

#66 - F - 295 M

DEV. RD. # 797-1

RENFREW CTY.

BRUDENELL TWP.

66-F-295M
SOILS DESIGN REPORT

Dev. Rd. 797-1, Twp. of Brudenell

County of Renfrew

DEPARTMENT OF HIGHWAYS, ONTARIO

Materials & Testing Division

Distribution

8 c.c. D.H.O. Kingston
1 c.c. File

Job Number 65315
January, 1966

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 65315

1287 caledonia road,

TORONTO 19, ONTARIO

Telephone: 789-1128

January 19, 1966

Department of Highways, Ontario,
Materials and Testing Division,
Downsview, Ontario.

Attention: Mr. A. Rutka, P.Eng.,
Materials & Testing Engineer.

Dear Sir:

Re: Soils Design Report, Dev.Rd. 797-1,
Twp. of Brudenell, County of Renfrew.

We respectfully submit our report for this project along with the accompanying soils profile, K810E-12.

The soils consist of bouldery fine sandy till over granitic type bedrock. In the central portion of the project the soils become more granular and some local gravel pits have been opened. Intensive granular explorations should be carried out north of the project, as indicated on the appended granular locations map.

The topography is severe and several rock cuts are encountered in the topographically high areas and muskeg deposits in the low areas. Three major muskeg deposits have been investigated and these are between -

- a) Stns. - 4 to 4 ±
- b) Stns. 51± to 60±
- c) Stns. 138± to 142±

Department of Highways, Ontario.

-2-

We believe the report to be complete within the terms of reference, but would be pleased to discuss any further points as they arise. We trust that this is satisfactory, and thank you for this opportunity to be of service on this project.

Yours very truly,

E.M. PETO ASSOCIATES LTD.,

JFG/hf

John F. Peto
for E.M. Peto, P.Eng.

TABLE OF CONTENTS

	<u>PAGE</u>	<u>NO.</u>
1.0 INTRODUCTION	1	
2.0 SOILS DATA	2	
3.0 CONSTRUCTION MATERIALS	4	
4.0 GRADELINE	5	
5.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES	6	

- Appended - Key Plan
- Laboratory Results
- Granular Location Map
- Seismic Report
- Boulder Treatment

Soils Profile K 810E-12
Accompanying This Report

SOILS DESIGN REPORT

For

Dev.Rd. 797-1

Twp. of Brudenell

3.4 Miles

PROPOSED GRADING, DRAINAGE & GRANULAR BASE

Soils Profile

K810E-12

Station To Station

0+00

180+00

E.M. Peto Job #

65315

1.0 INTRODUCTION

1.1 Background Data: Soils design work was completed on this project at the request of Mr. A. Rutka, Materials and Testing Engineer, Department of Highways, Ontario. The design consultants are Greer, Galloway and Associates.

The work was carried out in November, 1965 along with three similar projects completed at the same time. An early snow fall precluded any detailed investigations for granular materials and detailed topographic soils mapping along the right of way.

1.2 Location and Performance: The project is located about four miles west of Brudenell and forms part of the road connecting Brudenell with Wilno on Highway 60.

The existing road is gravel surfaced, about 18 ft. wide including shoulders, and has very poor vertical and horizontal alignments.

The performance on sections of the road crossing muskeg deposits is very poor and some of these sections flood during the Spring. Existing granular thicknesses consist of less than 3 ins. - 4 ins. of dirty pit run gravel over the subgrade.

1.0 INTRODUCTION - Cont'd.

1.3 Design Criteria: The following design criteria was issued on April 27th, 1965 and provides the design basis for this project.

Daily Traffic	- 25
Design Speed	- 40 m.p.h.
Horizontal Curvature	- 11°
Vision Curves	
Crest conditions	- 500 ft.
Sag conditions	- 400 ft.
Gradient	- 8%
Surface Width	
Including Shoulders	- 28 ft.
Right of Way	- 66 ft.
Surface Type	- Loose Top, Minimum granular
Structures	- None involved.

2.0 SOILS DATA

2.1 Terrain and Geology: The topography is extremely rough being composed of steep bedrock ridges covered with a mantle of bouldery sandy till. The higher ridges show exposed Precambrian bedrock while many of the depressions have been filled in with muskeg deposits.

In the central portion of the project, the soils are quite granular and a few local pits have been opened. Areas of potential granular materials exist just north of the project as shown on the appended granular location map. Unfortunately, weather conditions did not allow a proper investigation of these deposits at the time of the subgrade investigation, but airphoto interpretation and limited field work tend to suggest good potential.

2.0 SOILS DATA - Cont'd.

2.2 Boring Results: Power auger holes were placed every 100 ft. to 500 ft. apart along the proposed centreline. These holes were supplemented with hand auger holes in areas of difficult access and muskeg deposits. The results are noted on the soils profile (#K810E-12) which accompanies this report.

The general soil types encountered consist of bouldery fine sandy tills, with many areas of gravelly fine to medium sands (see Appended grading charts). These deposits are of variable depths over granitic type bedrock. Auger penetration of these soils was very difficult due to the high boulder content, and refusal was often caused by boulder interference, although it was difficult to distinguish boulders from bedrock.

Three major muskeg deposits were encountered along the route. These were located at;

- a) Stns. -4 to +4+00
- b) Stns. 51+ to 60+
- c) Stns. 138+ to 142+.

At each of the deposits, the depth of organic materials was investigated using the power auger along the road and hand auger sounding offsets. The material generally consisted of black amorphous to fine fibrous peat over organic silt and sand resting on a firm sandy bottom. Details of the treatment of these deposits is covered in Section 5.3 of this report.

2.0 SOILS DATA - Cont'd.

2.3 Seismic Results: Seismic investigations were completed in two cut areas to determine the approximate depths to bedrock, since auger work was limited by boulder interference. This work was completed by the Materials and Testing Division, Department of Highways, Ontario.

The sections covered by these surveys were as follows:

Stations 89+00 to 96+00
Stations 116+00 to 120+00

The results are shown on soils profile K810E-12 and a copy of the Seismic report is included in the Appendix.

3.0 CONSTRUCTION MATERIALS

3.1 Granular Sources: No large commercial sources of granular materials were found in the immediate area of this project. However, potential sand cushion and crushable prospects exist about 1000 ft. north of the project, as noted on the appended granular sketch map. In addition, small areas of useable granular materials are traversed by or adjacent to the road at the following stations:

- a) Station 47+
- b) Stations 62+ to 64+
- c) Stations 143+ to 148+

No extensive granular deposits have been proven in the immediate area, but the likelihood of them existing is great. However, for estimating purposes the average haul distance can be assumed arbitrarily to be five miles.

3.0 CONSTRUCTION MATERIALS - Cont'd.

3.2 Borrow Sources: The overburden in the area is generally shallow and consists of bouldery, silty fine to medium sands, containing many surface boulders. It is acceptable as earth borrow. These boulders may cause some difficulties in development of borrow sources.

4.0 GRADELINE

4.1 General Comments: In general, the proposed gradeline is compatible with the subgrade conditions. However, some revisions have been suggested, listed under heading 4.2 of this report, and these are also shown on the soils profile K810E-12. These revisions were discussed with the Materials and Testing Division, Kingston Region.

4.2 Gradeline Revisions: The following revisions are suggested:

<u>Stn. to Stn.</u>	<u>Remarks</u>
-4+ to +4+	Raised grade over muskeg deposit to provide optimum cover for riding deposit.
4+ to 24+	Generally raised grade to avoid long cuts and to improve driveway entrances, on recommendation of Materials and Testing, Kingston region.
41+ to 50+	Raised grade to avoid scratch cut and sub-excavation.
61+ to 65+	Lowered grade to produce a continuous cut section in acceptable granular material.

4.0 GRADELINE - Cont'd.

<u>Stn. to Stn.</u>	<u>Remarks</u>
84+ to 105+	Raised to reduce rock excavation and lowered to reduce height of adjacent fills, utilizing 450 ft. V.C., on recommendation of Materials and Testing, Kingston region.
121+ to 134+	Raised to avoid small rock knob treatments and scratch cuts.
144+ to 154+	Raised to avoid sub-excavation.
173+ to 183+	Ammended grade to provide better tie-in at end of project on recommendation of Materials and Testing, Kingston region.

5.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES

5.1 Granular Requirements:

- a) Type of Material: It is recommended that G.B.C. Class "A" and sand cushion be used on this contract.
- b) Depth and Width: The granular materials should be placed full width. The depth of granular materials should consist of 4 inch G.B.C. Class "A" over sand cushion, to the following total depths:
 - Rock Subgrades - 12 inches
 - Earth Subgrades - 12 inches

5.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES - cont'd.

The subgrade along some sections of the road is an acceptable sand cushion material, and in these sections only 4 inches of GBC Class "A" are required as outline on the soils profile.

5.2 Subgrade Treatment:

- a) Bouldery Cuts and Borrow Materials: Many of the cuts and borrow areas are bouldery and may cause excavation difficulties. It is recommended that the following "Special Information To Bidders" be included in the contract.

"The Contractor is hereby advised that several cuts on this contract are expected to consist of bouldery materials. Some boulders are expected to be over one cubic yard in size and will require drilling and shattering before removal."

- b) Treatment of Bouldery Subgrade in Cut Sections: It is expected that the subgrade in some cut sections will require special treatment due to a high boulder content. This may fall into two categories.

- (i) isolated large boulders within an otherwise boulder-free cut.
- (ii) cut material contains a high percentage of smaller boulders generally up to 12 inches - 18 inches maximum size.

The following treatments should be applied as required during construction for these conditions. Since the type and extent of treatment cannot be definitely determined at this time, no quantity is suggested for inclusion in the pre-engineering estimate. Payment should be as bid for earth and rock excavation.

5.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES - cont'd.

- (i) A special standard, "Treatment for Boulders in the Subgrade of Cut Sections", is included with this report. While it will not be necessary for the design engineer to use this standard for estimating purposes, it should be included in the contract drawings for the use of the construction personnel in treating these areas as they occur. In applying this standard the normal depth of excavation would be 12 ins. Any further excavation required to remove isolated boulders that occur within 3 feet of profile grade should be backfilled with boulder-free material similar to that in the remainder of the cut.
- (ii) When the entire cut contains numerous boulders of various sizes up to 12 inches - 18 inches maximum a different type of treatment should be considered. In this case the entire cut should be excavated to 36 inches below profile grade and be back-filled to subgrade elevation with boulder-free earth.

NOTE The above is for the information of the construction personnel only and is not to be included in the tender documents as a special provision.

- c) Disposal of Boulders: Boulders up to 9 inches in diameter can be utilized by increasing the depth of earth lifts to 15 inches. Boulders larger than this must be disposed of outside 1:1 slopes or in disposal areas.

5.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES - cont'd.

- d) Treatment of Isolated Rock and Earth Knobs: Isolated rock knobs may be encountered in small (less than 100 ft.) earth cuts. It is recommended that the earth portion be excavated to 36 inches and the rock shattered to 36 inches. If the adjacent fill is rock, then the cut should be backfilled with rock, allowing for 12 inches granular material. If the adjacent fill is earth, then the backfill should be earth.

The following "special" should be included to cover this contingency:

"The contractor is advised that small isolated rock knobs may be encountered within earth cuts. Should these be encountered during construction, the contractor will drill and blast these to the depth specified by the Engineer. Payment for rock so excavated will be as per the unit price for rock in the tender."

- e) Transition Points: Only those transition points indicated on the soils profile should be treated as shown, generally to a depth of 36 inches.
- f) Rock Subgrades: The rock should be shattered for a depth of 24 inches below grade, and the top 12 inches removed and replaced with granular materials.

5.3 Muskeg Treatment: The recommended treatment for the majority of muskeg deposits is to ride the new fill directly over the existing embankment and organic terrain. An assumption has been made that the total settlement will be 50% of the thickness of the fill applied. The majority of this settlement should take place immediately, but some will continue over the years, necessitating yearly maintenance. In addition, differential settlement can be expected between the fill over

5.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES - cont'd.

the existing embankment and that over the widening. However, it is suggested that riding of these deposits will be the most economical solution on a long term basis.

The following muskeg deposits will have to be treated:

<u>Stn. to Stn.</u>	<u>Max. Depth</u>	<u>Ave. Depth</u>	<u>Ht. New Fill</u>	<u>Description</u>	<u>Treatment</u>
-4± +4±	16'±	13'	3'±	Black Amorphous over dense silty sand.	Ride and allow for 25% settlement and displacement.
27± 28±	4'±		3'±	Amorphous peat over firm sand.	Excavate all organic material and backfill with rock or acceptable earth.
51± 60±	16'±	9'±	5'±	Amorphous peat over soft to firm organic silt mixed with sand over firm bottom.	Ride and allow for 50% settlement and displacement. Gradeline kept high due to possible flooding.
138± 142±	12'±	7'±	5'±	Amorphous peat over firm sand.	Ride and allow for 50% displacement and settlement.

5.4 Culverts and Culvert Backfill: Where culverts are located within muskeg deposits, they should be placed as close to the edges of the deposit as practical to avoid deep excavation treatment for their foundations. The following specific changes are recommended:

5.0 RECOMMENDATIONS AND CONSTRUCTION FEATURES - cont'd.

- a) Move the culvert from Stn. 58 ± to Stn. 59+50 ± to provide a better foundation.
- b) Move culvert from Stn. 140 ± to Stn. 139 ± to provide a better foundation. This will involve realigning a short section of the creek through the muskeg deposit.

Where soft foundation conditions cannot be avoided, the foundation excavation and bedding treatment should be carried to firm bottom. CIP culverts would be satisfactory on this project.

All granular backfill required for culverts should consist of sand cushion material.

5.5 Topsoil: Topsoil should be removed beneath all fills less than 4 ft. in height, especially where the proposed centreline crosses existing ditchlines. The average depth of topsoil on the widening and new alignments is about 6 inches.

5.6 Compaction Equipment: Since the majority of soils on this project are sandy, the suggested compaction equipment allotment is 100% wobble wheel rollers.

