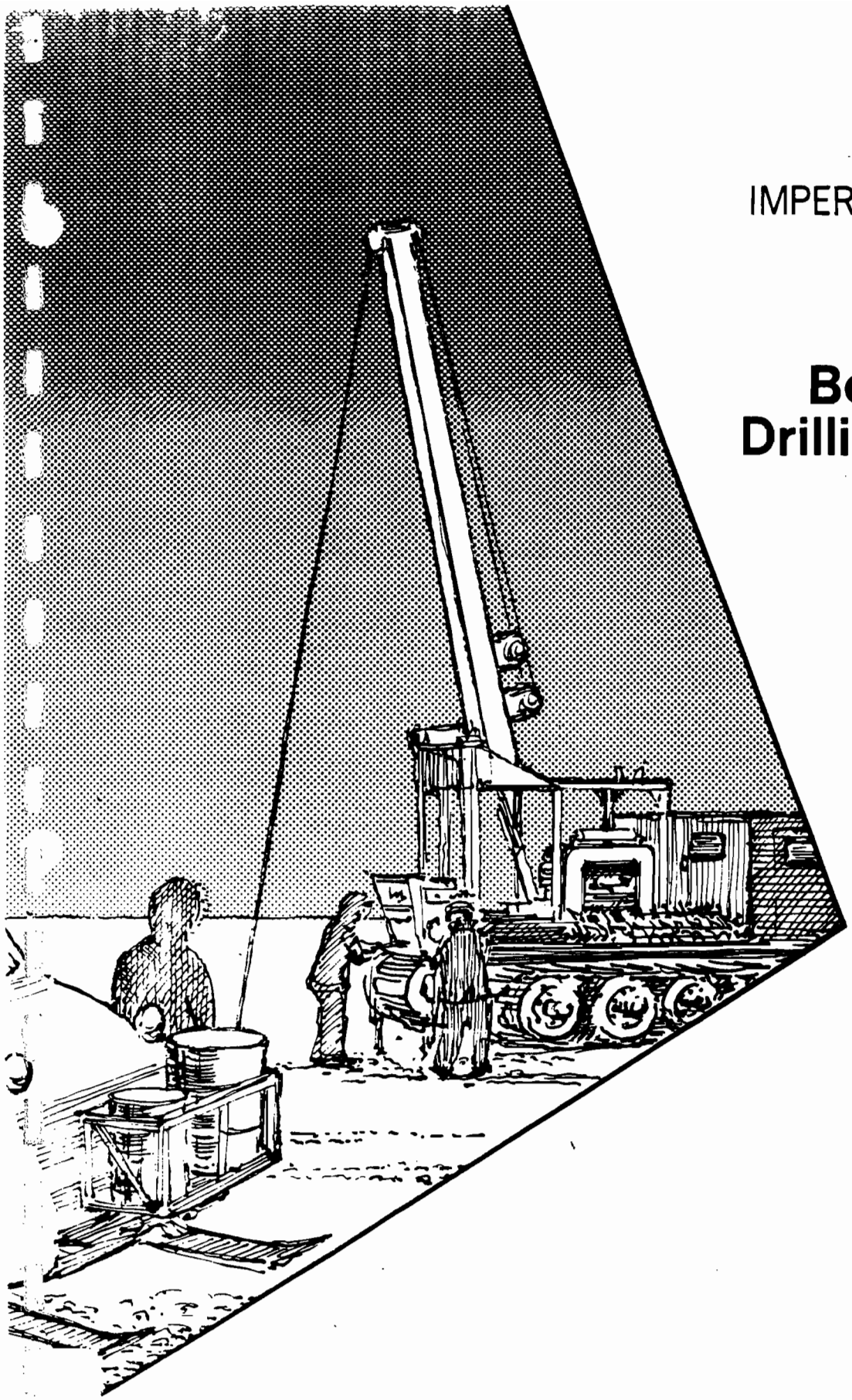


IMPERIAL OIL LIMITED

Beaufort Sea Drilling Program

WINTER 1974

(KADOK)

