

# 61-F-236 C

W.P. # 952-59

QUEENSWAY

OTTAWA

RIDEAU CANAL

BA 1177

DE LEUW, CATHER & COMPANY  
OF CANADA LIMITED  
CONSULTING ENGINEERS  
TORONTO OTTAWA

226 SPARKS STREET  
OTTAWA 4, ONTARIO  
CENTRAL 3-9663

Our Ref. 1068-Q-3b  
January 19th, 1961

Mr. F. I. Hewson,  
Consultant Liaison Engineer,  
Bridge Division,  
Department of Highways of Ontario,  
Parliament Buildings,  
Toronto, Ontario.

Dear Mr. Hewson:

Re: Foundation Investigation  
Rideau Canal and Queensway 1068-Q-3b

I enclose three (3) copies of McRostie's Foundation Investigation Report No. SF-510 for the proposed structure at Rideau Canal and the Queensway.

The final report for this structure, will be made by Dr. Colder on instructions from Larry Soderman. It is possible in this case, as there will be two Soil Consultants involved, that there would be two BA numbers required eventually.

*PRELIMINARY*

Yours very truly,  
DE LEUW, CATHER & CO. OF CANADA LIMITED

*Leon J Marshall*

Léon J. Marshall, P. Eng.,  
Chief Bridge Engineer

LJM/rm  
Encls.

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CONSULTING ENGINEERS  
OTTAWA 1

CANADA

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## PRELIMINARY STAGE OF THE REPORT ON THE FOUNDATION INVESTIGATION FOR NEW PROPOSED STRUCTURE AT THE RIDEAU CANAL AND THE QUEENSWAY

### 1. SCOPE OF REFERENCE

We were requested by the Ottawa Office of De leuw, Cather & Company of Canada to carry out a preliminary investigation of the subsurface conditions at the site of a proposed structure to carry the Queensway over the Rideau Canal. Recommendations as to the appropriate type of foundation at this site, on the basis of a pilot hole study were to be included in a preliminary stage report on subsoil conditions.

### 2. CONCLUSIONS & RECOMMENDATIONS

#### 2.1 Foundation Type

It was suggested at a meeting on August 24th, 1960, attended by Mr. Davis, Mr. Loderman and Mr. Marshall, that preliminary studies indicated the structure across the Rideau Canal would involve a span of about 200 feet in length. Thus the choice of foundation type most suitable for this structure should be made on the basis of additional representative strength characteristics of the various strata affected.

The adequacy of a footing type of foundation may be proven with additional details on the geometry of the structure. However, the suitability of a pile foundation may be considered if a footing type of foundation is shown to be impractical. Loads imposed on the abutments of a 200 foot span structure would be considerably more than loads on abutments of adjacent Queensway structures. On that basis, settlement predictions made from studies for neighbouring Queensway structures on footings cannot be extended for a structure on footings at this site although subsoil conditions appear somewhat similar.

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## PRELIMINARY STAGE OF THE REPORT ON THE FOUNDATION INVESTIGATION FOR THE PROPOSED STRUCTURE AT THE RIDEAU CANAL AND THE QUEENSWAY

### 1. TERMS OF REFERENCE

We were requested by the Ottawa Office of De Leuw, Cather & Company of Canada to carry out a preliminary investigation of the subsurface conditions at the site of a proposed structure to carry the Queensway over the Rideau Canal. Recommendations as to the appropriate type of foundation at this site, on the basis of a pilot hole study were to be included in a preliminary stage report on subsoil conditions.

### 2. CONCLUSIONS & RECOMMENDATIONS

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If a footing type of foundation is adopted for the structure at this site, footings on the west side of the Canal could lie on the stiff clay crust between elevations 205 and 190 indicated in the pilot hole. Since the ground surface on the east side of the Canal is considerably higher than on the west side, a borehole should be made near the proposed east side abutment in order to confirm the elevation and thickness of the clay crust if any. Then, footing elevations could be considered and determined. The stability of a footing type of foundation should be checked by analyzing failure circles passing beneath the bottom of the Rideau Canal. A borehole on both sides of the Canal bottom could be made to determine the shear characteristics of the various soil layers within the slip circle areas.

If a pile foundation is determined to be more suitable, the choice of pile type (either end bearing, friction or a combination of both) should be influenced by economic and design factors. These factors should include the sensitivity of the underlying cohesive soils if friction piles are considered and the rigidity required for bridge structure foundations.

## 2.2 Soil Strengths

An allowable bearing capacity of 3000 to 5000 pounds per square foot may be assumed for preliminary design of the west abutment involving a footing type of foundation bearing on clay soils between elevations 205 and 190. This range of bearing values may be expected to vary over the area considering the limitations of one borehole. A bearing capacity cannot be stated for the soils on the east side of the Canal until subsoil conditions are confirmed by a borehole in that vicinity.

## 2.3 Soil Compressibilities

Results from laboratory consolidation tests showed probable preconsolidation loads equal to 4.8 and 7.8 kips.

per square foot at about elevations 192 and 187 respectively. A foundation scheme limiting bearing pressures to these values near the elevations stated above would produce settlements of the structure which should be tolerable. However, the amount of settlement that could be produced from the compressible stratum should be checked after more details are known on the geometry of the structure. The compressibility properties of the sub-soil already determined should be confirmed in the east abutment area and then used in settlement computations. The settlement study should determine also what effect the additional loads have on neighbouring existing structures.

### 3. SITE INVESTIGATION

Plate No. 1 indicates the location of the pilot hole, made with our test drilling rig, for the structure at this site. Ten tube samples were taken from the cohesive stratum at about 5 foot intervals down to a depth of 50 feet below ground surface. In granular soils split barrel samples were recovered at about 10 foot intervals in conjunction with standard penetration resistance tests down to rock. Most samples were examined and classified in our laboratory. The groundwater level was observed and recorded during the drilling.

