

# 59-F-224C

BRIDGE # 11

OTTAWA

QUEENSWAY &

PARKDALE AVE

# MCROSTIE & ASSOCIATES

CONSULTING ENGINEERS

OTTAWA 1

CANADA

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59-F-224C

## FOUNDATION REPORT-BRIDGE NO. 11

### PARKDALE AVENUE

#### 1. TERMS OF REFERENCE

We were requested by the Ottawa Office of De Leuw Cather & Company of Canada Limited to carry out a foundation investigation at the site of a proposed bridge at Parkdale Avenue and the Queensway. A report was to be prepared on the investigation.

#### 2. RECOMMENDATIONS

##### 2.1 Soil Strengths

The suitability of structure footings at about elevation 223 was studied. Variations in density within the till soils below this elevation were found to be critical and any bearing capacity recommendation would be controlled by the density of the loosest areas observed under an abutment. The bearing capacities which would be recommended for each abutment are set out below.

East Abutment - for footings  
at or below elevation 222...

2,000 POUNDS PER  
SQUARE FOOT and  
groundwater control  
required.

West Abutment - footings at  
or below elevation 221....,,

2,000 POUNDS PER  
SQUARE FOOT AND  
groundwater control  
required.

Since local variations in density were observed in the boreholes and are critical, the final design on the basis of footings or soil support cannot be completed without results from Borehole No. 4. This borehole could not be made due to lack of property access permission. Furthermore, variations between borehole locations would need to be considered at the time of construction as more fully discussed under Section 2.4 - Construction Precautions.

## 2.2 Soil Compressibilities

The long term consolidation settlement of structures on a compressible soil deposit should always be considered. However, soils at this site are basically granular and consolidation settlements would not therefore be encountered.

## 2.3 Foundation Type

Owing to the varying densities of the till soils, relatively low bearing capacities would be required. With rock at shallow depths, it would be likely that short, end bearing piles would be economical compared with large spread footings. High capacity piles or expanded base caissons could be considered as these are likely to be more economical than light piles.

The use of piles for support of the structure would alleviate the critical construction stage evaluation of soil density variation, and the omission of borehole No. 4 would be less critical at this time.

## 2.4 Construction Precautions

If the till soils are considered for support of the structure, their natural densities will need to be protected during construction. An upward flow of

groundwater through the bottom of the excavation could result in damaging settlements under subsequent live load applications. Control of groundwater could be attempted by continuous pumping from well points, pits, or trenches outside the excavation area, or by connection of foundation drains lower than the excavation bottom to sewers of suitable depths.

Also if the till and sandy soil layers are used for support, the possibility of varying soil conditions between the borehole locations should be recognized. A careful watch should be kept during construction for these variations and any differences reported for appropriate action.

The existing practices of having payment procedures for pile type foundations sufficiently flexible to cover varying refusal lengths should be continued. Finally it should be mentioned again that the high numbers recorded for the standard penetration test in the Ottawa area till soils have been found not to represent the high degree of resistance to driving which might be expected from experience in many other locations.

### 3. SITE INVESTIGATION

#### 3.1 Field Work

Five boreholes were made at the site with our test drilling rig in the locations shown on Plate No. 1. A sixth borehole in the location marked as No. 4, was not executed due to the lack of permission from the present property owners. This borehole should be completed however, prior to contract drawings so that confirmation may be received of the expected ground conditions.

Two-inch split barrel samples were recovered and the standard penetration test performed in the boreholes. Groundwater levels were recorded during the field program and the underlying rock was diamond drilled with cores recovered for inspection. During the drilling a careful watch was kept for drops, discontinuities, and loss of drilling water so that information on the rock structure could be obtained.

#### 3.2 Laboratory Work

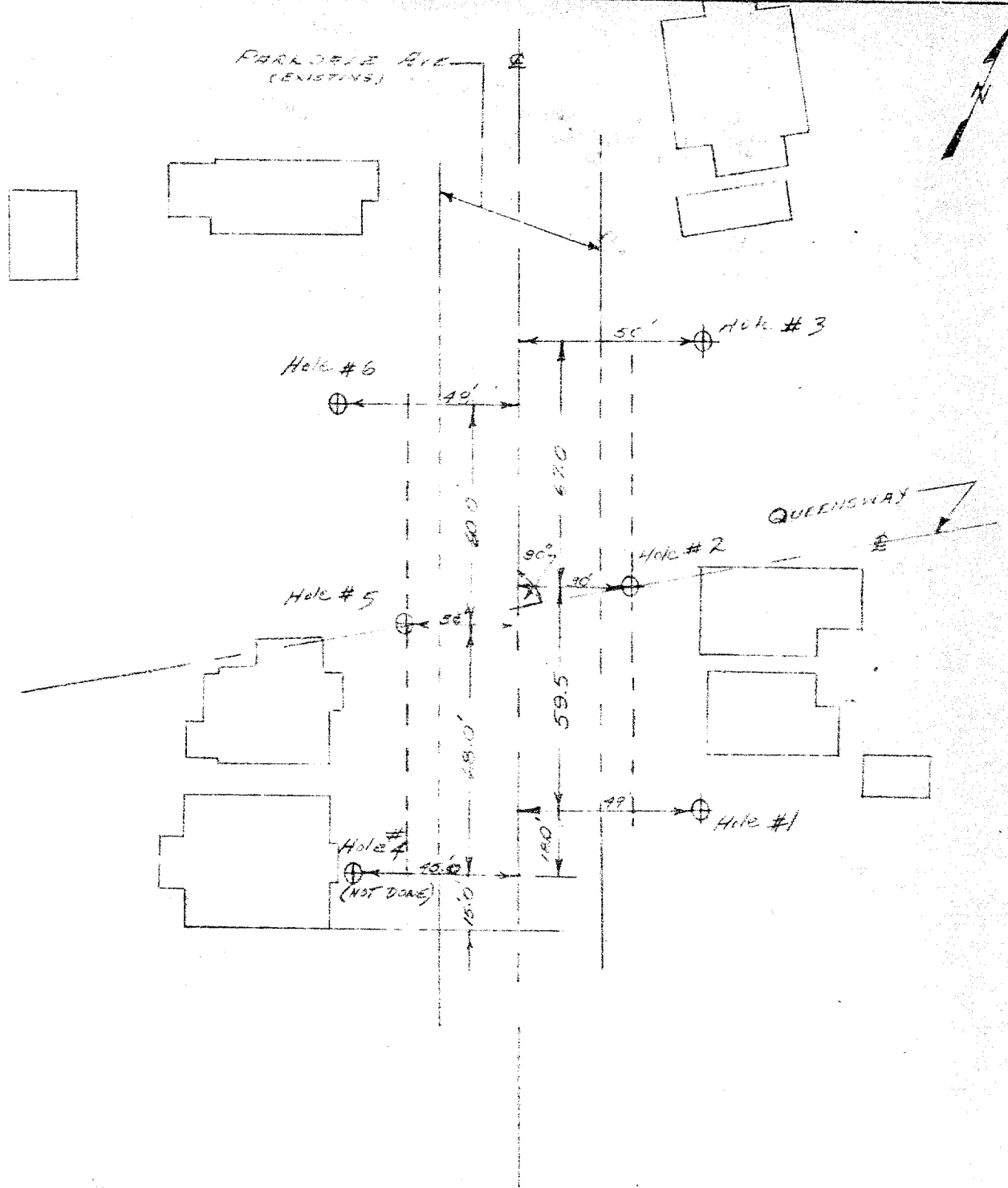
Routine water content tests were made on all samples to aid in judging their permeability and density. When it became evident that varying densities were involved and that these variations would decide the major recommendations on bearing capacities and foundation type, a reasonably complete group of mechanical analysis tests were done on the till soils below possible foundation level. Direct measurements of field density from the split barrel samples was attempted but was not successful due to the stone content of the tills and difficulties in retaining samples. When results of the laboratory tests were studied and compared with the field penetration tests and laboratory water contents it was seen that considerable variation in natural

densities could be inferred. Experience with the standard penetration test in till soils had led us to feel that it should not be used as an unsupported indication of density.

### 3.3 Observations

Soil and rock conditions are shown in detail on Plates 2 to 6 but can be generalized as consisting of a few feet of fill underlain by glacial till of varying densities to depths of about 20 feet. Sand layers occur in the till and beneath the soil deposits is shaley limestone of the Ottawa Formation. The upper few feet of the rock are, in places, weathered and two drops were encountered during the drilling program, indicating the presence of uncemented material.

Groundwater levels were 3 to 12 feet below the surface and they can be considered as being between the seasonal high and low levels. Adjacent municipal sewers will tend to control the range of groundwater variation and permanent drainage can fairly readily be established down to their level.



**McROSTIE & ASSOCIATES**  
**CONSULTING ENGINEERS**

**BOREHOLE LOCATIONS**  
**QWY & PARKDALE**

**SCALE 1" = 40'**

**PLATE 1**

McROSTIE & ASSOCIATES  
CONSULTING ENGINEERS  
OTTAWA CANADA

SOIL PROFILE AND SUMMARY  
OF FIELD AND LABORATORY TESTS

QWY 5 PARKDALE

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 233.9 DATE NOV 13<sup>th</sup> 1958

HOLE NO. 1

REMARKS CITY P.M. HOLLAND & TINDALL ELEV 220.7 GEOSTATIC DATUM

FOR MECHANICAL ANALYSIS SEE PLATES 7-1 INC.

UNCONFINED COMPRESSIVE STRENGTH KIPS/FT. <sup>2</sup>	SMALL SCALE PENETROMETER KIPS/FT. <sup>2</sup>	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PROBING OR VANE TEST	
							LB. HAMMER	NO CASING
							INCH DROP	INCH DIA. ROD
GROUND SURFACE							BLOWS PER FOOT OR	SHEAR STRENGTH IN KIPS PER FT. <sup>2</sup>
				TOPSOIL	0.0	233.9		
				MEDIUM DENSE TILL				
		24	1-1		3.2		○	
		79	1-2		5.0	228.0	○	
		(Stone)						
		35	1-3				○	
				DENSE TILL	10.0	223.8		
		64	1-4				○	
				OVERNIGHT WATER LEVEL @				
				11.5'				
		58	1-5				○	
		32	1-6	DENSE FINE SAND	15.0	218.8	○	
				DENSE TILL				
				DENSE SILT WITH SAND FRAGMENTS	18.0			
				WEATHERED ROCK	19.2		○	
				SHARLEY LIMESTONE	20.0	213.8		
				(Stone Recovered 74%)				
				BOTTOM OF HOLE	23.9	209.9		
							% WATER CONTENT	
							NATURAL	○
							LIQUID LIMIT	□
							PLASTIC LIMIT	△
							PLATE	
							2	

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## SOIL PROFILE AND SUMMARY OF FIELD AND LABORATORY TESTS

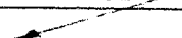
RWY PARKDALE

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 223.6 DATE NOV 7 1966

HOLE NO.

