CANEP - BROWN & ROOT

NIGLINTGAK GAS DEVELOPMENT
MACKENZIE RIVER DELTA, N.W.T.

1977 GEOTECHNICAL FIELD PROGRAM

VOLUME 2

PREPARED FOR

SHELL CANADA RESOURCES LIMITED
CALGARY, ALBERTA

D003551

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

APPENDIX B - EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the test hole logs to summarize the results of the field investigation and of subsequent laboratory testing are described in detail below, and are illustrated in the appended exhibit test hole log (Plate B-1).

General information, such as test hole number, test hole location, and rig type is noted in the upper portion of the test hole log. Detailed subsurface information observed at each test hole location and laboratory test data are presented in columnar form on the test hole log. Each column used is described in detail below using the reference numbers shown on the appended blank test hole log (Plate B-2).

It should be noted that the soil type, stratigraphic boundaries, and in situ conditions have been established only at the test hole location and that they are not necessarily representative of subsurface conditions elsewhere across the site.

Column 1: Test Data: The results of laboratory determinations of moisture content, Atterberg limits, and frozen bulk density and the results of in situ Dynamic Cone Penetration testing are plotted against depth on the grid in this column.

Column 2: Depth: The depth of test hole below existing ground surface is shown in feet in this column. While the presentation in the text of the report is in metric units, the test hole logs have not been converted from the British units used in the field program.

Column 3: Soil Group Symbol: A Soil classification symbol in accordance with a modification of the Unified Soil Calssification System[1] is noted in this column. A definition of each Group Symbol is given in Plate B-3 "Soil Classification System".

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1 References are listed on page B-7.

Column 4: Soil Graphic Log: Soil strata are depicted graphically in accordance with the "Graphic Symbol" column of Plate B-3 "Soil Classification System".

Column 5: Description: A detailed engineering description of each soil stratum encountered is noted in this column in accordance with the Modified Unified Soil Classification System. A description of the ground ice is included according to the NRC procedures.[2] The depths to interfaces between soil strata and depths to other significant observations are indicated in this column. The interface between differing soil strata is shown as a single continuous line. A short broken line indicates a change in the soil type modifiers where the soil type remains the same.

The term "current bedding" is used in this report to describe laminations or strata inclined to the main stratification, and is also known as cross bedding.

Column 6: Ice Graphic Log: The various types of ground ice are depicted graphically according to Plate B-4 "Ground Ice Classification".

Column 7: NRC Ice Type: (Visual Ice %): Abbreviated symbols for the forms of ground ice are noted in this column. A summary of the NRC classification[2] is contained in Plate B-4 "Ground Ice Classification". The volume of ground ice is estimated visually and expressed as a percentage of the total volume of soil and ice.

Column 8: Sample Type and Number: The type and reference number of each sample are recorded in this column at the appropriate depth. Soil samples are numbered in increasing numerical order with depth. The type of sample is indicated by the following prefixes:

- C Core sample
- S Split spoon standard penetrameter sample

U Tube sample (thin-walled unless otherwise noted)

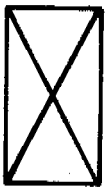
W Wash or Air Return samples

Where wash or air return samples have not been retained for testing, no number has been assigned.

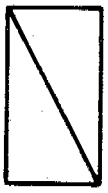
Column 9: Sample Condition: The condition of each sample, and whether it was recovered or lost, is recorded against depth in this column with the following symbols



undisturbed



disturbed



not recovered

Undisturbed samples refer to core or tube samples which have been recovered in a state relatively unchanged by sampling. Disturbed samples are any other samples recovered from the hole. 'Not recovered' refers to samples lost down the hole, wash samples, and air

return samples which were not retained for testing purposes.

Column 10: Sample Retained: Samples which were packaged, labelled and forwarded to the laboratory for testing are noted in this column at the appropriate depths.

Column 11: Other Information: Test data and field observations not incorporated into the previous columns are presented here, including references to special testing with results reported elsewhere in the report. P.P. in this column refers to Pocket Penetrometer readings.

REFERENCES FOR APPENDIX B

1. Waterways Experimental Station, 1953. Unified Soil Classification System. Testing Memo. 3-357, Vol. I.

2. Pihlainen, J.A. and Johnston, G.H. 1963. Guide to a field description of permafrost for engineering purposes. N.R.C. Tech. Mem. 79, NRC 7576, Ottawa.

TEST HOLE LOG

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GEOTECHNICAL DIVISION

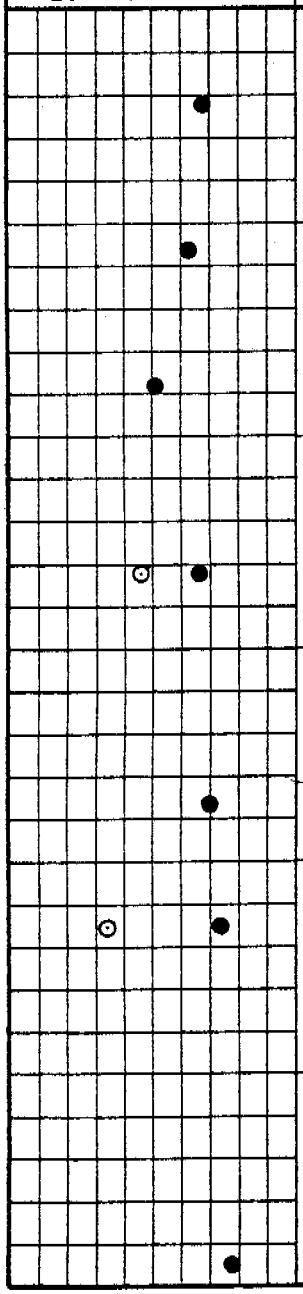
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-1

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 13:50	FINISH: 16:00
PROJECT NO.: K 3571	ELEVATION: 99.80 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, low plastic, grey		Vr 40%	W			Pilot hole to 1.0'.
					Vs 10%	C1		C1	
						C2			
5						C3		C3	Thaw Consolidation Test - See Plate K-27
					20%	C4			
						C5		C5	
						C6			
						C7		C7	
10					10%				
15			14.5' - clayey, low plastic, grey		Vx <5%	C8			
			17.5' - current bedded		Vs 5%	C9		C9	
			20.0' 1/4" ice lens			C10		C10	
20			21.5' 1/4" ice lens		Nb	C11			
						C12			
						C13			
25						C14		C14	
30			Bottom of Hole at 30.0'						

EXHIBIT LOG

Plate ____
Sheet 1 of 1

PLATE B-1

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO.

LOGGED BY:	DRAWN BY:	CHECKED:	DATE:
RIG:	METHOD:	START:	FINISH:

PROJECT NO.:	ELEVATION:	LOCATION:

W_p - ⊡ W - ⊙ W_L - ▵ BULK DENSITY (pcf) ● 60 80 100 120 MOISTURE CONTENT 20 40 60 80 (1)	DEPTH (feet) (2)	SOIL GROUP SYMBOL (3)	SOIL GRAPHIC LOG (4)	DESCRIPTION (5)	ICE GRAPHIC LOG (6)	NRC ICE TYPE VISUAL ICE % (7)	SAMPLE TYPE & NO. (8)	SAMPLE CONDITION (9)	SAMPLE RETAINED (10)	OTHER INFORMATION (11)

Plate ____
Sheet ___ of ___

PLATE B-2

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

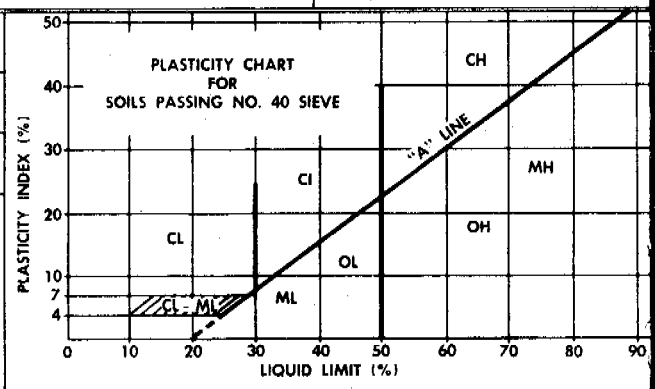
MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	COLOR CODE	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 200 SIEVE)	GRAVELS MORE THAN HALF COARSE GRAINS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	GW		RED	WELL GRADED GRAVELS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 4$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			GP		RED	POORLY GRADED GRAVELS, AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY GRAVELS (WITH SOME FINES)	GM		YELLOW	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC		YELLOW	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
	SANDS MORE THAN HALF FINE GRAINS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	SW		RED	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_U = \frac{D_{60}}{D_{10}} > 6$ $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
			SP		RED	POORLY GRADED SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		DIRTY SANDS (WITH SOME FINES)	SM		YELLOW	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE P.I. LESS THAN 4
			SC		YELLOW	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE P.I. MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT PASSES 200 SIEVE)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 50\%$	ML		GREEN	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (see below)	
		$W_L > 50\%$	MH		BLUE	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS		
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART NEGLIGIBLE ORGANIC CONTENT	$W_L < 30\%$	CL		GREEN	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		$30\% < W_L < 50\%$	CI		GREEN-BLUE	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
		$W_L > 50\%$	CH		BLUE	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS BELOW "A" LINE ON CHART	$W_L < 50\%$	OL		GREEN	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		$W_L > 50\%$	OH		BLUE	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			Pt		ORANGE	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE	

SOIL COMPONENTS

FRACTION	U S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL			50 - 35	and
coarse	3 inch	¾ inch		
fine	¾ inch	No 4	35 - 20	some
SAND			20 - 10	little
coarse	No 4	No 10		
medium	No 10	No 40	10 - 1	trace
fine	No 40	No 200		
SILT (non plastic) or **CLAY** (plastic)	No 200			

OVERSIZE MATERIAL

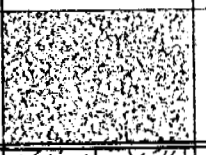
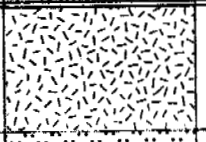
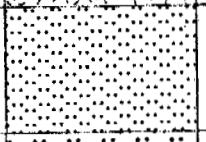
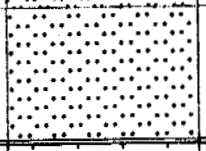
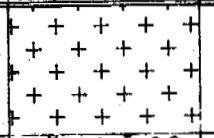
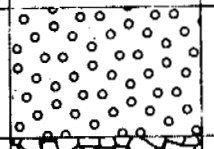
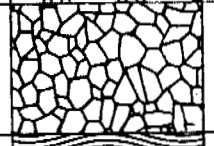
Rounded or subrounded COBBLES 3 inch to 8 inch BOULDERS > 8 inch	Not rounded ROCK FRAGMENTS > 3 inch ROCKS > 1 cubic yard in volume



1. ALL SIEVE SIZES MENTIONED ON THIS CHART ARE U.S. STANDARD, A.S.T.M. E.11.
2. BOUNDARY CLASSIFICATIONS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE GIVEN COMBINED GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL SAND MIXTURE WITH CLAY BINDER BETWEEN 5% AND 12%.