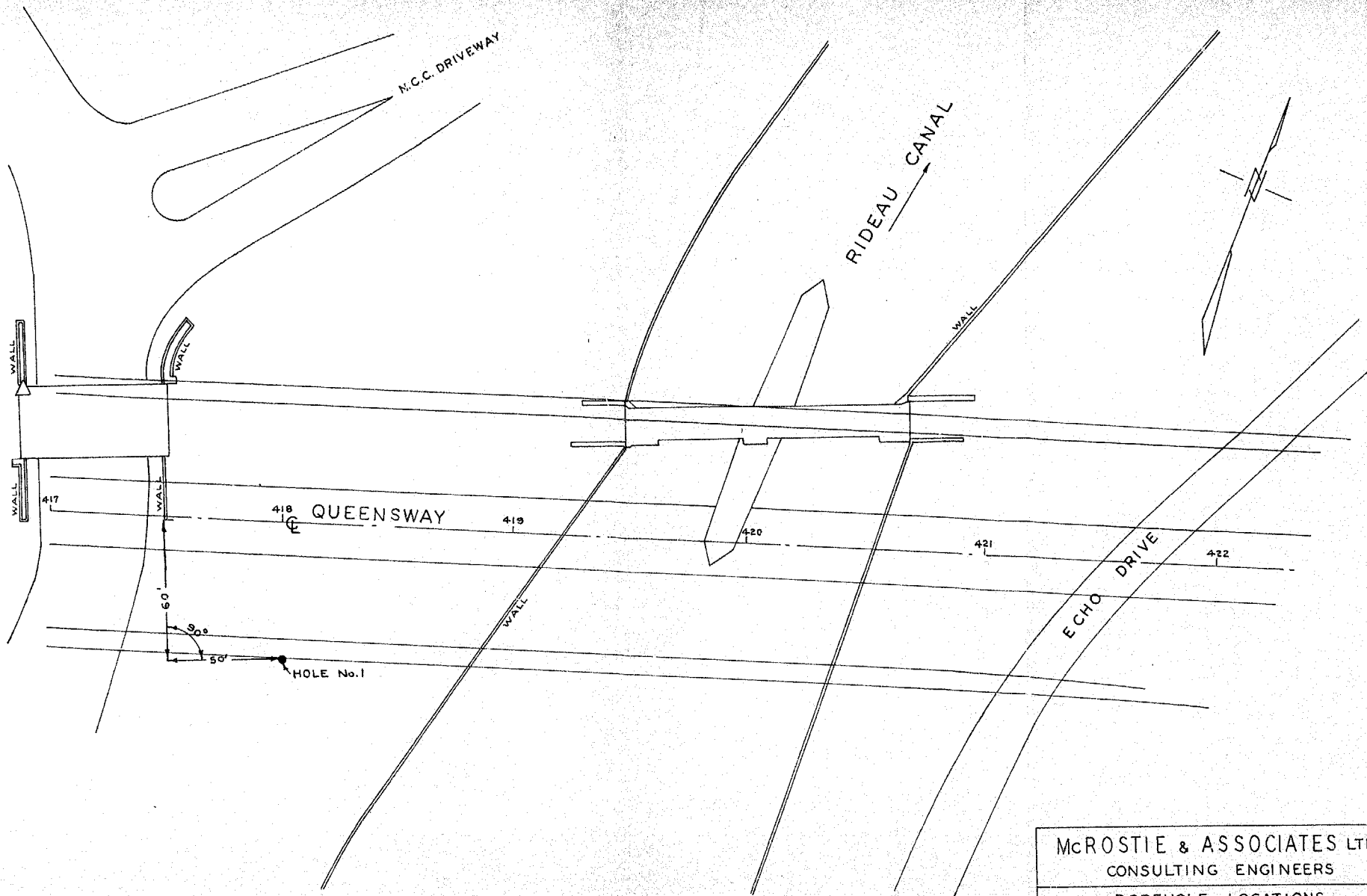
Rock was encountered at elevation 103.7 and was diamond drilled. Cores recovered were inspected and logged and the percentage of core recovery from each run was calculated. This assisted in evaluating the structural properties of the rock. The presence of seams in the rock formation would have been detected since a careful watch for drops of drill rods and loss of drill water was exercised throughout the drilling operations.

Three laboratory consolidation tests were made on samples 1-4, 1-5 and 1-10 recovered at depths shown on Plate No. 2. The results have been plotted on Plates Nos. 3, 4 and 5. A number of small scale penetrometer tests (Soiltest type) and some unconfined compression tests were made on samples, to provide preliminary strength figures of the compressible stratum. In the second stage investigation field vane tests and triaxial tests are required to improve the preliminary strength results. Classification tests were made on most samples and some of the results are shown on Plates Nos. 6 to 12.

The geotechnical profile of the subsurface as revealed by the pilot hole is shown on Plate No. 2. It can be generalized as consisting of about one foot of fill underlain by about 5 feet of loose silty sand overlying approximately 54 feet of clay and silt and clay mixture generally stiff. Underlying the cohesive stratum is approximately 40 feet of medium dense silt and sand mixture, underlain by about 8 feet of till varying from loose to dense with depth, overlying shale rock in a sound condition.

The overnight groundwater level reading at about 2 feet below ground surface can be considered as a seasonal high and can be expected to drop to at least 6 feet below ground level in drier seasons.