2

REMARKS SEE PLATE #2 - FOR MECHANICAL ANALYSISSEE PLATES #10 & 11

UNCONFINED COMPRESSIVE STRENGTH KIPS/FT. <sup>2</sup>	SMALL SCALE PENETROMETER KIPS/FT. <sup>2</sup>	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PROBING OR VANE TEST	
							.....LB. HAMMER	NO CASING
							.....INCH DROP	.....INCH DIA. ROD
GROUND SURFACE							BLOWS PER FOOT OR SHEAR STRENGTH IN KIPS PER FT. <sup>2</sup>	
					00	233.6		
				FILL				
			19 2-1		40		0	
			58 2-2				0	
			36 2-3	DENSE TILL				
			19 2-4	MEDIUM DENSE TILL	100	223.6		
					115			
			58 2-5	DENSE SANDY TILL				
			106 2-6	DENSE WELL GRADED SAND & GRAVEL	130			
			31 2-7	DENSE WELL GRADED SAND	145			
					175			
			35 2-8	DENSE FINE SAND				
			28 2-9	DENSE TILL	200	213.6		
					232			
				SHALEY LIMESTONE (CORE RECOVERY 97%)				
					282			
				SHALEY LIMESTONE (CORE RECOVERY 100%)		203.6		
					332	200.4		
				BOTTOM OF HOLE				
							0 20 40 60 80 100	
							% WATER CONTENT	
							NATURAL	○
							LIQUID LIMIT	□
							PLASTIC LIMIT	△
							PLATE	3

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### OTTAWA CANADA

# SOIL PROFILE AND SUMMARY

## OF FIELD AND LABORATORY TESTS

QWY / PARKDALE

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 232.4 DATE NOV 12 1953REMARKS SEE PLATE #2 FOR MECHANICAL ANALYSIS

HOLE NO.

3

UNCONFINED COMPRESSIVE STRENGTH KIPS/FT. <sup>2</sup>	SMALL SCALE PENETROMETER KIPS/FT. <sup>2</sup>	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PROBING OR VANE TEST	
							LB. HAMMER INCH DROP BLOWS PER FOOT OR	NO. CASING INCH DIA. ROD SHEAR STRENGTH IN KIPS PER FT. <sup>2</sup>
				GROUND SURFACE				
					0.0	230.4		
				FILL				
			9		4.0			
			14		5.1	225.4		
				MEDIUM DENSE TILL				
			21					
			8		10.0	220.4		
				LOOSE TILL				
			10		15.0	215.4		
			14		16.2			
				MEDIUM DENSE TILL				
			49		20.0	210.4		
				DENSE SILTY TILL				
				SHALTY LIMESTONE (CORE RECOVERY 12")				
				BOTTOM OF HOLE	26.9	203.6		

% WATER CONTENT  
 NATURAL ☐  
 LIQUID LIMIT ☐  
 PLASTIC LIMIT ☐

PLATE

4

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### OTTAWA CANADA

# SOIL PROFILE AND SUMMARY

## OF FIELD AND LABORATORY TESTS

QWY / PARKDALE

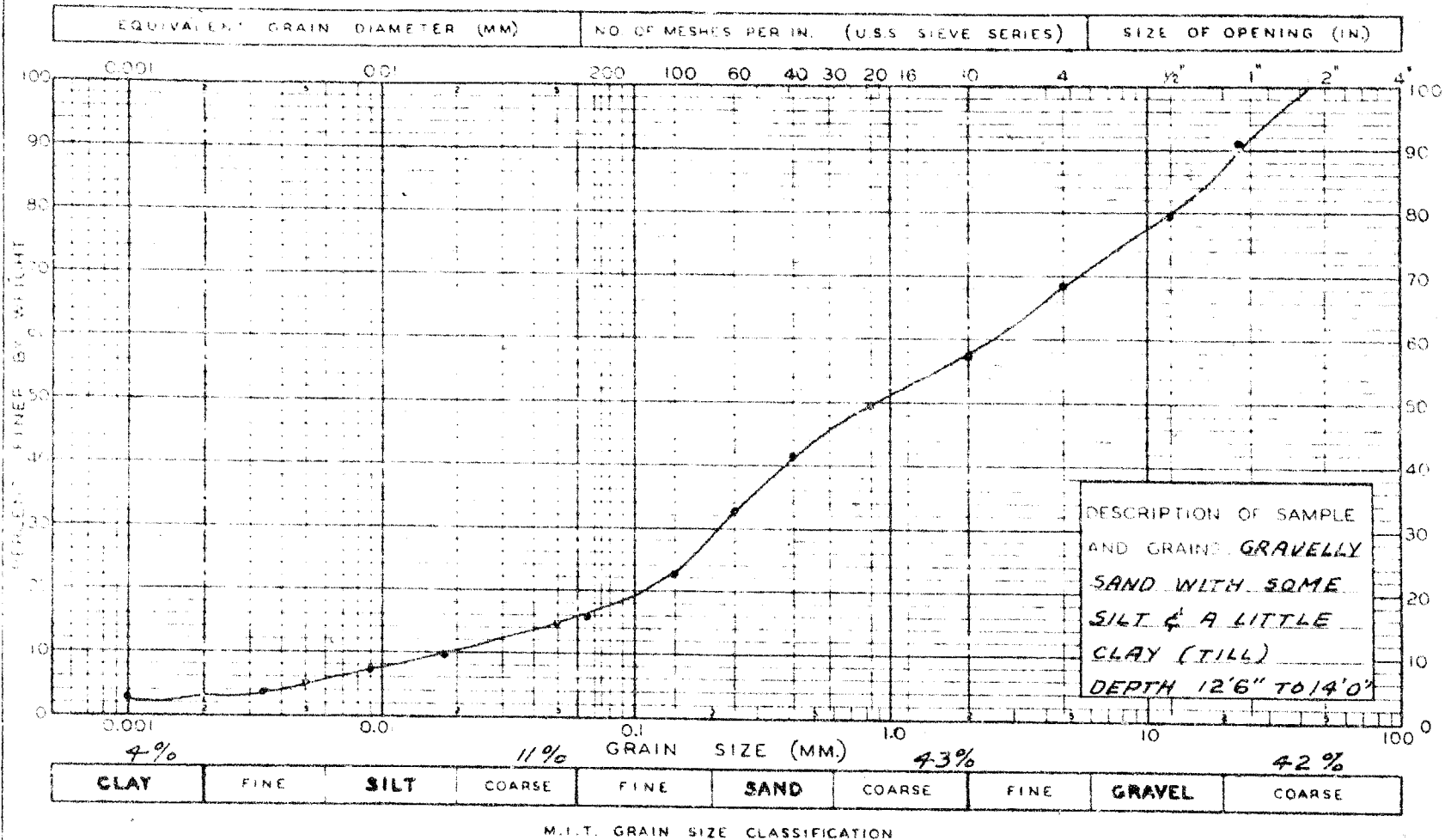
ELEVATION OF GROUND SURFACE (ZERO DEPTH) 234.5 DATE NOV 6 84  
 REMARKS SEE PLATE #2 FOR MECHANICAL ANALYSIS  
SEE PLATES 18 & 19

HOLE NO. 5

UNCONFINED COMPRESSIVE STRENGTH KIPS/FT. <sup>2</sup>	SMALL SCALE PENETROMETER KIPS/FT. <sup>2</sup>	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION	PROBING OR VANE TEST	
							.....LB. HAMMER	NO CASING
							.....INCH DROP	.....INCH DIA. ROD
GROUND SURFACE							BLOWS PER FOOT OR	SHEAR STRENGTH IN KIPS 'PER FT. <sup>2</sup>
				FILL	0.0	234.5		
		6	5-1		4.0		0	
		26	5-2	MEDIUM DENSE TILL	5.0	229.5	0	
					7.5			
		34	5-3	DENSE TILL	9.0		0	
					10.0	224.5		
		12	5-4	MEDIUM DENSE TILL	12.0		0	OVERNIGHT NOTE: 10.5' 10.5'
					12.5			
		28	5-5	DENSE TILL	15.0		0	
					15.0	219.5		
		30	5-6	DENSE WELL SORDED SAND	17.5		0	
					17.5			
		42	5-7	DENSE WELL SORDED SAND	19.0		0	
					19.0			
		36	5-8	GRAVEL	21.0		0	
		18	5-9	MEDIUM GRADE SAND WITH GRAVEL	22.0	214.5	0	
		22	5-10	DENSE SANDY TILL	23.0		0	
				SHALEY LIMESTONE (CORE RECOVERY 100%)	25.0	209.5		
					28.0			
				SHALEY LIMESTONE (CORE RECOVERY 100%)	30.0	204.5		
					33.2	201.3		
				BOTTOM OF HOLE				
							0 20 40 60 80	
							% WATER CONTENT	
							NATURAL	0
							LIQUID LIMIT	□
							PLASTIC LIMIT	△
							PLATE	5



