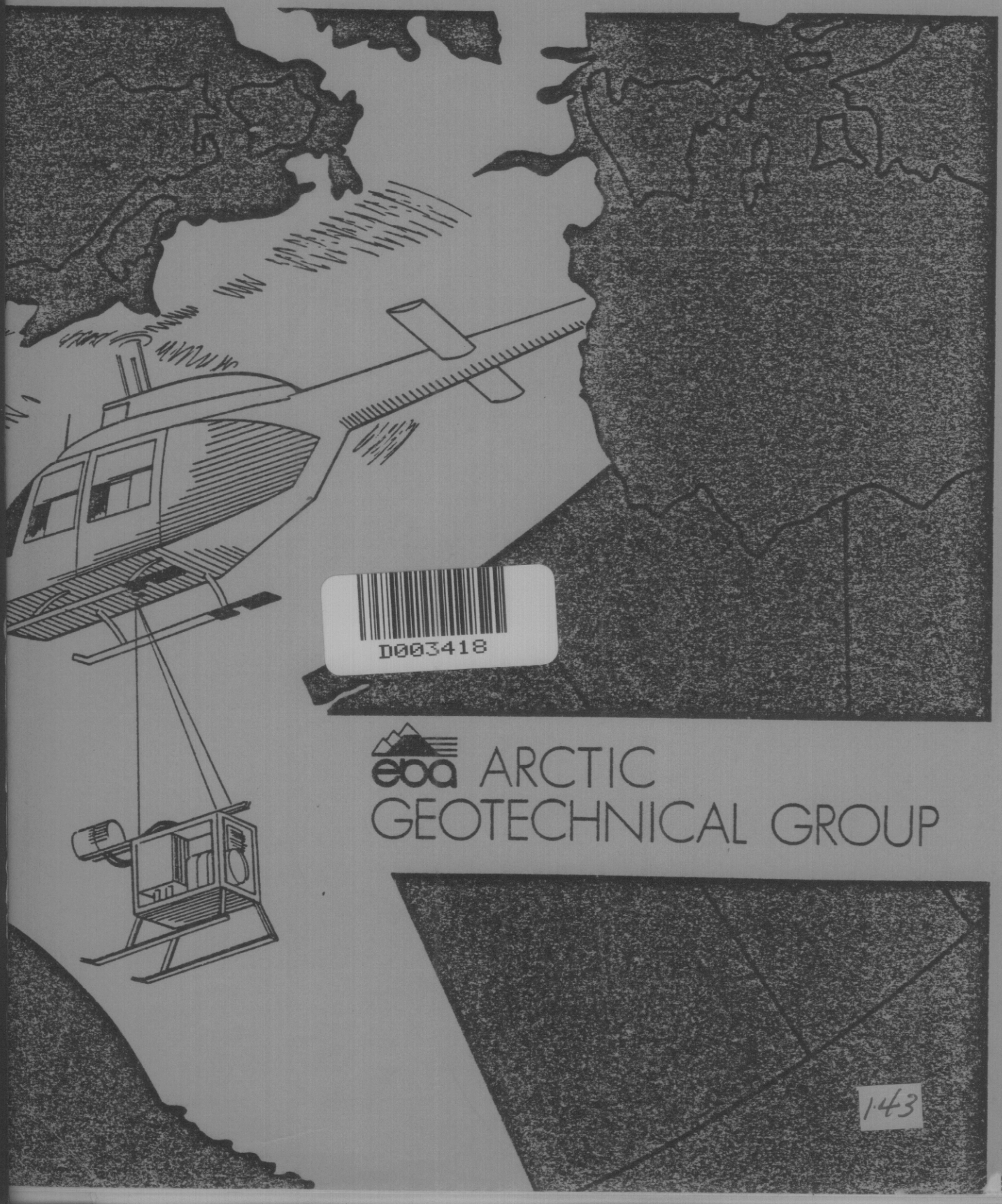
EVALUATION OF OFFSHORE BORROW RESOURCES

AND

INVESTIGATION OF A PROPOSED AIRSTRIP SITE

TUKTOYAKTUK, N.W.T.



eba ARCTIC GEOTECHNICAL GROUP

Don Hayley

EVALUATION OF OFFSHORE BORROW RESOURCES AND INVESTIGATION OF A PROPOSED AIRSTRIP SITE TUKTOYAKTUK, N.W.T.

Submitted To:

IMPERIAL OIL LTD.

FRONTIER PLANNING GROUP

CALGARY, ALBERTA

JUNE, 1973

~~463-3645~~ 451-2121

E.W. Brooker & Associates Ltd.

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1. INTRODUCTION

1.1 General

Arctic development has perpetually been hampered by a lack of suitable unfrozen earth construction materials. Imperial Oil Engineers have been experimenting for more than a year with a large suction dredge which is capable of excavating non permafrost underwater soils and depositing them on land. In anticipation of utilizing the dredge during the 1973 summer season for construction of onshore facilities, an investigation of bay bottom materials present in the Tuktoyaktuk area has been carried out. Numerous exploratory holes were drilled from the ice along the east side of Tuktoyaktuk harbour near the IOL base camp to differentiate suitable construction materials. In addition, offshore borrow resources in the bay adjacent to Tuktoyaktuk settlement have been assessed.

The possibility of utilizing the dredged bay bottom material for construction of an airstrip to service the Imperial Oil base camp at Tuktoyaktuk is also under consideration. The proposed strip must be capable of accommodating Hercules and Electra type aircrafts for which minimum requirements would be 6000 feet in length and 200 feet in width. Three alternative sites have been selected by Imperial Oil engineers and a field drilling program has been carried out at one of these sites. The findings of the airstrip investigation are presented in Section III of the report and some preliminary design requirements are discussed in Section IV.

This investigation and report was requested by Mr. J. J. A. deJong of Imperial Oil Limited, Frontier Planning Group and authorization was issued by service order No. 13S97179 on April 13, 1973.

1.2 Construction Techniques

The bay bottom materials are to be retreived by the suction dredge and stock-piled on the land surface. Dredging rate is believed to be in the order of 500 cubic yards of solids per hour which is discharged through a pipe 24 inches in diameter. Solid material comprises only about 15% of the total discharged

volume, thus a large water flow from the stockpile back to the bay must be contended with. After excess water has drained from the dredged soil, it will be loaded and trucked to the airstrip or other site for grade construction purposes.

In some instances the dredged material may be deposited directly where fill is required. This technique is adequate for infilling lakes or other depressions where natural lateral confinement is provided. It is proposed to use this technique for reclaiming the area within Tuktoyaktuk settlement which is currently occupied by the lake (Drawing A-1).

The most suitable soil for construction purposes, utilizing this scheme, is sand. Previous study by Brooker & Associates for Imperial Oil Ltd. on behavior of dredged silt has shown that poor drainage characteristics can lead to development of significant pore pressures within the deposition mound which may result in serious instability problems. Thus, the construction material must be reasonably free draining. On the other hand, previous experience has shown that dredging of gravel sized material is a very inefficient operation.

1.3 Scope

The scope of this investigation consisted of the following:

a. Evaluation of potential sources of offshore borrow material suitable for construction purposes, with particular reference to the proposed airstrip.

b. Evaluation of potential offshore borrow material for lake infilling at Tuktoyaktuk settlement.

c. Preliminary evaluation of subsurface conditions at three alternative airstrip sites selected by IOL engineers. Only one site was drilled, however, due to lake of time created by impending spring breakup.

d. Evaluation of the data to determine technical feasibility and material quantities required for preliminary design of an airstrip at the location investigated.

Other factors, which are associated with the proposed construction scheme but have not been considered are:

a. Evaluation of possible stockpile areas for dredged material.

b. Hydrological and geothermal aspects of underwater excavation and water discharge on the ground surface.

c. Evaluation of possible access roads to the new airstrip.

II. POTENTIAL OFFSHORE BORROW SOURCES

2.1 General

Seventy-nine exploratory borings were drilled in the vicinity of Tuktoyaktuk with a Mayhew 1000 rotary rig. Fifty-six of the boreholes were located offshore at a fairly regular spacing of 500 or 1000 feet in areas where dredging would be feasible and sandy soils are most likely to occur (Drawing A-1).

Permafrost was not encountered during offshore drilling of most boreholes. In a few cases, close to shore where it was frozen to the bottom at the time of the field work, frozen soil was encountered. Borehole logs indicating ice thickness, water depth and bottom soils to the maximum depth of penetration are contained in Appendix C.

Three potential borrow areas, which are close to possible construction sites, have been outlined in Drawing A-1. The materials found within the outlined areas are considered the most suitable of all soils encountered during the offshore borrow investigation. The potential borrow areas are designated as I, II, and III as described below.

2.2 Borrow Area I

Proposed Borrow Area I is located in the two bays immediately south of the IOL base camp. It is in close proximity to alternative airstrip location C. The

surface area outlined as suitable for underwater excavation is 284,000 square yards.

Gradation analysis of four representative soil samples obtained from boreholes in this region are shown in Figure 1. It is apparent that a wide range of material types is present varying from clayey sand to sand with some gravel. Some care will have to be taken if this source is utilized in order to minimize the quantity of silt and clay size materials excavated.

2.3 Borrow Area II

Borrow Area II (205,000 yds^2) is located north of the IOL camp at the mouth of a river which discharges into Tuktoyaktuk Bay. Proximity to alternative airstrip sites A and B (not investigated) is good. The soil generally has a narrower range of gradation characteristics than that of Area I as indicated in Figure 2. In general, the soil ranges from silty sand with some clay to clean sand with a trace of gravel. This material is preferable to that identified in Area I since less sorting would be necessary.

2.4 Borrow Area III

Area III is located in Tuktoyaktuk Bay adjacent to the settlement as indicated in Drawing A-1. This is a potential source of material for infilling the lake within the settlement. Both sand and gravel were identified in the bay. Gravel thickness overlying the sand ranges from 0 to 14 feet. The gravel contains sand, silt and clay as indicated in Figure 3 and would generally be termed 'dirty'. The underlying sand is fine to medium grained, 'uniform' material which would probably be ideal for lake infill.

The borrow area outlined has a surface area more than twice that of the lake to be infilled. Thus, there would be little difficulty obtaining the necessary fill from this nearby borrow source.

GRAIN SIZE DISTRIBUTION

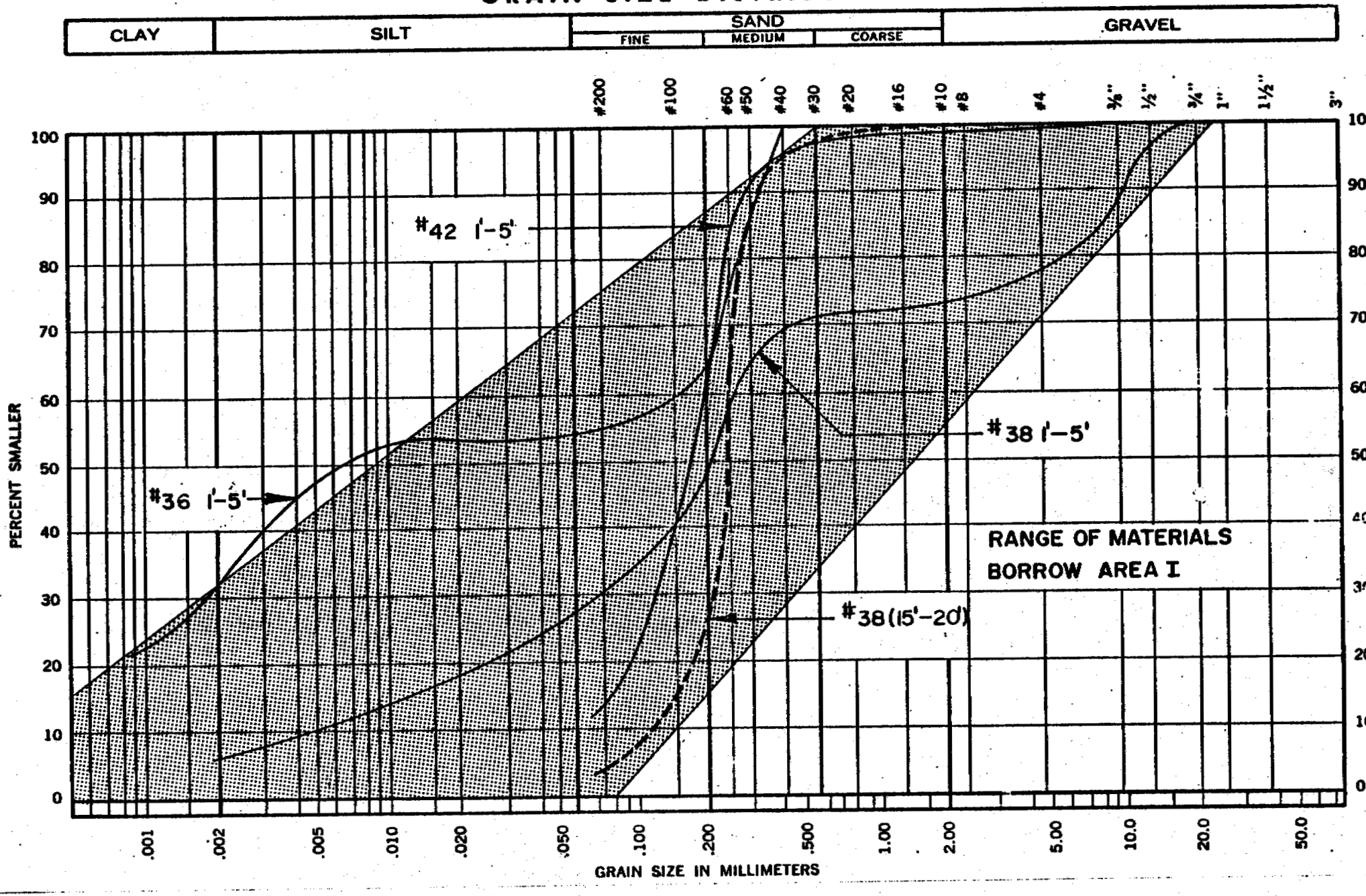

FIGURE 1

GRAIN SIZE DISTRIBUTION

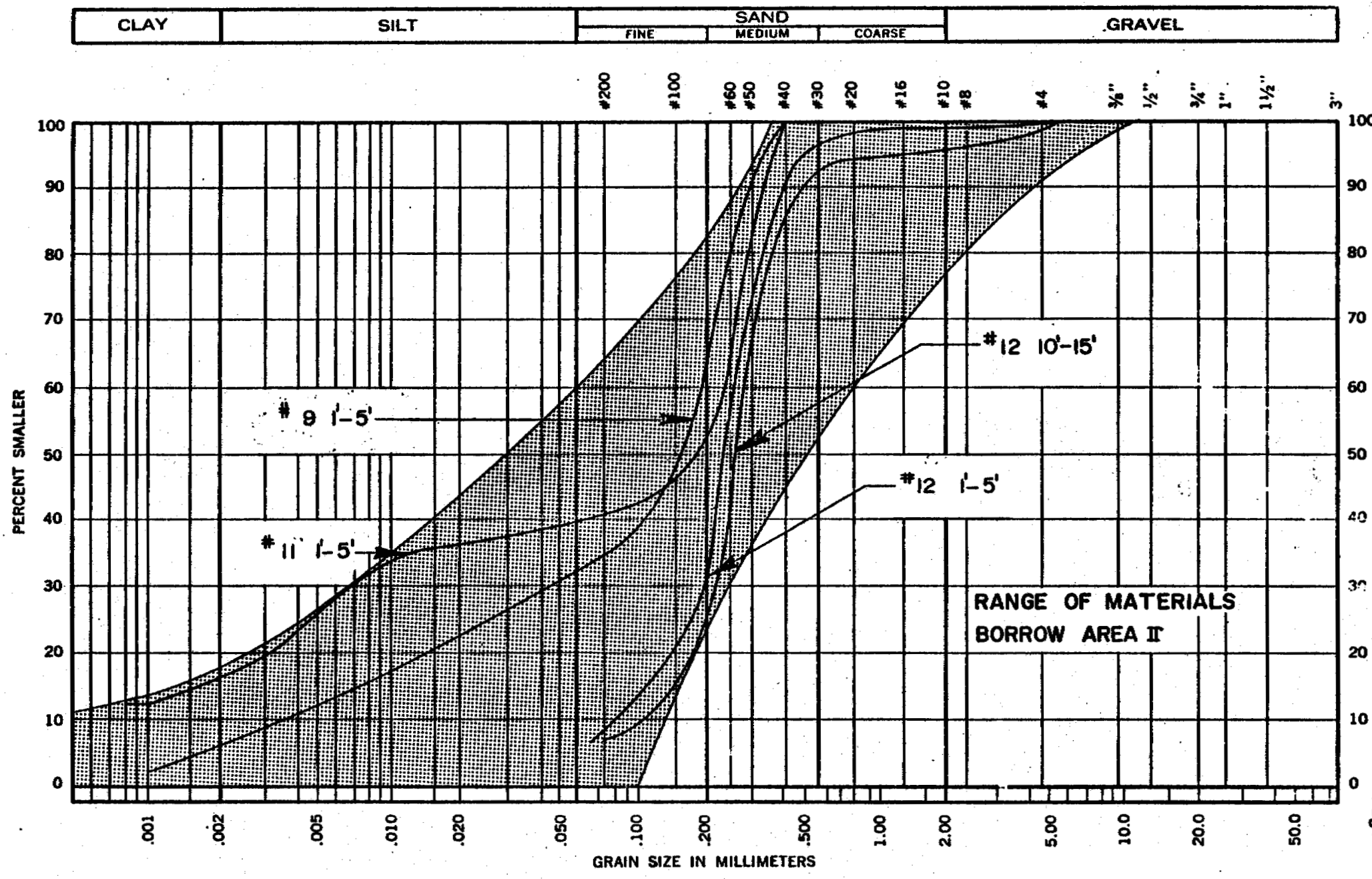

FIGURE 2

GRAIN SIZE DISTRIBUTION

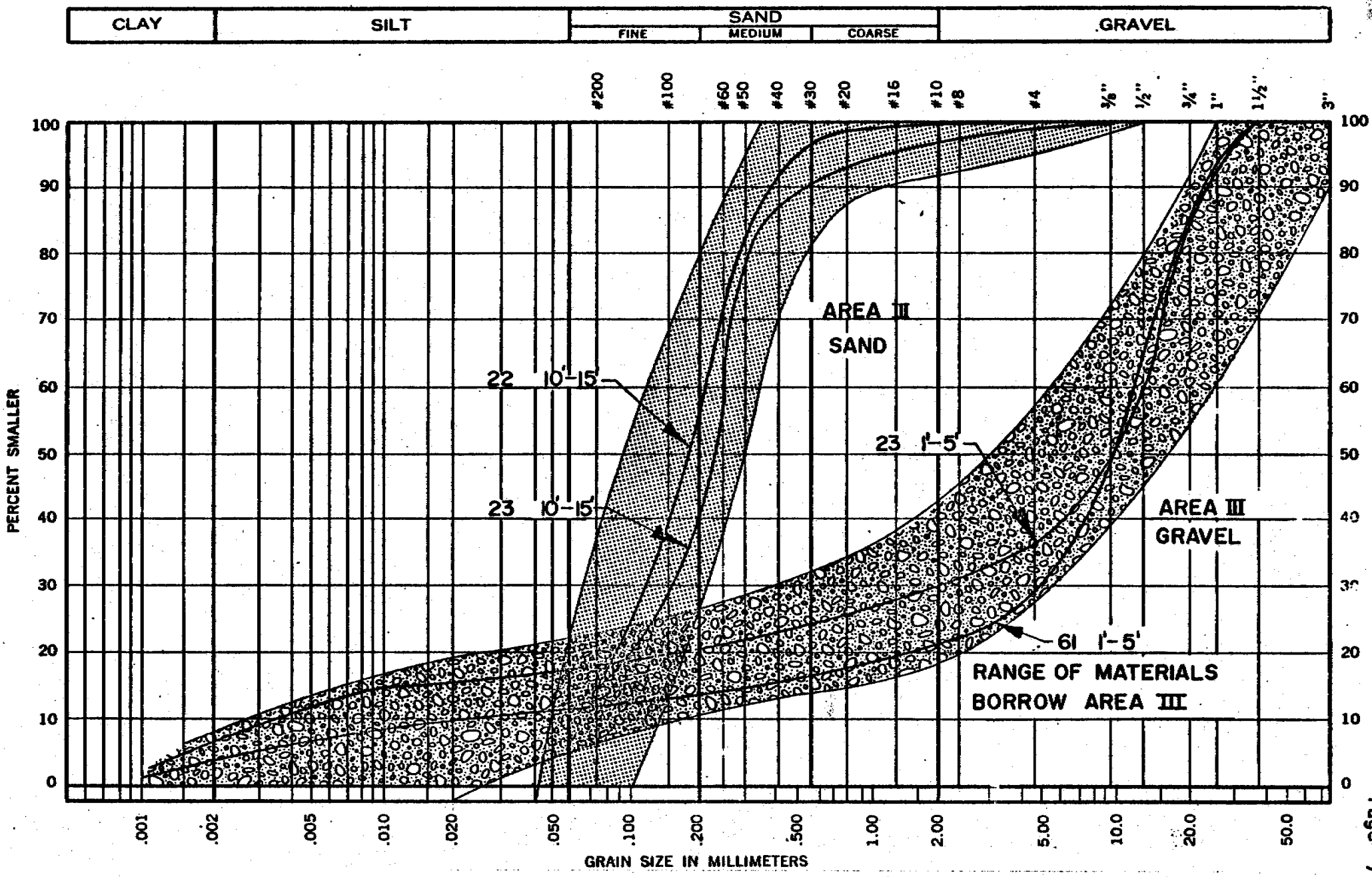

FIGURE 3

III. SUBSURFACE CONDITIONS AT AIRSTRIP C

3.1 General

The onshore boreholes were lcoated predominately along the centerline of the proposed airstrip site, alternative C. The borehole spacing was not regular but varied according to topographic and terrain conditions determined from study of the airphotos. Several holes were drilled off the centerline to confirm the extent of specific topographic features. Detailed borehole logs together with associated laboratory data for all onshore holes are contained in Appendix B.

3.2 Site Description

The proposed airstrip site, referred to as Alternative C, is located approximately 1 mile southeast of the IOL base camp at Tuktoyaktuk as indicated on the site plan, Drawing A-1. Topography is flat to undulating along its length, with low, flat hills rising about 10 feet above surrounding level areas. The centerline profile has been determined by ground survey and subsurface conditions examined by drilling and logging 23 boreholes.

Evaluation of the field data is shown in Drawing A-2. The area in the region of the airstrip has been sub-divided into four terrain types, described in the following subsections, depending upon the surface soils present and a relative estimate of sensitivity to disturbance by construction activities.