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BOREHOLE LOCATIONS CANAL & QUEENSWAY	
SCALE: 1" = 40'	PLATE No. 1

McROSTIE & ASSOCIATES  
CONSULTING ENGINEERS  
OTTAWA CANADA

## SOIL PROFILE AND SUMMARY OF FIELD AND LABORATORY TESTS

RIDEAU CANAL &amp; QUEENSWAY

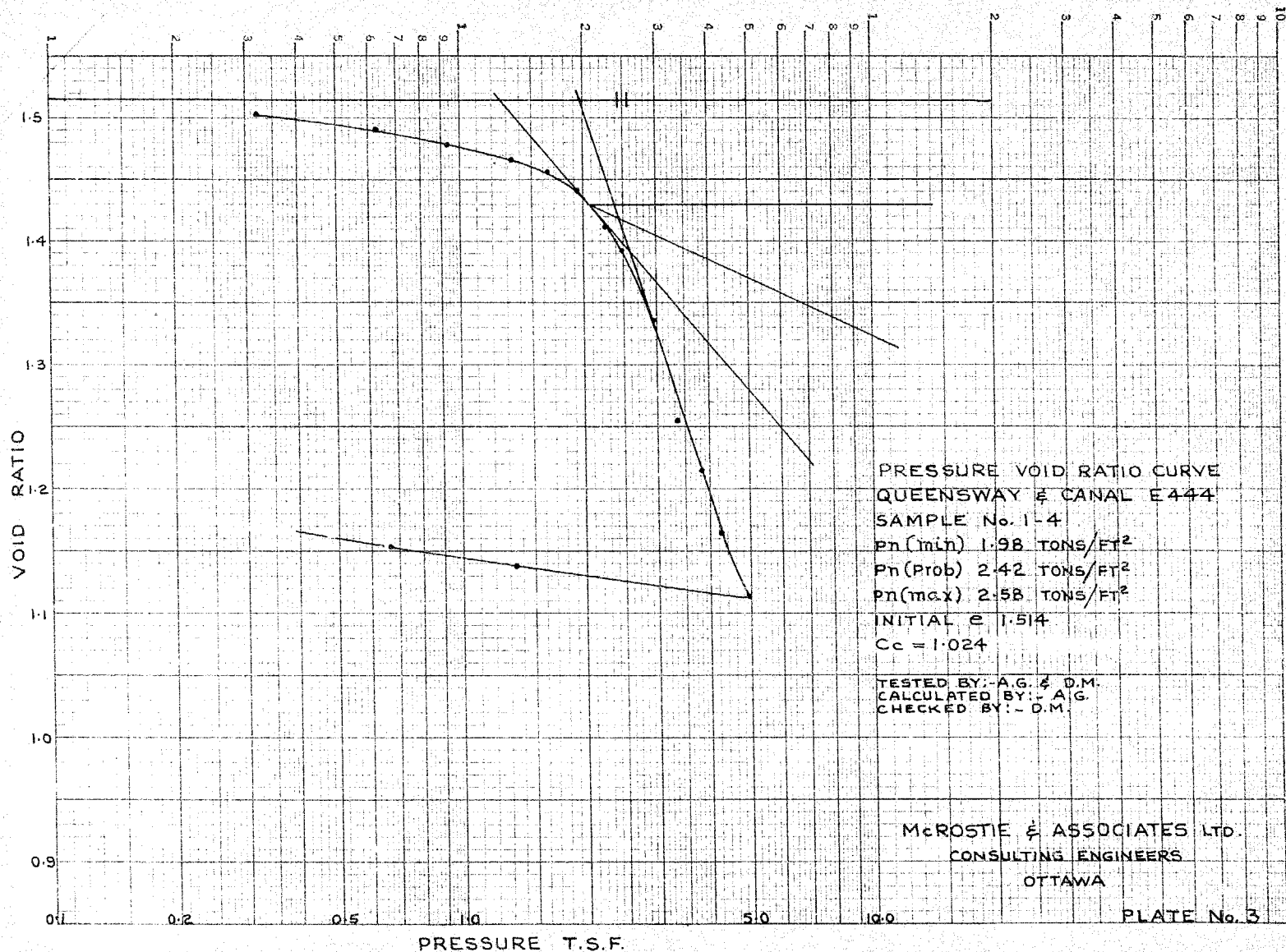
ELEVATION OF GROUND SURFACE (ZERO DEPTH) 211.6' DATE MAY 17 1960

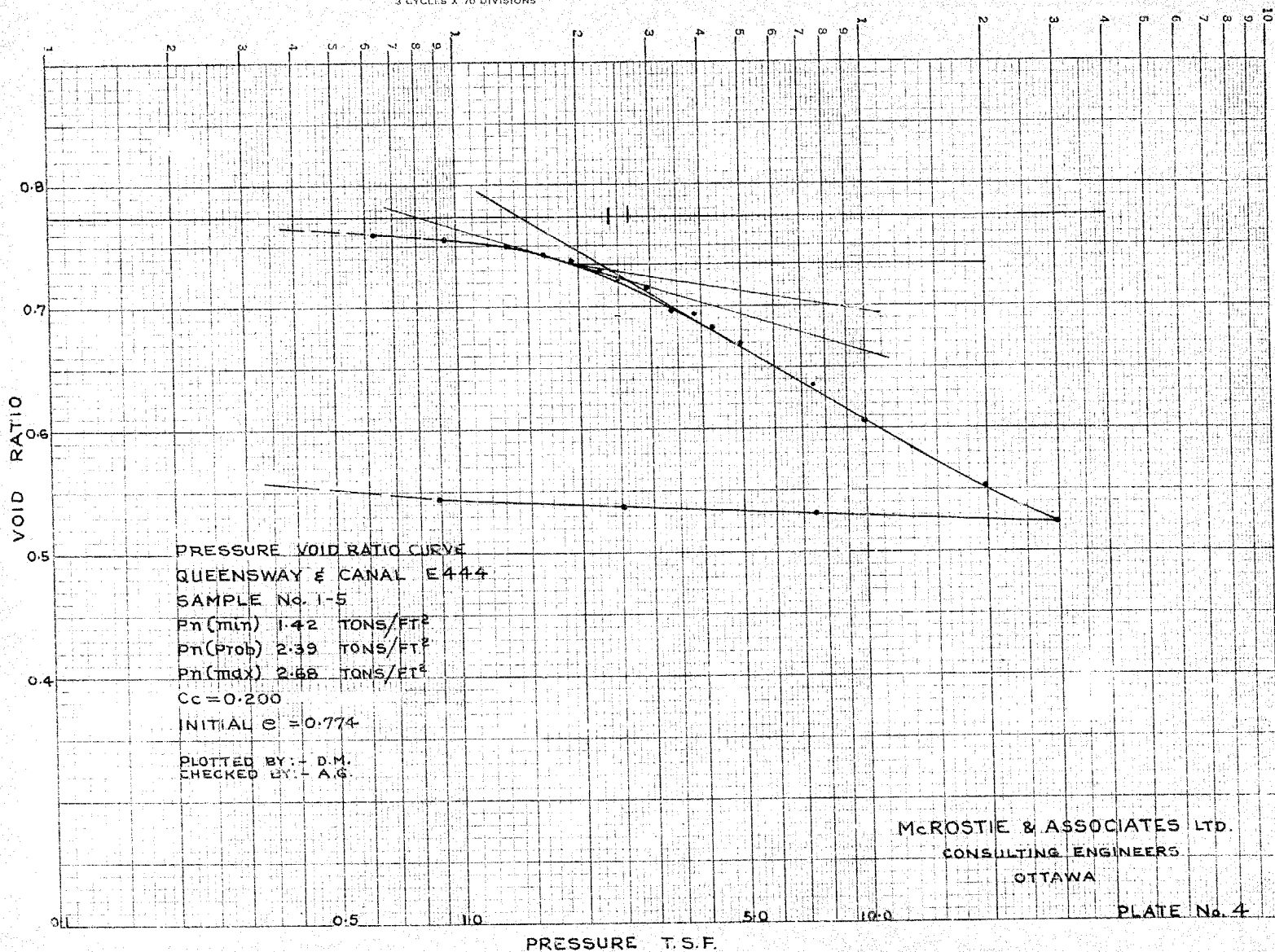
HOLE NO.

