

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31G5-127

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. 17

LOCATION GREENS CREEK,
E. of OTTAWA

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS: _____

BA 686

3165-127
GEOCRES No.

(C O P Y)

REPORT ON FOUNDATION INVESTIGATION

AT

GREENS CREEK AND HIGHWAY 17 ALTERNATIVE

EAST OF OTTAWA

TO

DeLEUW CATHER AND COMPANY OF CANADA LTD.

MARCH 23, 1956
Report No. 231



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FOUNDATION INVESTIGATION AT GREENS CREEK

3165-127
GEOCRE No.

1. GENERAL

The investigation at Greens Creek is similar in many respects to the investigation at the Montreal Road intersection. Frequent reference will be made in this report to the principles set out in our Montreal Road report dated February 16, 1956, and some of the explanations will be referenced here but not repeated.

2. FIELD WORK

Two boreholes were made at the site in the locations shown on plate one. Hole No. 1 represents the soils typical of the flood plain of the creek, and Hole No. 2 represents the soils in the banks of the gully.

Two inch, thin wall tube samples were taken to a depth of 80 feet, then the holes were extended to probing refusal, without sampling, to determine the depth of the compressible soil layer. Split spoon samples were taken in conjunction with standard penetration tests in the silty soils of the flood plain.

Groundwater levels were observed during the investigation.

3. LABORATORY WORK

Samples from the thin wall tubes were tested in unconfined compression, and were classified visually. A limited number of moisture content tests were made. Representative samples were tested to obtain the consolidation properties of the significant, compressible, soil layers.

4. OBSERVATIONS

4.1 Site

The proposed structure is situated in the flood plain of Greens Creek, with one abutment on the

steep bank of the creek and one in the flood plain itself. Flow in the creek varies from zero in winter seasons to several feet above flood plain in spring.

4.2 Soil Types

4.2.1 Topsoil - A few inches of topsoil occurs at both hole locations.

4.2.2 Brown-grey Fissured Clay - in the creek bank, approximately seven feet of medium soft clay is found below the topsoil. This layer can be expected to become thicker at points higher up the slope.

4.2.3 Alluvium and Organic Soil - in the flood plain there is approximately 9 feet of very loose, recently deposited soil, mixed with organic matter. This is material laid down by flood waters and will be very heterogeneous.

4.2.4 Medium Soft, Grey Clay - a layer of slightly fissured clay, varying from 20 to 40 feet in thickness, underlies the alluvium.

4.2.5 Stiff Grey Clay - the clay becomes stronger with depth and stiff layers from 30 to 50 feet thick underly the medium soft clays.

4.2.6 Deep soils - the soil density and strength continues to increase with depth until probing refusal is met at elevation 27 to 37, probably in sandy soils. Bedrock is probably at or below sea level.

4.3 Groundwater

In the flood plain, groundwater is at the surface and can be expected to remain high. In the creek bank, groundwater was at an elevation about 10 feet below the creek water level. This indicated that the clay soils are not very permeable, whatever flow of groundwater that takes place, is actually through the fissures rather than the clay.

5. DESIGN RECOMMENDATIONS

5.1 Soil Bearing Capacity

The bearing capacity that can be assigned to the soil for the support of piers or abutments does not change with depth, once the medium, grey, clay layers are reached. As they commence about 10 feet below the surface in both holes, they have been assumed to be the load bearing strata.

For loads applied at or below El. 136 in the flood plain section, and at or below El. 145 in the creek bank section, the recommended allowable load which can be added to the soil is 2200 POUNDS PER SQUARE FOOT.

The suggestions concerning the use of hollow piers which were made in our Montreal Road report dated February 16, 1956, are also applicable here.

5.2 Soil Shear Strength

Similarly, the recommendations pertaining to shear strength at the Montreal Road site are applicable here. A unit weight of 110 lbs. per cubic foot, a shear strength of 1200 pounds per square foot, and no angle of internal friction can be assumed for the clay soils beneath the embankment. An important difference however, is in the fact that the layer of alluvial and organic soil exists at the embankment site.