3.3 Glaciofluvial Sand and Gravel

Glacial outwash, consisting of sandy gravel and sand is very close to the ground surface on the hill tops outlined in Drawing A-2. Peat and organic silt ranging in thickness from ½ to 2 feet overlies the granular soil in most places. These areas are generally the best drained of the regions studied. Little or no

visible ice segregation was found in the sand and gravel throughout the depth of borehole penetration. The granular materials encountered range in texture from clean well graded sandy gravel to silty sand with some clay.

3.4 Lacustrine Silt and Clay

Silt and clay of lacustrine origin surround the sand and gravel hills. Active ice wedging is apparent on the airphotos throughout most of these areas and excess ice content in the soil has been estimated at up to 60% but is commonly 20 to 30%. The soil ranges from non to low plastic clayey silt with some sand to high plastic clay. These areas would be subject to severe settlement if permitted to thaw.

3.5 Thin Lacustrine Sediments Over Sand and Gravel

In these areas, a thin veneer of silt and clay overlies the glaciofluvial sand and gravel. Depth of thaw stable material generally ranges from 3 to 12 feet. The soil types are similar to those described above. The areas should be considered moderately sensitive to disturbance by construction activities.

3.6 Organic Terrain

Areas designated in Drawing A-2 as organic terrain were found to have peat extending to a depth of 4 to 8 feet underlain by lacustrine silt and clay. Visual estimated excess ice content in the peat is often as high as 35% of the total volume. The peat itself will be only moderately sensitive to thaw settlement due to loss of excess ice, however, it will be highly compressible under load after thaw has occurred. Present insitu total moisture content of the peat is commonly 500 to 800 percent.

IV. AIRSTRIP CONSTRUCTION

4.1 General

No attempt has been made at this particular time to evaluate which of the three alternative airstrip sites is most desirable. Alternative C is a feasible site from a geotechnical engineering standpoint. Grade construction at this site is discussed in this section of the report.

4.2 Geothermal Considerations

In view of the thaw sensitive nature of most soils encountered beneath the proposed airstrip it is necessary to design a grade which will ensure degradation of the permafrost does not occur. The depth of thaw in a homogeneous silty sand subgrade with gravel surface has been estimated at 6 to 7 feet, based on the Modified Berggren equation. Thus, if 6 to 7 feet of sand is placed on the tundra at a time when the existing active layer is frozen, thaw below the existing ground level should not occur. Fill placement on a frozen surface will minimize the amount of settlement which would occur as a result of compression of the surface organic soils. Moreover, the frozen peat will act as a heat sink, providing further safety against degradation of the permafrost table (high latent heat).

It is considered feasible to cut, to a limited extent, the tops of gravel mounds. In these areas only, all surface organic soil should be stripped off, exposing the frozen sand and gravel. Over excavation by at least 2 feet is recommended, with reconstruction to grade by placement of fill from the borrow source.

4.3 Grade Design

A tentative grade has been selected based on the foregoing geothermal requirements as indicated in Drawing A-2. The grade is 7000 feet long, with the north

3200 feet level and the south 3800 feet sloping up from the center at 0.13 percent. Minimum total fill depth in critical areas is 6 feet and average depth is 8.6 feet. Three separate cuts are anticipated through gravel knolls as indicated on the profile, Drawing A-2. Total fill requirements, including 3/1 sideslopes all around, has been estimated at 554,000 cubic yards.

This grade is considered a good starting point for further study of feasibility of the project. It is believed to be conservative in that additional cut or reduced fill thickness may be justified based on more detailed field and analytical study.

In order to insure the airstrip is serviceable during all weather conditions, a prepared granular surface will be required. Thickness of the prepared gravel surface depends upon final quality of the subgrade and aircraft wheel-load. Ministry of Transport design standards for Electra type aircraft would require between 1½ and 2½ feet of compacted gravel[1]. Since it would be a very expensive undertaking, to place this quantity of gravel (about 100,000 cubic yards) at Tuktoyaktuk it may be desirable to reduce the thickness considerably and allow the strip to become unserviceable during 1 or 2 weeks of spring breakup.

4.4 Soil Compaction

The following benefits would be derived from adequately compacting the subgrade soil.

1. Shear strength of the soil would be improved substantially thus reducing the thickness of gravel surface course required.

2. Infiltration of surface water and the tendancy for frost heave would both be reduced as a result of decreased permeability.

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[1] Wheel loading from an Electra is more severe than that from a Hercules.

3. Differential settlement, which can lead to a costly maintenance problem, within the fill would be minimized.

It is recommended that thickness of the intial lift be 2 to 3 feet with this followed by 1 foot thick lifts. The lifts should be compacted by a large vibrating drum roller imparting a dynamic force in the order to 25,000 ft. lbs. Final relative density of the top 2 feet of subgrade soils should be at least 80 percent. Relative density of the gravel surface course should be at least 90 percent. In order to achieve these density requirements it will be necessary to ensure the fill is not frozen at the time of placement and compaction.

4.5 Drainage

Natural surface drainage in the area is believed to be unaffected by construction of an airstrip at alternative location C. This fact should be verified by further ground reconnaissance during the spring or summer. If surface drainage is interrupted, culverts may be required through the fill. Water must not be allowed to pond alongside the newly constructed fill.

Drainage from the fill itself should be given adequate consideration. A shaped subgrade, which will not allow water to pond on top should be constructed and maintained. Sideslopes may be subjected to erosion from runoff if not protected. Landscaping and seeding the slopes to encourage vegetation growth would probably provide adequate erosion protection.

V. SUMMARY AND CONCLUSIONS

The following conclusions are based on an evaluation of the field data together with the airstrip design recommendations stated in the previous section.

1. Three potential offshore borrow areas have been defined by exploratory borings. The materials identified within these regions varies from clayey sand to silty gravel. The order of preference of borrow areas with respect to material type is: III, II and I.

2. Sufficient sand and gravel material is available in the bay (Borrow Area III) to infill the lake in Tuktoyaktuk settlement.

3. Alternative location C, chosen by Imperial Oil engineers for proposed construction of an airstrip at Tuktoyaktuk, in a feasible site from an engineering standpoint. An estimate of construction cost can be prepared from the information provided.

4. A more detailed field investigation of subsurface conditions, particularly in the vicinity of proposed cuts, should be undertaken before proceeding with final design. Also, regional drainage patterns should be studied during the spring and summer months.

5. Minimum fill thickness required to ensure degradation of the permafrost does not occur has been estimated at 6 to 7 feet. More comprehensive geothermal analyses should be undertaken to verify this prior to final design.

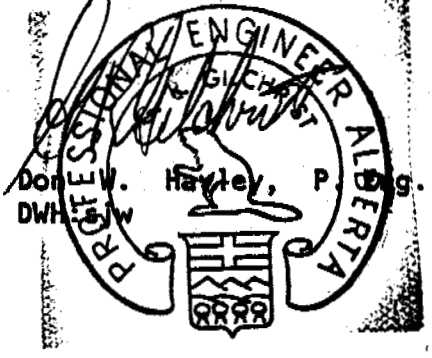
6. Silty sand fill may be dredged from the bay nearby (Borrow Area I), stockpiled to drain and trucked to the site. The unfrozen fill should be placed in lifts and compacted wth a large vibratory roller.

7. A gravel surface course is required to improve all-weather capability of the strip. The thickness of gravel can be minimized if the strip is allowed to become unserviceable for a week or two during spring breakup.

8. Other airstrip sites A and B, which have not been investigated, may possibly be more desirable locations. Most recommendations stated herein would also apply to these, however, no estimate of fill quantities can be made at this time.

Respectfully Submitted,

ELMER W. BROOKER & ASSOCIATES LTD.



Don W. Hayley, P. Eng.
DWH:jw

453-3675
451-2121

TUKTOYAKTUK

BORROW AREA III
191,000 yds²

82,000yds²

MOT
AIRSTRIP

BORROW AREA II
205,000yds²

AIRSTRIP "A"

AIRSTRIP "B"

IOL CAMP

BORROW AREA I
284,000 yds²

AIRSTRIP "C"

N

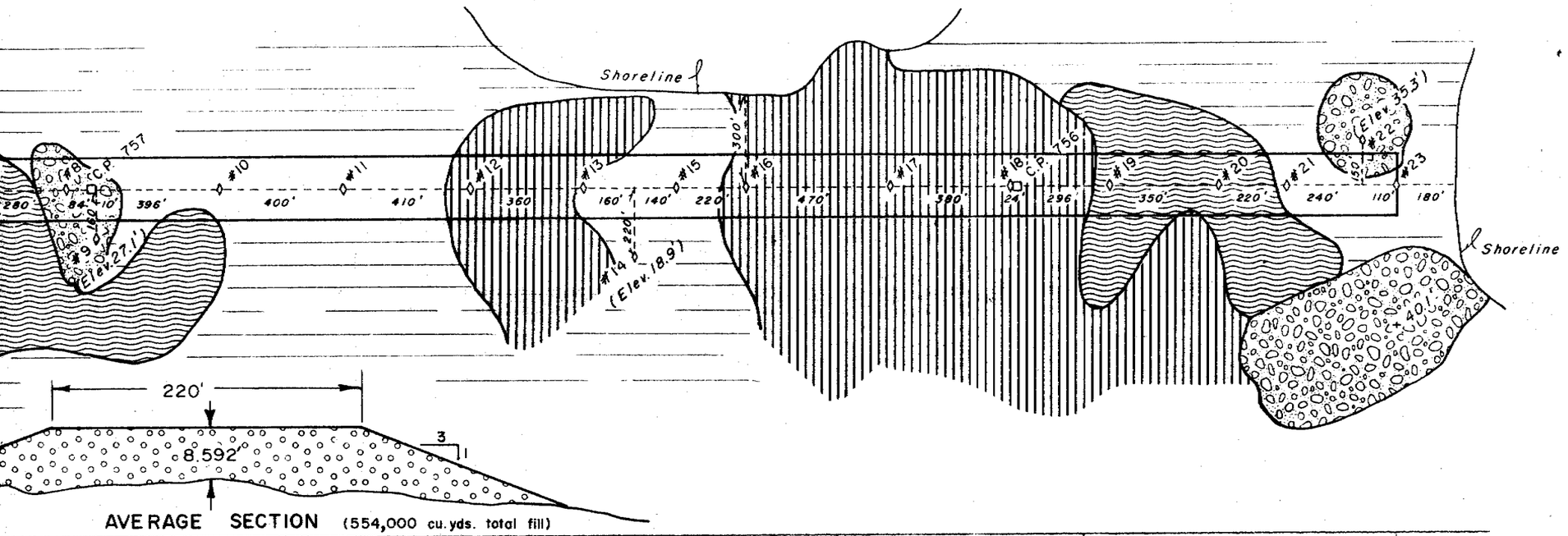
LOCATION OF OFFSHORE BOREHOLES AND POTENTIAL BORROW AREAS

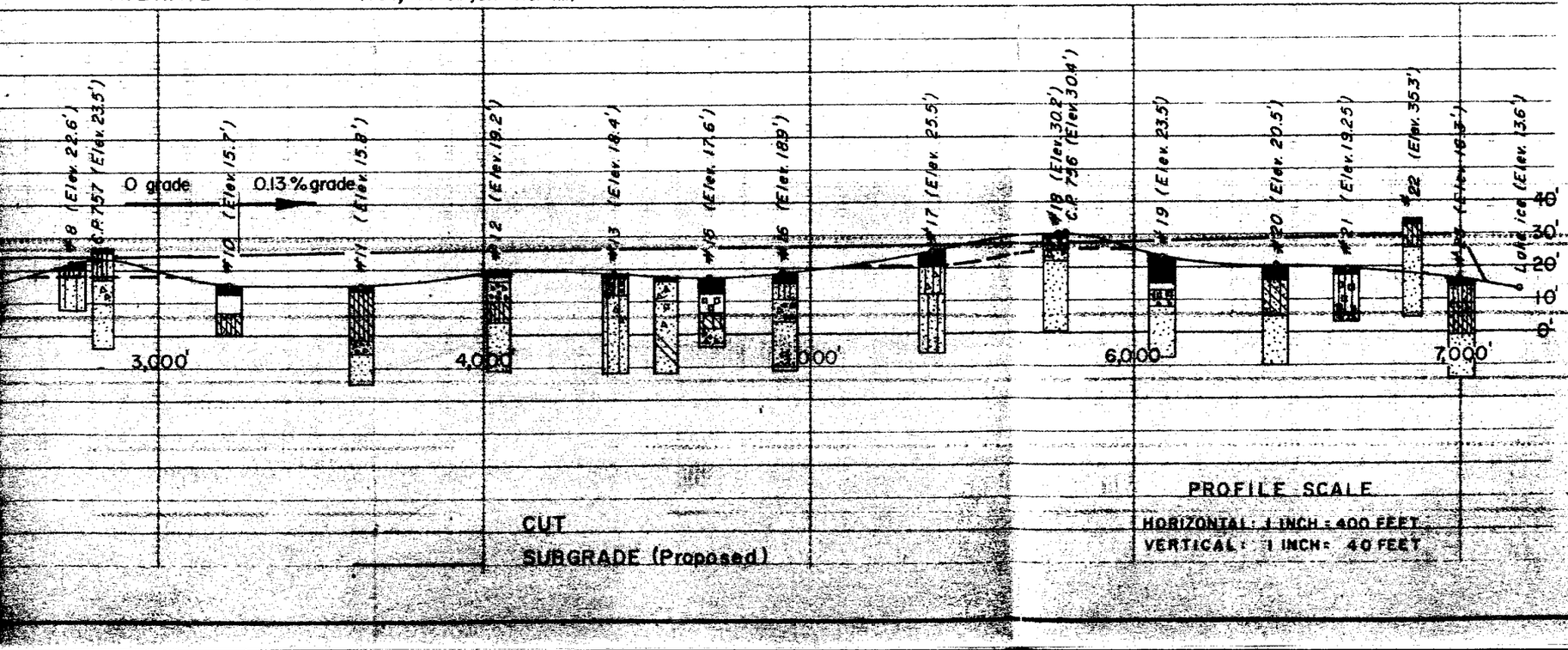
eda

DRAWING A-1

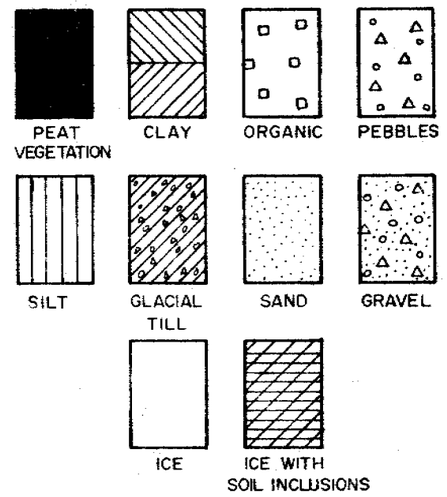
OIL
LACUSTRINE
Sensitive and
After Thaw)

DEEP LACUSTRINE SILT AND CLAY
HIGH ICE CONTENT, ICE WEDGING
(Exceedingly Thaw Sensitive)





SOIL LEGEND:



◊ denotes lath - Drill hole #

□ denotes ¼" x 1' iron bar and 2"x2" Control Point tag

+ denotes top of hills.

Note:

Level circuit is closed to geodetic datum, and is referred to Station Jeff (3003). (Elevation 30.0')

SITE EVALUATION
and
PRELIMINARY GRADE DESIGN

IMPERIAL OIL LIMITED
AIRSTRIP "C", TUKTOYAKTUK, N.W.T.

DRAWING A-2

BROOKER & ASSOCIATES LTD.

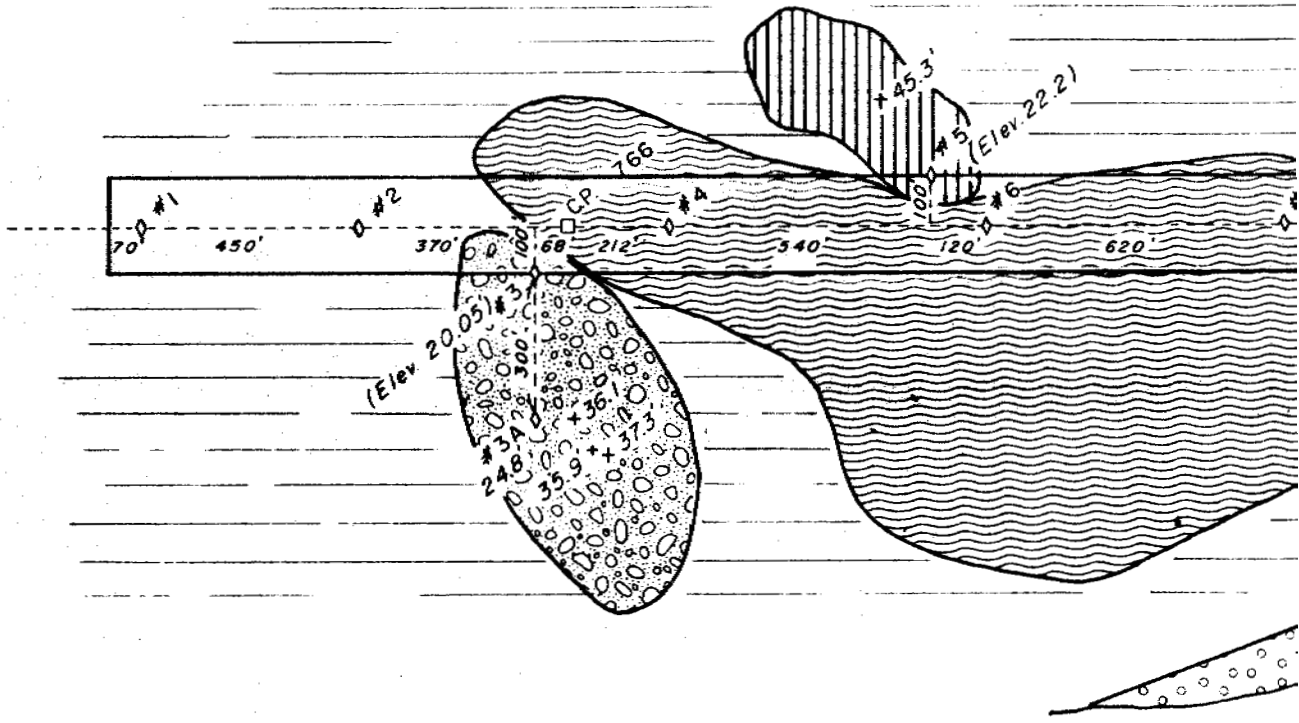
HAMILTON & OLSEN SURVEYS LTD
Edmonton — Alberta
W.S. 6468, H.B.O. 317-25/29, D.H. K

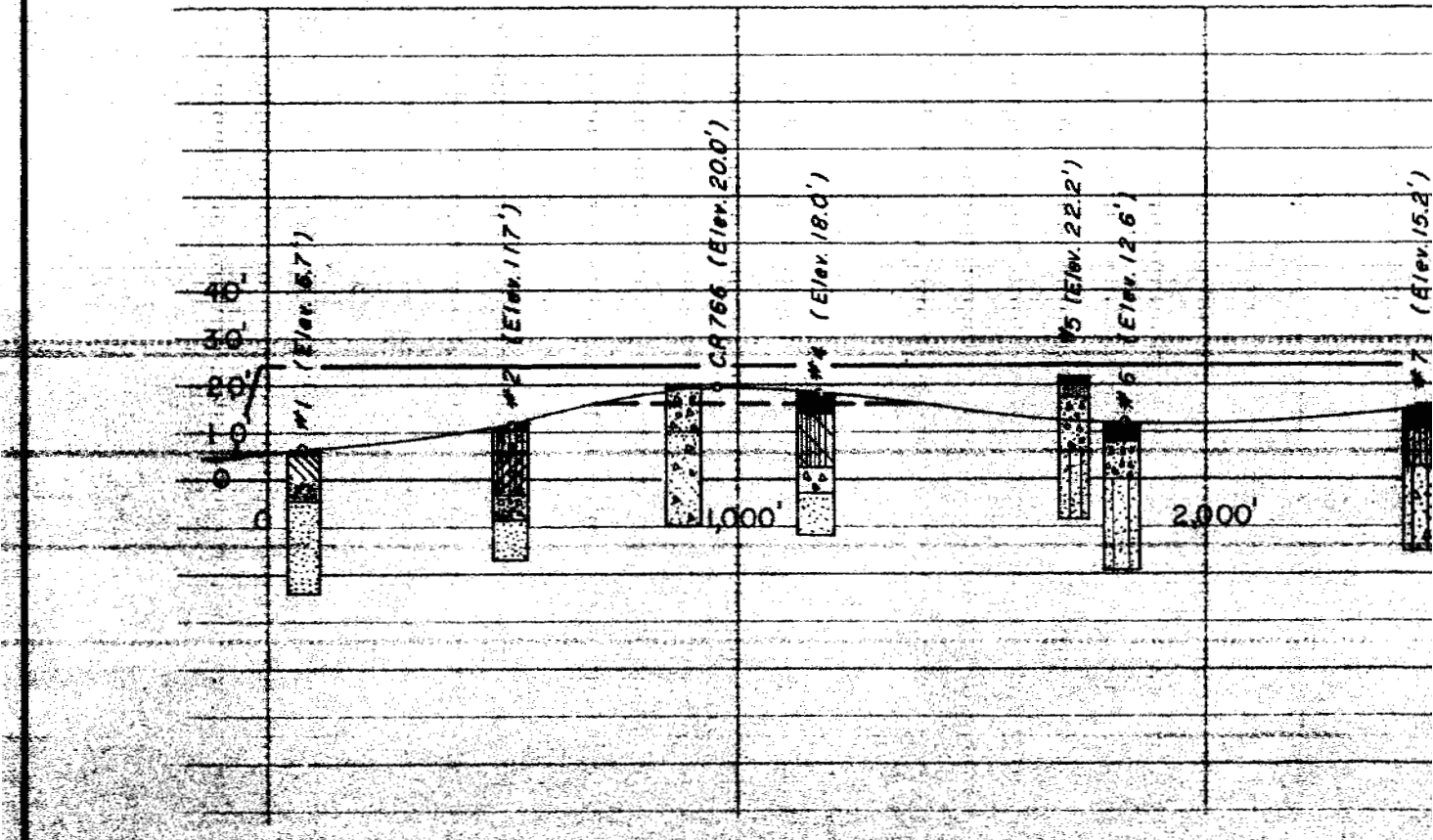
TERRAIN TYPE

SAND & GRAVEL — GLACIO-FLUVIAL (Thaw Stable)

THIN LACUSTRINE SEDIMENTS OVER SAND & GRAVEL (Moderately Thaw Sensitive)

THICK ORGANIC (Peat) OVERLYIN
SEDIMENTS (Tha
Very Compressible





APPENDIX B

FIELD AND LABORATORY INVESTIGATION

The field drilling program was carried out between April 13 and 24, 1973. A total of 55 holes were drilled offshore from the ice in Tuktoyaktuk Bay to assess potential soil borrow material and 24 were drilled onshore to evaluate subsurface conditions at one proposed airstrip site. The holes were advanced with a Nodwell mounted Mayhew 1000 rotary drill rig utilizing air as the circulating medium. For offshore work, the rig was modified with a 'Becker Conversion' which reversed normal circulation of air in the hole and allowed the cuttings to be blown up the center of a double walled casing. All cuttings were caught in a 'cyclone' and bagged in five foot intervals for classification and testing purposes. The reverse circulation technique was abandoned for onshore drilling because it was found to be ineffective for drilling frozen soil. Undisturbed samples of frozen or unfrozen soil were not obtained during the field work. Thus, estimates of ground ice type and quantity must be considered very approximate only, based on judgement of the experienced field technician.