REMARKS B.M. (EL. 219.61) GEODETIC CITY B.M. AT S.W. CORNER OF

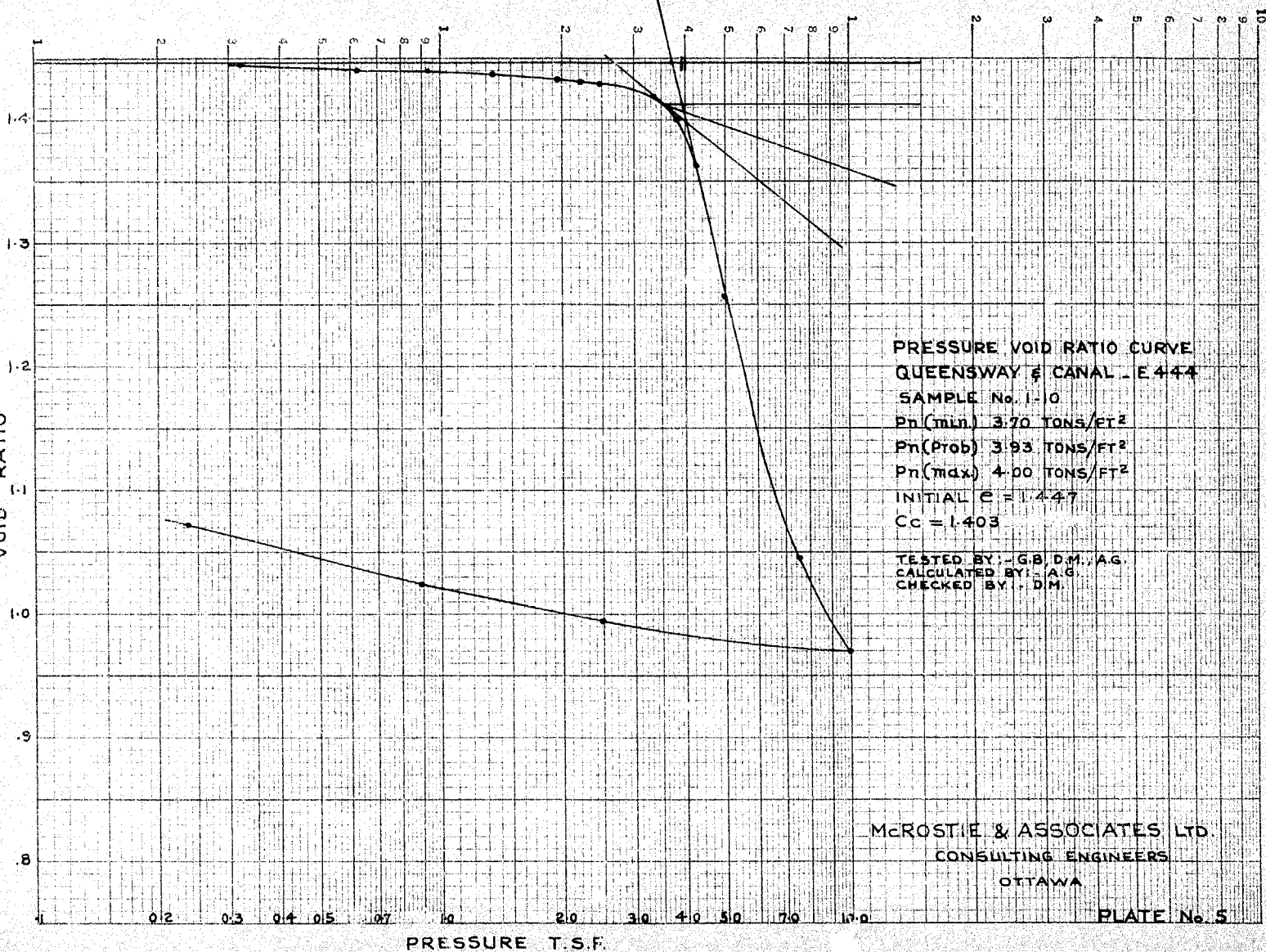
PRETORIA &amp; DRIVEWAY

UNCONFINED COMPRESSION STRENGTH KIPS/FT. <sup>2</sup>	SMALL SCALE PENETROMETER KIPS/FT.	STANDARD PENETRATION BLOWS/F.T.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PROBING OR VANE-TEST	
							LB. HAMMER	NO CASING
							INCH DROP	INCH DIA. ROD
							BLOWS PER FOOT OR	SHEAR STRENGTH IN KIPS PER SQ. FT.
				TOP SOIL	0'	211.6'		
				SILT FINE SAND WITH A LITTLE CLAY VERY LOOSE (SM)	0'	209.6'		OVER NIGHT WATER LEVEL - 209.1'
1.9	4.4	1-1A	1-1B	CLAY, BROWNISH GRAY, FISSEURED STIFF, HIGH PLASTICITY (CH)	12'			
1.9	4.4	1-3		CLAY GRAY, STIFF, HIGH PLASTICITY (CH)				
2.7	4.4	1-4						
1.6	4.4	1-5		SILT, STIFF TO MEDIUM SOFT LOW PLASTICITY (ML)	25'	186.6'		
	4.4	1-6			30'	181.6'		
	4.4	1-7						
	4.4	1-8		CLAY GRAY, STIFF LOW PLASTICITY (CL)				
4.0	4.4	1-9						
	4.4	1-10						
1.3	4.4	1-11		CLAYEY SILT, GRAY, STIFF TO MEDIUM SOFT LOW PLASTICITY (CL-ML)	50'	161.6'		
	4.4	1-12		SANDY SILT WITH SOME CLAY & A TRACE OF GRAVEL NON PLASTIC MEDIUM DENSE (ML)	60'			
	4.4	1-13						
	4.4	1-14			71.5'	140.1'		
	4.4	1-15		SILT WITH SOME SAND & A LITTLE CLAY NON PLASTIC MEDIUM DENSE (ML)				
	4.4	1-16						
	4.4	1-17		SANDY SILT WITH A LITTLE GRAVEL & A TRACE OF CLAY NON PLASTIC MEDIUM DENSE (ML)	100'			
	4.4	1-18		SILT SAND WITH A LITTLE CLAY & A TRACE OF GRAVEL (MEDIUM DENSE)	106'	105.6'		
	4.4			SHALE	107.9'	103.7'		
	4.4			CORE RECOVERY - 98%	113.2'			
	4.4			CORE RECOVERY - 100%	118.3'	93.3'		
	4.4			BOTTOM OF HOLE				