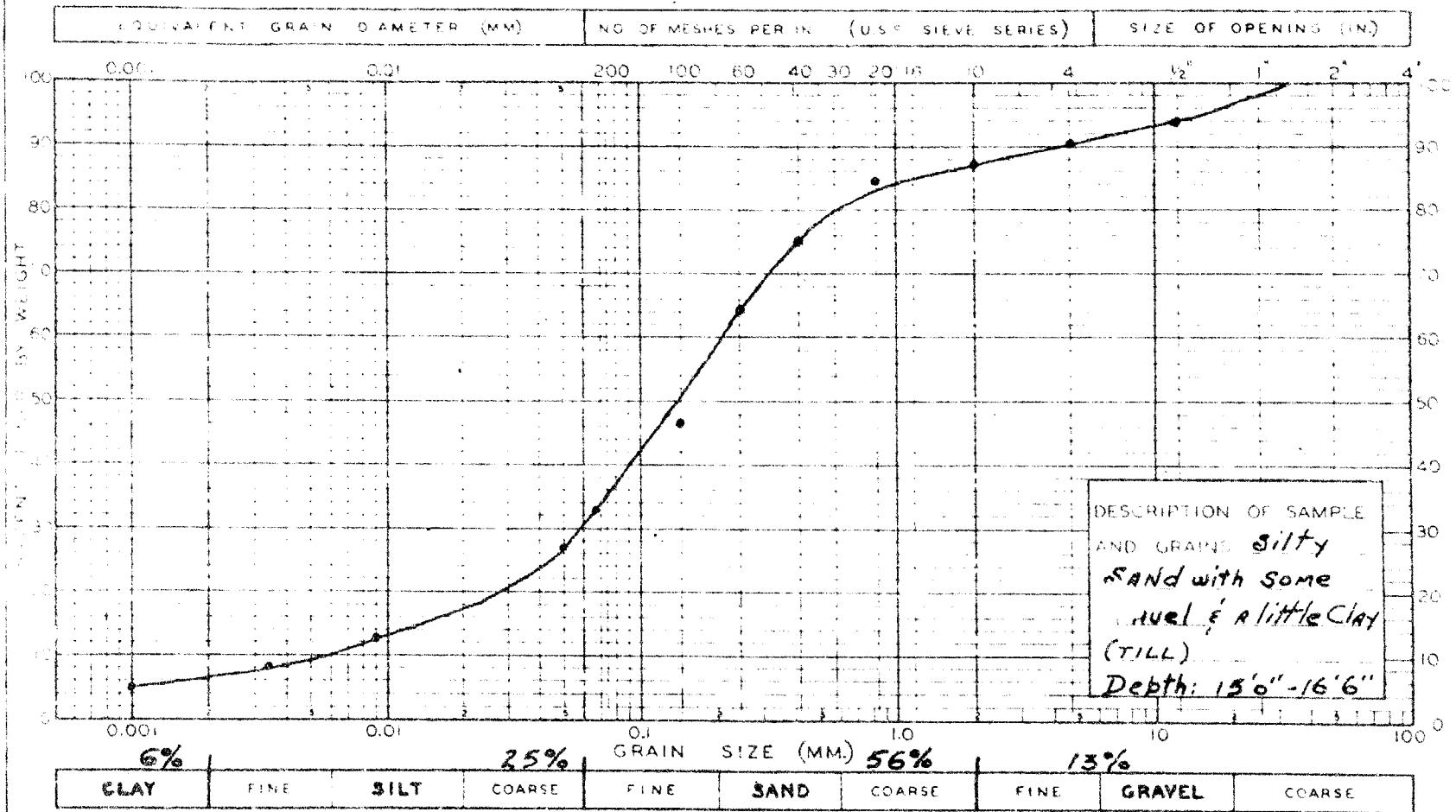
# MECHANICAL ANALYSIS OF SOILS



PROJECT: <u>QUEENSWAY &amp; PARKDALE</u>		SAMPLE NO. <u>1-5</u>	
PLOTTED: <u>C.V.</u>	DATE: <u>12, 1, 59</u>	REMARKS: <u>002 TO 105 SIZE = 18%</u>	
CHECKED: <u>D.M.</u>	DATE: <u>12, 1, 59</u>		

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# MECHANICAL ANALYSIS OF SOILS

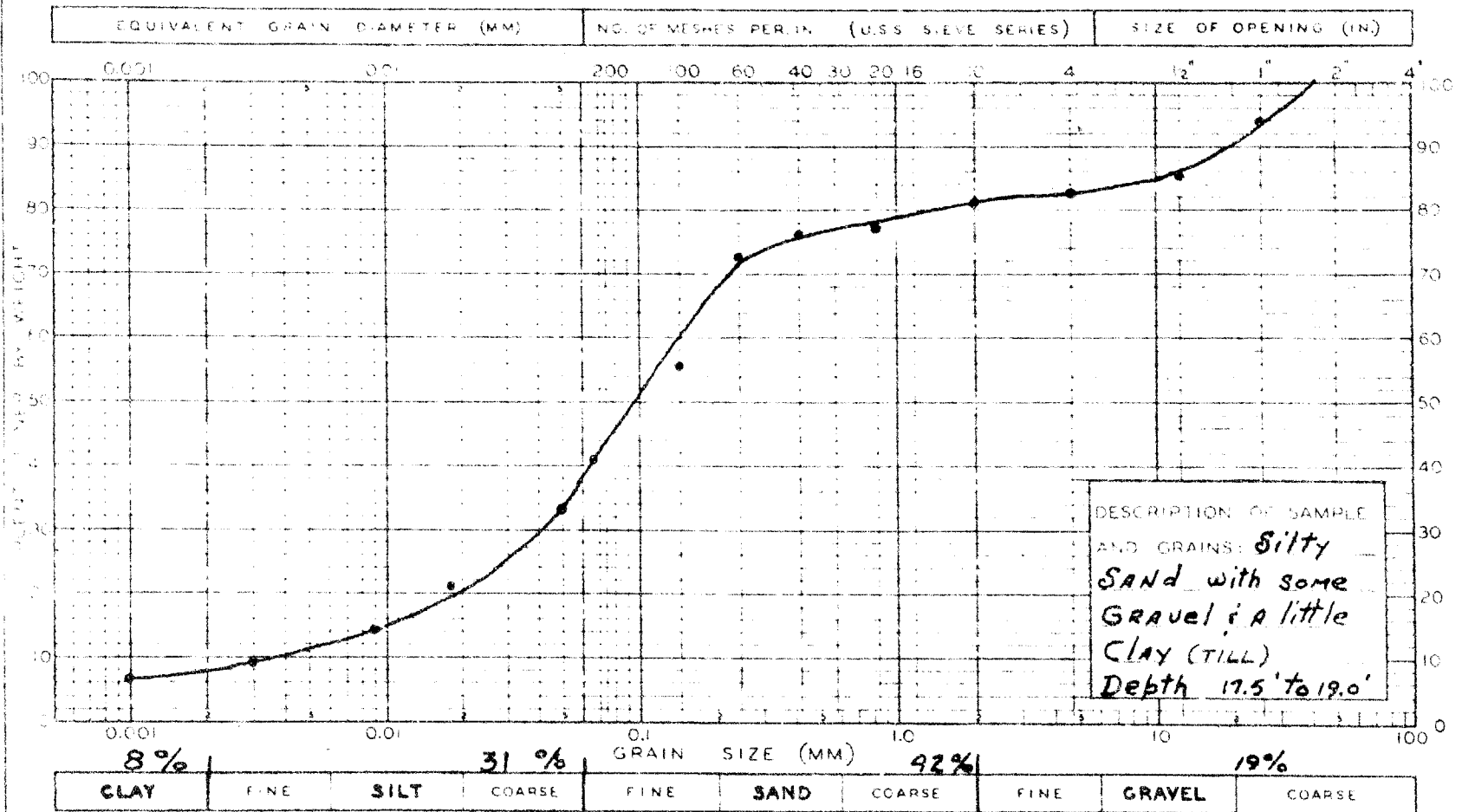


M.I.T. GRAIN SIZE CLASSIFICATION

PROJECT: <i>Qwy. f. PARKdale</i>		SAMPLE NO. <i>1-6</i>		<b>McROSTIE &amp; ASSOCIATES</b> <b>CONSULTING ENGINEERS</b>
PLOTTED: <i>D.M.</i>	DATE: <i>9-1-59</i>	REMARKS: <i>.002 to .105 size = 41%</i>		
CHECKED: <i>G.B.</i>	DATE: <i>9-1-59</i>			

SAMPLE NO. *1-6*

# MECHANICAL ANALYSIS OF SOILS



DESCRIPTION OF SAMPLE  
AND GRAINS: *Silty*  
*SAND with some*  
*GRAVEL & a little*  
*CLAY (TILL)*  
*Depth 17.5' to 19.0'*