This very soft material can fail by plastic flow from beneath the embankment causing sinking of the roadbed. Also, in areas where sand deposits happen to be continuous, porewater pressures are increased by the weight of the fill, shearing resistance disappears and failure of the base may occur due to sliding along such liquified sand layers. For these reasons we do not feel that the embankment should be constructed on top of the alluvial and organic soils. Some method of removing these soils should be adopted.

Since the thickness of alluvial soil encountered (9 feet) is likely a maximum, it would seem that excavation would be a suitable method of removal. Consideration should also be given, however, to the displacement method. This method would probably require a surcharge of 15 feet or more above final grade to displace the loose material. Blasting to aid the displacement method should not be used owing to the extreme sensitivity of the underlying clay.

If the excavation method is chosen, a group of shallow boreholes should be made prior to construction to confirm the depth of material to be removed.

5.3 Soil Consolidation

5.3.1 Loads - the weight of a 15 foot embankment is the largest force acting. Due to its width, (110 feet at bottom) it will raise the stress in the full 80 feet of compressible soils and cause consolidation of the entire deposit. Movement of abutments will correspond with the movement of adjacent portions of the embankment. The settlement of piers would be considerably less due to the smaller area which they load.

5.3.2 Soil Properties - the consolidation properties of the soil are indicated on the attached graph, Plate 4, and indicate that the soil has a "yield point" indicating precompression in its geological history. Fortunately the stresses due to a 15 foot embankment fall within the precompressed range.

5.3.3 Settlements - we have calculated the settlement under the centre of the embankment, assuming the alluvial soils to be replaced by embankment material, and find it to be 1.0 feet. Piers, if any, have not been investigated, but should they be required, their settlement could be estimated as slightly less than the 0.3 feet calculated for piers at the Montreal Road site. Once again, these values should now be considered precise since the present state of our knowledge requires considerable judgment to be used in the interpretation of test results.

5.

5.3.4 Timing of Settlements - as before, this can only be roughly estimated, but such estimates would range from 2 to 6 years for the major portion of settlements to take place.

5.4 Foundation Type

Spread footings have been assumed in the foregoing. Piles would probably need to be at least 100 feet long and have not been considered economically feasible.