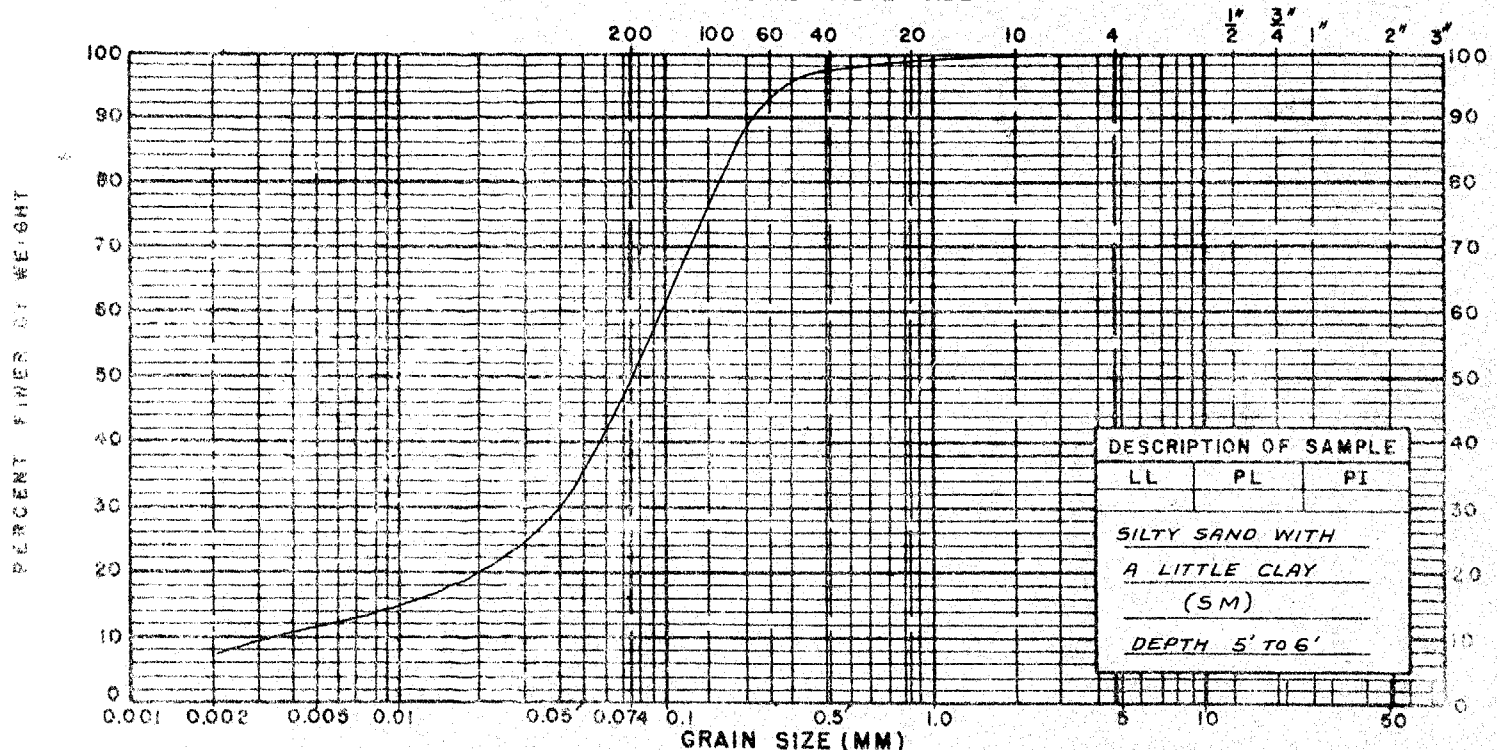




VOID RATIO



UNIFIED SOIL CLASSIFICATION  
MECHANICAL ANALYSIS OF SOILS  
U.S. STANDARD SIEVE SIZE



CLAY OR SILT		SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
50%		50%				

CRITERIA		
SOIL TYPE	Cu	Cc
GW	>4	1-3
SW	>6	1-3

PROJECT QUEENSWAY & CANAL E-444 SAMPLE No. 1-1A

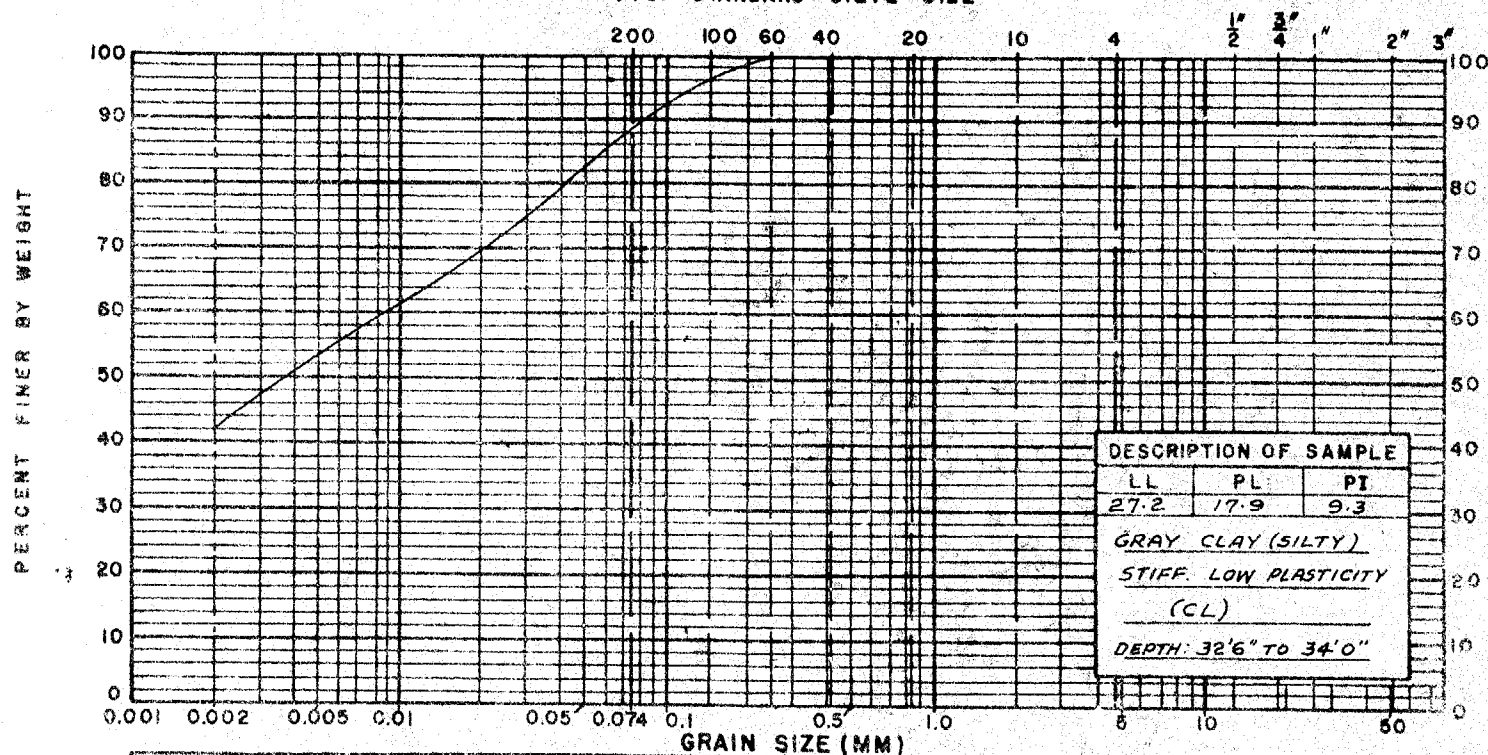
PLOTTED D.M. DATE MAY 30, 1960

REMARKS

CHECKED G.B. DATE MAY 30, 1960

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OTTAWA, CANADA

UNIFIED SOIL CLASSIFICATION  
MECHANICAL ANALYSIS OF SOILS  
U. S. STANDARD SIEVE SIZE



DESCRIPTION OF SAMPLE		
LL	PL	PT
27.2	17.9	9.3
GRAY CLAY (SILTY)		
STIFF, LOW PLASTICITY		
(CL)		
DEPTH: 32'6" TO 34'0"		