PROJECT: *Qwy i Parkdale*

SAMPLE NO. *1-7*

PLOTTED: *C.J.* DATE: *9-1-59*

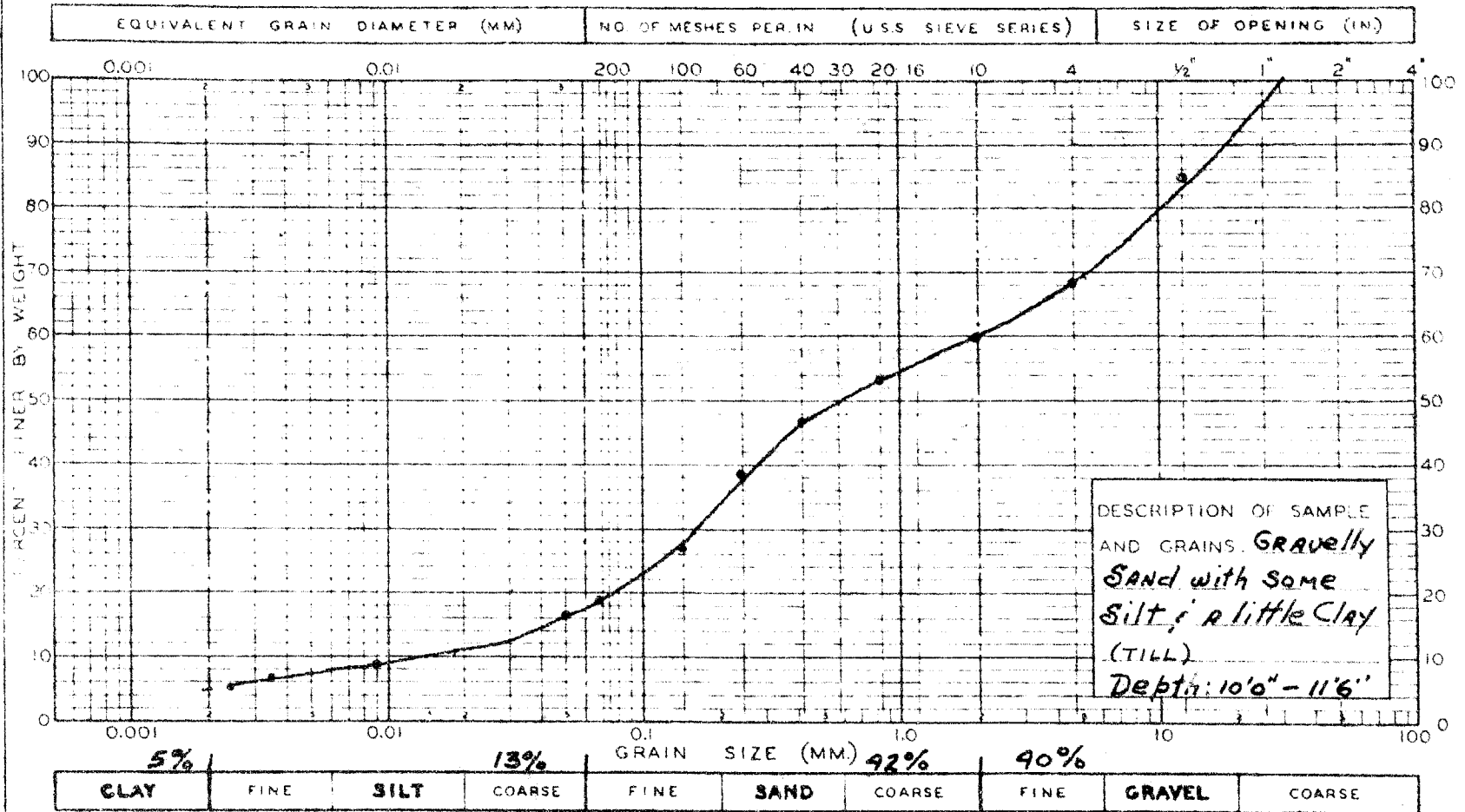
REMARKS: *.002 to .105 size = 98%*

CHECKED: *G.B.* DATE: *9-1-59*

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SAMPLE NO. 1-7

# MECHANICAL ANALYSIS OF SOILS



M.I.T. GRAIN SIZE CLASSIFICATION

PROJECT: *Qwy f PARKdale*

SAMPLE NO. *2-4*

PLOTTED: *D.M.* DATE: *8-1-59*

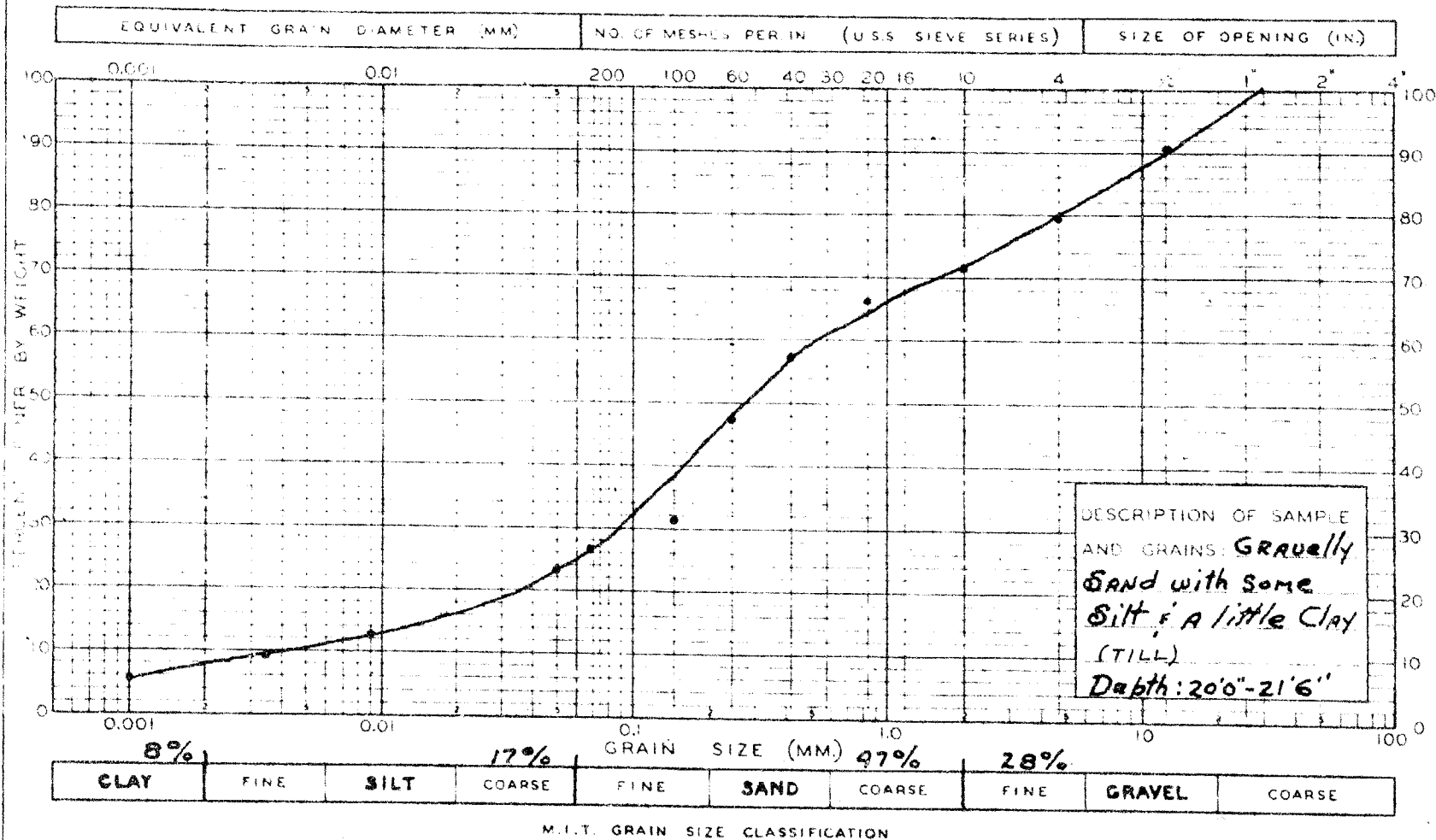
REMARKS: *.0075 to .105 size = 20%*

CHECKED: *G.B.* DATE: *9-1-59*

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SAMPLE NO. 2-4

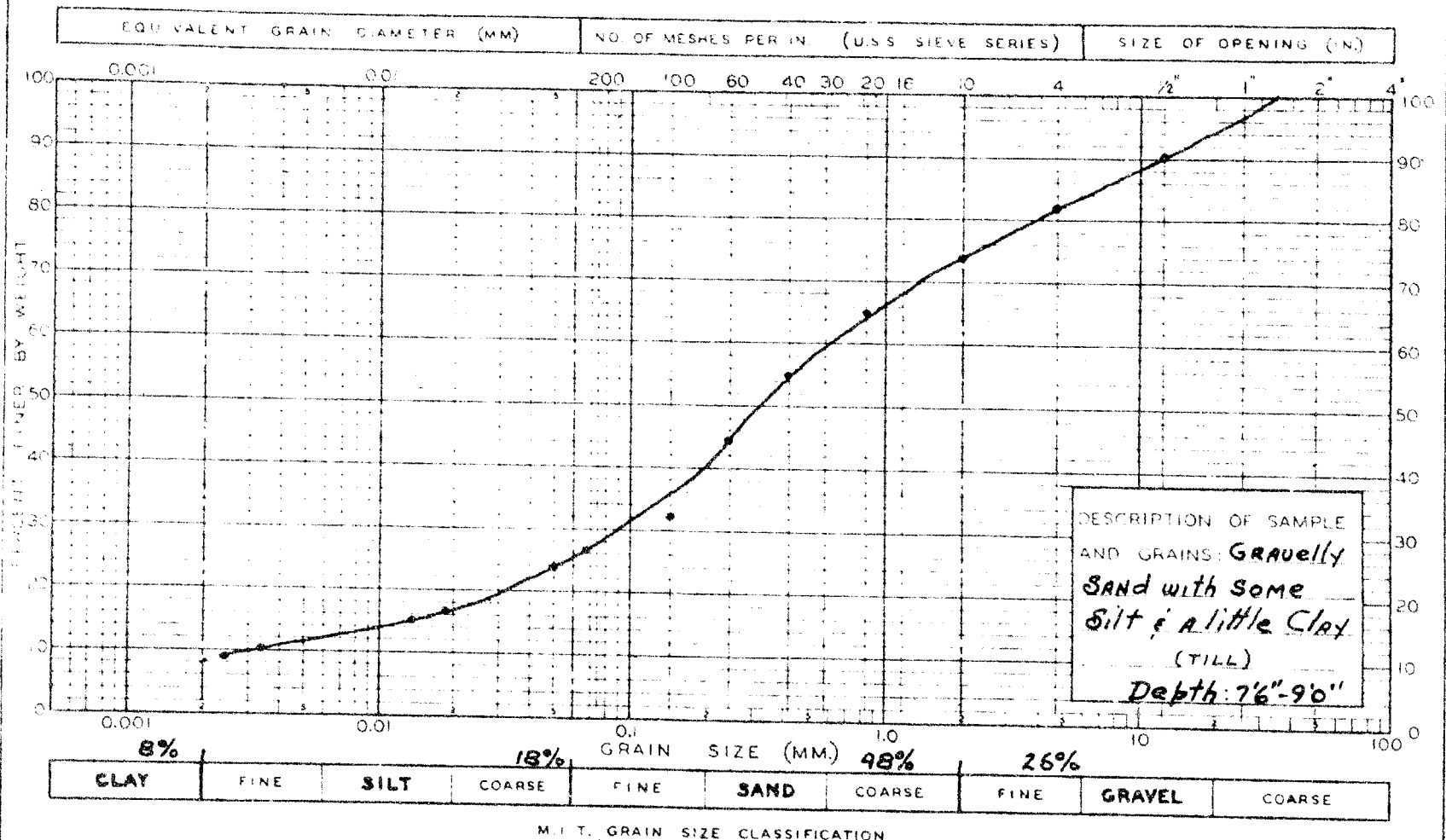
# MECHANICAL ANALYSIS OF SOILS



PROJECT: <i>Qwy. &amp; PARKdale</i>		SAMPLE NO. <i>2-9</i>
PLOTTED: <i>D.M.</i>	DATE: <i>8-1-59</i>	REMARKS: <i>0.02 to .105 size = 28%</i>
CHECKED: <i>G.B.</i>	DATE: <i>9-1-59</i>	

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# MECHANICAL ANALYSIS OF SOILS