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GROUND ICE CLASSIFICATION

Category	Group Symbol	Subgroup Symbol	Graphic Symbol	Description
		F		Undifferentiated
Non-visible Ice	N	Nf		Poorly bonded or friable frozen soil
		Nbn		Well bonded frozen soil with no excess ice
		Nbe		Well bonded frozen soil with excess ice. Free water present when sample thawed
Visible Ice less than one inch thick	V	Vx		Individual ice crystals or inclusions
		Vc		Ice coatings on particles
		Vr		Random or irregularly oriented ice formations
		Vs		Stratified or distinctly oriented ice formations
Visible Ice greater than one inch thick	ICE	ICE + soil type		Ice greater than one inch thick with soil inclusions
		ICE		Ice greater than one inch thick without soil inclusions

Adapted from NRC 7576

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TABLE C-1

Test Hole Locations and Elevations
Plant Site

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
PS-1	7 688 813.65	488 919.35	1.433	99.177
PS-2	7 688 901.47	488 938.84	1.469	99.213
PS-3	7 689 018.58	488 964.83	1.475	99.219
PS-4	7 689 106.41	488 984.34	1.823	99.567
PS-5	7 689 125.90	488 896.51	1.853	99.597
PS-6	7 689 038.08	488 877.01	1.954	99.698
PS-7	7 688 920.97	488 851.02	1.939	99.683
PS-8	7 688 833.15	488 831.52	2.051	99.795
PS-9	7 688 846.15	488 772.97	2.076	99.820
PS-10	7 688 933.97	488 792.47	1.801	99.545
PS-11	7 688 992.53	488 805.47	1.808	99.552
PS-12	7 689 051.08	488 818.46	1.811	99.555
PS-13	7 689 138.90	488 837.96	1.771	99.515
PS-14	7 689 151.90	488 779.41	1.579	99.323
PS-15	7 689 064.07	488 759.91	1.594	99.338
PS-16	7 688 946.97	488 733.92	1.945	99.689
PS-17	7 688 859.15	488 714.42	1.853	99.597

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 19, 20 February 1977
RIG: NORTHLAND	METHOD: 3" & 4" CRREL	START: 16:40	FINISH: 0:15
PROJECT NO.: K 3571	ELEVATION: 99.18 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, low plastic, occasional organic laminations, grey to brown		Vr Vs 60% 20%	W C1		C1	Pilot hole to 0.8' Thaw Consolidation Test - See Plate C-52
					65%	C2			
5						C3		C3	
			6.7' - sandier, fine grained		40%	C4 C5			
						C6		C6	
					5%	C7			
10					Nb	C8			
			11.2' - trace fine sand						
			12.2' 1/4" ice lenses		Vr Vs 30% 15%	C9		C9	
					30%	C10		C10	Triaxial Strength Test - see Plate C-55
15					10%	C11		C11	
					Nb	C12			
						C13		C13	
						C14			
20						C15		C15	
			20.8' - sandier, fine grained			C16			
						C17		C17	
						C18			
25						C19			
			26.2' 1/4" ice lens			C20		C20	
			28.2'			C21			
			29.0' 1/16" ice lens - trace fine sand		Vx20% Nb Vs20%	C22		C22	

Plate C-1
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 19, 20 February 1977
RIG: NORTHLAND	METHOD: 3" & 4" CRREL	START: 16:40	FINISH: 0:15
PROJECT NO.: K 3571	ELEVATION: 99.18 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, non plastic, occasional organic laminations, grey to brown		Vs 20%	C22			
						C23			Grain Size Analysis See Plate C-35
					Vr 5%	C24		C24	
						C25		C25	
35						C26			
						C27		C27	
					Nb	C28		C28	Grain Size Analysis See Plate C-36 Triaxial Strength Test - See Plate C-54
						C29			
40			40.0'			C30		C30	
			Bottom of Hole at 40.0'						
45									

Plate C-2
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-2

LOGGED BY: DC/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 19 February 1977
RIG: NORTHLAND	METHOD: 3" & 4" CRREL	START: 1:00	FINISH: 10:45
PROJECT NO.: K 3571	ELEVATION: 99.21 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, little organics to 3.0' depth, low plastic, grey-brown		Vr Vs 60% / 30%	W			Pilot hole to 1.0'
					Nb	C1		C1	
			3.5' 1/4" ice lenses		Vs 30%	C2			
					Vr Vs 70%	C3			
5					Vs 10%	C4		C4	Grain Size Analysis See Plate C-37
			7.2' 1/8" ice lenses		5%	C5		C5	
					Nb	C6			
			9.7' Vs ice lenses			C7		C7	
						C8		C8	S.G.=2.700 Triaxial Strength Test - See Plate C-55
			13.3' Vs ice lenses			C9			
						C10		C10	
15						C11			
						C12		C12	
						C13			
						C14			
						C15		C15	
20						C16			
						C17			
						C18			
						C19		C19	
						C20			
						C21			
25			25.0' - wood particles		Vr Vs <5%	C22		C22	
			26.5' 1/2" ice lens		26.0'	C23			
			- sandier, fine grained, non plastic, grey			C24		C24	
30			29.4' - trace of organics		Nb				

Plate C-3
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-2

LOGGED BY: DC/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 19 February 1977
RIG: NORTHLAND	METHOD: 3" & 4" CRREL	START: 1:00	FINISH: 10:45
PROJECT NO.: K 3571	ELEVATION: 99.21 m	LOCATION: Plant Site	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, low plastic, grey		Nb	C25			
						C26		C26	
						C27			
35						C28		C28	
			36.0' - trace fine sand		Vr Vs <5%	C29			
						C30		C30	
40			40.0'			C31			
			Bottom of Hole at 40.0'						

Plate C-4
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

TEST HOLE NO. PS-3

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 20, 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:10	FINISH: 2:15
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE RETAINED
0	ML	SILT - clayey, trace fine sand, trace of organics to 5.5' depth, low plastic, grey-brown	Vr 60%	W	
			Vs Vx 30%	C1	C1
				C2	
		4.2' - trace sea shells	ICE+		
5			Vs 65%	C3	C3
			ICE+	C4	
			Vs 15%	C5	
			50%		
				C6	C6
			25%	C7	
			20%		
10		10.2' - trace of organics	Vx <5%	C8	C8
				C9	
		13.0' - sandier, fine grained	Vs <5%	C10	C10
				C11	
15			Vr Vs 15%	C12	C12
				C13	
		20.0' 1/8" ice lens	30%	C14	C14
20		21.5' - and fine sand, non plastic, current bedding to 1/16" thickness, grey-brown	10% Vx Vr <5%	C15	
				C16	C16
			Nb	C17	
25				C18	C18
		27.0' - wood chips		C19	
30				C20	C20

OTHER INFORMATION: Pilot hole to 1.0'

Plate C-5
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-3

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 20, 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:10	FINISH: 2:15
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Plant Site	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - some fine sand, trace organic laminations, low plastic, grey-brown		Nb	C20			
					Vr 5%	C21		C21	
35					Nb				
			36.0' - clayey, trace fine sand, trace organic laminations, current bedded, grey-brown		Vs Vr 5%	C22 C23 C24 C25		C23 C25	
40					Vr <5%	C26		C26	
			43.0' - mottled light and dark grey		Nb	C27			
			44.5' - laminated		Vr 10% / 5%	C28 C29 C30		C29	
45					Nb	C31		C32	
			48.5' 1/4" ice lenses 49.2'			C32			
50						C33		C33	
			53.6' - 1" sand layers, medium grained 53.9'		Vx 10%	C34 C35			
55			55.0' - 30% medium sand in 1/2" layers 56.0'						
			57.5'						
	GP		GRAVEL - some sand, layered			C36			Bottom of Hole at 61.0'
	ML		58.0' SILT (TILL-LIKE) - clayey, trace sand, medium plastic, odourous, black		Vr 25%	C37 C38		C37	
60			Bottom of Hole at 61.0'						

Plate C-6
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

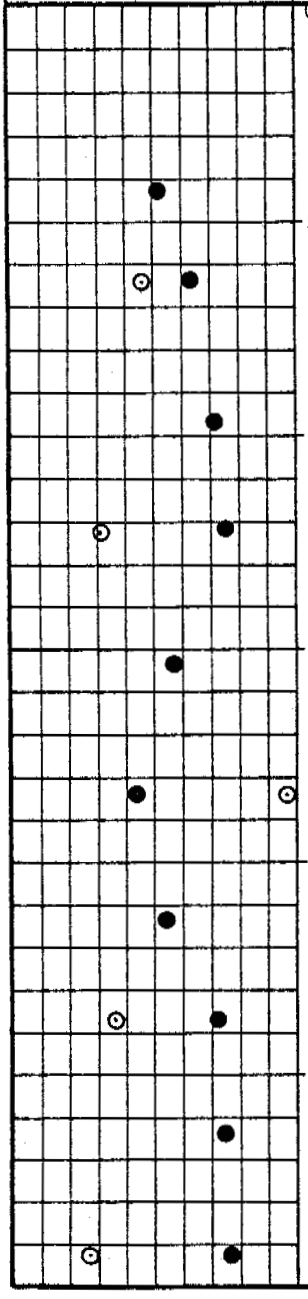
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-4

