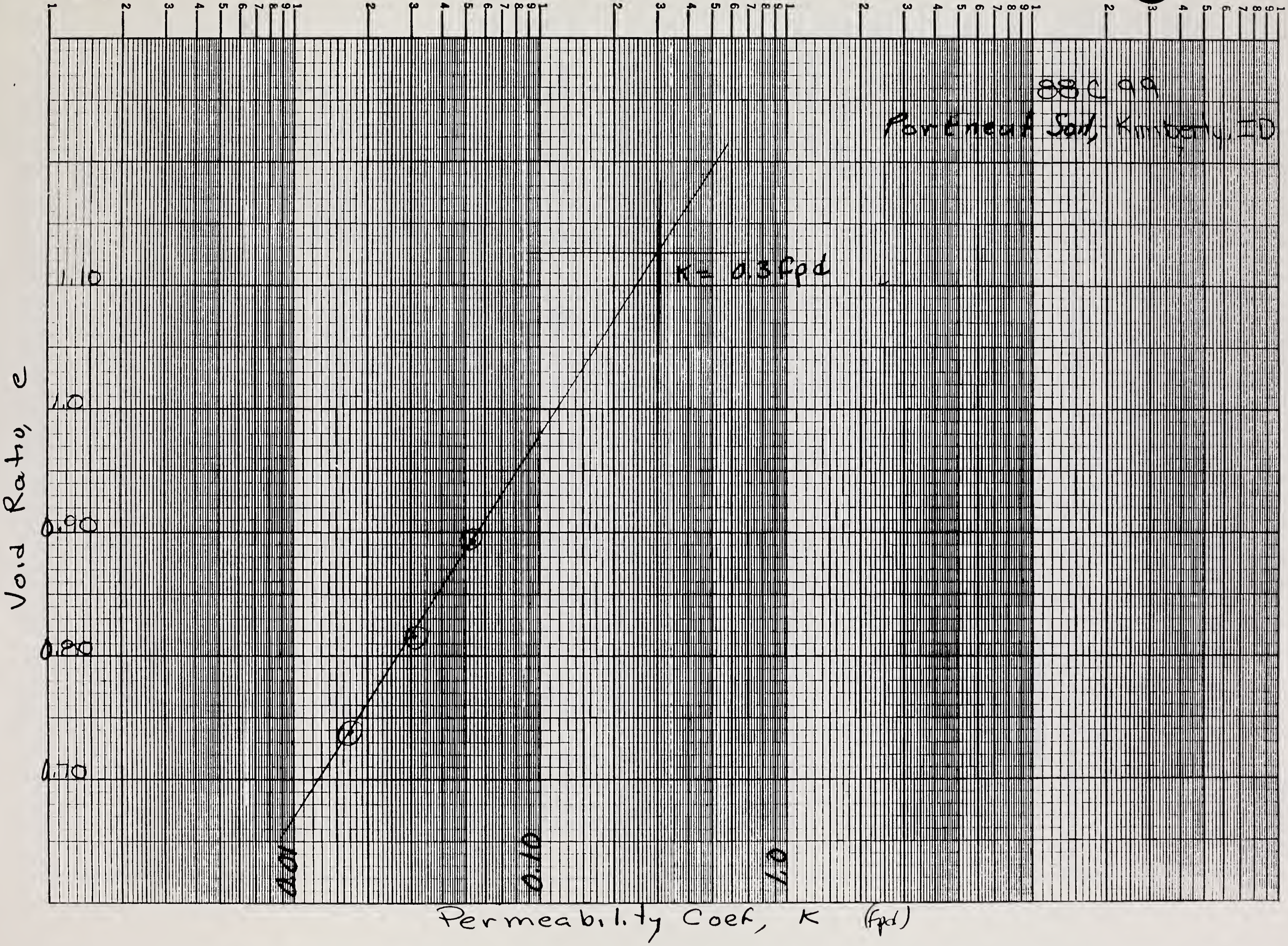


REMARKS

e_0 = 1.127

Volume Change = 18.3%

K at e_0 =


88C99
Portneuf Soil, Kimberly, ID
K = 0.3 fpd
1.10
1.0
0.90
0.80
0.70
Void Ratio, e
0.01
0.10
1.0
Permeability Coef, K (fpd)

Test 1

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 100

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE: WePP - SHarpsBurg, Lincoln, Ne
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

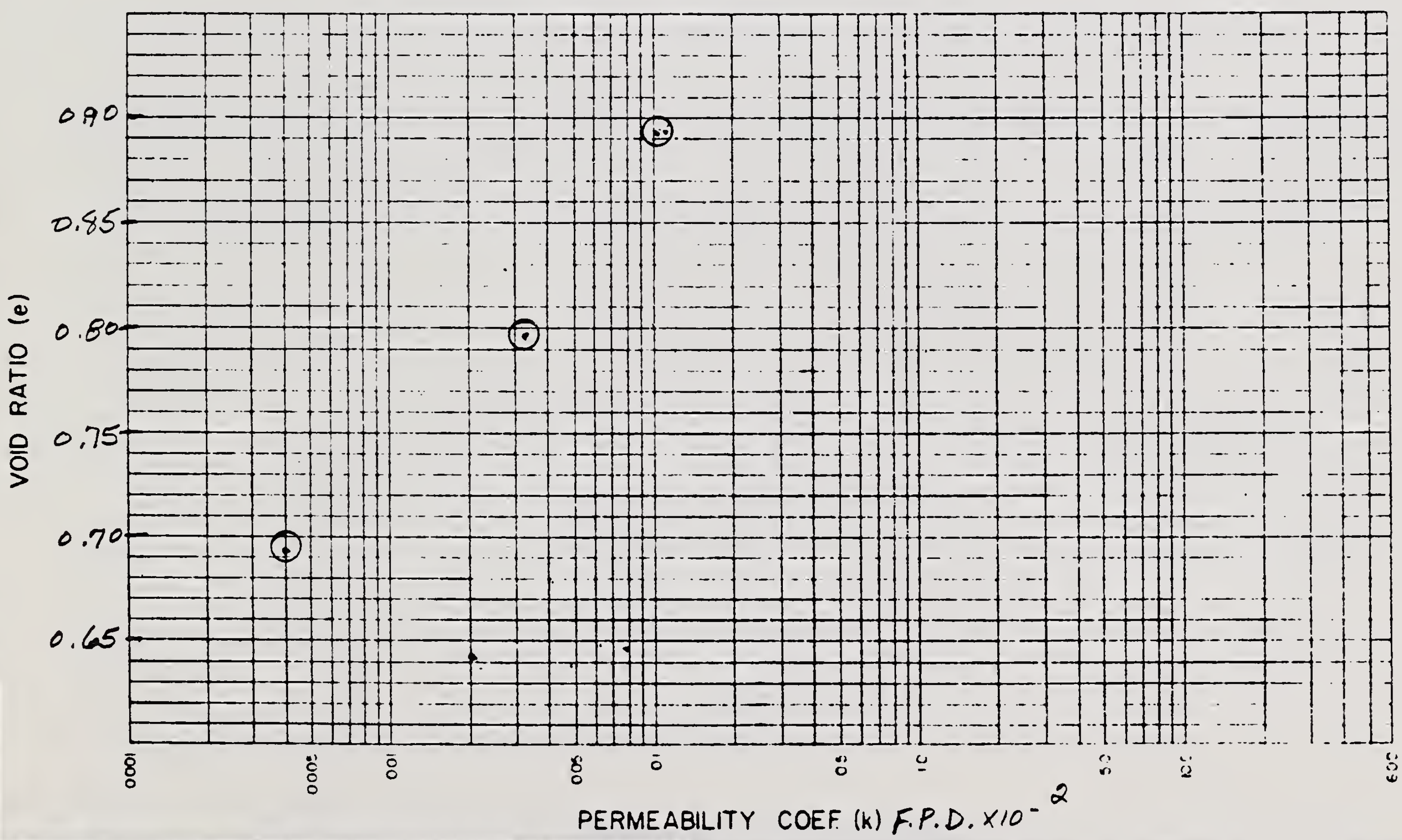
CLASSIFICATION: CL LL 49 PI 30

TEST NO.	1 2000	2 4800	3 8800	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.39	1.46	1.55	
VOID RATIO	.8945	.7976	.6922	
PERMEABILITY COEF F.P.D.	.00116	.00032	.00004	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-)#4	2.63
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS
Falling Head Perm



REMARKS

e_0 = 1.307

Test 2

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 100

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE WePP - SHarpsburg - Lincoln, Ne		SAMPLE LOCATION	
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

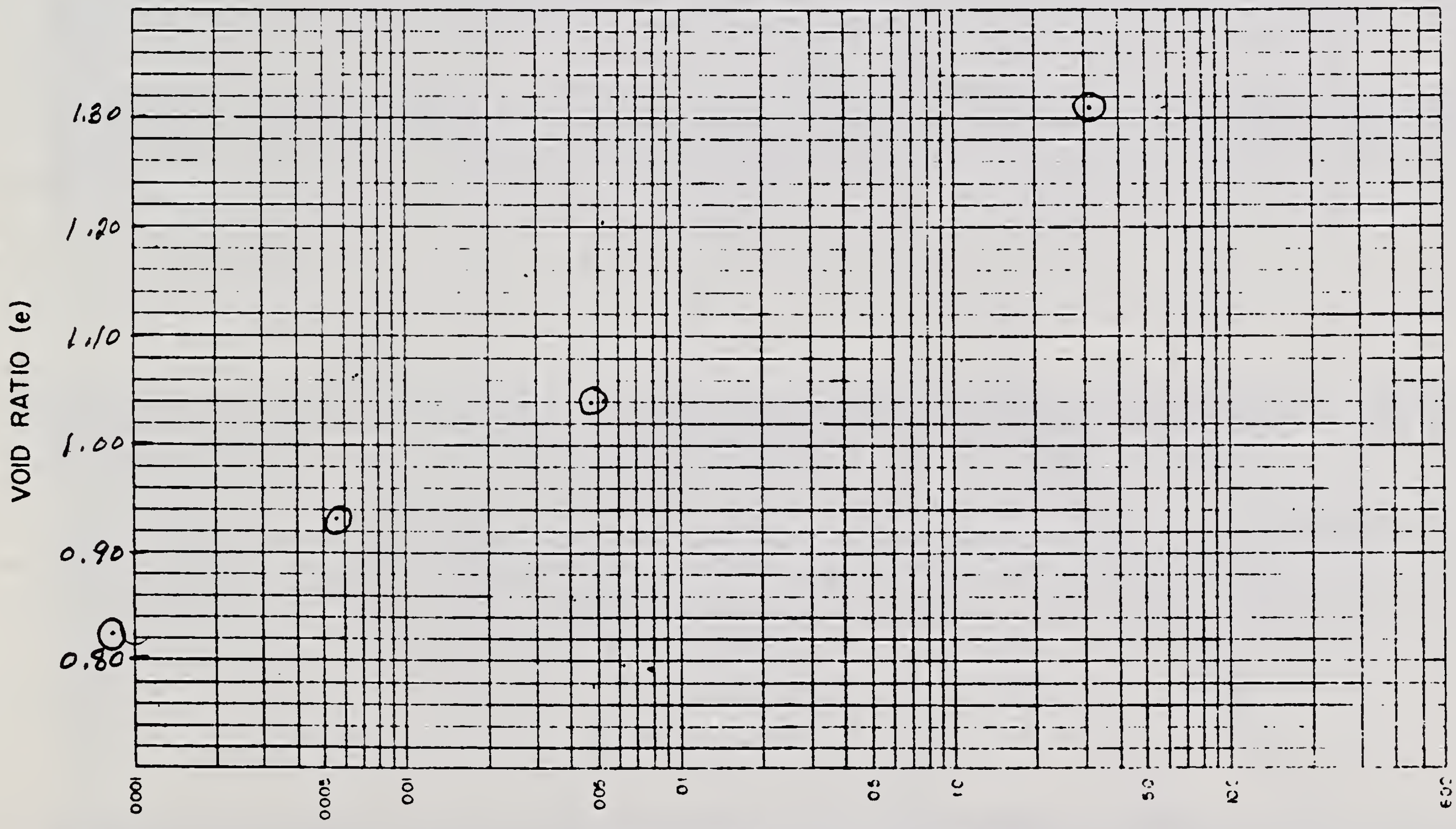
CLASSIFICATION CL LL 49 PI 30

SPECIFIC GRAVITY

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.14	1.29	1.36	1.44
VOID RATIO	1.3084	1.0424	.9307	.8222
PERMEABILITY COEF F.P.D.	5.7984	.05329	.00685	.00104
PERCOLATION COEF				
H/L DURING TEST				