Volume 1

EBA Engineering Consultants Ltd.
Arctic Geotechnical Group

LIST OF FIGURES

LIST OF APPENDICIES

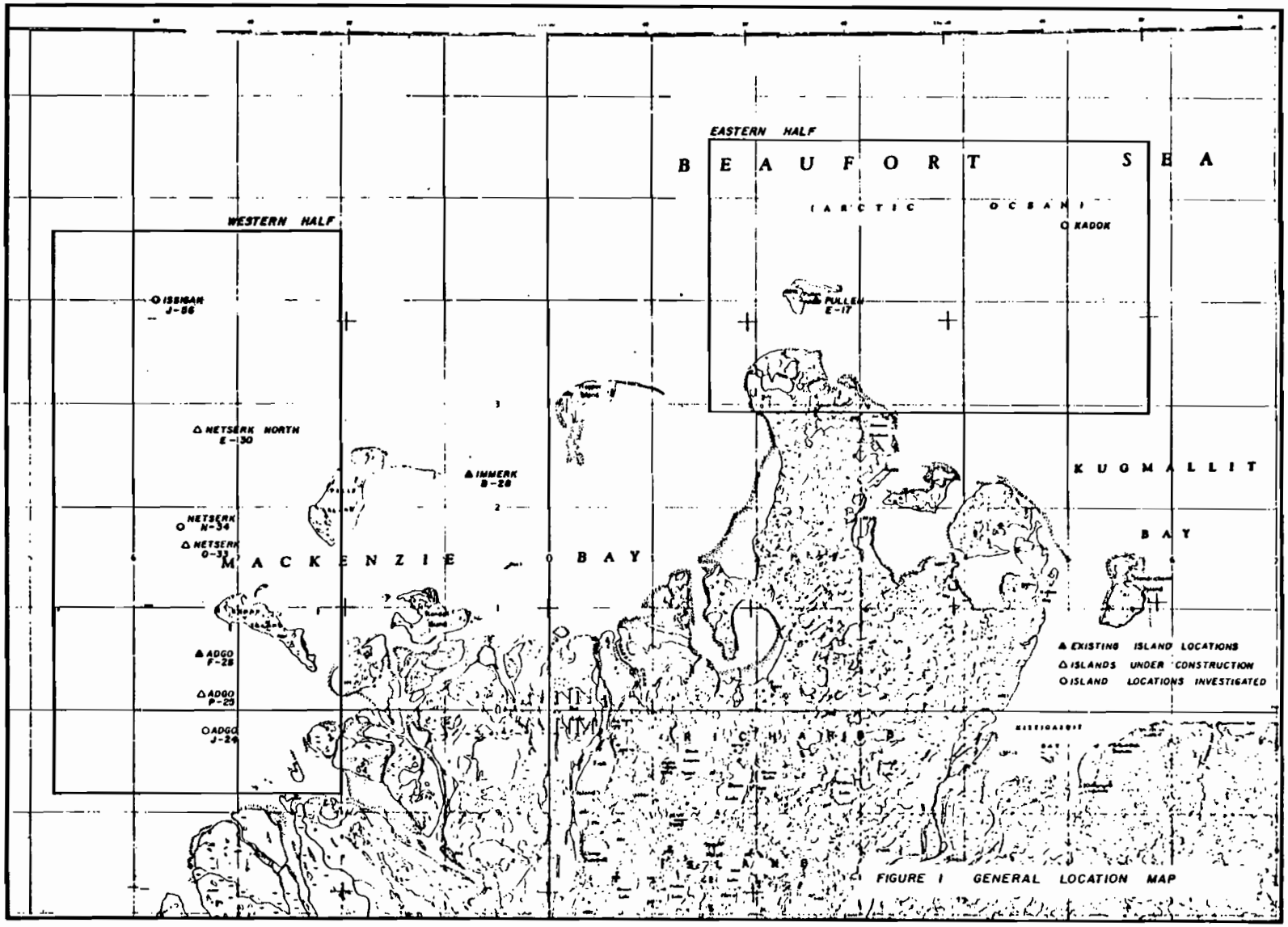
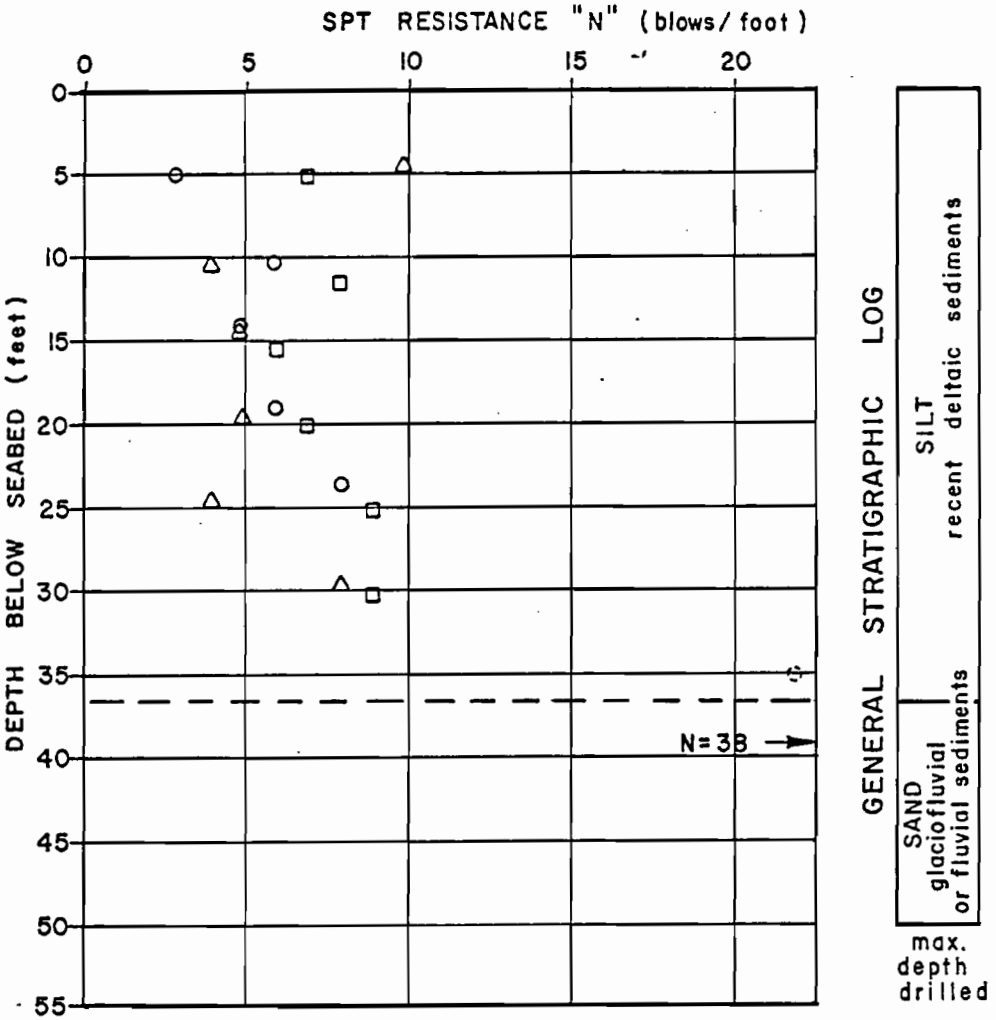


FIGURE 1 GENERAL LOCATION MAP



BOREHOLE DESIGNATION

KADOK	
BH	SYMBOL
416	○
419	△
420	□

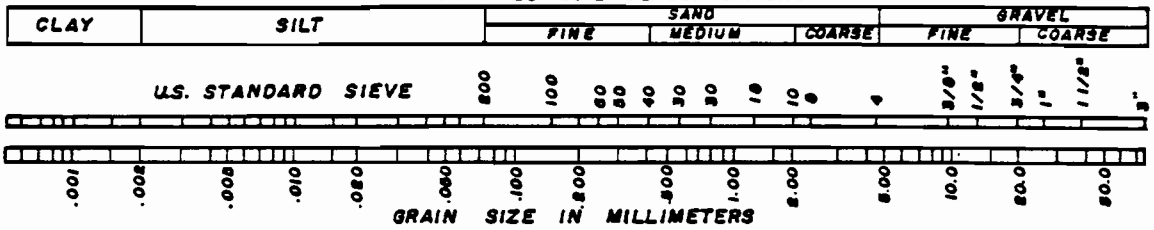
FIGURE 2
DEPTH - DENSITY
RELATIONSHIP for
KADOK ISLAND SITE
WATER DEPTH 33 FEET

APPENDIX 1

BOREHOLE LOGS

SYMBOLS AND TERMS USED IN LOGGING BOREHOLES

GRAIN SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION)



TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on Nº 200 sieve): includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N BLOWS PER FOOT
Very loose	0 - 20 %	0 - 4
Loose	20 - 40 %	4 - 10
Compact, or Medium	40 - 75 %	10 - 30
Dense	70 - 90 %	30 - 50
Very dense	90 - 100 %	> 50

The number of blows, N, on a 2" O.D. split spoon sampler of a 140 lb. wt. falling 30" required to drive the sample a distance of 1' from 6" to 18".