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 22, 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 21:05	FINISH: 3:10
PROJECT NO.: K 3571	ELEVATION: 99.57 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, some organics to 0.5' depth, trace of organic laminations, low plastic, brown		Nb	C1		C1	
2.0'			- dry, powdery, friable		Nf	C2			
					Vs 50%	C3		C3	
5					60%	C4			
5.5'									
6.2'			- rusty layer - dry, friable layers		20%	C5		C5	
			1" layers 70% Vs with Nb layers alternating		30%	C6			
10.0'			- current bedding, brown and grey		Vr Vs 5%	C7		C7	
10						C8		C8	
					Nb	C9			
			1" clear ice 15.3'		Vr Vs 60%	C10		C10	
						C11			Cored down side of ice wedge
			Vertical ice wedge from 15.3' to 23.5' depth			C12		C12	
15						C13			
						C14			
						C15		C15	
20									
23.5'					Vr 50%	C16			
					Nb	C17		C17	
						C18			
25						C19		C19	
26.0'			- sandier, fine grained						
28.0'					Vs 5%	C20			
28.4'			- sand layer		Nb	C21		C21	
30									

Plate C-7
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-4

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 22, 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 21:05	FINISH: 3:10
PROJECT NO.: K 3571	ELEVATION: 99.57 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, trace organic laminations, low plastic, current bedded, grey		Nb	C22			
31.5'			- wood chips to 1/2" size			W			
						C23			
						C24		C24	
35						C25			
						C26			
37.5'			- some fine sand						
38.0'						C27		C27	
40.0'						C28		C28	
40			Bottom of Hole at 40.0'						

Plate C-8
Sheet 2 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-5

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 5:40	FINISH: 11:15
PROJECT NO.: K 3571	ELEVATION: 99.60 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, some organics to 1.5' depth, low plastic, grey-brown		Vx,Vr 10%	W			Pilot hole to 0.6'
						C1		C1	Thaw Consolidation Test - See Plate C-52
					<5%	C2		C2	
					65%	W			
5					Vs 45%	C3		C3	
					10%	C4		C4	
					Nb				
					Vs 30%	C5		C5	
						C6			
					10%				
					25%	C7			
10					40%	C8		C8	
					20%				
					35%	C9		C9	
					60%				
15					20%	C10			
					30%				
						C11		C11	Grain Size Analysis See Plate C-38
					5%	C12			
20			20.0' - sandier, current bedded, grey		Nb	C13			
								C14	
						C14		C14	
						C15			
25								C16	
						C16			
						C17			
30						C18		C17	

Plate C-9
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-5

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 5:40	FINISH: 11:15
PROJECT NO.: K 3571	ELEVATION: 99.60 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, low plastic, current bedded, grey		Nb	C19		C19	
						C20		C20	
			34.5'			C21			
35	SM		SAND - medium grained, brown						
	ML		35.0' SILT - clayey, trace fine sand, low plastic, current bedded, grey		Vs <5%	C22		C22	
						C23			
						C24		C24	
40								C24	
						C25			
			41.5' 2" of 20% VrVs			C26		C26	
			44.5' - trace of organics			C27		C27	
45			Bottom of Hole at 45.0'						

Plate C-10
Sheet 2 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-6

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:30	FINISH: 16:20
PROJECT NO.: K 3571	ELEVATION: 99.70 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

122.0 ⊙

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED
0	ML	SILT - clayey, trace fine sand, little organics to 4.0' depth, low plastic, brown	Nb	W		
				C1		C1
			Vr Vs 45%	W		C1
5				C2		C2
				C3		
			Nb	C4		C4
		9.0' - sandier, fine grained	Vr Vs <5%	C5		
			15%	C6		C6
10			20%	C7		
			15%	C8		C8
			45%	C9		C9
15			35%	C10		
			5%	C11		C11
				C12		
20			5%	C13		C13
			<5%	C14		
		23.5' - current bedded				
			Nb	C15		C15
25	SM	25.0' SAND - silty, fine grained, trace organic laminations, current bedded, brown		C16		
				C17		C17
30				C18		

OTHER INFORMATION

Pilot hole to 1.0'

Thaw Consolidation Test - See Plate C-52

Plate C-11
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-6

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:30	FINISH: 16:20
PROJECT NO.: K 3571	ELEVATION: 99.70 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, low plastic, grey-brown		Vs 5%	C19		C19	
						C20		C20	
					<5%	C21			
35						C22		C22	
			37.5' - trace of organics			C23			
						C24		C24	
			39.0' - clayey, low plastic						
40			40.0'						
			Bottom of Hole at 40.0'						

Plate C-12
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

TEST HOLE NO. PS-7

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5, 6 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:25	FINISH: 1:45
PROJECT NO.: K 3571	ELEVATION: 99.68 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, little organics to 1.0' depth, low plastic, grey to brown		Vx <5%	W			Pilot hole to 0.5' Thaw Consolidation Test - See Plate C-52
					Nb	C1		C1	
					<5%	C2		C2	
					Vx 40%	C3			
5					Vs 25%	C4			
					10%	C5		C5	
					Vx <5%	C6		C6	
10			10.0' - faint current bedding		Vs 15%	C7		C7	
					<5% 10%	C8			
					30%	C9		C9	
			15% Vs ice 14.1' – 14.6'		Nb	C10			
						C11			
15			10% Vs ice			C12		C12	
			16.0' - current bedding		Vs 20%	C13		C13	
					<5%	C14			
					15%				
20					Vx<5%	C15		C15	
					Nb				
			22.0' - sandy, little organic laminations, grey and brown		Vs 5% Nb	C16		C16	
						C17			
25						C18		C18	
						C19		C19	
30						C20		C20	

Plate C-13
Sheet 1 of 2

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GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-7

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5, 6 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:25	FINISH: 1: 45
PROJECT NO.: K 3571	ELEVATION: 99.68 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, low plastic, grey		Vs<5%	C21			
					Nb	W			
						C22		C22	
						C23		C23	
35						C24			
						C25			
						C26		C26	
						C27		C27	
40						C28		C28	
						C29		C29	
						C30		C30	
45			45.0'						
			Bottom of Hole at 45.0'						

Plate C-14
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

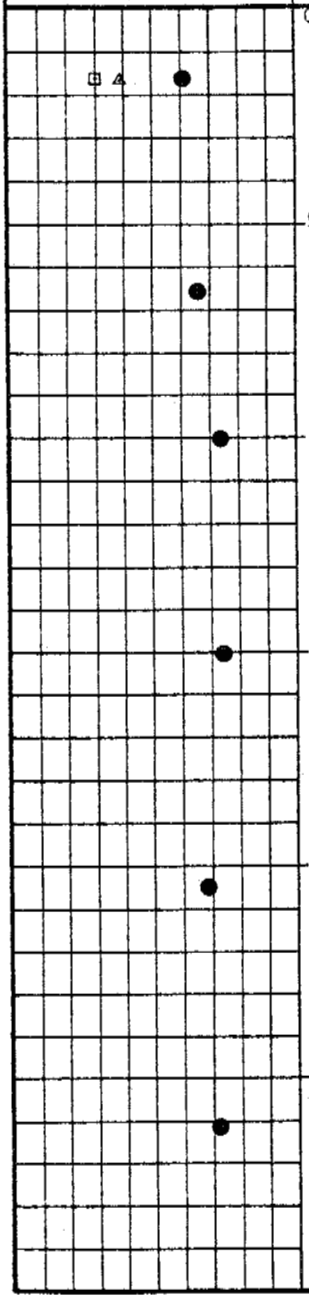
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-8

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 2:10	FINISH: 8:40
PROJECT NO.: K 3571	ELEVATION: 99.80 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace fine sand, some organics to 1.5' depth, low plastic, grey-brown		Vx <5%	W			Pilot hole to 1.0'
				Vs Vx 35%	C1		C1	Grain Size Analysis See Plate C-39 Thaw Consolidation Test - See Plate C-52
				Vx Vr 70%	C2			
5					W			
				Vs <5%	C3		C3	
				Nb			C3	
		8.5' - current bedded, occasional sand lenses			C4			
					C5			
10				Vs <5%			C5	
				Nb	C6		C6	
		12.0' 1/8" Vs ice lens			C7			
					C8		C8	
15		15.0' - sandy, fine grained, current bedded			C9		C9	
					C10		C10	
				Vs 10%	C11			
				Nb				
20					C12		C12	
					C13		C13	
		22.0' - organic lamination, brown			C14			
					C15		C15	
25		25.1' 1/16" Vs ice lens			C16		C16	
					C17		C17	
		27.5' - sand layers						
		28.0' - clayey, low plastic, grey			C18			
				Vs 5%	C19			
30								

Plate C-15
Sheet 1 of 2

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-8

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 2:10	FINISH: 8:40
PROJECT NO.: K 3571	ELEVATION: 99.80 m	LOCATION: Plant Site	

W_p - □ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, low plastic, current bedded, grey		Vs 5%	C19		C19	
						C20		C20	Grain Size Analysis See Plate C-40
					Nb	C21		C21	
35						C22		C22	
			37.0' 1/16" Vs ice lens			C23			
						C24			
40			40.2' - trace gravel		Vr <5%	C25		C25	
			42.5'						
			Bottom of Hole at 42.5'						
45									

Plate C-16
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

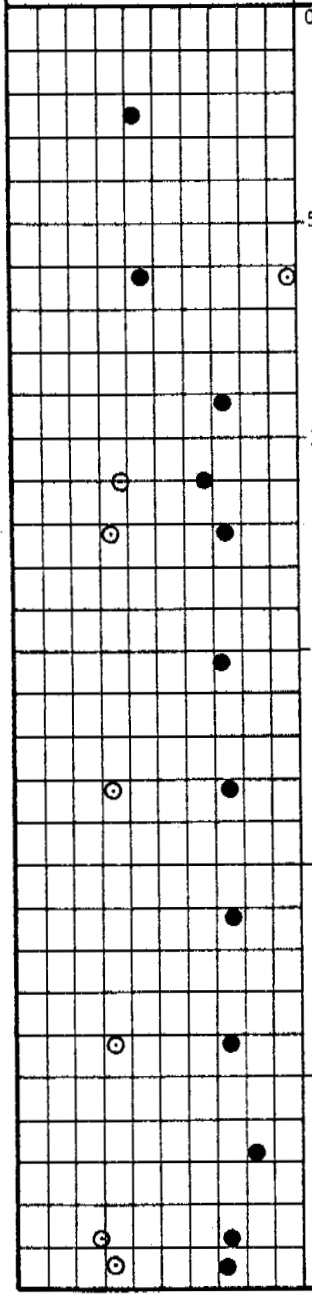
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-9