CLAY OR SILT		SAND		GRAVEL	
FINE	COARSE	FINE	COARSE	FINE	COARSE
88%		12%			

CRITERIA		
SOIL TYPE	Cu	Cc
GW	> 4	1-3
SW	> 6	1-3

PROJECT QUEENSWAY & CANAL E-444

SAMPLE No. 1-7

PLOTTED A.G. DATE MAY 31, 1960

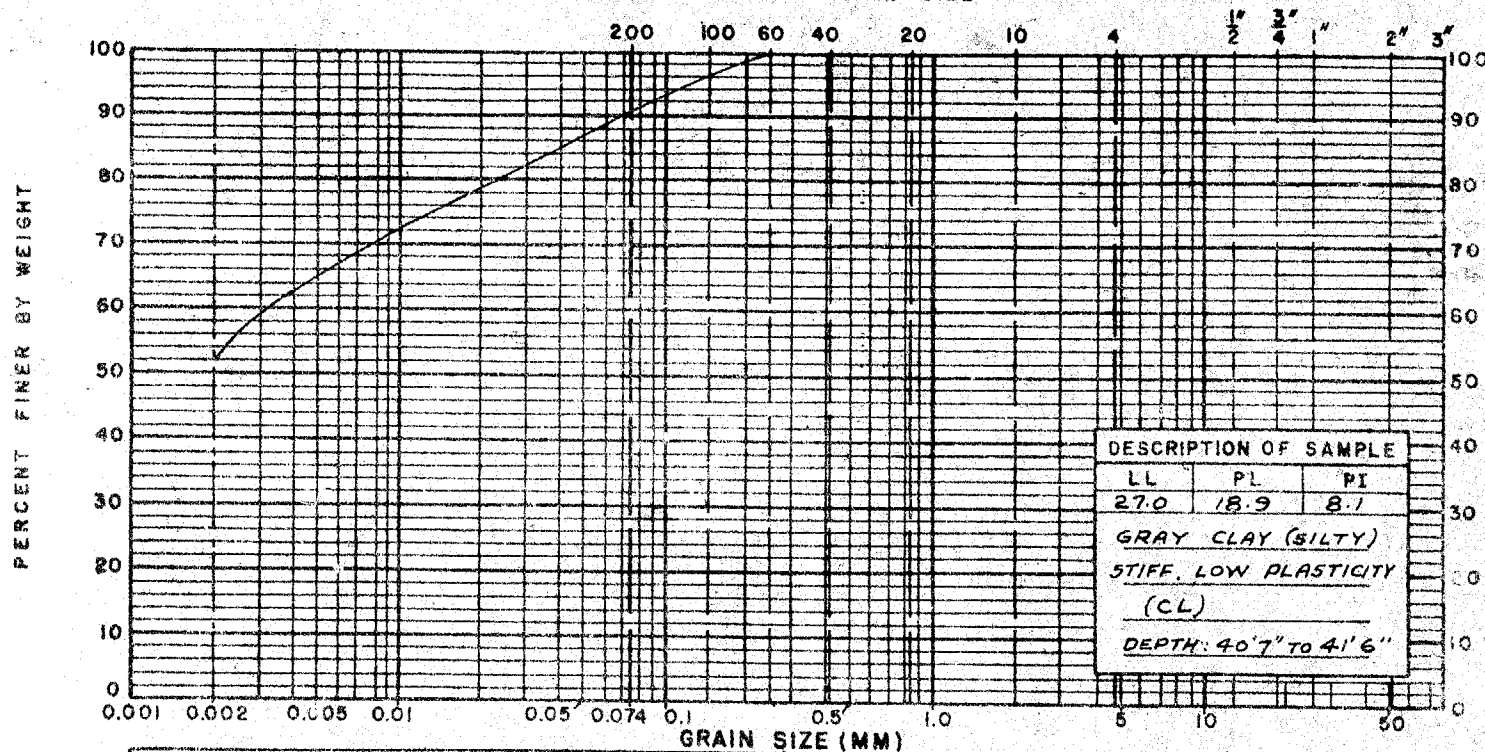
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REMARKS

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UNIFIED SOIL CLASSIFICATION  
MECHANICAL ANALYSIS OF SOILS  
U. S. STANDARD SIEVE SIZE



DESCRIPTION OF SAMPLE

LL	PL	PI
27.0	18.9	8.1
GRAY CLAY (SILTY)		
STIFF, LOW PLASTICITY		
(CL)		
DEPTH: 40' 7" TO 41' 6"		

CLAY OR SILT		SAND		GRAVEL	
FINE	COARSE	FINE	COARSE	FINE	COARSE

CRITERIA		
SOIL TYPE	Cu	Cc
GW	> 4	1-3
SW	> 6	1-3

92%

8%

PROJECT QUEENSWAY & CANAL

E-444

SAMPLE No. 1-9

PLOTTED A.G. DATE JUNE 3, 1960

REMARKS

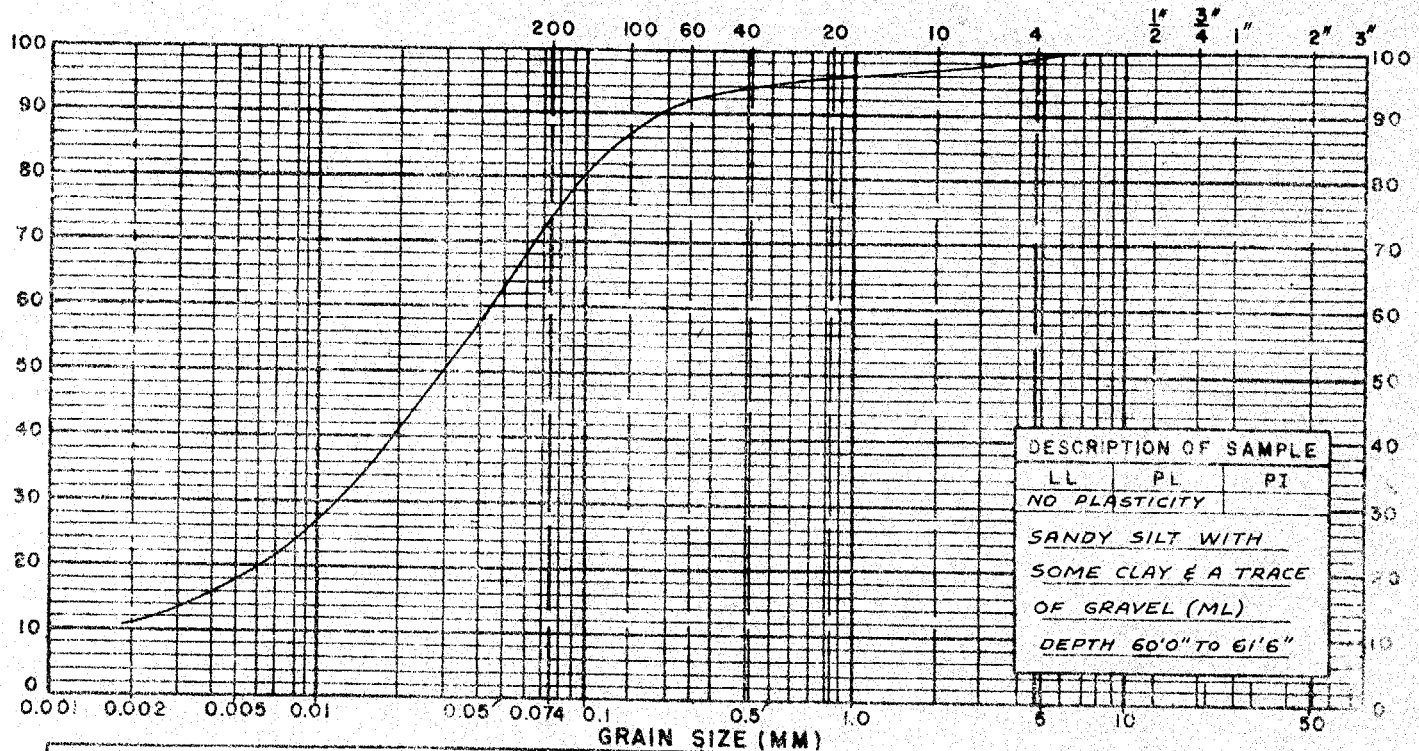
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UNIFIED SOIL CLASSIFICATION  
MECHANICAL ANALYSIS OF SOILS  
U.S. STANDARD SIEVE SIZE

