

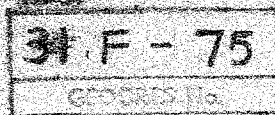
W.P. 67-58

HWY. 62 4

BONNECHERE

RIVER

31F-75



~~31 F - 75~~  
TL 62A-5.  
W.P. 67-58

REPORT OF FOUNDATION INVESTIGATION  
FOR THE  
PROPOSED CROSSING OF HIGHWAY NO. 62  
AT THE  
BONNECHERE RIVER NEAR BONNECHERE, ONTARIO

for the

DEPARTMENT OF HIGHWAYS - ONTARIO

by the

Engineering Division  
HUNTING TECHNICAL AND EXPLORATION SERVICES LIMITED  
Toronto, Ontario

July, 1958

of

## ORDER OF CONTENTS

<u>Section</u>		<u>Page</u>
1.1	PURPOSE OF REPORT	
	1.11 General	1
1.2	DISCUSSION OF PROCEDURES	
	1.21 Location of Boreholes	2
	1.22 Subsurface Drilling and Sampling	2
	1.23 Soil Testing	3
1.3	DISCUSSION OF SITE	
	1.31 Geographic Location	4
	1.32 Site Geology	4
	1.33 Water Conditions	4
	1.34 Soil Conditions	4
1.4	COMMENTS ON FOUNDATIONS OF STRUCTURE	
	1.41 General	7
	1.42 Spread Footing Foundation	7
	1.43 Pile Foundation	8
	1.44 Recommendations	9
1.5	PERSONNEL	10
1.6	APPENDICES	
	1.61 General Plan of Site	
	1.62 Subsurface Sections	
	1.63 Office Logs of Boreholes	
	1.64 Air Photo of Site	
	1.65 Photos of Site	
	1.66 Soil Classification Charts	

Section 1.1

PURPOSE OF REPORT

1.11 General

The purpose of this report is to present the results of a subsurface soil investigation for the foundation of a new bridge to replace the existing single-lane stone and timber Bonnechere River bridge on Highway No. 62.

Section 1.2DISCUSSION OF PROCEDURES1.21 Location of Boreholes

The borehole locations for this investigation were established by Department of Highways' surveyors. At the completion of the work each borehole was marked with a large stake denoting the hole number for future reference. The locations and elevations of top of the boreholes are shown on the plan in Appendix 1.61.

1.22 Subsurface Drilling and Sampling

A primary program, specified by the client, of 4 soil borings was carried out in the vicinity of the proposed site of the new Bonnechere River Bridge.

Two skid mounted, hydraulic head junior Longyear diamond drilling rigs were used on this project. All boring and sampling operations were completed by experienced soil sampling crews under the supervision of engineering personnel experienced in soil sampling procedures.

All soil borings were performed by the standard wash boring procedure. By this method, drill casing was driven into the soil by a 350 lb. hammer to a depth determined by the boring supervisor. All the soil contained inside the casing during this operation was thoroughly washed out to the bottom of the casing. Sampling tools were then lowered to the bottom of the hole. The sample was then taken and the sampling tools removed from the hole. Additional lengths of casing were added as required and the procedure repeated.

Attempts were made to obtain samples in the cohesionless soils by means of a 2-inch O. D. standard split spoon sampler. The standard penetrat-

ion test using a 140 lb. hammer falling 30 inches was recorded for each foot of sampler penetration. When necessary, recovery of samples for identification and correlation was obtained with a side slit sampler. All samples were visually examined and classified on the site, then placed in jars and forwarded to the engineering office. Where samples obtained were representative and relatively undisturbed, apparent density tests were made on site to obtain the approximate specific weight of the material.

#### 1.23 Soil Testing

Selective samples from each strata were forwarded to the laboratory as a check on the visual field classification.

The results of all tests are given in the Appendices. The laboratory tests on the samples were performed by:

Donald Inspection Limited,  
340 Richmond Street West,  
Toronto 1, Ontario.

Section 1.3DISCUSSION OF SITE1.31 Geographic Location

The proposed bridge site is located on the King's Highway No. 62 at the proposed new crossing of the Bonnechere River. The site is in the County of Renfrew, Township of Richards, Lot 24, Concession 6.

1.32 Site Geology

The soils found at the site vary from coarse sands to silts with increasing depth thus are typical of an emergent landform which was probably originated either in the post-glacial Champlain Sea or in one of the large inter-glacial lakes.

While bedrock was not encountered in the boreholes, geological maps of the area indicate that it should be granitic.

The surface geological features of the site area are shown in the airphoto in Appendix 1.63.

1.33 Water Conditions

At the time of subsurface explorations, the water table in the boreholes and the adjacent river level was found to be at elevation 563.2.

There appears to be a difference of about 4.0 feet between high and low water level in the river. Because of the sandy nature of the river bed, we have anticipated that scouring effects may go as deep as elevation 545 in the vicinity of the footings. In the centre of the river, it may go deeper still.

1.34 Soil Conditions

The borings indicate that the soil stratification is fairly uniform throughout the site. The soils encountered consisted generally of four structural types in the following order:

1. Topsoil - very loose brown sand intermixed with decomposed vegetation.
2. Loose fine to coarse sand (with some gravel and traces of decomposed organic matter).
3. Fine to medium grey silty sand (with small traces of clayey silt).
4. Medium to dense grey fine sandy silt.

The physical properties of the soil types are summarized below in the order of their occurrence from the ground surface.

1. Very loose brown sand intermixed with decomposed vegetation:

This layer of topsoil exists about 1 foot on both sides of the river. This material is considered to have no structural value and should be removed before the construction of the abutments and the approaches to the bridge.

2. Loose fine to coarse sand:

This stratum occurs to a depth of about 16 feet on both sides of the river. The first 5 feet generally consists of loose fine to medium sand which becomes coarser and more gravelly in the deeper regions. There are traces of organic matter (mainly wood fragments) throughout the layer. For this reason this stratum is believed to represent recent alluvium and thus can be expected to be somewhat variable in content.

The average standard penetration resistance of this stratum is 3 blows/foot, with a range of from 1 to 10 blows/foot.

3. Medium grey fine silty sand:

This stratum is the predominant soil at the site in consideration of the foundation of the bridge.

The upper part of this layer was observed to occur at approximately elevation 550 in all of the boreholes. The soil material here is loose and saturated and is invariably under a hydrostatic head believed to have originated from the nearby upland regions.

At approximately elevation 530 the soil becomes more dense as evidenced by the hard driving on the casings. There are very small traces of clayey silt throughout the layer, but it is believed they will have very little or negligible effect on the structural formation of the entire stratum.

The apparent field density of this material averages 120 lbs/cu foot. The standard penetration resistance averages about 7 blows/foot, varying from 3 to about 16 blows/foot maximum in the deeper regions.

4. Medium to dense grey fine sandy silt:

This soil lies below elevation 510 more or less and is the final stratum encountered in all the boreholes.

The apparent field density of this soil is about 125 lbs/cu foot and appears to become more dense with depth. The standard penetration resistance varies from 6 blows/foot in the upper regions to a maximum of 66 blows/foot in the deeper regions.

The maximum depth reached by boring in this stratum is elevation 465. From elevation 465 dynamic core penetration test was performed down to elevation 438 at which depth the penetration rod was observed to have bounced on a hard layer.

Section 1.4COMMENTS ON FOUNDATIONS OF STRUCTURE1.41 General

Our understanding of the proposed bridge is that abutments are contemplated in the vicinity of chainages 528+20 and 528+96. We have assumed that the approaches to the bridge will be on fill contained and protected by wing walls. We have also assumed that the maximum height of the approach fills would be in the order of ten feet.

1.42 Spread Footing Foundation

Because of the uncertainties of scouring under the present river bed, we have assumed that spread footings would have to be placed at a maximum elevation of 544. Assuming the footings to be 12 feet wide and placed at elevation 544, we have determined the allowable soil pressure corresponding to a 1 inch maximum settlement to be in the order of 2 Kips per square foot. However, to put the footings in at elevation 544 would require considerable excavation in loose fine to coarse sand below the water table. In order to prevent flooding of the excavation and liquefaction of the bottom of the excavation, the free water surface in the soil surrounding the excavation must be kept below the bottom of the excavation at all times. We expect that excavations could be made using sheet-piling and well points (or deep well pumps), however due to the loose nature of the sand, it could be a tricky procedure.

Because of the low penetration resistance of the soil above elevation 544, it would not be advisable to place a spread footing above that elevation, unless steps are taken to stabilize (by vibroflotation or chemical grouting) the sand beneath the footing. In addition, provision should be made for permanent sheet-piling around the abutments.

### 1.43 Pile Foundations

Friction Piling into the silty sand stratum appears to be a feasible method of securing a satisfactory and economical foundation for the bridge.

We have estimated that 10-inch wooden piles driven to approximately elevation 520 will develop a permissible bearing capacity of about 15 tons per pile (allowing a factor of safety of 2). Such piles should be spaced not less than 30 inches centre to centre. Batter piles should be provided to take care of any horizontal load from the structure.

It is anticipated that difficulties may be encountered during driving of the piles because of induced compaction of the underlying sandy soil. Under such circumstances jetting of water by the side of the pile simultaneous with the driving may be used. All piles should be finally driven without jetting for at least 5 feet before the required elevation is attained. It is estimated that the required length of piles will be about 40 feet, but the exact length should be checked with standard or established driving formula.

Depending on design requirements, other types of piles may be employed to give a higher carrying load per pile. In such an event, the piles would have to be driven deeper or into the denser sandy silt stratum. Perhaps a pile test may be necessary.

With reference to excavations in connection with placing the pile cap, it should be realized that unless the free water surface is kept below the bottom of the excavation, liquefaction of the soil could occur with subsequent damage to the load carrying capacity of the piles. Well points could probably be used successfully on this site to control the ground water.

1.44 Recommendations

(1) In our opinion, a pile foundation would be the most satisfactory type of foundation for this structure. Ten inch wooden piles driven to approximately elevation 520 are expected to provide a safe bearing load of 15 tons per pile. Such piles should not be spaced less than 30 inches centre to centre.

(2) Other types of piles may be employed to give a higher carrying capacity per pile as required. This engineering office will be glad to provide any additional information in this respect and to have the opportunity to supervise any pile driving or loading test which may be deemed as necessary by your Bridge Design Office.

(3) Well points will be required, to control the ground water, for excavations below the water table. It will be necessary to keep the free water surface below the bottom of the excavation at all times to prevent liquefaction of the soil.

(4) We do not envisage any stability problems in connection with a 10 foot high approach fill.

Section 1.5

PERSONNEL

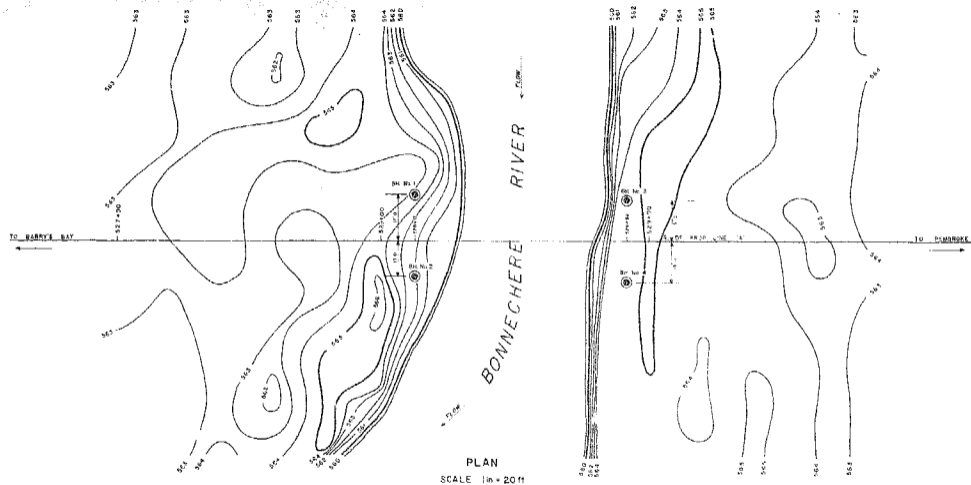
The field work for this project was performed under the supervision of I. E. Thurber, B.Sc. and R. A. Dunbar, P. Eng.