All boreholes were located in the field by a survey crew from Hamilton and Olsen Surveys Ltd. Edmonton. In addition, a centerline profile of the proposed airstrip site was determined and elevation of all boreholes obtained. All elevations have been referred to the Geodetic Benchmark system.

Soil samples retained were shipped to the Brooker Edmonton Laboratory for further examination and testing. Testing was restricted to Classification Tests predominantly Atterberg Limites and Grain Size Analysis. The results are included in the borehole logs and on summary sheets included in this appendix.

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X WATER CONTENT % ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
PEAT - dark brown fibrous		0		
CLAY - med. brown - silty - med. plasticity		2 4	Vs 35-40%	
GRAVEL - med. brown - sandy		6 8		
SAND - med. brown - fine to med. grained - trace of silt		10 12 14 16 18 20 22 24 26 28	Nbn	
END OF HOLE		30		

eba civil engineers

PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 6.7'
DEPTH 30'

HOLE NO.
B.H. #1
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X / WATER CONTENT % ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0		
SILT - med. brown - some organics 13% Sand - poorly graded 77% Silt 10% Clay		2 4	Vs 35-40%	
SILT - Grey - some clay - low plasticity - some organics		6 8 10 12 14	Vs 10-15%	
GRAVEL - med. brown - sandy		16 18	Nbn	
SAND - med. brown - fine grained - trace of silt		20 22 24 26 28	Nbn	
END OF HOLE		30		

civil engineers

PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 11.7'
DEPTH 30'

HOLE NO.
B.H.2
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0	Vs 15 -20%	
GRAVEL - med. brown - sandy - well graded	51% Gravel 44% Sand 5% Silt	2 4	nbn	
		6 8		
SAND - lt. brown - fine to med. grained - some silt - trace of gravel		10 12 14 16 18 20 22 24 26 28 30	nbn	
END OF HOLE				

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PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 20.05'
DEPTH 30'

HOLE NO.
B.H. #3
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0	Vs 10-15%	
SILT - med. brown - sandy		2		
GRAVEL - med. brown - angular particles - silty - some sand 12% Gravel 48% Sand 32% Silt 8% Clay		4		
		6	Nbn	
		8		
SAND - lt. brown - fine to med. grained - trace of silt		10		
		12		
		14		
		16		
		18		
		20		
		22		
		24		
		26		
		28		
		30		
END OF HOLE				

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PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 24.8'
DEPTH 30'

HOLE NO. B.H.#3a
SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
PEAT - dark brown - fibrous		0 2 4	Vs 20-25% ICE
SILT - grey - some clay - low plasticity		6 8 10 12 14	Vs 40-45% Vs 10-15%
GRAVEL - grey - sandy		16 18 20	Vx 10-15%
SAND - grey - fine grained - trace of silt - some gravel		22 24 26 28 30	Nbn
END OF HOLE 30'			

DRY DENSITY p.c.f. X
WATER CONTENT % ●

40 60 80 100 120 140 160
0 20 40 60 80 100 120

civil engineers

PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 18.0'
DEPTH 30'

HOLE NO.
B.H. #4
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (x ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
PEAT - dark brown, fibrous		0	Vs 15-20%	
SILT - med. brown, sandy — 70% Sand, 24% Silt, 6% Clay		2		
GRAVEL - med. brown, sandy, poorly graded — 78% Gravel, 17% Sand, 5% Silt		4	Nbn	
		6		
		8		
		10		
		12	NF	
		14		
SAND - med. brown, fine grained, some silt		16	Nbn	
		18		
		20		
		22		
		24		
		26		
		28		
		30		
END OF HOLE				

civil engineers

PROJECT
I.O.L. Airstrip 'C"
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 22.2'
DEPTH 30'

HOLE NO.
B.H.#5
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0 2 4	Vs 25-30%	
GRAVEL - med. brown - sandy - some silt and clay		6 8 10 12 14	Nbn	
SAND - lt. brown - fine grained - trace of silt		16 18 20 22 24 26 28		
END OF HOLE		30		

eoa civil engineers

PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 12.6'
DEPTH 30'

HOLE NO.
B.H.#6

SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0 2 4	Vs 15-20%	
SILT - grey - sandy - trace of clay		6 8 10 12 14	Vs 10-15%	
SAND - med. brown - silty - fine grained - some gravel		16 18 20 22 24 26 28	Nbn	
END OF HOLE		30		

eba civil engineers

PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 15.2
DEPTH 30'

HOLE NO.
B.H.#7
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
PEAT - dark brown, fibrous		0	Vs 15-20%	
SAND - med. brown - silty - some gravel	33% Gravel 47% Sand 15% Silt 5% Clay	2	Nbn	
SAND - med. brown - fine grained - some silt		4 6 8 10 12 14		
END OF HOLE				

40 60 80 100 120 140 160
0 20 40 60 80 100 120

civil engineers

PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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ELEVATION 22.6
DEPTH 15'

HOLE NO.
B.H. #8
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dark brown, fibrous		0	Vs 10-15%	
SAND - med. brown - silty - fine grained - some gravel - well graded		2	NF	
44% Gravel 46% Sand 10% Silt		4		
		6		
		8	Nbn	
		10		
- med. brown - fine to med. grained - trace of silt		12		
		14		
		16		
		18		
		20		
		22		
		24		
		26		
		28		
		30		
END OF HOLE				

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PROJECT
I.O.I. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 27.1'
DEPTH 30'

HOLE NO.
B.H.#9

SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X / WATER CONTENT % ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dk. brown - fibrous		0	Vs 40-45%	
		2		65.6
CLAY - grey - high plasticity - silty		4	ICE	
		6		
		8		
55% Silt 45% Clay		10	Vs 30-35%	
		12		
		14		
END OF HOLE				

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I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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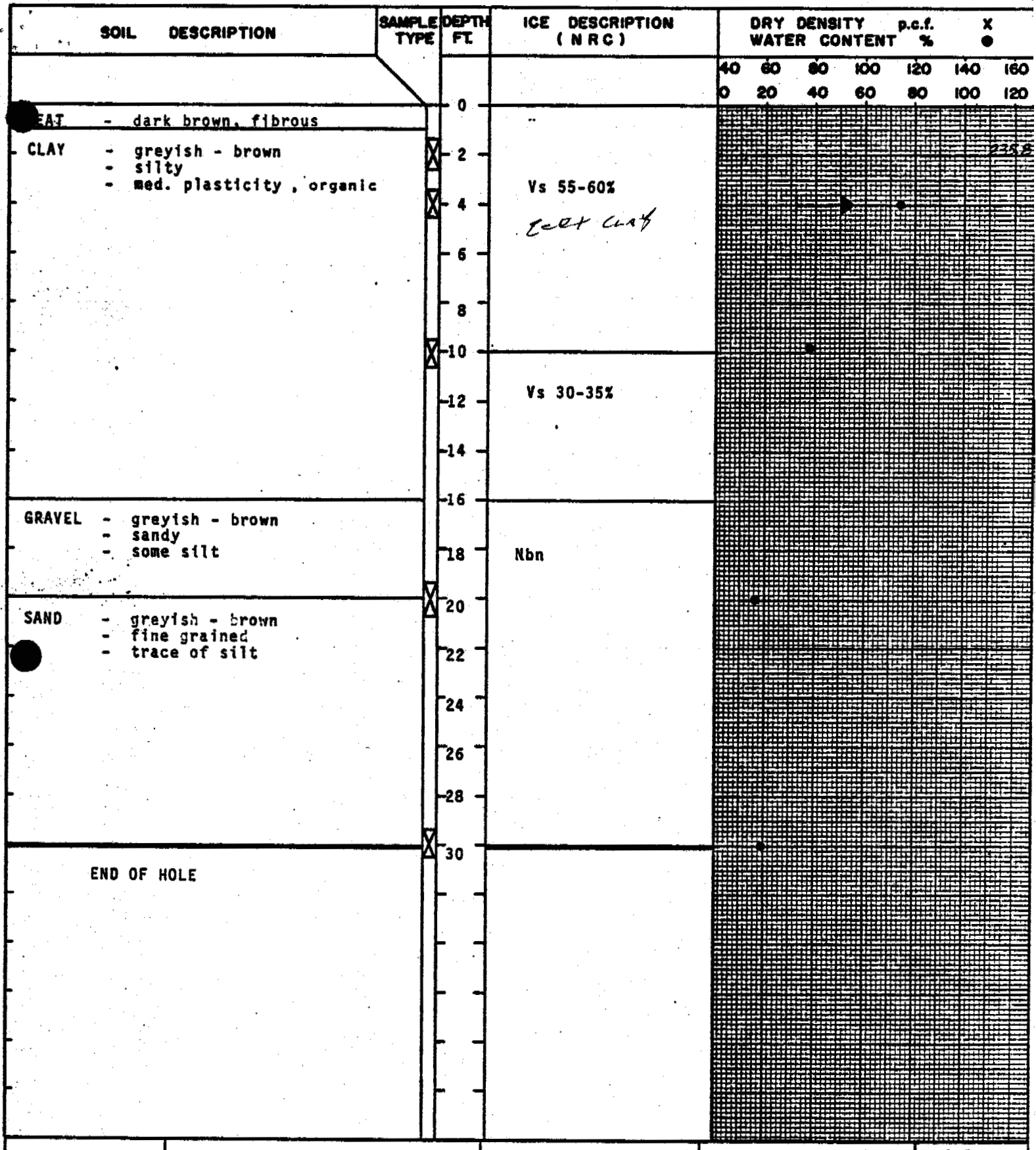
ELEVATION 15.7'
DEPTH 15'

HOLE NO.
B.H.#10

SHEET
1 of 1



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Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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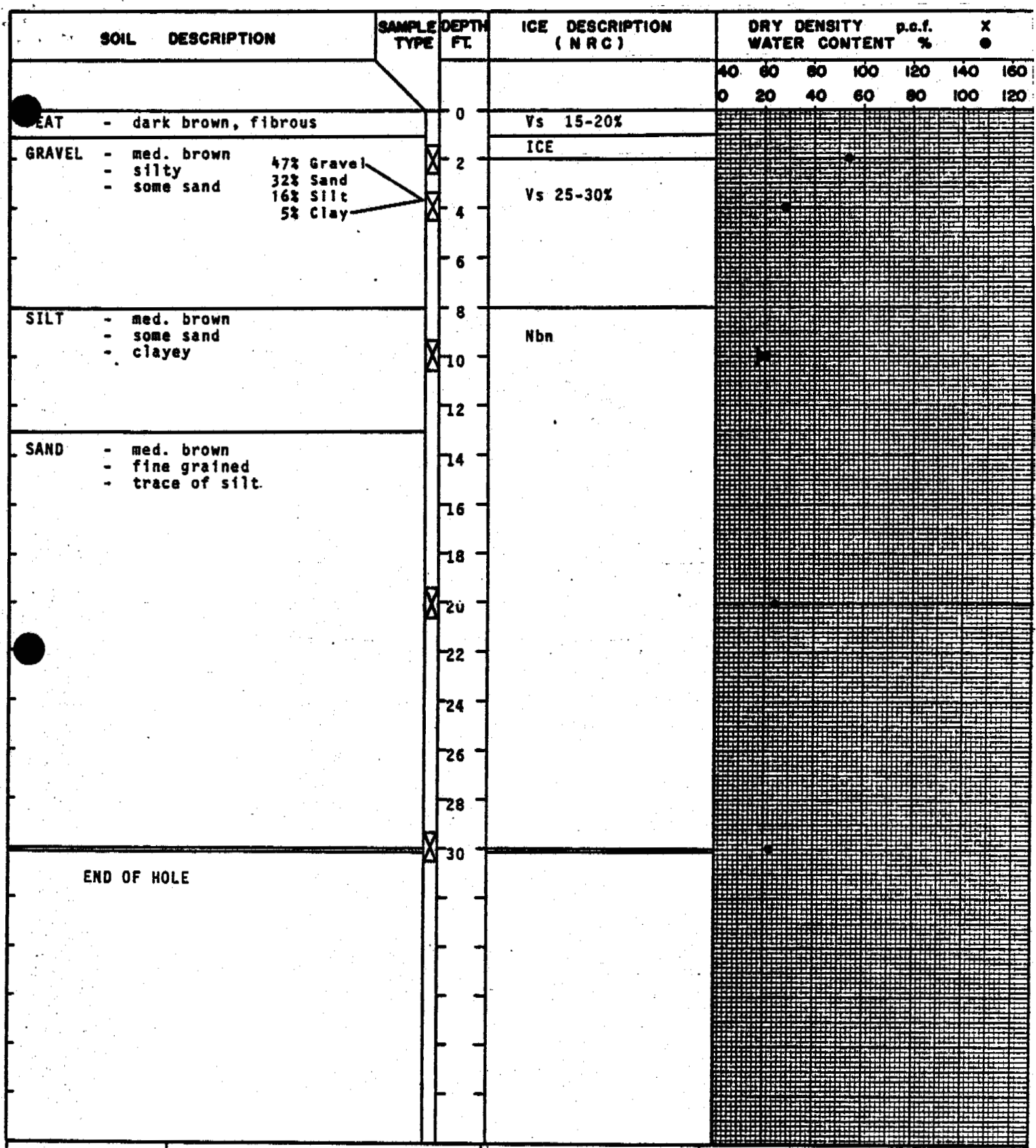
ELEVATION 15.8'
DEPTH 30'

HOLE NO.
B.H. #11

SHEET
1 of 1



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Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 19.2'
DEPTH 30'

HOLE NO.
B.H. #12
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
PEAT - med. brown, fibrous		0		
SILT - med. brown - some organics - some clay - trace of gravel		2 4 6	Vs 30-35%	
SAND - med. brown - silty - trace of gravel		8 10	Nbn	
- med. brown - fine grained - trace of silt		12 14 16 18 20 22 24 26 28		
END OF HOLE		30		

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PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 18.4'
DEPTH 30'

HOLE NO.
B.H.#13
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
PEAT - dark brown - fibrous		0 2	Vs 15-20%
SAND - grey - trace of gravel		4 6	ICE
- some organics		8 10	Nbn
- gravelly		12 14 16	
- trace of clay		18 20	
- grey - fine grained		22 24 26 28	
END OF HOLE		30	

DRY DENSITY p.c.f. X
WATER CONTENT % ●

40 60 80 100 120 140 160
0 20 40 60 80 100 120

105.7

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Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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ELEVATION 18.9'
DEPTH 30'

HOLE NO.
B.H.#14
SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X / WATER CONTENT % ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0 2 4	Vs 20-25%	298.4 47.6
SILT - grey - organic		6 8 10	Ice with Soil Inclusions	
CLAY - grey - silty - med. plasticity		12 14	Nbn	
GRAVEL - grey - sandy		16 18 20		
END OF HOLE				

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PROJECT
I.O.I. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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ELEVATION 17.6'
DEPTH 20'

HOLE NO.
B.H.#15

SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X / WATER CONTENT % ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0 2		
SILT - med. brown - sandy - trace of gravel		4 6	Vs 30-35%	
GRAVEL - med. brown - sandy - some silt		8 10 12 14	Nbn	
SAND - med. brown - fine grained - trace of silt		16 18 20 22 24 26 28		
END OF HOLE		30		

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PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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ELEVATION 18.9'
DEPTH 30'

HOLE NO.
B.H.#16

SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
PEAT - dark brown - fibrous		0 2	Ice with soil inclusions
SAND - med. brown - some silt - trace of gravel - some clay		4 6 8 10	Vs 30-35% Vs 10-15%
SAND - lt. brown - fine grained - trace of silt		12 14 16 18 20 22 24 26 28 30	Nbn
END OF HOLE			

DRY DENSITY p.c.f. X
WATER CONTENT % ●

40 60 80 100 120 140 160
0 20 40 60 80 100 120

2223

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PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

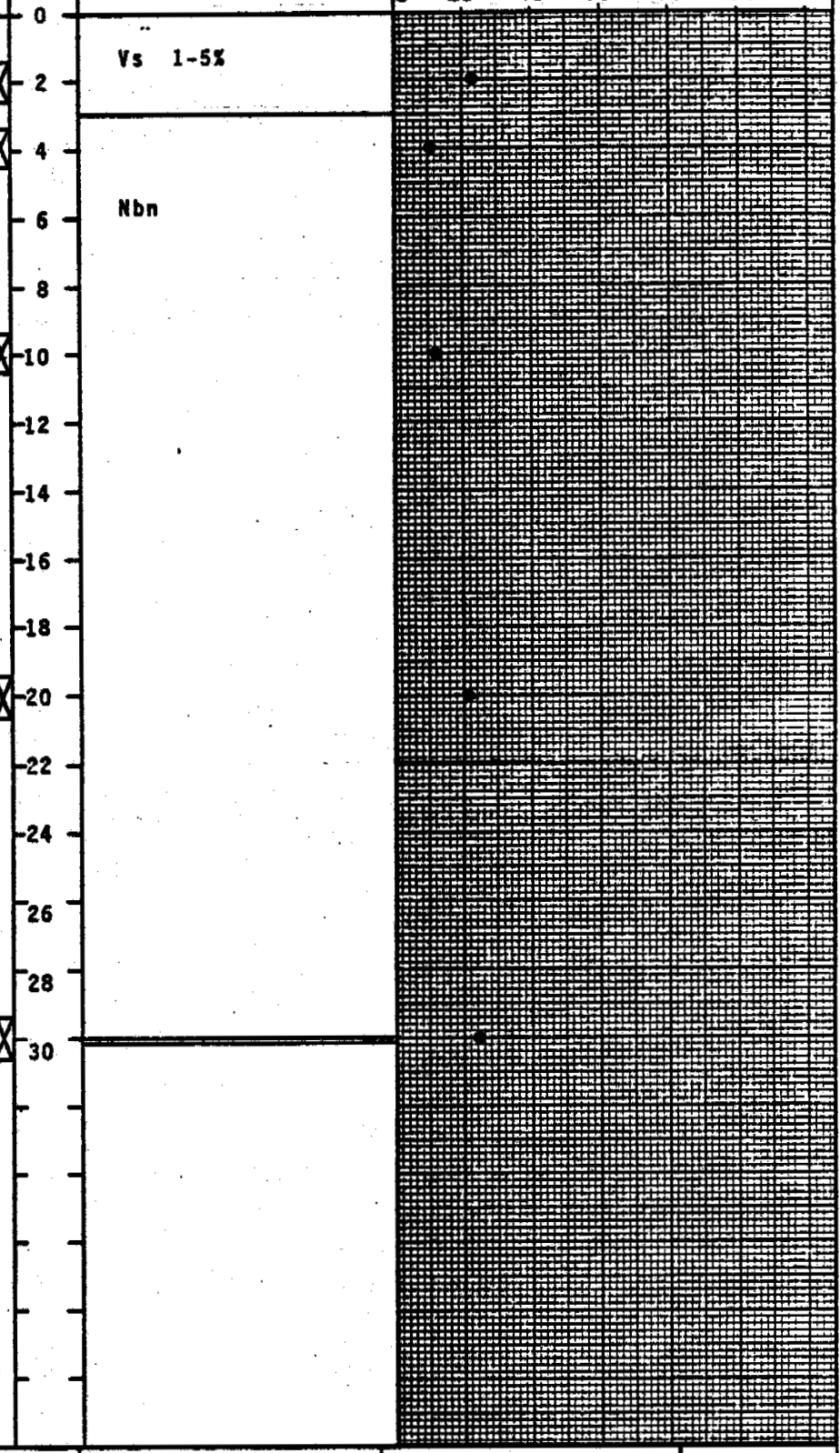
ELEVATION 25.5'
DEPTH 30'

HOLE NO.
B.H. #17
SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
PEAT - dark brown, fibrous		0	
SILT - lt. brown, some clay - organic		2	Vs 1-5%
GRAVEL - med. brown 77% Gravel - sandy 15% Sand - some silt 8% Silt - poorly graded		4	
		6	Nbn
SAND - med. brown - fine grained - some cobbles		8	
		10	
		12	
		14	
		16	
		18	
		20	
		22	
		24	
		26	
		28	
		30	
END OF HOLE			

DRY DENSITY p.c.f. X
WATER CONTENT % ●

40 60 80 100 120 140 160
0 20 40 60 80 100 120



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I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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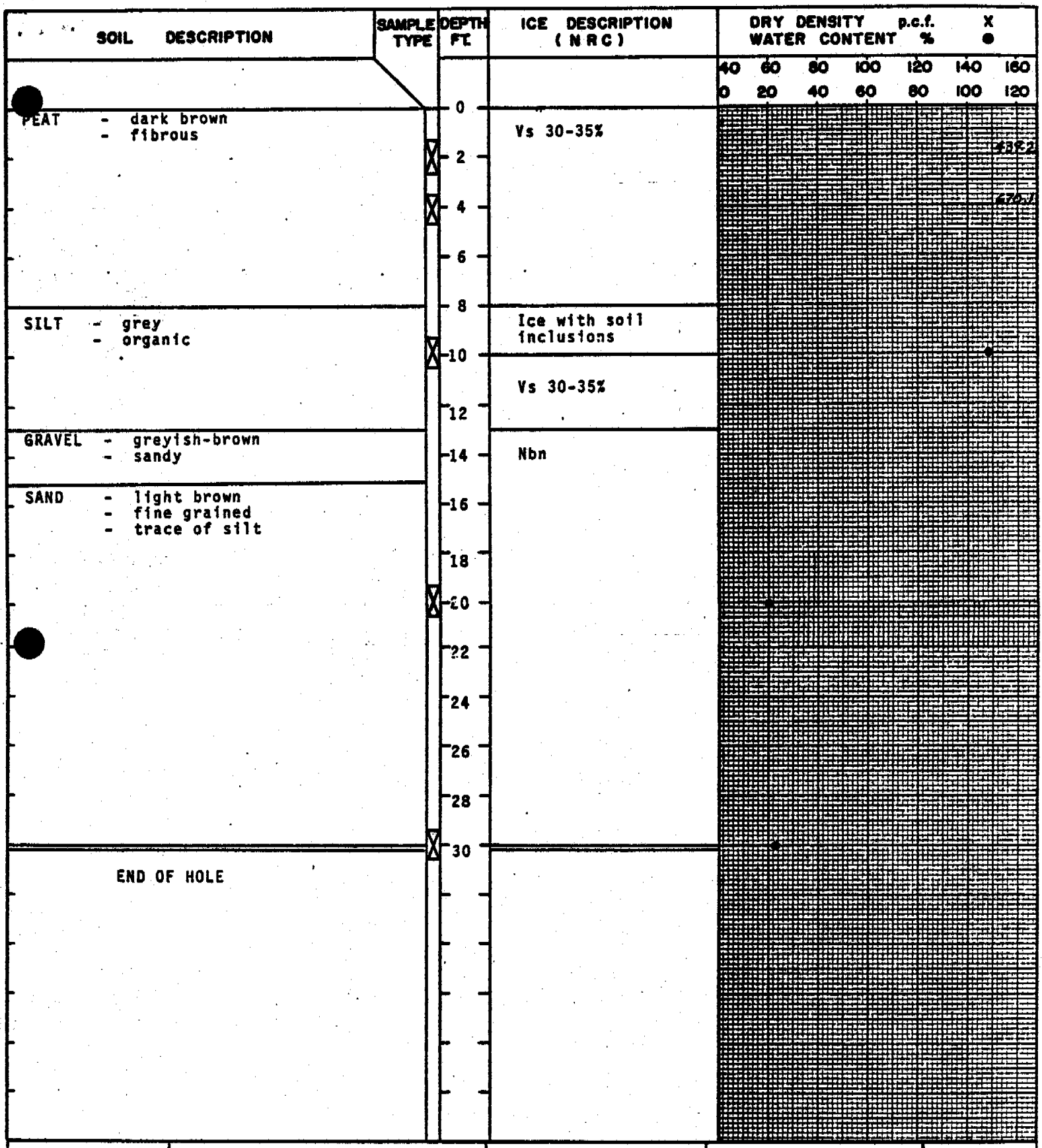
ELEVATION 30.2'
DEPTH 30'