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18, 20 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:40	FINISH: 10:30
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, trace of organics, low plastic, brown		Vr Vs 70%	W			Pilot hole to 1.0'
					Vs 50%	C1		C1	
					ICE+	C2			
5					Vs 50%	C3		C3	
					ICE+				
					Vs 60%				
					ICE+			C4	
					Vr Vs 60%	C4			
					Vx Vr 15%	C5			
			9.5' - wood, roots			C6		C6	Specific Gravity = 2.72
10			10.5' - some fine sand, trace of organic laminations, grey and brown			C7		C7	Triaxial Strength Test - See Plate C-55
					Vr Vs 10%	C8		C8	
					Nb	C9			
15					Vs <5%	C10		C10	
					Vr Vs 5%	C11			
						C12		C12	
						C13		C13	
20						C14		C14	
					Vr 5%	C15			
						C16		C16	Grain Size Analysis See Plate C-41
						C17		C17	Triaxial Strength Test - See Plate C-54
25			25.5' - trace fine sand, trace of organic laminations, grey and brown		Nb	C18			C19 - Triaxial Strength Test - See Plate C-54
						C19		C19	
30									Plate C-17 Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-9

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18, 20 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:40	FINISH: 10:30
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - trace of fine sand, trace of organic laminations, low plastic, grey and brown		Nb Vr 15%	C20			
				Nb	C21			
					C22		C22	
35					C23		C23	
		36.0' - little fine sand, non plastic			C24		C24	Grain Size Analysis See Plate C-42 Triaxial Strength Test - See Plate C-54
					C25		C25	
					C26			
40					C27		C27	
				Vx Vr <5%	C28		C28	
					C29		C29	
					C30			
45				Nb	C31		C31	
					C32		C32	
					C33			
					C34		C34	
50					C35		C35	
					C36			
		52.7' - little organics			C37		C37	
		53.5'			C38		C38	Grain Size Analysis See Plate C-43
55	SM	SAND - fine grained, silty, trace of organic laminations, non plastic, current bedded, grey and brown						
		57.0' - 1/2" root		Vx 10%	C39		C39	
				Vr <5%	C40		C40	
60		Bottom of Hole at 60.0'						

Plate C-18
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

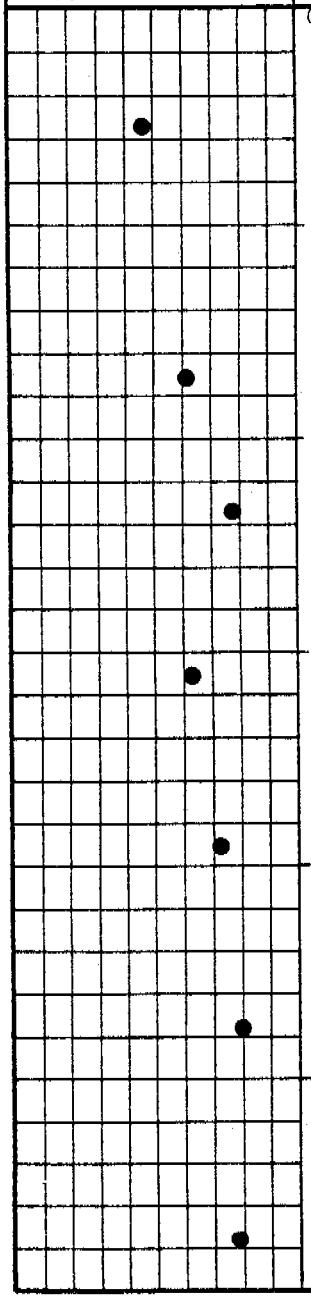
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-10

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:00	FINISH: 18:15
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: Plant Site	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace fine sand, trace of organics, low plastic, brown		Vs 20%	W			Pilot hole to 0.5'
				40%	C1			
				Vs Vr 60%			C1	
					C2		C2	
5				Vs 20%	C3			
					C4			
				Nb	C5		C5 C5	
		8.5' - organic laminations		Vs <5%	C6			
10				5%	C7		C7	
				30%	C8		C8	
		15.0' - grey			C9		C9	
		17.0' - sandier, organic laminations		Vs Vr 20%	C10		C10	
				Nb	C11		C11	
20				Vs <5%	C12			
				5%	C13		C13	
				Nb	C14		C14	
25		25.5' - light brown sand lenses		Vs 5%	C15			
					C16		C16	Plate C-19
30		Bottom of Hole at 30.0'			C17		C17	Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

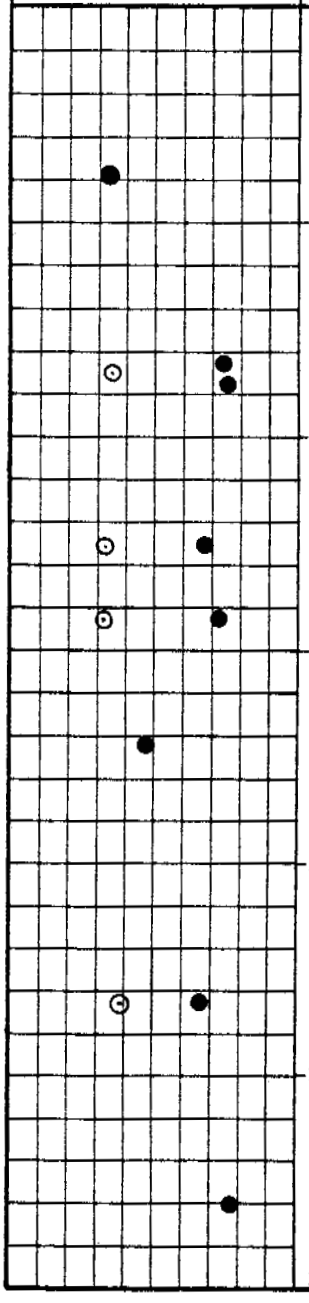
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-11

LOGGED BY: GCD/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2, 3 March 1977
RIG: S. D. S.	METHOD: VTM	START: 4:15	FINISH: 11:20
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) 60 80 100 120
MOISTURE CONTENT 20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace fine sand, some organics to 4.7' depth, low plastic, grey		Vx Vr 40%	C1			
				10% Vs 75%	C2			
				60%	C3		C3	Thaw Consolidation Test - See Plate C-53
5				40% Vr Vs 60%	C4			
					C5		C5	
				Vx 10%			C5	Specific Gravity = 2.72
10				Nb				
					C6		C6	
		13.5' - sand lenses						Triaxial Strength Test - See Plate C-55
15				Vs <5%			C6	
				Vr Vs 10%				
				Vr Vs 50%			C7	
				Vr Vs 5%	C7			
							C7	
20		21.3' - 1/4" organic layers						
					C8			
				Nb			C8	
							C8	
25				Vr Vs <5%				
					C9		C9	
30							C9	

Plate C-20
Sheet 1 of 4

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-11

LOGGED BY: GCD/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2, 3 March 1977
RIG: S. D. S.	METHOD: VTM	START: 4:15	FINISH: 11:20
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - trace fine sand, trace of organics, low plastic, grey	Vr Vs <5%	C10		C10	
			5%			C10	
35			5%	C11		C11	Triaxial Strength Test - See Plate C-54
			<5%			C11	
40			5%	C12		C12	
			<5%			C12	
45			Nb	C13		C13	Grain Size Analysis See Plate C-44
		51.0' - and fine sand, layered, non plastic, grey				C13	
50				C14		C14	
						C14	Grain Size Analysis See Plate C-45
55				C15		C15	
60						C15	

Plate C-21
Sheet 2 of 4

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-11

LOGGED BY: GCD/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2, 3 March 1977
RIG: S. D. S.	METHOD: VTM	START: 4:15	FINISH: 11:20
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
60	ML	SILT - and sand, layered, non plastic, grey		Nb	C16		C16	
							C16	
65					C17		C17	
							C17	
		68.5' / 69.0' - gravel and sand layer						
70	CI	CLAY (TILL-like) - silty, trace of fine to coarse sand, trace fine gravel to 1/2" size, medium plastic, grey		Vs Vx 5%	S18		S18	N=104
				Vr Vs Vx 15%	C19		C19	
75							C19	
				Vs 15%	C20		C20	
80		80.5' - 6" silt layer		Vr 5%	C21		C20	
85		85.0' - trace of organics		Vr Vs 15%	C22		C22	
				10%			C22	
90								

Plate C-22
Sheet 3 of 4

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-11

LOGGED BY: GCD/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2, 3 March 1977
RIG: S. D. S.	METHOD: VTM	START: 4:15	FINISH: 11:20
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
90	CI		CLAY (TILL-like) - silty, trace fine to coarse sand, occasional fine gravel to 1/2" size, trace of organics, medium plastic, grey		Vr Vs 10%	C23			
			94.5'						
95	ML		SILT (TILL-like) - trace fine sand, low plastic, grey-brown		Nb	C24		C24 C24	
			99.0' --- - 4" sand layer						
100			100.0'						
			Bottom of Hole at 100.0'						

Plate C-23
Sheet 4 of 4

TEST HOLE LOG

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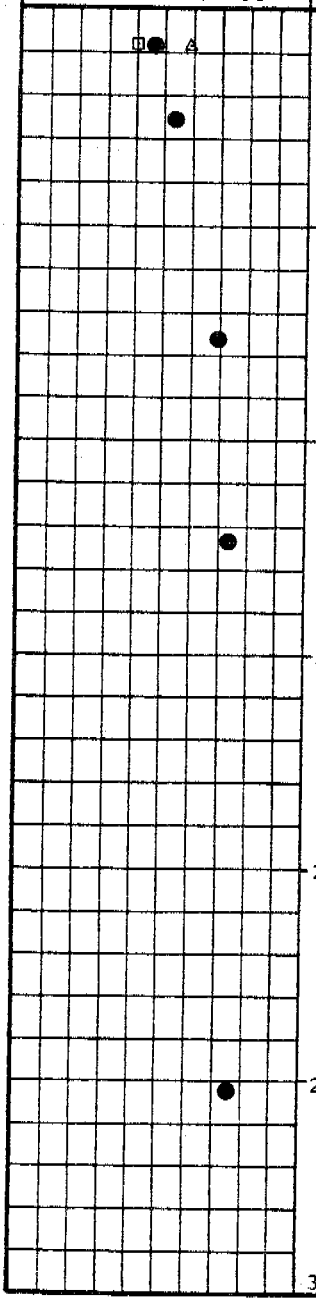
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-12