This report was prepared by W. W. F. Wong, P. Eng., N. W. E. Lee, P. Eng., and J. Kilgour, P. Eng.

Section 1.6

APPENDICES

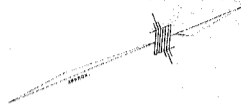
1.61 General Plan of Site



PLAN

SCALE 1 in = 20 ft

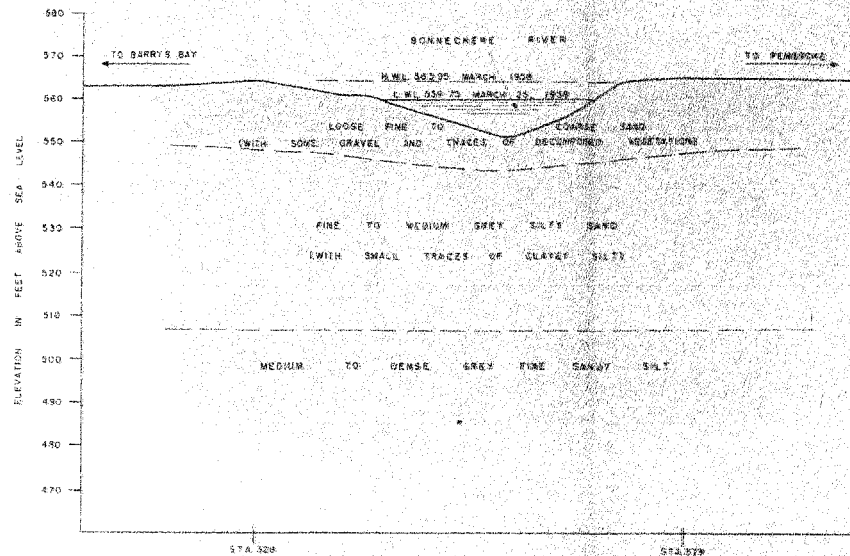
COUNTY OF RENFREW TOWNSHIP OF RICHARDS  
CON. VI LOT. 24



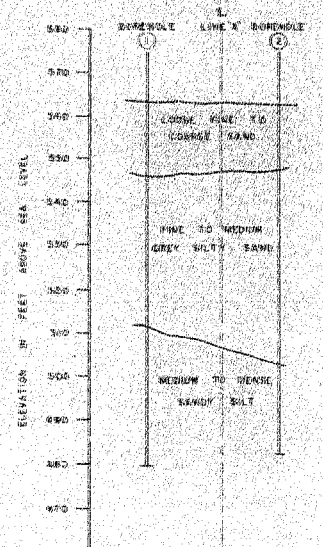
HUNTING TECHNICAL & EXPLORATION SERVICES LTD. TORONTO		
DEPARTMENT OF HIGHWAYS - ONTARIO		
PLAN SHOWING LOCATION OF BOREHOLES FOR PROPOSED CROSSING AT BONNECHERE RIVER AND THE KING'S HIGHWAY No. 62 PROPOSED LINE "A" BRIDGE SITE		
SCALE - 1 in = 20 ft	DRAWN BY - D.S.	DATE - JULY 1950
REFERENCE - PLAN E-1398		

1.62 Subsurface Sections

SCALE: HORIZ. 1"=200'  
VERT. 1"=20'

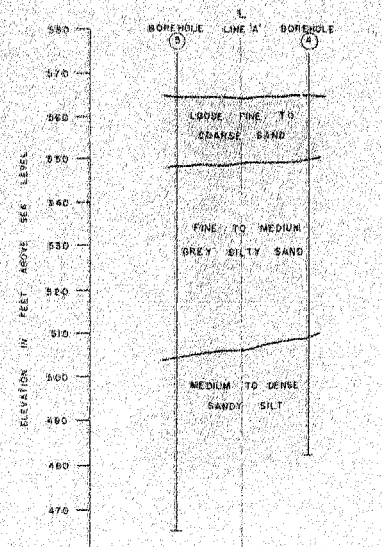


PROBABLE SOIL PROFILE ALONG L OF PROPOSED LINE A



SOIL PROFILE

ALONG BOREHOLES 1 B 2









SOIL PROFILE

ALONG BOREHOLES 3 B 4

PROPOSED CROSSING AT BONNECHERE RIVER  
AND KNOX'S HIGHWAY No. 62 LINE A

1.63 Office Logs of Boreholes

JOB No. H-530/58 LOCATION BONNECHERE RIVER  
CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO  
COORDINATES CH. 520+13.0 OFFSET 17'-0" LEFT OF C.  
ELEV. (surface): 564.0 (collar) Datum D.M.D.  
BORING# NUMBER 1  
Date (started): JULY 14, 1958 (finished) JULY 16, 1958  
RIS No. TYPE LONGYEAR JR. &

	silt		gravel
	clay		peat
	sand		fill

s — standard penet. 25.5  
v — vane shear  
p — pocket penetrometer

$k_f$  — field density  
 $C$  — consolidation last  
 $M$  — mechanical analysis  
 $T$  — triaxial shear  
 $K$  — permeability  
 $U$  — unconfined compression

S.S.W. — side slit  
SS — split spoon  
ST — Shelby tube  
TWP — thin walled piston  
DB — diamond bit

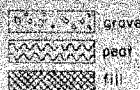
SAMPLE CONDITION	
	undisturbed
	disturbed by representative fall
	lost

BORING LOG				FIELD TESTS								LABORATORY TESTS				
SCALE	DEPTH	ELEV.	WATER OBSERVATION	LOG DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT)			No	COND.	DEPTH		TYPE	RECOVERY LENGTH REC FIRST DRIV	PENETRATION RESISTANCE (BLOWS PER FOOT)	ATTENBERG LIMITS WD X — O WL ● — NATURAL WATER CONTENT	REMARKS
FT	FT	FT	LOG		1/2	1	1 1/2			FROM	TO					
0	0					STANDARD PENETRATION TEST X (BLOWS PER FOOT) 20 40 60				FT	FT					
	1-5	562-5						1		15	3-0	S.S.	18/18	1		
5								2		7-0	8-5	S.S.	6/18	3		
10								3		12-0	13-5	S.S.W.		10		
15								4		17-0	18-5	S.S.W.		8		
20	17-0	547-0						5		22-0	23-5	S.S.	6/18	6		
25								6		27-0	28-5	S.S.	4/18	5		
30								7		32-0	33-5	S.S.	9/18	8		
35								8		37-0	38-5	S.S.	4/18	15		
40								9		42-0	43-5	S.S.W.		5		
45								10		47-0	48-5	S.S.		6		
50	52-0	512-0						11		52-0	53-5	S.S.	18/18	20		
55								12		57-0	58-5	S.S.	13/18	17		
60								13		62-0	63-5	S.S.	9/18	19		
65								14		67-0	68-5	S.S.	15/18	35		
70								15		72-0	73-5	S.S.	16/18	37		
75								16		77-0	78-5	S.S.	12/18	66		
80																

JOB No. H-530/55 LOCATION BONHECHERE RIVER  
 CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO  
 COORDINATES CH 1/28+13.0, OFFSET 17' 0" LEFT OF C  
 ELEV. (surface) 564.0 (collar) Datum D.H.O.  
 BOREHOLE NUMBER 1  
 DATE (started) JULY 14, 1959 (finished) JULY 16, 1959  
 RIG No. TYPE LONGYEAR JR A

# HUNTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 1

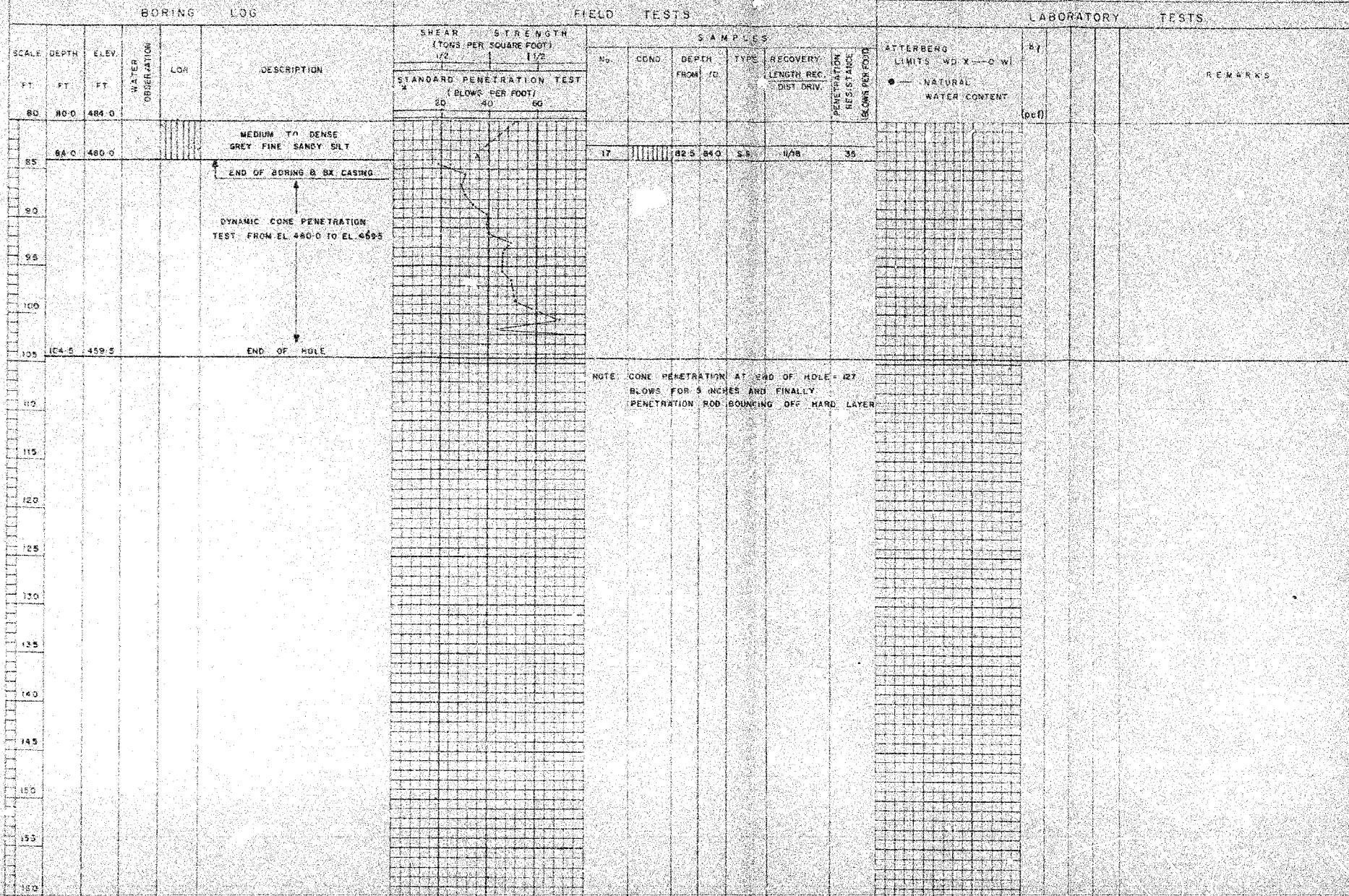
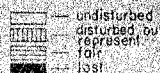


x — standard penet. 2.5.5  
 Δ — vane shear  
 o — pocket penetrometer

S<sub>t</sub> — field density  
 C — consolidation test  
 M — mechanical analysis  
 T — triaxial shear  
 K — permeability  
 U — unconfined compression

SSW — side sill  
 S.S. — split spoon  
 ST — Shelby tube  
 T.W.P. — thin walled piston  
 D.B. — diamond bit

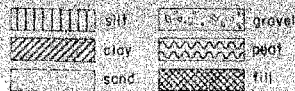
SAMPLE CONDITION



JOB NO. H-530/58 LOCATION BONNECHERE RIVER  
 CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO  
 COORDINATES CH. 526+15.0, OFFSET 13'0" RIGHT OF E.  
 ELEV. (SURFACE) 563.0 (COLOR) Datum D.M.O.  
 BOREHOLE NUMBER - 2  
 DATE (STARTED) JULY 14, 1958 (FINISHED) JULY 15, 1958  
 R.G. No. TYPE LONGYEAR JR. A.

# HUNTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 2



x - standard penet. 2 S.S.  
 a - vane shear  
 o - pocket penetrometer

f - field density  
 C - consolidation test  
 M - mechanical analysis  
 T - triaxial shear  
 K - permeability  
 U - unconfined compression

S.S.W. - side slit  
 S.S. - split spoon  
 ST - Shelby tube  
 T.W.P. - thin walled piston  
 D.B. - diamond bit

SAMPLE CONDITION  
 (disturbed)  
 (disturbed but repressed)  
 (fair)  
 (lost)

BORING LOG				FIELD TESTS				LABORATORY TESTS			
SCALE	DEPTH	ELEV.	WATER OBSERVATION	LOG	DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT) 1/2 1/2	STANDARD PENETRATION TEST (BLows PER FOOT) 20 40 60	SAMPLES	ATTERBERG LIMITS WD % - LL %	%	REMARKS
FT	FT	FT						NO. COND. DEPTH FROM TO TYPE RECOVERY LENGTH REC. BEST QRV. PENETRATION RESISTANCE (BLows PER FOOT)		(pcf)	
0	0	563.0									
1.0	1.0	562.0									
5					LOOSE FINE TO COARSE SAND (WITH SOME GRAVEL AND TRACES OF DECOMPOSED ORGANIC MATTER)			1 5.0 6.5 S.S. 9/18 2			
10								2 10.0 11.5 S.S. 6/18 2			
15	13.0	548.0						3 15.0 16.5 S.S. 4/18 4			
20								4 20.0 21.5 S.S.W. 6			
25								5 25.0 26.5 S.S.W. 7			
30								6 30.0 31.5 S.S.W. 3			
32					FINE TO MEDIUM GREY SILTY SAND (WITH SMALL TRACES OF CLAYEY SILT)			7 35.0 36.5 S.S. 18/18 14			
40								8 40.0 41.5 S.S. 3/18 7			
45								9 45.0 46.5 S.S. 15/18 8			
50								10 50.0 51.5 S.S.			
55								11 55.0 56.5 S.S.			
60	60.0	503.0						12 60.0 61.5 S.S. 6/18 19			
65								13 65.0 66.5 S.S. 13/18 17			
70					MEDIUM TO DENSE GREY FINE SANDY SILT			14 70.0 71.5 S.S. 17/18 25			
75								15 75.0 76.5 S.S. 11/18 23			
80	80.0	493.0			END OF BORING & BY CASING						

CB No. H-330/55 LOCATION BONNECHERE RIVER

CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO

COORDINATES CH 525+13.0; OFFSET 15' 0" RIGHT OF E

ELEV (SURFACE) 323.0 (collar)

Datum B.H.O.

BOREHOLE NUMBER 2

DATE (started) JULY 14, 1958 (finished) JULY 16, 1958

RIG No.

TYPE LUNYEAR JR. A

# HUNTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 2



silt



gravel



clay



peat



sand



fill

X — standard penet. 2.5.5

A — vane shear

Q — pocket penetrometer

N<sub>1</sub> — field density

C — consolidation test

M — mechanical analysis

T — triaxial shear

K — permeability

U — unconfined compression

SSW — side sill

SS — split spoon

ST — Shelby tube

TWP — thin walled piston

D.B. — diamond bit

SAMPLE CONDITION

— undisturbed

— disturbed but

— (disturbed)

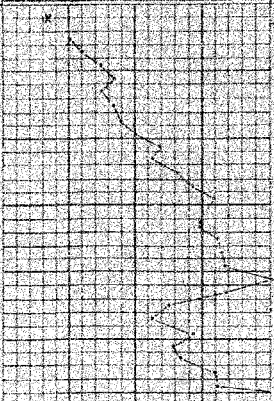
— fair

— lost

## BORING LOG

## FIELD TESTS

## LABORATORY TESTS

SCALE DEPTH			ELEV FT	WATER OBSERVATION	LOG	DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT)		SAMPLES						ATTENBERG		REMARKS	
FE	FT	FT					1/2	1/2	No.	COND.	DEPTH FROM TO	TYPE	RECOVERY LENGTH REC. DIST CORN.	PENETRATION RESISTANCE (BLOWS PER FOOT)	LIMITS w.p. x — o.w.	— NATURAL WATER CONTENT (pcf)		
80	80.0	483.0				END OF BORING @ EX. CASING	STANDARD PENETRATION TEST (BLOWS PER FOOT)											
							20	40	50									
																		
85																		
90																		
95																		
100																		
105																		
110	110.0	453.0				END OF HOLE												
115																		
120																		
125																		
130																		
135																		
140																		
145																		
150																		
155																		
160																		

DYNAMIC CONE PENETRATION  
TEST FROM EL. 483.0 TO EL. 453.0

NOTE: CONE PENETRATION AT END OF HOLE = 122  
BLOWS PER FOOT AND FINALLY PENETRATION  
ROD BOUNCING OFF HARD LAYER

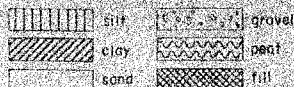
DYNAMIC CONE PENETRATION TEST FROM EL. 483.0 TO EL. 453.0

NOTE: CONE PENETRATION AT END OF HOLE 122 BLOWS PER FOOT AND FINALLY PENETRATION ROD BOUNCING OFF HARD LAYER

JOB No. H-510/55 LOCATION BONNECHERE RIVER  
 CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO  
 COORDINATES CH 328+92.0, OFFSET 15.0 LEFT OF C  
 ELEV (SURFACE) 503.0 (collar) Datum O.H.O.  
 BOREHOLE NUMBER 3  
 DATE (started) JULY 3, 1958 (finished) JULY 10, 1958  
 HIG No. TYPE LONGYEAR JR. A.

# HUNTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 3



x — standard penet. test  
 A — vane shear  
 o — pocket penetrometer

N — field density  
 C — consolidation test  
 M — mechanical analysis  
 T — triaxial shear  
 K — permeability  
 U — unconfined compression

SSW — side vial  
 SS — split spoon  
 ST — Shelby tube  
 TWP — thin walled piston  
 D.B. — diamond bit

SAMPLE CONDITION  
 — undisturbed  
 — disturbed but representative  
 — lost

## BORING LOG

## FIELD TESTS

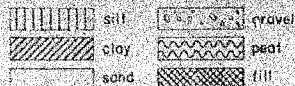
## LABORATORY TESTS

SCALE	DEPTH	ELEV.	WATER OBSERVATION	LOG	DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT)		SAMPLES				ATTENBERG		REMARKS		
						1/2	1 1/2	No.	COND.	DEPTH FROM TO	TYPE	RECOVERY LENGTH REC. DIST. DRIV.	PENETRATION RESISTANCE (BLows PER FOOT)		LIMITS - WD X - G WI	
						STANDARD PENETRATION TEST X (BLOWS PER FOOT)									NATURAL WATER CONTENT (pct)	
FT.	FT.	FT.				20	40	60	FT.	FT.						
0	0	565.0														
	2.5	562.5			LOOSE FINE TO COARSE SAND  (WITH SOME GRAVEL AND TRACES OF DECOMPOSED ORGANIC MATTER)				1							
5									2	4.0	5.5	S.S.	2			
									3	7.0	8.5	S.S.	5			
10									4	10.0	11.5	S.S.	3			
									5	13.0	14.5	S.S.	2			
15	16.0	548.0							6	17.0	18.5	S.S.	1			
20									7	20.0	21.5	S.S.	8			
25									8	25.0	26.5	S.S.	9			
30					FINE TO MEDIUM GREY SILTY SAND				9	32.0	33.5	S.S.	1			
35					(WITH SMALL TRACES OF CLAYEY SILT)											
40									10	40.0	41.5	S.S.	16			
45									11	45.0	46.5	S.S.	13/18	9		
50									12	50.0	51.5	S.S.	6			
55										55.0	56.5	S.S.	3			
60	60.0	505.0							13	60.0	61.5	S.S.	9/18	6		
65					MEDIUM TO DENSE GREY FINE SANDY SILT				14	65.0	66.5	S.S.	14/18	17		
70									15	70.0	71.5	S.S.	17/18	19		
75									16	75.0	76.5	S.S.	17/18	24		
80																

JOB No. N-530/58 LOCATION DONNECHERE RIVER  
 CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO  
 COORDINATES CH. 520+92.0; OFFSET 15'-0" LEFT OF C  
 ELEV. (EL. FACE) 565.0 (collar) Datum D.H.O.  
 BOREHOLE NUMBER 3  
 DATE (started) JULY 5, 1958 (finished) JULY 10, 1958  
 RIG No. TYPE LONGYEAR JR. A.

# HUNTING TECHNICAL AND EXPLORATION SERVICES

BOREHOLE No. 3



x — standard penet. 2 & 5  
 A — vane shear  
 o — pocket penetrometer

f — field density  
 C — consolidation test  
 M — mechanical analysis  
 T — triaxial shear  
 K — permeability  
 U — unconfined compression

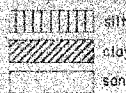
SSW — side silt  
 SS — split spoon  
 ST — Shelby tube  
 TWP — thin walled piston  
 DB — diamond bit

SAMPLE CONDITION  
 — undisturbed  
 — disturbed, but  
 — repressed  
 — fair  
 — lost

BORING LOG					FIELD TESTS							LABORATORY TESTS			
SCALE	DEPTH	ELEV.	WATER OBSERVATION	LOG	DESCRIPTION	SHEAR STRENGTH (TONS PER SQUARE FOOT)		SAMPLES				ATTERBERG LIMITS		REMARKS	
FT	FT	FT				1/2	1 1/2	No.	COND.	DEPTH FROM TO	TYPE	RECOVERY LENGTH REC. DIST. DRIV.	WATER CONTENT		
80	80.0	465.0													
85															
90					MEDIUM TO DENSE GREY FINE SANDY SILT			17		80.0 81.5	S.S.	9/16	17		
95								18		85.0 86.5	S.S.	16/16	24		
								19		90.0 91.5	S.S.	17/16	20		
								20		95.0 96.5	S.S.	13/16	31		
100	100.0	465.0			END OF BORING & B4 CASING			21		100.0 101.5	S.S.	15/16	27		
105															
110															
115					DYNAMIC CONE PENETRATION TEST FROM EL. 465.0 TO EL. 438.0										
120															
125															
127.0	438.0				END OF HOLE										
130															
135															
140															
145															
150															
155															
160															

NOTE: CONE PENETRATION AT END OF HOLE \*  
 45 BLOWS FOR 1 INCH AND FINALLY  
 PENETRATION ROD BOUNCING OFF  
 HARD LAYER.