Yours very truly,

E.M. PETO ASSOCIATES LTD.,



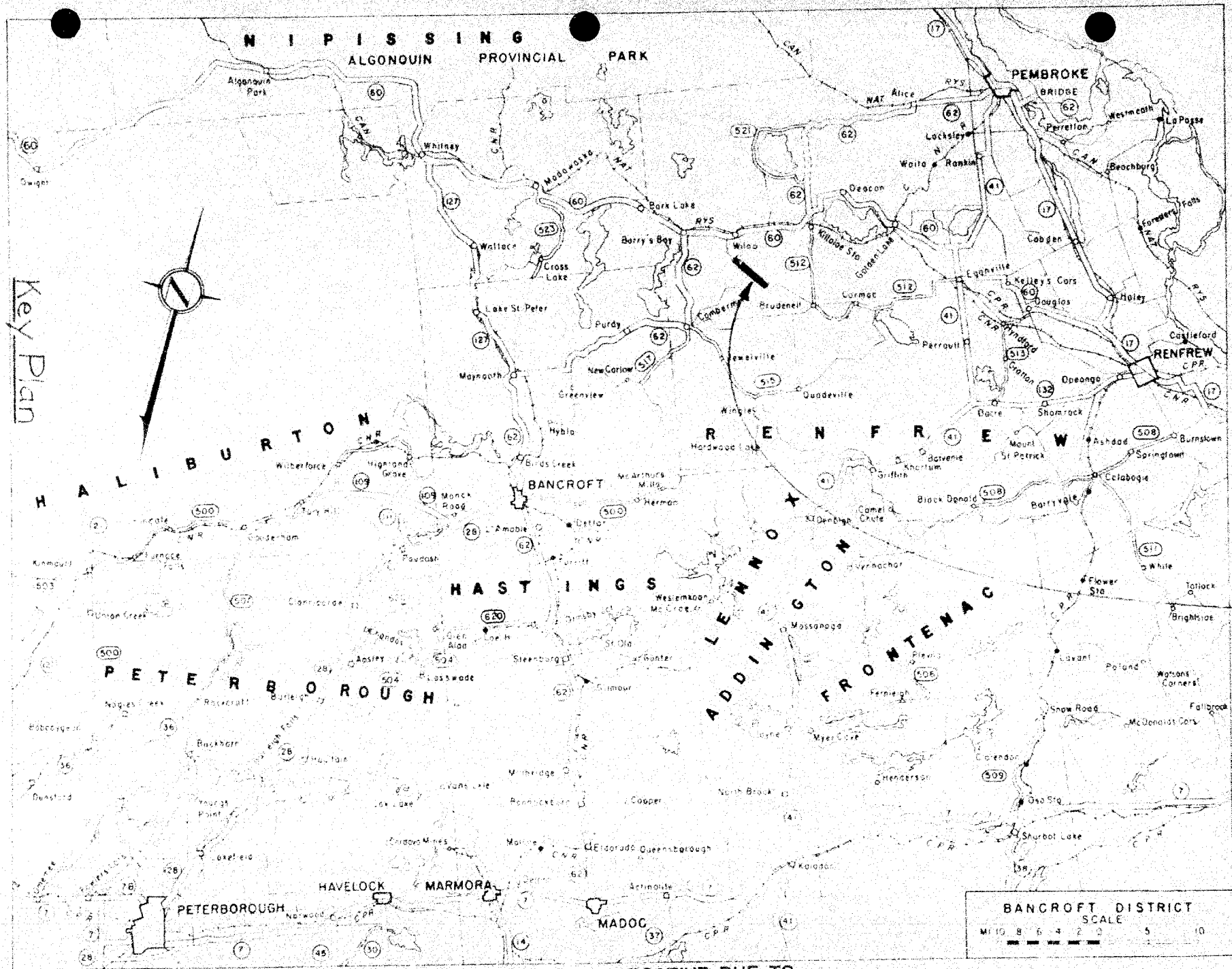
C.F. Freeman, P.Eng.,
Chief Engineer.

JFG/hf

Prepared by:

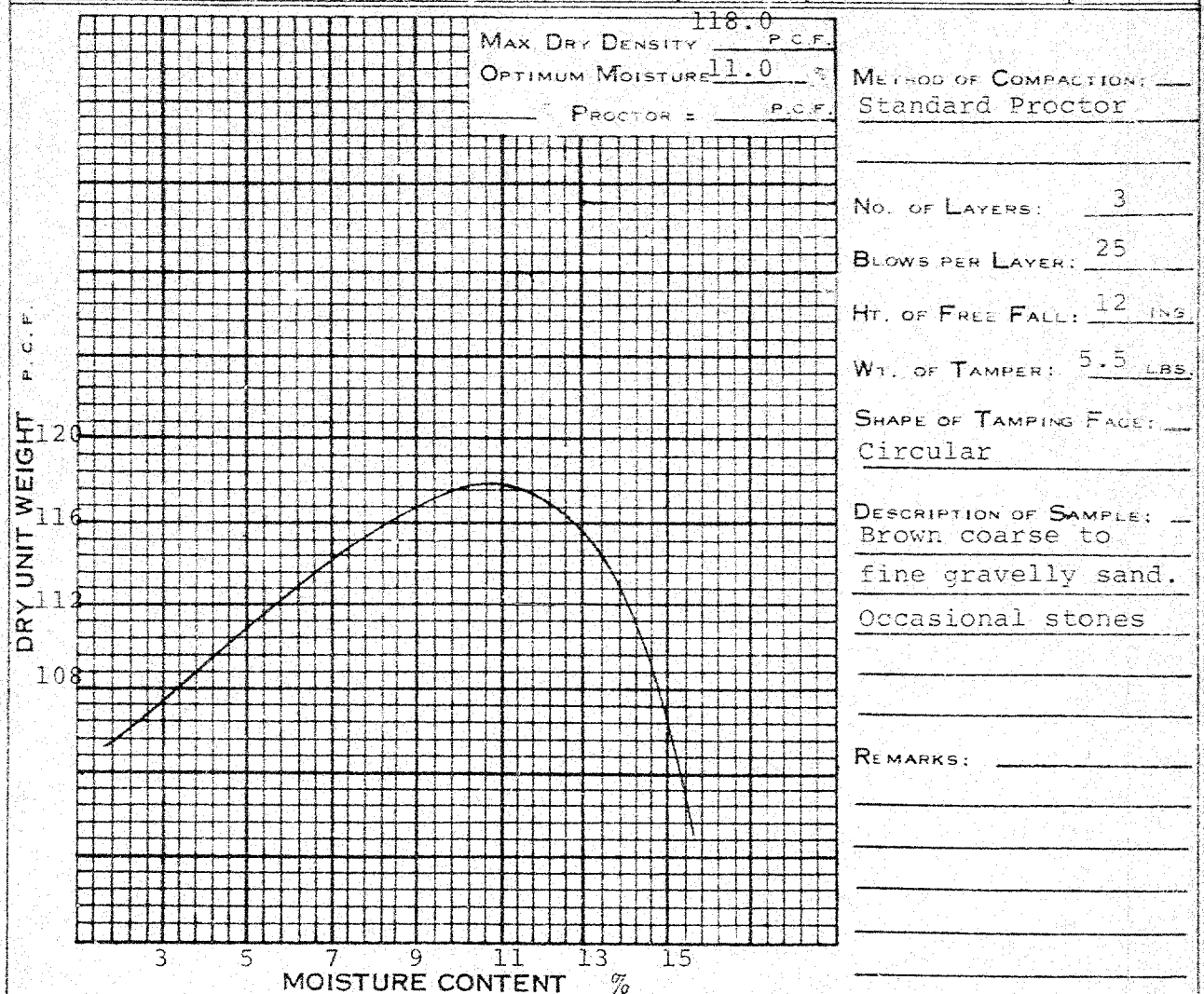


J.F. Gartner, P.Eng.



COMPACTION TEST

TRIAL NUMBER		1	2	3	4	5	6
UNIT WT. DETERMINATION	WT. SAMPLE WET & MOLD	13.56	13.66	13.78	13.88	14.02	13.78
	WT. MOLD (LBS)	9.63	9.63	9.63	9.63	9.63	9.63
	WT. SAMPLE WET	3.93	4.03	4.15	4.25	4.39	4.15
	VOLUME OF MOLD (CU. FT.)	1/30	1/30	1/30	1/30	1/30	1/30
	WET UNIT WEIGHT (P. C. F.)	117.9	120.9	124.5	127.5	131.7	124.5
	DRY UNIT WEIGHT (P. C. F.)	108.8	115.0	115.6	116.2	118.0	108.5
MOISTURE CONTENT	TIN No.	10	18	27	34	43	11
	WT. SAMPLE WET & TIN	197.5	190.0	195.5	196.5	199.0	238.0
	WT. SAMPLE DRY & TIN	191.8	182.7	184.3	182.3	182.4	212.3
	WT. WATER (GMS)	5.7	7.3	11.2	14.2	16.6	25.7
	WT. TIN EMPTY	34.3	36.0	37.5	37.0	36.8	36.9
	WT. DRY SOIL	157.5	146.7	146.8	145.3	145.6	175.4
MOISTURE CONTENT %		3.6	5.0	7.7	9.8	11.4	14.7