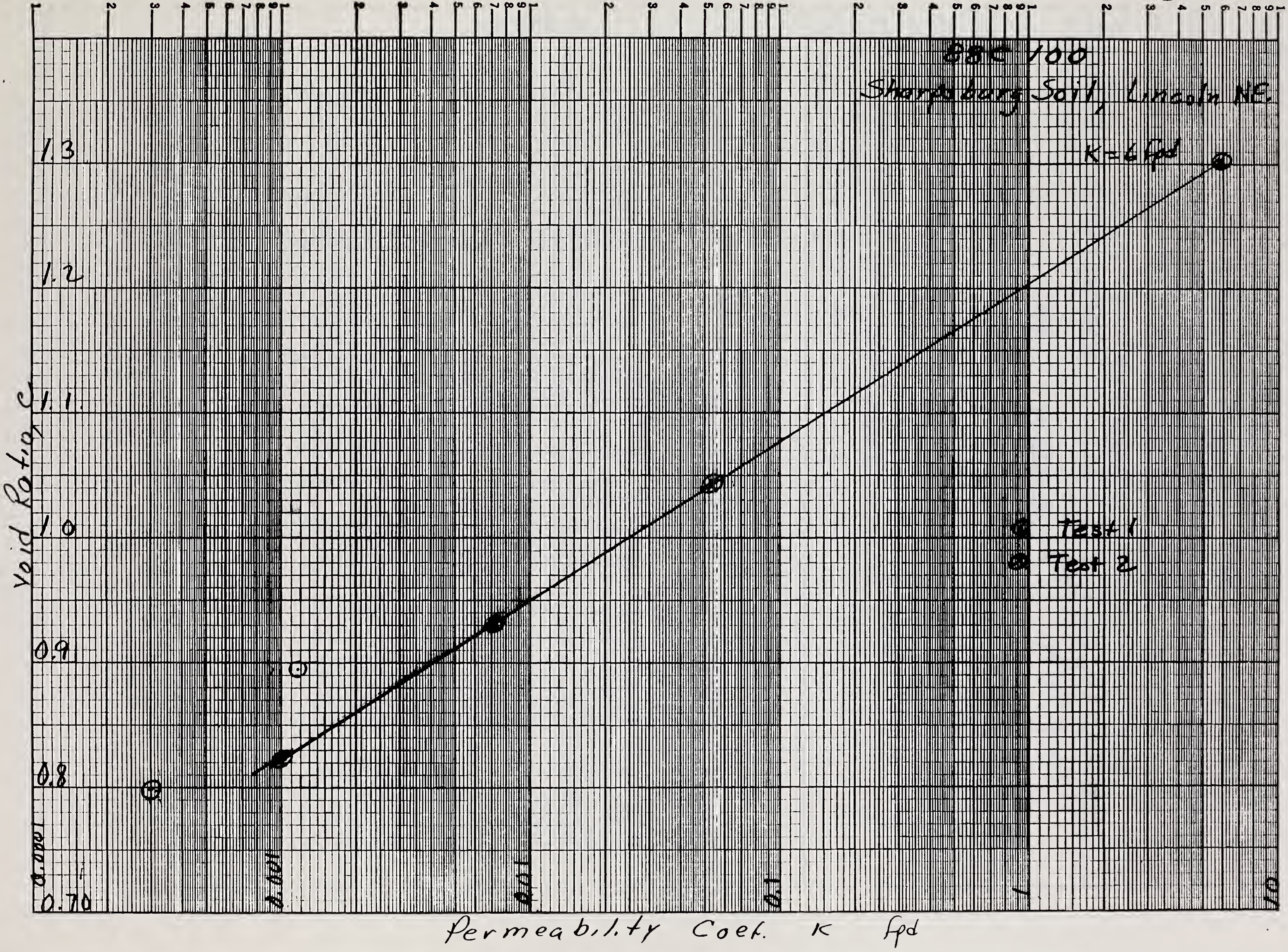
G_s (-)#4	2.63
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS
Falling Head Perm



REMARKS

e_o = 1.307


BBC 100
Sharpsburg Soil, Lincoln NE.
K=6 fpd
Test 1
Test 2
1.3
1.2
1.1
1.0
0.9
0.8
0.70
Void Ratio, e
0.0001
0.001
0.01
0.1
1
10
Permeability Coef. K fpd

Test 1

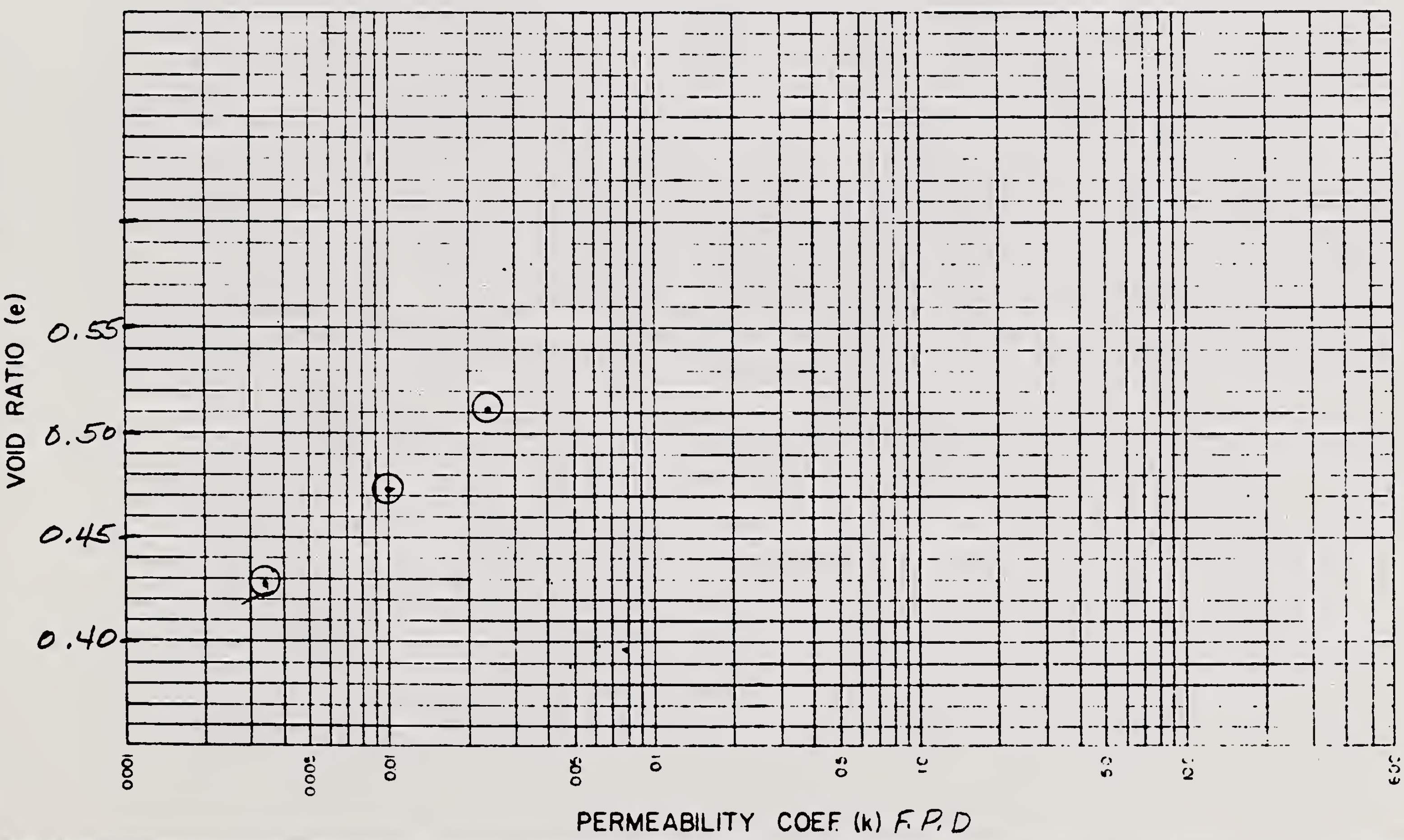
SCS-ENG-127
REV. 1-72

LABORATORY NO. 88C 101

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE WePP - Sverdrup, Morris, MN.				SAMPLE LOCATION
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN		
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY		DATE

CLASSIFICATION	SC	LL 25 PI 9			SPECIFIC GRAVITY	
TEST NO.	2000	2 4000	3 8000	4	G_s (-)#4	2.63
INITIAL MOISTURE %					G_s (+)#4	
DRY DENSITY ☐ g/cc ☐ pcf	1.74	1.79	1.84		G_m(Bulk)(+) #4	
VOID RATIO	.5104	.4715	.4291		TEST SPECIFICATIONS Falling Head Perm.	
PERMEABILITY COEF F.P.D.	.02443	.01039	.00343			
PERCOLATION COEF						
H/L DURING TEST						



REMARKS

e_o = 0.801

Volume change = 20.7%

K at e_o =

Test 2

SCS-ENG-127
REV. 1-72

88C101

MATERIALS TESTING REPORT | U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE | SOIL PERMEABILITY

PROJECT and STATE WePP - Sverdrup - Morris, MN.			SAMPLE LOCATION
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

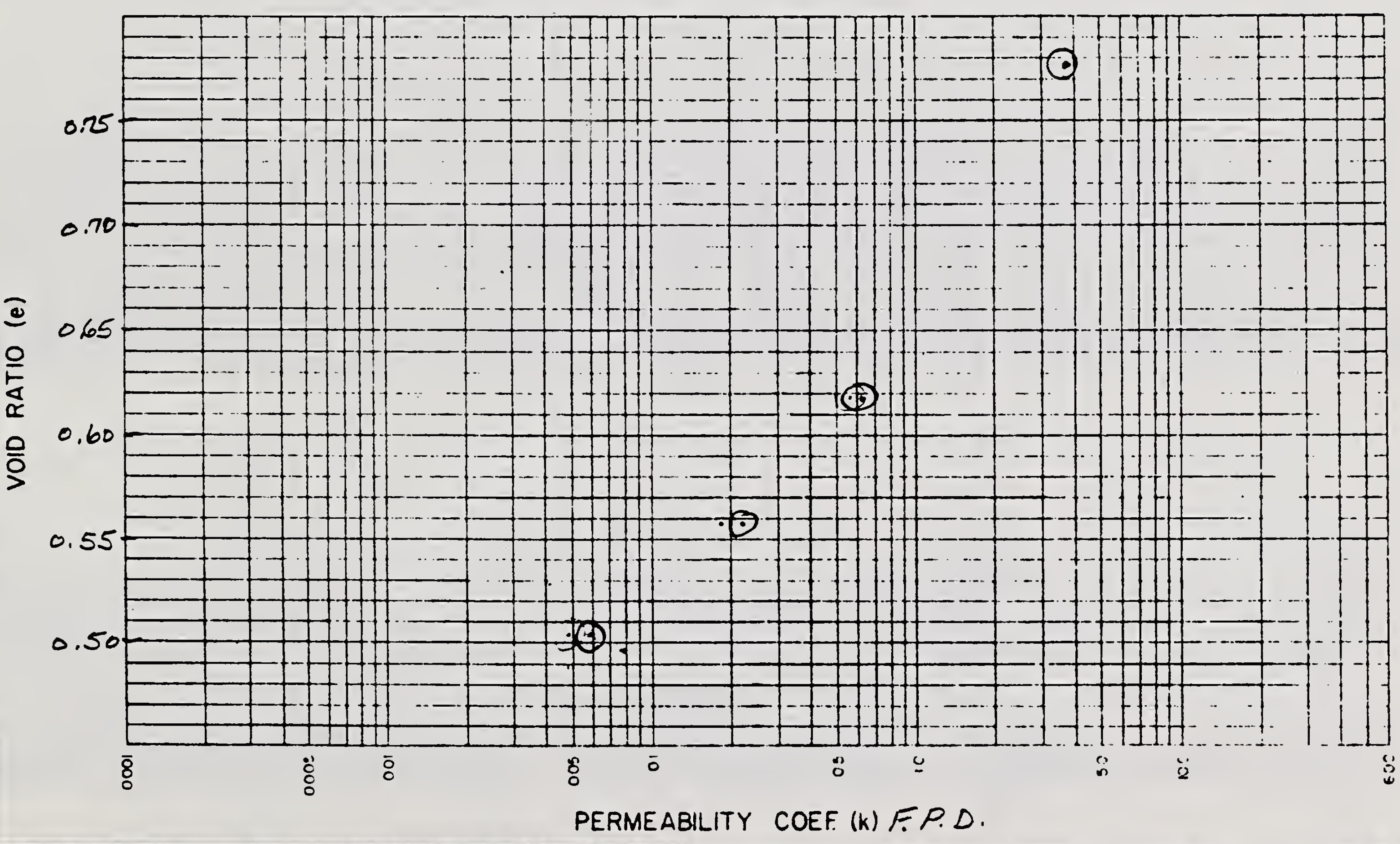
CLASSIFICATION SC LL 25 PI 9

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.48	1.62	1.69	1.75
VOID RATIO	.7777	.6195	.5588	.5032
PERMEABILITY COEF F.P.D.	3.7722	.6268	.21954	.05891
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

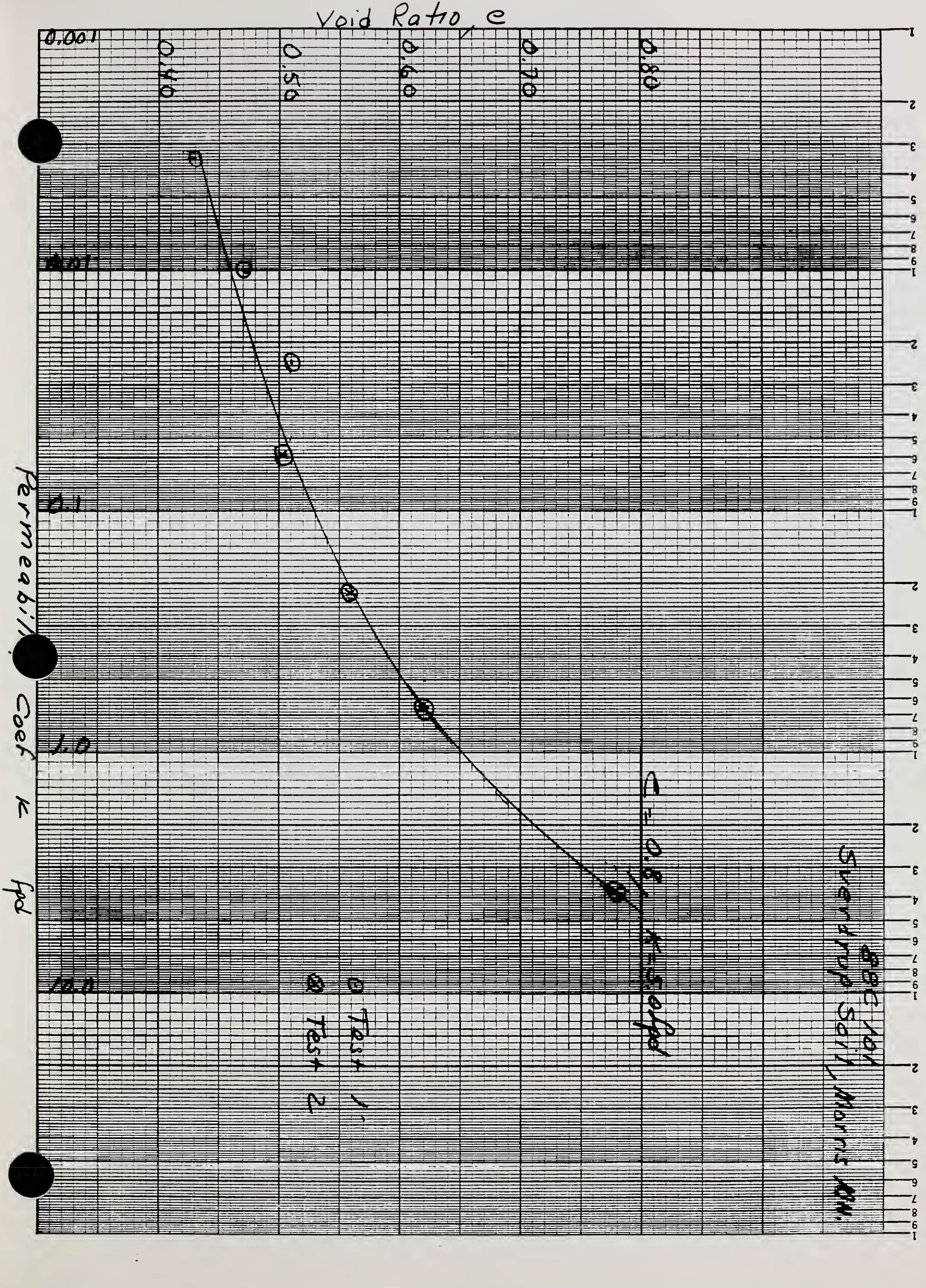
G_s (-)#4	2.63
G_s (+)#4	
G_m(Bulk)(+)#4	