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:30	FINISH: 17:30
PROJECT NO.: K 3571	ELEVATION: 99.56 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OH	ORGANIC SILT - high plastic		Vs 50%	W		C1	Pilot hole to 0.5'
		1.5'						Thaw Consolidation Test - See Plate C-53
	ML	SILT - clayey, some organics to 1.5' depth, trace fine sand, low plastic, brown		Vs Vr 20%	C1		C1	Grain Size Analysis See Plate C-46
				ICE+	C2			
5				Vs 50% 20%	C3			
				50% 10%	C4			
				Nb	C5		C5	
		8.5' - grey		Vs 30%	C6		C6	
				Nb	C7		C7	
10				Vs 20%	C8			
					C9		C9	
				30%				
		16.5' - laminated, sandier		Nb	C10		C10 C10	
					C11			
15				Vs 5%	C12			
					C13			
					C14		C14	
				Nb	C15			
20				Vs 5%	C16			
		28.2' - light brown sand lenses to 1/4" thickness			C17			
25								
30								

Plate C-24
Sheet 1 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-12

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:30	FINISH: 17:30
PROJECT NO.: K 3571	ELEVATION: 99.56 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, low plastic, laminated, grey		Vs 5%	C17		C17	
						C18		C18	
						C19			
35						C20		C20	
			36.5' - yellow sand layers			C21			
						C22		C22	
40						C23		C23	
						C24			
						C25		C26	
45			45.0'			C26			
			Bottom of Hole at 45.0'						

Plate C-25
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

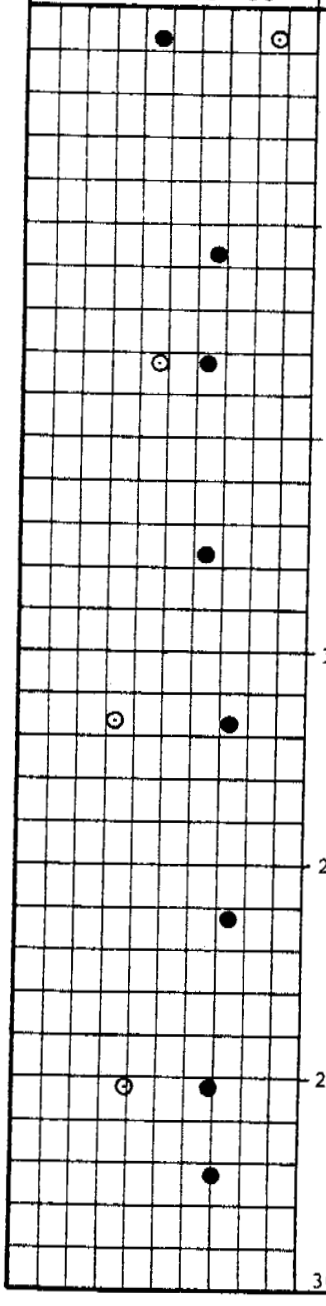
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-13

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 2:00	FINISH: 5:00
PROJECT NO.: K 3571	ELEVATION: 99.52 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, some organics to 1.0' depth, low plastic, grey		Vx Vr <5%	C1		C1	Pilot hole to 0.5'
					10%				
					40%	C2		C2	
					65%	C3			
5					Vs 35%	C4		C4	
					<5%	C5		C5	
					20%	C6		C6	
					Nb Vs 25%	C7			
			10.5' - current bedded			C8		C8	
10					20%			C9	
						C9			
					25%	C10		C10	
			16.4' - sandy, fine grained		Nb	C11		C11	
						C12			
15						C13		C13	
			20.5' - sandy, organic laminations			C14		C14	
						C15		C15	
						C16		C16	
20						C17		C17	
			27.0' - no sand			C18		C18	
						C19		C19	
25									
30			Bottom of Hole at 30.5'		Vs, 5%				

Plate C-26
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

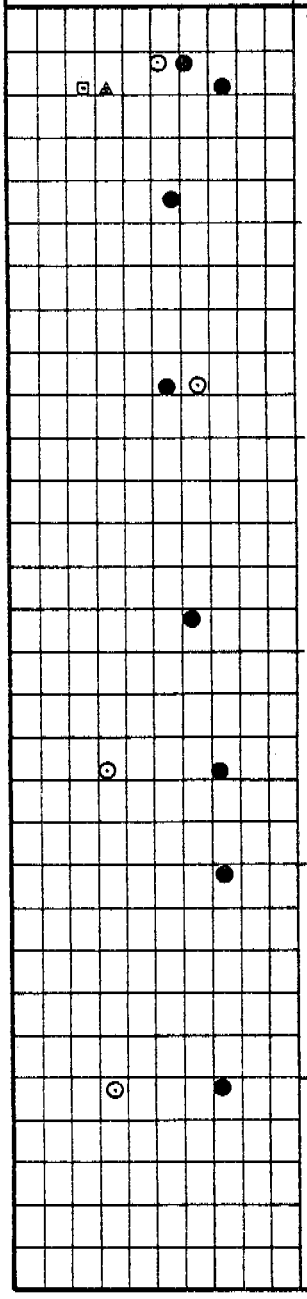
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-14

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 4, 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 13:00	FINISH: 1:45
PROJECT NO.: K 3571	ELEVATION: 99.32 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, some organics to 2.0' depth, low plastic, laminated, brown		Vr Vs 30% 50% ICE+ Vr Vs 70% 40% Vs 60% Vr Vs 60% Vs 30% 5% <5%	W C1 C2 C3 C4 C5 C6		C1 C1 C3 C4 C6	Pilot hole to 0.6' Thaw Consolidation Test - See Plate C-53 Grain Size Analysis See Plate C-47
5									
9.0'			- grey, non laminated		Nb	C7 C8			
10									
13.0'			1" of 30% Vs ice			C9		C9	
15					Vs 20% Nb	C10 C11		C11 C11	
20					Vs 20% Nb	C12 C13		C13	
21.5'			2" of 5% Vs ice			C14		C14	
25						C15 C16		C15	
30						C17 C18		C17	Plate C-27 Sheet 1 of 3

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-14

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 4, 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 13:00	FINISH: 1:45
PROJECT NO.: K 3571	ELEVATION: 99.32 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - trace fine sand, low plastic, grey		Nb	C18			
				Vs <5%	C19		C19	
35		35.0' - laminated			C20		C20	
					C21		C21	
		38.5' - non laminated			C22		C22	
40				Nb	C23		C23	
					C24		C24	
		42.7' -and fine sand, non plastic, layers to 3/4" thickness			C25		C25	Grain Size Analysis See Plate C-48
45					C26		C26	
					C27			
					C28		C28	
					C29		C29	
50		50.7' - wood chips to 52.5' depth			C30			
					C31		C31	
					C32			
		54.0' - non layered, low plastic			C33		C33	
55					C34		C34	
		56.2' 1/16" ice lenses			C35		C35	
					C36		C36	
					C37			
60					C38		C38	

Plate C-28
Sheet 2 of 3

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-14

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 4, 5 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 13:00	FINISH: 1:45
PROJECT NO.: K 3571	ELEVATION: 99.32 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
60	ML		SILT - trace fine sand, low plastic, grey		Nb	C39		C39	
						C40		C40	
			63.0'					C41	
	SM ML		SAND AND SILT - alternating 1/2" layers of sand and silt, non plastic, grey			C41			
65						C42		C42	
			66.5'					C42	
	ML		SILT - low plastic, grey			C43		C43	
			67.3'						
	GP		67.8' GRAVEL - sandy, silty		Vs <5%	W			
	ML		SILT (TILL-like) - some fine sand, trace gravel, clayey, low plastic, grey		Vx Vr 40%	C44		C45	
70						C45		C45	
					20%				
			72.7'			C46		C46	
			Bottom of Hole at 72.7'						
75									

Plate C-29
Sheet 3 of 3

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GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-15

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 4 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 6:00	FINISH: 9:30
PROJECT NO.: K 3571	ELEVATION: 99.34 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OH	ORGANIC SILT - trace fine sand, clayey, high plastic		Nb	W			Pilot hole to 1.0'
1.6'	ML	SILT - clayey, trace of fine sand, low plastic, grey		Vx <5%	C1		C1	Thaw Consolidation Test - See Plate C-53
				Vx Vr 60%	C2		C2	Grain Size Analysis See Plate C-49
5					C3			
				75%	W			
8.5'		- sandier, fine grained		Vs 10%	C4		C4	
				Nb	C5		C4	
10					C6		C6	
					C7		C7	
15					C8		C8	
				Vs <5%	C9		C9	
				Nb	C10		C10	
20					C11			
					C12		C12	
					C13		C13	
25					C14		C14	
					C15		C15	
28.0'		- laminated		Vs 5%	C16			
30		Bottom of Hole at 30.0'			C17		C17	

Plate C-30
Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-16

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 4 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 1:00	FINISH: 5:30
PROJECT NO.: K 3571	ELEVATION: 99.69 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, clayey, some organics to 1.0' depth, low plastic, grey		Vx Vr 5%	W			Pilot hole to 1.0'
						C1		C1	Grain Size Analysis See Plate C-50
					Vx Vr Vs 55%	C2			
5						C3			
					Vs 40%	C4		C4	
					Vx Vs 20%	C5			
					15%	C6		C6	
					30%				
					5%	C7		C7	
					<5%				
					25%	C8			
					Vs <5%	C9		C9	
10									
					Nb	C10		C10	
						C11		C11	
					Vx Vr 15%	C12			
					Nb				
15						C13		C13	
					Vx Vr 15%	C14			
					Nb	C15		C15	
						C16		C16	
						C17		C17	
20									
						C18			
25									
			27.8' 3" of 15% Vx, Vr ice		Vx,Vr 30%				
30									