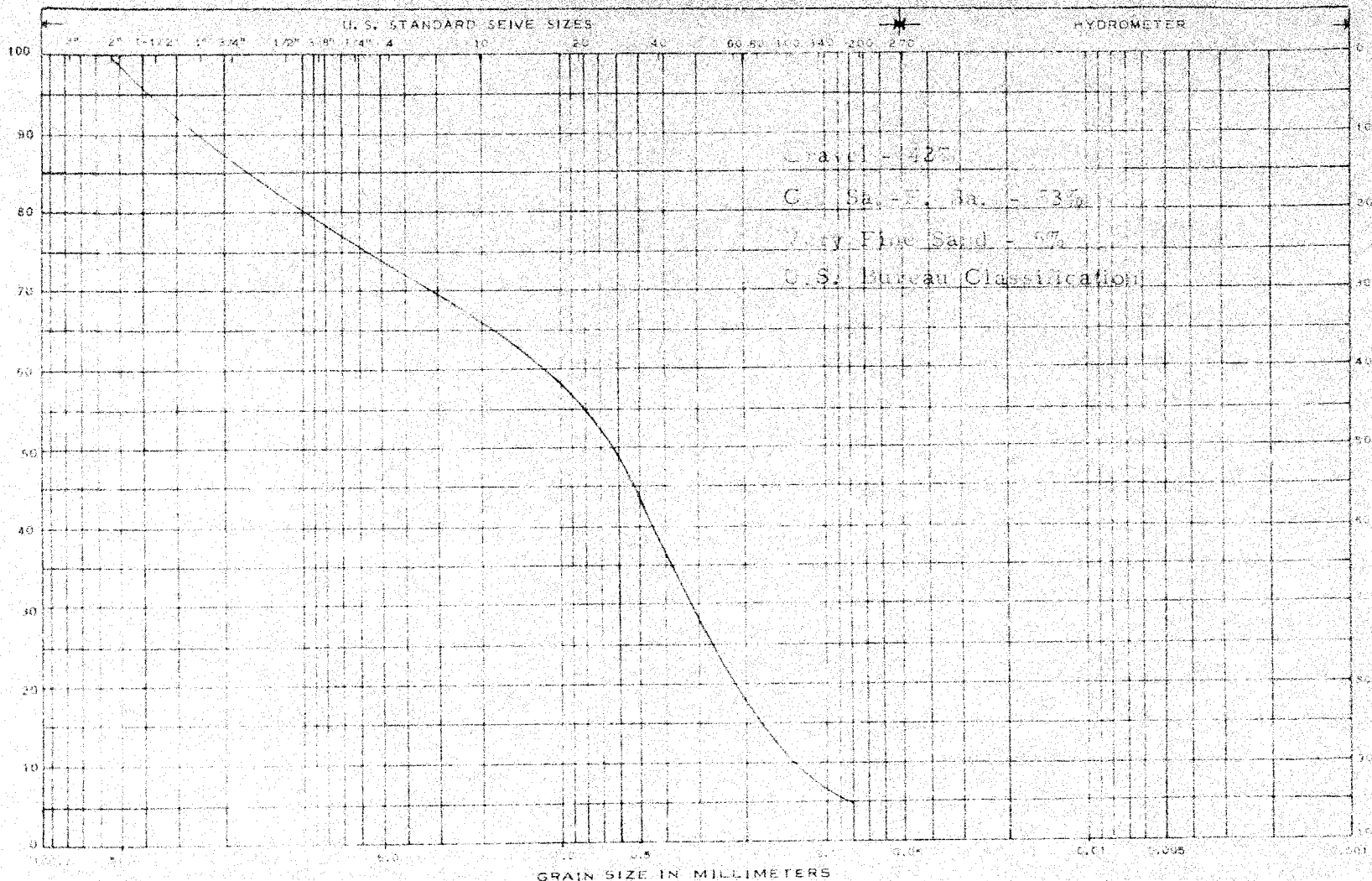


SOIL TESTING LABORATORY
e. m. peto associates ltd.
TORONTO, ONTARIO

JOB NAME 65315
JOB No. CH 63+20
SAMPLE 0'-10"
TECHNICIAN V.T.
DATE 17/12/65

e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

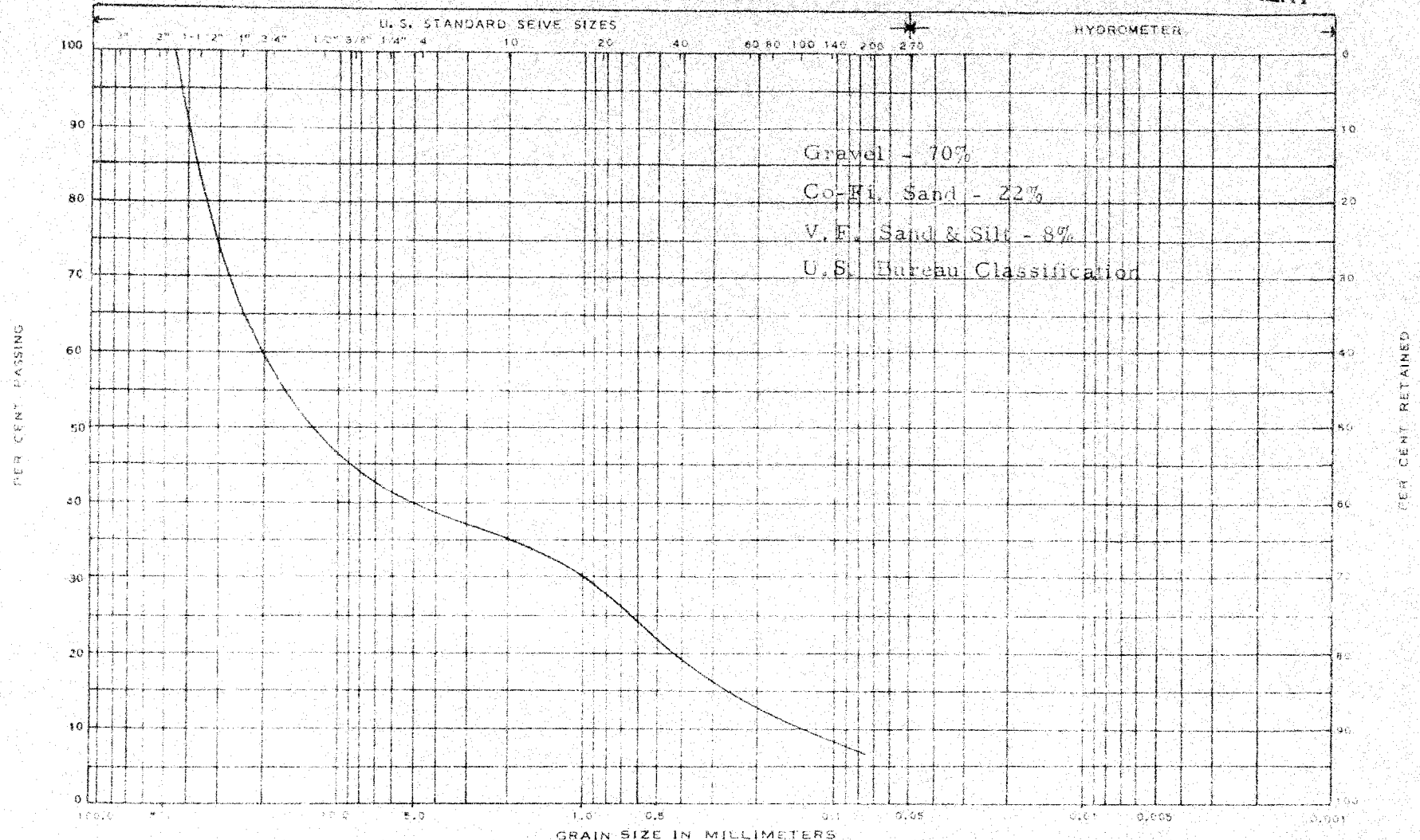
JOB NAME D.H.C. Killaloe JOB NO. 3315 HOLE NO. 3 + 00 SAMPLE NO. _____

DEPTH 3'-4' ELEVATION _____ REMARKS SAND CUSHION M/C 17%

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

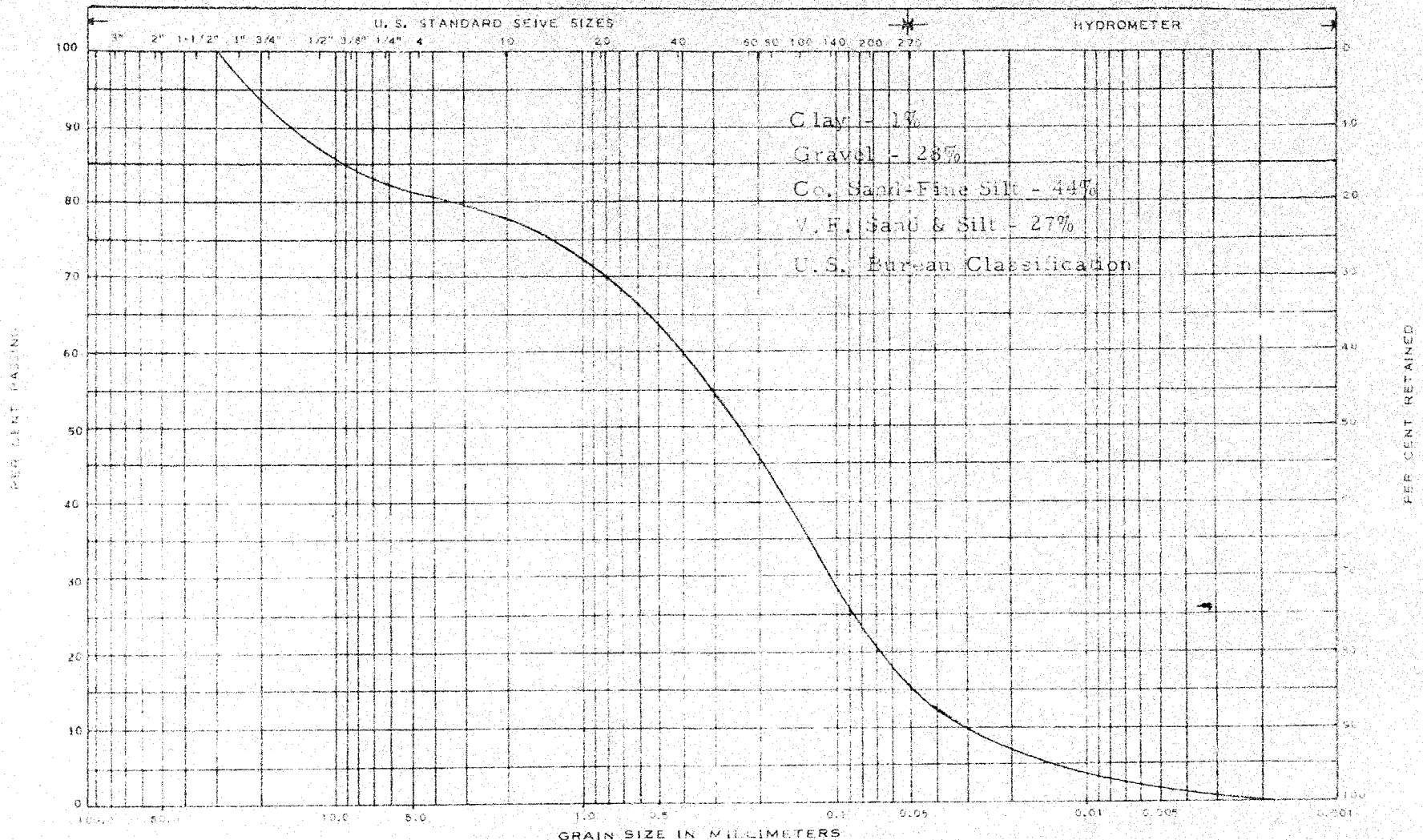
JOB NAME D.H.C. Killaloe JOB NO. 65315 HOLE NO. 7 + 20 SAMPLE NO. _____
 DEPTH 1'-3' ELEVATION _____ REMARKS SAND CUSHION M/C 9%

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STANDARD	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
----------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

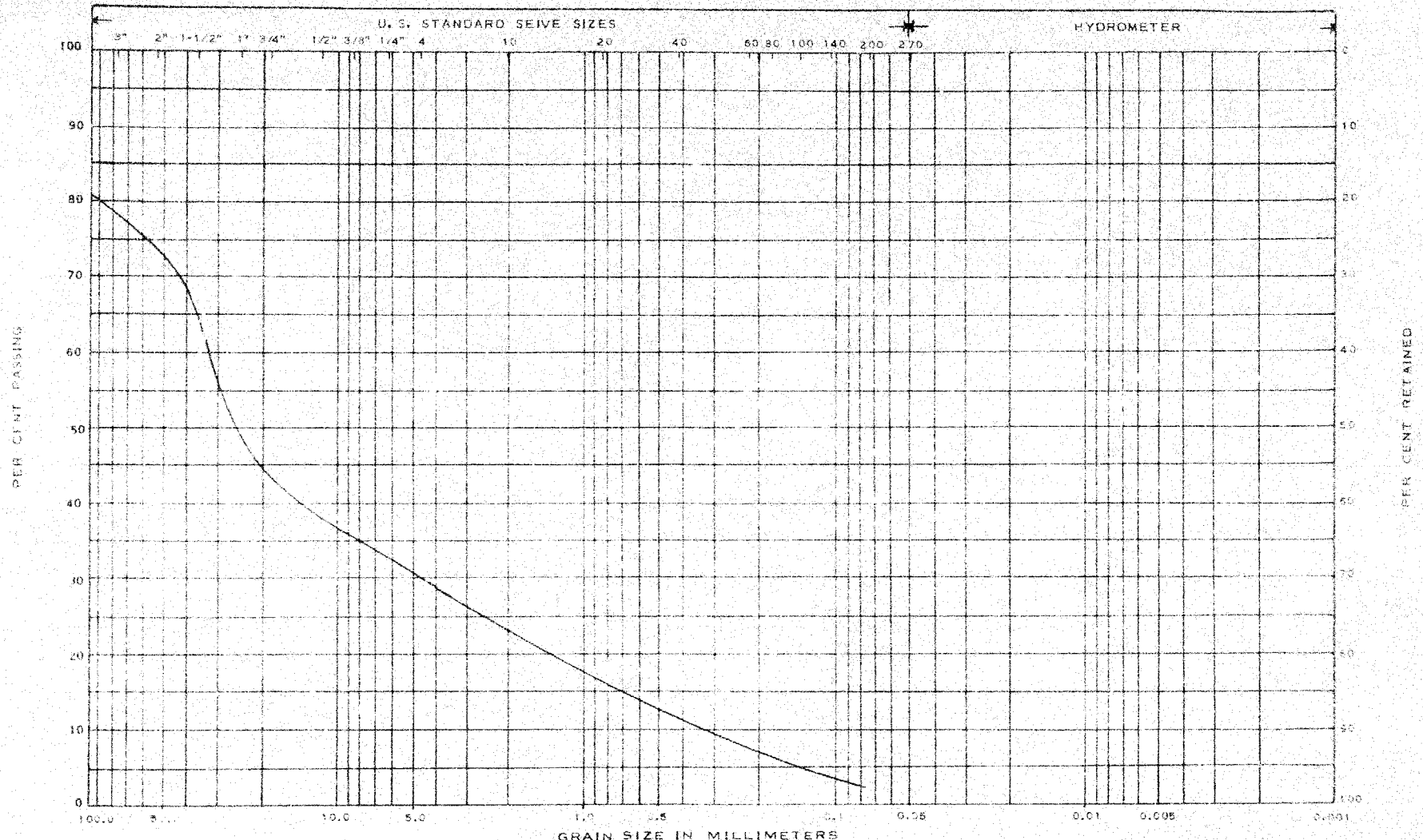
JOB NAME D.H.O. Killaloe JOB NO. 55315 HOLE NO. 14+00 SAMPLE NO. _____
 DEPTH _____ ELEVATION _____ REMARKS BOULDERY FINE TO MEDIUM SAND M/C 7%

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

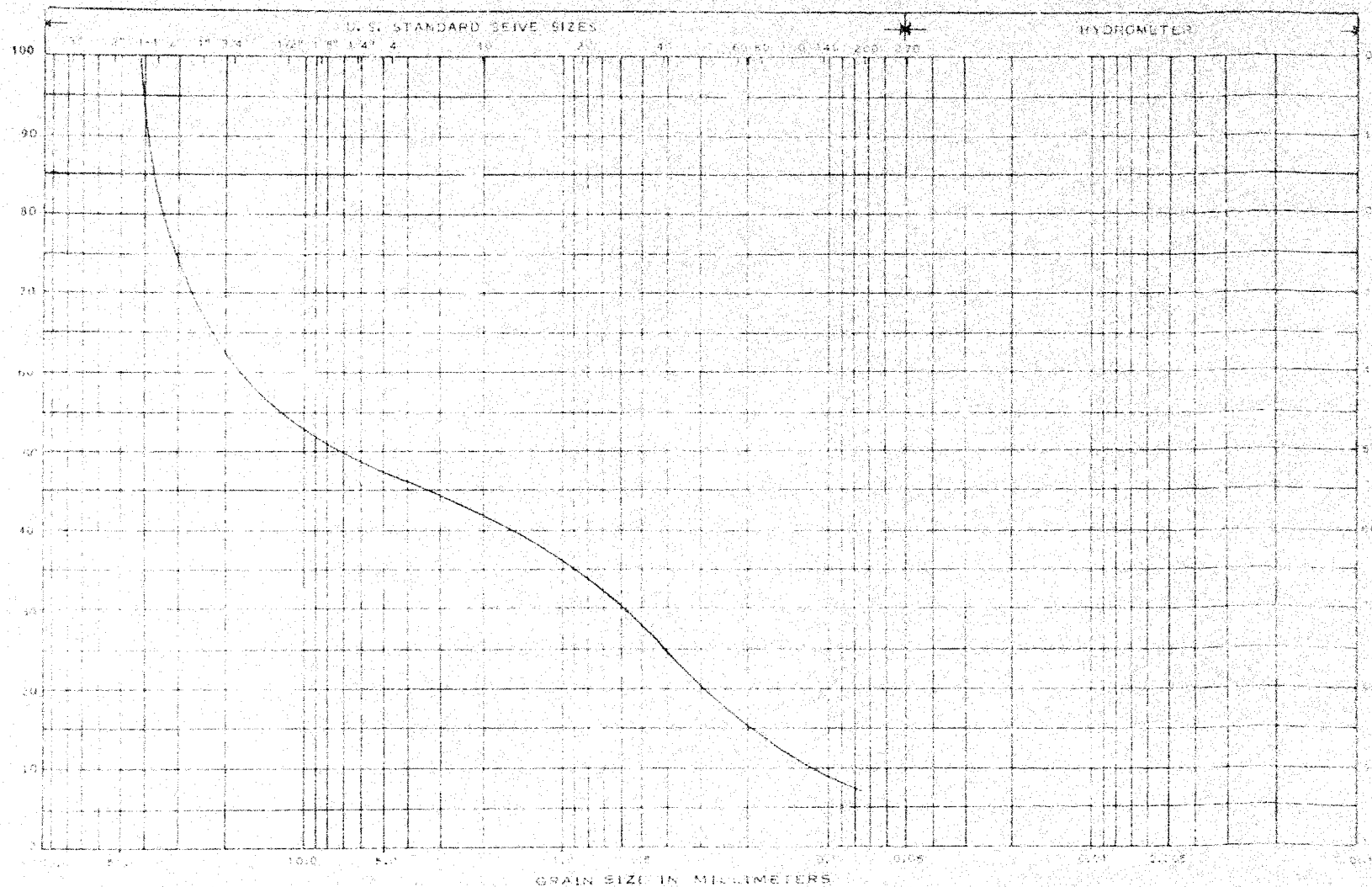
MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D. H. O. Killaloe JOB NO. 65315 HOLE NO. 44 + 00 SAMPLE NO. 2
 DEPTH 7'-10' ELEVATION _____ REMARKS SAND CUSHION