HOLE NO.
B.H.#18
SHEET
1 of 1



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PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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ELEVATION 23.5'
DEPTH 30'

HOLE NO.
B.H.#19

SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
PEAT - lt. brown - fibrous		0 2	Vs 15-20%	63x4
		4	Vs 10-15%	2284
CLAY - grey - sandy - some silt		6 8 10 12 14		
SAND - lt. brown - fine grained - trace of silt		16 18 20 22 24 26 28	Nbn	
END OF HOLE		30		

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PROJECT
I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
LOGGED BY DY

ELEVATION 20.5'
DEPTH 30'

HOLE NO.
B.H.#20

SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
PEAT - dark brown - fibrous		0	Vs 15-20%	
		2	Ice	
SILT - dark brown - peaty		4	Ice with soil inclusions	
		6		
		8	Vs 65-70% Ice + Silt	
		10		
		12		
GRAVEL - med. brown, sandy - Cobbles		14	Nbn	
END OF HOLE				

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Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73

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ELEVATION 19.25'

DEPTH 15'

HOLE NO.
B.H.#21

SHEET
1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
PEAT - dark brown, fibrous		0	Vs 10-20%
SILT - grey, some sand		2	Vs 55-60% Ice + Silt
		4	
		6	
SILT - med. brown - sandy - some clay		8	Vs 10-15%
		10	
		12	
		14	
SAND - med. brown - fine grained - some silt		16	Nbn
		18	
		20	
		22	
		24	
		26	
		28	
		30	
END OF HOLE			

DRY DENSITY p.c.f. X
WATER CONTENT % ●

40 60 80 100 120 140 160
0 20 40 60 80 100 120

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I.O.L. Airstrip 'C'
Tuktoyaktuk, N.W.T.
E-604

DATE April 21/73
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ELEVATION 16.3'
DEPTH 30'

HOLE NO.
B.H.#23

SHEET
1 of 1

SUMMARY OF TEST RESULTS

IMPERIAL OIL LIMITED
AIRSTRIP C
TUKTOYAKTUK

JOB No. E-604

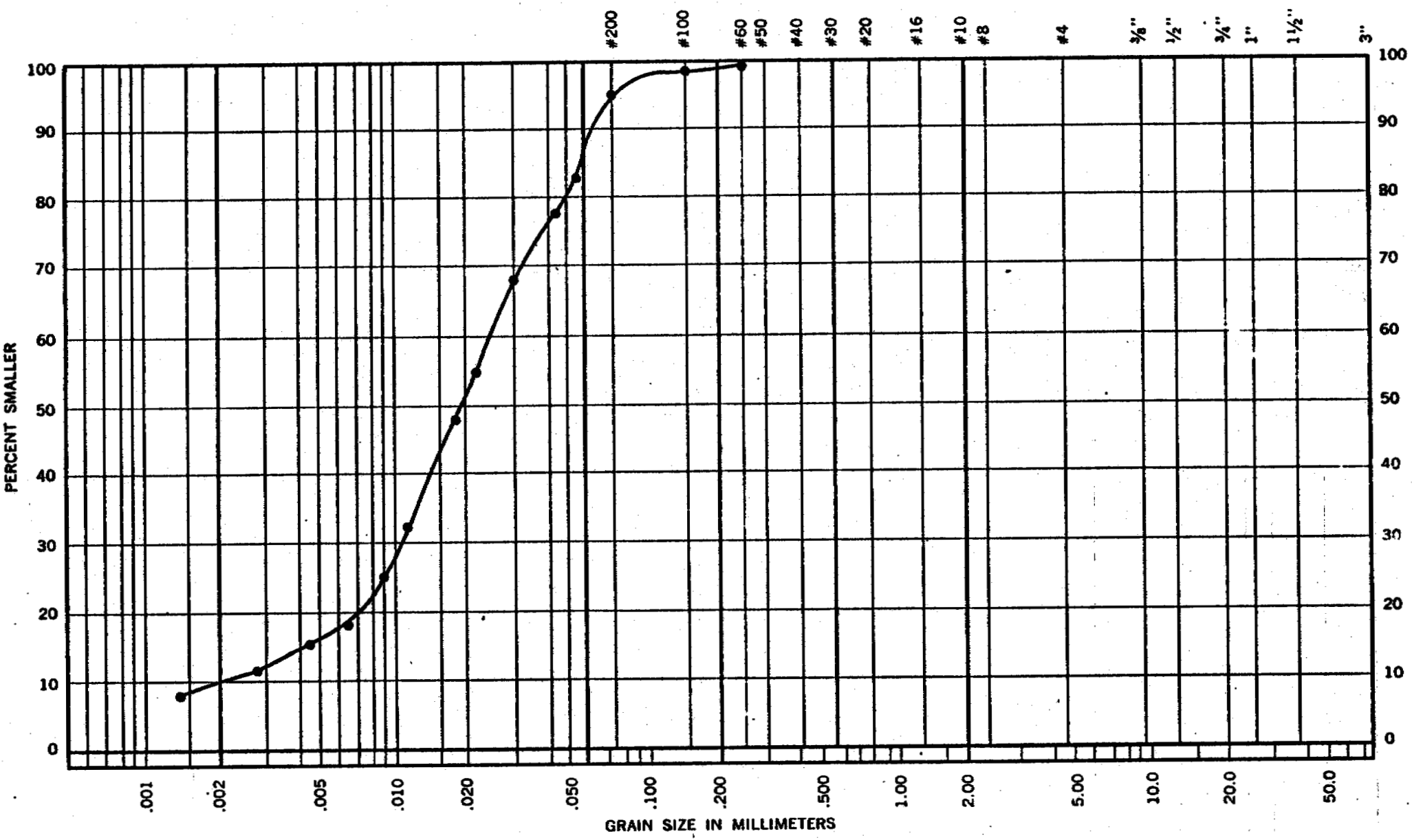
TEST HOLE	DEPTH	NATURAL WATER CONTENT	Atterberg Limits			MECHANICAL ANALYSIS (M.L.T. CLASSIFICATION)				SPECIFIC GRAVITY	ORGANIC CONTENT %	DRY DENSITY PCF	STRATA CLASSIFICATION
			W_L	W_P	PI								
	feet	%	%	%	%	% CLAY	% SILT	% SAND	%GRAVEL				
2	4	111.1				10	77	13					
3	4	12.9					5	44	51				
3A	4	28.7				8	32	48	12				
5	2	29.1				6	24	70					
5	4	5.7					5	17	78				
6	7	29.0	20.1	12.7	7.4								
8	2	16.4				5	15	47	33				
9	4	13.8					10	46	44				
10	10	56.5	50.4	20.8	29.6	45	55						
11	4	74.4	55.3	33.3	22.0								
12	4	28.2				5	16	32	47				
12	10	20.6	22.3	17.2	5.2								
16	4	71.9	17.4	12.6	4.8								
17	4	29.3	19.2	13.5	5.7								
18	4	11.4					8	15	77				
22	4	13.2				5	15	34	46				
23	2	112.9	42.4	32.9	9.5								

E. W. BROOKER & ASSOCIATES LTD.

Drwg. No. _____

GRAIN SIZE DISTRIBUTION

CLAY	SILT	SAND			GRAVEL
		FINE	MEDIUM	COARSE	



BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

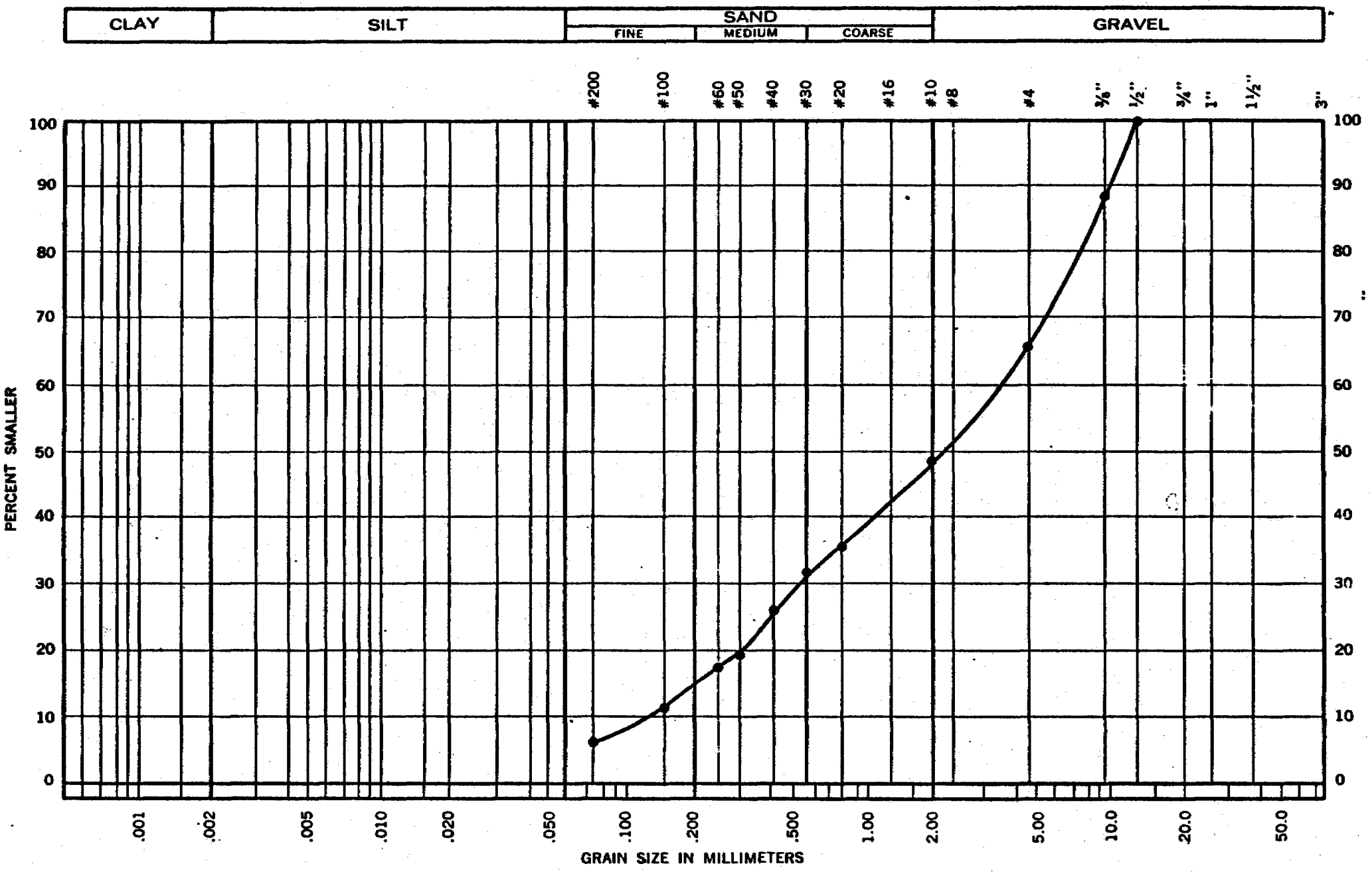
PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E-604 DATE MAY 7/73

SAMPLE No. B.H. 2

DEPTH 4'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

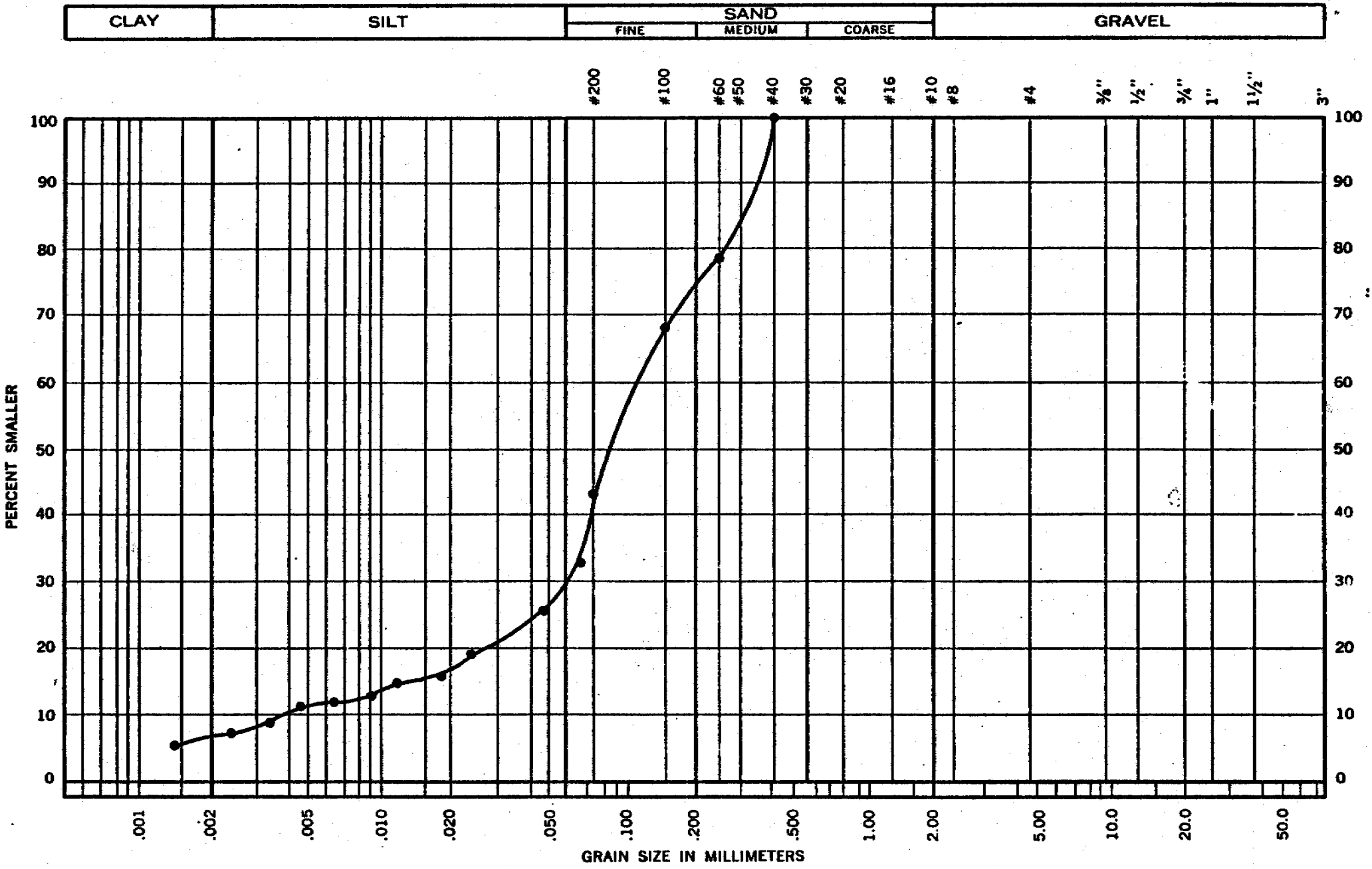
PROJECT L.O.L. AIRSTRIP 'C'

JOB No. E-604 DATE MAY 4/73

SAMPLE No. B.H. 3

DEPTH 4'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

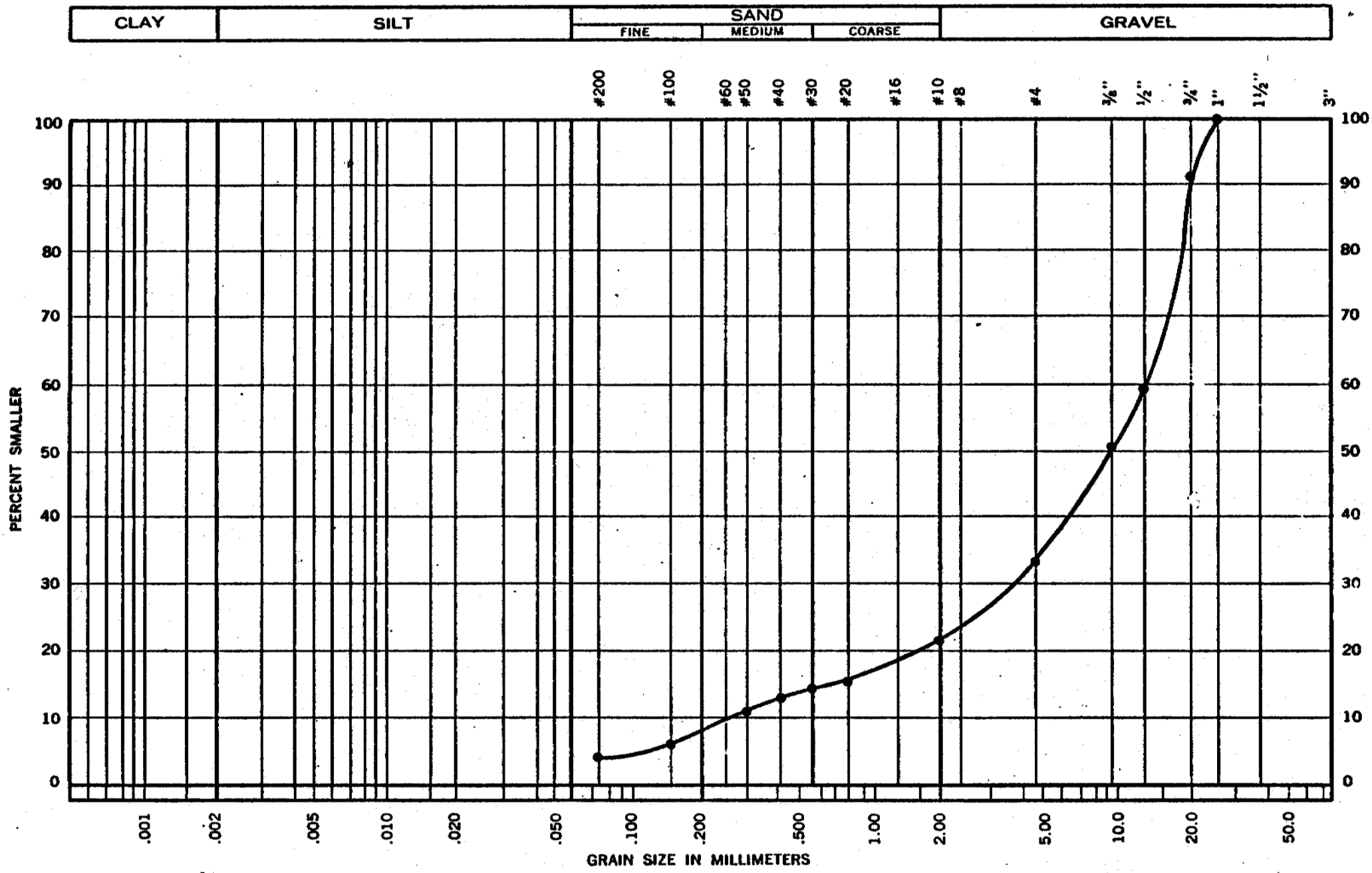
PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E604 DATE MAY 7/73

SAMPLE No. BH 5

DEPTH 2'

GRAIN SIZE DISTRIBUTION



BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

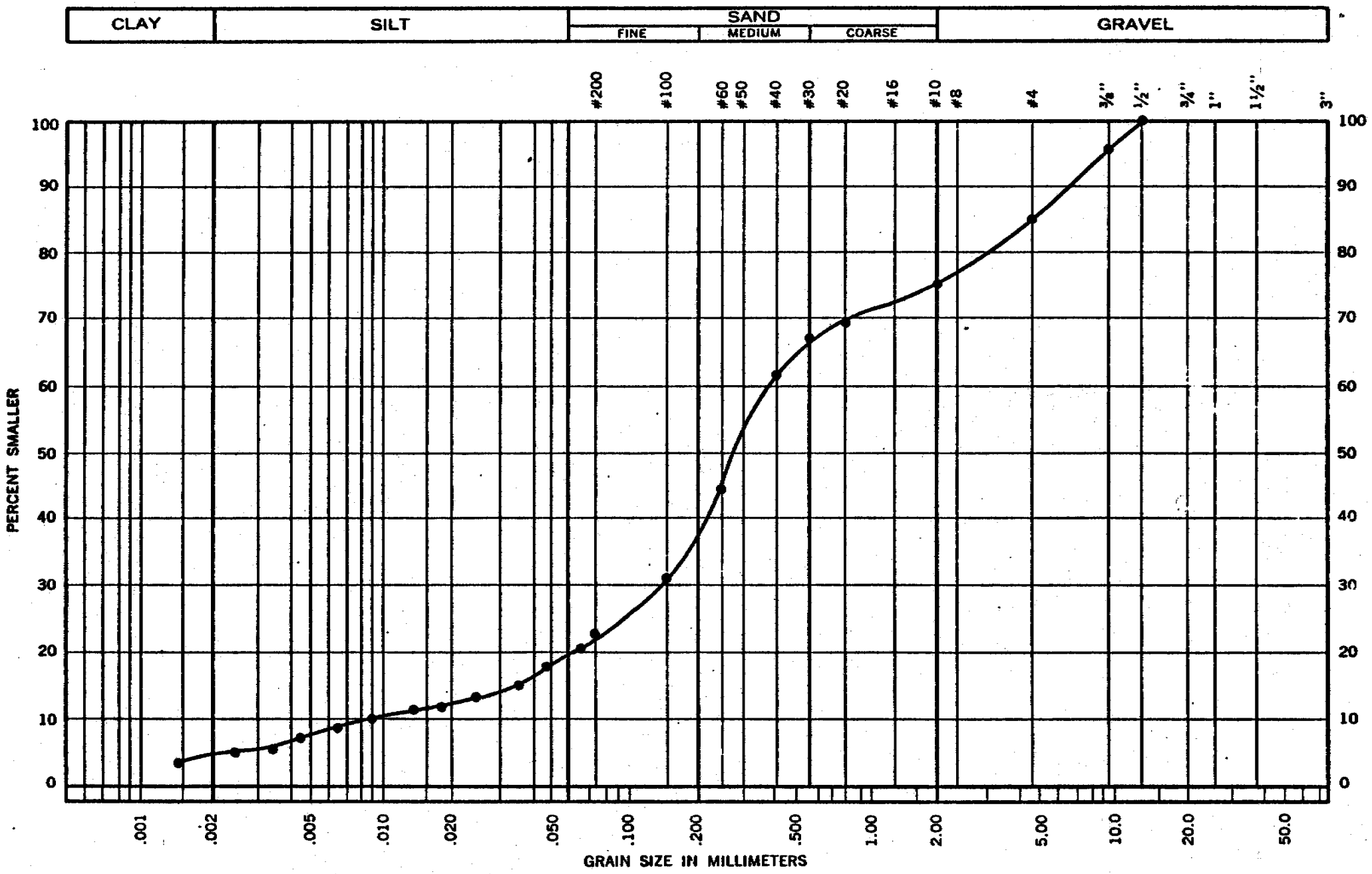
PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E 604 DATE MAY 4/73