TEST SPECIFICATIONS
Falling Head Perm



REMARKS

$e_0 = 0.801$


Void Ratio, e
0.40
0.50
0.60
0.70
0.80
0.001
0.01
0.1
1.0
10.0
Permeability Coef k fpd
e = 0.8
k = 5.0 fpd
SBC 101
Sverdrup Soil, Morris MN.
⊙ Test 1
⊗ Test 2

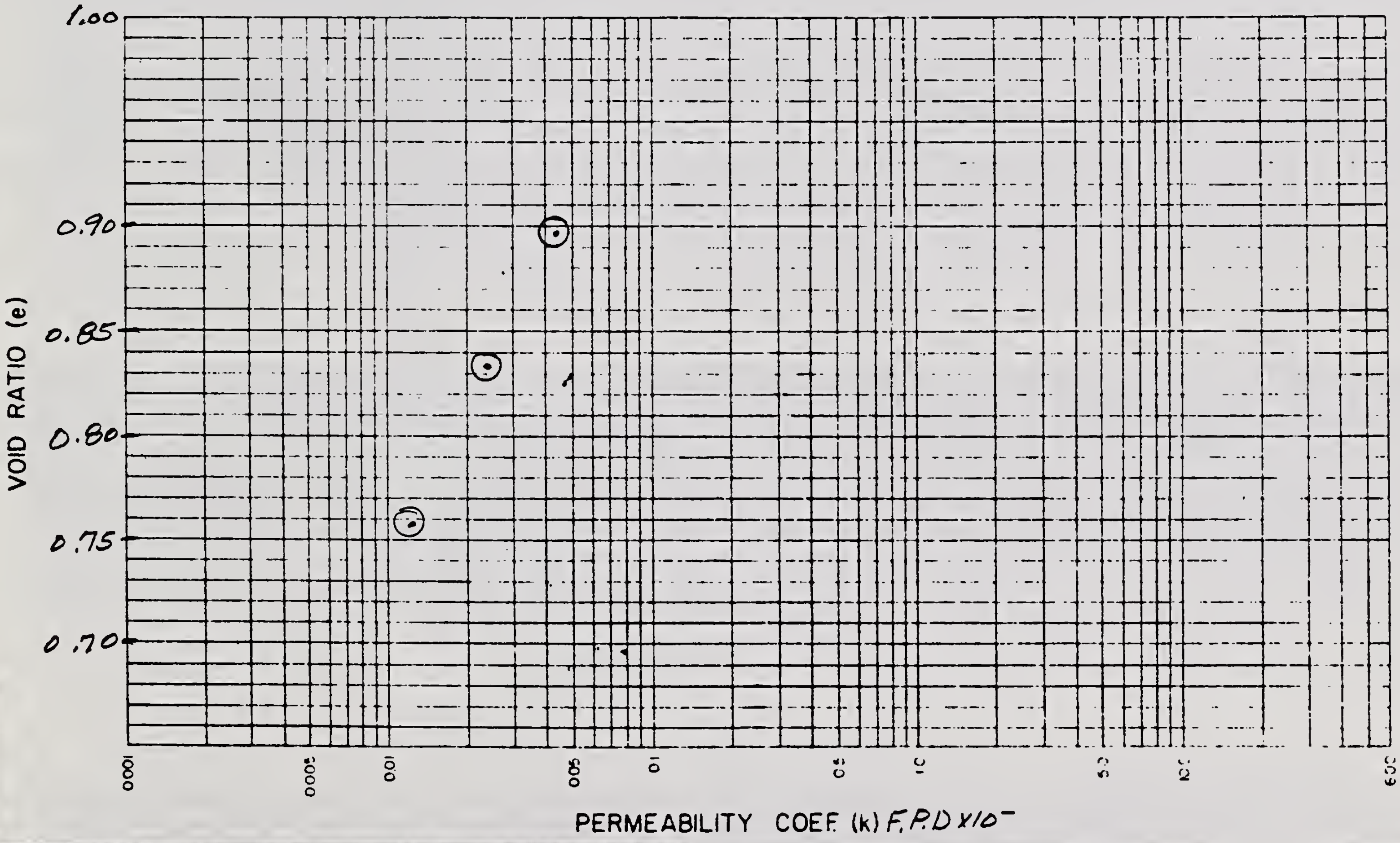
SCS-ENG-127
REV. 1-72

LABORATORY NO. 88C 102

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE WePP- Walla Walla - Pullman, WA.			SAMPLE LOCATION
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

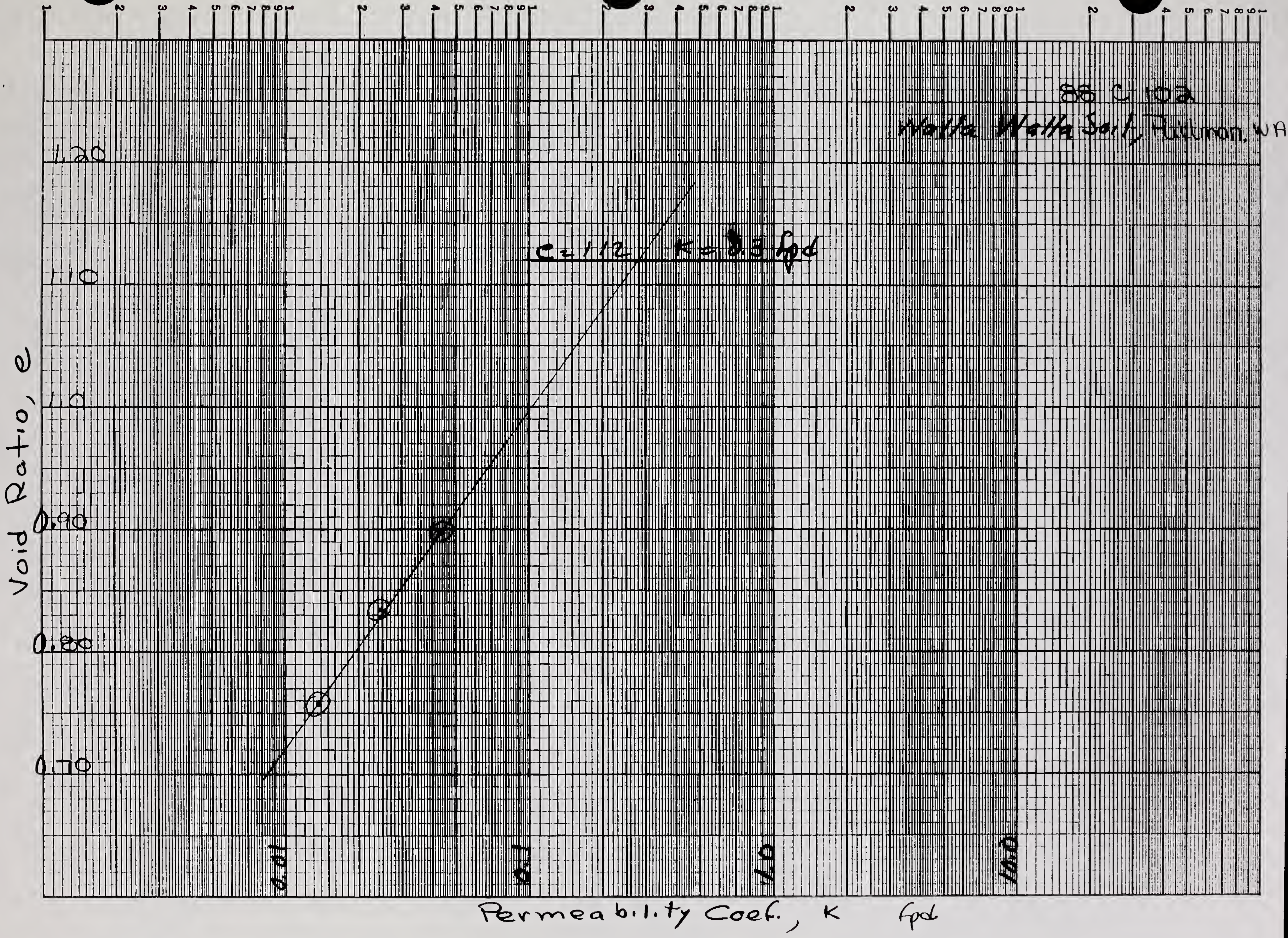
CLASSIFICATION CL - ML LL 28 PI 4					SPECIFIC GRAVITY	
TEST NO.	1 2000	2 4800	3 8800	4	G_s (-)#4	2.65
INITIAL MOISTURE %					G_s (+)#4	
DRY DENSITY ☐ g/cc ☐ pcf	1.40	1.45	1.51		G_m(Bulk)(+) #4	
VOID RATIO	.8969	.8320	.7589		TEST SPECIFICATIONS Falling Head Perm.	
PERMEABILITY COEF F.P.D.	.04369	.02458	.01389			
PERCOLATION COEF						
H/L DURING TEST						



REMARKS

$e_0 = 1.12$

K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS



Test 1

SCS-ENG-127
REV. 6-72

LABORATORY NO. 882103

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE: WePP Whitney - Fresno, CA.
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

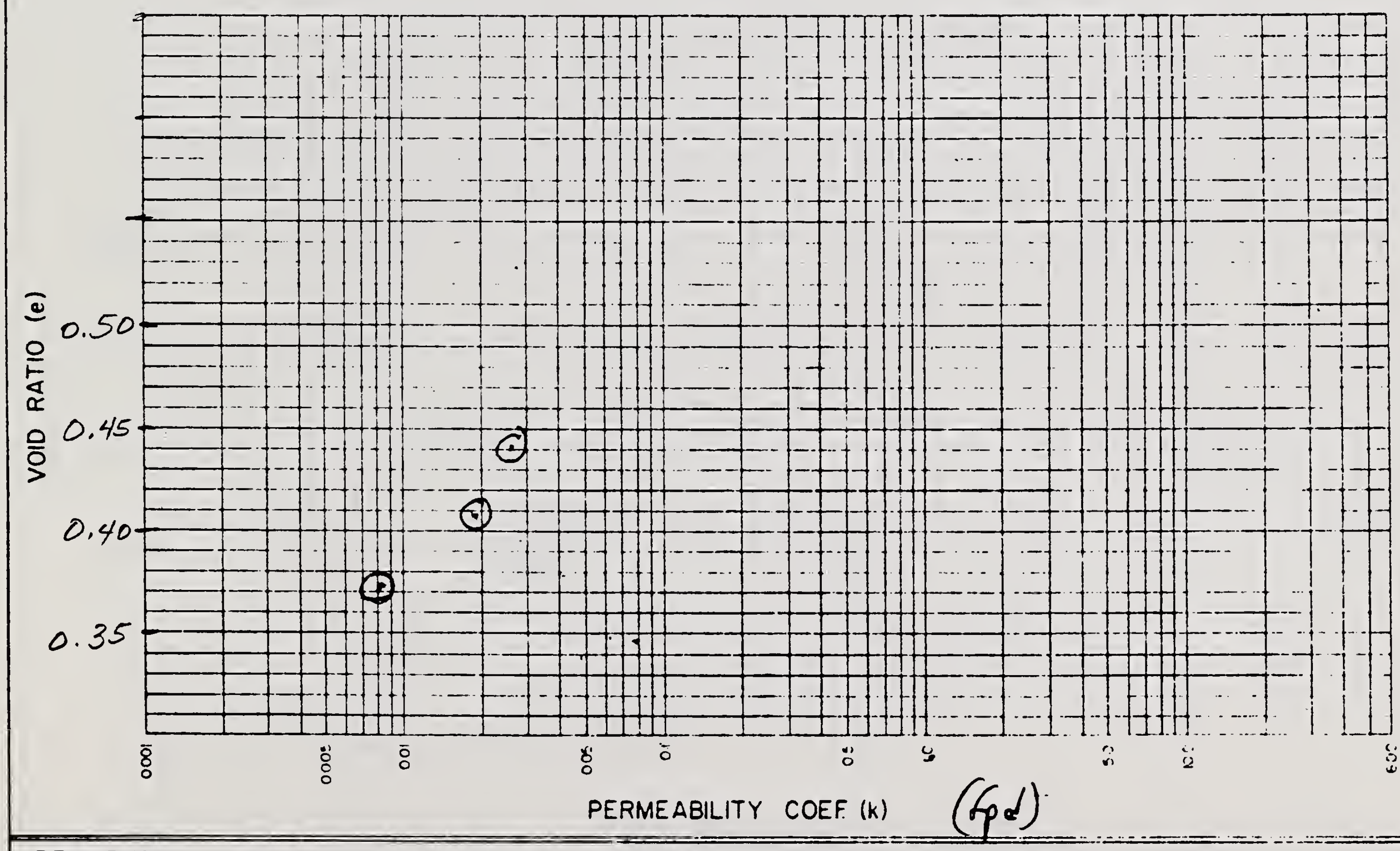
CLASSIFICATION: NoNe Plastic SM LL___ PI___

TEST NO	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.85	1.90	1.95	
VOID RATIO	.4402	.4080	.3709	
PERMEABILITY COEF F.P.D.	.02646	.01906	.00836	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-)#4	2.67
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS: FAlling Head Perm.