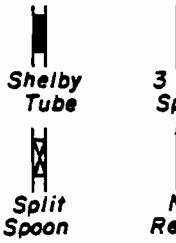
FINE GRAINED SOILS (major portion passing Nº 200 sieve): includes (1) inorganic and organic siltys and clays, (2) gravelly, sandy, or silty, clays, and (3) clayey silt. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH TON/SQ. FT.	N BLOWS PER FOOT
Very soft	less than 0.25	< 2
Soft	0.25 to 0.50	2 - 4
Firm	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
Very stiff	2.00 to 4.00	15 - 30
Hard	4.00 and higher	> 30

ICE DESCRIPTION
(AFTER NRC TM Nº 79)

Non Visible Ice	Nf	Poorly bonded
	Nbn	Well bonded
	Nbe	Excess ice
Visible Ice Less than 1 inch thick	Vx	Individual ice crystals or inclusions
	Vc	Ice coatings or particles
	Vr	Rondom or irregularly oriented ice formations
	Vs	Stratified or distinctly oriented ice formations
Visible Ice Greater Than 1 inch thick	ICE	Ice with soil inclusions
	ICE	Ice without soil inclusions

SAMPLER TYPE
(SHOWN IN SAMPLES COLUMN)

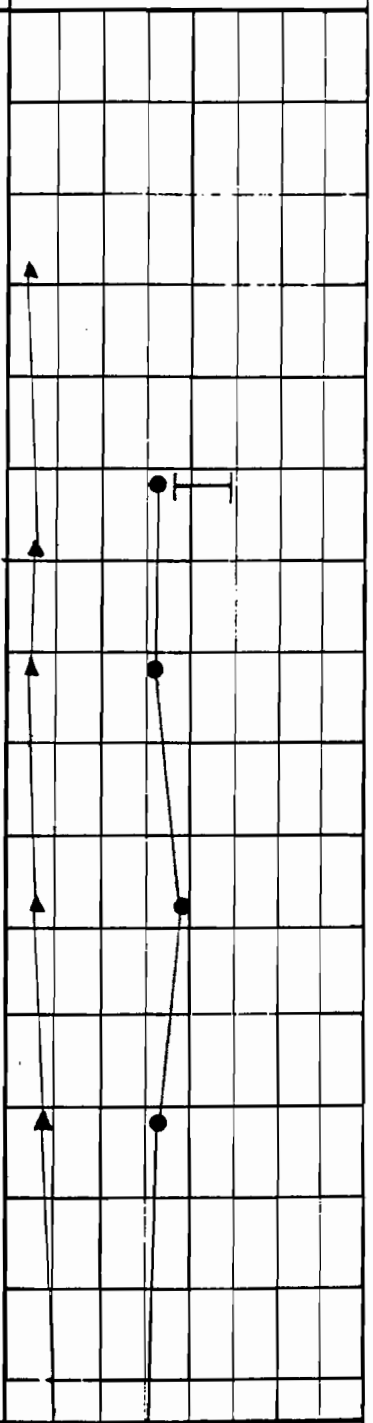


IMPERIAL OIL LIMITED

BEAUFORT SEA DRILLING PROGRAM — 1974

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE	GROUND ICE CONDITION
	SEA BOTTOM		
2	-no recovery		NOT FROZEN
4			
6			
8			
10	SILT -moist, medium plastic		
12			
14	-stratified		
16			
18	CLAY SILT -moist, some organics		
20			
22			
24	-trace of organics, moist stratified, med. grey-brown non-plastic		
26			
28			
30			

MOISTURE CONTENT % ●
SPT RESISTANCE ▲
10 20 30 40 50 60 70
COMP. STRENGTH T.S.F. ■
1 2 3

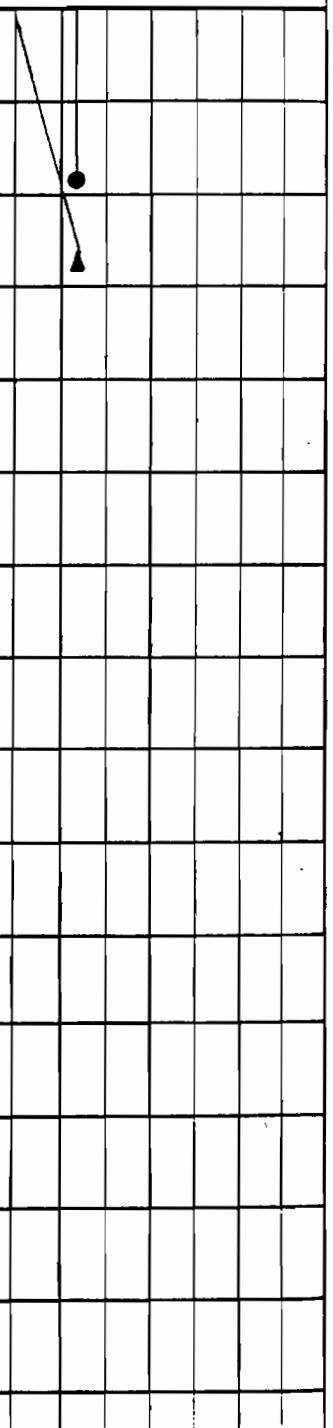


eda	ICE THICKNESS (ft.) 6	DATE DRILLED 11/4/74	HOLE No. 416
	WATER DEPTH (ft.) 33½	TECH CME	
	COMPLETION DEPTH (ft.) 69½	REGION KADOK	PAGE 1 OF 2

IMPERIAL OIL LIMITED

BEAUFORT SEA DRILLING PROGRAM — 1974

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE	GROUND ICE CONDITION	MOISTURE CONTENT % ● SPT RESISTANCE ▲ 10 20 30 40 50 60 70 COMP. STRENGTH T.S.F. ■ 1 2 3
32			NOT FROZEN	
34	SAND -clean, med. to fine, trace of silt, uniform			
36				
38	END OF HOLE			
40	-Sand sloughed up the inside of the hollow stem			



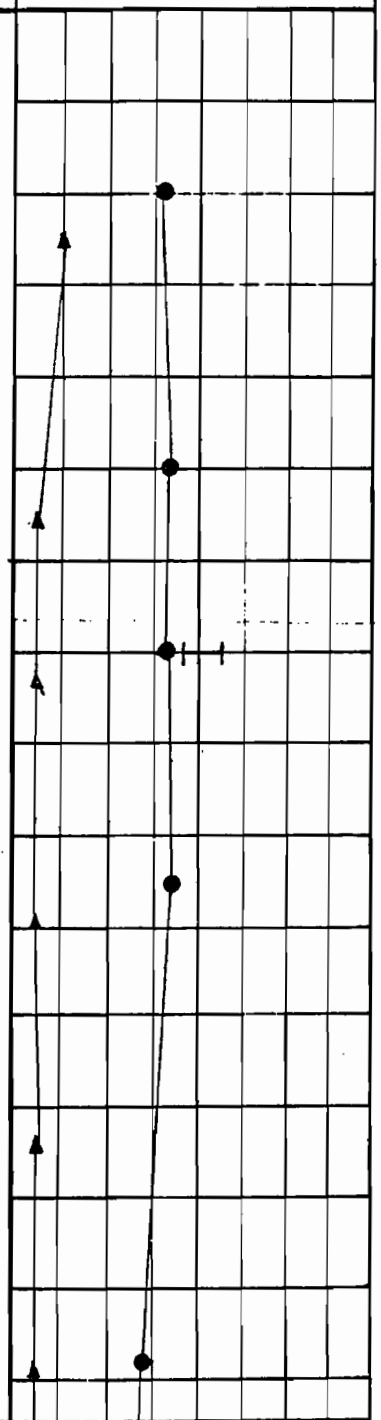
eda	ICE THICKNESS (ft.) 6	DATE DRILLED 11/4/74	HOLE No. 416
	WATER DEPTH (ft.) 33½	TECH . CME	
	COMPLETION DEPTH (ft.) 69½	REGION KADOK	PAGE 2 OF 2