GRAIN SIZE DISTRIBUTION

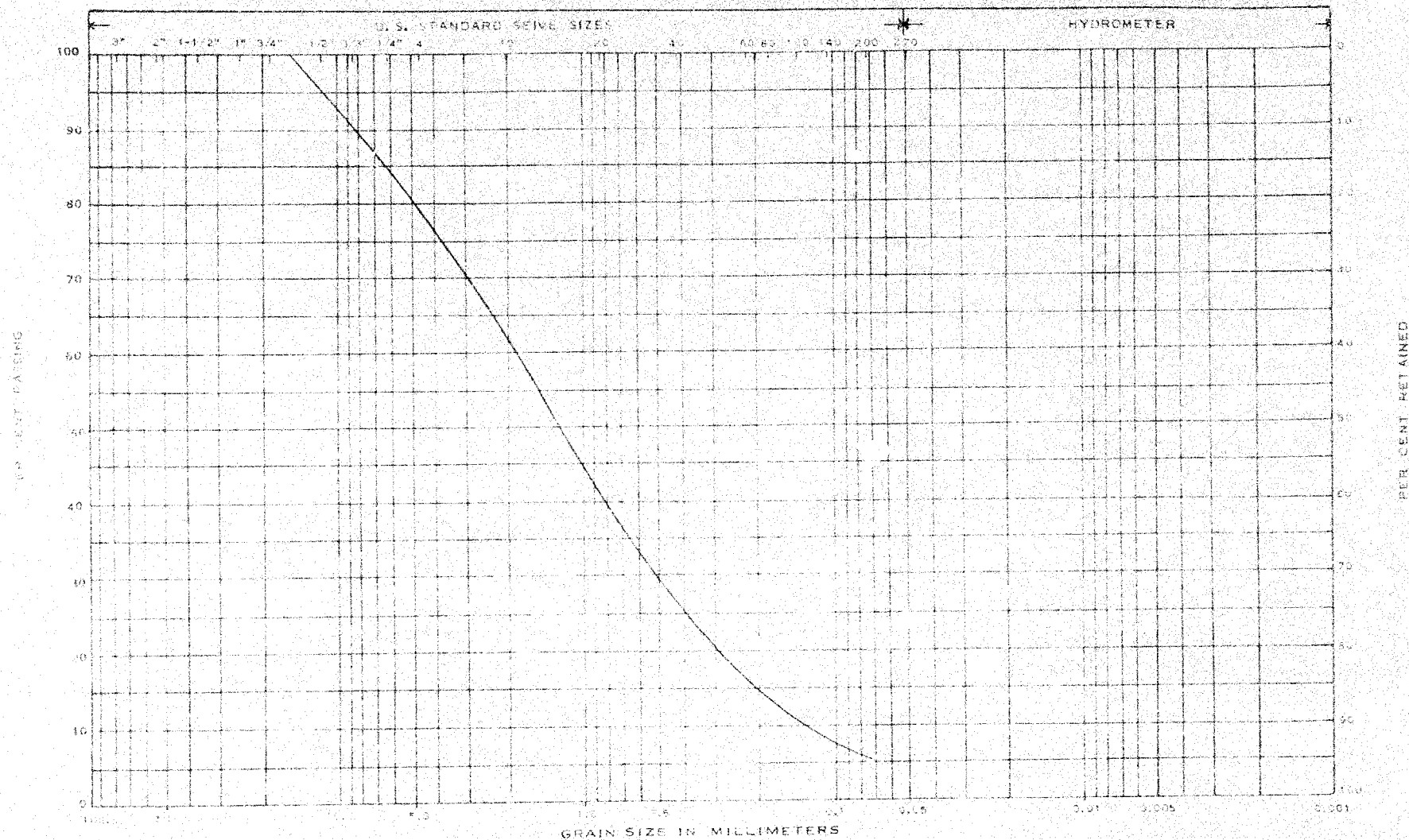
e. m. peto associates ltd.

Toronto 19, Ontario



e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	-------------	-----------	-----------	-------------	-----------	-----------	------

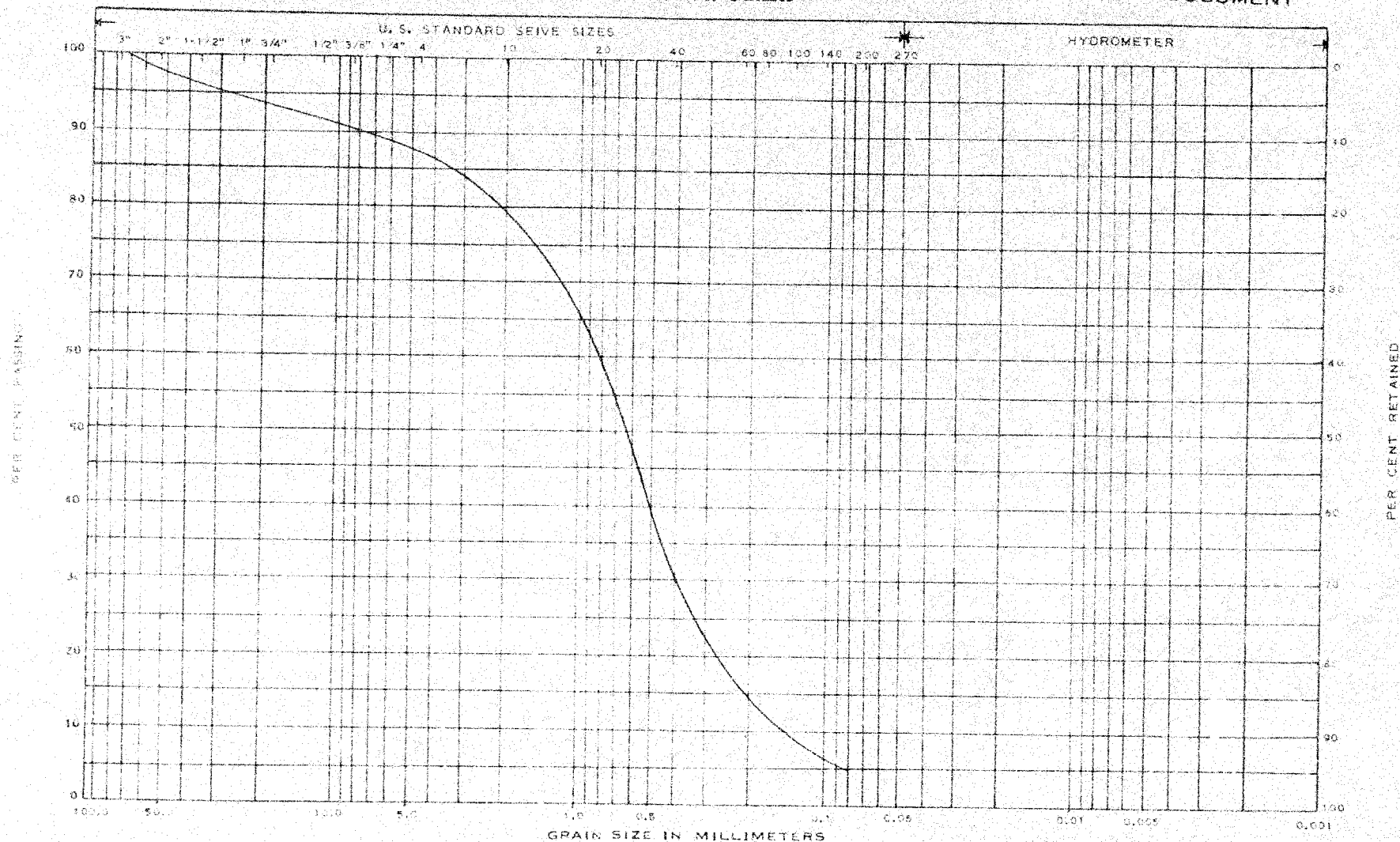
MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D. H. O. Killaloe JOB NO. 55315 HOLE NO. 52 + 00 SAMPLE NO. _____
 DEPTH 4'-5' ELEVATION _____ REMARKS SAND CUSHION M/C 5%

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

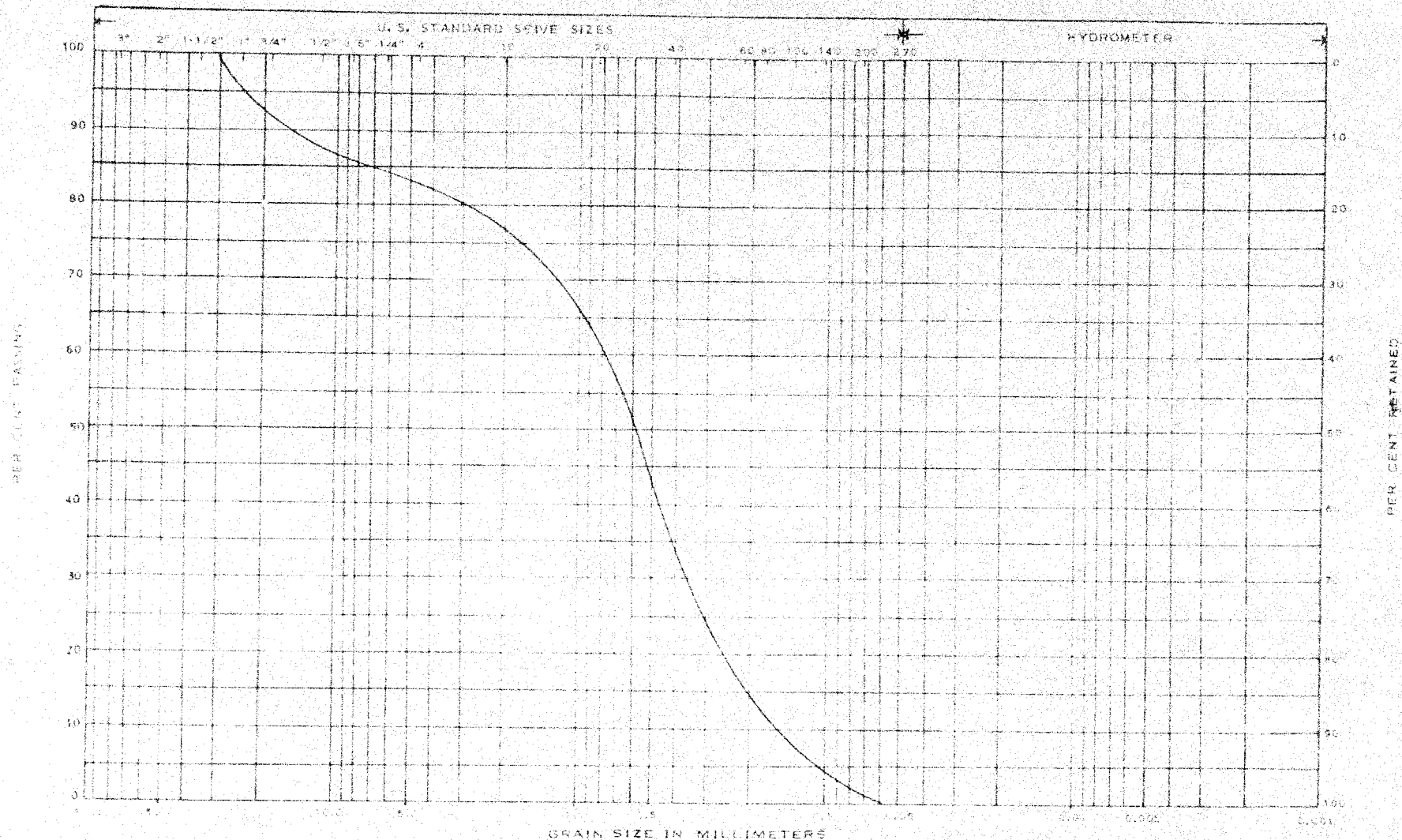
MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D.H.O. Killaloe JOB NO. 05315 HOLE NO. 63 + 20 SAMPLE NO. _____
 DEPTH 0' - 10' ELEVATION _____ REMARKS SAND CUSHION

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	-------------	-----------	-----------	-------------	-----------	-----------	------