6. CONSTRUCTION FEATURES

6.1 Protection of soil

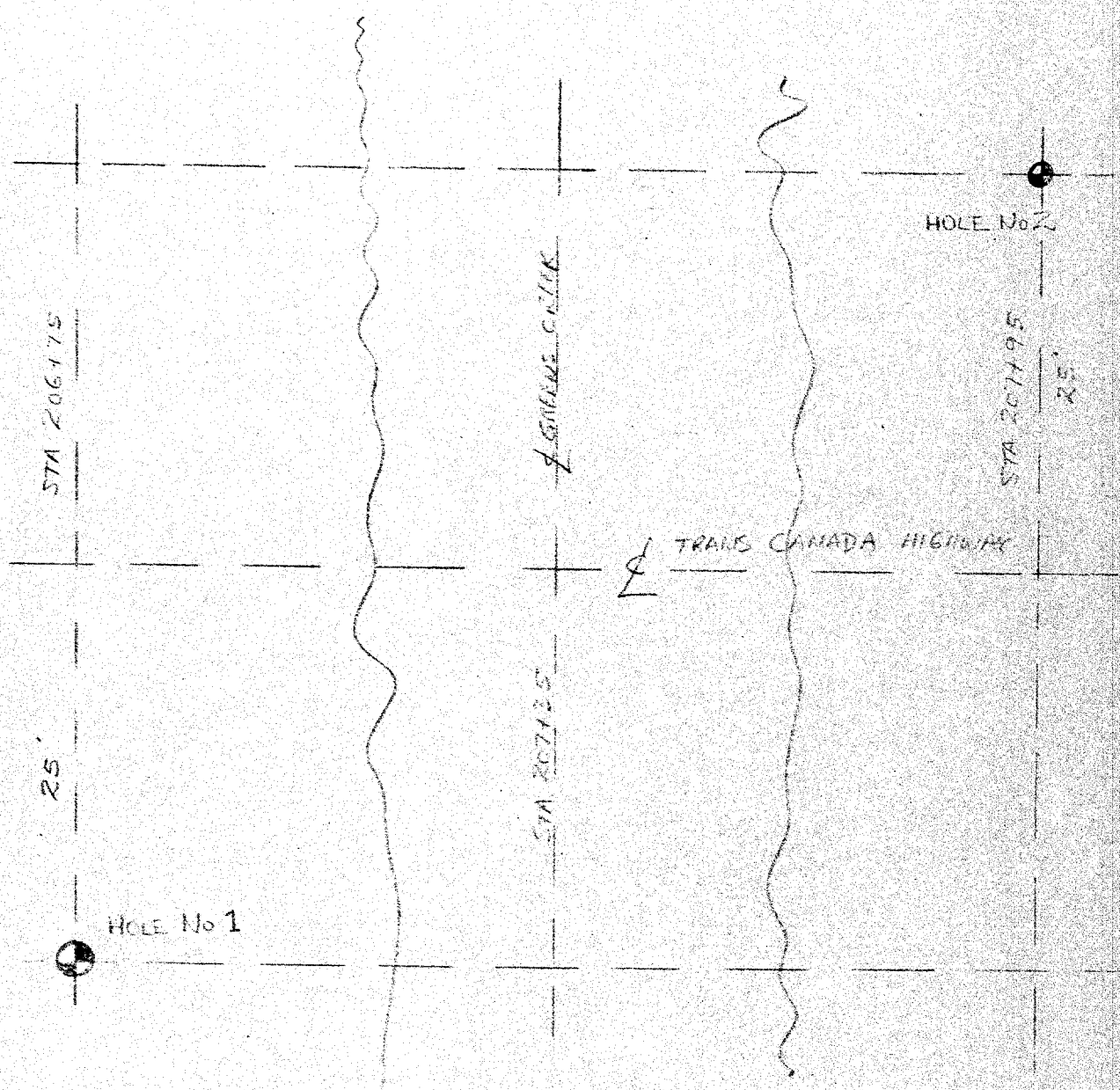
The suggestions for soil protection in paragraph 5.1 of our Montreal Road report should be considered applicable here.

6.2 Groundwater

In the flood plain, soil, either sheet piling or wide excavation and cofferdams will probably be required for the construction of abutment footings. A considerable flow of water is to be expected in the soils above the clay. The use of wellpoints might also be considered instead of piling or cofferdams.

6.3 Settlement Gauges

Gauges, as suggested in the previous report, are also recommended here. Gauges in the embankment fill would provide additional useful data if an observation programme becomes possible.



SEE DWG C-17-B3-ST 1

<p>G. C. McROSTIE CONSULTING CIVIL ENGINEERS</p>	
<p>BOREHOLE LOCATIONS GREENS CREEK AT TRANS CANADA HIGHWAY</p>	
<p>SCALE 20 FT = 1 IN</p>	<p>PLATE 1</p>

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OTTAWA CANADA

SOIL PROFILE AND SUMMARY
OF LABORATORY TESTS

TRANS-CANADA HIGHWAY - EAST OF OTTAWA
 GREENS CREEK CROSSING

ELEVATION OF GROUND SURFACE (ZERO DEPTH) _____

145.9

HOLE NO.