IMPERIAL OIL LIMITED

BEAUFORT SEA DRILLING PROGRAM — 1974

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE	GROUND ICE CONDITION
	SEA BOTTOM		
2			
4	SILT -trace of clay , trace of fine sand, slight plasticity medium grey-brown		NOT FROZEN
6			
8			
	CLAY SILT -medium plastic		
10			
12			
14			
16			
18			
20			
22			
24			
26			
28	-low plasticity		
30			

MOISTURE CONTENT % ●
SPT RESISTANCE ▲
10 20 30 40 50 60 70
COMP. STRENGTH T.S.F. ■
1 2 3



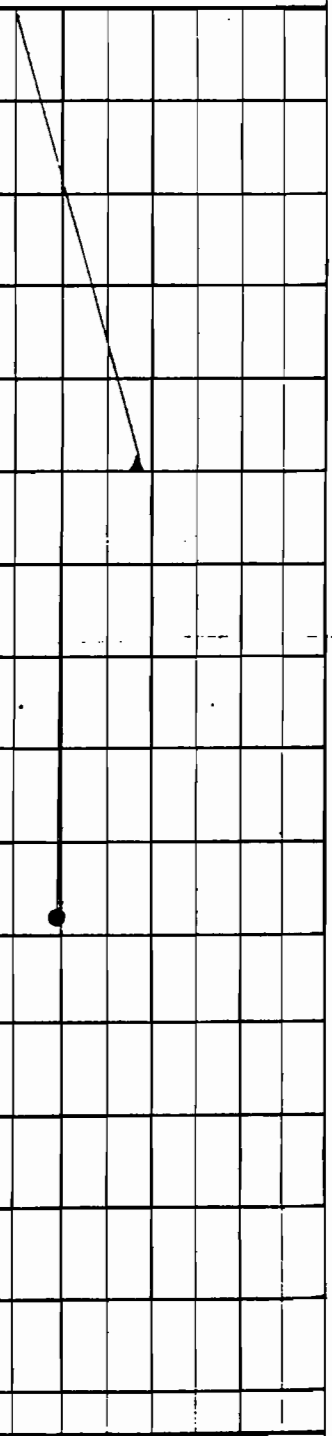
eda	ICE THICKNESS (ft.) 5½	DATE DRILLED 16/4/74	HOLE No. 419
	WATER DEPTH (ft.) 33	TECH . KOS	
	COMPLETION DEPTH (ft.) 83½	REGION KADOK	PAGE 1 OF 2

IMPERIAL OIL LIMITED

BEAUFORT SEA DRILLING PROGRAM — 1974

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE	GROUND ICE CONDITION
32	CLAY SILT -as above		NOT FROZEN
34			
36			
38			
40	SAND -medium grain size, trace of silt		
42			
44			
46			
48			
50			
52	END OF HOLE -sand sloughed up the inside of the hollow stem		
54			
56			
58			
60			

MOISTURE CONTENT % ●
SPT RESISTANCE ▲
10 20 30 40 50 60 70
COMP. STRENGTH T.S.F. ■
1 2 3



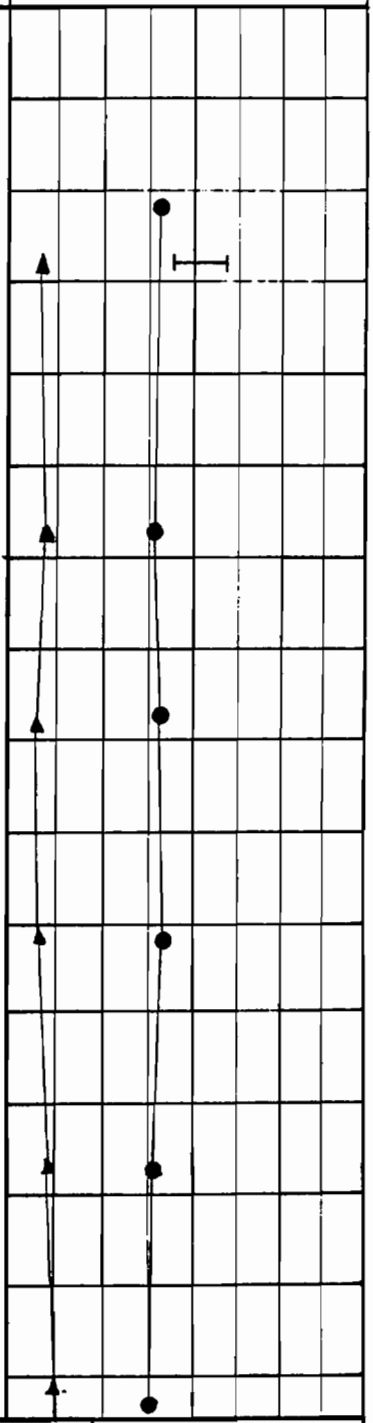
ICE THICKNESS (ft.) 5½	DATE DRILLED 16/4/74	HOLE No. 419
WATER DEPTH (ft.) 33	TECH KOS	
COMPLETION DEPTH (ft.) 83½	REGION KADOK	PAGE 2 OF 2

IMPERIAL OIL LIMITED

BEAUFORT SEA DRILLING PROGRAM — 1974

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE	GROUND ICE CONDITION
	SEA BOTTOM		
2			NOT FROZEN
4	SILT -some organics, moist, medium grey		
6			
8			
10			
12			
14			
16			
18			
20			
22			
24	-some marine shells		
26			
28			
30	SILT - CLAY -trace of fine sand		

MOISTURE CONTENT % ●
SPT RESISTANCE ▲
10 20 30 40 50 60 70
COMP. STRENGTH T.S.F. ■
1 2 3



eba	ICE THICKNESS (ft.) 5½	DATE DRILLED 12/4/74	HOLE No. 420
	WATER DEPTH (ft.) 32½	TECH CME	
	COMPLETION DEPTH (ft.) 73½	REGION KADOK	PAGE 1 OF 2

IMPERIAL OIL LIMITED

BEAUFORT SEA DRILLING PROGRAM — 1974

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE	GROUND ICE CONDITION	MOISTURE CONTENT % ● SPT RESISTANCE ▲ 10 20 30 40 50 60 70 COMP. STRENGTH T.S.F. ■ 1 2 3
32	SILT -as above		NOT FROZEN	
34				
36				
38				
	SAND			
40				
42				
	END OF HOLE			
44	-sand sloughed up inside of hollow stem auger			
46				
48				

eda	ICE THICKNESS (ft.) 5½	DATE DRILLED 12/4/74	HOLE No. 420
	WATER DEPTH (ft.) 32½	TECH . CME	
	COMPLETION DEPTH (ft.) 73½	REGION KADOK	PAGE 2 OF 2