PERCENT FINER BY WEIGHT



DESCRIPTION OF SAMPLE

LL PL PI  
NO PLASTICITY  
SANDY SILT WITH  
SOME CLAY & A TRACE  
OF GRAVEL (ML)  
DEPTH 60'0" TO 61'6"

CLAY OR SILT

SAND

GRAVEL

FINE

MEDIUM

COARSE

FINE

COARSE

73%

26%

1%

CRITERIA

SOIL TYPE	Cu	Cc
GW	> 4	1-3
SW	> 6	1-3

PROJECT QUEENSWAY & CANAL E-444

SAMPLE No. 1-12

PLOTTED D.M. DATE MAY 30, 1960

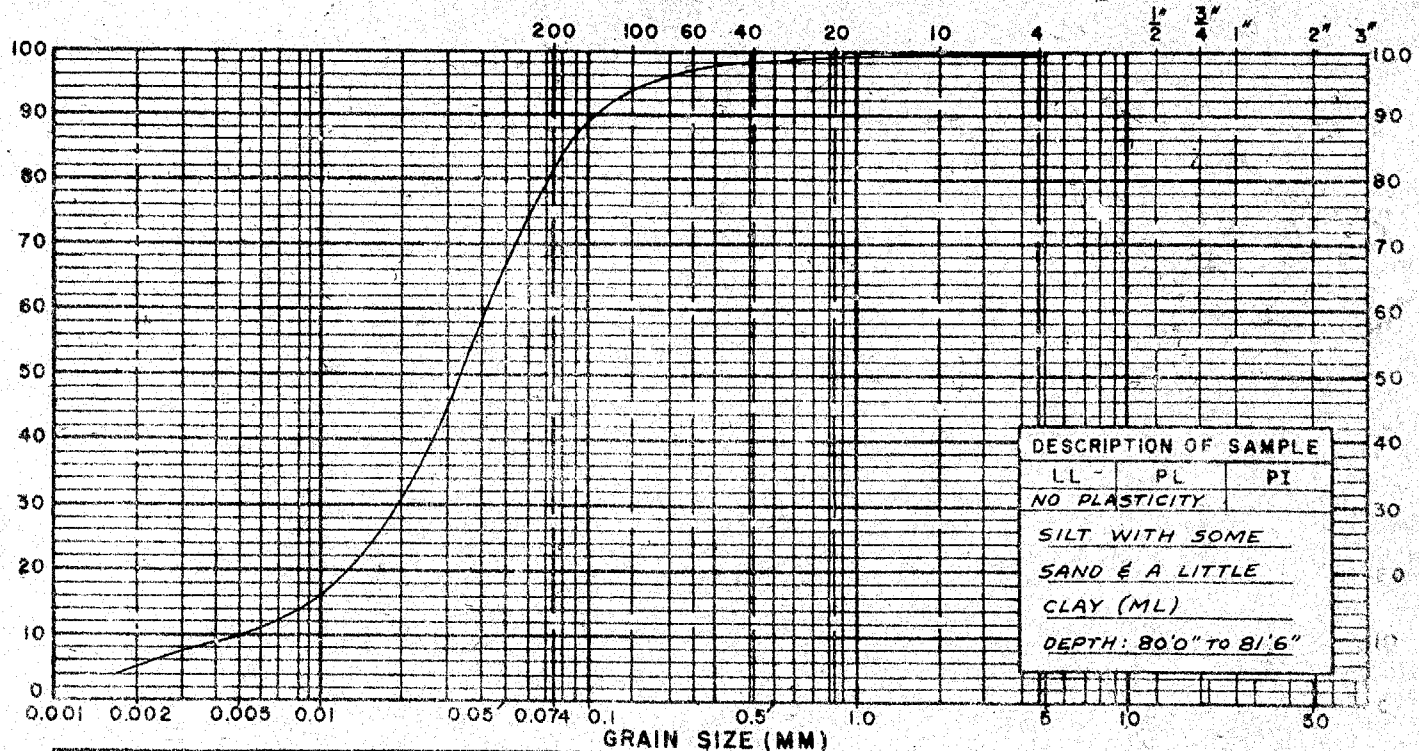
REMARKS

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UNIFIED SOIL CLASSIFICATION  
MECHANICAL ANALYSIS OF SOILS  
U.S. STANDARD SIEVE SIZE

PERCENT FINER BY WEIGHT



DESCRIPTION OF SAMPLE

LL - PL PI  
NO PLASTICITY  
SILT WITH SOME  
SAND & A LITTLE  
CLAY (ML)  
DEPTH: 80'0" TO 81'6"