REMARKS GEODETIC DATUM

1

BORINGS BY McRostie TESTING BY McRostie DATE 19 Jan/56

UNCONFINED COMPRESSIVE STRENGTH	MOISTURE CONTENT %	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PENETRATION TEST	
							LB. HAMMER INCH DROP	NO CASING INCH DIA. ROD
KIPS/FT ²				GROUND SURFACE	0	145.9	Ground water level	
			1	XXXX TOP SOIL XXXX CE Very loose mixture of sand, silt & clay 2.6'				
			2	As above plus organic matter				
17			3		10	135.9		
26			4					
26			5					
19	63.4		6		20	125.9		
19			7					
19			8					
23			9		30	115.9		
23			10					
22			11					
21			12					
22			13	Medium soft, slightly fissured, grey	40	105.9		
22	60.0		14	clay				
26			15		50	95.9		
26			16					
26			17	Stiff, slightly fissured, grey	60			
26			18	clay	70			
26			19					
26			20		80			
26			21	Soil (no samples) Density increases with depth	90			
26			22		100	45.9		
26			23		110			
26			24		120	25.9		
26			25	Bottom of hole 112.9'				
26			26					
26			27					
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26			100					

G. C. McROSTIE
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OTTAWA CANADA

SOIL PROFILE AND SUMMARY
OF LABORATORY TESTS

TRINITY CIRCLE HIGHWAY - EAST OF OTTAWA
 GREENS CREEK CROSSING

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 157.48

REMARKS Geodetic station

HOLE NO.

2

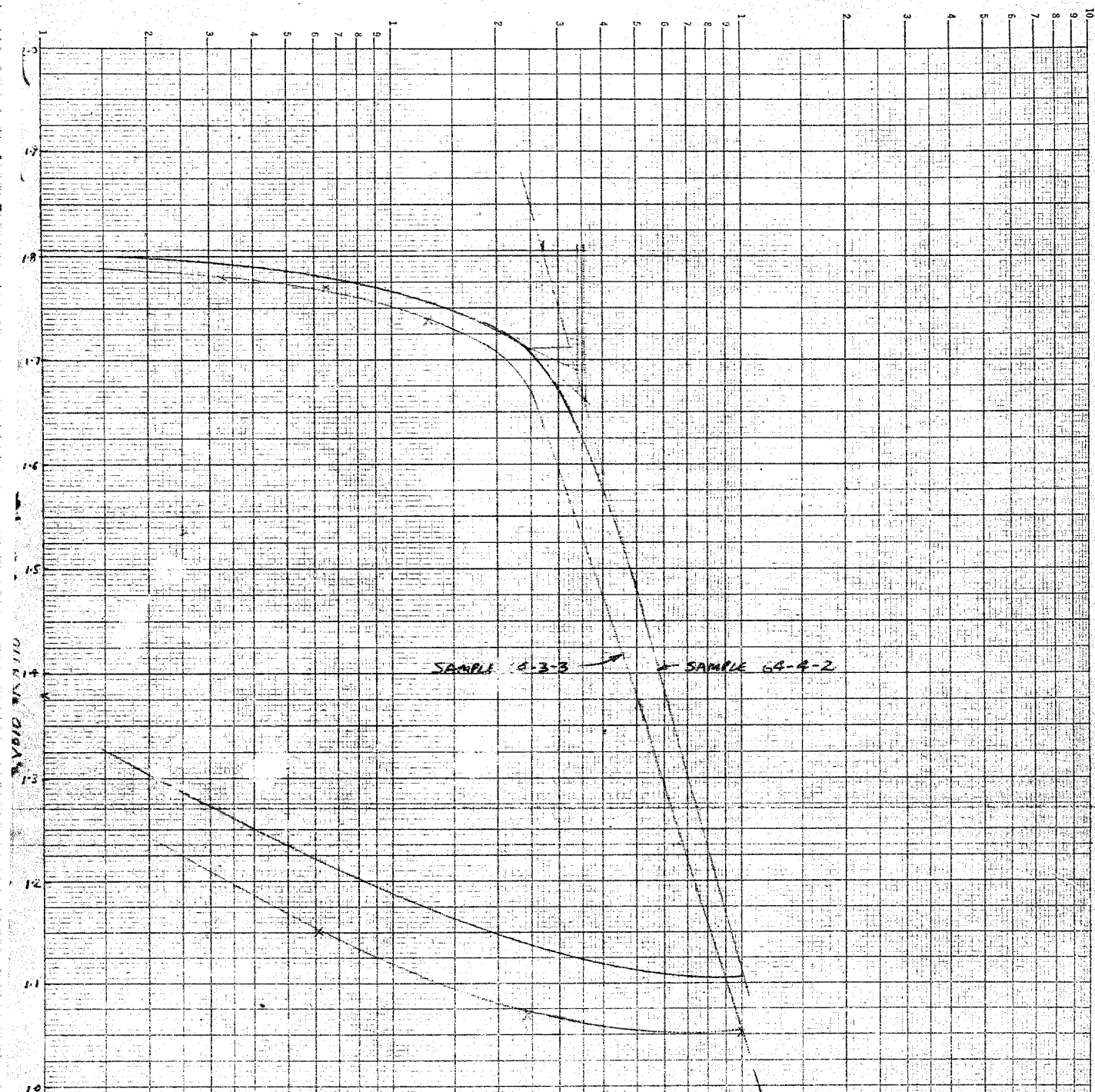
BORINGS BY McRostie TESTING BY McRostie DATE 25 Jan 56