APPENDIX 2

GRAIN SIZE CURVES

UNIFIED SOIL CLASSIFICATION
INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3 inches and basing fractions on estimated weights)				GROUP SYMBOLS (1)	TYPICAL NAMES	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS More than half of material is larger than No 200 sieve size (1)	GRAVELS More than half of coarse fraction is larger than No 4 sieve size (For visual classifications the 1/4" size may be used as equivalent to the No 4 sieve size)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No 200 sieve size) coarse grained soils are classified as follows: Less than 5% GW GP SW SP. More than 12% GM GC SM SC. 5% to 12% Borderline cases requiring use of dual symbols.
			Predominantly one size or a range of sizes with some intermediate sizes missing	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.	
		GRAVELS WITH FINES (Appreciable amount of fines)	Non plastic fines (for identification procedures see ML below.)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.	
			Plastic fines (for identification procedures see CL below.)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.	
	SANDS More than half of coarse fraction is smaller than No 4 sieve size	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes	SW	Well graded sands, gravelly sands, little or no fines.	
			Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.	
		SANDS WITH FINES (Appreciable amount of fines)	Non plastic fines (for identification procedures see ML below.)	SM	Silty sands, poorly graded sand-silt mixtures.	
			Plastic fines (for identification procedures see CL below.)	SC	Clayey sands, poorly graded sand-clay mixtures.	
FINE GRAINED SOILS More than half of material is smaller than No 200 sieve size (The No 200 sieve size is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No 40 SIEVE SIZE					
		DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)		
	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
		Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, silty clays, lean clays
		Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays.
		Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	Readily identified by color, odor spongy feel and frequently by fibrous texture					Peat and other highly organic soils.

Cu = $\frac{D60}{D10}$ Greater than 4

Cc = $\frac{(D30)^2}{D10 \times D60}$ Between one and 3

Not meeting all gradation requirements for GW

Atterberg limits below "A" line, or PI less than 4

Atterberg limits above "A" line with PI greater than 7

Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols

Cu = $\frac{D60}{D10}$ Greater than 4

Cc = $\frac{(D30)^2}{D10 \times D60}$ Between one and 3

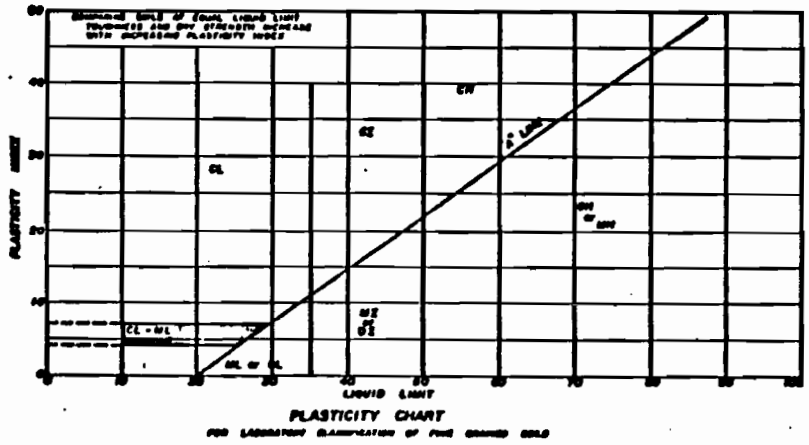
Not meeting all gradation requirements for SW

Atterberg limits below "A" line or PI less than 4

Atterberg limits above "A" line with PI greater than 7

Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols

The Extended Unified Soil Classification defines intermediate or medium plastic silt or clay (ie. MI or CI) for soils having a liquid limit between 35 and 50%.



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

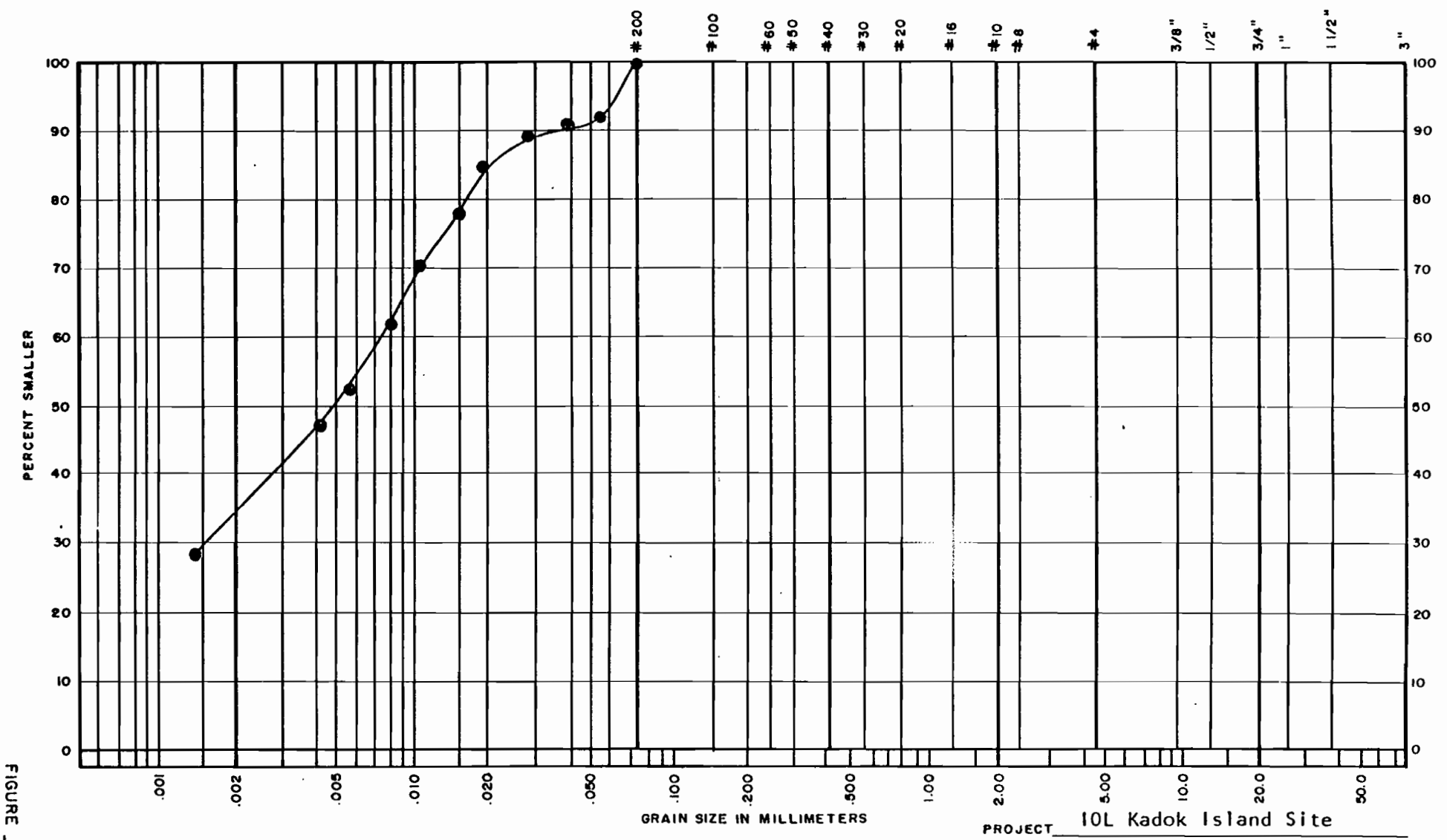
(1) Boundary classifications - Soils possessing characteristics of two groups are designated by combinations of group symbols For example GW GC well graded gravel sand mixture with clay binder

(2) All sieve sizes on this chart are U S standard

UNIFIED SOIL CLASSIFICATION CHART

eoa Engineering Consultants Ltd.