Plate C-31
Sheet 1 of 2

TEST HOLE LOG

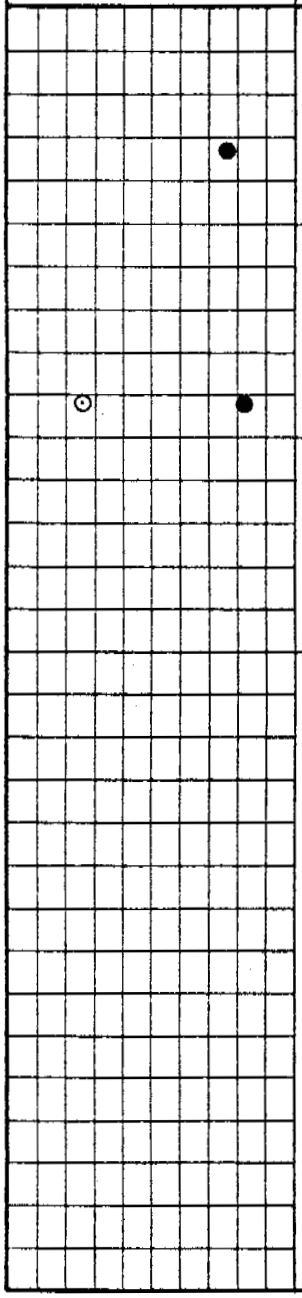
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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

TEST HOLE NO. PS-16

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 4 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 1:00	FINISH: 5:30
PROJECT NO.: K 3571	ELEVATION: 99.69 m	LOCATION: Plant Site	



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, low plastic, grey		Vx,Vr 30%	C19		C19	
					Nb	W			
						C20		C20	
35						C21		C21	
					Vr 15%	C22			
					Nb	C23		C23	
						C24		C24	
40						C25		C25	
			42.9' - 1" sand layer		Vx,Vr 15%	C26			
			45.0'		Nb	C27			
45			Bottom of Hole at 45.0'						

Plate C-32
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

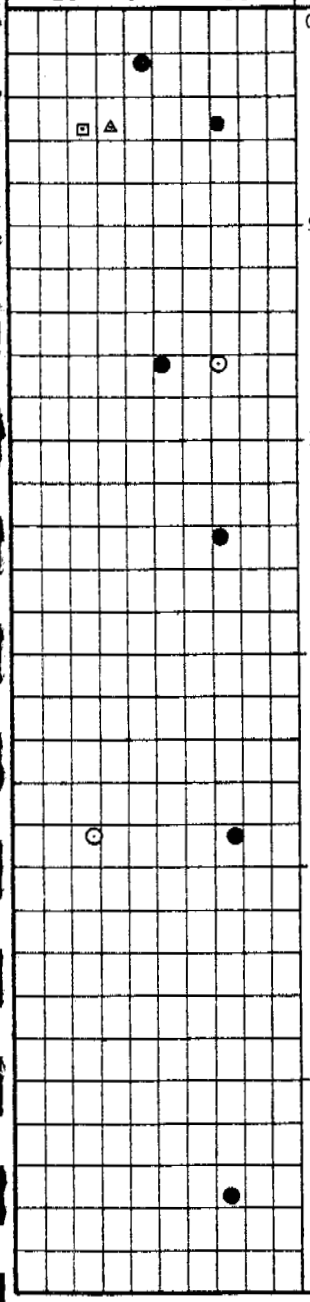
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-17

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:30	FINISH: 23:30
PROJECT NO.: K 3571	ELEVATION: 99.60 m	LOCATION: Plant Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace fine sand, clayey, some organics to 1.0' depth, low plastic, grey-brown		Vx Vs 5%	W C1		C1	Pilot hole to 1.0' Thaw Consolidation Test - See Plate C-53 Grain Size Analysis See Plate C-51
5				Vx Vr 65%	C2 W		C1	
				Vs 10%	C3 C4		C3 C4	
10		11.5' - layered		<5%	C5 C6 C7		C5 C6	
15				<5%	W C8 C9 C10		C8 C9 C11	
20					C11 C12			
25				Nb	C13 C14		C13	
30								

Plate C-33
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. PS-17

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:30	FINISH: 23:30
PROJECT NO.: K 3571	ELEVATION: 99.60 m	LOCATION: Plant Site	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, low plastic, grey		Nb	C14		C14	
						W			
						C15			
					Vx Vs 5%	C16			
35								C16	
			37.0'		Vx <5%	C17			
			- current bedded		Nb	C18		C18	
						C19		C19	
40			40.5'			C20			
			Bottom of Hole at 40.5'						
45									

Plate C-34
Sheet 2 of 2

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

PROJECT: Niglintgak Gas Project
LOCATION: Plant Site
DATE: February/March 1977
JOB NO. K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
PS-1	2.0' -2.5'	C1	ML	SILT - clayey, trace fine sand, low plastic, occasional organic laminations, grey to brown - frozen, Vr Vs 10%							115.7	88.3	30.9	Thaw Consolidation Test Plate C-52
PS-1	15.0' -16.0'	C11	ML	SILT - clayey, trace fine sand, low plastic, occasional organic laminations, grey to brown - frozen, Vr Vs 10%/Nb										Triaxial Strength Test Plate C-55
PS-1	32.0' -33.0'	C24	ML	SILT - clayey, trace fine sand, non plastic, occasional organic laminations, grey to brown - frozen, Vr 5%	non plastic			1.6	94.4	4.0				
PS-1	37.4' -38.4'	C28	ML	SILT - clayey, non plastic, occasional organic laminations, grey to brown - frozen, Nb	non plastic			0.4	93.7	5.9				Triaxial Strength Tests (2) Plate C-54
PS-2	5.5' -6.3'	C4	ML	SILT - clayey, trace fine sand, non plastic, grey-brown - frozen, Vs 10%	non plastic			2.2	88.0	9.8				
PS-2	11.5' -12.5'	C8	ML	SILT - clayey, trace fine sand, non plastic, grey-brown - frozen, Nb										Triaxial Strength Test Plate C-55
PS-5	0.8' -1.5'	C1	ML	SILT - clayey, trace fine sand, some organics, low plastic, grey-brown - frozen, Vx Vr 10%							102.6	70.2	39.7	Thaw Consolidation Test Plate C-52
PS-5	17.0' -17.6'	C11	ML	SILT - clayey, trace fine sand, non plastic, grey-brown - frozen, Vs 30%	non plastic			6.2	80.5	13.3				
PS-6	1.0' -2.0'	C1	ML	SILT - clayey, trace fine sand, little organics, low plastic, brown - frozen, Vs 30%							93.5	54.4	33.3	Thaw Consolidation Test Plate C-52
PS-7	0.7' -1.4'	C1	ML	SILT - clayey, trace fine sand, little organics to 1.0' depth, low plastic, grey to brown - frozen, Vx <5%							113.4	86.3	33.4	Thaw Consolidation Test Plate C-52
PS-8	1.2' -2.0'	C1	ML	SILT - clayey, trace fine sand, some organics to 1.5' depth, low plastic, grey-brown - frozen, Vx <5%/Vs Vx 35%	40	30	10	4.8	77.0	18.2	100.2	68.2	44.3	Thaw Consolidation Test Plate C-52
PS-8	32.2' -33.0'	C24	ML	SILT - clayey, low plastic, current bedded, grey - frozen, Nb				0.4	95.0	4.6				
PS-9	10.5' -11.5'	C7	ML	SILT - some fine sand, trace organic laminations, grey and brown - frozen, Vx Vr 15%										Triaxial Strength Test Plate C-55
PS-9	24.7' -25.5'	C16	ML	SILT - some fine sand, trace organic laminations, grey and brown - frozen, Vr 5%	non plastic			34.2	63.8	2.0				Triaxial Strength Test Plate C-54

TABLE C-2

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

PROJECT: Niglintgak Gas Project
LOCATION: Plant Site
DATE: February/March 1977
JOB NO.: K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
PS-9	28.5' -30.0'	C19	ML	SILT - trace fine sand, trace organic laminations, grey and brown - frozen, Nb										Triaxial Strength Test Plate C-54
PS-9	35.5' -36.5'	C24	ML	SILT - trace organic laminations, low plastic, grey and brown - frozen, Nb	32	30	2	0.4	91.7	7.9				Triaxial Strength Test Plate C-54
PS-9	55.5' -56.5'	C38	SM	SAND - fine grained, silty, trace organic laminations, non plastic, current bedded, - frozen, Nb grey and brown	non plastic			71.1	27.1	1.8				
PS-11	3.5' -4.3'	C3	ML	SILT - trace fine sand, some organics, low plastic, grey - frozen, Vs 60%							73.8	31.3	43.5	Thaw Consolidation Test Plate C-53
PS-11	13.8' -14.5'	C6	ML	SILT - trace fine sand, some organics, low plastic, grey - frozen, Vs <5%										Triaxial Strength Test Plate C-55
PS-11	38.8' -39.8'	C11	ML	SILT - trace fine sand, trace organics, low plastic, grey - frozen, Vr Vs <5%										Triaxial Strength Test Plate C-54
PS-11	49.0' -50.0'	C13	ML	SILT - trace fine sand, trace organics, low plastic, grey - frozen, Nb				1.0	94.4	4.6				
PS-11	54.0' -55.0'	C14	ML	SILT - and fine sand, layered, non plastic, grey - frozen, Nb	non plastic			35.9	59.3	4.8				
PS-12	0.5' -1.1'	C1	OH	ORGANIC SILT - clayey, trace fine sand, high plastic - frozen, Vs 50%	59	40	19	6.2	70.1	23.7	88.1	50.5	64.2	Thaw Consolidation Test Plate C-53
PS-14	1.5' -2.2'	C1	ML	SILT - trace fine sand, some organics to 2.0' depth, low plastic, laminated, - frozen, ICE plus brown	34	27	7	2.0	82.9	15.1	114.9	89.9	30.9	Thaw Consolidation Test Plate C-53
PS-14	42.7' -43.5'	C25	ML	SILT - and fine sand, non plastic, layers to 3/4" thickness - frozen, Nb	non plastic			43.8	53.4	2.8				
PS-15	1.0' -1.6'	C1	OH	ORGANIC SILT - trace fine sand, clayey, high plastic - frozen, Vx <5%	68	51	17	9.0	70.8	20.2	79.6	39.7	73.3	Thaw Consolidation Test Plate C-53
PS-16	2.1' -2.9'	C1	ML	SILT - trace fine sand, clayey, low plastic, grey - frozen, Vx Vr 5%				0.8	84.4	14.8				
PS-17	2.3' -3.0'	C1	ML	SILT - trace fine sand, clayey, low plastic, grey-brown - frozen, Vx Vs 5%	32	25	7	2.0	83.6	14.4	116.1	87.7	30.5	Thaw Consolidation Test Plate C-53