PROJECT: *Qwy & PARKdale*

SAMPLE NO. *3-3*

PLOTTED: *D.M.* DATE: *7-1-59*

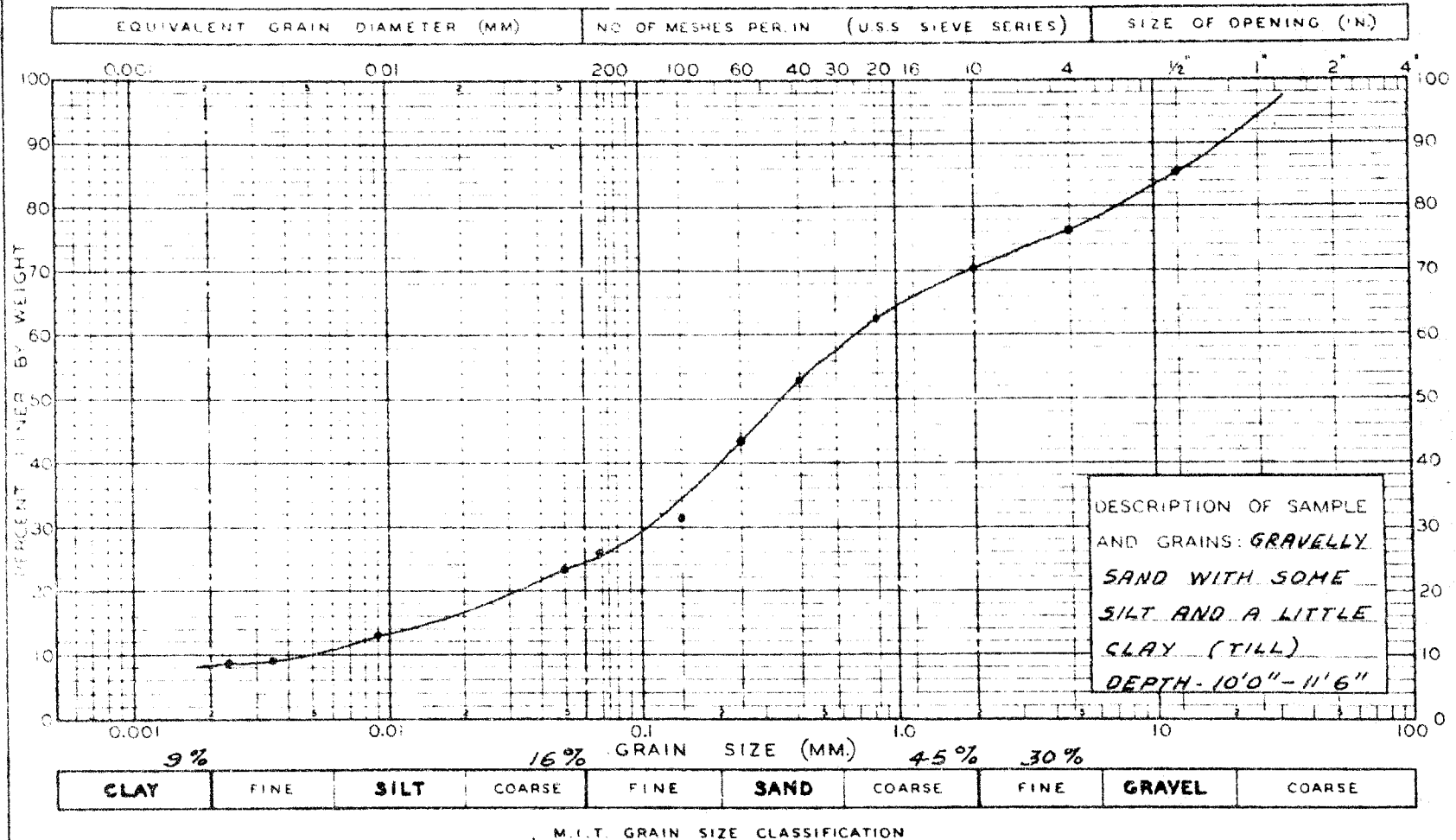
REMARKS: *0.002 to 105 size = 2.9%*

CHECKED: *C.J.* DATE: *9-1-59*

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SAMPLE NO. *3-3*

# MECHANICAL ANALYSIS OF SOILS



PROJECT: *QUEENSWAY & PARKDALE*

SAMPLE NO. *3-4*

PLOTTED: *D.M.* DATE: *8-1-59*

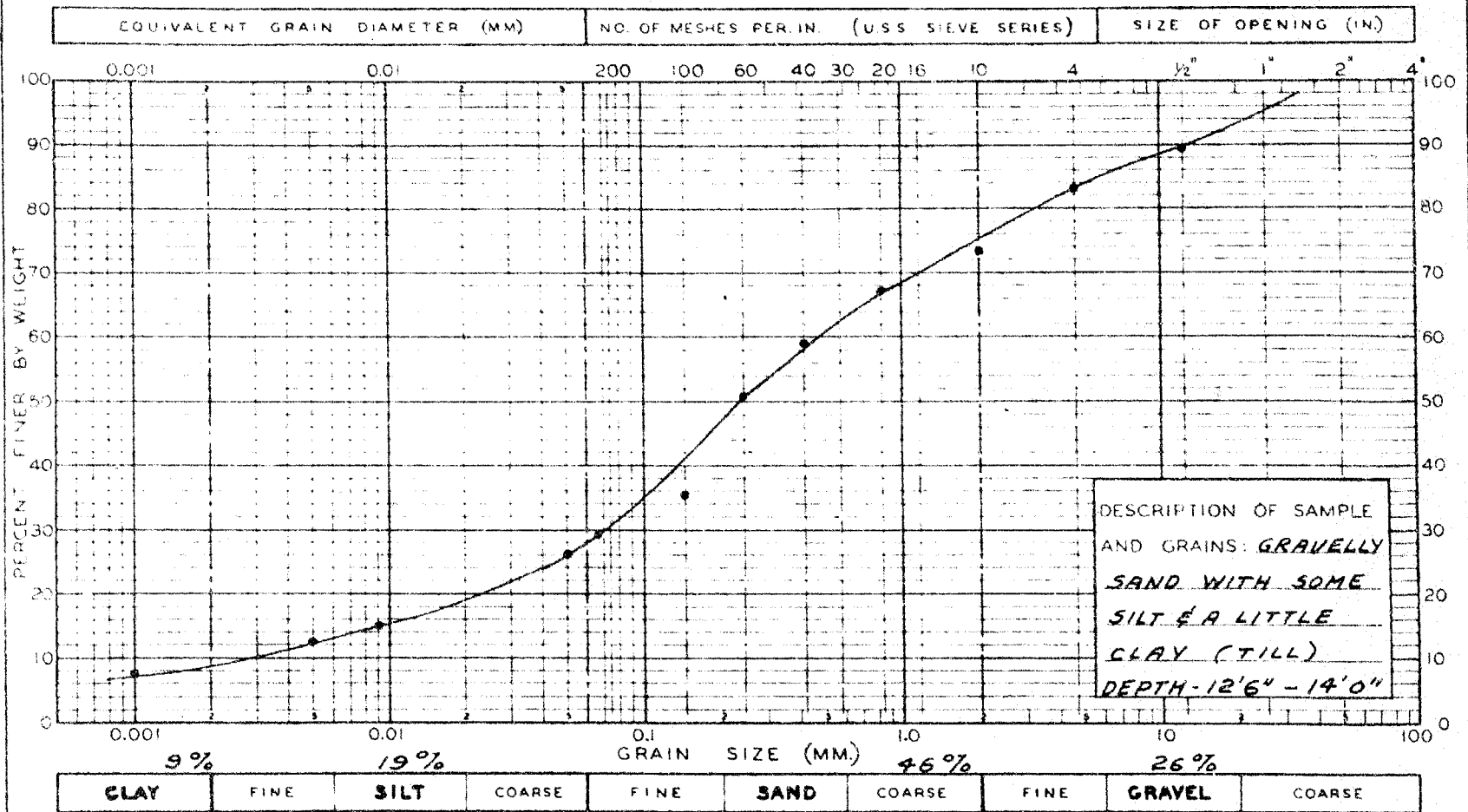
REMARKS: *.002 TO .105 SIZE = 25%*

CHECKED: *G.B.* DATE: *9-1-59*

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SAMPLE NO. *3-4*

# MECHANICAL ANALYSIS OF SOILS



M.I.T. GRAIN SIZE CLASSIFICATION

PROJECT: QUEENSWAY & PARKDALE

SAMPLE NO. 3-5

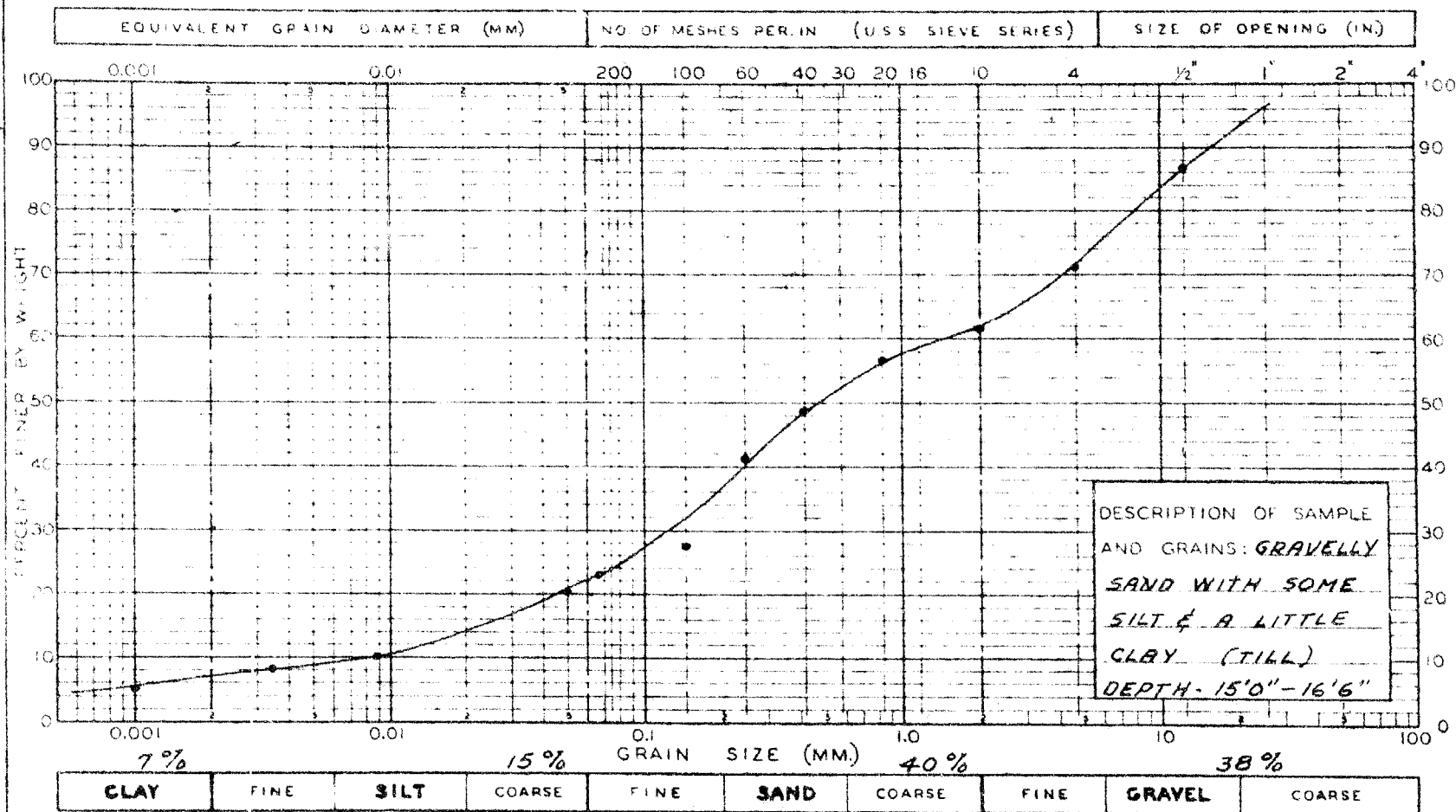
PLOTTED: G.B. DATE: 8-1-59

REMARKS: .002 TO .105 SIZE = 29%

CHECKED: D.M. DATE: 9-1-59

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# MECHANICAL ANALYSIS OF SOILS