GRAIN SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION)



FIGURE

SAMPLE DESCRIPTION Clay Silt

EBA Engineering Consultants Ltd.

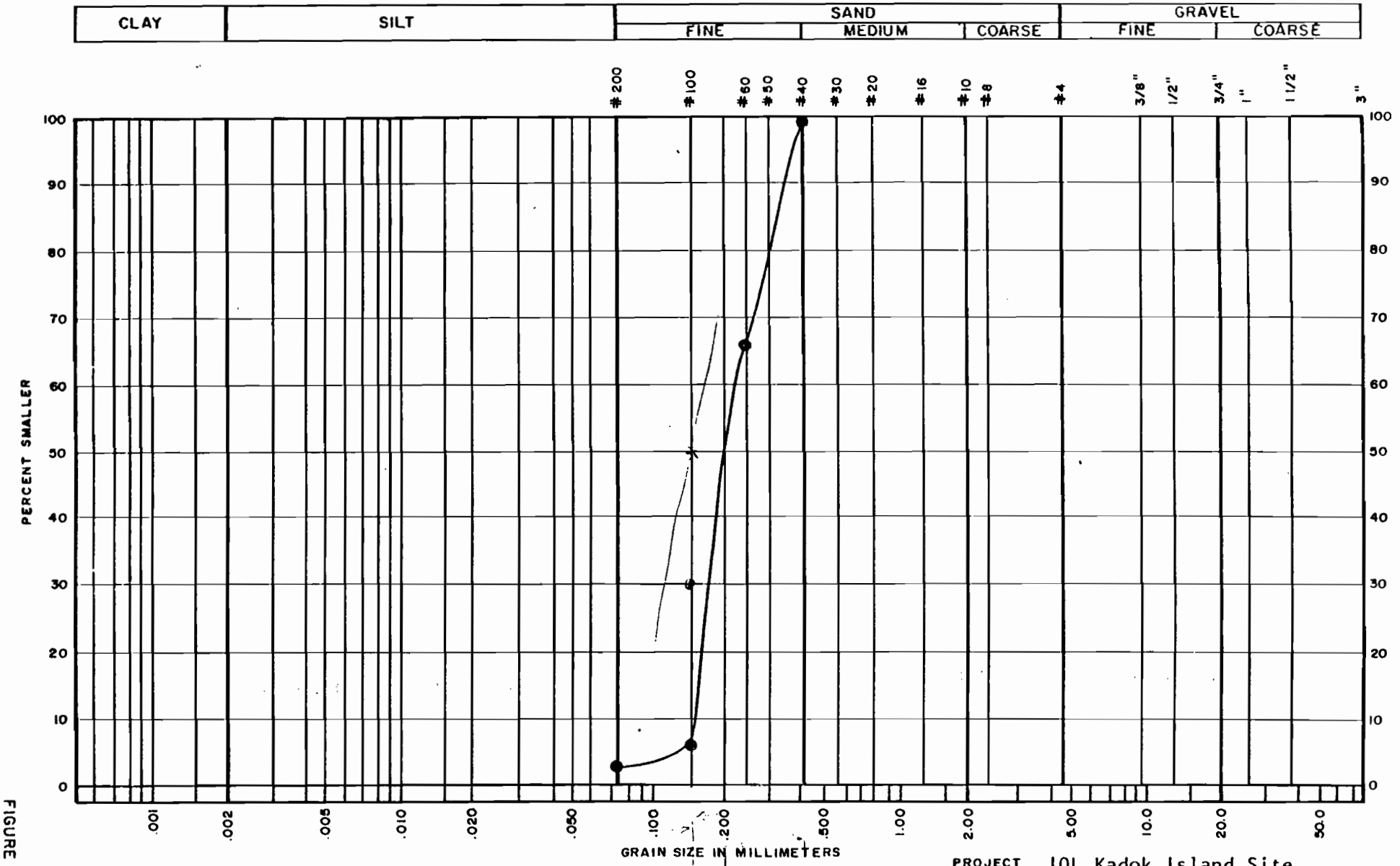
PROJECT 10L Kadok Island Site

JOB No. E-660 DATE April 26/74

HOLE No. 416 SAMPLE No.

DEPTH 18½ - 20'

GRAIN SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION)