TABLE C-2

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-1, C24
SOURCE	Plant Site
HOLE PS-1 DEPTH	32.0'-33.0'
TECHNICIAN B.C.	DATE TESTED 15/4/77

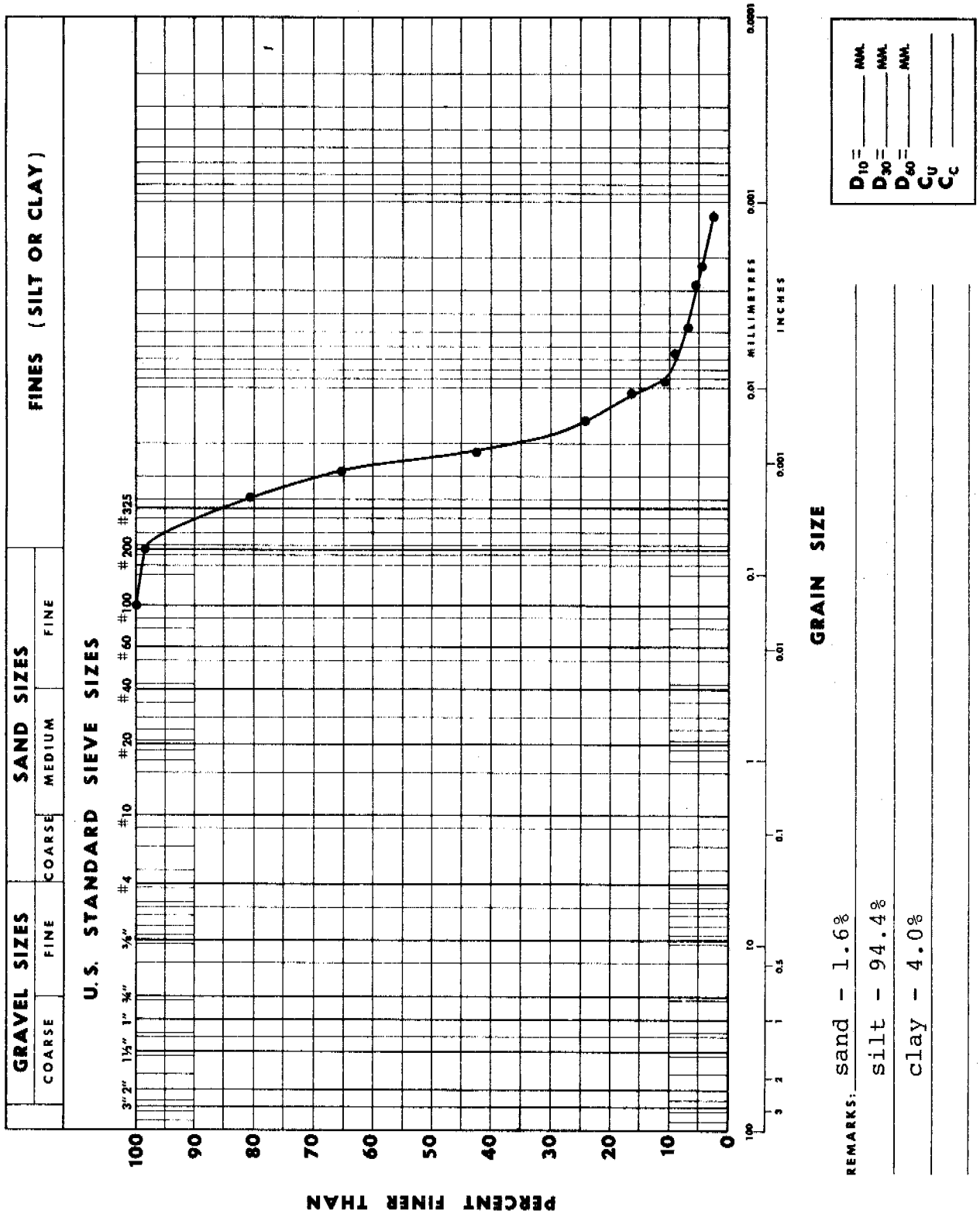
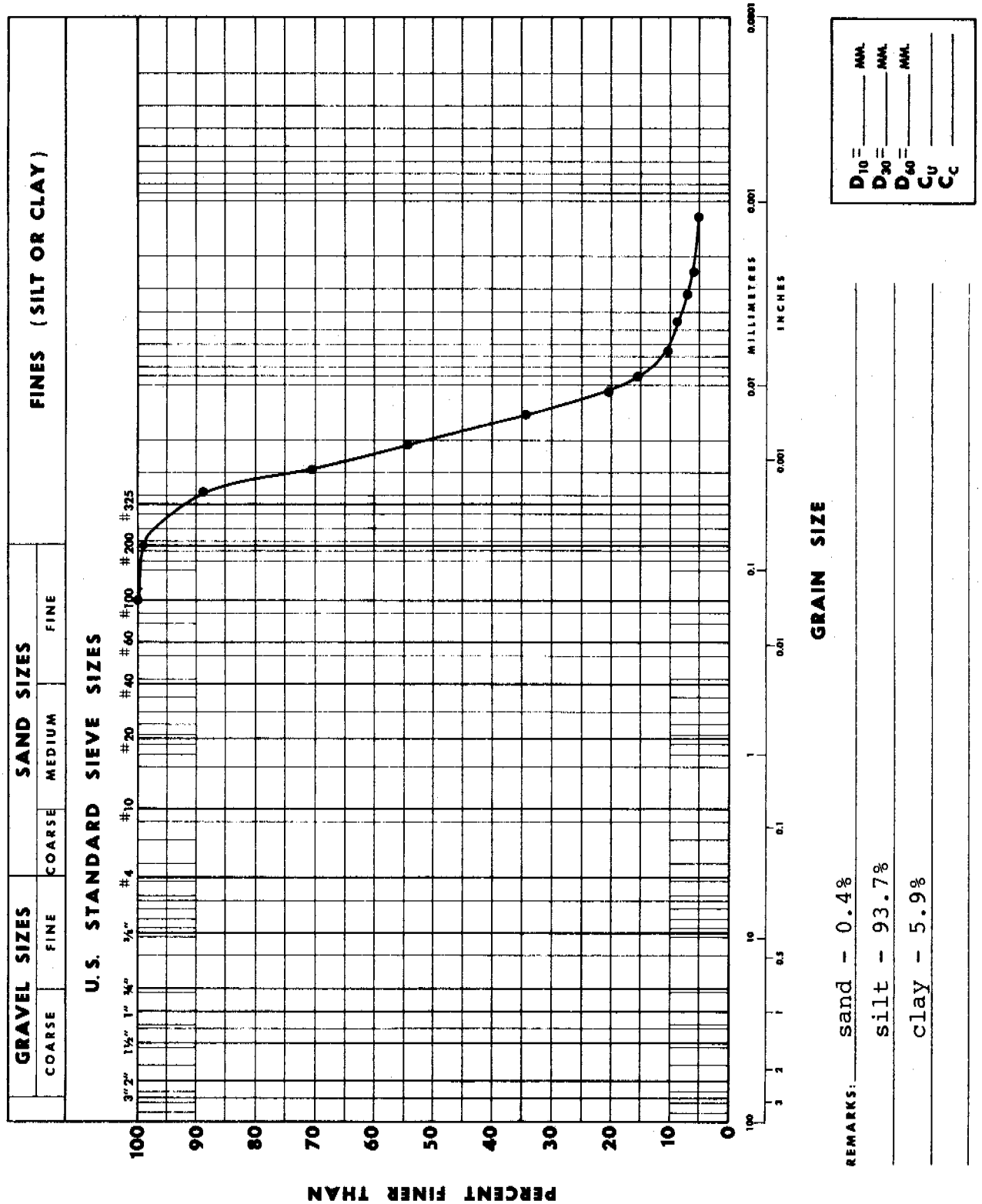


PLATE C-35

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-1 C28
SOURCE	Plant Site
HOLE	PS-1 DEPTH 37.4'-38.4'
TECHNICIAN	B.C. DATE TESTED 15/4/77



REMARKS: sand - 0.4%
silt - 93.7%
clay - 5.9%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