JOB No. 1530/58 LOCATION BONNECHERE RIVER  
CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO  
COORDINATES CH 528+02.0; OFFSET 15'-0" RIGHT OF A  
ELEV. (SURFACE) 365.0 (color) Datum D.M.  
BOREHOLE NUMBER 4  
DATE (started) JULY 5, 1958 (finished) JULY 10,  
RIG No. TYPE LONGYEAR JR. A







X — standard penet. 25.5  
A — vane shear  
O — pocket penetrometer

C — consolidation test  
M — mechanical analysis  
T — triaxial shear  
K — permeability  
U — unconfined compression

SS — split spoon  
ST — Shelby tube  
TWP — thin walled piston  
D.B. — diamond bit

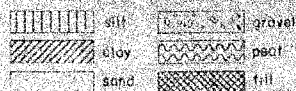
SAMPLE CONDITION


 — undisturbed  

 — disturbed but represent  

 — fair  

 — lost

[illegible]

JOB No. 830/88 LOCATION BONNECHERE RIVER  
 CLIENT DEPARTMENT OF HIGHWAYS - ONTARIO  
 COORDINATES CH 528+92.0 OFFSET 15'-0" RIGHT OF E  
 ELEV (SURFACE) 565.0 (collar) Datum D.M.O.  
 BOREHOLE NUMBER 4  
 DATE (STARTED) JULY 5, 1958 (FINISHED) JULY 10, 1958  
 RIG No. TYPE LONGYEAR JR. A

# HUNTING TECHNICAL AND EXPLORATION SERVICES



X — standard penetr 2 & 5  
 A — vane shear  
 P — pocket penetrometer

C — consolidation test  
 M — mechanical analysis  
 T — triaxial shear  
 K — permeability  
 U — unconfined compression

S.S. — split spoon  
 S.T. — Shelby tube  
 T.W.P. — thin walled piston  
 D.B. — diamond bit

## SAMPLE CONDITION



BORING LOG				FIELD TESTS							LABORATORY TESTS			
SCALE	DEPTH	ELEV	WATER OBSERVATION	LOG	DESCRIPTION	SHEAR STRENGTH (TENS PER SQUARE FOOT) 1/2 1 1/2	STANDARD PENETRATION TEST (BLOWS PER FOOT) 20 40 60	SAMPLES				ATTERBERG LIMITS WP X — O WL	REMARKS	
FT.	FT.	FT.						No.	COND.	DEPTH FROM TO	TYPE	RECOVERY LENGTH REC. DIST. DRIV.	PENETRATION RESISTANCE (BLOWS PER FOOT)	
	80.0	485.0			MEDIUM TO DENSE GREY FINE SANDY SILT			15		80.0-81.5	S.S.	12/78	37	
	83.0	482.0												
	85				END OF BORING 8 BY CASING									
	90				DYNAMIC CONE PENETRATION TEST FROM EL 482.0 TO EL 467.0									
	95													
	98.0	467.0			END OF HOLE									
	100													
	105													
	110													
	115													
	120													
	125													
	130													
	135													
	140													
	145													
	150													
	155													
	160													

NOTE CONE PENETRATION AT END OF HOLE 92 BLOWS PER FOOT

1.64 Air Photo of Site



2000-0000

2000-0000

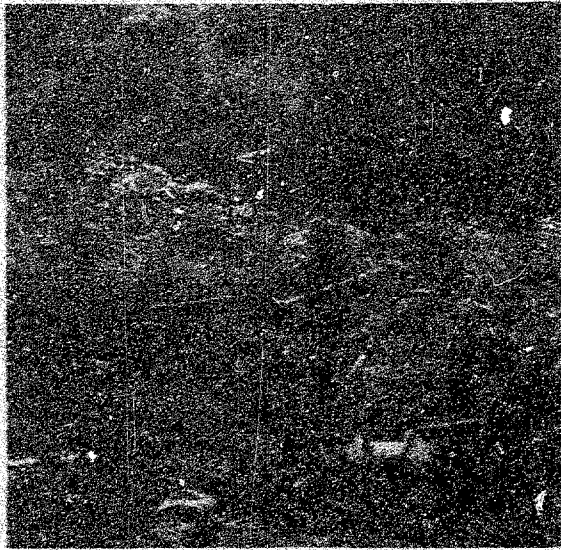
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1.65 Photos of Site

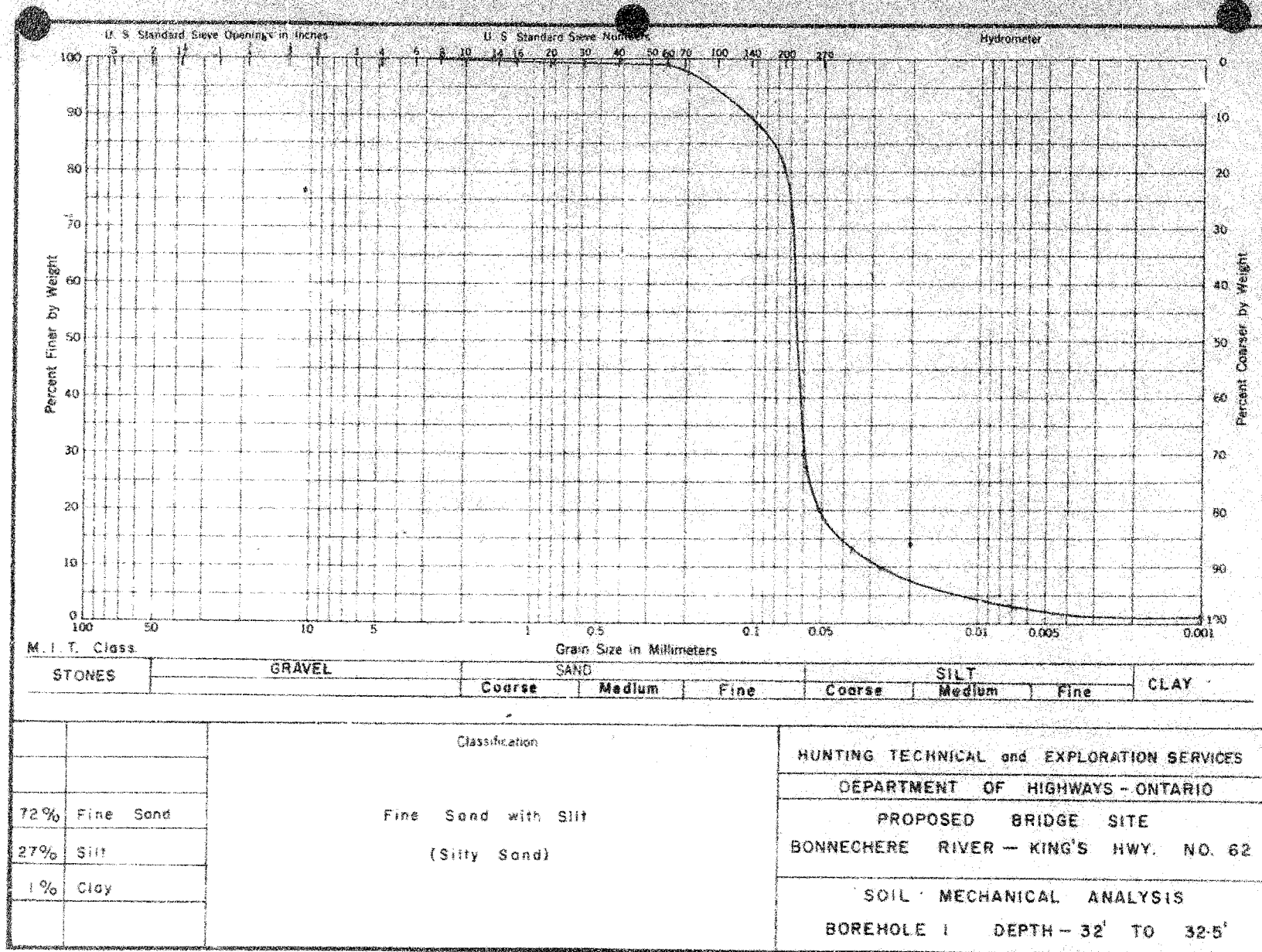


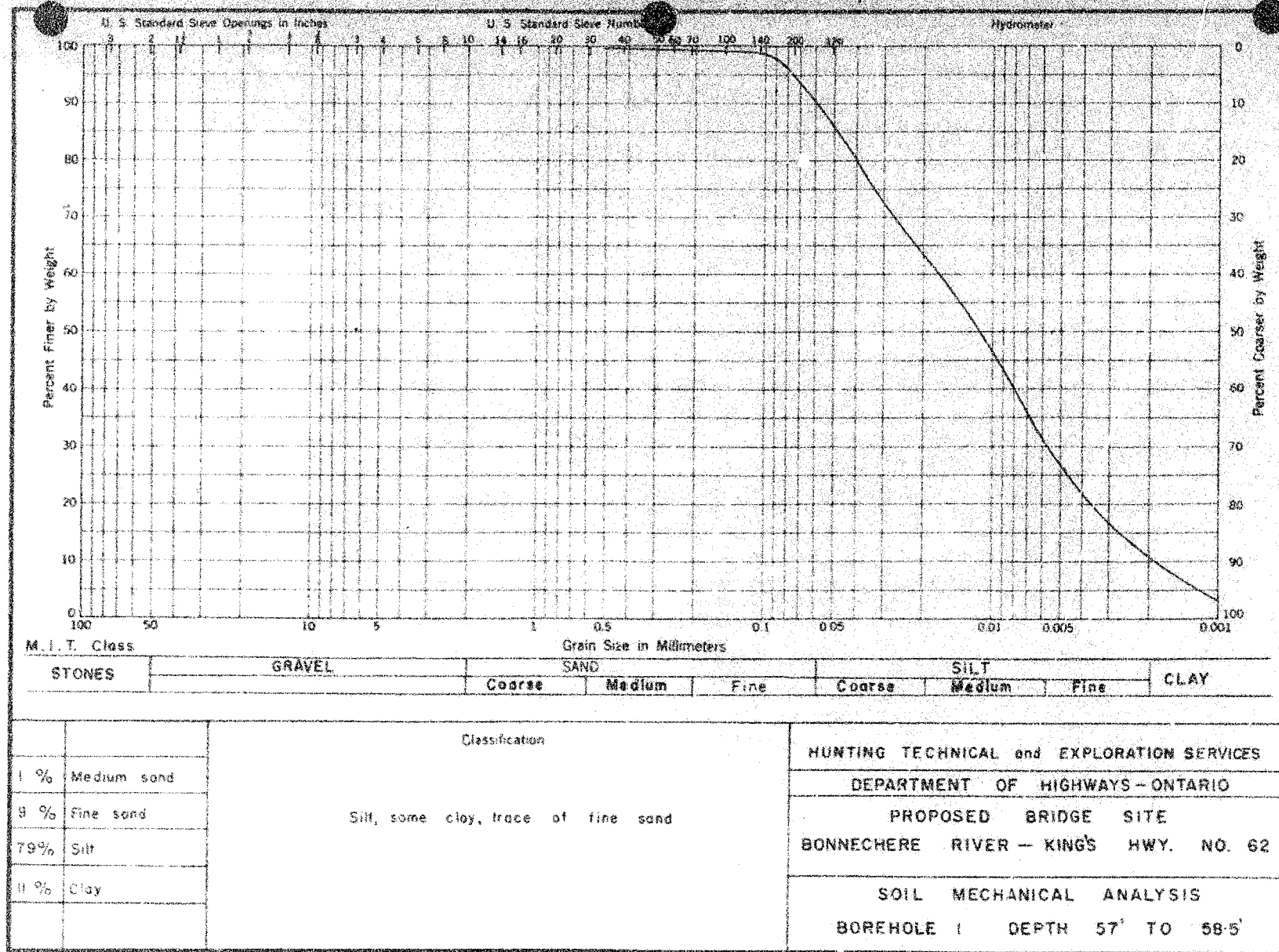
View of Site from Station 529+00 (approximately) Looking South