SAMPLE No. B.H. 5

DEPTH 4'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

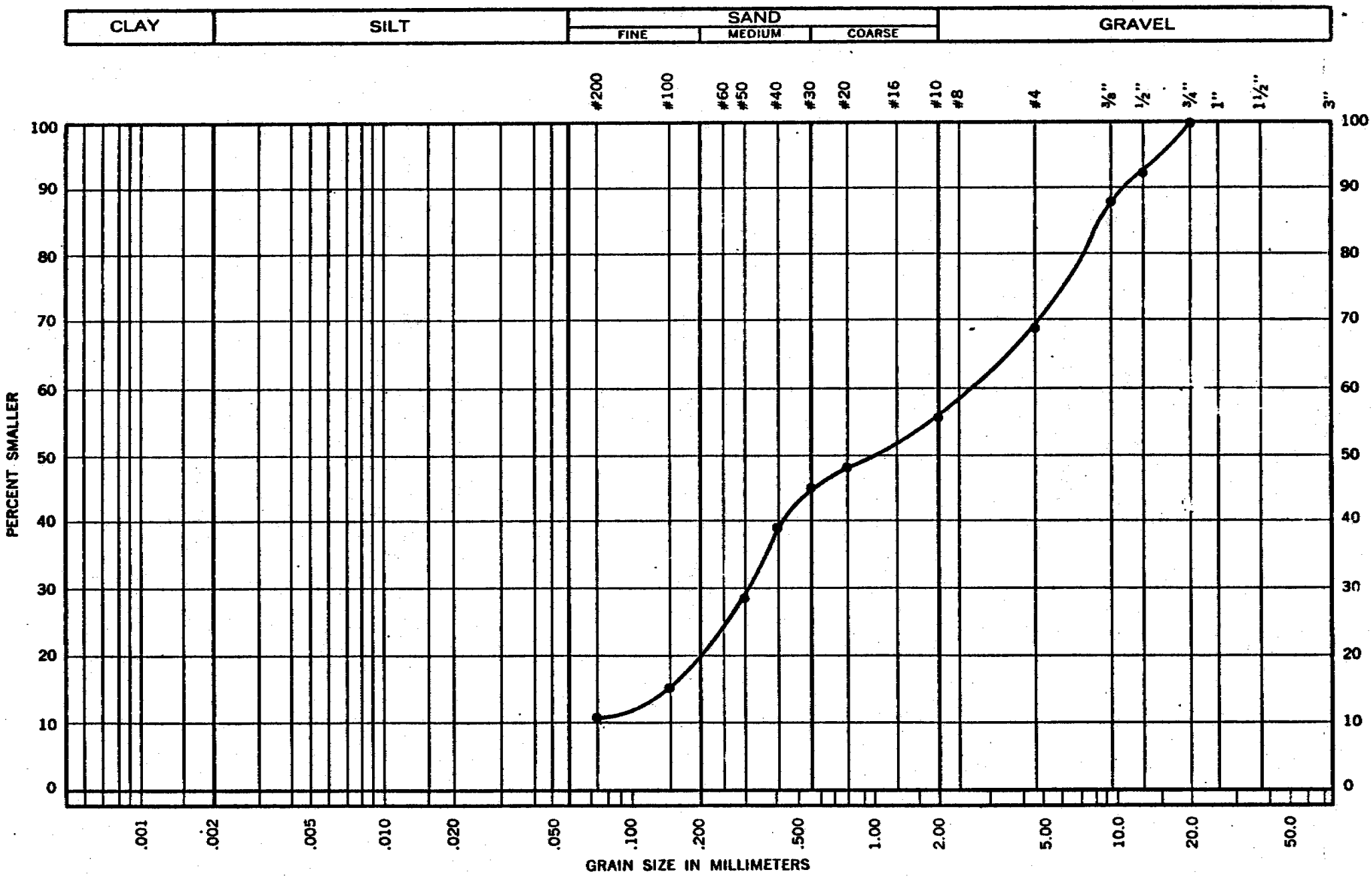
PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E-604 DATE MAY 7/13

SAMPLE No. BH 8

DEPTH 2'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

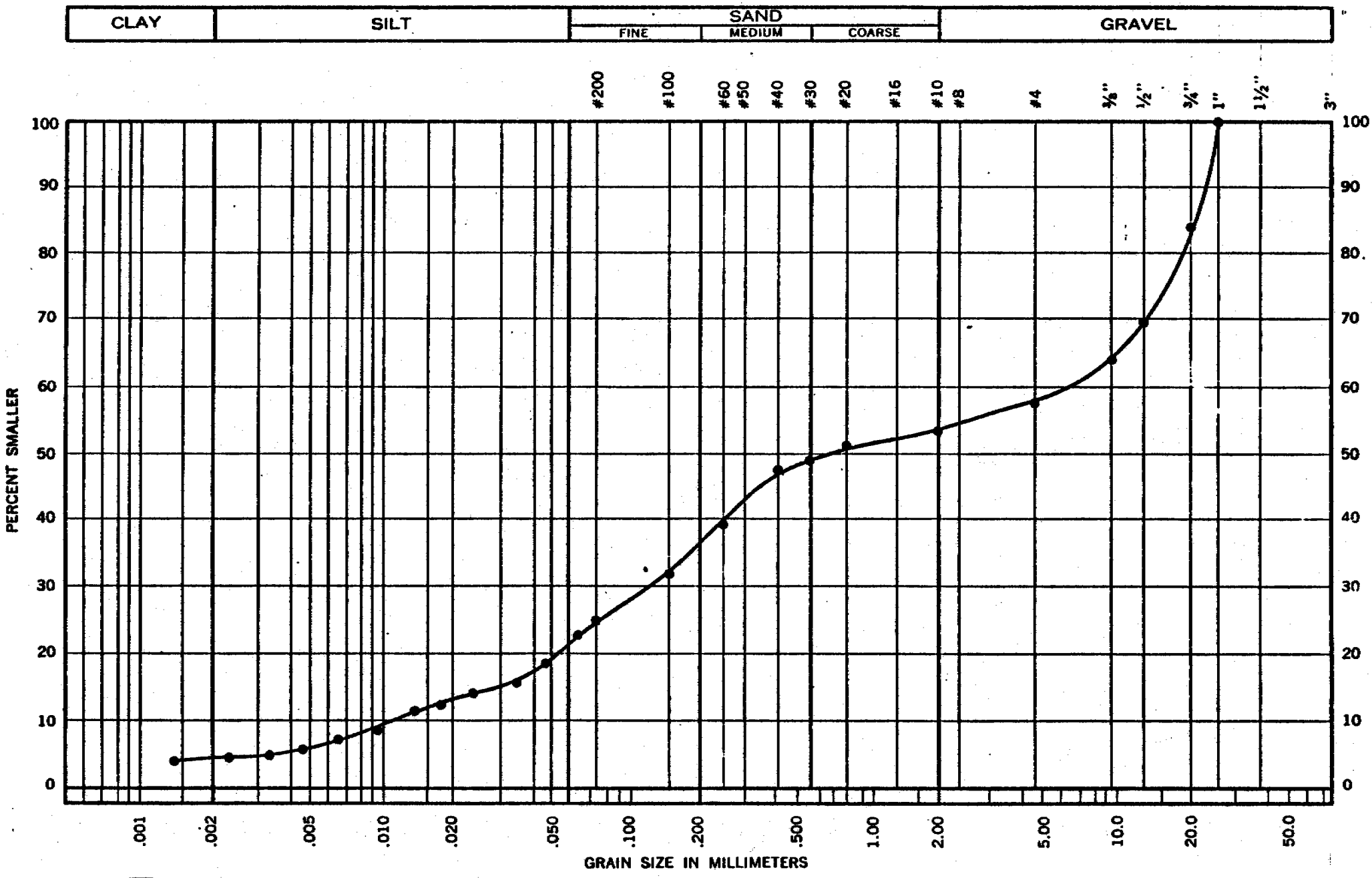
PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E-604 DATE MAY 4/73

SAMPLE No. B.H. 9

DEPTH 4'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

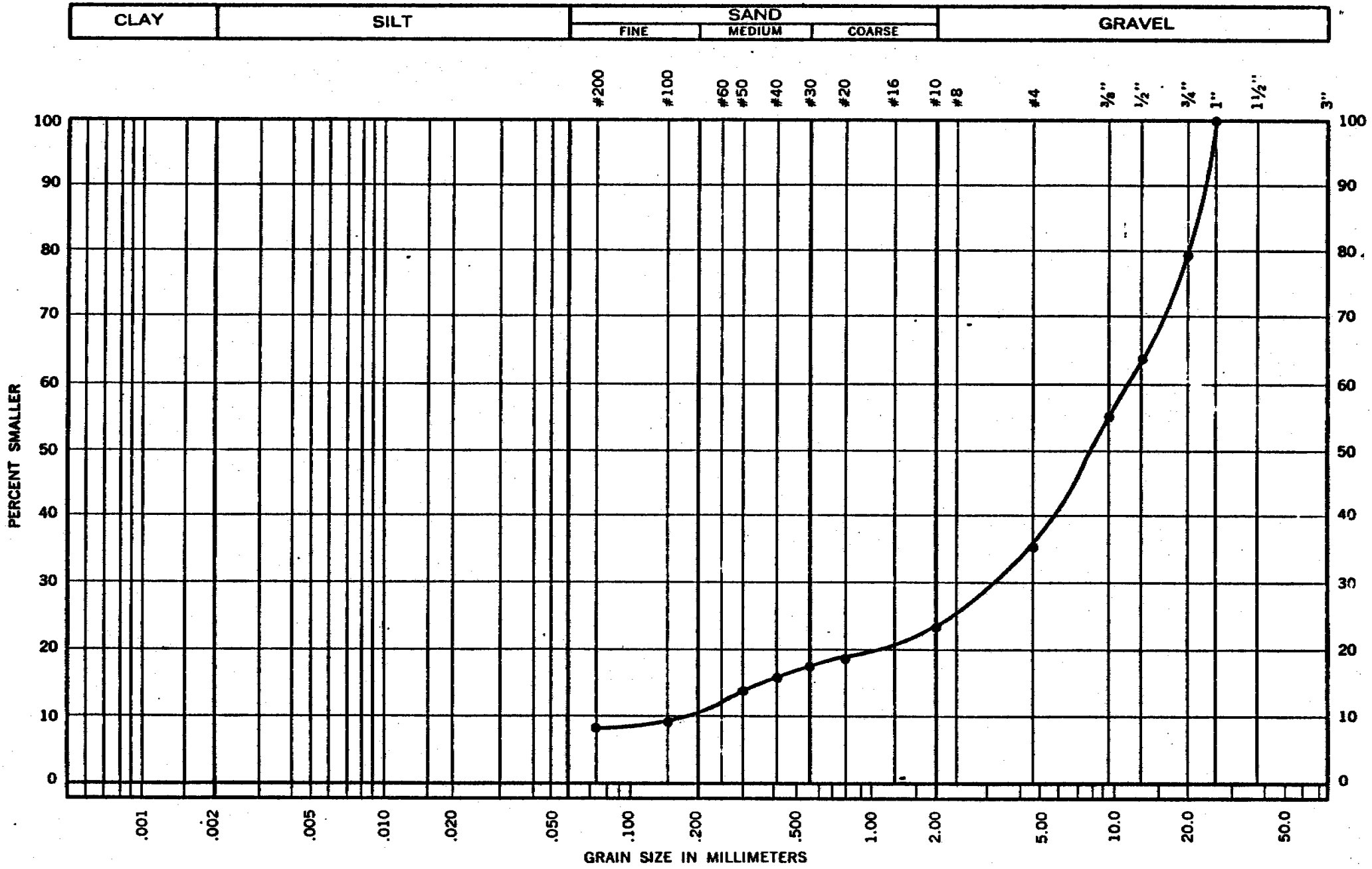
PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E-604 DATE MAY 7/73

SAMPLE No. B.H. 12

DEPTH 4'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

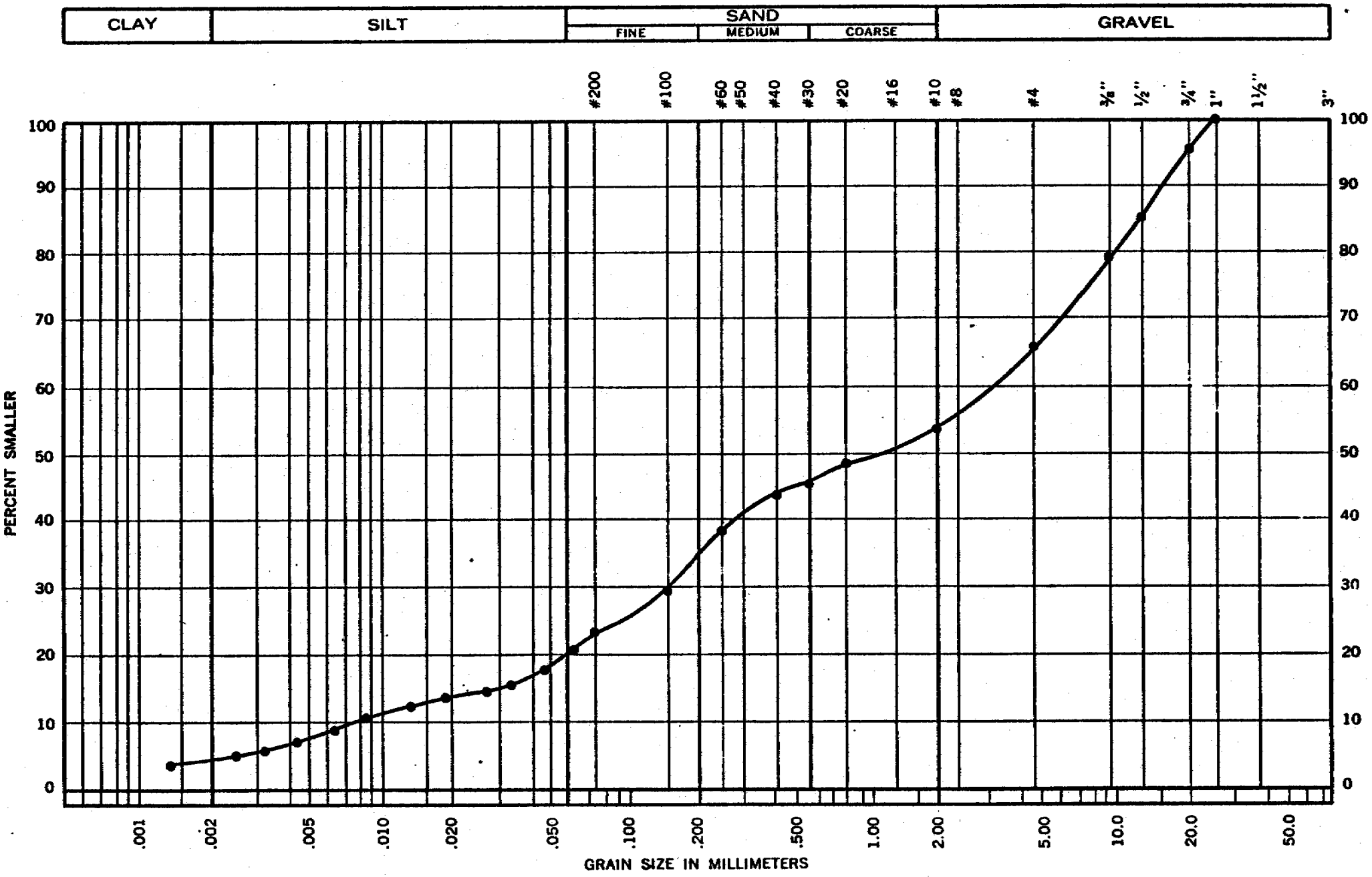
PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E 604 DATE MAY 4/73

SAMPLE No. B.H. 1B

DEPTH 4'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT I.O.L. AIRSTRIP 'C'

JOB No. E 604 DATE MAY 7/73

SAMPLE No. B.H. 22

DEPTH 4'

OFFSHORE DATA

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X / WATER CONTENT % ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
CLAY – Dark Brown – High Plasticity – Some Silt		0 – 10	Unfrozen	
SILT – Dark Brown – Some Sand		10 – 16		
END OF HOLE Ice level 7' Ice and water 30' Depth of hole from ice level 45'		16 – 40		

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I.O.L. - Tuk
Offshore Borrow Invest.
E-604

DATE April 16/73
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ELEVATION
DEPTH 15'

HOLE NO. 2

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X / ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
CLAY - Dark Brown - Silty		0 2 4 6	Unfrozen	
SILT - Dark Brown - Sandy		8 10		
SAND - Medium Brown - Fine Grained		12 14 16 18 20 22 24 26 28 30		
END OF HOLE		32		
Ice level 7' Ice and water 23' Depth of hole from ice level 55'		34 36 38 40		

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DATE April 16/73
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ELEVATION
DEPTH 32'

HOLE NO. 3

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
CLAY - Dark Brown - Silty - Trace of Gravel		0 2 4 6 8 10 12	Unfrozen	
END OF HOLE				
Ice level 7' Water and ice 27' Depth of hole from ice level 40' Rig unable to force returns up.		14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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Offshore Borrow Invest.
E-604

DATE April 16/73

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ELEVATION _____

DEPTH 13'

HOLE NO. 4

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SAND - Dark Brown - Silty - Fine Grained		0 2	Unfrozen	
- Thin Gravel Layer		4 6 8 10		
END OF HOLE		12 14 16 18 20		
ce level 7' Ice and water 25' Depth of hole from ice level 45'		22 24 26 28 30 32 34 36 38 40		

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Offshore Borrow Invest.
E-604

DATE April 17/73
LOGGED BY DY

ELEVATION
DEPTH 20'

HOLE NO. 5

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
CLAY - Medium Brown - Silty - Some Gravel		0 2 4 6 8 10	Unfrozen	40 60 80 100 120 140 160 0 20 40 60 80 100 120
END OF HOLE				
Ice level 7' Ice and water 14' Depth of hole from ice level 25' Drilling refusal		12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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Offshore Borrow Invest.
E-604

DATE April 17/73
LOGGED BY DY

ELEVATION
DEPTH 11'

HOLE NO. 6

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
CLAY - Dark Brown - High Plasticity		0 – 2 – 4 – 6	Unfrozen
SAND - Medium Brown - Fine Grained - Some Silt		8 – 10 – 12 – 14 – 16 – 18 – 20 – 22 – 24	Unfrozen
END OF HOLE			
Ice level 7' Ice and water 30' Depth of hole from ice level 55'		26 – 28 – 30 – 32 – 34 – 36 – 38 – 40	

DRY DENSITY p.c.f. X
WATER CONTENT % ●

40 60 80 100 120 140 160
0 20 40 60 80 100 120

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E-604

DATE April 16/73

LOGGED BY DY

ELEVATION

DEPTH 25'

HOLE NO. 7

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
		0		40 60 80 100 120 140 160 0 20 40 60 80 100 120
CLAY - Dark Brown - Silty		2 4 6 8 10 12 14 16 18	Unfrozen.	
- Trace of Sand				
SAND - Grey - Fine Grained - Some Silt		20 22 24		
END OF HOLE Ice level 7' Ice and water 30' Depth of hole from ice level 55'		26 28 30 32 34 36 38 40		

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ELEVATION _____

DEPTH 25'

HOLE NO. 8

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ⊙
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
CLAY - Grey - Silty		0 2 4 6 8 10 12 14 16 18	Unfrozen.	
END OF HOLE		20		
Water level 7' Ice and water 32' Depth of hole from ice level 45'		22 24 26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 20'

HOLE NO. 10

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SAND - Medium Brown - Silty - Some Clay 61% Sand 23% Silt 16% Clay		0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34	Unfrozen	
END OF HOLE				
Ice level 7' Ice and water 10' Depth of hole from ice level 45'		36 38 40		

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ELEVATION
DEPTH 35'

HOLE NO. 11

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ●
				40 60 80 100 120 140 160
				0 20 40 60 80 100 120
ICE		0	Frozen	
		2		
END OF HOLE		4		
Gravel @ 0'18"		6		
Drilling Refusal		8		
		10		
		12		
		14		
		16		
		18		
		20		
		22		
		24		
		26		
		28		
		30		
		32		
		34		
		36		
		38		
		40		

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ELEVATION

DEPTH 0'18"

HOLE NO. 13

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
GRAVEL - Sandy - Grey Clay	X	0	Nbn	
END OF HOLE Ice level 4' No water Drilling Refusal Grey Clay sluff from B.H. 10		2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
1'

DEPTH

HOLE NO. 14

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
GRAVEL - Sandy - Medium Brown		0 2	Nbn	
END OF HOLE Ice level 4' No water Drilling refusal T.H.'s 15 and 16 - frozen gravel. Surface sample taken from T.H. 16		4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 3'

HOLE NO. 16A

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X / ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
CLAY - Grey, - Silty - Some Sand		0 2 4 6 8		
SAND - Grey - Silty - Fine Grained		10 12 14		
END OF HOLE Ice level 6' Ice and water 25' Depth of hole from ice level 40'		16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 15'