UNCONFINED COMPRESSIVE STRENGTH	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PENETRATION TEST	
						140 LB. HAMMER 30 INCH DROP	NO CASING 1.3 INCH DIA. ROD
KIPS/FT ²			GROUND SURFACE			BLOWS PER FOOT	
						20	40
			GROUND SURFACE		157.48		
1.3		1	Med. soft fissured brown grey clay	0			
1.2		2		1			
1.9		3		2			
1.6		4		3			
1.7		5	Medium soft fissured grey clay	4			
2.1		6		5			
2.6		7		6			
1.4-2.6		8		7			
2.3		9		8			
2.6		10		9			
2.6		11		10			
2.6		12		11			
2.6		13		12			
2.3		14		13			
2.3		15		14			
2.6		16		15			
2.6		17	Stiff, slightly fissured, grey clay	16			
2.5		18		17			
2.5		19		18			
2.6		20		19			
			Soil (no samples)	20			
			Density increases with depth	21			
			Bottom of hole	22			
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				200			

% WATER CONTENT

PLATE

3



LOG P - E CURVE
SAMPLE 64-3-3
DEPTH 20'-8"

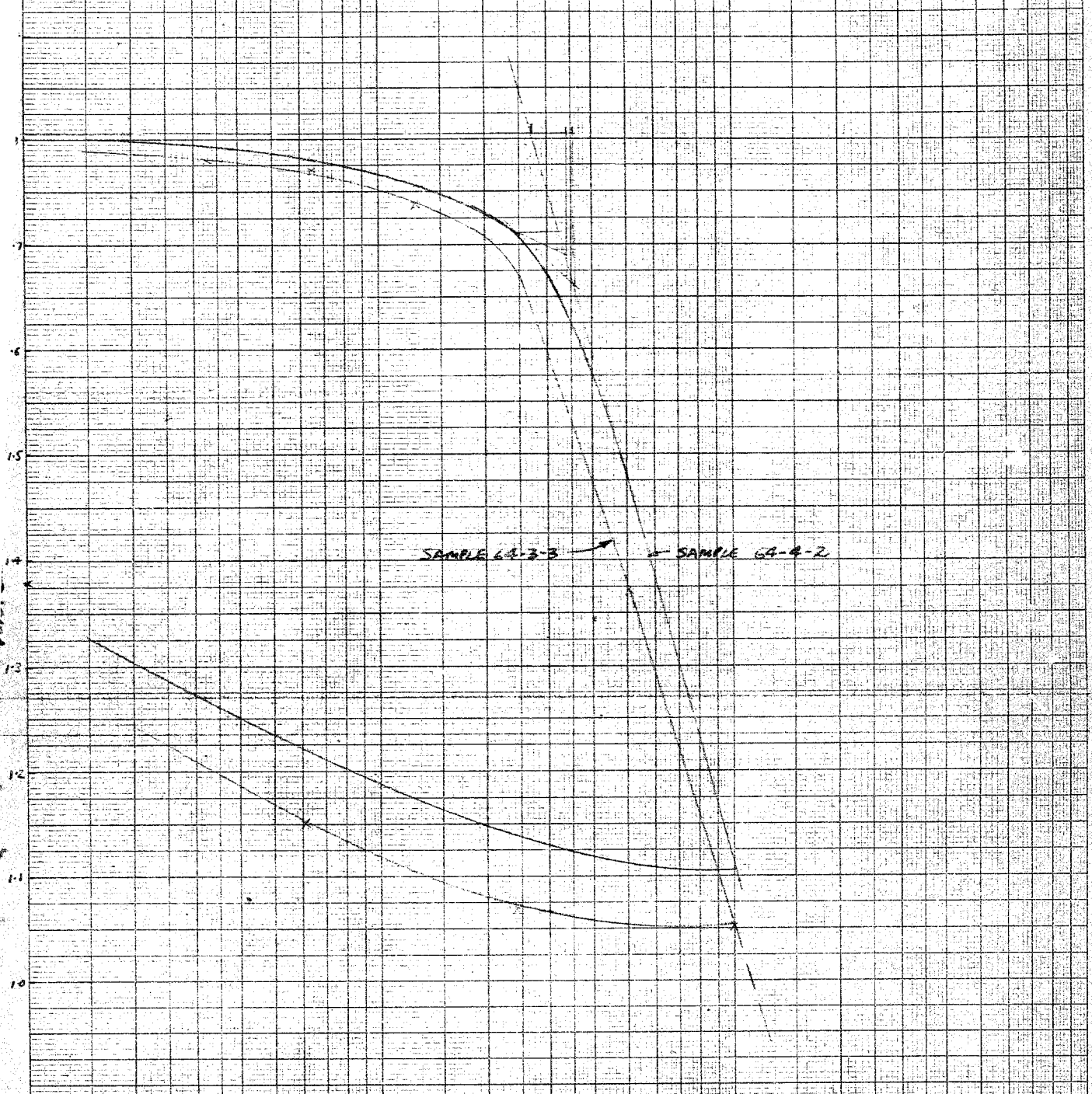