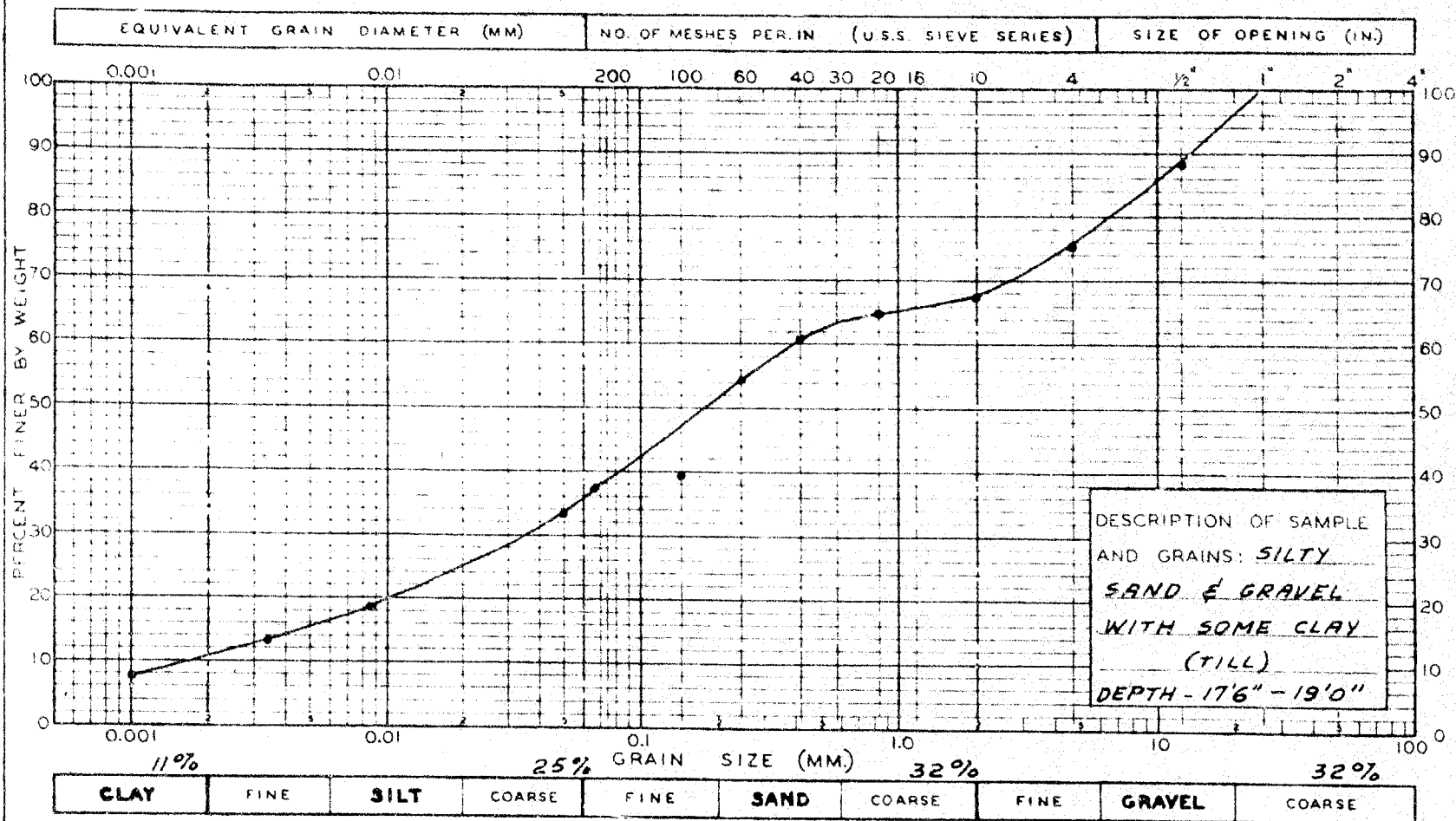


M. I. T. GRAIN SIZE CLASSIFICATION

PROJECT: <u>QUEENSWAY &amp; PARKDALE</u>		SAMPLE NO. <u>3-6</u>
PLOTTED: <u>D.M.</u>	DATE: <u>10-1-59</u>	REMARKS: <u>.002 TO .105 SIZE = 24%</u>
CHECKED: <u>C.J.</u>	DATE: <u>10-1-59</u>	

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# MECHANICAL ANALYSIS OF SOILS