REMARKS

e₀ = 0.734

Volume Change = 20.9%

Test 2

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 103

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

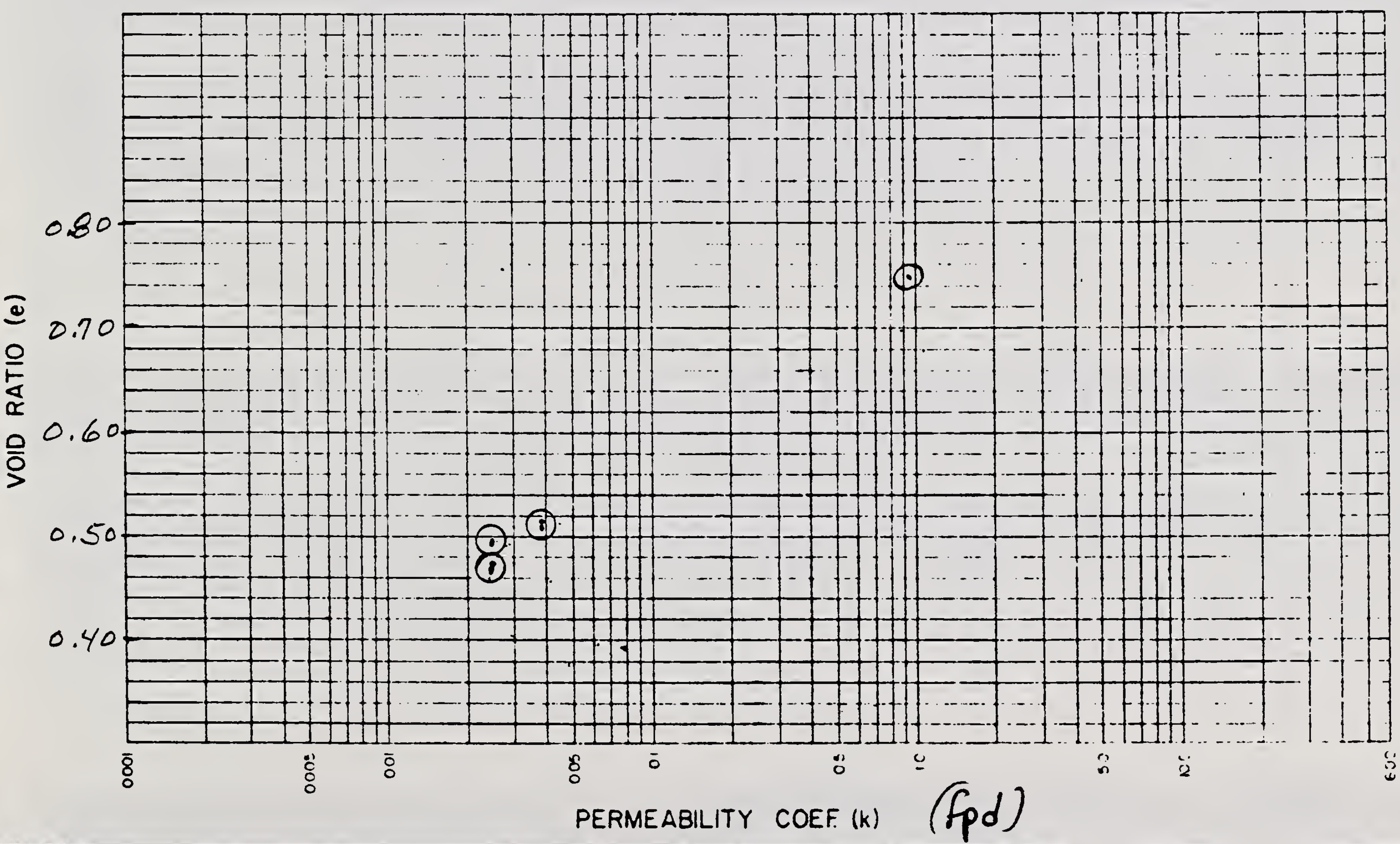
PROJECT and STATE WePP - Fresno, CA.	SAMPLE LOCATION

FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN

TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

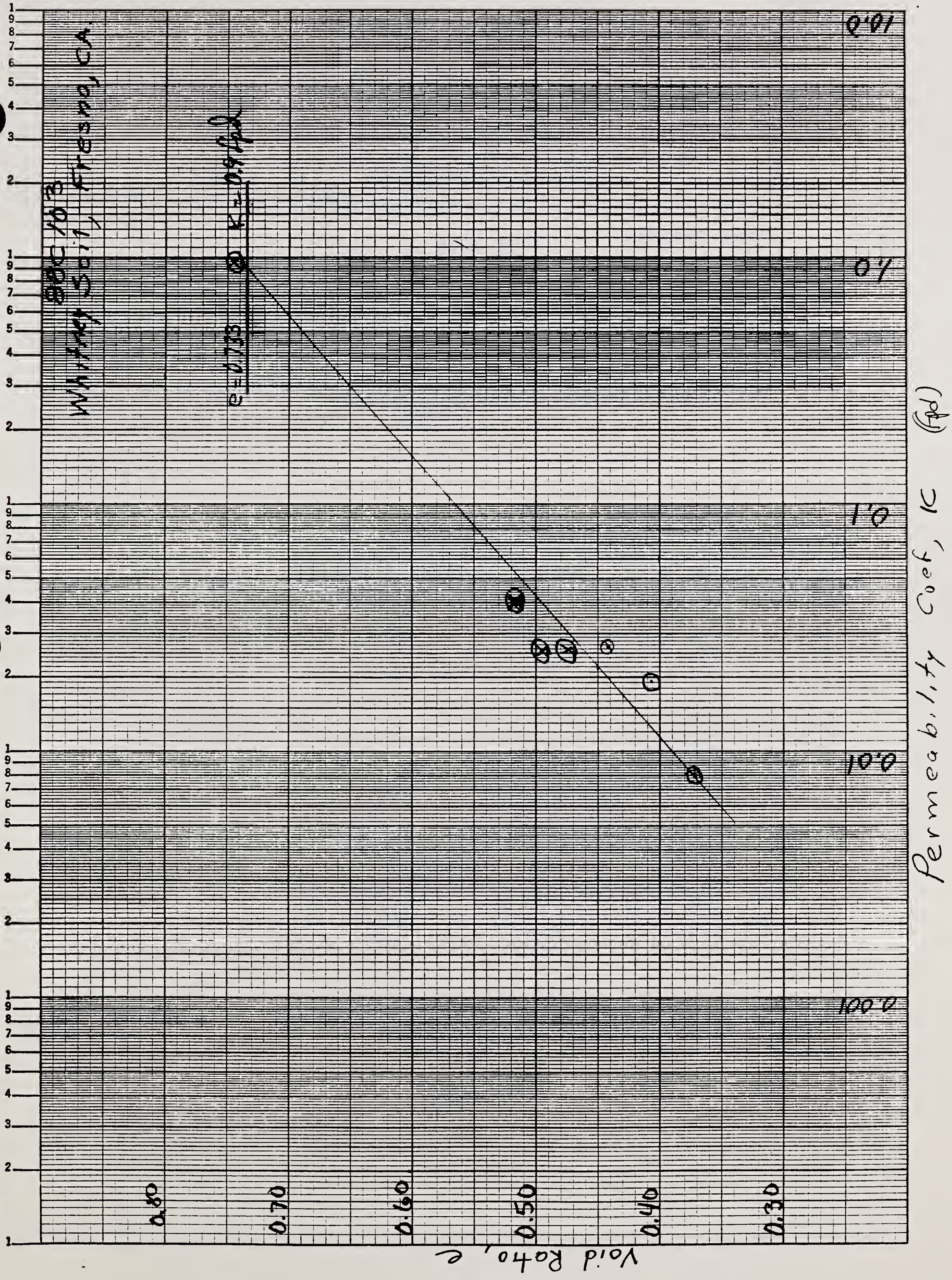
CLASSIFICATION NoN-Plastic SM LL ___ PI ___	SPECIFIC GRAVITY

TEST NO.	1 100	2 500	3 1000	4 2000	G_s (-)#4	2.67
INITIAL MOISTURE %					G_s (+)#4	
DRY DENSITY ☐ g/cc ☐ pcf	1.53	1.76	1.79	1.81	G_m(Bulk)(+) #4	
VOID RATIO	.7447	.5167	.4950	.4737	TEST SPECIFICATIONS Falling Head Perm.	
PERMEABILITY COEF F.P.D	.94641	.03901	.02547	.02579		
PERCOLATION COEF						
H/L DURING TEST						



REMARKS

$e_o = 0.733$


88C 103
Whitney Soil, Fresno, CA.
e=0.738 ⊗ K=0.9 fpd
10.0
0.1
1.0
0.01
0.001
Permeability Coef, K (fpd)
0.80
0.70
0.60
0.50
0.40
0.30
Void Ratio, e

SCS-ENG-127
REV. 6-72

Test 1

LABORATORY NO. 88C 104

MATERIALS TESTING REPORT	**U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE: WePP - Willams - McClusky, ND.
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML, Lincoln
APPROVED BY:
DATE:

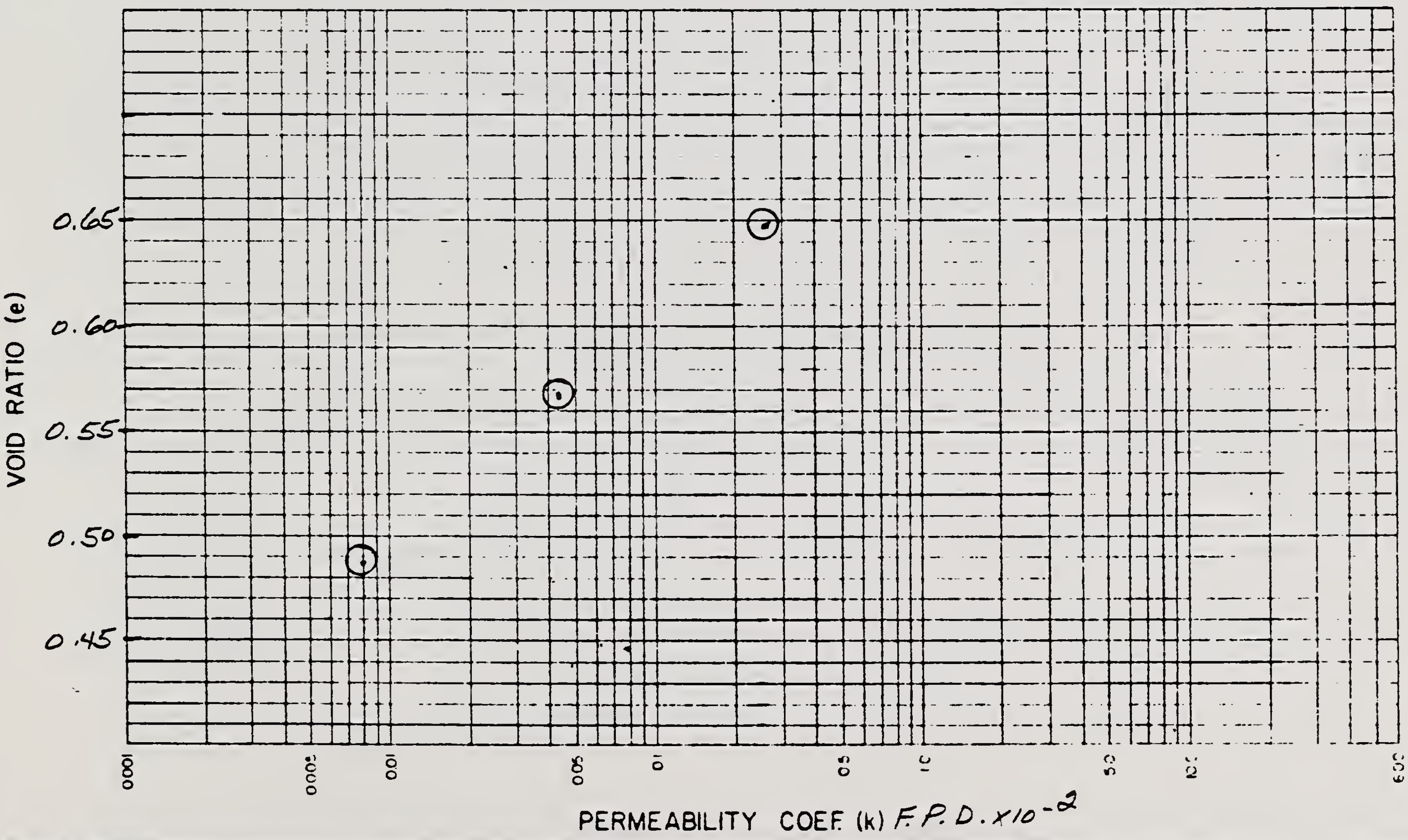
CLASSIFICATION: CL LL 37 PI 19

TEST NO.	2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.57	1.65	1.74	
VOID RATIO	.6480	.5685	.4865	
PERMEABILITY COEF F.P.D.	.00279	.00043	.00008	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-) #4	2.59
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS: Falling Head Perm.



REMARKS

e_0 = 1.233
Volume change = 33.4 %

Test 2

SCS-ENG-127
REV. 6-72

LABORATORY NO. 88C 104.