HOLE NO. 17

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
GRAVEL - Medium Brown - Sandy - Well Graded		0 2 4	Unfrozen	
END OF HOLE		6		
Ice level 7' Water and ice 20' Depth of hole from ice level 26' Drilling refusal		8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 6'

HOLE NO. 18

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ⊖
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
CLAY - Grey - High Plasticity - Some Silt		0 2 4 6 8	Unfrozen	
END OF HOLE		10		
Ice level 6' Ice and water 45' Depth of hole from ice level 55'		12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 10'

HOLE NO. 19
SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SILT - Dark Brown - Sandy - Some Clay		0 2 4 6 8 10 12 14 16 18 20 22 24	Unfrozen	
END OF HOLE				
Ice level 7' Ice and water 25' Depth of hole from ice level 50'		26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 25'

HOLE NO. 20

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
CLAY - Sandy - Some Gravel		0 2 4 6 8	Unfrozen	
SAND - Grey - Silty		10 12 14 16 18		
END OF HOLE		20		
ce 7' Ice and Water 25' Depth of hole from ice level 45'		22 24 26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 20'

HOLE NO. 21

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SILT - Dark Brown - Clayey - Trace of Fine Sand		0 2 4 6 8	Unfrozen	
END OF HOLE		10		
Ice 7' Ice and water 35' Depth of hole from ice level 45'		12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 10'

HOLE NO. 32

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X / ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SILT - Dark Brown - Clayey - Some Gravel		0 2 4 6 8 10	Unfrozen	
END OF HOLE		12		
Ice 7' Ice and water 23' Depth of hole from ice level 35'		14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 12'

HOLE NO. 33

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SILT - Grey - Sandy - Trace of Clay		0 2 4 6 8 10	Unfrozen	
SAND - Dark Brown - Fine Grained - Silty		12 14 16 18 20	Unfrozen	
END OF HOLE		22		
Ice 7' Ice and water 23' Depth of hole from ice level 45'		24 26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 22'

HOLE NO. 34

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X WATER CONTENT % ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
7' Ice 58' Water		0		
		2		
		4		
		6		
No drill stem to reach bottom		8		
		10		
		12		
		14		
		16		
		18		
		20		
		22		
		24		
		26		
		28		
		30		
		32		
		34		
		36		
		38		
		40		

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ELEVATION
DEPTH N/A

HOLE NO. 35

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % X ⊕
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SAND - Medium Brown - Fine Grained - Clayey - Some Silt 44% Sand 24% Silt 32% Clay		0 2 4 6 8 10	Unfrozen	
END OF HOLE		20		
Ice 7' Ice and water 35' Depth of hole below ice level 55'		22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 20'

HOLE NO. 36

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % / X ⊕
CLAY - Medium Brown - Silty		0–2	Unfrozen	
SAND - Dark Brown - Silty - Some Gravel		2–20		
END OF HOLE		20		
e 7' Ice and water 45' Depth of hole below ice level 65'		20–40		

40 60 80 100 120 140 160
0 20 40 60 80 100 120

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ELEVATION
DEPTH 20'

HOLE NO. 37

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X WATER CONTENT % o 40 60 80 100 120 140 160 0 20 40 60 80 100 120
SAND - Dark Brown - Gravelly - Some Silt - Trace of Clay 27% Gravel 46% Sand 21% Silt 6% Clay		0 2 4 6 8 10 12 14	Unfrozen	
SAND - Medium Brown - Fine Grained - Trace of Silt 97% Sand 3% Silt		16 18 20 22 24 26		
END OF HOLE				
Ice 7' Ice and water 13' Depth of hole from ice level 40'		28 30 32 34 36 38 40		

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ELEVATION
DEPTH 25'

HOLE NO. 38

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X / ⊙)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SILT - Dark Brown - Sandy		0 2 4	Unfrozen	
SAND - Dark Brown - Silty - Some Gravel		6 8 10 12 14		
SAND - Medium Brown - Fine Grained - Some Silt		16 18 20 22		
END OF HOLE		24		
Ice 7' Water and ice 20' Depth of hole from ice level 45'		26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 25'

HOLE NO. 39

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SAND - Dark Brown - Some Gravel		0 2 4 6 8 10	Unfrozen	
CLAY - Dark Brown - High Plasticity - Sandy - Some Gravel		12 14 16 18 20 22 24 26 28 30 32 34 36 38 40	Unfrozen	
END OF HOLE Ice 7' Ice and water 33' Depth of hole from ice level 45' Rig unable to force returns beyond 45'				

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ELEVATION

DEPTH 12'

HOLE NO. 40

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X WATER CONTENT % ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SILT - Greyish-brown - Some clay		0 2 4 6 8	Unfrozen	
CLAY - Grey-brown - High Plasticity - Sandy - Some Gravel		10 12 14		
END OF HOLE Ice level 7' Ice and water 30' Depth of hole from ice level 45'		16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 15'

HOLE NO. 41

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ⊕
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SAND - Med. Brown - Fine to Medium Grained - Trace of Silt 2% Gravel 90% Sand 8% Silt		0 2 4 6 8 10 12 14 16 18 20 22 24	Unfrozen	
END OF HOLE Ice level 7' Water and ice 20' Depth of hole from ice level 45'		26 28 30 32 34 36 38 40		

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ELEVATION

DEPTH 25'

HOLE NO. 42

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
CLAY - Grey - Some Silt - High Plasticity		0 2 4 6 8	Unfrozen	
END OF HOLE Ice level 7' Water and ice 60' Depth of hole from ice level 70'		10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

40 60 80 100 120 140 160
0 20 40 60 80 100 120

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ELEVATION
DEPTH 10'

HOLE NO. 43

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
CLAY - Grey - Sandy - Some Gravel		0 2 4 6 8 10 12 14	Unfrozen	
END OF HOLE Ice level 7' Ice and water 40' Depth of hole from ice level 55'		16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 15'

HOLE NO. 44

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X / WATER CONTENT % ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SAND - Dark Brown - Silty - Some Gravel		0 2 4 6 8	Unfrozen	
SAND - Dark Brown - Some Silt - Fine Grained		10 12 14 16 18		
END OF HOLE Ice level 7' Water and Ice 23' Depth of hole from ice level 45'		20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 20'

HOLE NO. 45

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. ✕ / WATER CONTENT % ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SILT - Dark Brown - Trace of Sand		0 2 4 6 8	Unfrozen	
CLAY - Dark Brown - High Plasticity - Sandy - Some Gravel		10 12 14	Unfrozen	
SAND - Dark Brown - Silty		16 18 20 22 24		
END OF HOLE Ice Level 7' Water and Ice 30' Depth of hole from ice level 55'		26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 25'

HOLE NO. 46

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SAND - Medium Brown - Trace of Silt - Trace of Gravel 2% Gravel 91% Sand 3% Silt		0 2 4 6 8 10	Unfrozen	
SAND - Medium Brown - Trace of Gravel - Trace of Silt 4% Gravel, 88% Sand, 8% Silt		12 14	Unfrozen	
SAND - Medium Brown - Medium Grained - Trace of Silt		16 18 20 22 24 26 28 30 32 34 36		
END OF HOLE		38		
Ice Level 7' No water Depth of hole from ice level 45'		40		

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ELEVATION
DEPTH 38'

HOLE NO. 12

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
GRAVEL - Grey - Sandy - Rounded particles		0 2 4 6	Unfrozen	
SAND - Grey to Dark Brown - Fine grained 2% Gravel 98% Sand		8 10 12 14 16 18		
END OF HOLE		20		
Ice thickness 7' Water and ice 15' Depth of hole below ice level 35'		22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 20'

HOLE NO. 22

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SAND - Grey - Some silt - Gravelly - Trace of Clay 69% Gravel 15% Sand 11% Silt 5% Clay		0 2 4 6 8	Unfrozen	
    13% Silt 5% Gravel 82% Sand		10 12 14		
SAND - Dark Brown - Fine Grained - Trace of Silt		16 18 20		
END OF HOLE		22		
Ice thickness 7' Water and ice 22' Depth of hole below ice level 45'		24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 23'

HOLE NO. 23

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
GRAVEL - Grey - Sandy		0 2 4	Unfrozen	
SAND - Dark Brown - Fine to medium grained - Trace of silt		6 8 10 12 14 16 18 20 22 24 26 28 30		
END OF HOLE		32		
Ice thickness 7' Water and ice 13' Depth of hole below ice level 45'		34 36 38 40		

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ELEVATION
DEPTH 32'

HOLE NO. 24

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X / O)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
SAND - Dark Brown - Silty - Gravelly		0 2 4	Unfrozen	
SAND - Dark Brown - Fine Grained		6 8 10 12 14		
END OF HOLE		16 18 20		
Ice thickness 7' Water and ice 20' Depth of hole below ice level 40'		22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 20'

HOLE NO. 25

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SILT - Dark Brown - Some Clay - Medium Plasticity		0 2 4 6 8 10 12 14	Unfrozen	
END OF HOLE				
Ice thickness 7' Water and ice 30' Depth of hole below ice level 45' Returns to dense for rig to force up		16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 15'

HOLE NO. 26

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X / WATER CONTENT % ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SILT - Dark Brown - Some Clay - Medium Plasticity		0 2 4 6 8 10 12 14	Unfrozen	
END OF HOLE				
Ice thickness 7' Water and ice 30' Depth of hole below ice level 45'		16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 15'

HOLE NO. 27

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY ___ p.c.f. X WATER CONTENT % ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
GRAVEL - Dark Brown - Sandy - Coarse particles		0 2 4	Unfrozen	
SAND - Medium Brown - Fine to medium grained - Trace of silt		6 8 10 12 14 16 18 20 22		
END OF HOLE		24		
Ice thickness 7' Water and ice 20' Depth of hole below ice level 45'		26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH 25'

HOLE NO. 28

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. X WATER CONTENT % ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
Ice thickness 7' Ice and water depth 65' No drill stem to reach bottom		0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH N/A

HOLE NO. 29

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
7' ice 58' water No drill stem to go deeper		0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

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ELEVATION
DEPTH N/A

HOLE NO. 30

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ⊕
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SAND - Dark Brown - Silty - Some gravel		0–4	Unfrozen	
- Medium brown - Fine to medium grained		10–14	Unfrozen	
Drill stem plugged END OF HOLE 20'		18–20		
Ice thickness 7' Water and ice 23' Depth of hole below ice level 50'		20–40		

civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-6048

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 20'

HOLE NO. 31

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X / ●
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
SAND – Med. Brown – Fine to medium grained 1% gravel 94% sand 5% silt		0 2 4 6	Unfrozen	
SAND – Med. Brown – Fine to medium grained		8 10 12 14 16 18 20 22 24		
END OF HOLE 25'				
Ice thickness 7' Water and ice 10' Depth of hole below ice level 35'		26 28 30 32 34 36 38 40		

civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-604B

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 25'

HOLE NO. 47

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
SAND - Med. Brown - Silty		0 2	
GRAVEL - Dark Brown - Sandy - Coarse rounded particles		4 6 8	Unfrozen
GRAVEL - Dark Brown - Sandy - Coarse rounded particles		10 12 14 16	Unfrozen
END OF HOLE		18	
Ice thickness 7' No water Depth of hole below ice level 25' Material too dense to penetrate		20 22 24 26 28 30 32 34 36 38 40	

DRY DENSITY p.c.f. X
WATER CONTENT % O

40 60 80 100 120 140 160
0 20 40 60 80 100 120

civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-6048

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 18'

HOLE NO. 48

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. – X WATER CONTENT % – ●
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
GRAVEL – Dark Brown – Sandy – Coarse rounded particles		0 2 4 6 8	Unfrozen	
SAND – Med. Brown – Trace of Silt – Fine Grained		10 12 14 16 18	Unfrozen	
END OF HOLE 20'		20		
Ice thickness 5' No water Depth of hole below ice level 25'		22 24 26 28 30 32 34 36 38 40		

EGA civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-6048

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 20'

HOLE NO. 49

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 / 0 20 40 60 80 100 120
GRAVEL - Med. Brown - Coarse	X	0	Nbn	
END OF HOLE		2		
Ice thickness 4'		4		
No water		6		
Depth of hole below ice level 5'		8		
Drilling refusal		10		
		12		
		14		
		16		
		18		
		20		
		22		
		24		
		26		
		28		
		30		
		32		
		34		
		36		
		38		
		40		

eca civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-6048

DATE April 20/73

LOGGED BY DY

ELEVATION

DEPTH 1'

HOLE NO. 50

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % — X ⊙
				40 60 80 100 120 140 150 / 0 20 40 60 80 100 120
GRAVEL - Dark Brown - Sandy - Some Silt 78% Gravel 11% Sand 6% Silt 5% Clay		0 2 4 6 8	Unfrozen	
- Dark Brown - Sandy - Some Silt		10 12 14	Unfrozen	
SAND - Dark Brown - Fine Grained		16 18 20		
- Dark Brown - Fine grained		22 24		
END OF HOLE				
Ice Thickness 7' Ice and water depth 10' Depth of hole below ice level 35'		26 28 30 32 34 36 38 40		

eda civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-6048

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 15'

HOLE NO. 61
SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
GRAVEL - Coarse - Well graded - Some sand - Rounded particles		0 2 4 6 8 10	Unfrozen	
SAND - Med. Brown - Fine grained		12 14 16 18 20	Unfrozen	
SAND - Med. Brown - Fine grained		22	Unfrozen	
END OF HOLE		24	Nbn	
Ice thickness 7' Ice and water depth 10' Depth of hole below ice level 35'		26 28 30 32 34 36 38 40		

civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-604B

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 25'

HOLE NO. 62

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)
CLAY - Black - Organic		0 2	VS 35-40%
SAND - Med. Brown - Silty - Some Gravel		4 6	Nbn
SAND - Med. Brown - Fine Grained		8 10	Unfrozen
END OF HOLE Ice thickness 5' No water Depth of hole below ice level 15'		12 14 16 18 20 22 24 26 28 30 32 34 36 38 40	

DRY DENSITY p.c.f. X
WATER CONTENT % ⊕

40 60 80 100 120 140 160
0 20 40 60 80 100 120

civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-604B

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 10'

HOLE NO. 64

SHEET 1 of 1

SOIL DESCRIPTION	SAMPLE TYPE	DEPTH FT.	ICE DESCRIPTION (NRC)	DRY DENSITY p.c.f. / WATER CONTENT % (X ●)
				40 60 80 100 120 140 160 0 20 40 60 80 100 120
GRAVEL - Dark Brown - Sandy - Silty		0 2 4	Nbn	
End of Hole		6 8		
Ice thickness 7' No water Depth of hole below ice level 15'		10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40		

eoa civil engineers

PROJECT
N.W.T. - Tuk
Offshore Borrow Invest.
E-6048

DATE April 19/73
LOGGED BY DY

ELEVATION
DEPTH 8'

HOLE NO. 65

SHEET 1 of 1

SUMMARY OF TEST RESULTS

IMPERIAL OIL LIMITED
OFFSHORE BORROW INVESTIGATION
TUKTOYAKTUK

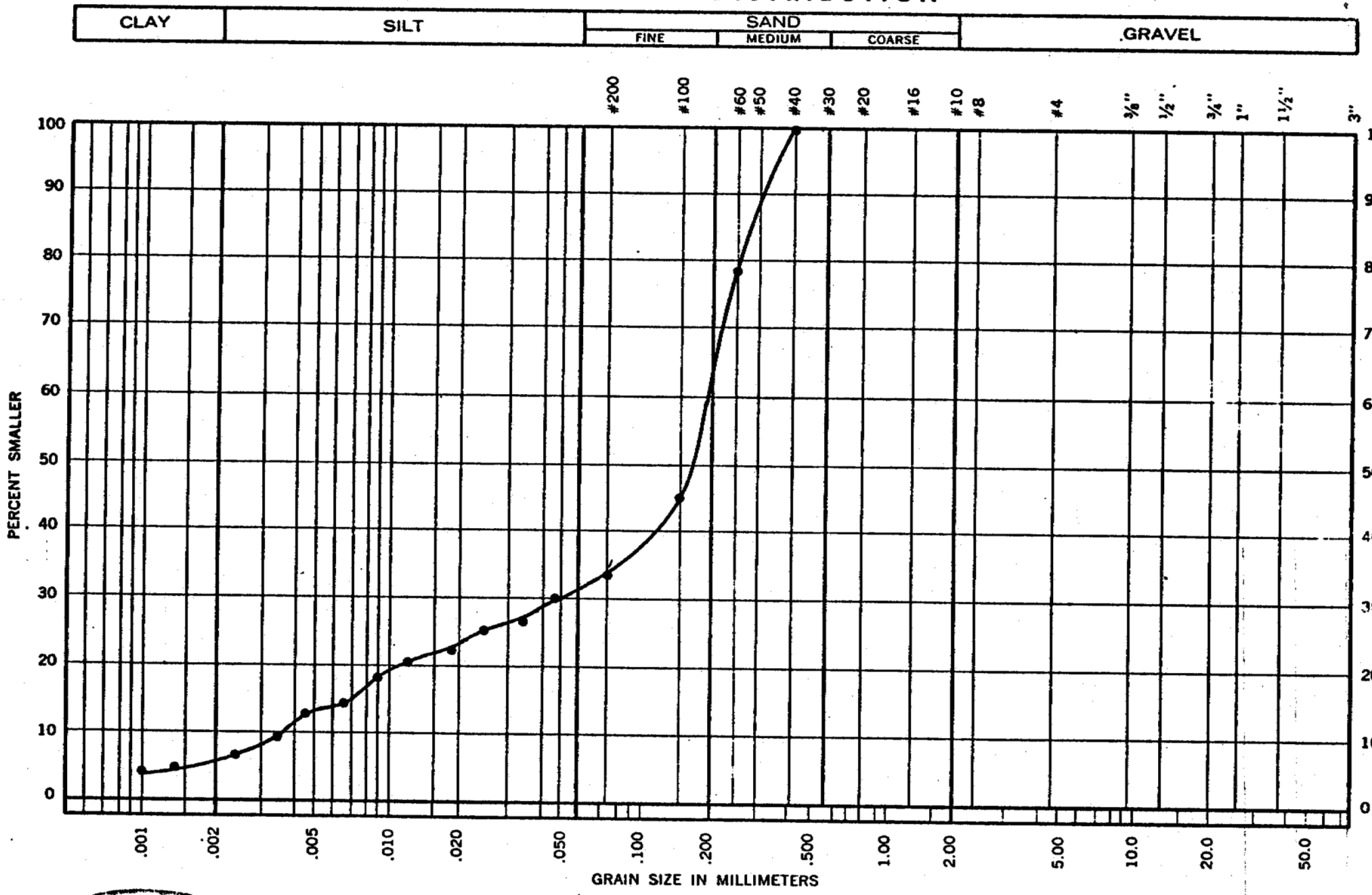
JOB No. E-604

TEST HOLE	DEPTH	NATURAL WATER CONTENT	Atterberg Limits			MECHANICAL ANALYSIS (M.L.T. CLASSIFICATION)				SPECIFIC GRAVITY	ORGANIC CONTENT %	DRY DENSITY PCF	STRATA CLASSIFICATION
			W_L	W_P	PI								
	feet	%	%	%	%	% CLAY	% SILT	% SAND	%GRAVEL				
22	1 - 5	SAMPLE GIVEN TO IMPERIAL OIL LIMITED											
22	10 - 15							98	2				
23	1 - 5					5	11	15	69				
23	10 - 15						13	82	5				
47	1 - 5						5	94	1				
61	1 - 5					5	6	11	78				
9	1 - 5					6	27	67					
11	1 - 5					16	23	61					
12	1 - 5						3	91	2				
12	10 - 15						8	88	4				
36	1 - 5					32	24	44					
38	1 - 5					6	21	46	27				
38	15 - 20						3	97					
42	1 - 5						8	90	2				

E. W. BROOKER & ASSOCIATES LTD.

Drwg. No. _____

GRAIN SIZE DISTRIBUTION



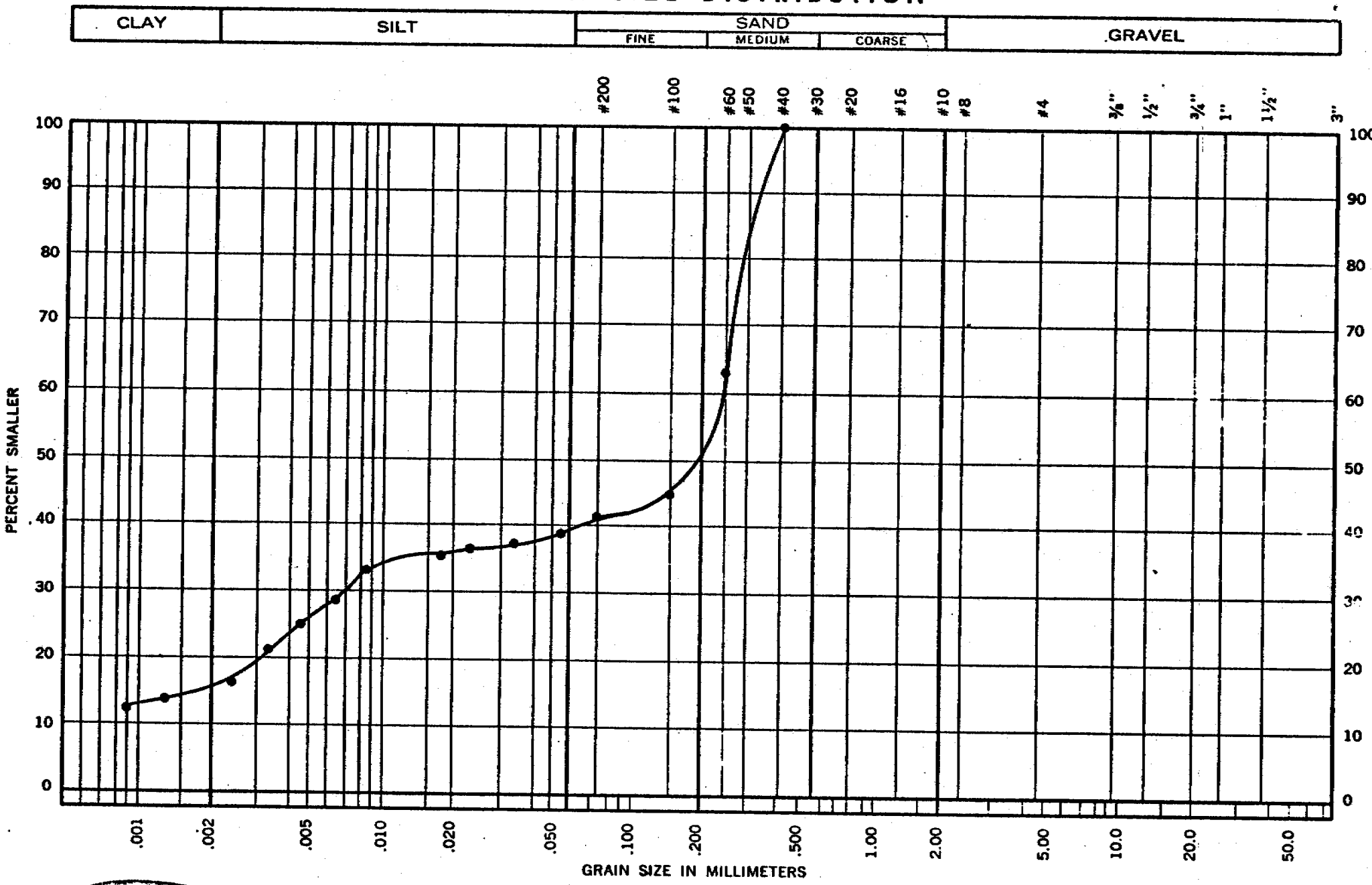
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT I.O.L. OFFSHORE BORROW
JOB No. E-604 DATE MAY 14/73
SAMPLE No. B.H. 9
DEPTH 1'-5'