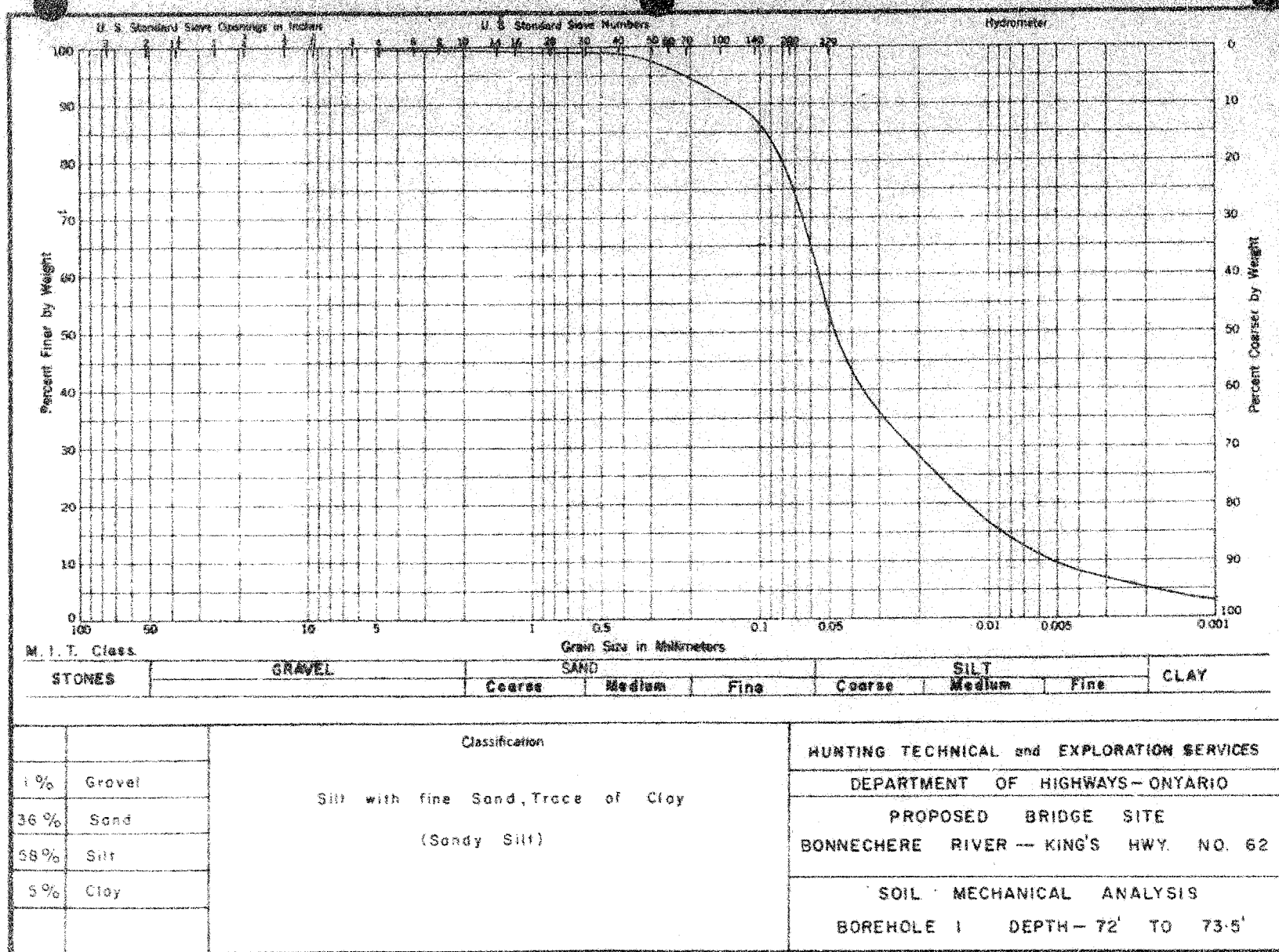


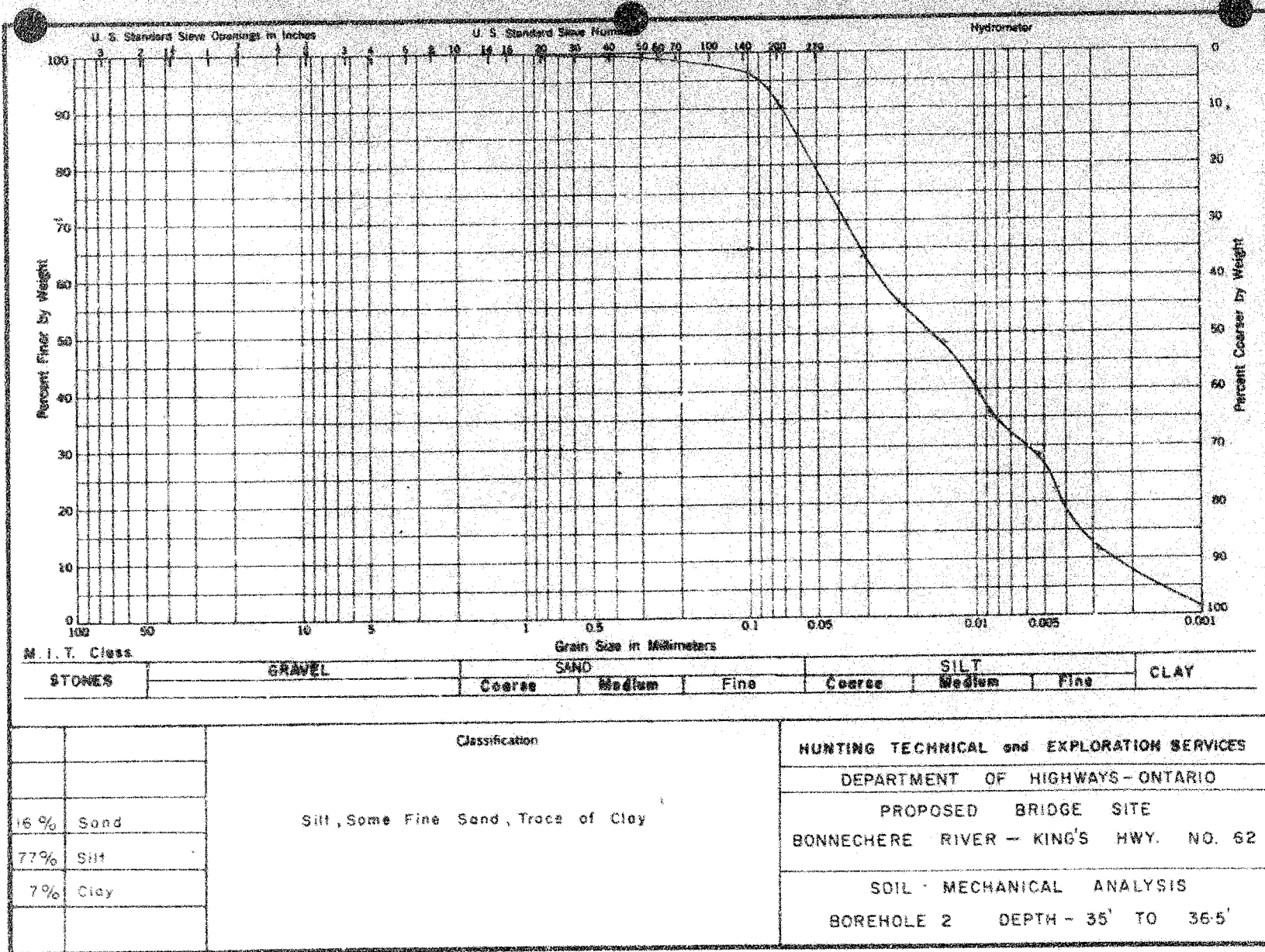
View of Site on North Bank Looking West

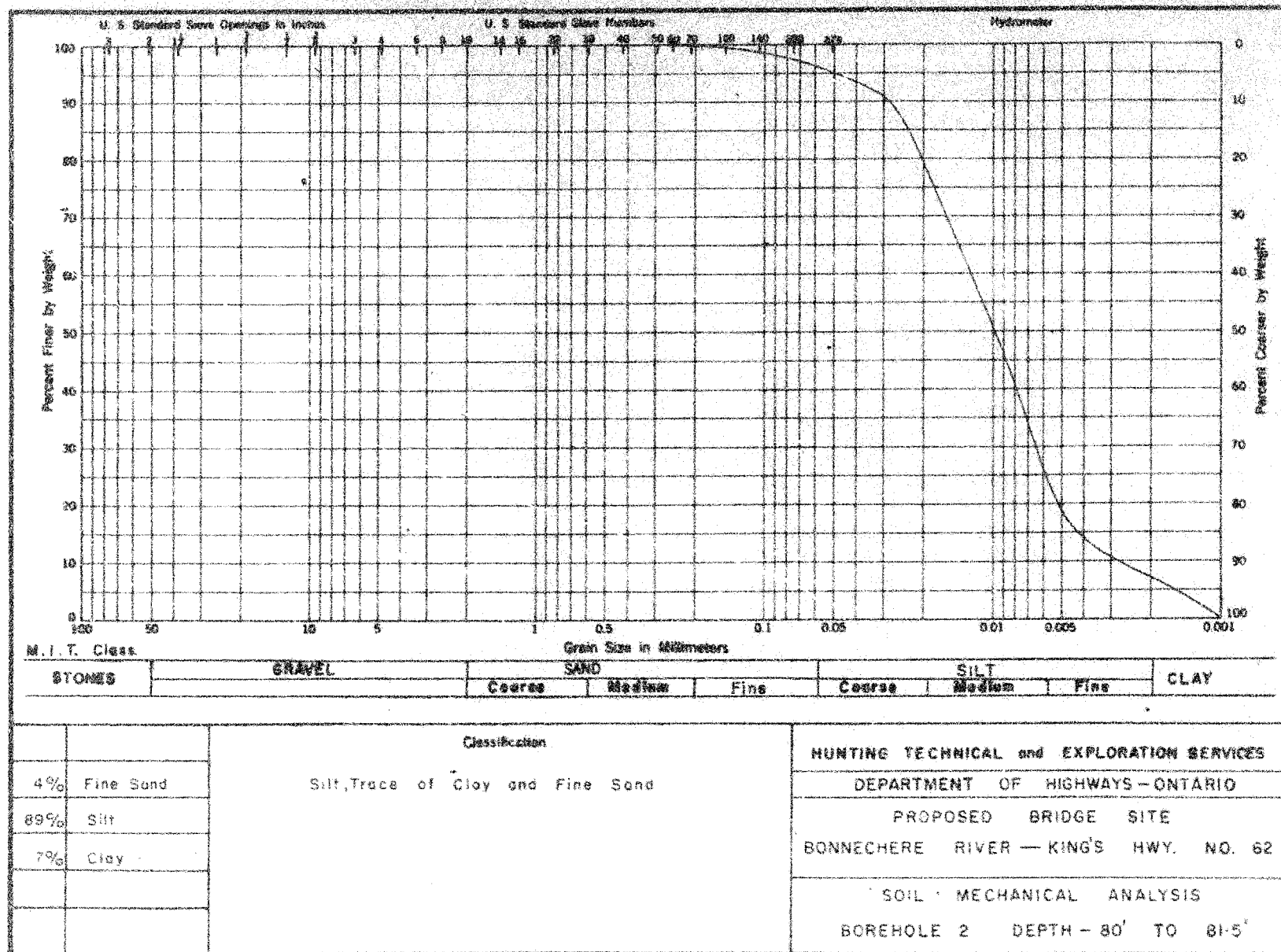
1.66 Soil Classification Charts

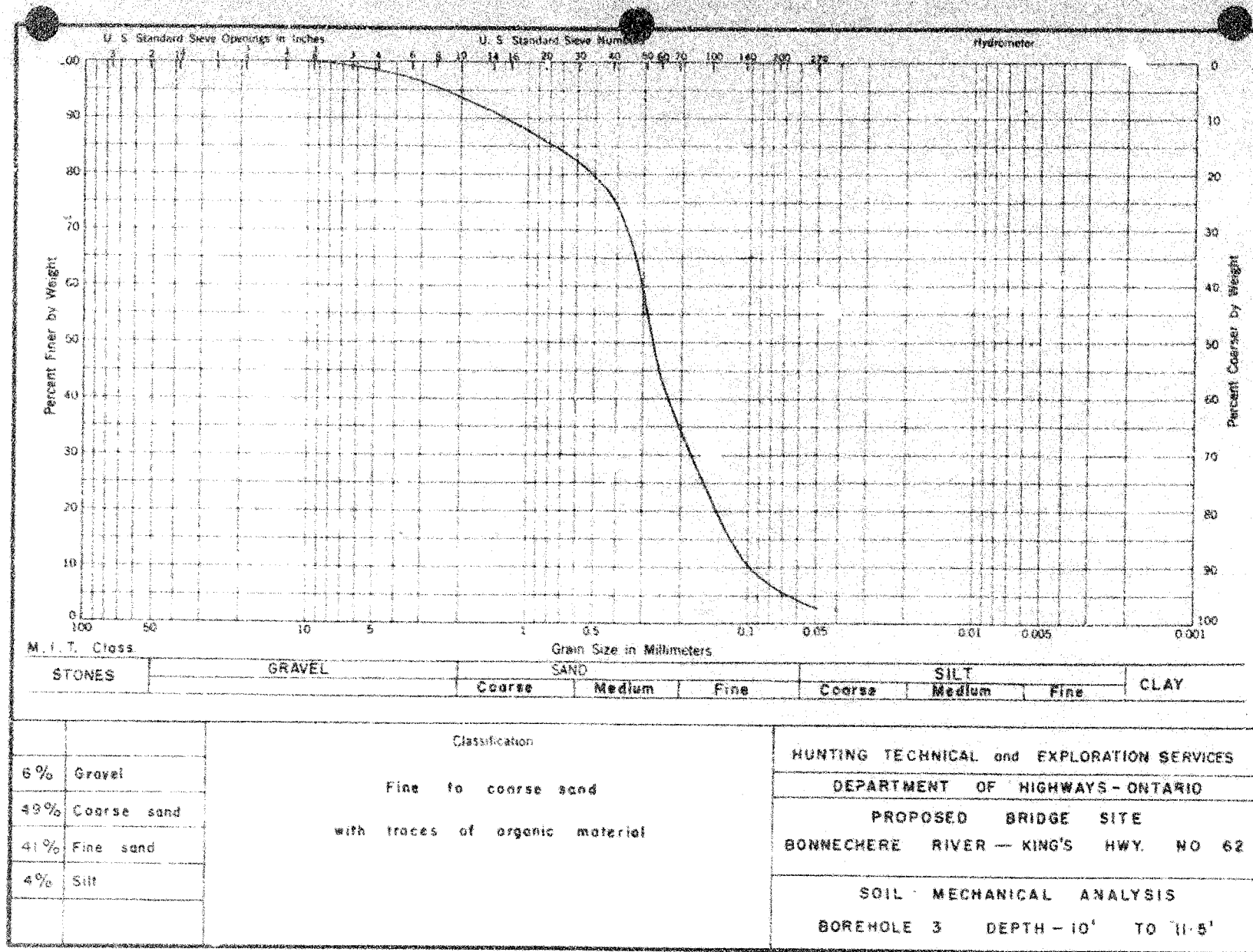


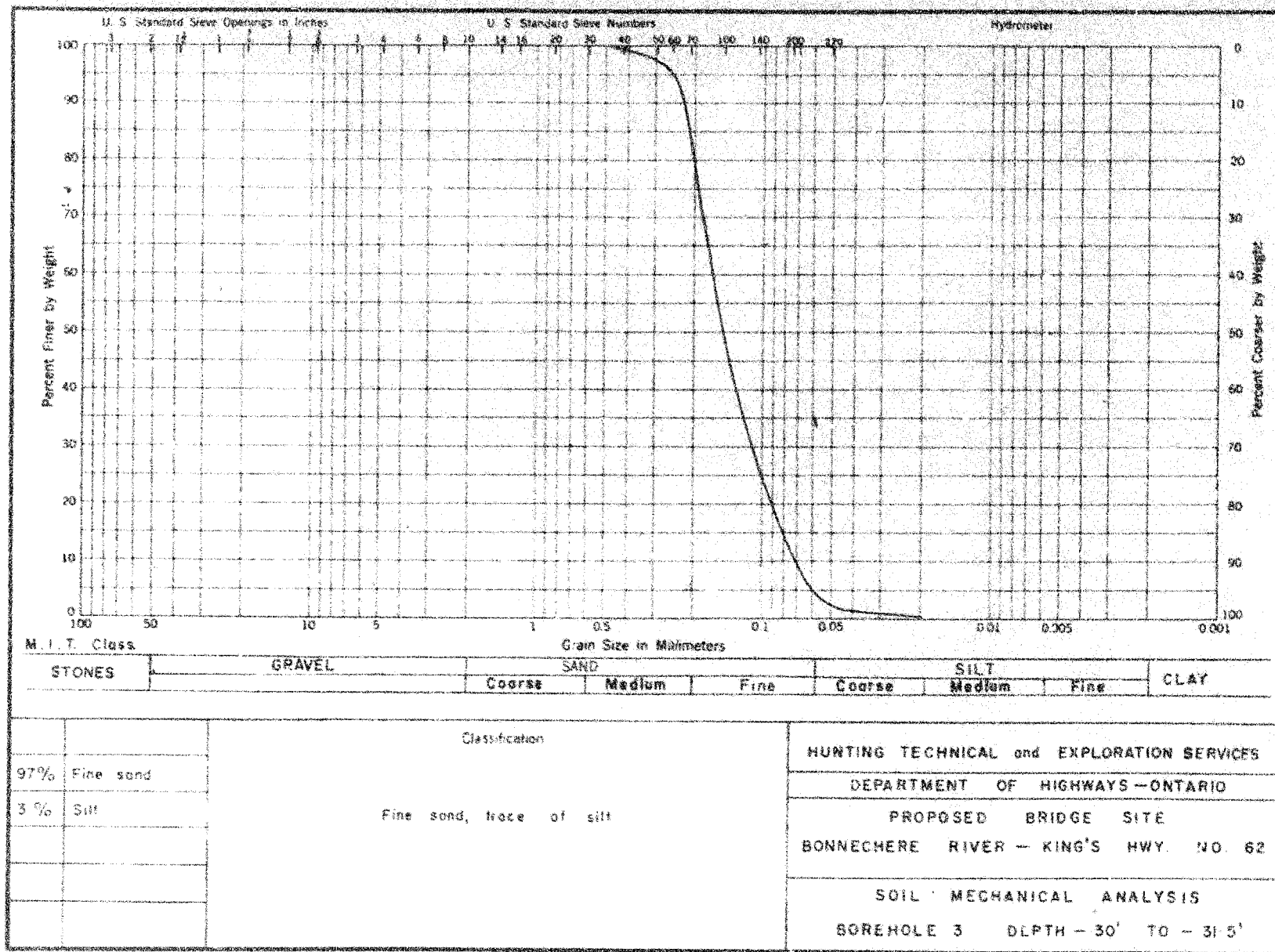


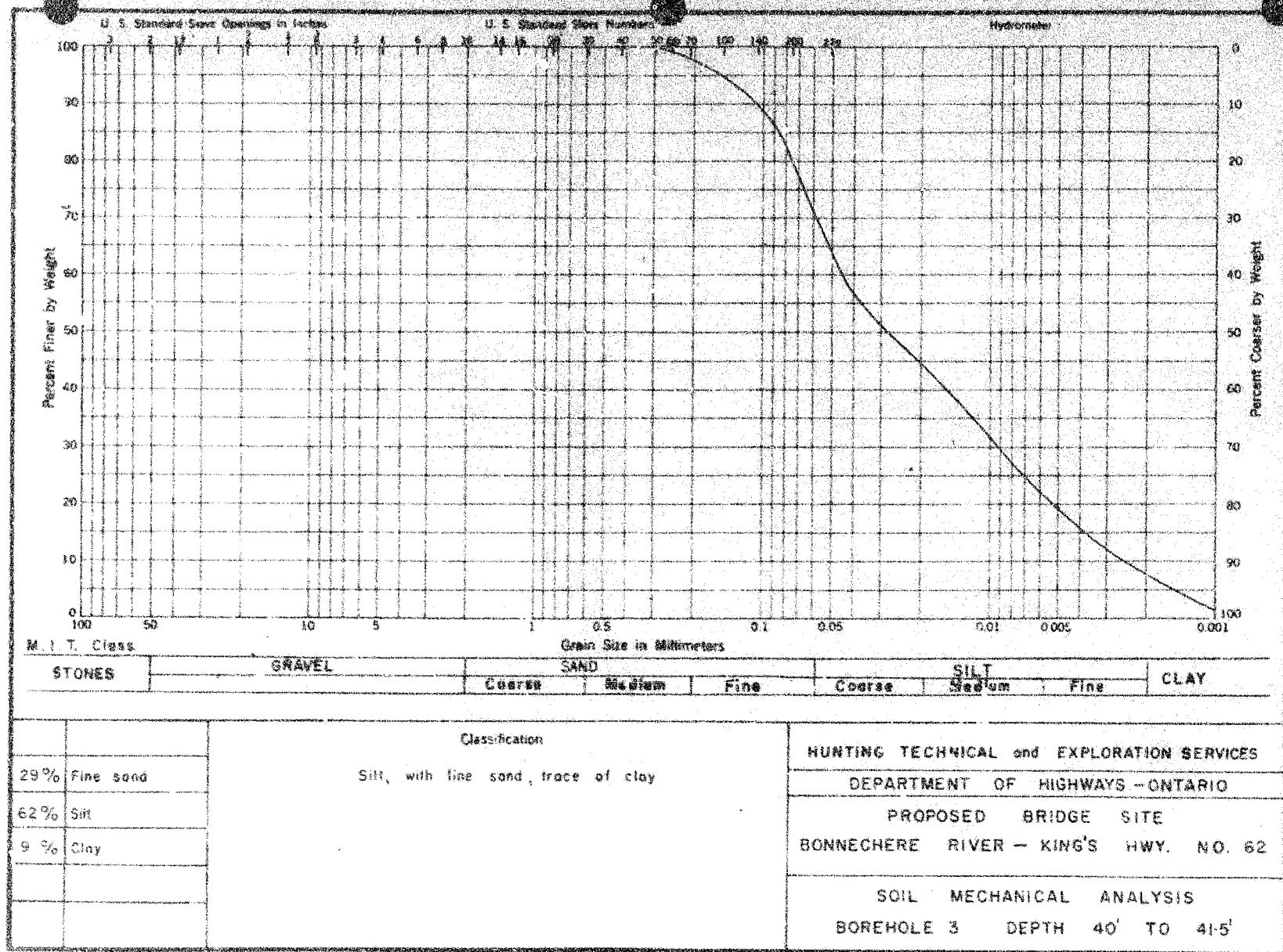