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE WEPP. - Williams - McClusky, ND.		SAMPLE LOCATION	
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

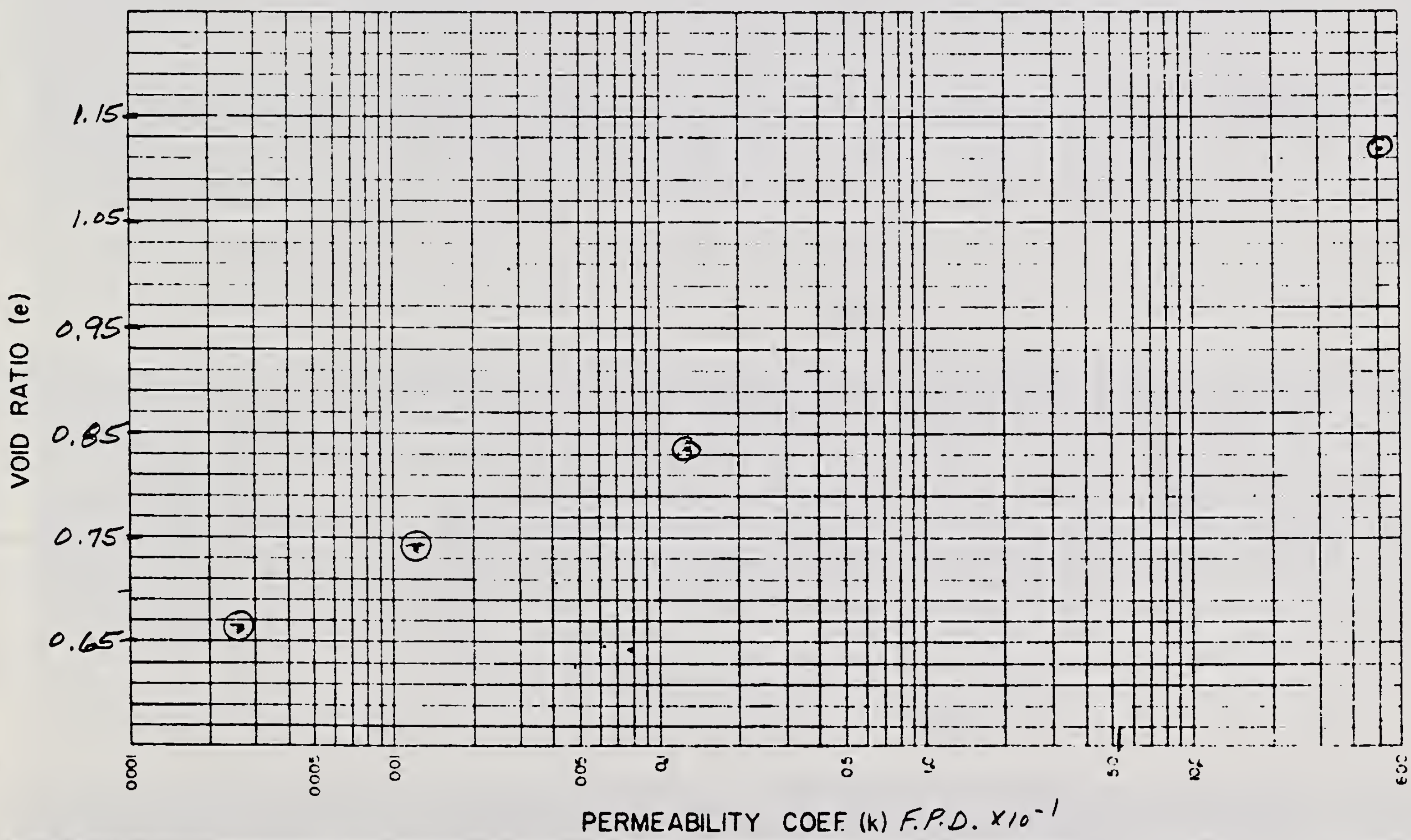
CLASSIFICATION CL LL 37 PI 19

TEST NO	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.22	1.41	1.49	1.56
VOID RATIO	1.1244	.8343	.7421	.6633
PERMEABILITY COEF F.P.D.	5.0753	.01275	.00134	.00027
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

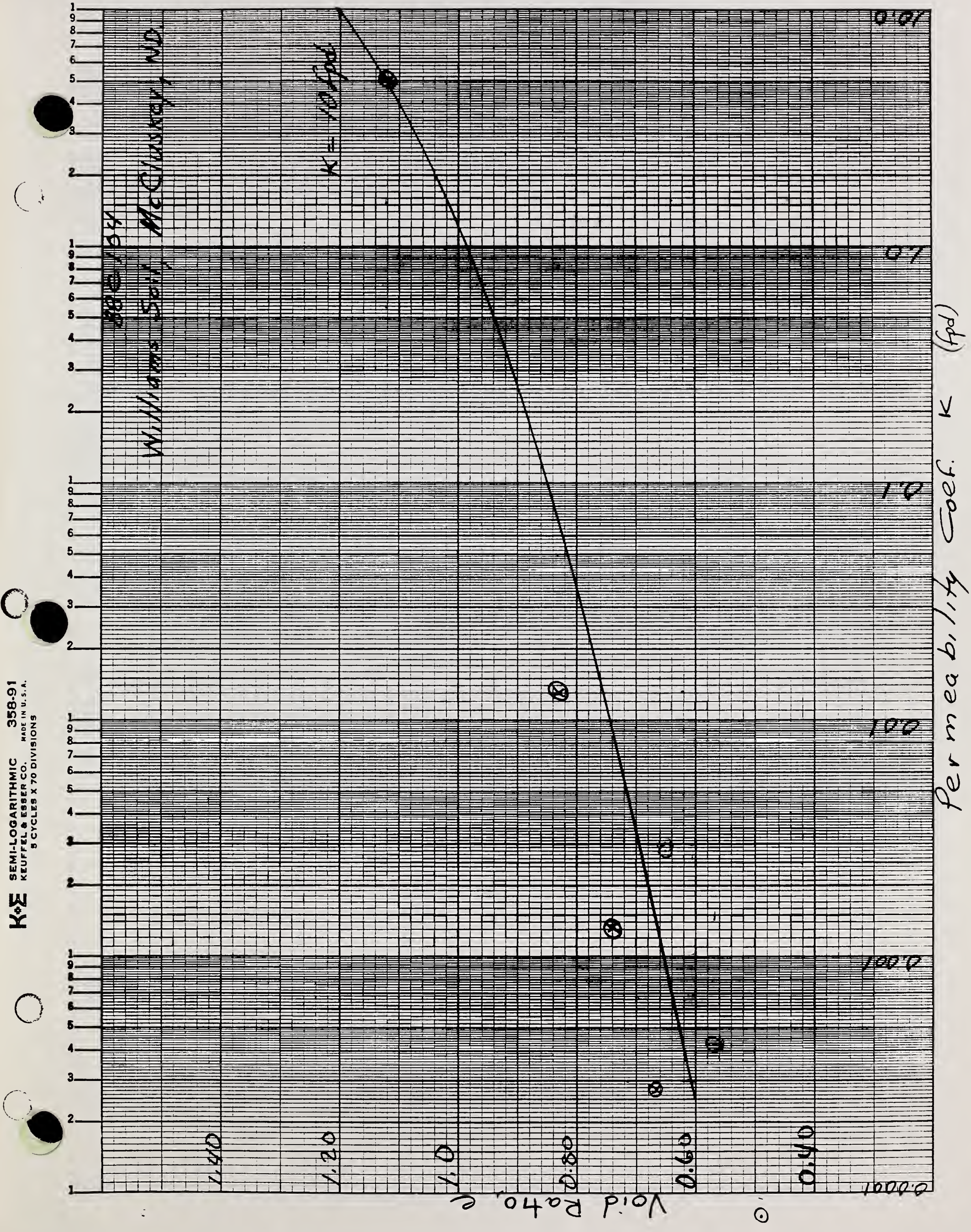
G_s (-)#4	2.59
G_s (+)#4	
G_m(Bulk)(+)#4	

TEST SPECIFICATIONS
Falling Head Perm.



REMARKS

$e_0 = 1.233$


88@134
Williams Soil, McCluskey, ND.
K = 10 fpd
Permeability Coef. K (fpd)
10.0
1.0
0.1
0.01
0.001
0.0001
1.40
1.20
1.0
0.80
0.60
0.40
Void Ratio, e
K+E SEMI-LOGARITHMIC 358-91
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS

SCS-ENG-127
REV. 6-72

Laboratory No. 88C105

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE: WePP- Woodward OK

SAMPLE LOCATION:

FIELD SAMPLE NO:

DEPTH:

GEOLOGIC ORIGIN:

TYPE OF SAMPLE: Compacted

TESTED AT: SML, Lincoln

APPROVED BY:

DATE:

CLASSIFICATION

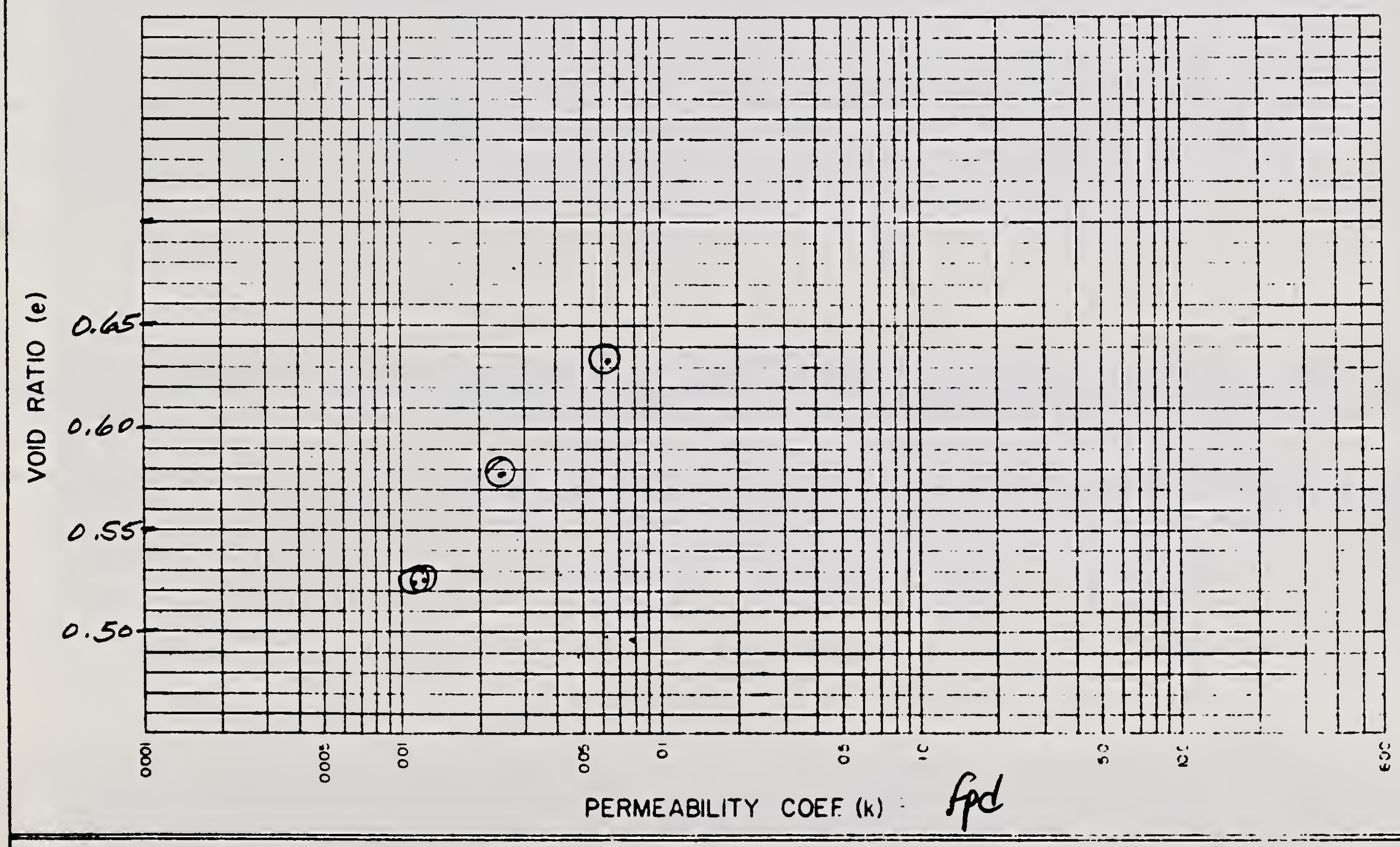
LL ___ PI ___

TEST NO	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.60	1.65	1.71	
VOID RATIO	.6339	.5783	.5245	
PERMEABILITY COEF F.P.D.	.06220	.02516	.01232	
PERCOLATION COEF				
H/L DURING TEST				

SPECIFIC GRAVITY

G_s (-)#4	2.61
G_s (+)#4	
G_m(Bulk)(+) #4	

TEST SPECIFICATIONS
Falling Head Perm.

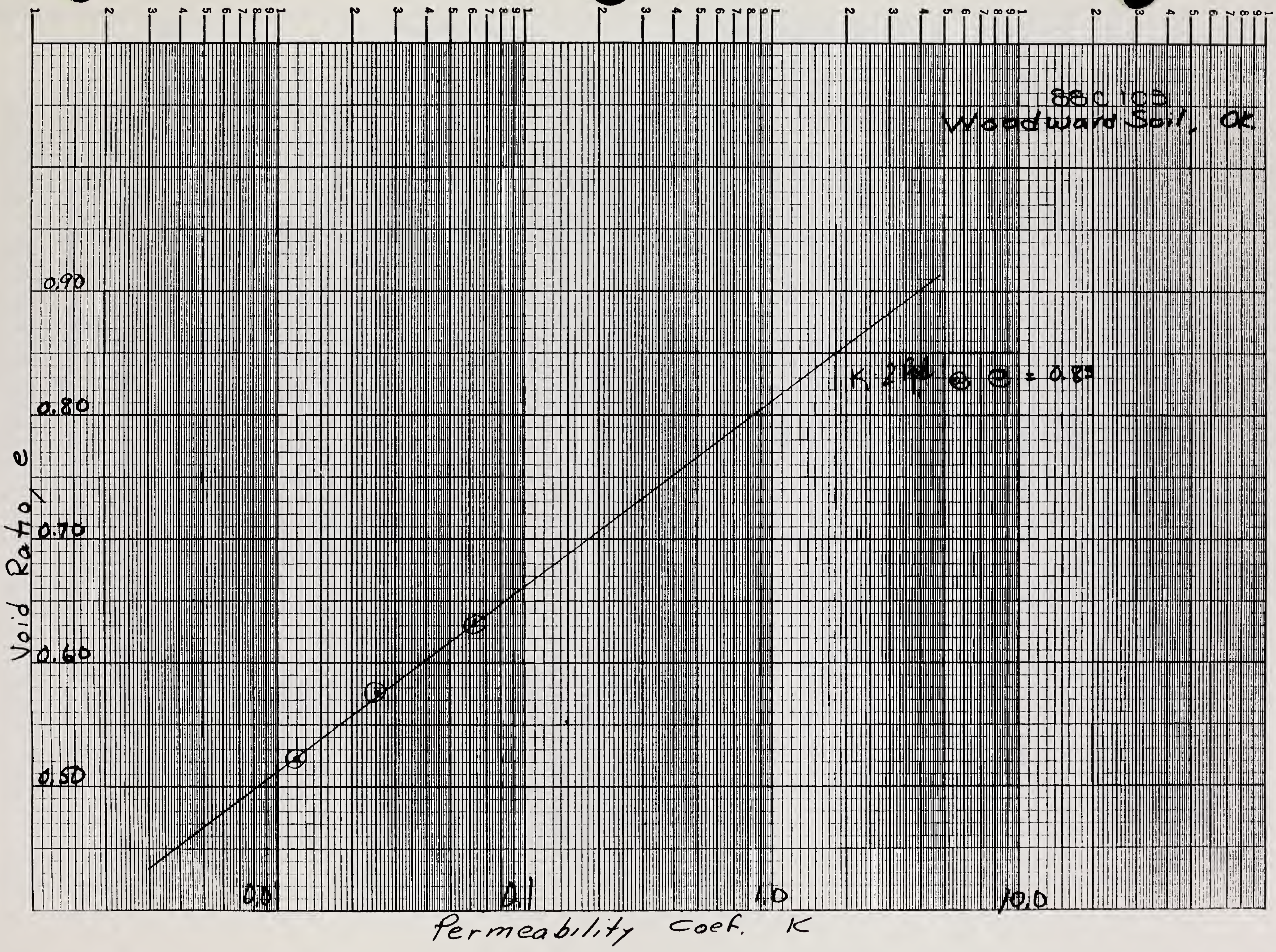


REMARKS

e_o = 0.851

Volume change = 17.6%

K+E SEMI-LOGARITHMIC 359-91G
KEUFFEL & ESSER CO. MADE IN U.S.A.
5 CYCLES X 70 DIVISIONS



Test 1

SCS-ENG-127
REV. 6-72

[illegible] NO. 88C106

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL PERMEABILITY

PROJECT and STATE: WePP- ZAHL ND.
SAMPLE LOCATION:
FIELD SAMPLE NO:
DEPTH:
GEOLOGIC ORIGIN:
TYPE OF SAMPLE: Compacted
TESTED AT: SML - Lincoln
APPROVED BY:
DATE:

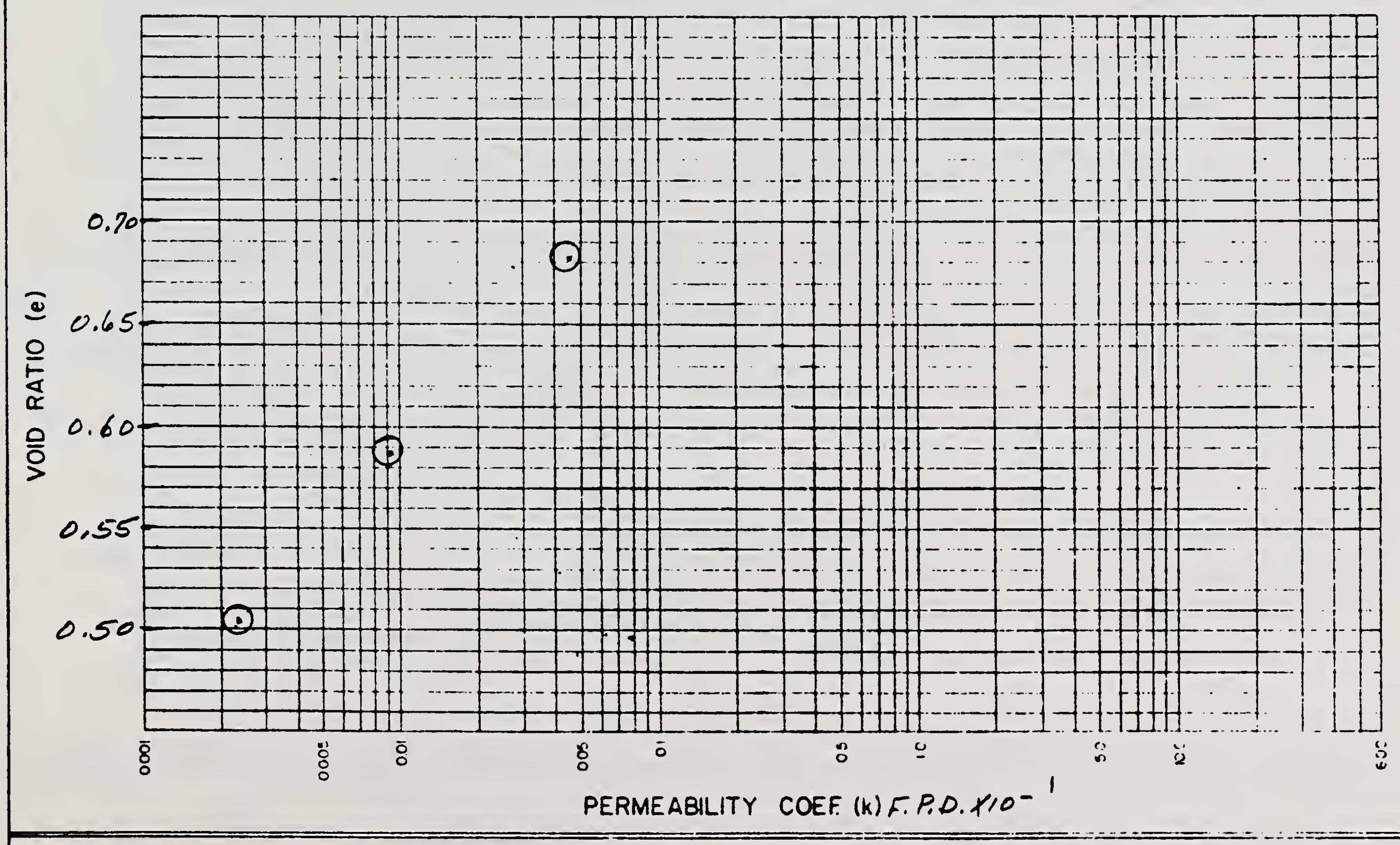
CLASSIFICATION
LL ___ PI ___

SPECIFIC GRAVITY

TEST NO.	1 2000	2 4000	3 8000	4
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.53	1.63	1.72	
VOID RATIO	.6803	.5853	.5023	
PERMEABILITY COEF F.P.D.	.00466	.00091	.00024	
PERCOLATION COEF				
H/L DURING TEST				

G_s (−) #4	2.58
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS
Falling Head Perm.



REMARKS

$e_0 = 1.064$

Volume Change = 27.2%

Test 2

SCS-ENG-127
REV. 6-72

LABORATORY NO 88C 106

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE **SOIL CONSERVATION SERVICE**	**SOIL PERMEABILITY**

PROJECT and STATE WePP- Zahl- North DAkota		SAMPLE LOCATION	
FIELD SAMPLE NO	DEPTH	GEOLOGIC ORIGIN	
TYPE OF SAMPLE Compacted	TESTED AT SML, Lincoln	APPROVED BY	DATE

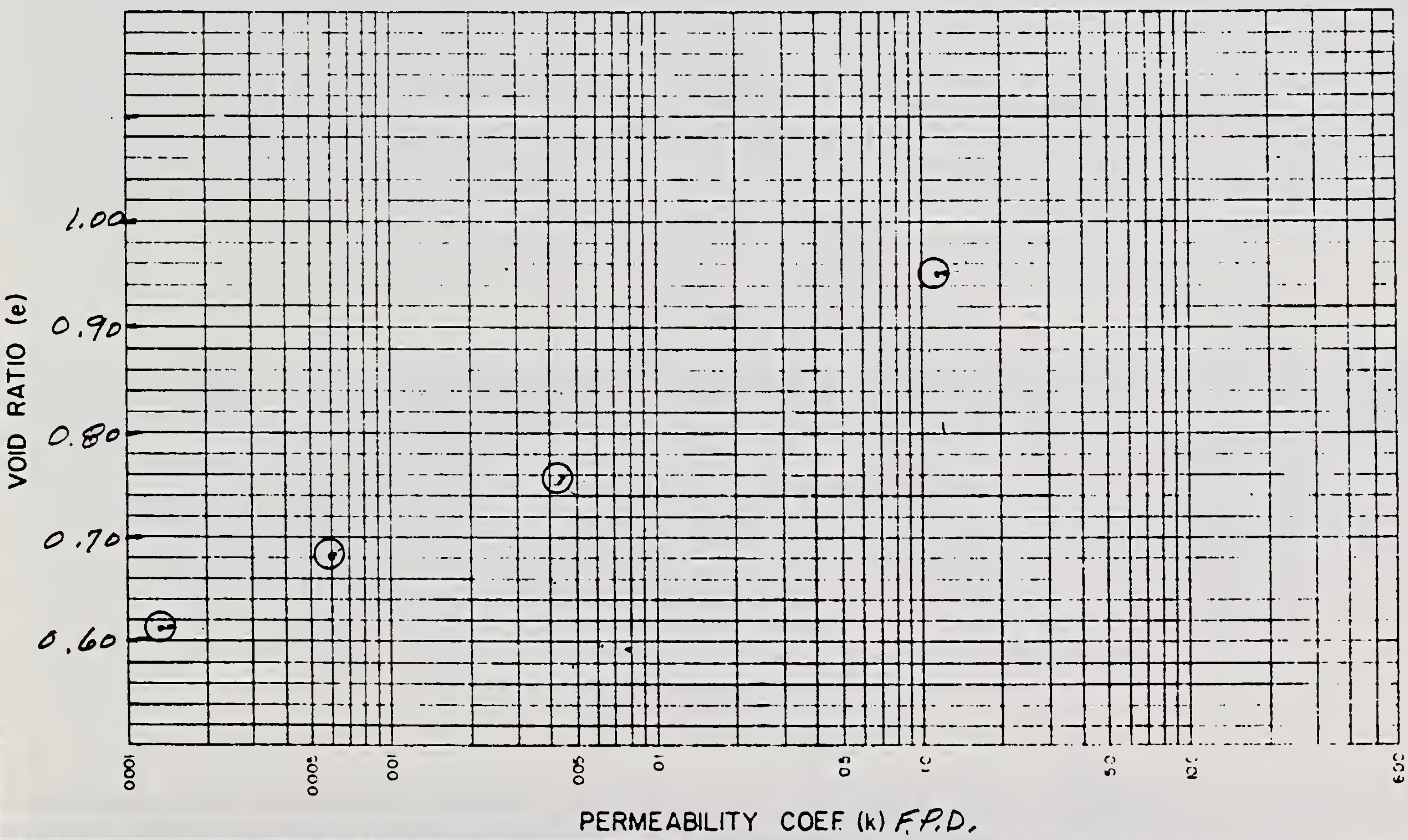
CLASSIFICATION CL LL 31 PI 13

SPECIFIC GRAVITY

TEST NO.	1 100	2 500	3 1000	4 2000
INITIAL MOISTURE %				
DRY DENSITY ☐ g/cc ☐ pcf	1.32	1.47	1.54	1.60
VOID RATIO	.9568	.7582	.6802	.6129
PERMEABILITY COEF F.P.D.	1.2669	.04477	.00608	.00149
PERCOLATION COEF				
H/L DURING TEST				

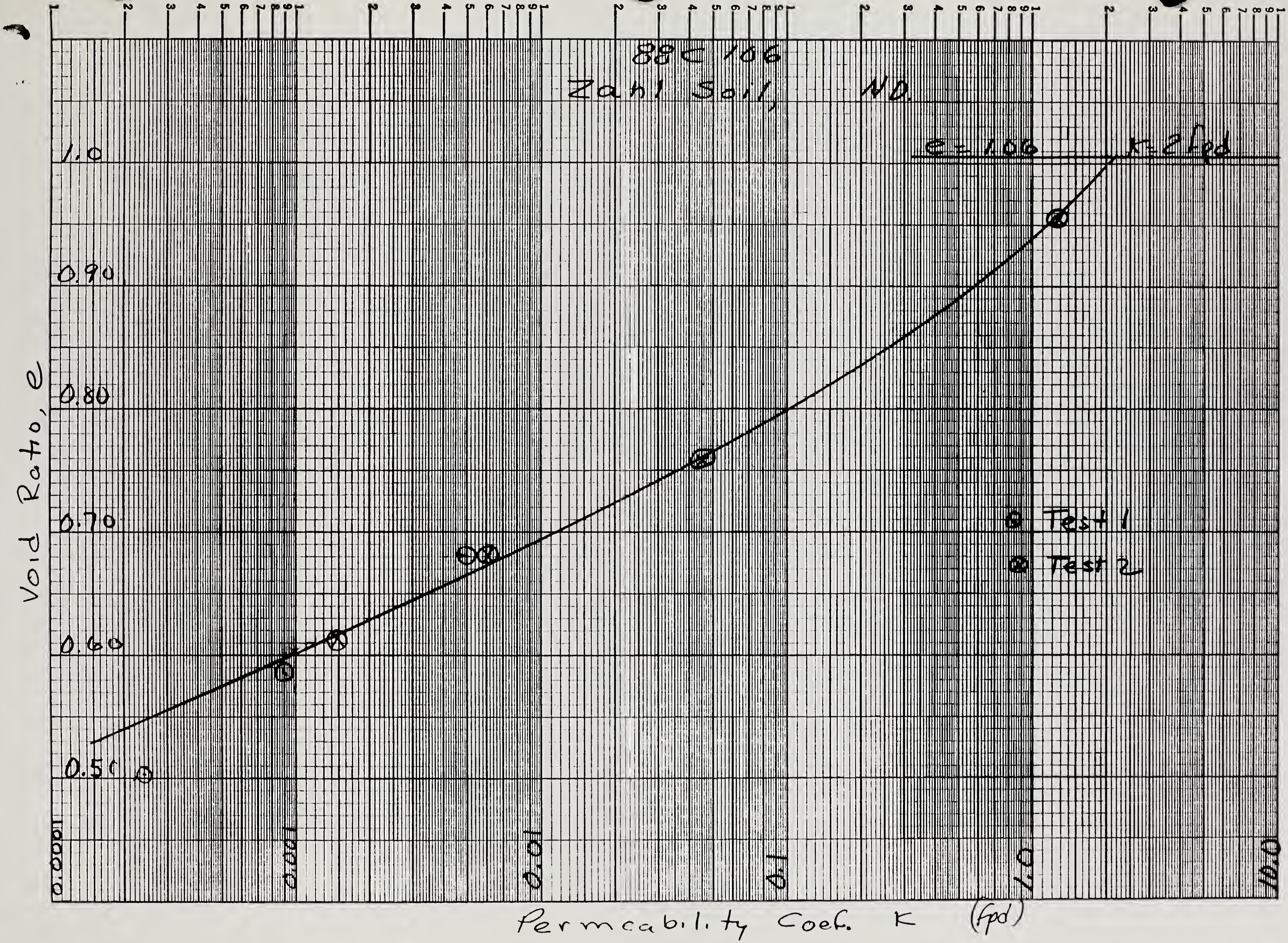
G_s (-) #4	2.58
G_s (+) #4	
G_m (Bulk) (+) #4	

TEST SPECIFICATIONS
FAlling Head Perm.



REMARKS

$e_0 = 1.064$


88C 106
Zahl Soil, ND.
e = 1.06
k = 2 fpd
1.0
0.90
0.80
0.70
0.60
0.50
Void Ratio, e
⊙ Test 1
⊗ Test 2
0.0001
0.001
0.01
0.1
1.0
10.0
Permeability Coef. K (fpd)

Effect of Conductivity of Eroding Water on Critical Shear Stress

Lorn Dunigan:

Here are the WEPP water samples you had requested and how they were made up. We approximated the actual divalent / monovalent cation ratio with Ca^{++} and Na^{+} in the chloride form. The ratio ~~which~~ is an important factor in the ability of these waters to ~~Fl~~ disperse or flocculate soil colloids.