CLAY OR SILT

SAND

GRAVEL

FINE

MEDIUM

COARSE

FINE

COARSE

CRITERIA

SOIL TYPE	Cu	Cc
GW	> 4	1-3
SW	> 6	1-3

81%

19%

PROJECT QUEENSWAY & CANAL E-444

SAMPLE No. 1-15

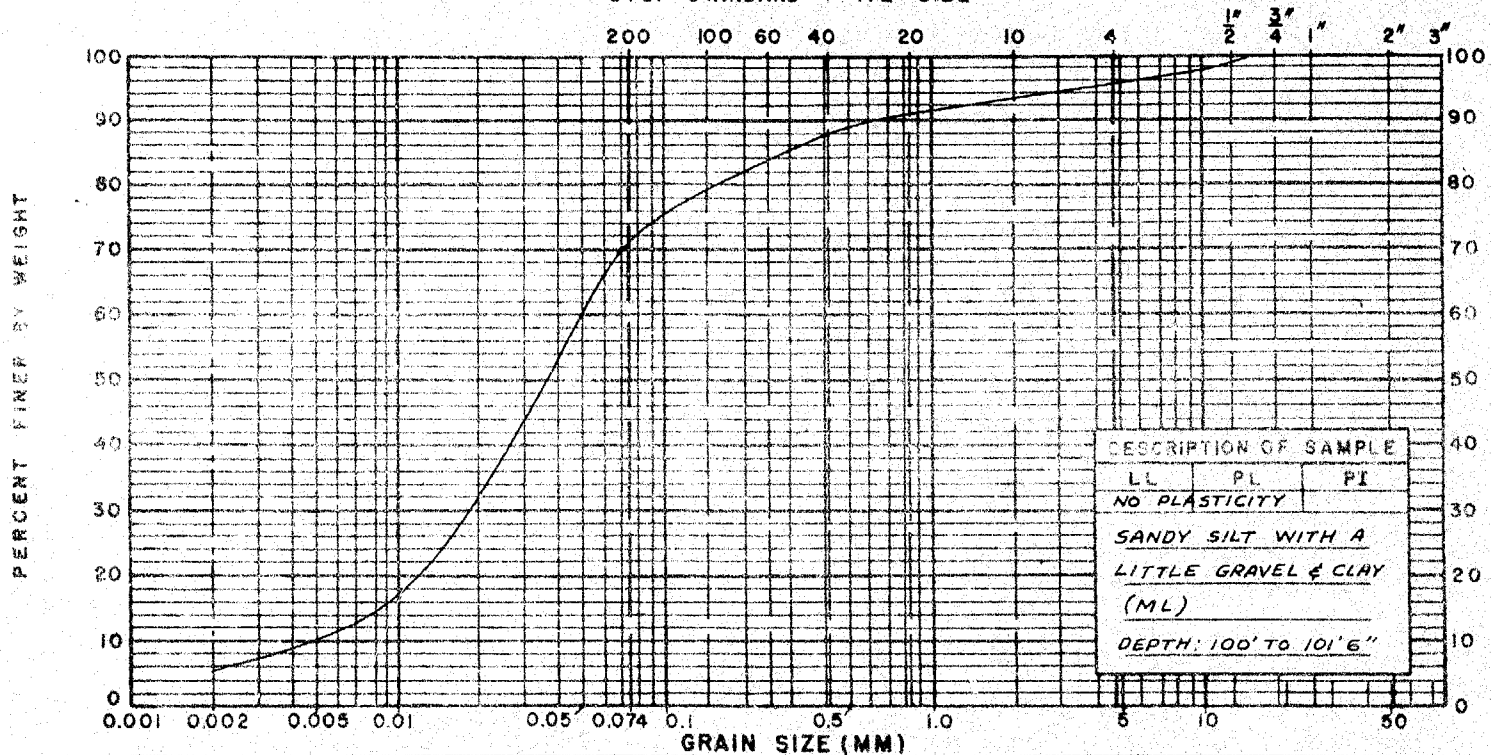
PLOTTED D.M. DATE MAY 30, 1960

REMARKS

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**UNIFIED SOIL CLASSIFICATION  
MECHANICAL ANALYSIS OF SOILS  
U.S. STANDARD SIEVE SIZE**



**DESCRIPTION OF SAMPLE**

LL	PL	PI
NO PLASTICITY		
SANDY SILT WITH A LITTLE GRAVEL & CLAY (ML)		
DEPTH: 100' TO 101' 6"		

CLAY OR SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE
71%		24%		5%	

CRITERIA		
SOIL TYPE	Cu	Cc
GW	> 4	1-3
SW	> 6	1-3

PROJECT QUEENSWAY & CANAL E. 444 SAMPLE No. 1-17

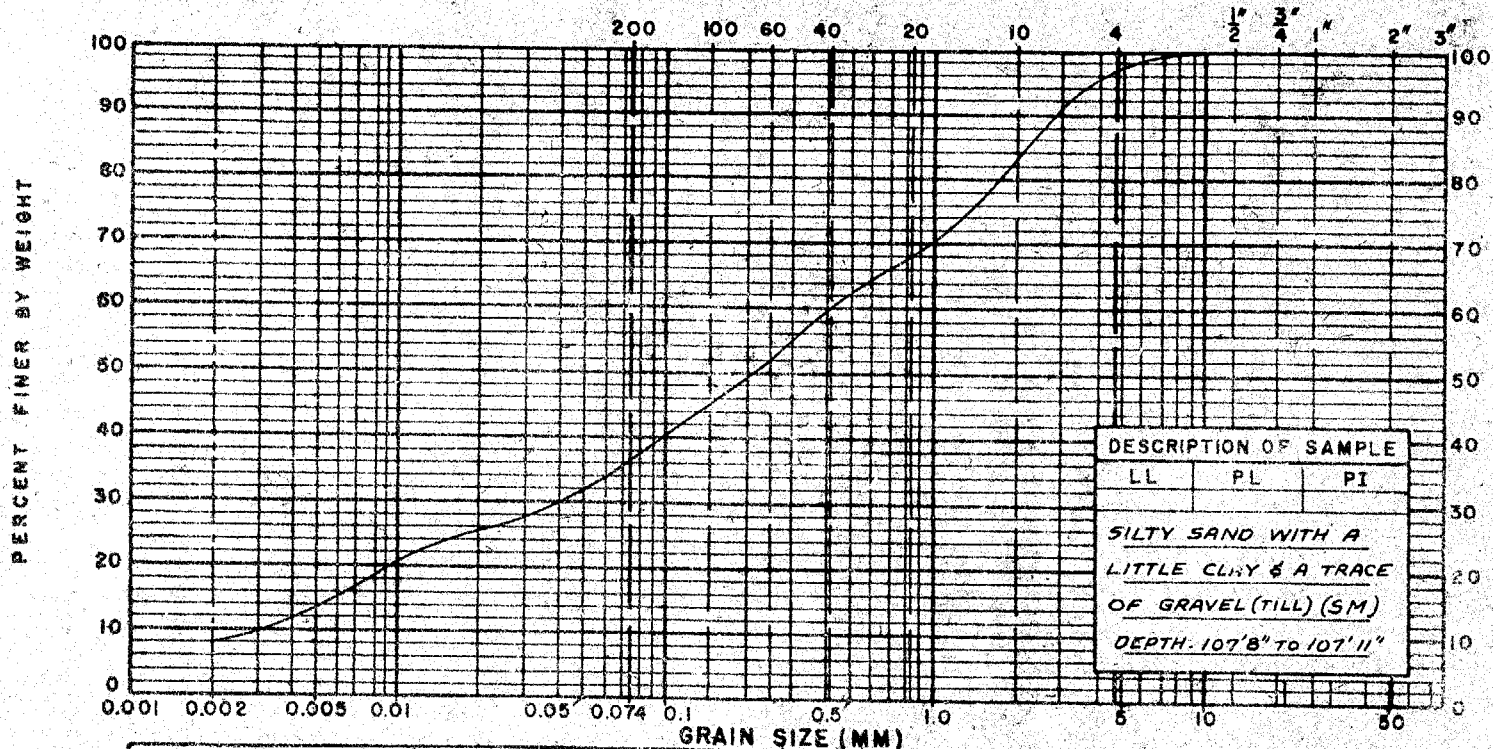
PLOTTED A.G. DATE MAY 31, 1960

CHECKED G.B. DATE JUNE 1, 1960

REMARKS \_\_\_\_\_

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UNIFIED SOIL CLASSIFICATION  
MECHANICAL ANALYSIS OF SOILS  
U.S. STANDARD SIEVE SIZE



CLAY OR SILT		SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE
	36%		61%			3%

CRITERIA		
SOIL TYPE	Cu	Cc
GW	> 4	1-3
SW	> 6	1-3

PROJECT QUEENSWAY & CANAL E-445

SAMPLE No. 1-18

PLOTTED A.G. DATE MAY 31, 1960

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