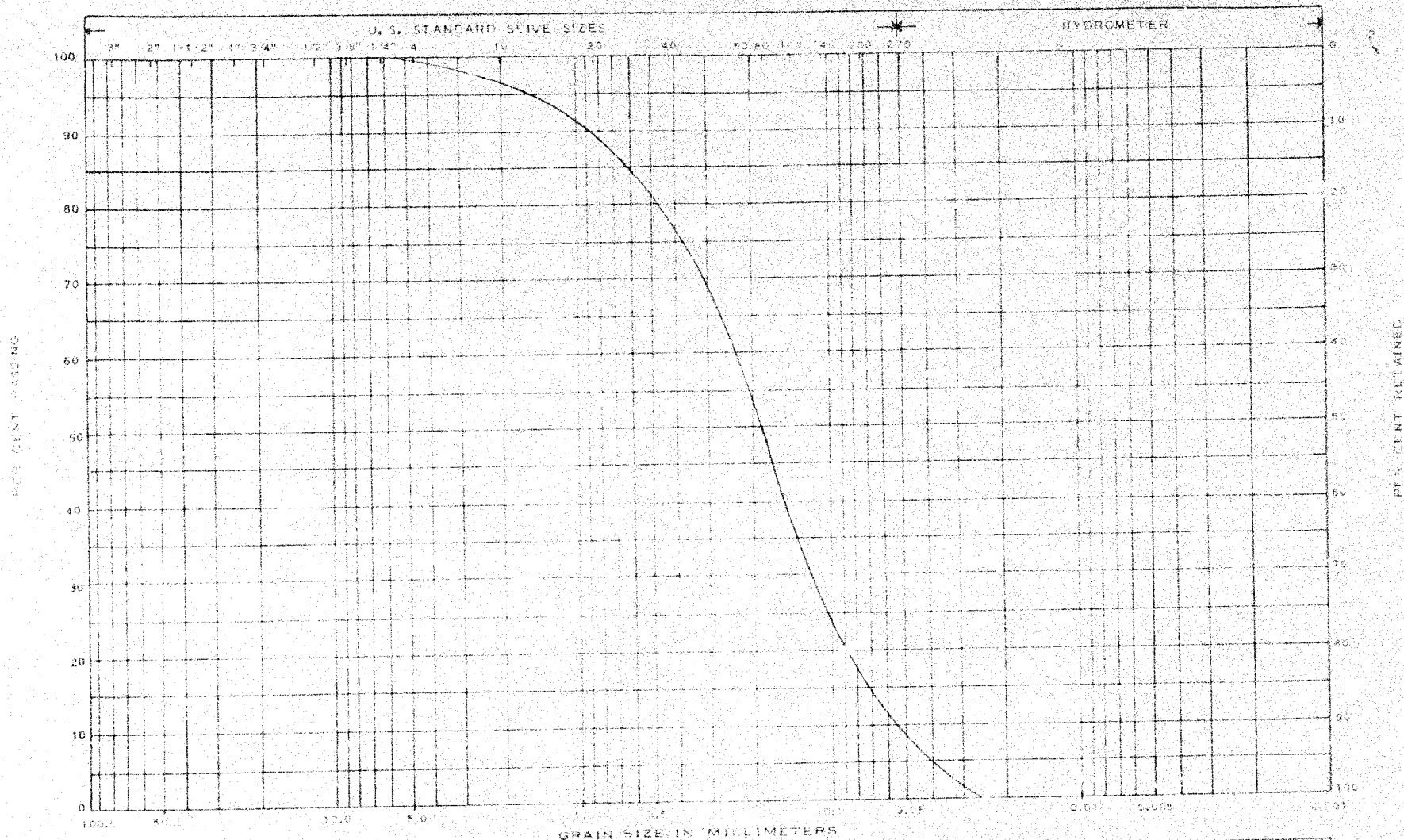
MASS INST. OF TECH. CLASSIFICATION

JOB NAME D. H. O. Killaloe JOB NO. 6315 HOLE NO. 63-20 SAMPLE NO. _____
DEPTH 0' - 10' ELEVATION _____ REMARKS SAND CUSHION - Somewhat lacking in fines

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D.H.O. Killaloe JOB NO. 313 HOLE NO. 122 + 00 SAMPLE NO. _____

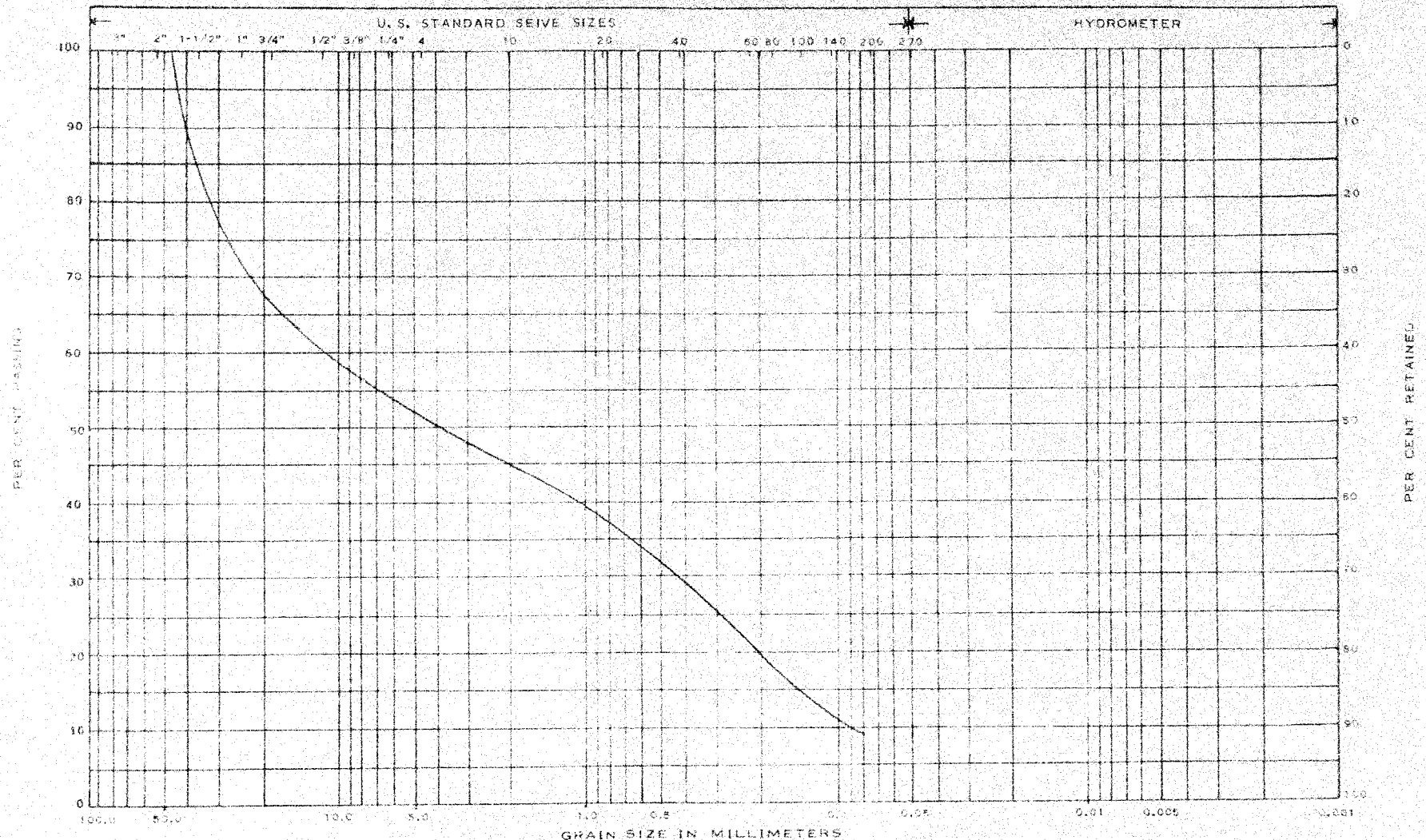
DEPTH 0'-5' ELEVATION _____ REMARKS Grading falls just outside SAND CUSHION ENVELOPE 11/C 57

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

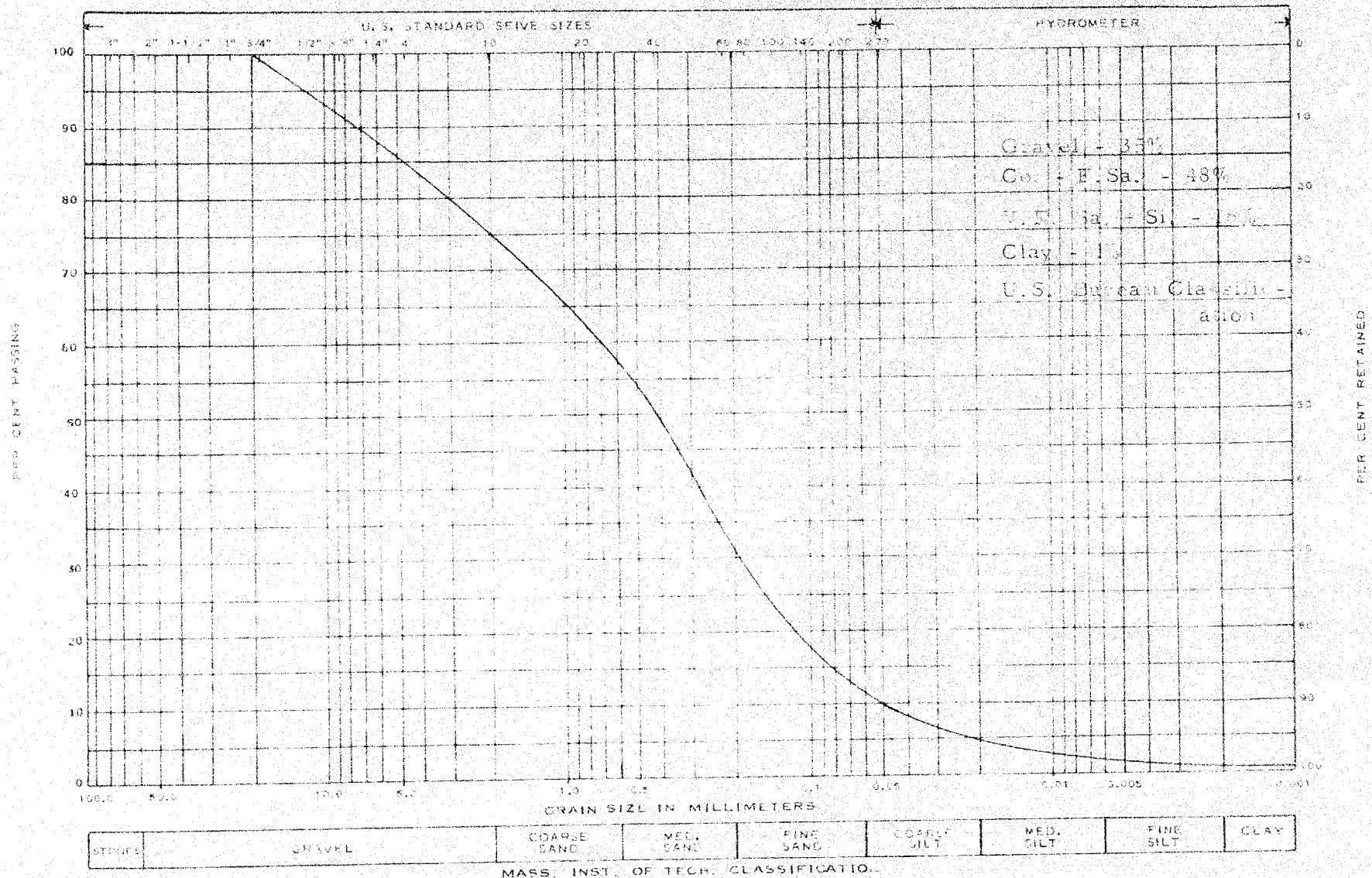
MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D.H.O. Killaloe JOB NO. 65315 HOLE NO. 125 + 00 SAMPLE NO. _____
 DEPTH 3'-4' ELEVATION _____ REMARKS SAND CUSHION M/C 6%

GRAIN SIZE DISTRIBUTION

e. m. pelo associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



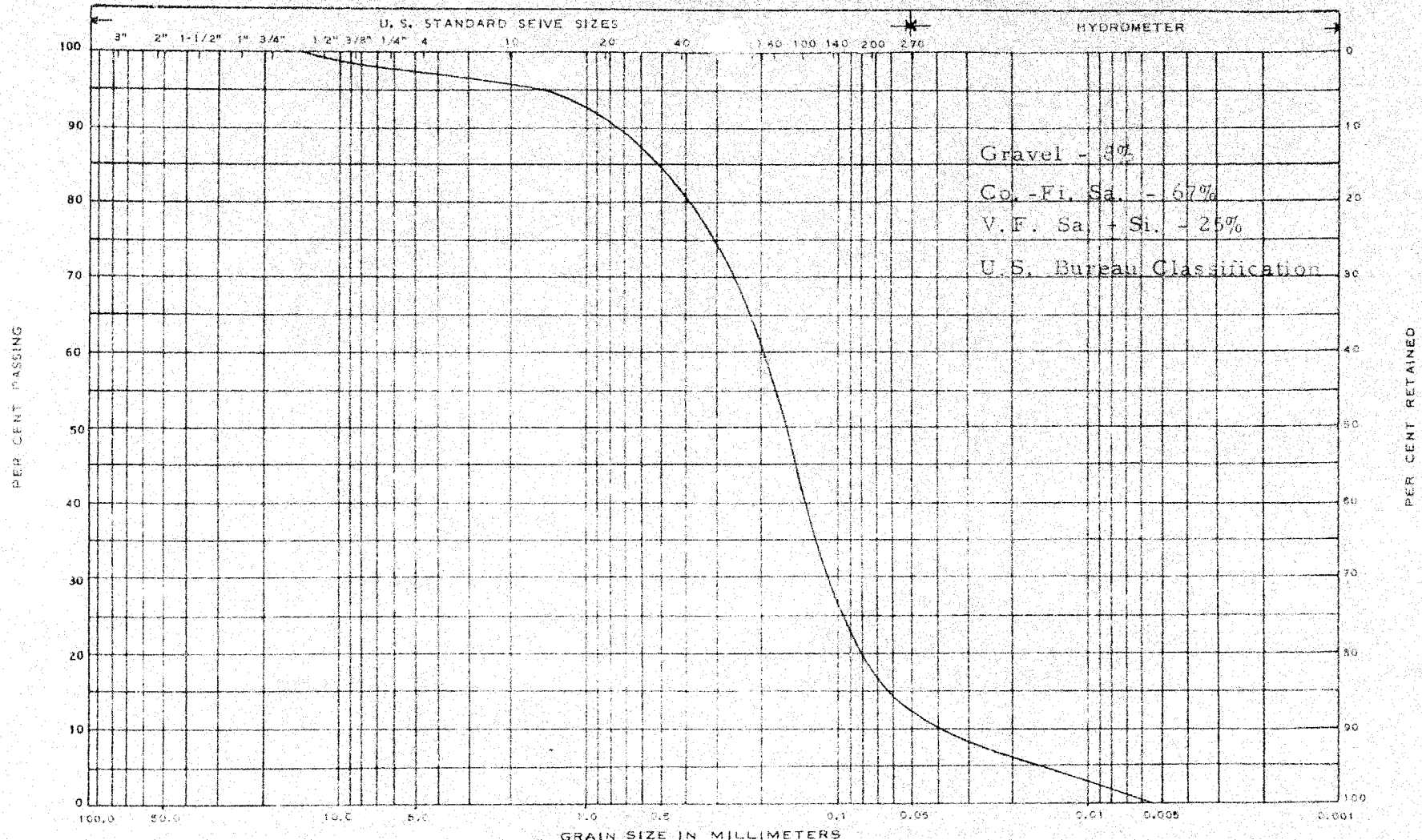
JOB NAME D.H.C. Killaloe JOB NO. 55315 HOLE NO. 130 + 00 SAMPLE NO. _____