$P_H (MIN) = 2.0 \text{ KG/CM}^2$
 $P_H (PROB) = 2.6$
 $P_H (MAX) = 2.7$

$C_c = 1.810 - 0.735 = 1.075$
 $C_u = 1.800$

LOG P - E CURVE
SAMPLE 64-4-2 - GREENE CREEK
DEPTH 46'-0"

$P_H (MIN) = 2.7 \text{ KG/CM}^2$
 $P_H (PROB) = 3.4 \text{ KG/CM}^2$
 $P_H (MAX) = 3.6 \text{ KG/CM}^2$

$C_c = 1.947 - 0.140 = 1.807$
 $C_u = 1.805$



LOG P-E CURVE

SAMPLE 64-3-3

DEPTH 20'±8"

$$P_u(\text{MIN}) = 2.0 \text{ KG/CM}^2$$

$$P_u(\text{PROB}) = 2.6$$

$$P_u(\text{MAX}) = 2.7$$

$$C_u = 1.810 - 0.925 = 1.075$$

$$C_u = 1.800$$

$$\frac{C_u}{P_u} = \frac{0.8}{2.6} = 0.31$$

LOG P-E CURVE

SAMPLE 64-4-2

GREEN'S CREEK

DEPTH 48'±0"

$$P_u(\text{MIN}) = 2.7 \text{ KG/CM}^2$$

$$P_u(\text{PROB}) = 3.2$$

$$P_u(\text{MAX}) = 3.6 \text{ KG/CM}^2$$

$$C_u = 1.787 - 0.190 = 1.207$$

$$C_u = 1.805$$

$$\frac{C_u}{P_u} = \frac{0.67}{3.4} = 0.20$$

PLATE 4

PRESSURE - KG./CM²