M.I.T. GRAIN SIZE CLASSIFICATION

PROJECT: QUEENSWAY & PARKDALE

SAMPLE NO. 3-7

PLOTTED: C.J. DATE: 10-1-59

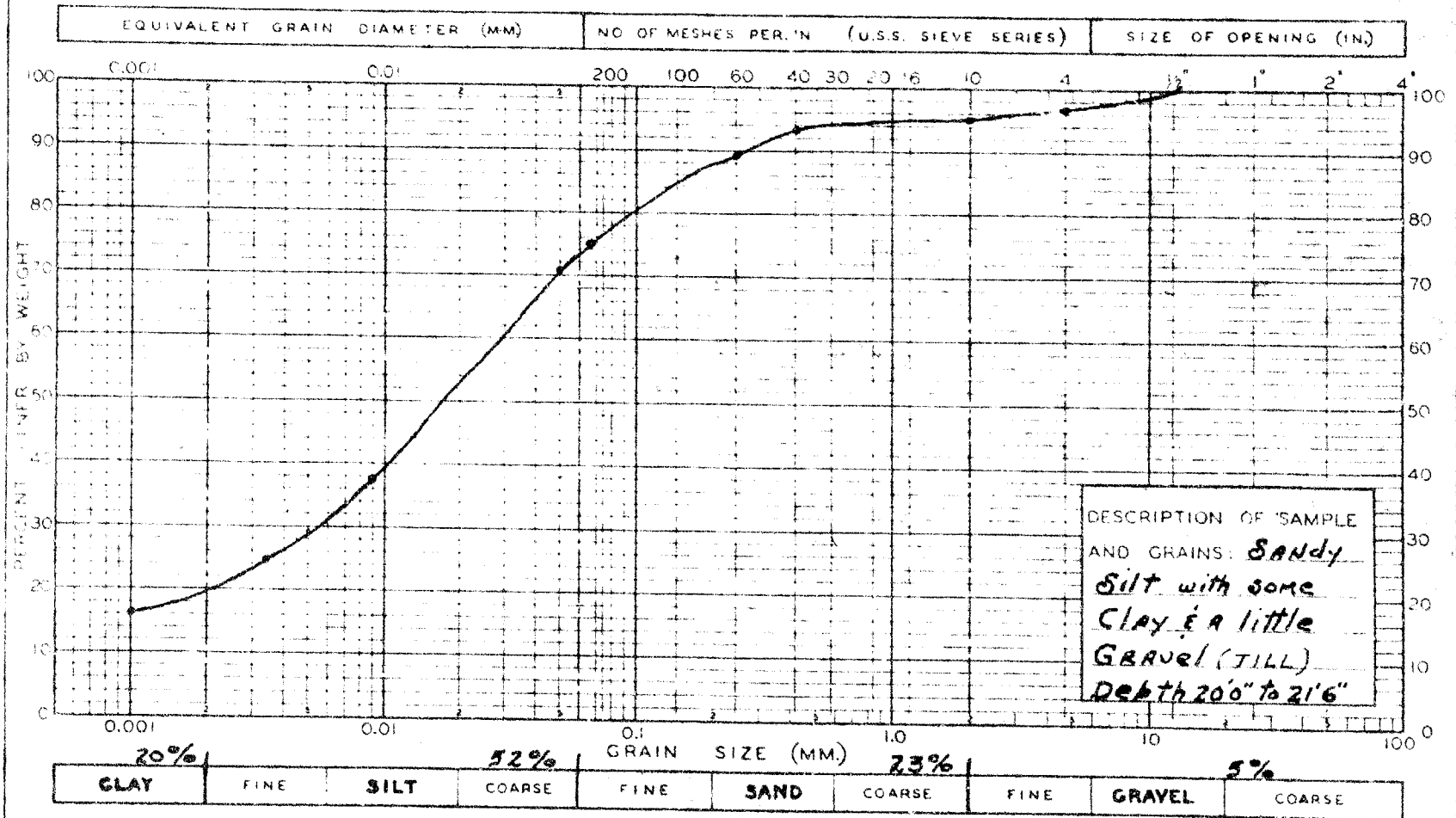
REMARKS: .002 TO .105 SIZE = 34%

CHECKED: G.B. DATE: 10-1-59

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CONSULTING ENGINEERS

SAMPLE NO. 3-7

# MECHANICAL ANALYSIS OF SOILS



PROJECT: *Qwy. & PARKdale*

SAMPLE NO. *3-8*

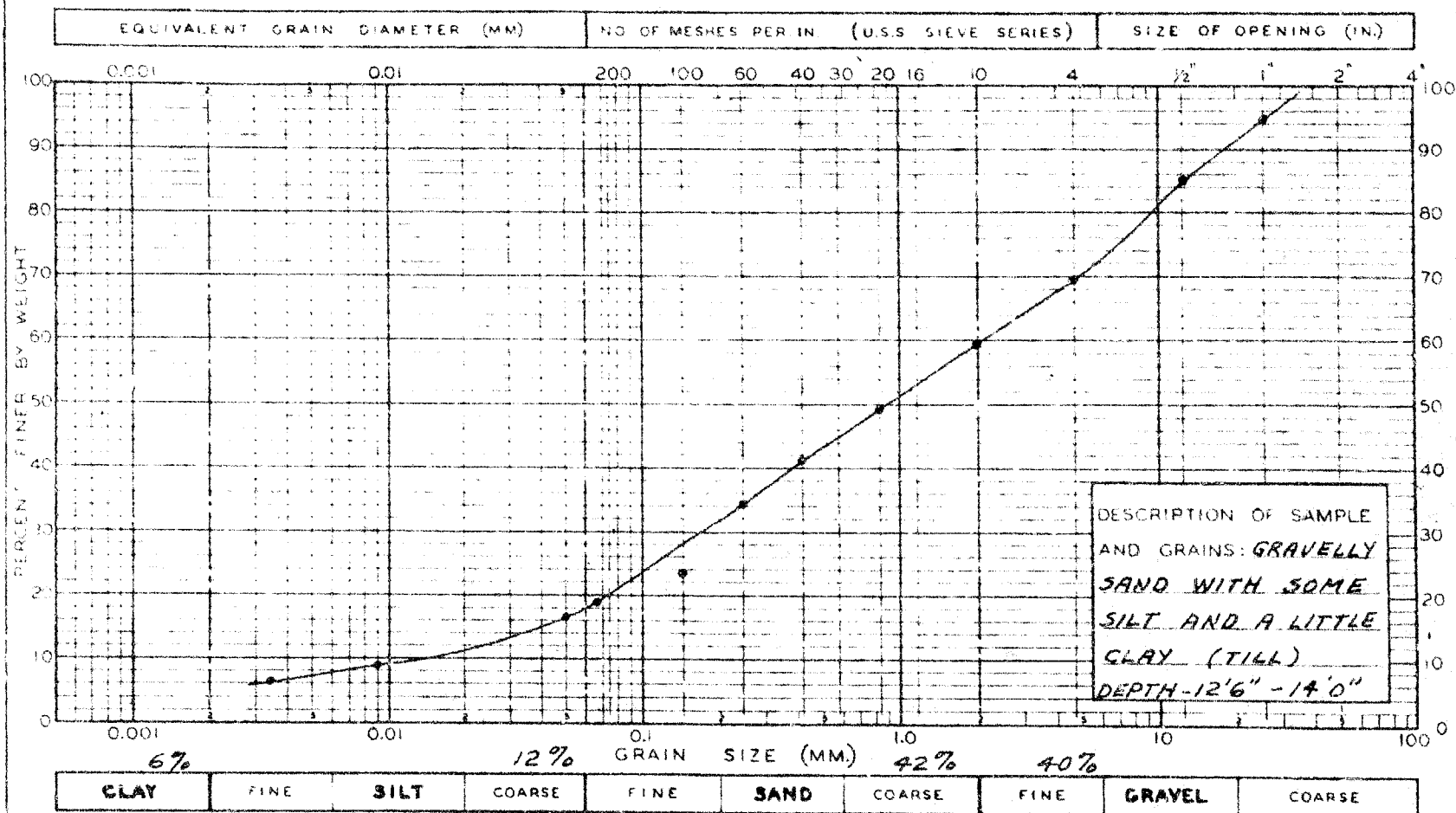
PLOTTED: *C.U.* DATE: *9-1-59*

REMARKS: *.002 to .105 = 62%*

CHECKED: *G.B.* DATE: *9-1-59*

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# MECHANICAL ANALYSIS OF SOILS



M.I.T. GRAIN SIZE CLASSIFICATION

PROJECT: *QUEENSWAY & PARKDALE*

SAMPLE NO. *5-5*

PLOTTED: *D.M.* DATE: *8-1-59*

REMARKS: *.002 TO .105 SIZE = 20%*

CHECKED: *G.B.* DATE: *9-1-59*

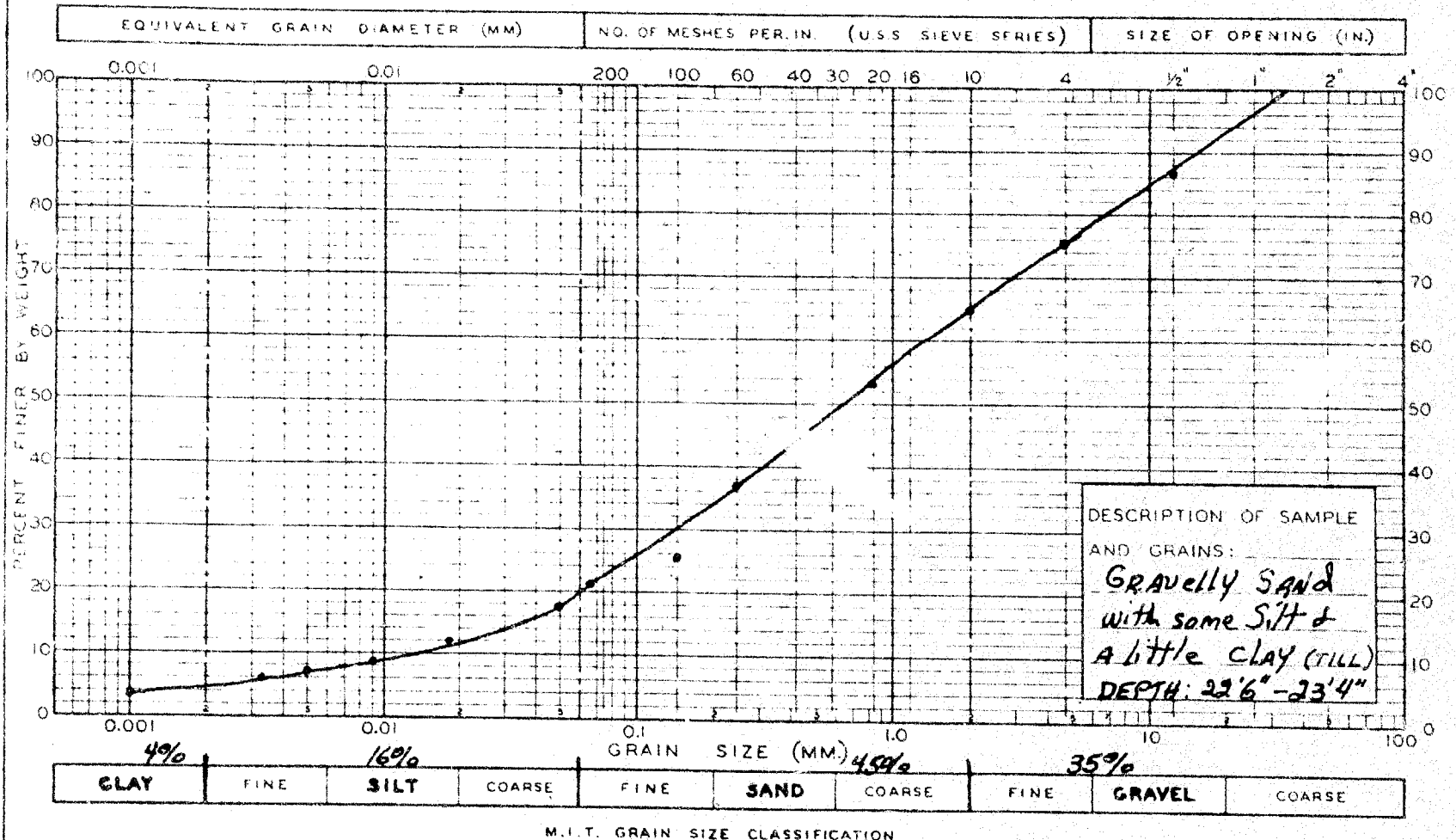
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FORM 58