GRAIN SIZE DISTRIBUTION



FIGURE

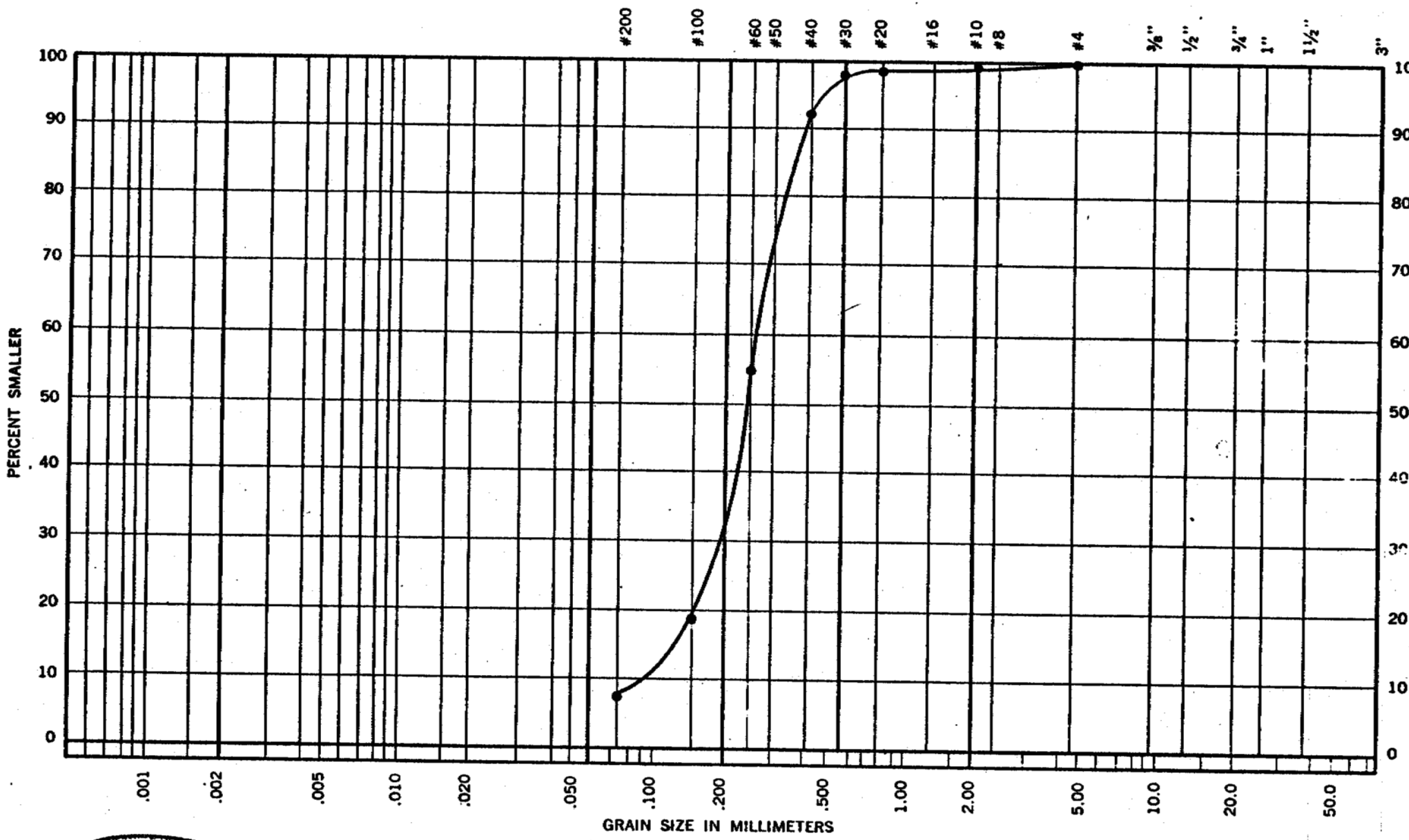
BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT I.O.L. OFFSHORE BORROW
JOB No. E-604 DATE MAY 14/73
SAMPLE No. B.H. 11
DEPTH 1'-5'

GRAIN SIZE DISTRIBUTION

CLAY	SILT	SAND			GRAVEL
		FINE	MEDIUM	COARSE	



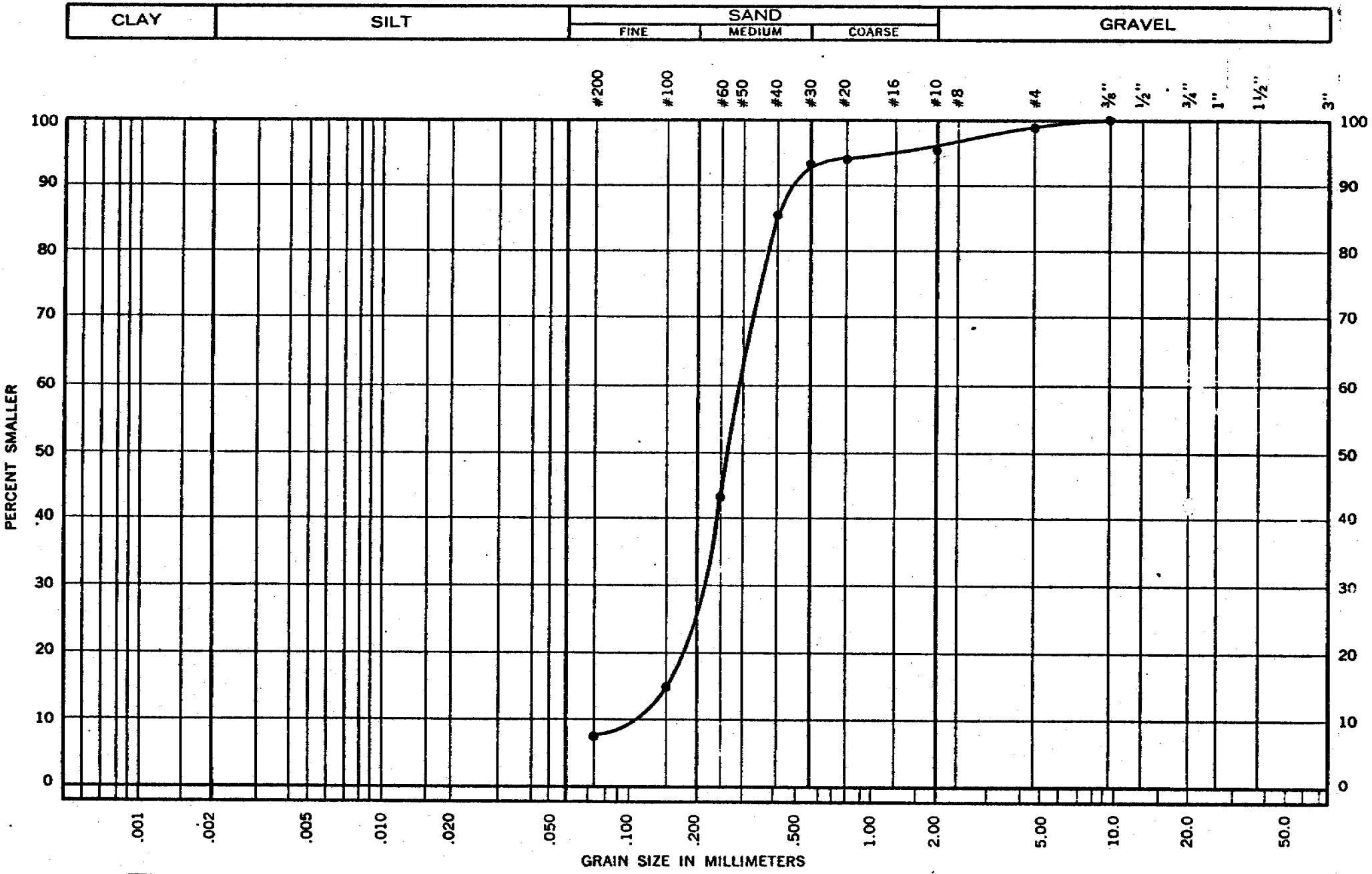
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT I.O.L. OFFSHORE BORROW
JOB No. E-604 DATE MAY 11/73
SAMPLE No. B.H. 12
DEPTH 1'-5'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

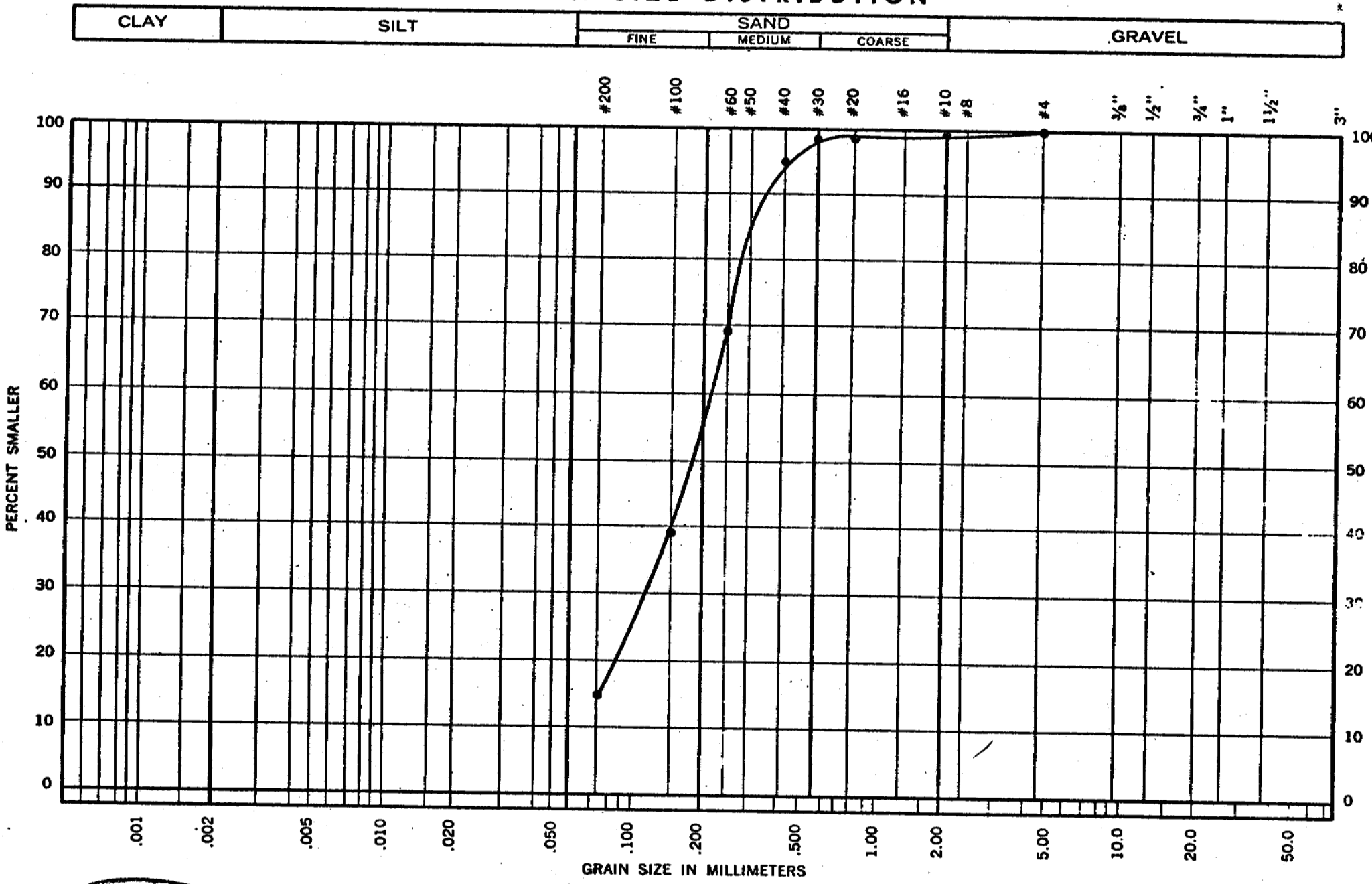
PROJECT I.O.L. OFFSHORE BORROW

JOB No. E-604 DATE MAY 10, 1973

SAMPLE No. B.H. 12

DEPTH 10'-15'

GRAIN SIZE DISTRIBUTION



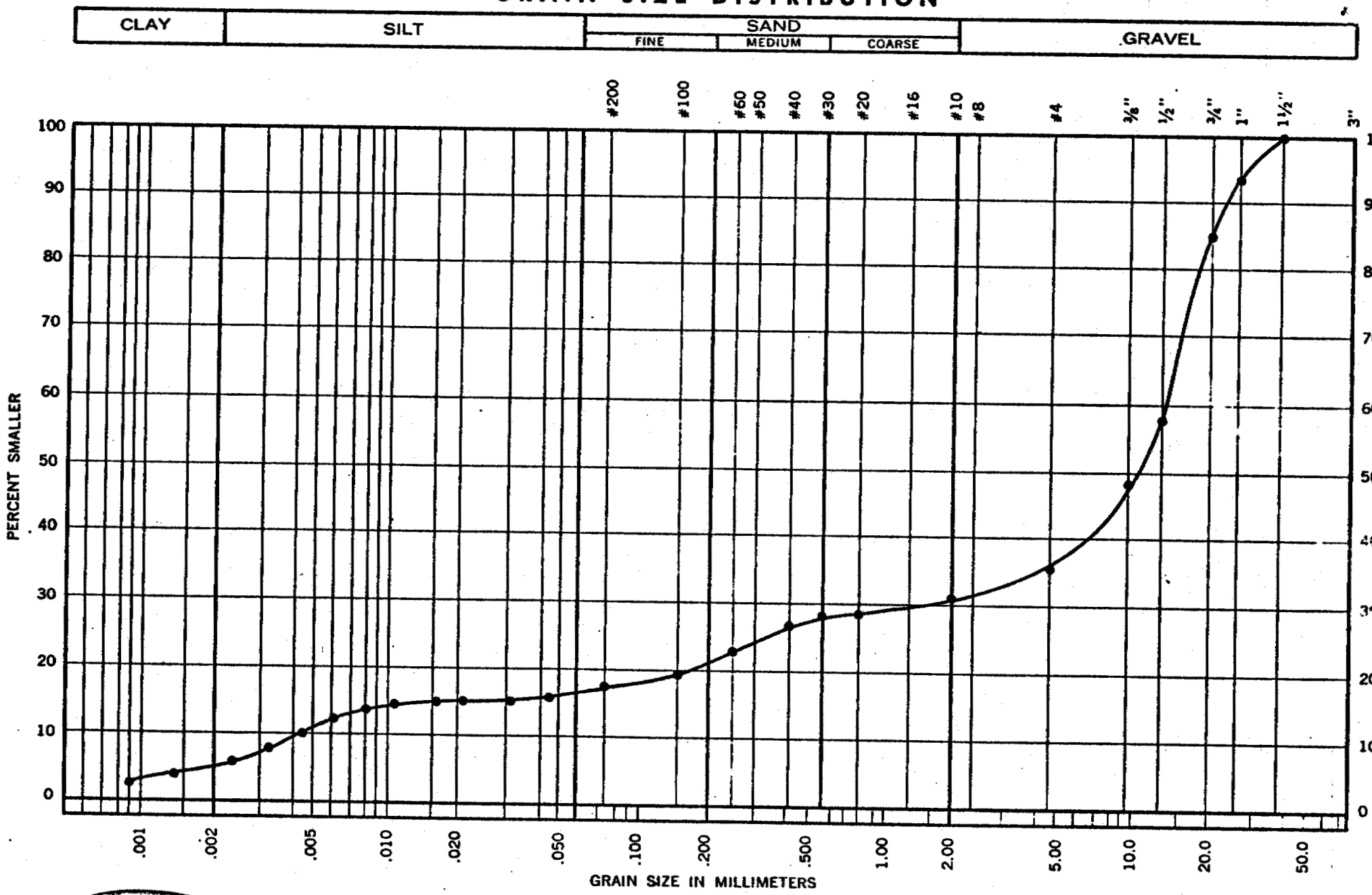
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT N.W.T. OFFSHORE BORROW
JOB No. E-604B DATE MAY 11/73
SAMPLE No. B.H. 22
DEPTH 10'-15'

GRAIN SIZE DISTRIBUTION



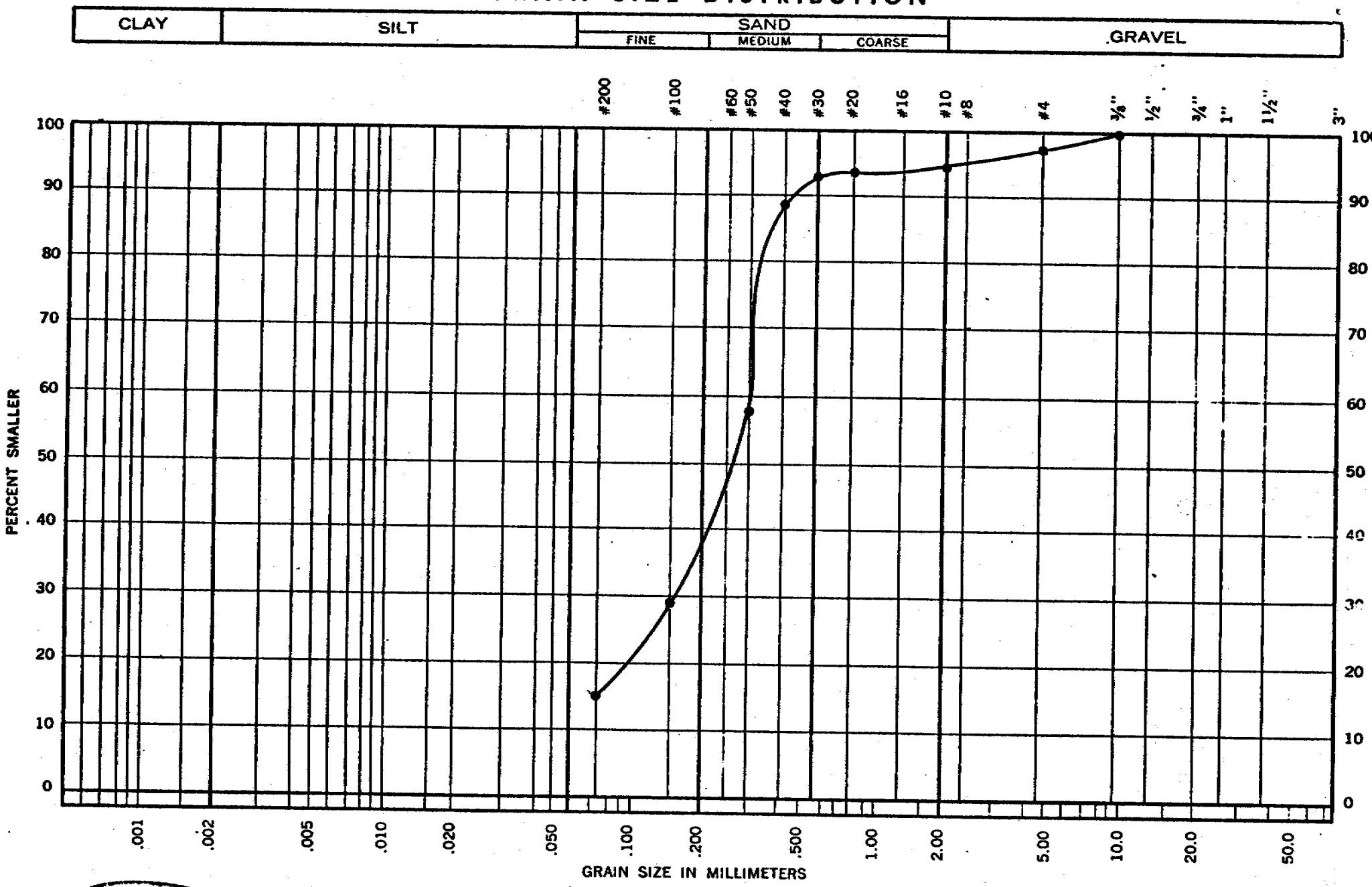
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT N.W.T. OFFSHORE BORROW
JOB No. E-604B DATE MAY 14/73
SAMPLE No. BH 23
DEPTH 1'-5'