DEPTH 5'-7' ELEVATION _____ REMARKS Gravelly Medium to Fine SAND M/C 9%

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

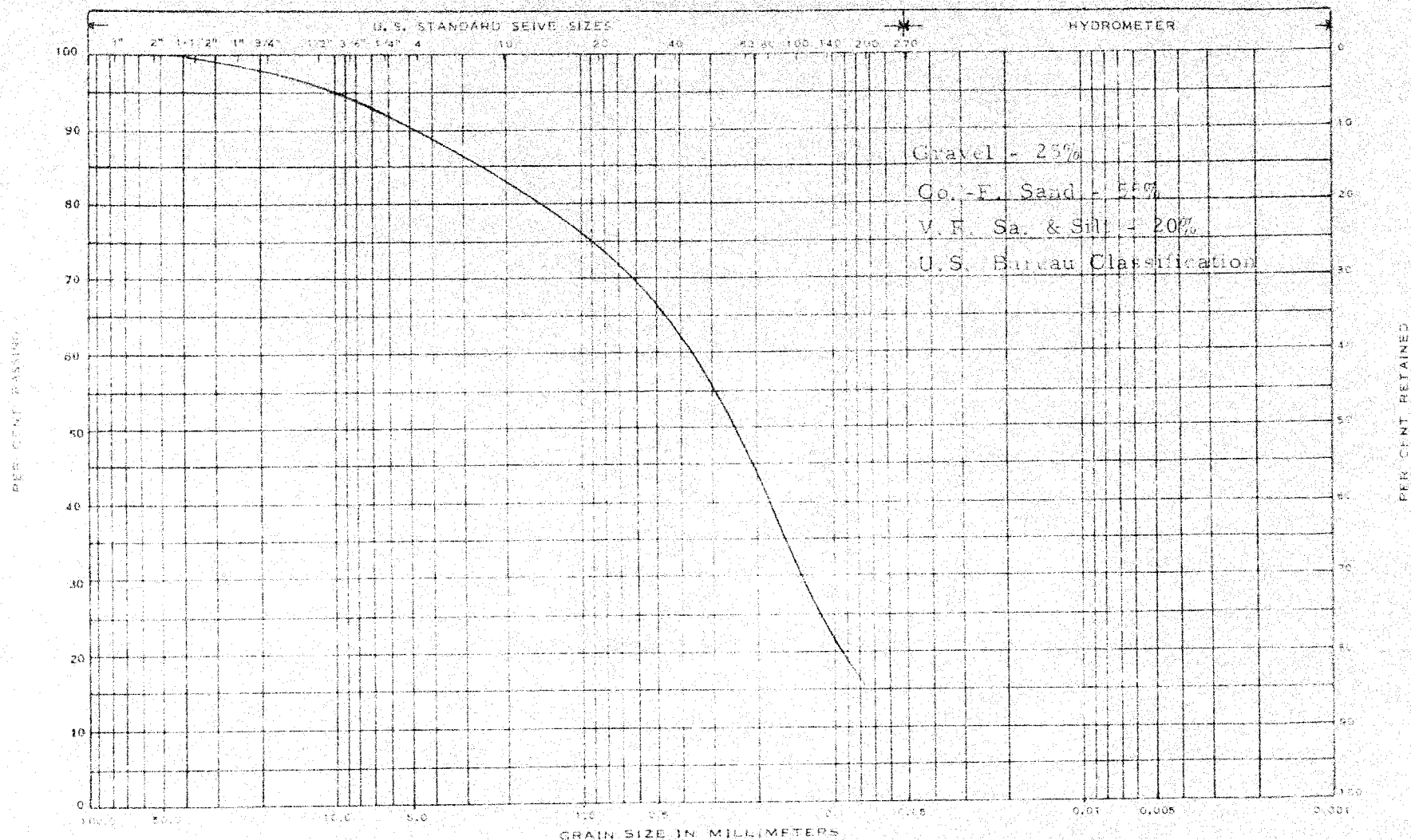
MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D. H. O. Killaloe JOB NO. 65315 HOLE NO. 141 + 00 SAMPLE NO. 2
 DEPTH 4'-20' ELEVATION _____ REMARKS Fine to Medium SAND

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.
Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D.H.C. Killaloe JOB NO. 6835 HOLE NO. 141 + 00 SAMPLE NO. _____

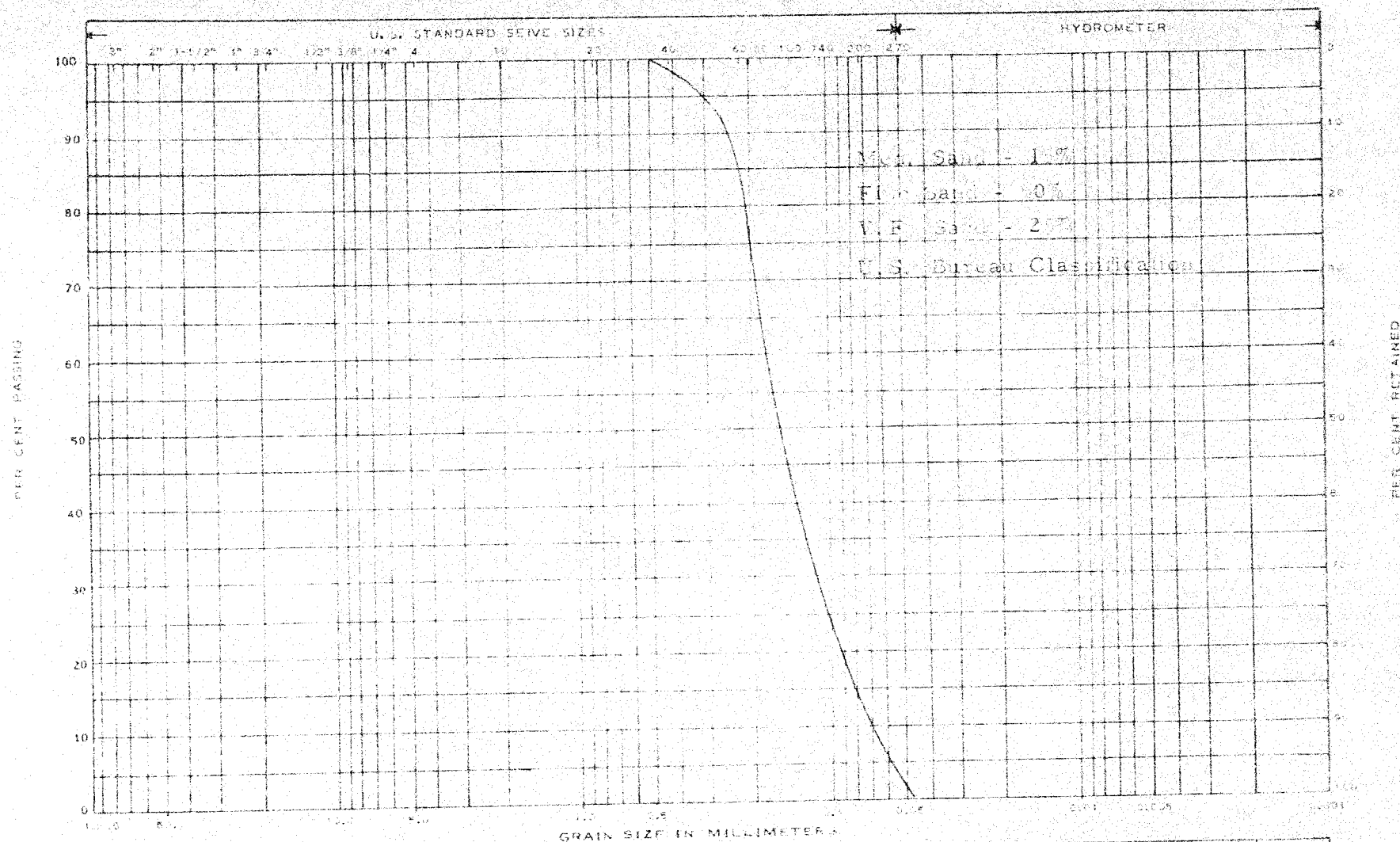
DEPTH 1'-3' 11" ELEVATION _____ REMARKS Grading Falls just outside SAND CUSHION ENVELOPE

GRAIN SIZE DISTRIBUTION

FINE TO MEDIUM SAND

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

Toronto 19, Ontario



GRAIN SIZE IN MILLIMETERS								
GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY	
100	60	40	20	10	5	2	0.075	

MASS INST OF TECH. CLASSIFICATION

JOB NAME D. O. Killaloe JOB NO. 1315 HOLE NO. 143 + 00 SAMPLE NO. _____

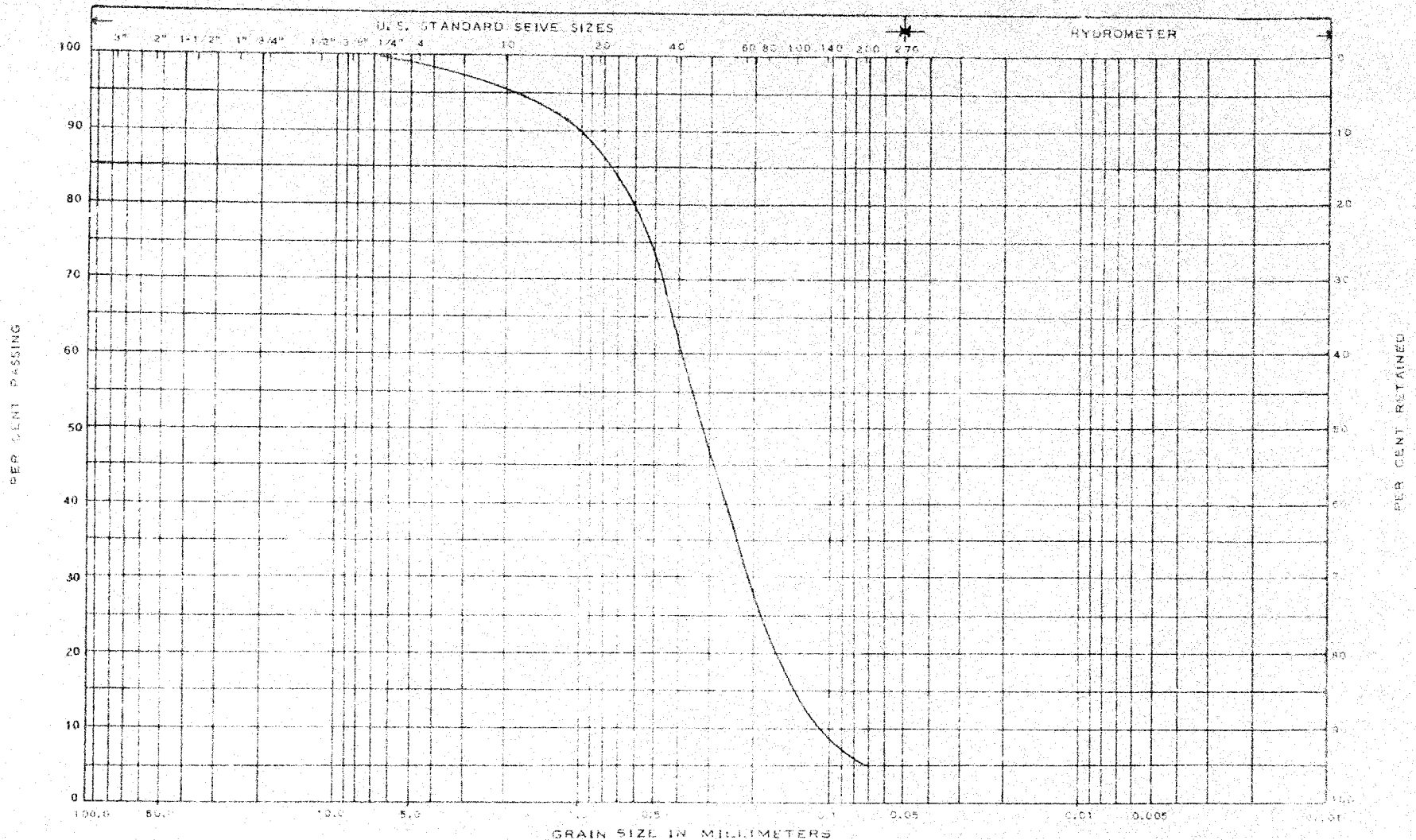
NAME _____
DEPTH 1' - 1" ELEVATION _____ REMARKS FINE TO VERY FINE SAND M/C 10%

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

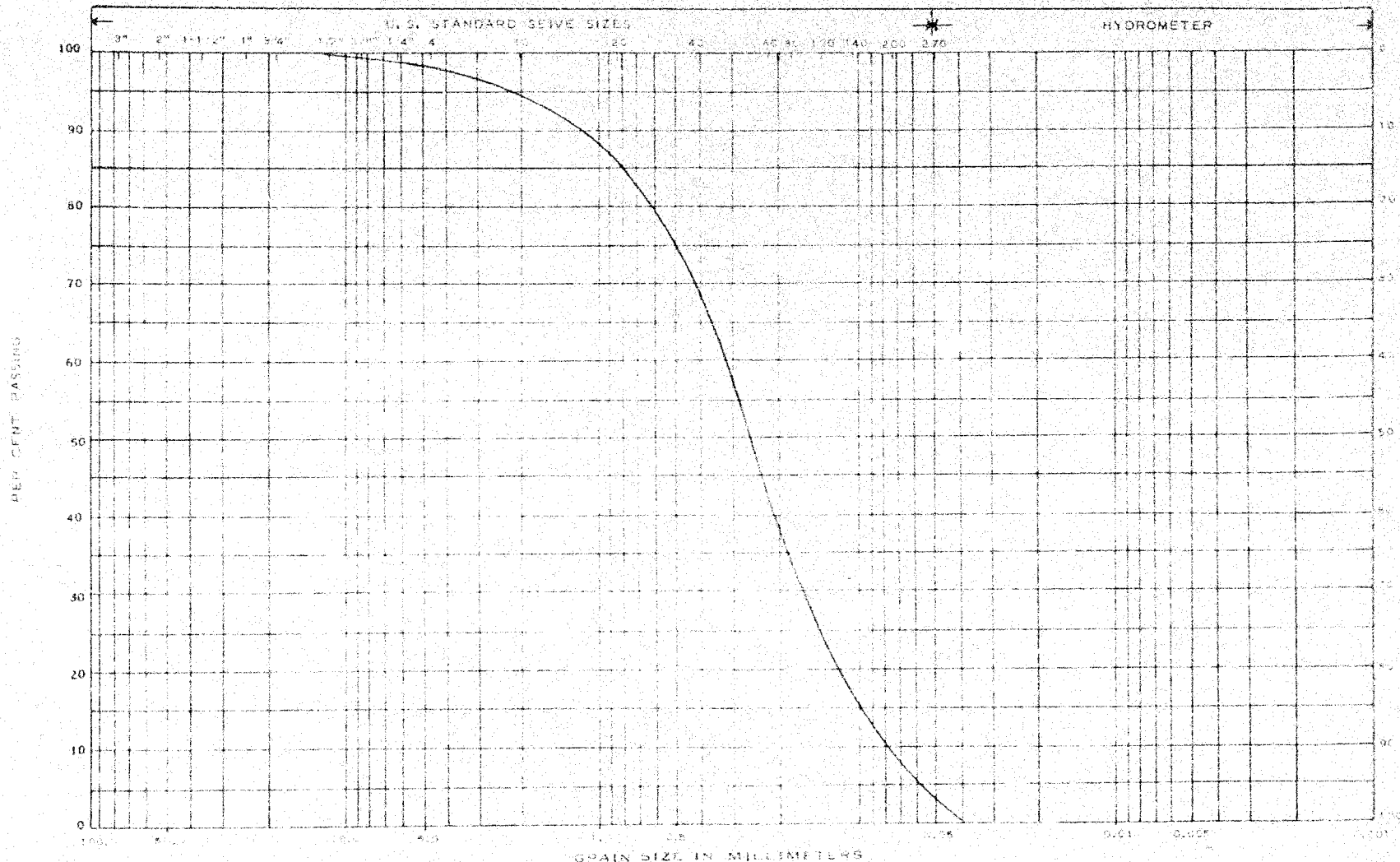
MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D.H.O. Killaloe JOB NO. 15315 HOLE NO. 145 + 00 SAMPLE NO.
 DEPTH 3' - 4' ELEVATION REMARKS SAND CUSHION M/C 3%