Because we approximated the actual system, which contains some Mg^{++} and $SO_4^{=}$ with neutral salts that don't have the propensity for ion-pairing that Mg^{++} and $SO_4^{=}$ do, the measured conductivity of the artificial water samples is slightly greater than that of the actual water, but not by a significant

amount (see the attached data sheets). It is ~~the~~ same for a ~~theoretical value~~ solution of ~~that~~ composition however.

Sample #	EC mmhos/cm Theoretical	Actual	original water sample
87T 7455	0.33	0.37	0.28
87T 7458	1.41	1.4[illegible]	1.02
87P 4000	0.62	0.62	0.55
87T 7381	3.6	3.7	3.01

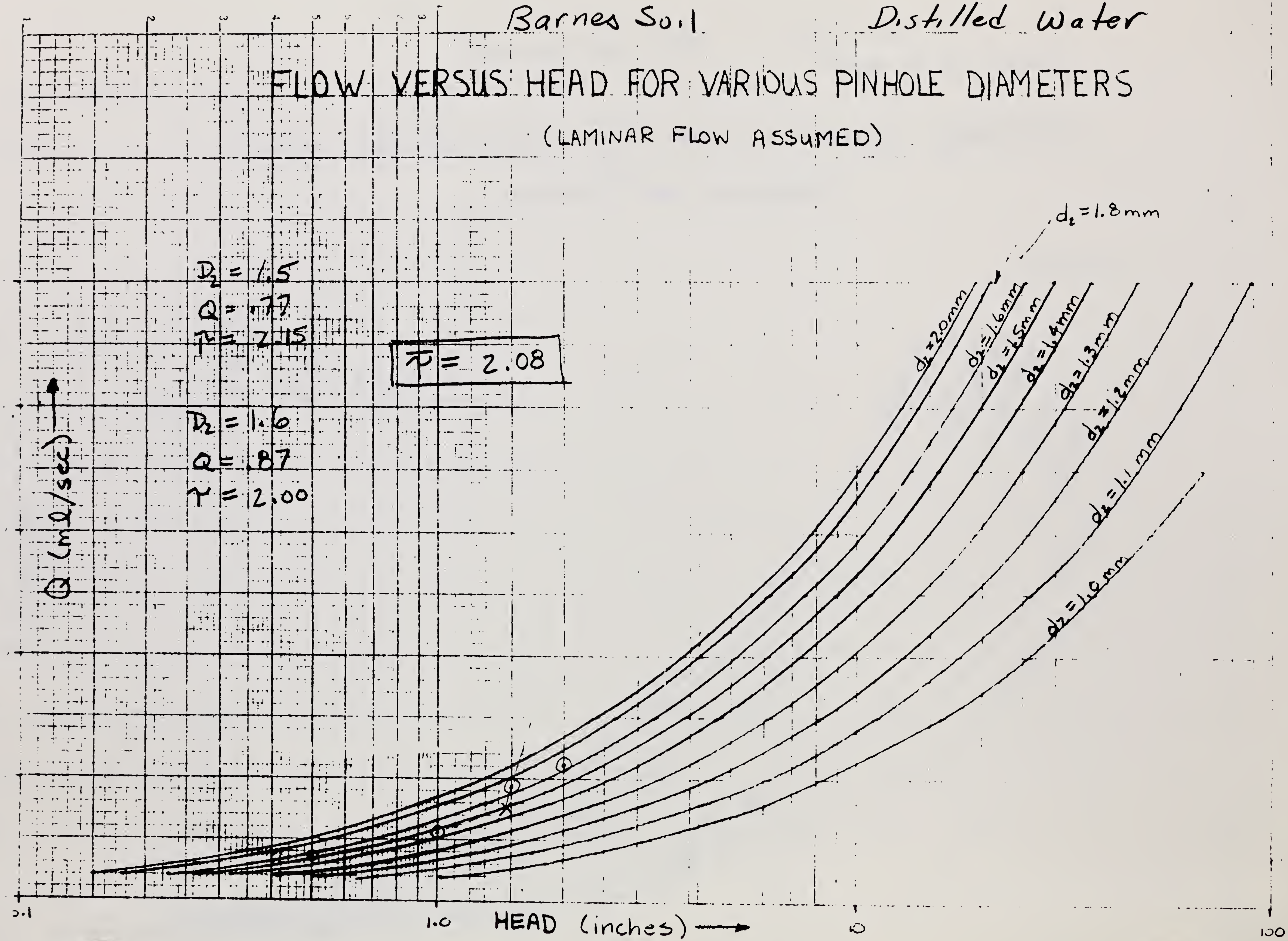
Terry Sobecki, Soil Scientist, NSSC.

OOC 7C

Barnes Soil Distilled Water

FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

(LAMINAR FLOW ASSUMED)

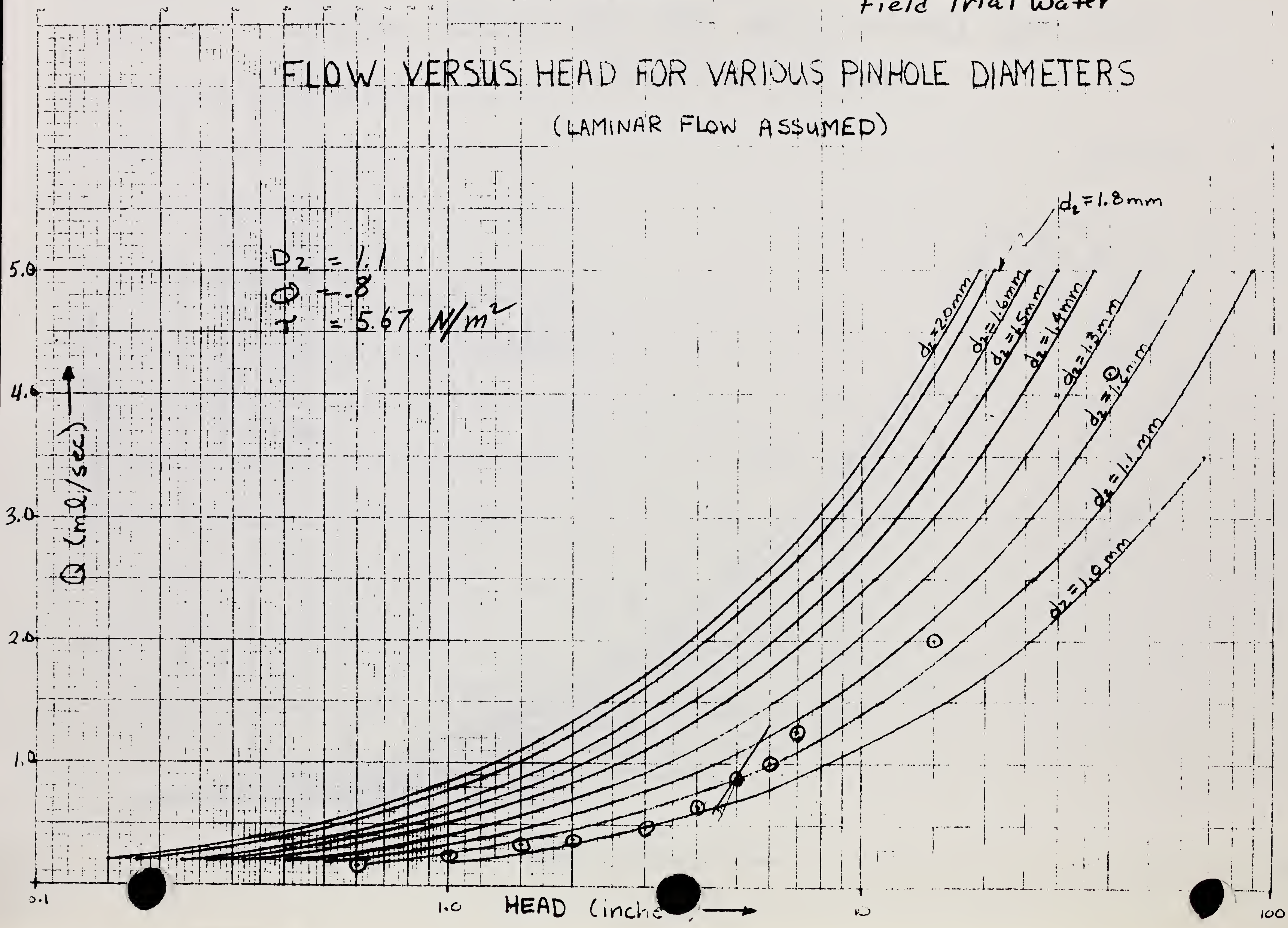


Barnes Soil ND

88C 92
Field Trial Water

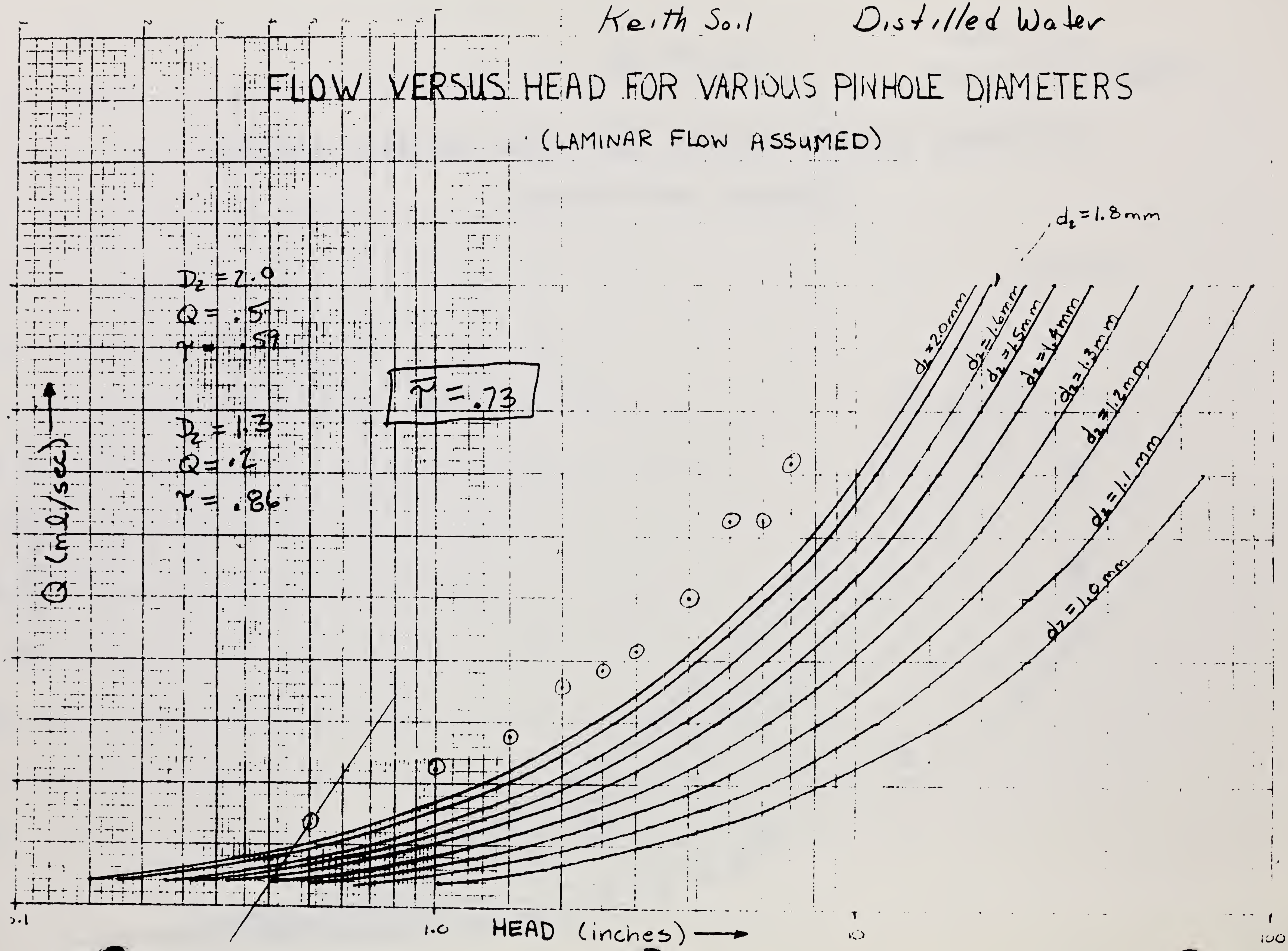
FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

(LAMINAR FLOW ASSUMED)



88C 95

Keith Soil Distilled Water



FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

(LAMINAR FLOW ASSUMED)