FIGURE

SAMPLE DESCRIPTION Sand with a Trace of Silt

PROJECT 101 Kadok Island Site

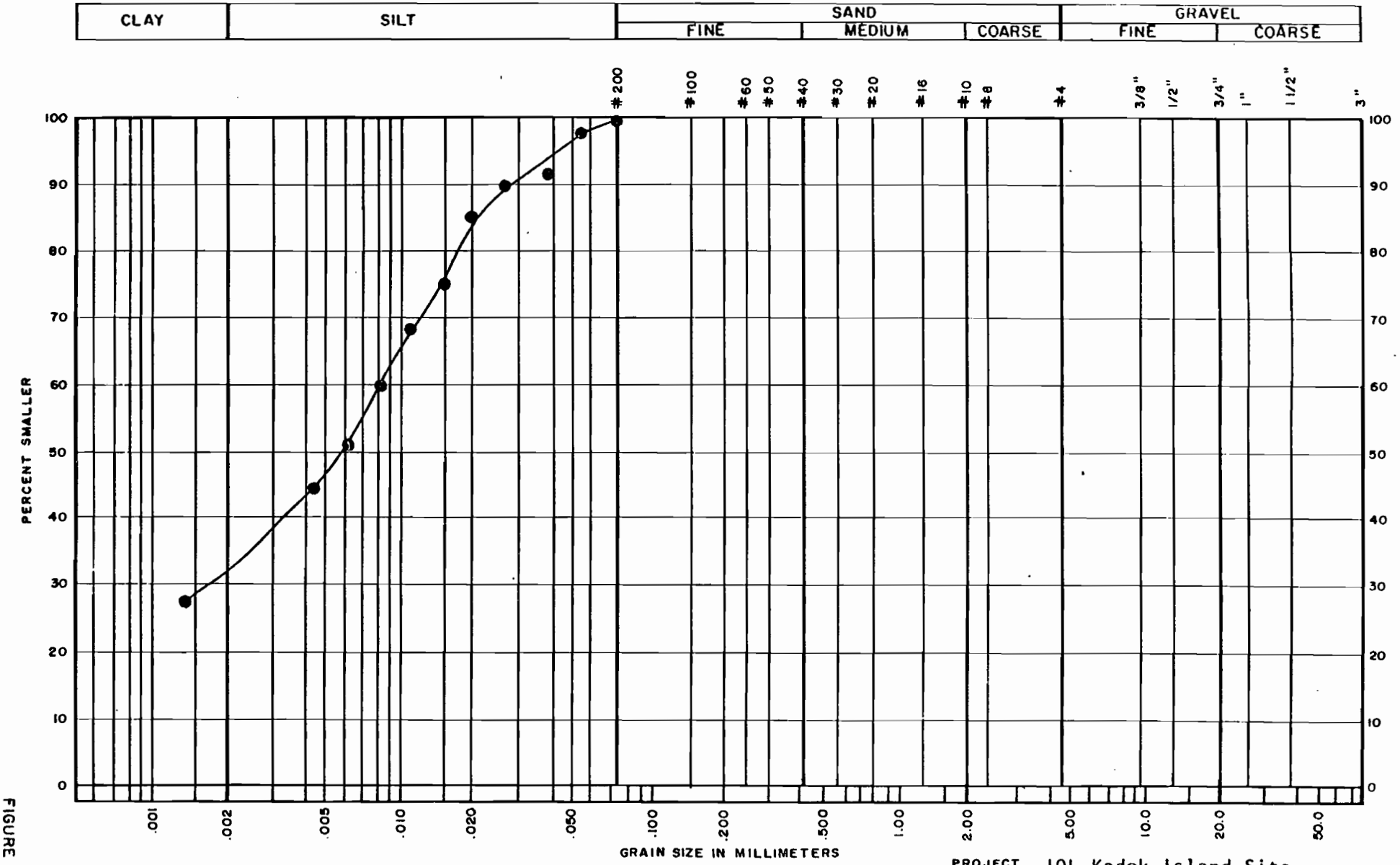
JOB No. E-660 DATE April 26/74

HOLE No. 416 SAMPLE No.

DEPTH 33½'

EBA Engineering Consultants Ltd.

GRAIN SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION)



FIGURE

SAMPLE DESCRIPTION Clay Silt

PROJECT 101 Kadok Island Site

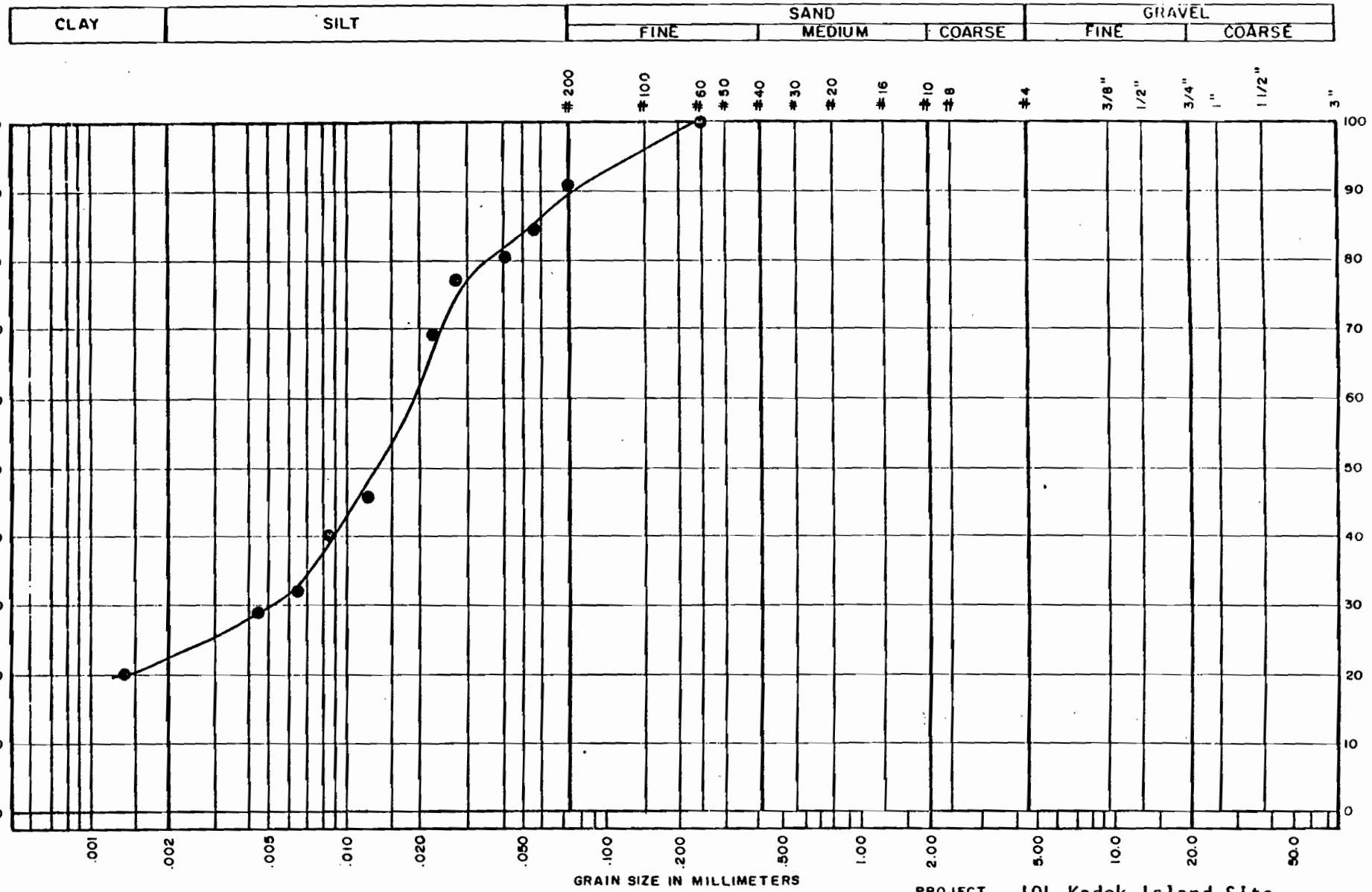
JOB No. E-660 DATE April 26/74

HOLE No. 419 SAMPLE No.

DEPTH 14'

EBA Engineering Consultants Ltd.

GRAIN SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION)