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

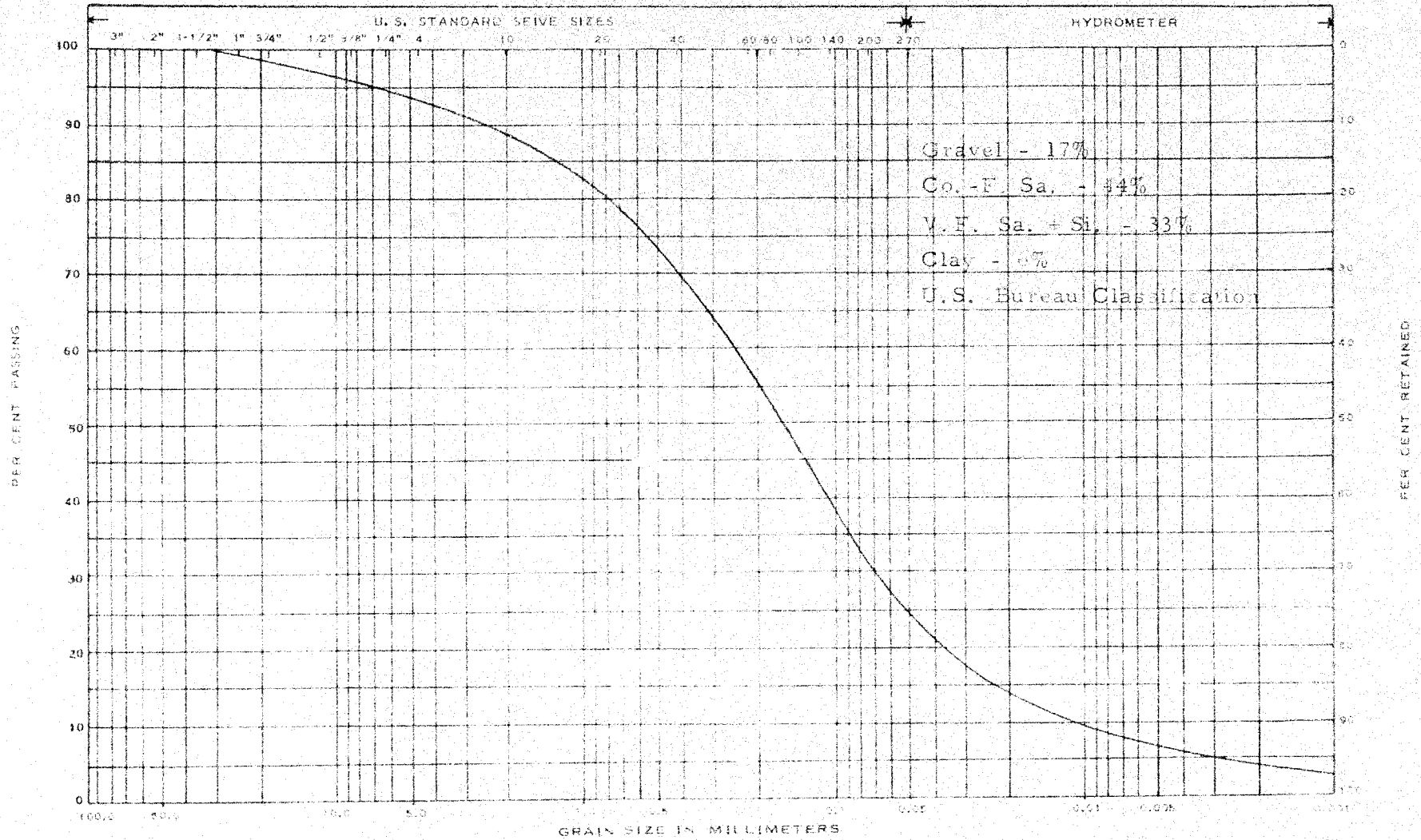
JOB NAME D. H. O. Killaloe JOB NO. 65315 HOLE NO. 14 + 00 SAMPLE NO. 2
 DEPTH ELEVATION REMARKS SAND CUSHION 11.0 4%

GRAIN SIZE DISTRIBUTION

DEFECTS IN NEGATIVE DUE TO
 CONDITION OF ORIGINAL DOCUMENT

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

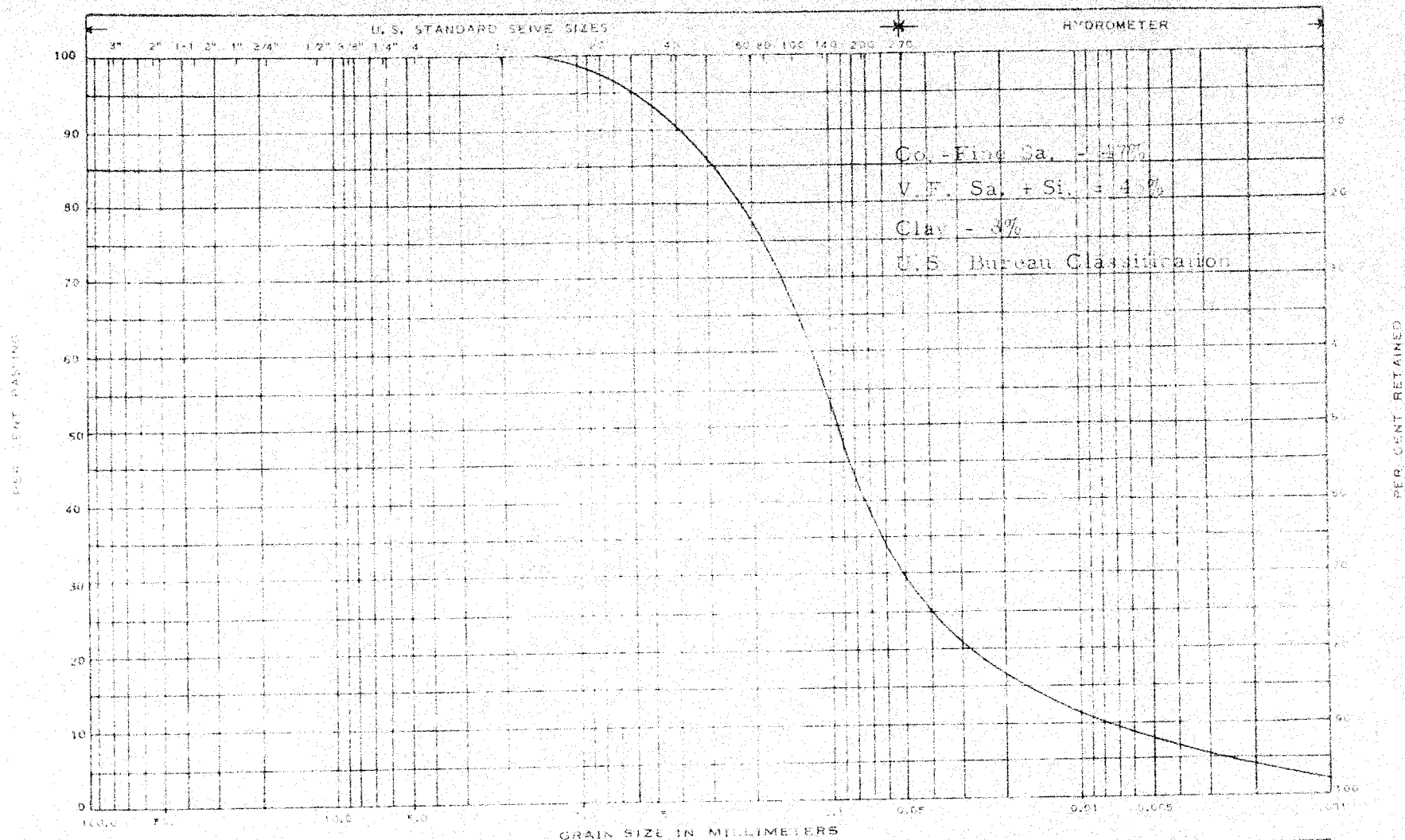
JOB NAME D.H.O. Killaloe JOE NO. 85315 HOLE NO. 158 + 00 SAMPLE NO. _____

DEPTH 4' - 5' ELEVATION _____ REMARKS GRAVELLY SAND LOAM M/C 12%

GRAIN SIZE DISTRIBUTION

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

e. m. peto associates ltd.
Toronto 19, Ontario



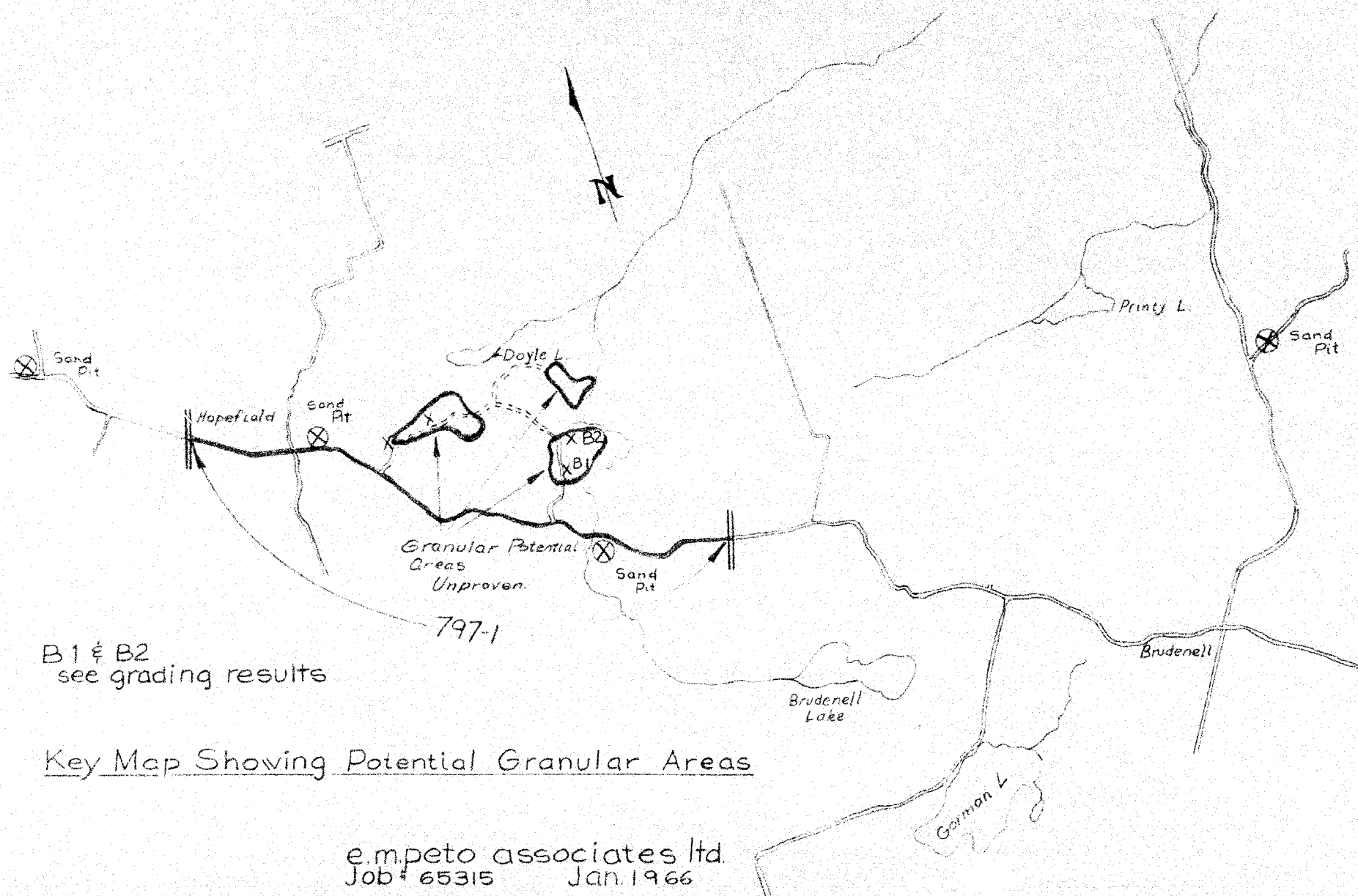
STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME D.H.C. Killaloe JOB NO. 5315 HOLE NO. 173 + 00 SAMPLE NO. _____