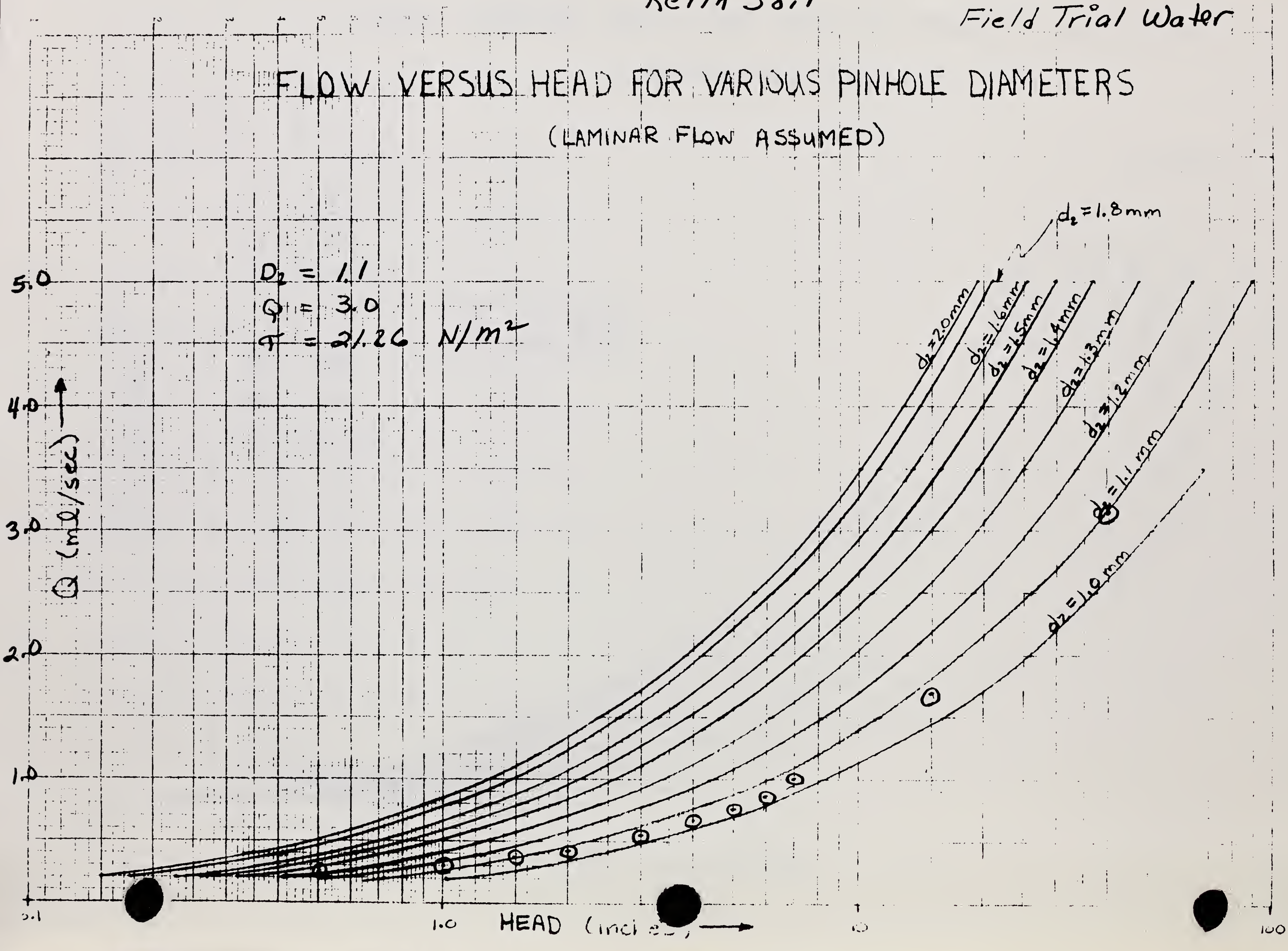
$D_2 = 2.0$
$Q = .5$
$r = .59$

$D_2 = 1.3$
$Q = .2$
$r = .86$

$\boxed{\bar{r} = .73}$

Keith Soil

88C95
Field Trial Water



FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

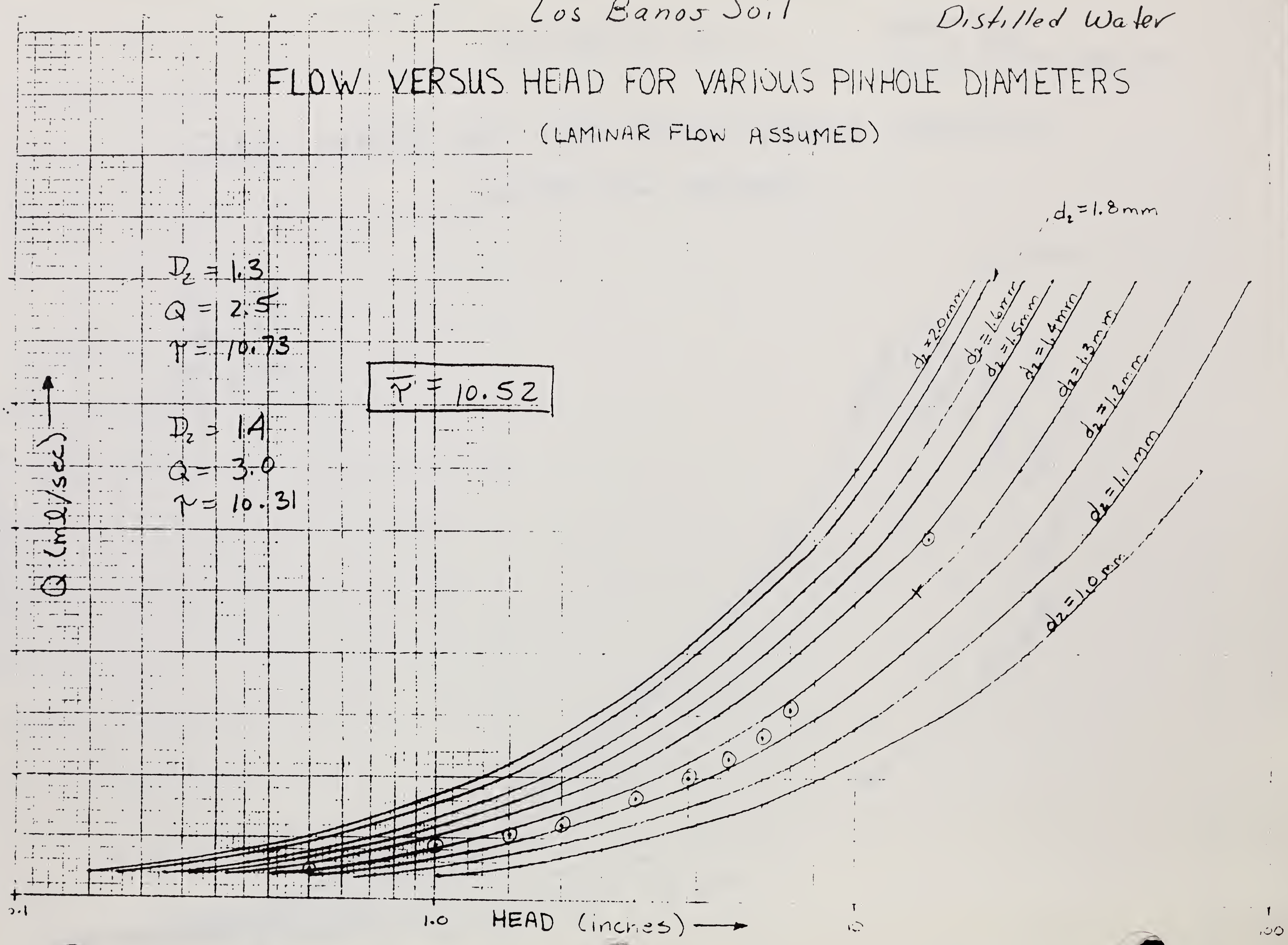
(LAMINAR FLOW ASSUMED)

$D_2 = 1.1$
$Q = 3.0$
$\tau = 21.26\ N/m^2$

Los Banos Soil 68C 96 Distilled Water

FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

(LAMINAR FLOW ASSUMED)

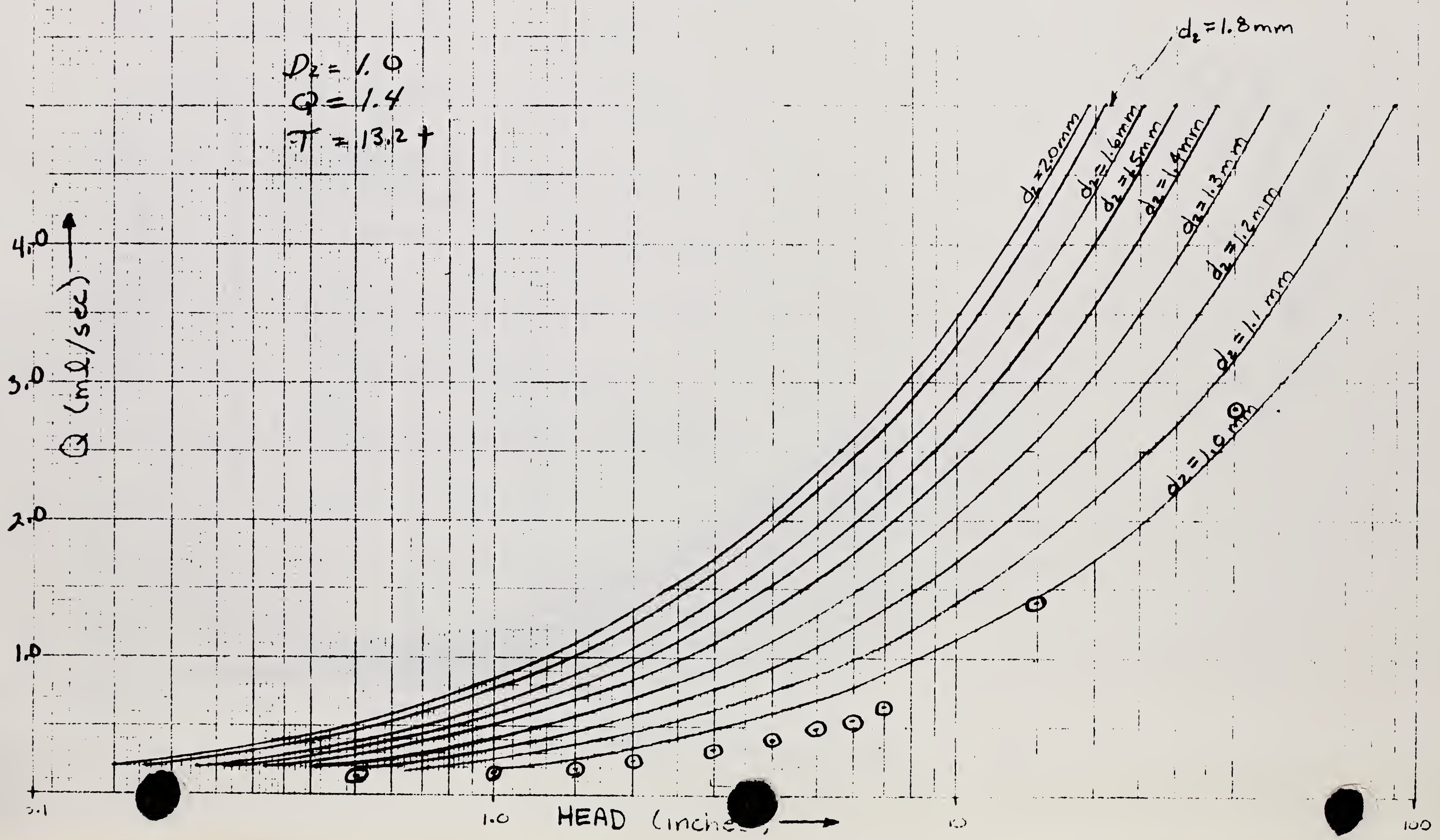


Los Banos Soil

88C96
Field Trial Water

FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

(LAMINAR FLOW ASSUMED)

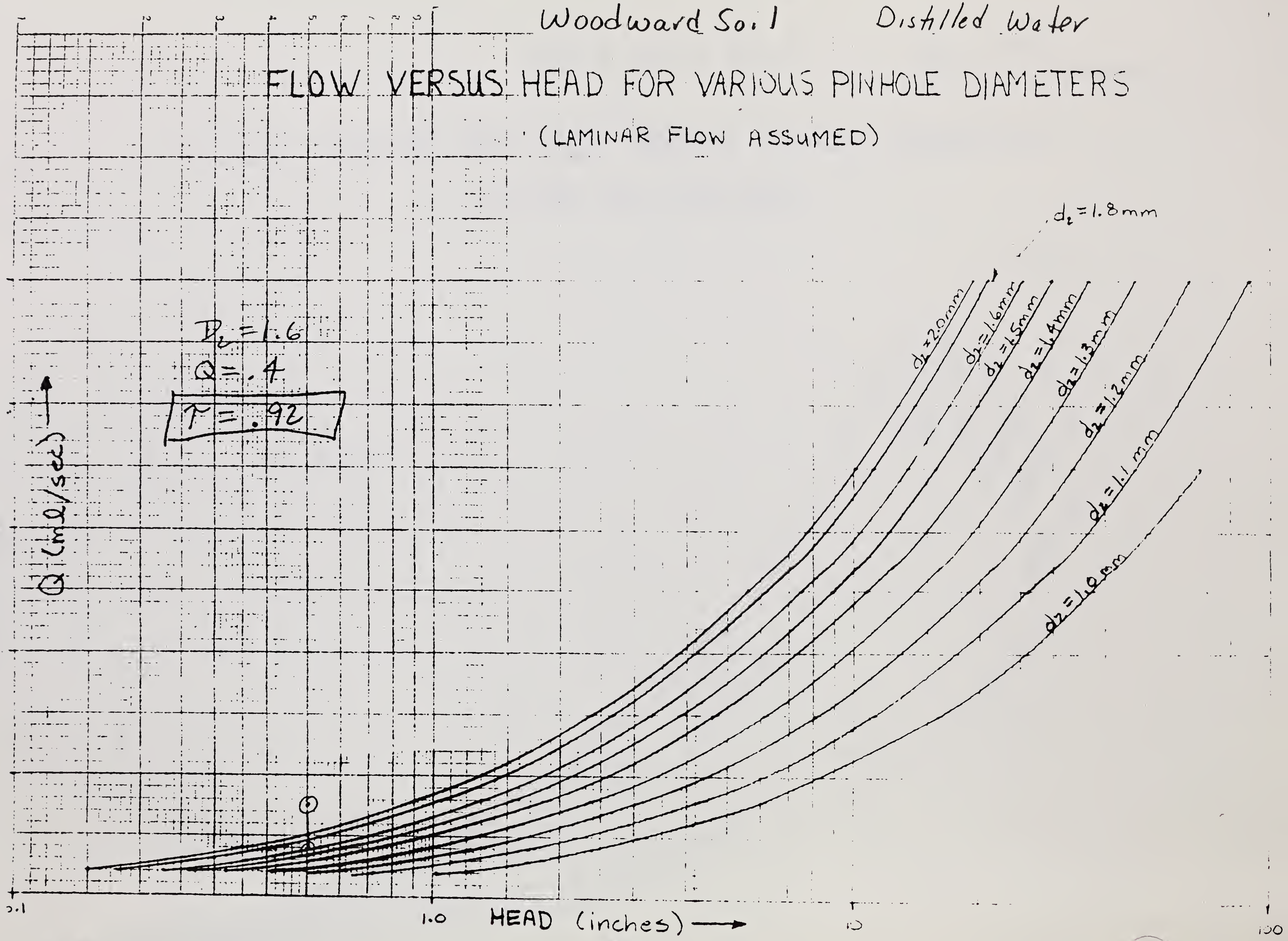


88C 105

Woodward Soil   Distilled Water

FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

(LAMINAR FLOW ASSUMED)



Woodward Soil

88C105
Field Trial Water

FLOW VERSUS HEAD FOR VARIOUS PINHOLE DIAMETERS

(LAMINAR FLOW ASSUMED)