FIGURE

SAMPLE DESCRIPTION Clayey, with some Sand

PROJECT 101 Kadok Island Site

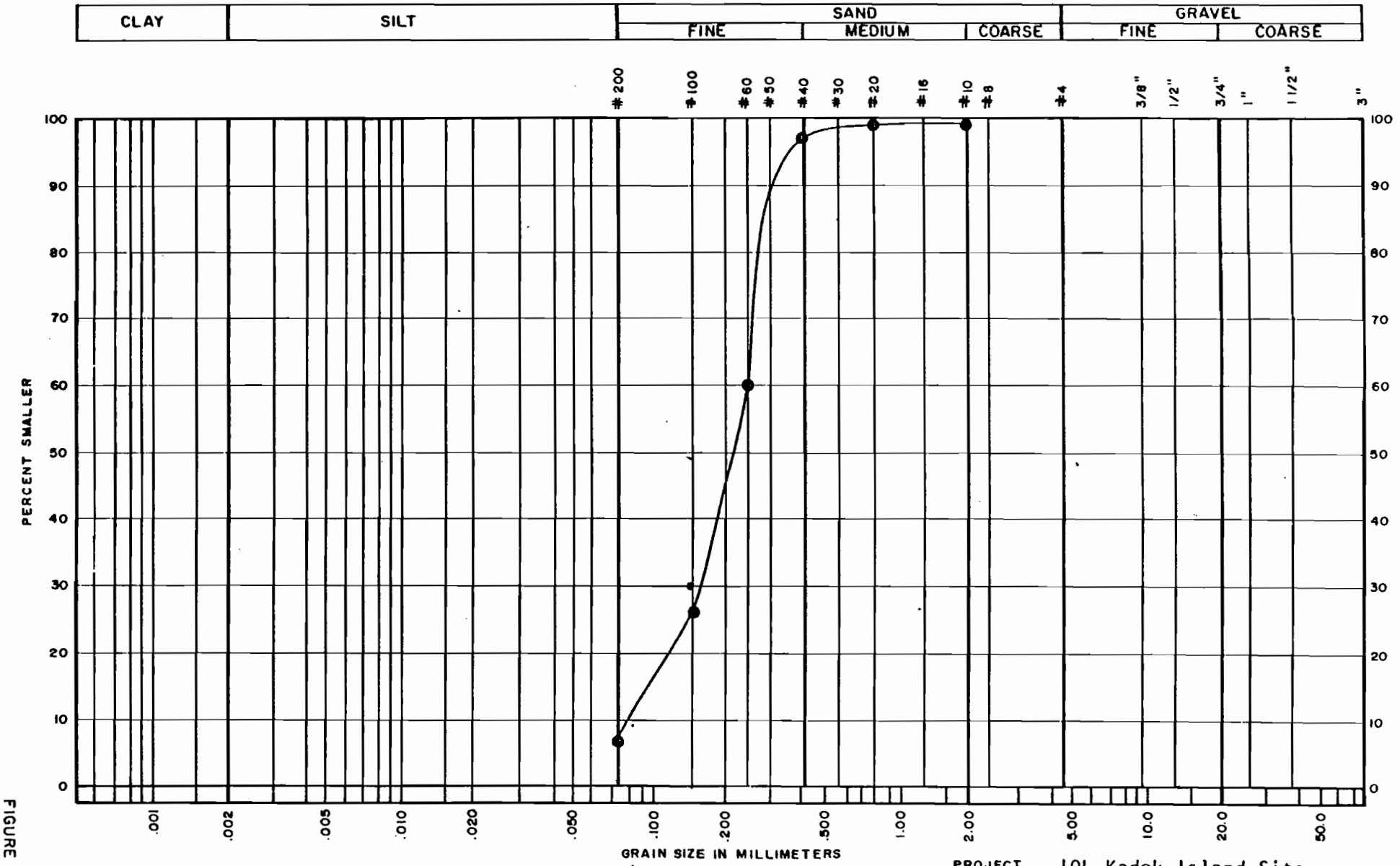
JOB No. E-660 DATE April 26/74

HOLE No. 419 SAMPLE No.

DEPTH 39'

EBA Engineering Consultants Ltd.

GRAIN SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION)



FIGURE

SAMPLE DESCRIPTION Sand with a Trace of Silt

PROJECT 101 Kadok Island Site

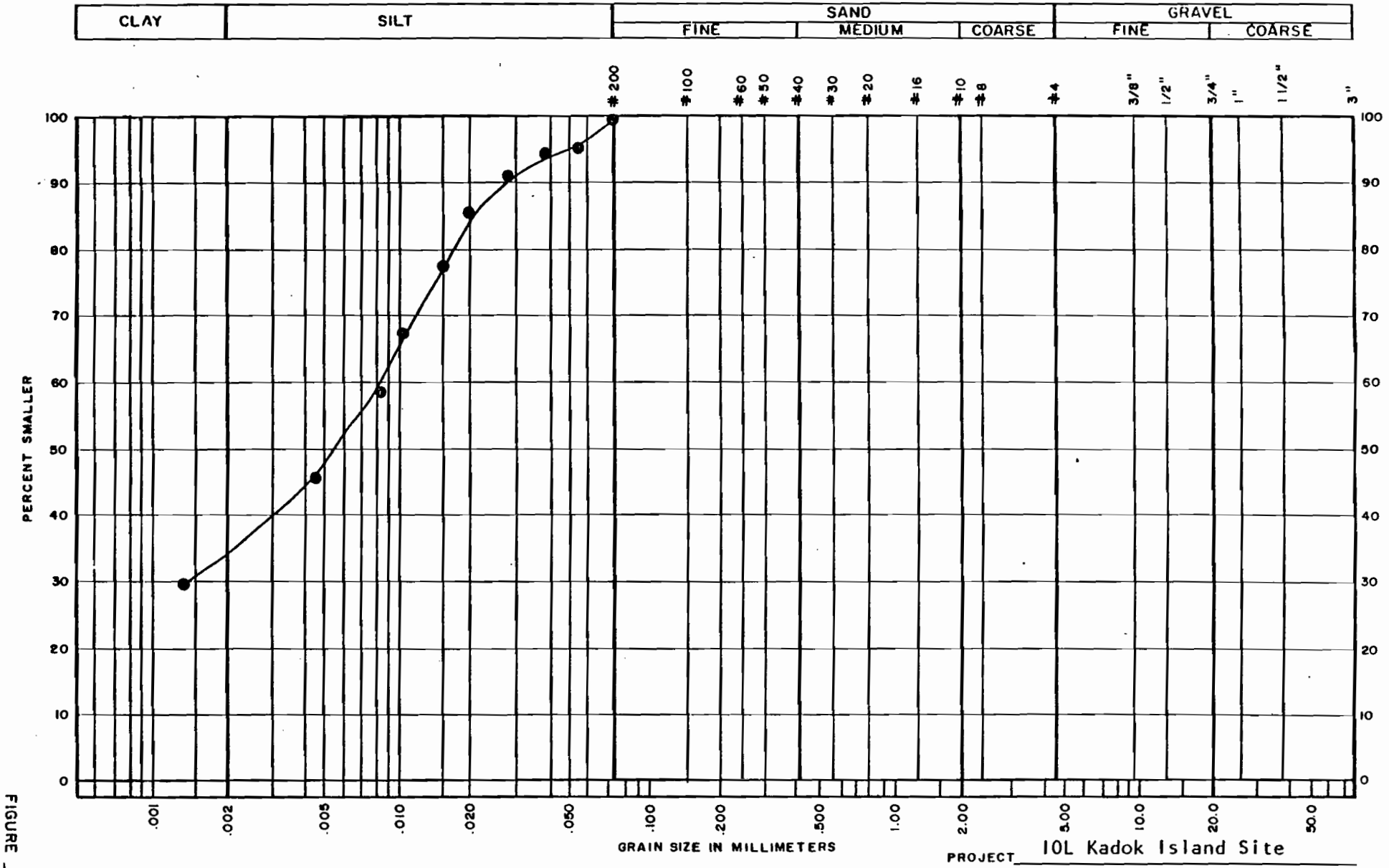
JOB No. E-660 DATE April 26/74

HOLE No. 419 SAMPLE No.

DEPTH 49'

EBA Engineering Consultants Ltd.

GRAIN SIZE DISTRIBUTION
(UNIFIED SOIL CLASSIFICATION)



FIGURE

SAMPLE DESCRIPTION Clay Silt

PROJECT 10L Kadok Island Site

JOB No. E-660 DATE April 26/74

HOLE No. 420 SAMPLE No.

DEPTH 29½' - 31'

EBA Engineering Consultants Ltd.