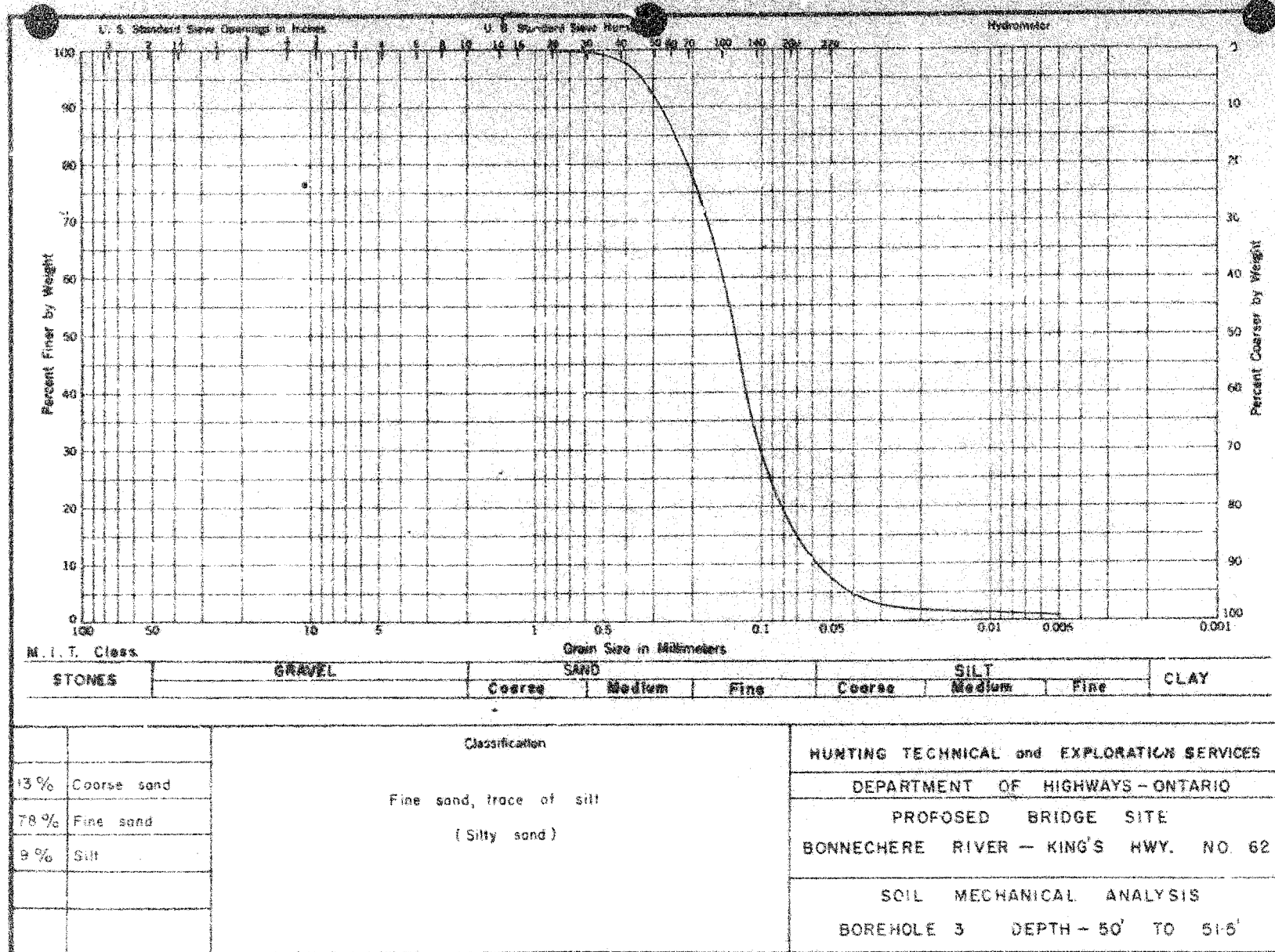


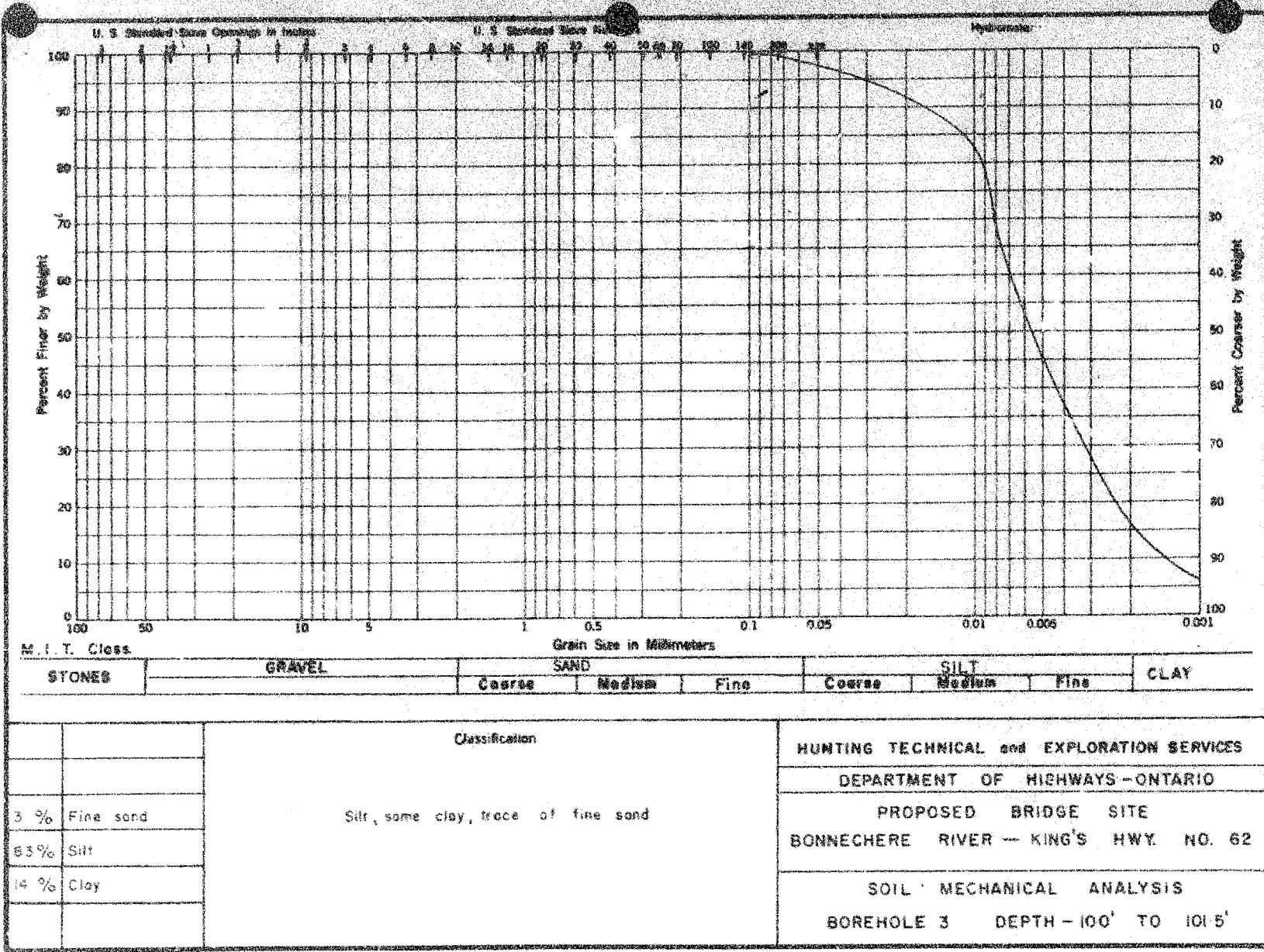


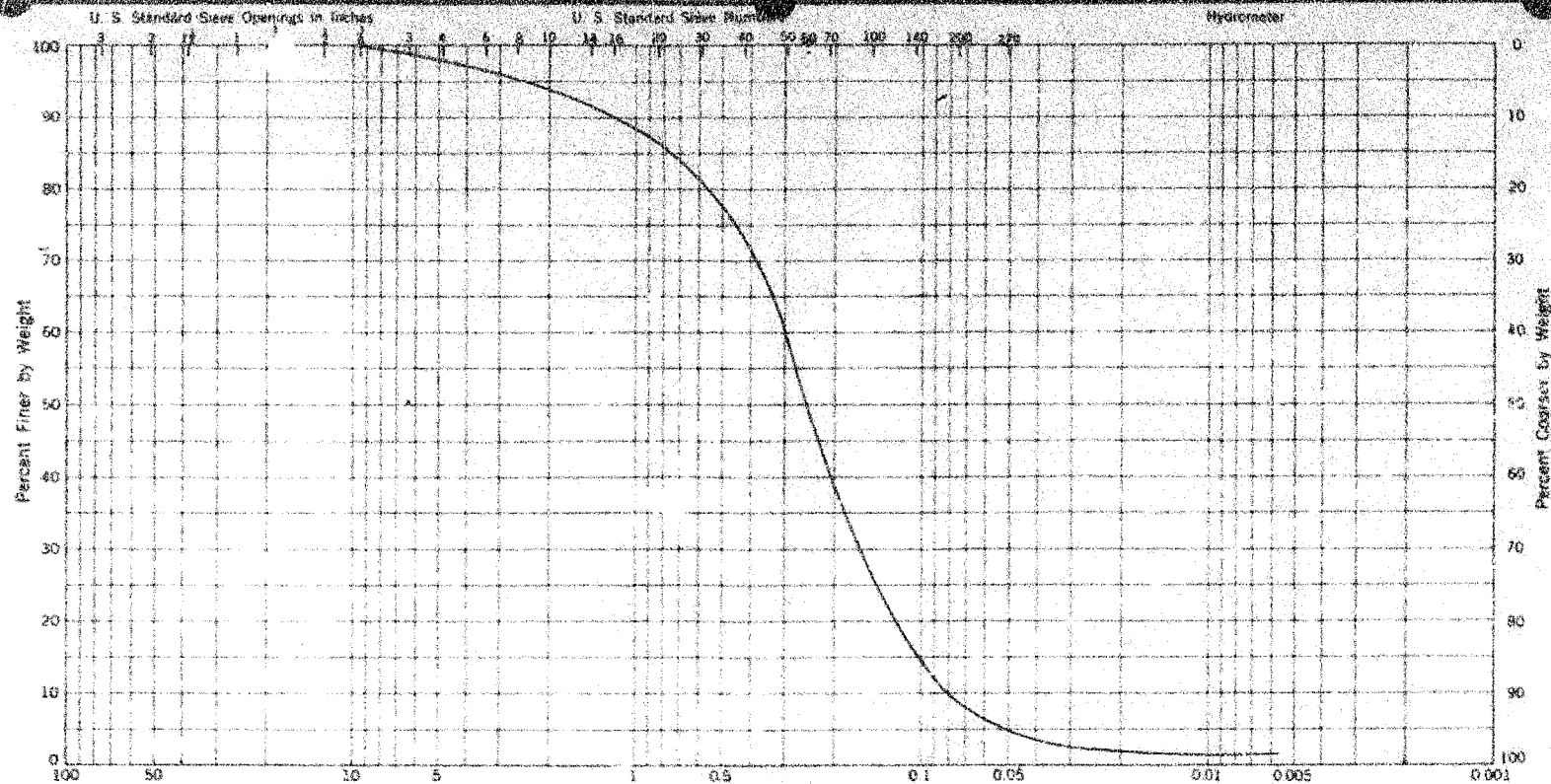


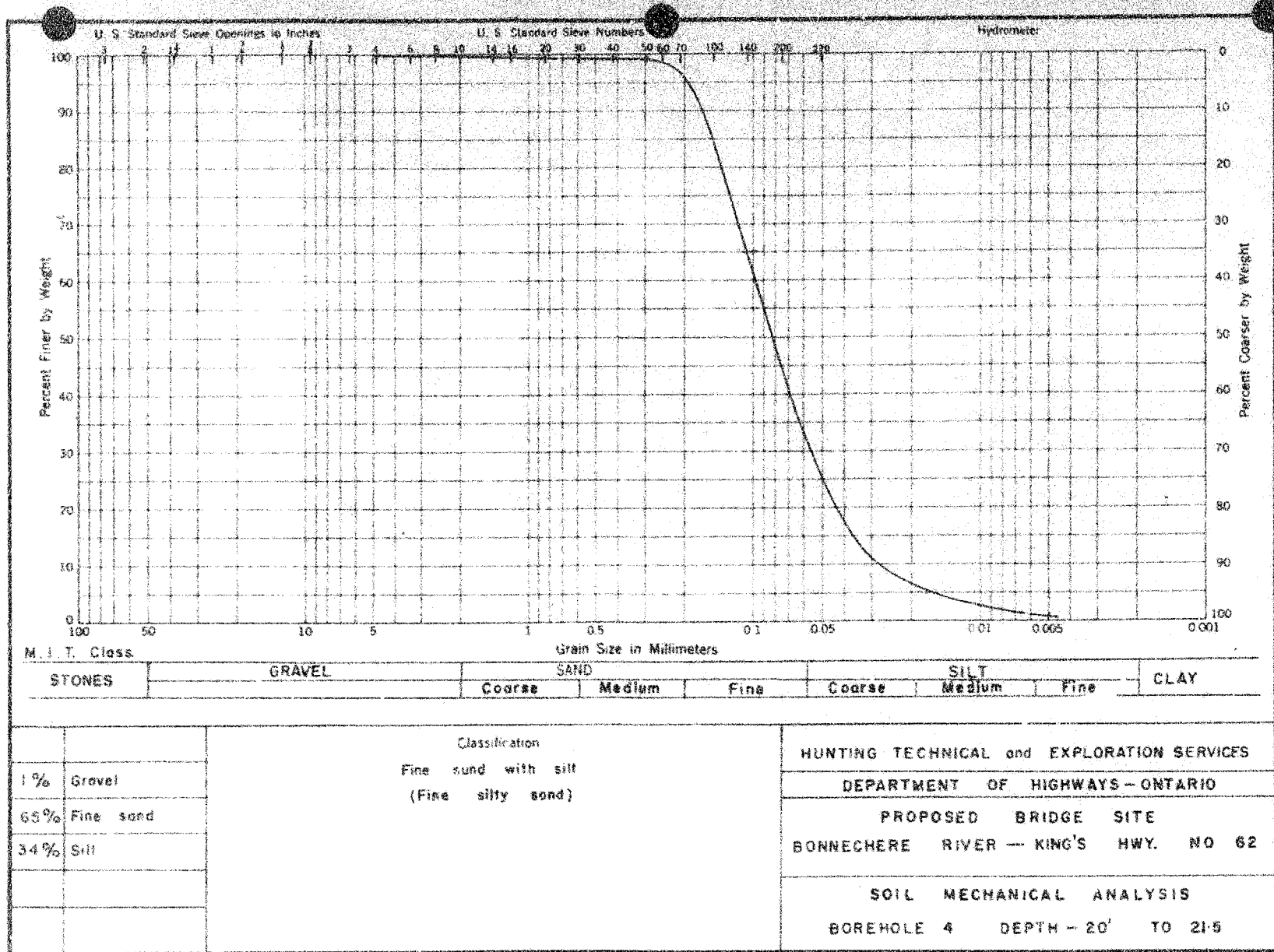


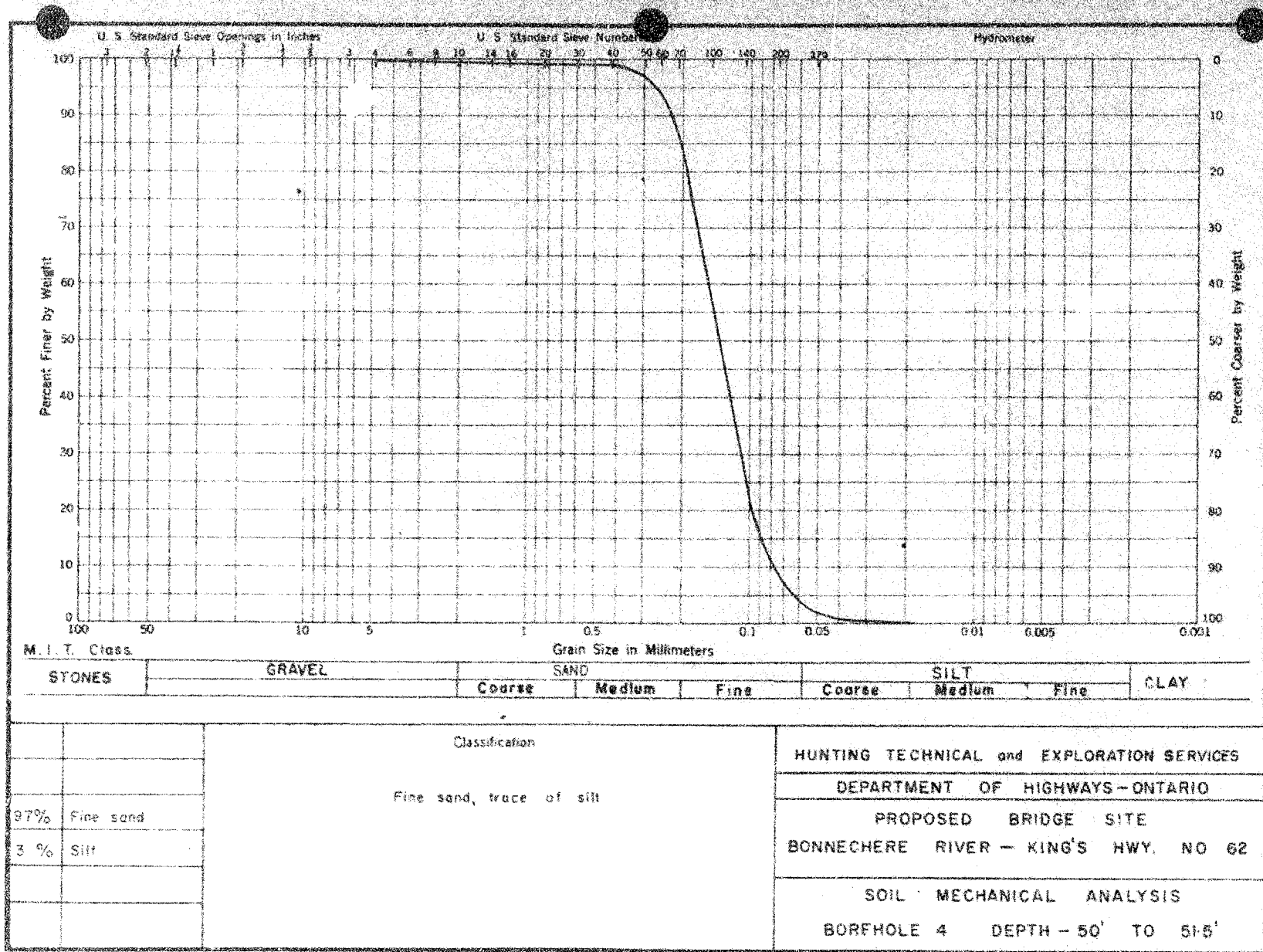


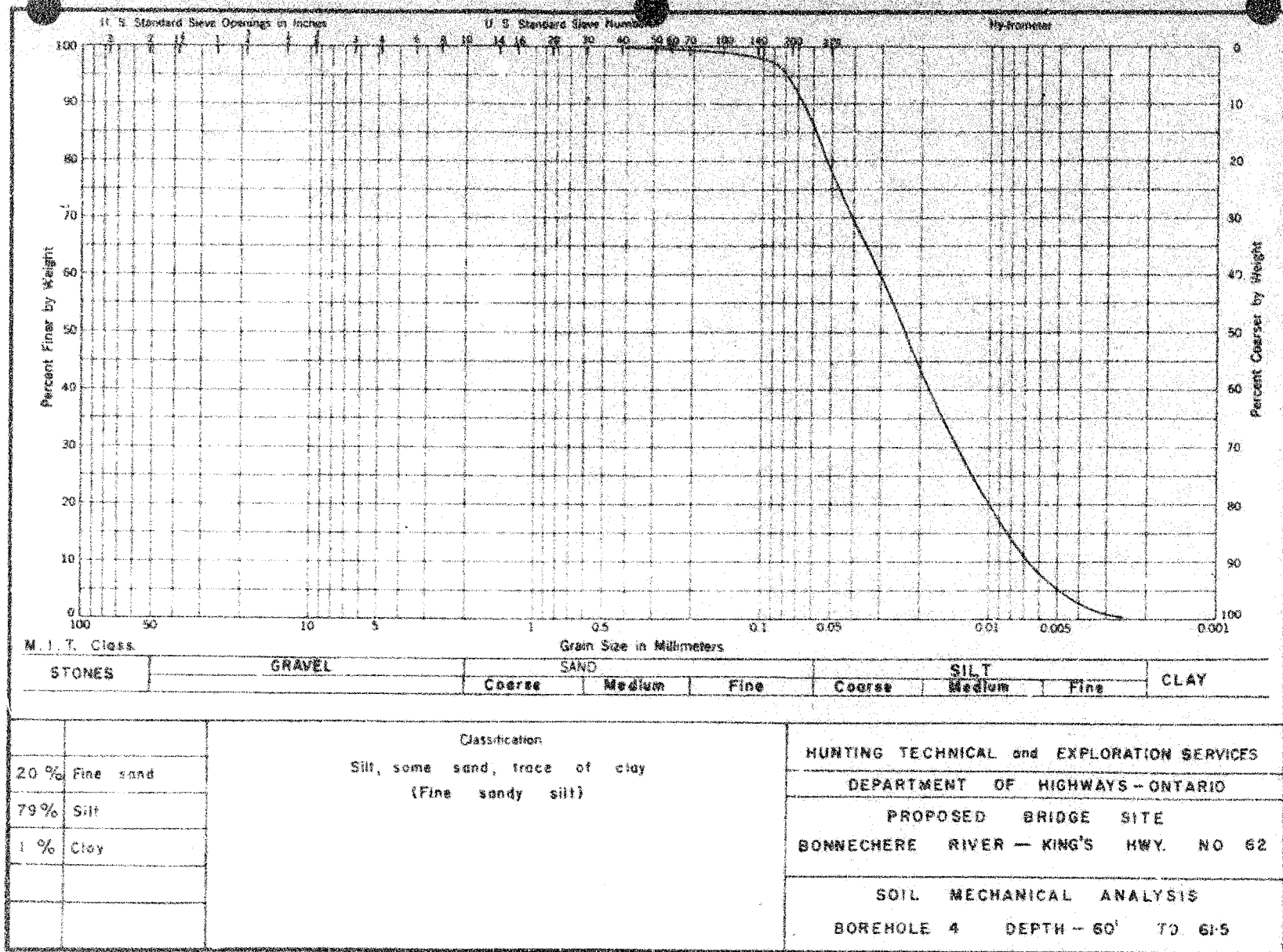










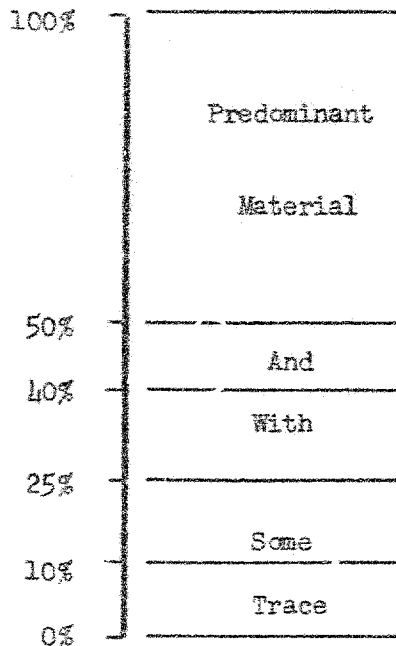


HUNTING TECHNICAL & EXPLORATION SERVICES

1450 O'Connor Drive Toronto, Ontario

SOIL TYPES

The following system was used in classifying the various soils by name:



Example:

Medium dense grey silt with fine sand  
(Penet. resist.) (colour) (pred. type) (25%-40%) (other type)  
or relative density

Unless believed to have a significant effect on the soil characteristics the minor soil types (i.e. traces) present are disregarded in the name used on the boring log and cross-sections. The complete classification is given with the gradation analysis.

In all cases the strength characteristics (e.g. penetration resistance) is quoted first, followed by the colour and finally the descriptive name based on the mechanical analysis.