DEPTH 5'-7" ELEVATION _____ REMARKS SAND LOAN M/C 12%

GRAIN SIZE DISTRIBUTION



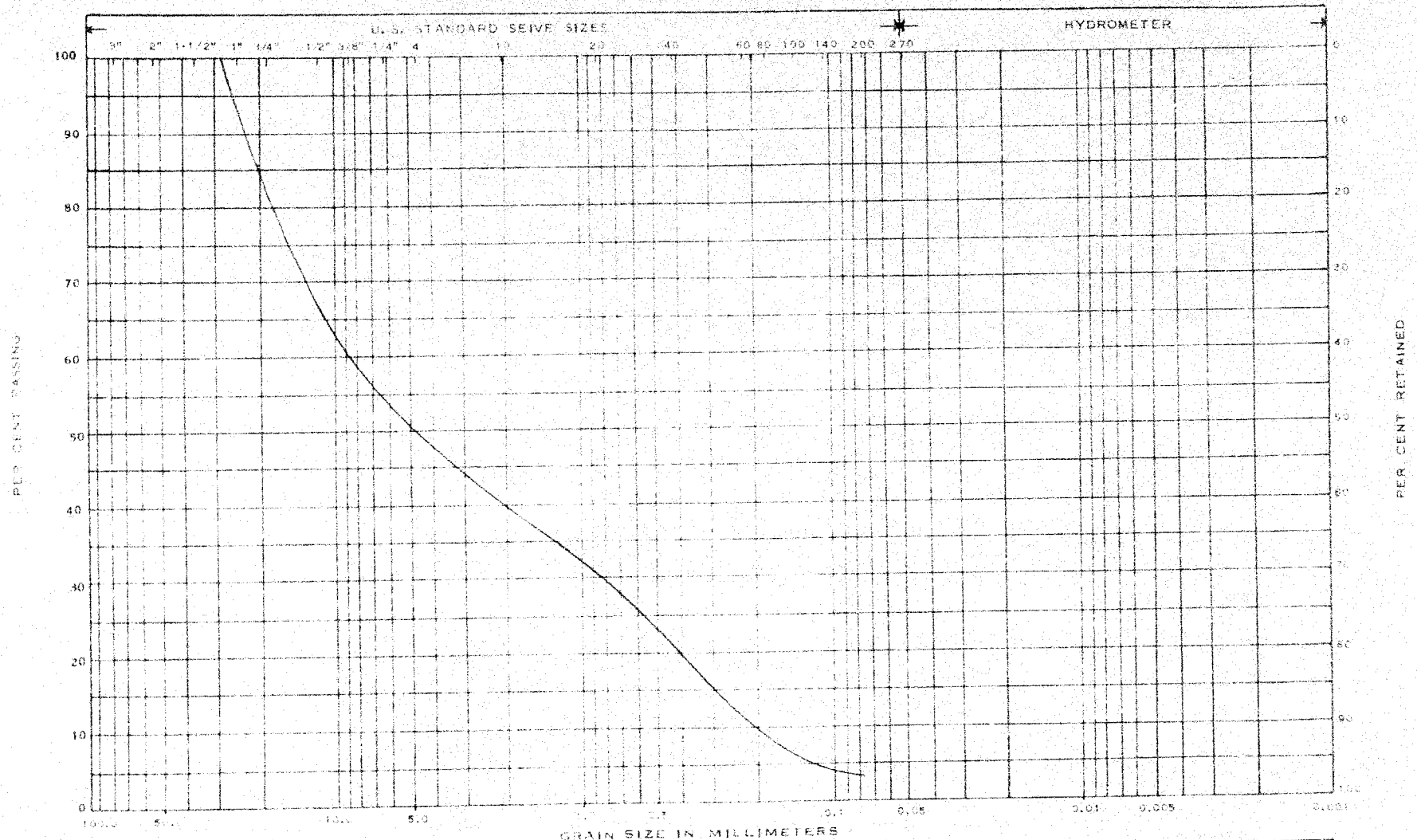
B1 & B2
see grading results

Key Map Showing Potential Granular Areas

e.m.peto associates ltd
Job # 65315 Jan. 1966
Dev. Rd 797-1

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

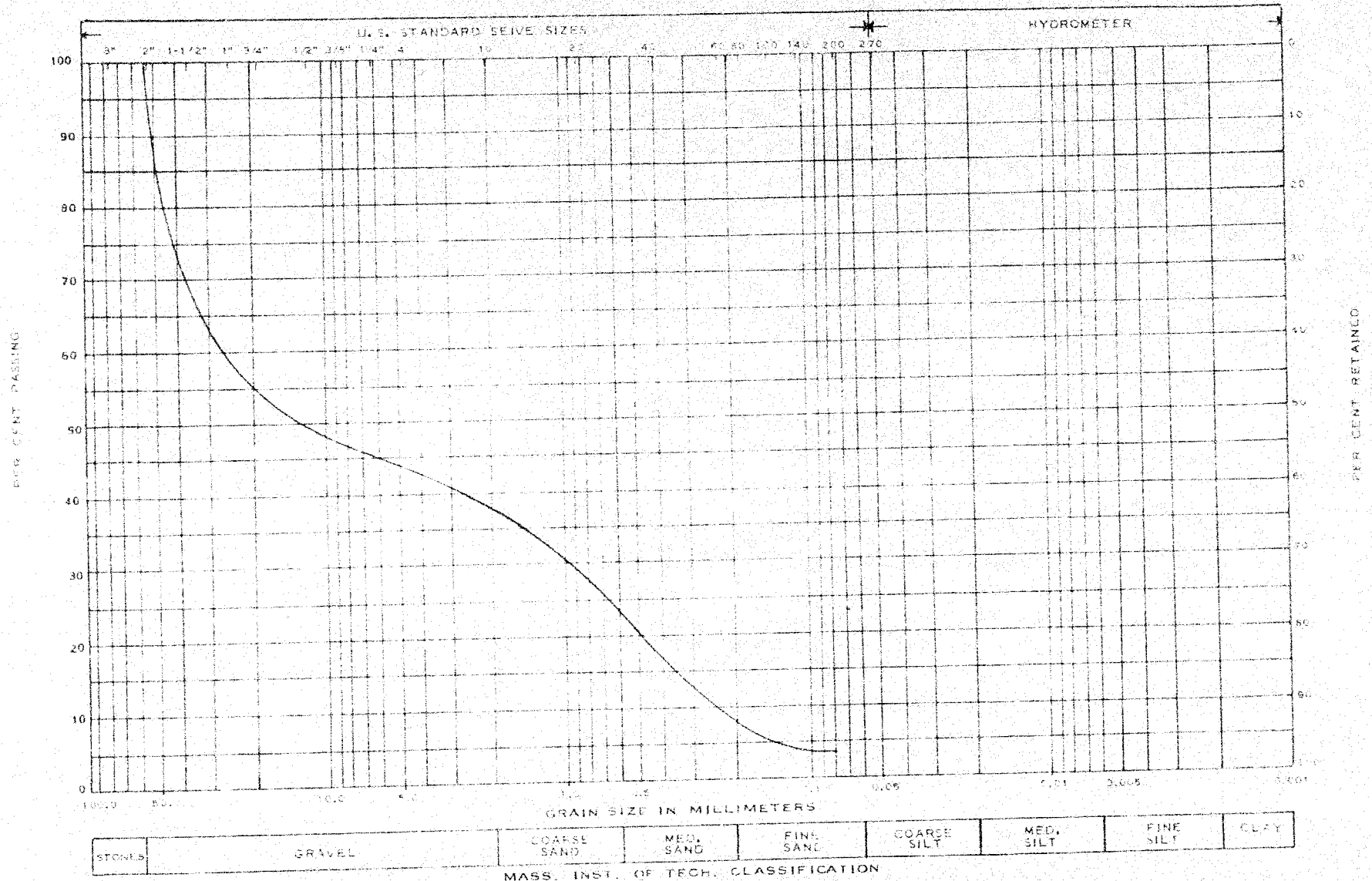
JOB NAME D.H.O. Billaloe JOB NO. 15315 HOLE NO. B-1 SAMPLE NO. _____

DEPTH _____ ELEVATION _____ REMARKS SAND CUSHION QUALITY

GRAIN SIZE DISTRIBUTION

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

e. m. peto associates ltd.
Toronto 19, Ontario



SEISMIC INVESTIGATION
DEVELOPMENT ROAD PE 797-1

SUMMARY

The surveyed area is located on the Development Road PE 797-1, in the Township of Brudenell, in the County of Renfrew.

The main purpose of the seismic investigation was to determine the depth to bedrock within the survey area. The geophysical seismic technique enabled us to fulfill this purpose on the above mentioned project.

INTRODUCTION

To improve the horizontal alignment of the Development Road the centreline is to be shifted away from the existing roadway at two locations.

At two proposed cuts, it was impossible to determine the depth to bedrock using hand or power auger equipment, because of high percentage of boulders at or near the surface. These cuts were located as noted below:

Station 89+00 to Station 96+00

Station 116+00 to Station 120+00

Therefore, at the request of Mr. J. Gruspier, Regional Materials Engineer, Kingston, a seismic survey of the above mentioned cuts was undertaken between November 30th and December 2nd, 1965.

TEST PROCEDURE

A model facsimile seismograph FS-2 with two channels was used to measure the velocity of the sound waves in this investigation.

Seismic depth determinations were made at 100-foot intervals along centreline. By measuring the velocity of shock waves in both directions at each 100-foot interval it was possible to obtain a continuous profile of the bedrock where encountered.

This survey involved the investigation of two cut sections to determine:

- 1) The characteristics of overburden through analyzing the velocities.
- 2) The investigation of the bedrock beneath the overburden.

PHYSIOGRAPHY

The project is located northeast of Madawaska Valley Physiographic Region in the vicinity of Golden and Clear Lakes. The area shows the usual characteristics of the Precambrian Shield. The relief may be locally variable as much of the area is unusually rough and rugged with many steep cliffs, rolling hills and deep valleys.

GEOLOGY

BEDROCK STRATIGRAPHY

The bedrock of the area is entirely Precambrian in age. The older groups of rock consist of a great thickness of steeply inclined granite gneiss. The strata is interbedded with thin seams of amphibolite and granulite facies. The rock is very massive and has a fine-grained mosaic structure.

PLEISTOCENE

Overlying the Precambrian formation is a deposit of bouldery, stoney, silty sand till with a velocity of 4,300 ft./sec.

There is no size assortment and no evidence of stratification. Alternating layers of slightly different texture and composition may also give an effect of pseudostratification. This till derived from several rock types.

Intercalated lenses of sand and gravel may occur, and their presence emphasizes that there is no sharp distinction between ice-laid and water-laid materials. Most sand and gravel lenses are of local extent. The large amount of water flushed out most of the clay and silt fractions, leaving a coarse-textured till.

PRESENTATION OF SEISMIC RESULTS

The results of the investigation are presented in the form of seismic profiles in this report. The overburden and the bedrock are indicated with the actual velocities.

CONCLUSIONS

Conclusions which resulted from the seismic investigation, interpretation and study are summarized as follows:

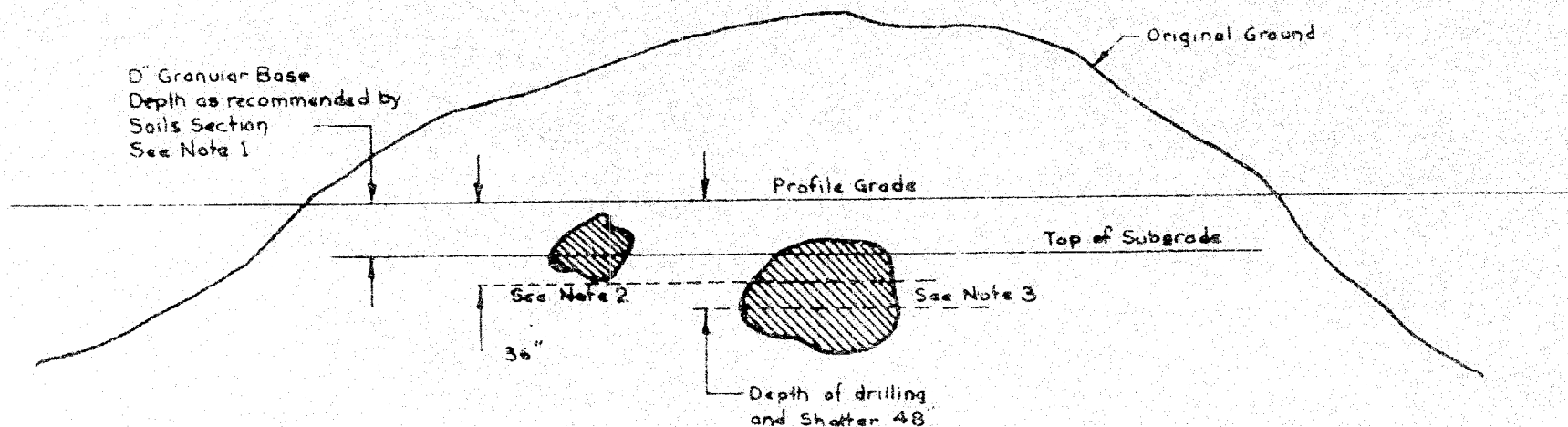
The profiles are self-explanatory and very little description is needed here. The maximum depth of overburden recorded was 13 feet. The very consistent high velocity of the bedrock is indicative of its dense matrix.

The proposed rock, Pleistocene sediments and the adjacent granular borrow areas will probably provide sufficient material to build the fill embankments for this project.

The bouldery till in this project is expected to cause excavation difficulties.

Harry's Bay,
December 4, 1967.

G. Szenasi,
Geophysicist.



PROFILE GRADE is the top of the granular base course at the E of the pavement, prior to the placing of the 5/8" crushed gravel driving surface or the pavement.

NOTES

1. Material to D" below profile grade to be excavated full width after treatment of boulders has been carried out as indicated hereunder.
2. Boulders partially within D" of profile grade but no deeper than 36" - remove completely.
3. Boulders partially within D" of profile grade but deeper than 36" below profile grade - drill and shatter to a depth of 48" or 24" below subgrade elevation whichever is the greater; excavate for a minimum of 12" below subgrade elevation.
4. Excavation below top of subgrade to be backfilled with similar boulder-free material from adjacent areas.

DEPARTMENT OF HIGHWAYS-ONTARIO

CUT SECTIONS-SUBGRADE BOULDER TREATMENT