SAMPLE NO. *5-5*

PLATE #18

# MECHANICAL ANALYSIS OF SOILS



PROJECT: Queensway & Parkdale

SAMPLE NO. 5-10

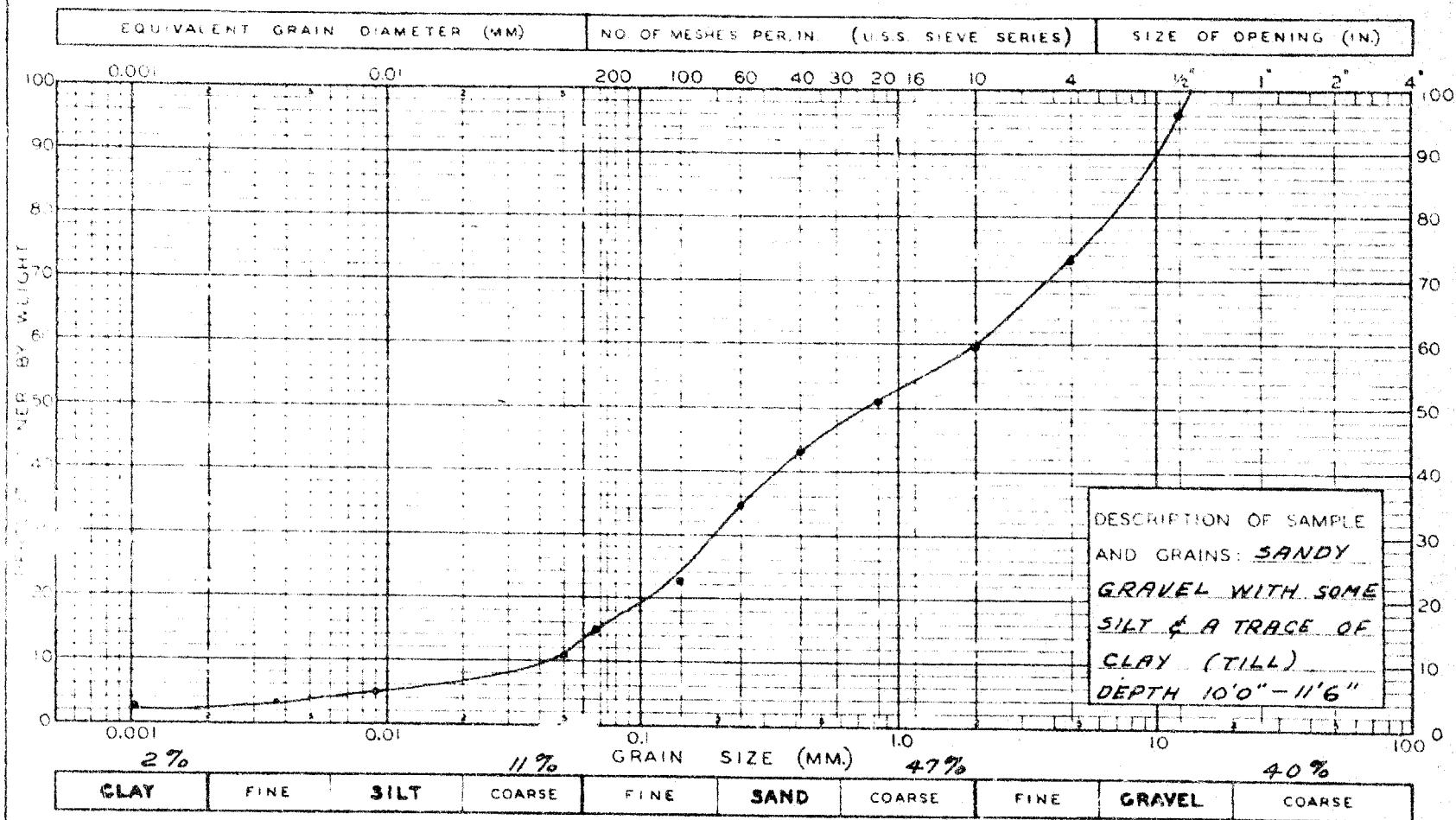
PLOTTED: Y. B. DATE: JAN 8/59

REMARKS: .002 + .105 size = 29%

CHECKED: D.M. DATE: 9-1-59

**McROSTIE & ASSOCIATES**  
CONSULTING ENGINEERS

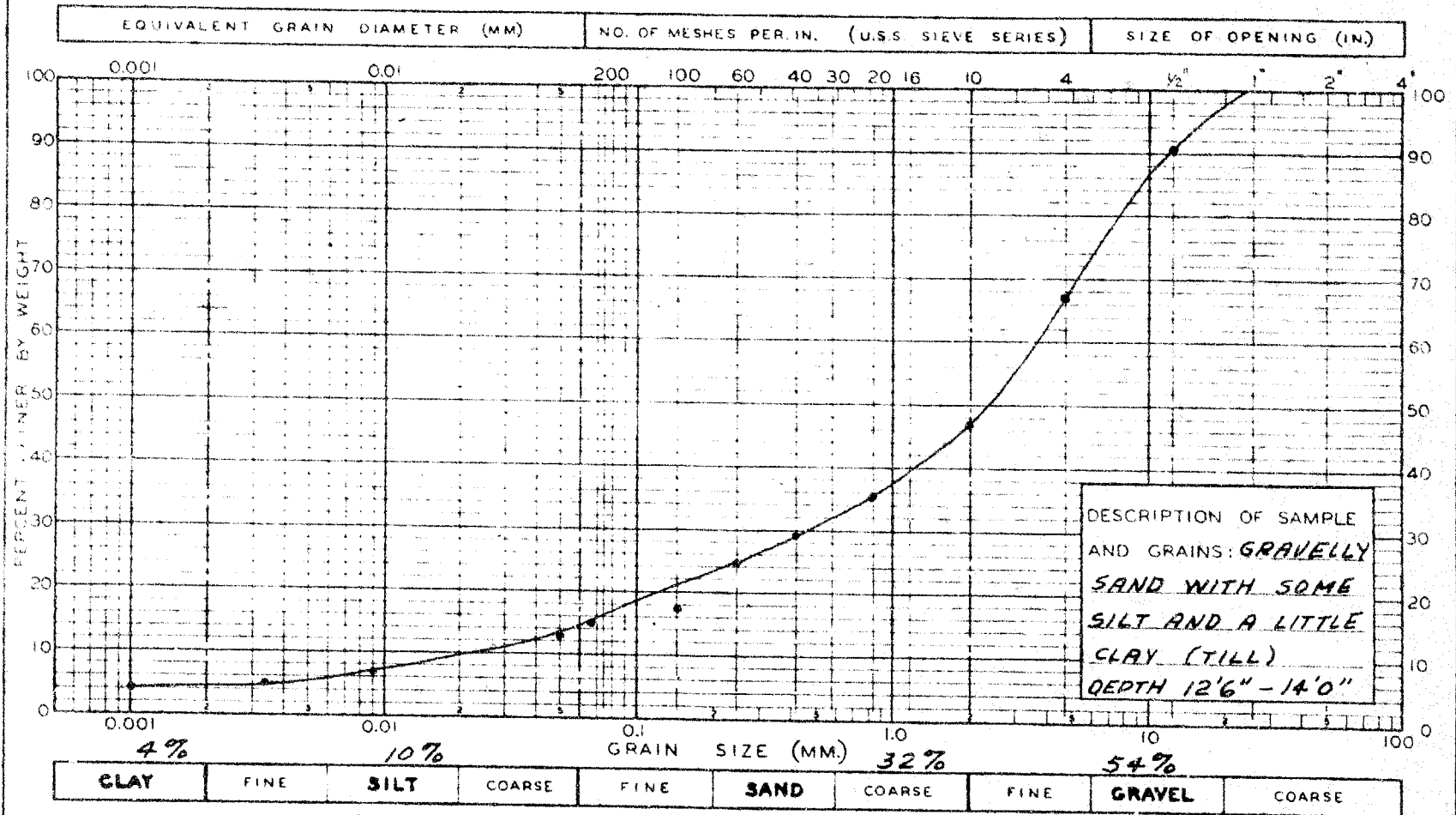
# MECHANICAL ANALYSIS OF SOILS



PROJECT: <u>QUEENSWAY &amp; PARKDALE</u>		SAMPLE NO. <u>6-4</u>
PLOTTED: <u>C.J.</u>	DATE: <u>8-1-59</u>	REMARKS: <u>.002 TO .105 SIZE = 20%</u>
CHECKED: <u>G.B.</u>	DATE: <u>9-1-59</u>	

**McROSTIE & ASSOCIATES**  
CONSULTING ENGINEERS

# MECHANICAL ANALYSIS OF SOILS



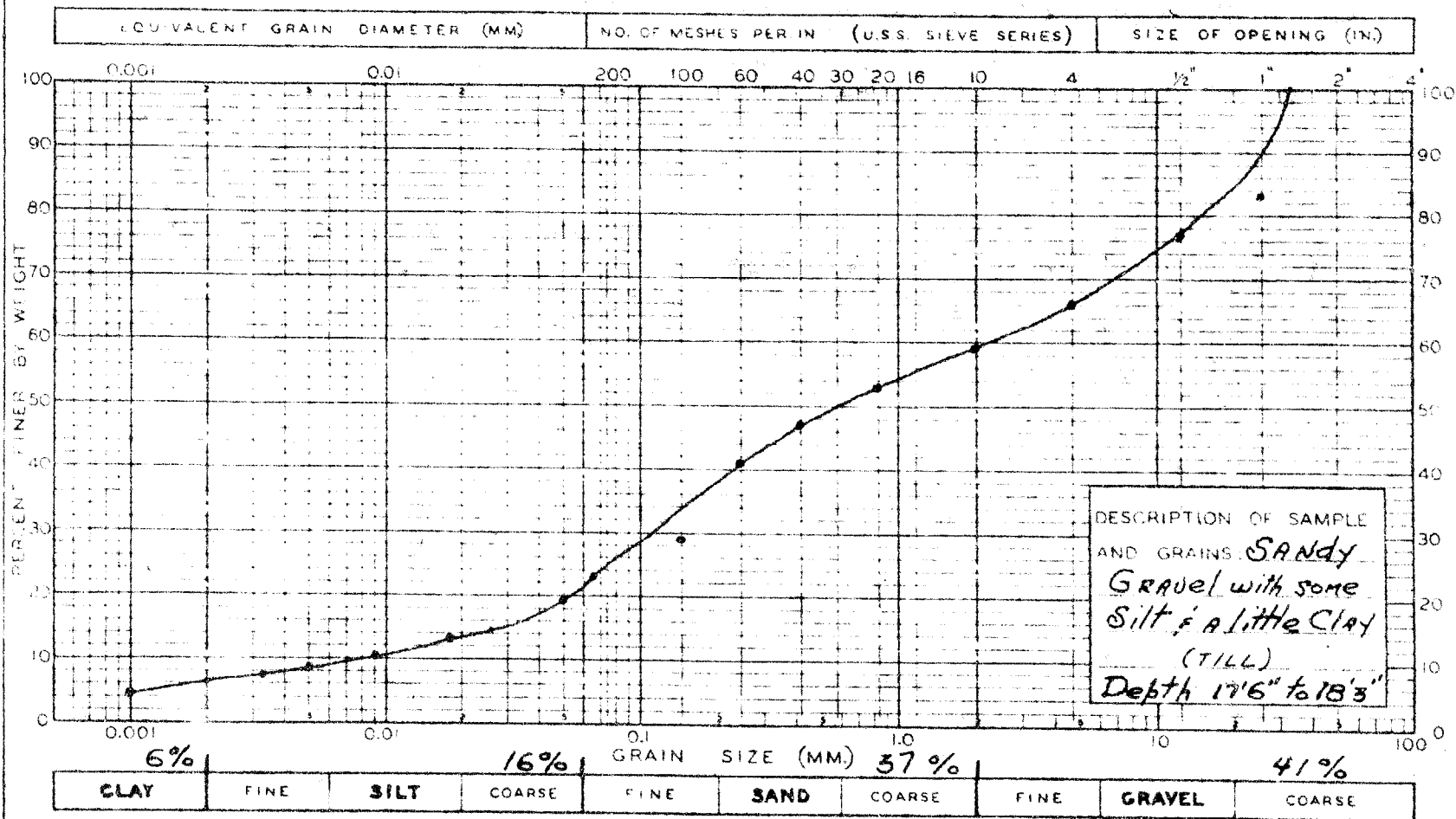
DESCRIPTION OF SAMPLE  
AND GRAINS: **GRAVELLY**  
**SAND WITH SOME**  
**SILT AND A LITTLE**  
**CLAY (TILL)**  
**DEPTH 12'6" - 14'0"**

M.I.T. GRAIN SIZE CLASSIFICATION

PROJECT: <b>QUEENSWAY &amp; PARKDALE</b>		SAMPLE NO. <b>6-5</b>	
PLOTTED: <b>C.J.</b>	DATE: <b>8-1-59</b>	REMARKS: <b>.002 TO .105 = 14%</b>	
CHECKED: <b>G.B.</b>	DATE: <b>9-1-59</b>		

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CONSULTING ENGINEERS

# MECHANICAL ANALYSIS OF SOILS



M.I.T. GRAIN SIZE CLASSIFICATION

PROJECT: <i>Quay Parkdale</i>		SAMPLE NO. <i>6-7</i>	
PLOTTED: <i>C.V.</i>	DATE: <i>JAN. 12/59</i>	REMARKS: <i>.002 to .105 Size = 26%</i>	
CHECKED: <i>D.M.</i>	DATE: <i>JAN. 12/59</i>		

**McROSTIE & ASSOCIATES.**  
CONSULTING ENGINEERS

SAMPLE NO. 6-7