GRAIN SIZE DISTRIBUTION



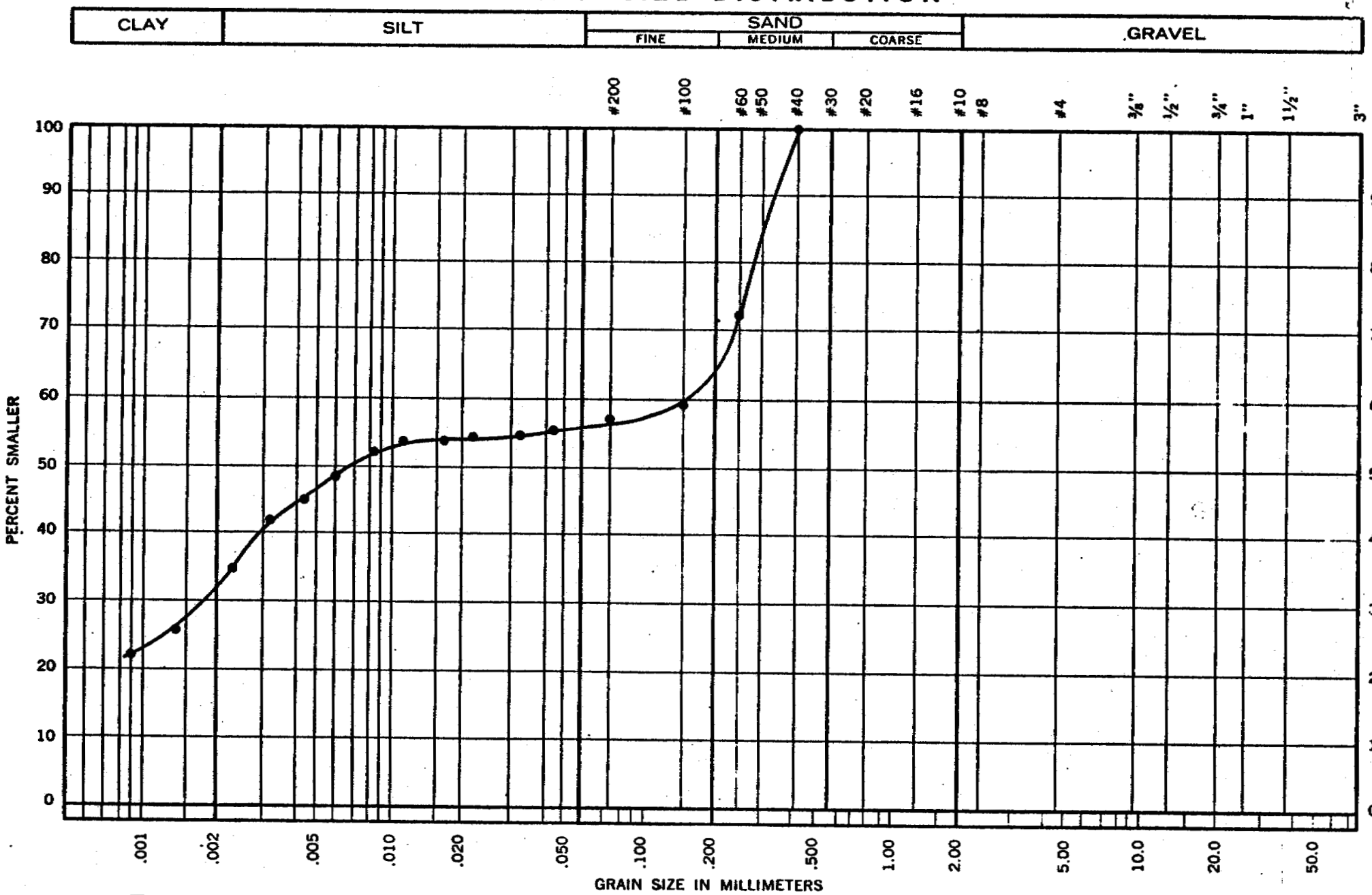
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT N.W.T. OFFSHORE BORROW
JOB No. E-604B DATE MAY 11/73
SAMPLE No. B.H. 23
DEPTH 10'-15'

GRAIN SIZE DISTRIBUTION



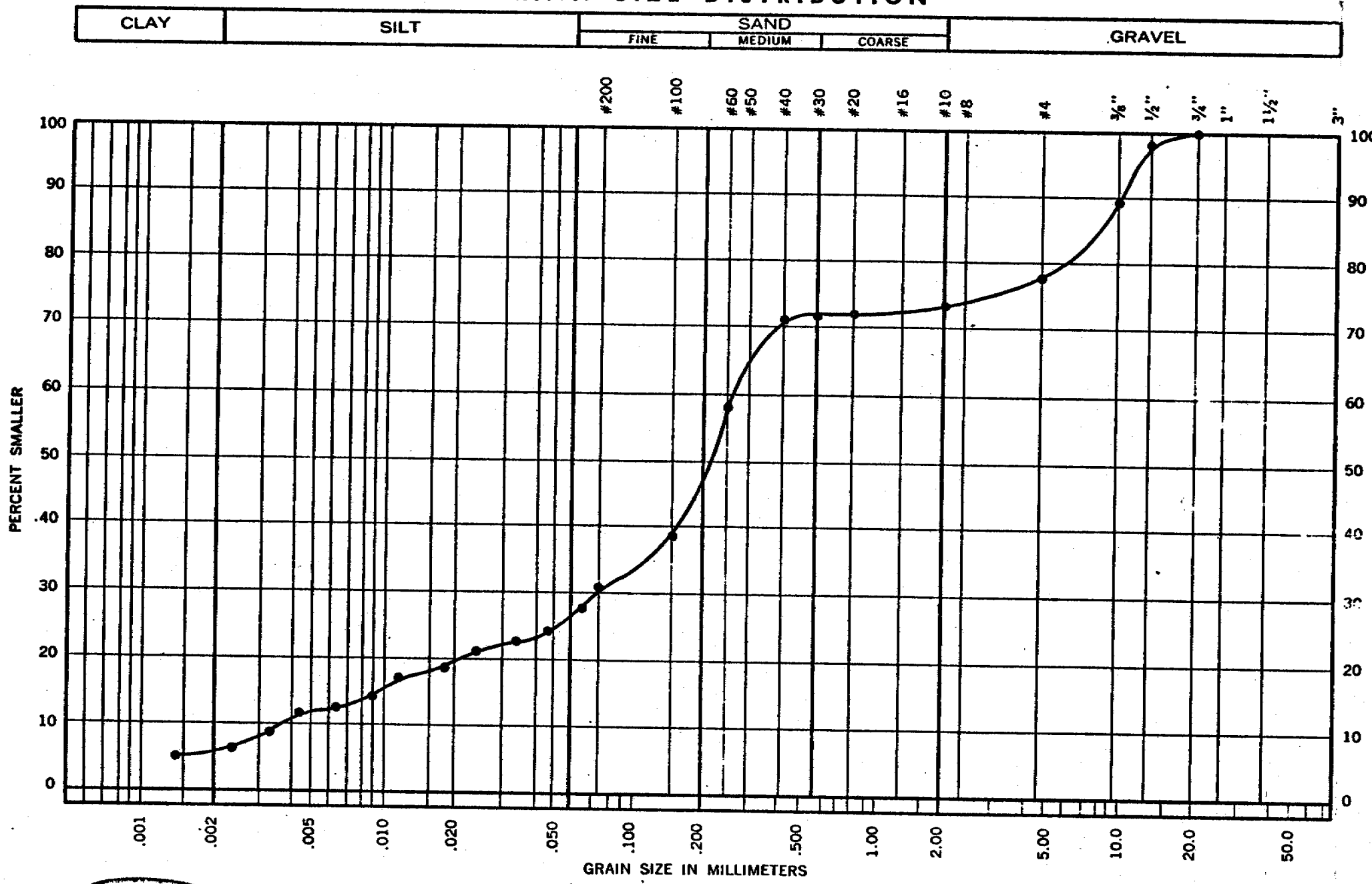
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT N.W.T. OFFSHORE BORROW
JOB No. E-604B DATE MAY 14/73
SAMPLE No. B.H. 36
DEPTH 1'-5'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

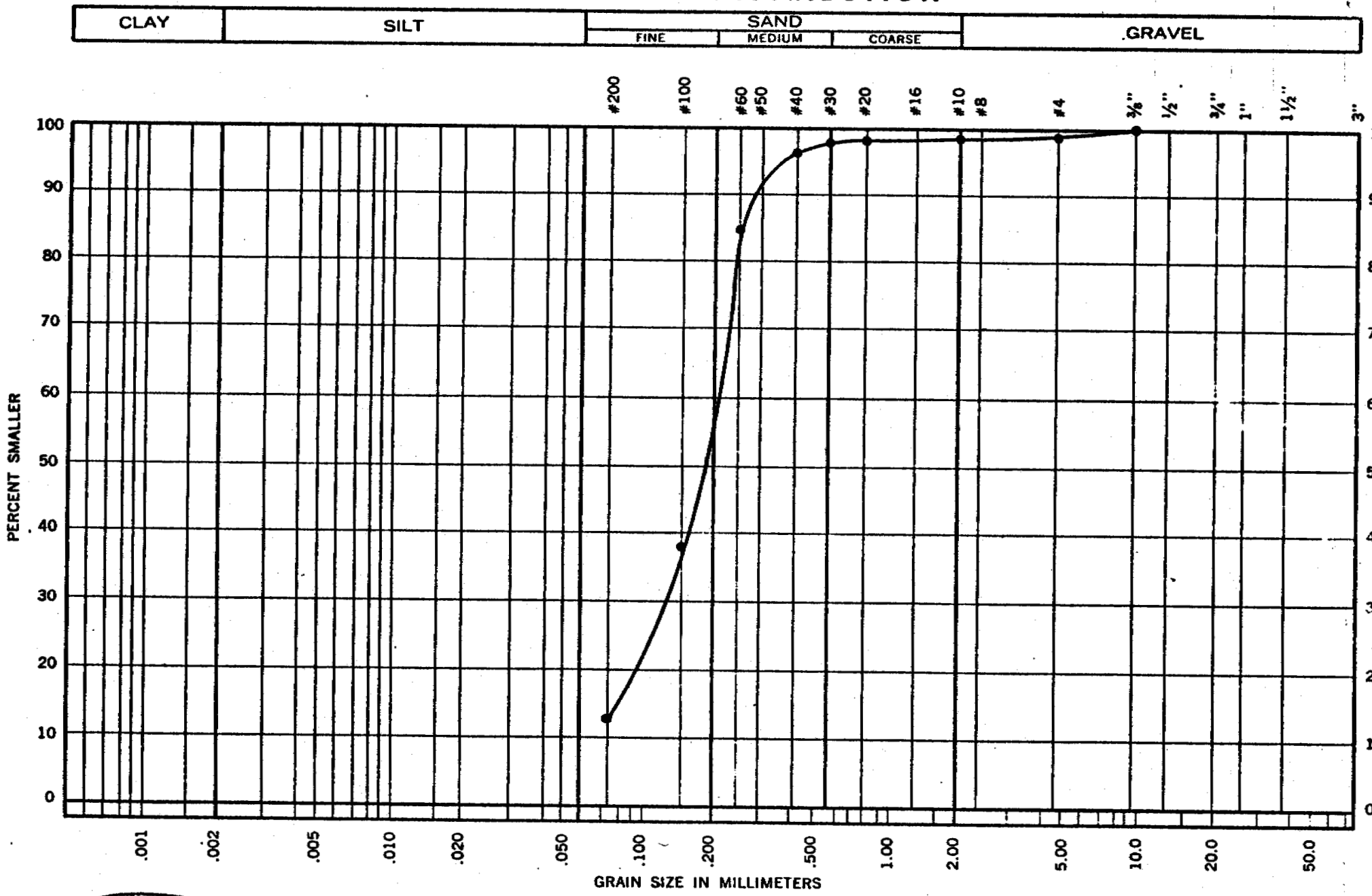
SAMPLE DESCRIPTION _____

PROJECT I.O.L. OFFSHORE BORROW

JOB No. E-604 DATE MAY 14/73

SAMPLE No. B.H. 38

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

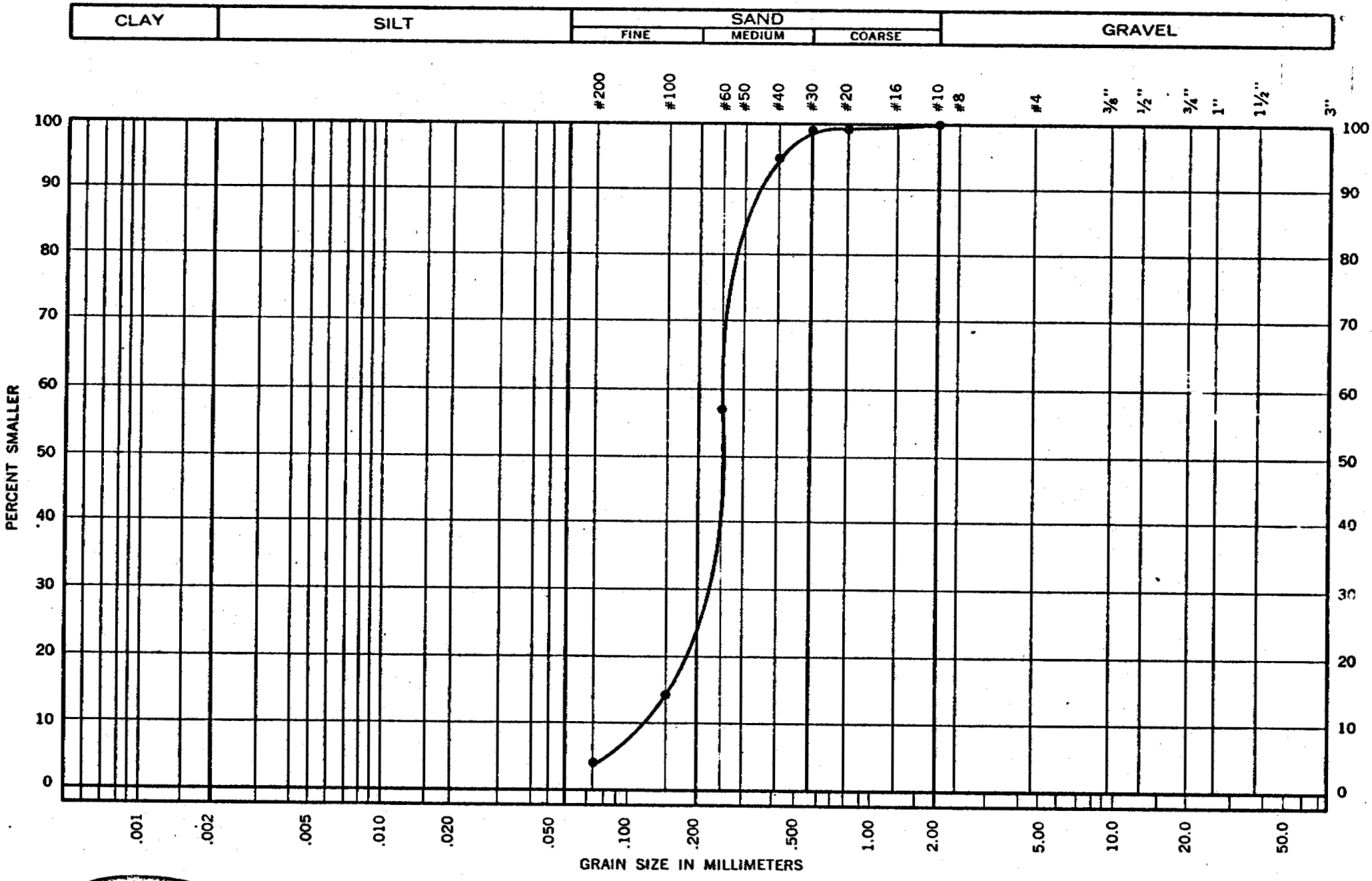
PROJECT I.O.L. OFFSHORE BORROW

JOB No. E-604 DATE MAY 11 '73

SAMPLE No. B.H. 42

DEPTH 1'-5'

GRAIN SIZE DISTRIBUTION



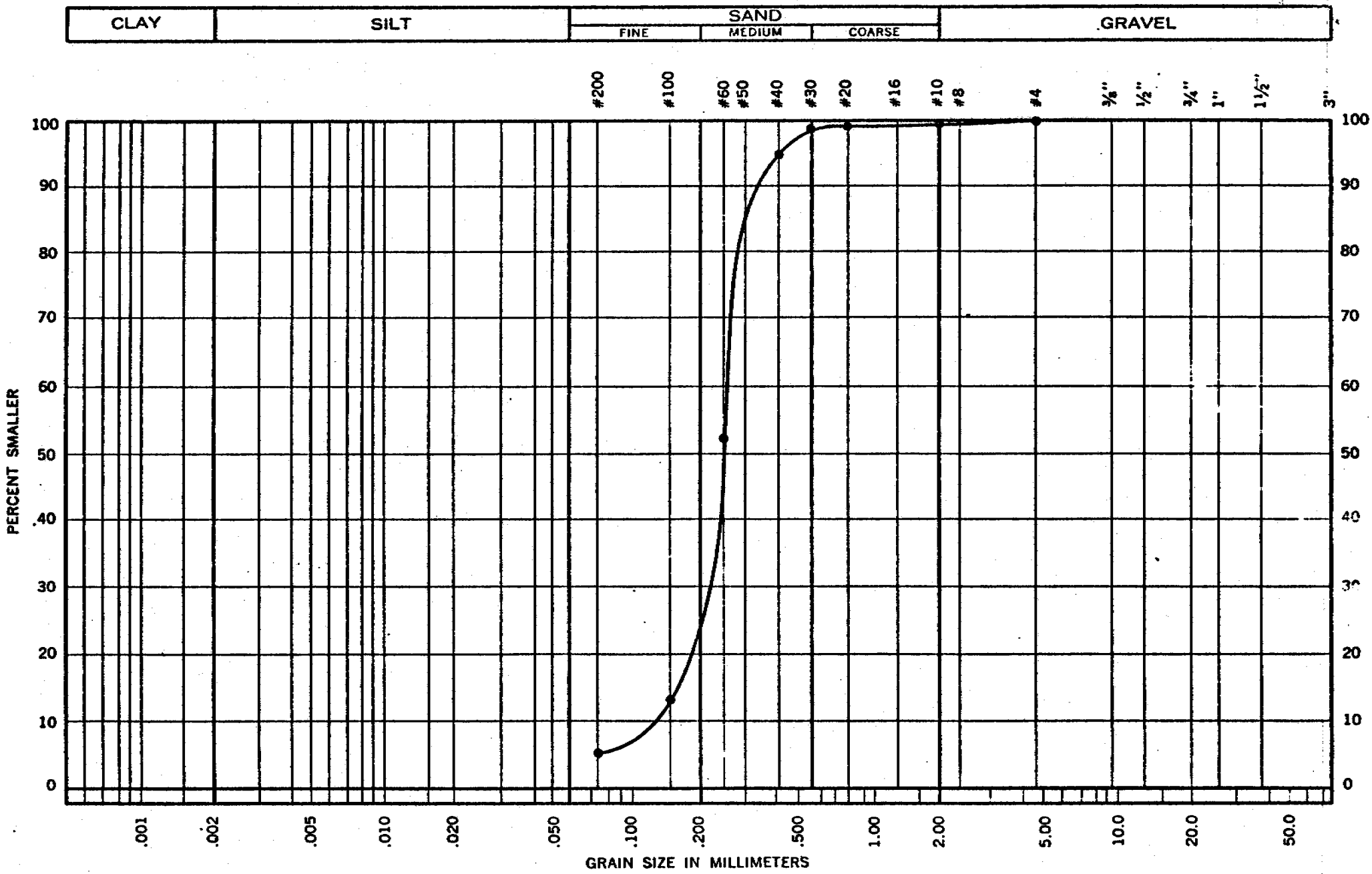
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT I.O.L. OFFSHORE BORROW
JOB No. E-604 DATE MAY 10, 1973
SAMPLE No. B.H. 38
DEPTH 15'-20'

GRAIN SIZE DISTRIBUTION



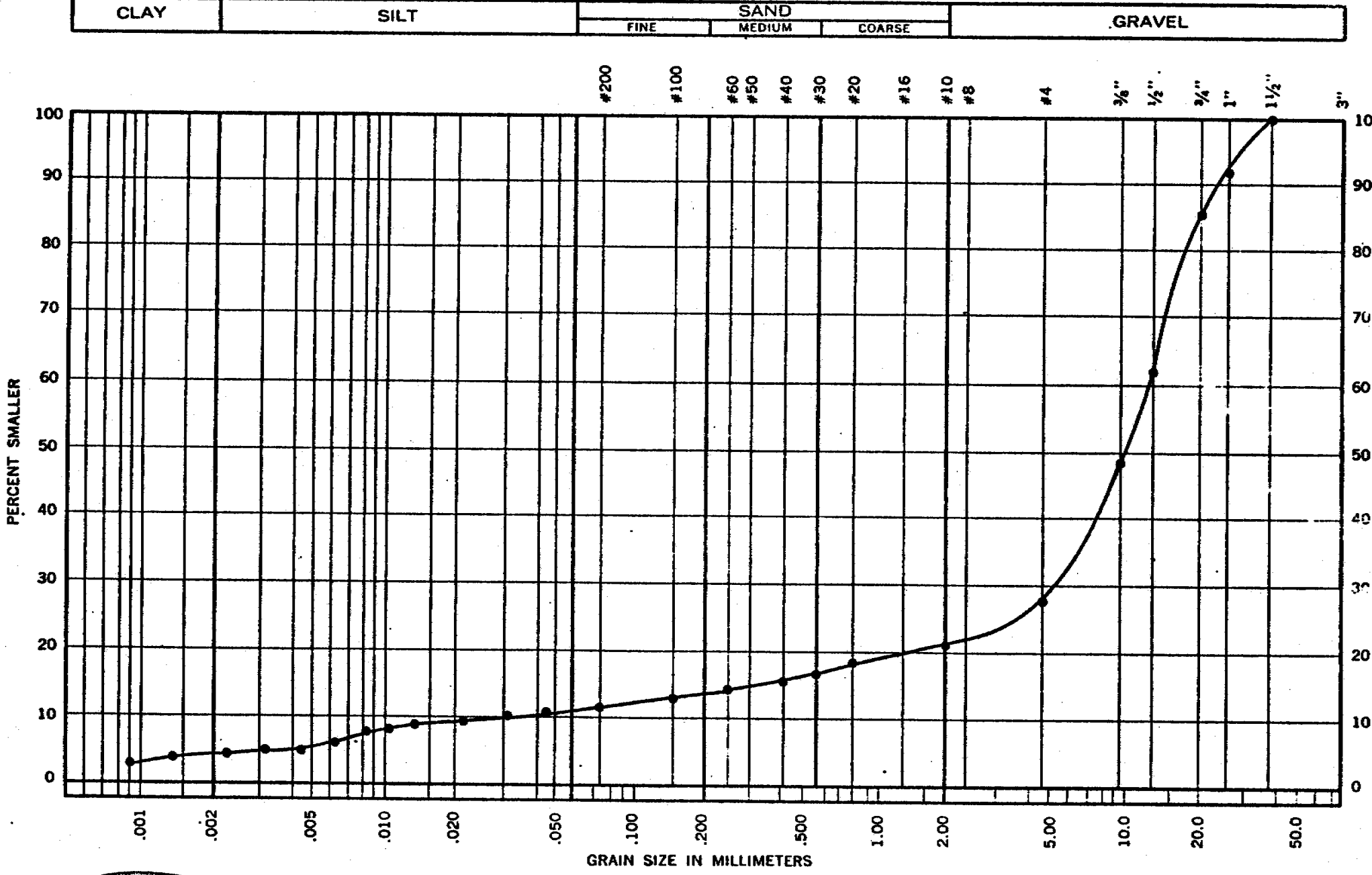
FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT N.W.T. OFFSHORE BORROW
JOB No. E-604B DATE MAY 11/73
SAMPLE No. B.H. 47
DEPTH 1'-5'

GRAIN SIZE DISTRIBUTION



FIGURE

BROOKER & ASSOCIATES

SAMPLE DESCRIPTION _____

PROJECT N.W.T. OFFSHORE BORROW
JOB No. E-604 B DATE MAY 14/73
SAMPLE No. B.H. 61
DEPTH 1'-5'