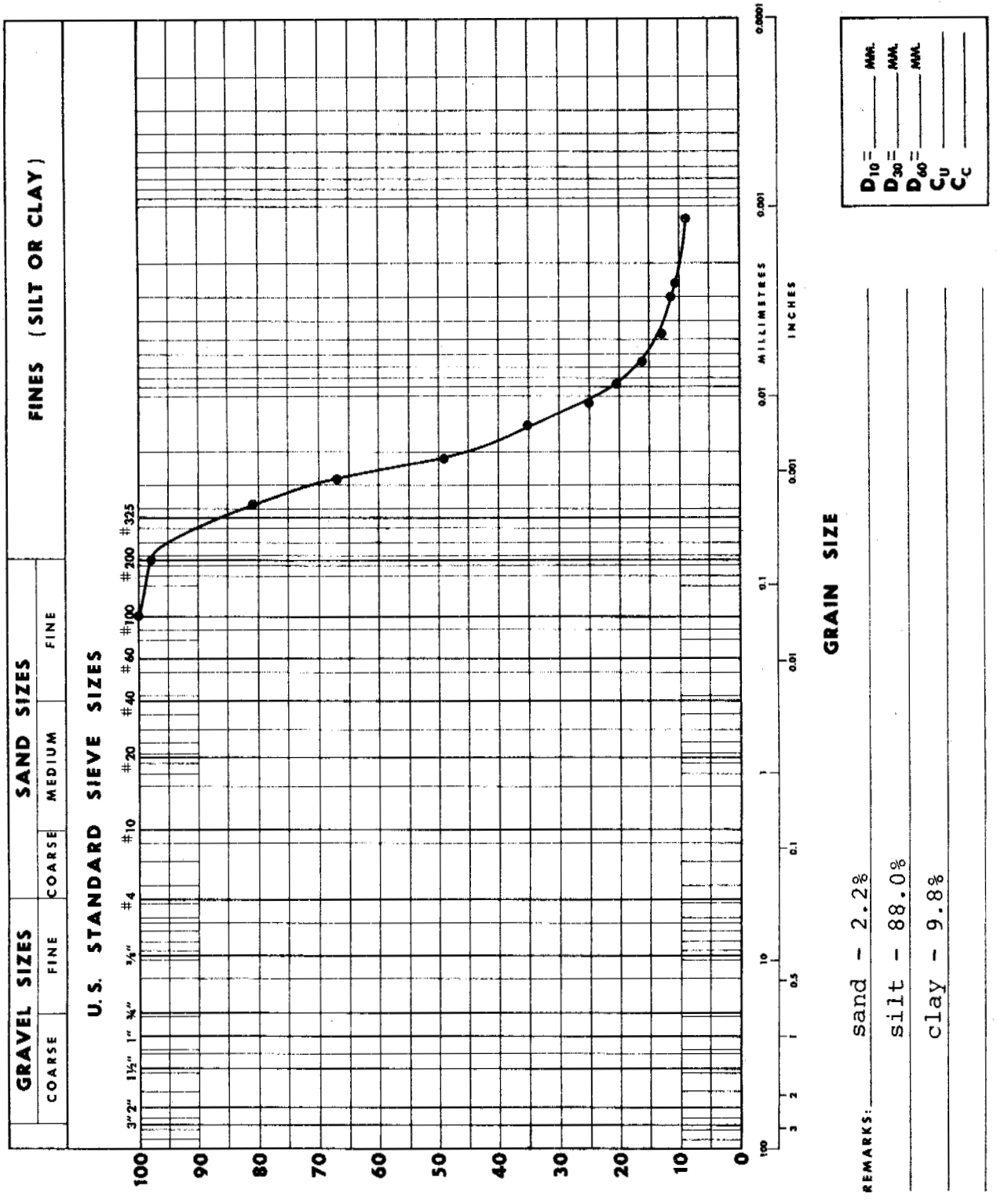
PLATE C-36

GU202-0373

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-2, C4
SOURCE	Plant Site
HOLE PS-2 DEPTH	5.5'-6.3'
TECHNICIAN B.C.	DATE TESTED 1/5/77



REMARKS: sand - 2.2%
silt - 88.0%
clay - 9.8%

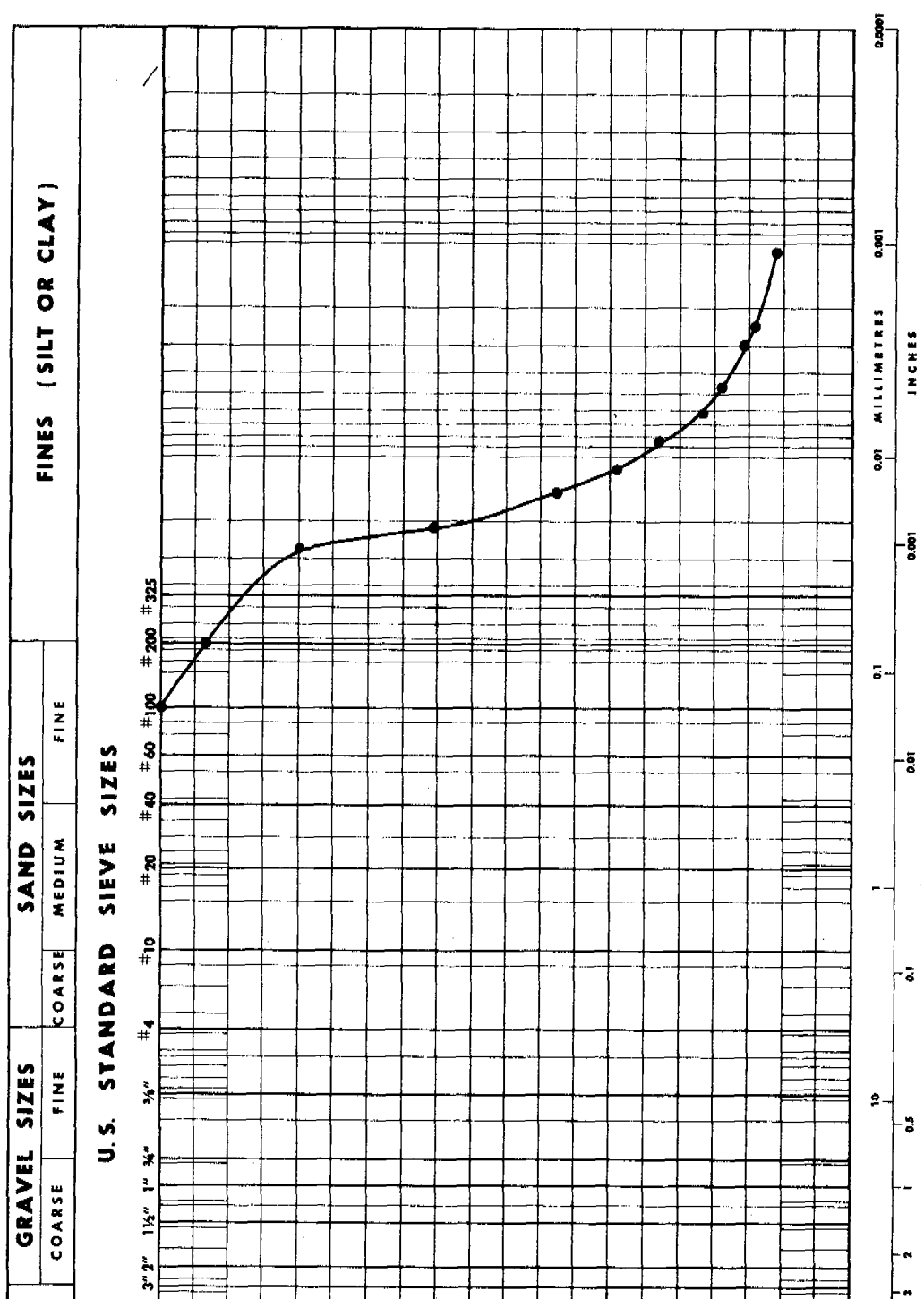
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-37

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-5, C11
SOURCE	Plant Site
HOLE PS-5 DEPTH	17.0'-17.6'
TECHNICIAN B.C.	DATE TESTED 2/5/77



GRAIN SIZE

D_{10} = ____ MM.
D_{30} = ____ MM.
D_{60} = ____ MM.
C_U = ____
C_C = ____

REMARKS: sand - 6.2%
silt - 80.5%
clay - 13.3%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

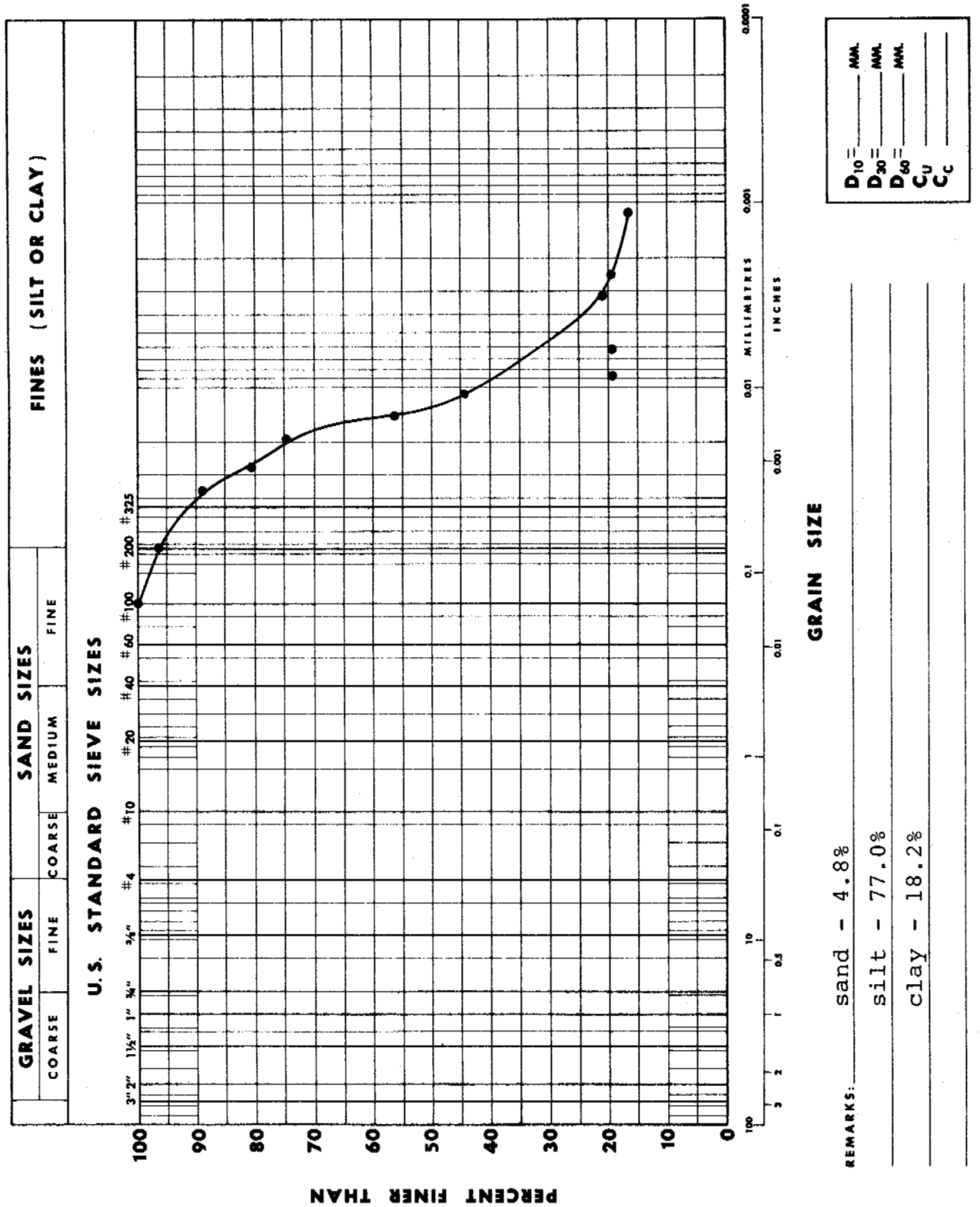
PLATE C-38

GU202-0373

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-8, C1
SOURCE	Plant Site
HOLE PS-8 DEPTH	1.2'-2.0'
TECHNICIAN B.C.	DATE TESTED 27/4/77



REMARKS: sand - 4.8%
silt - 77.0%
clay - 18.2%

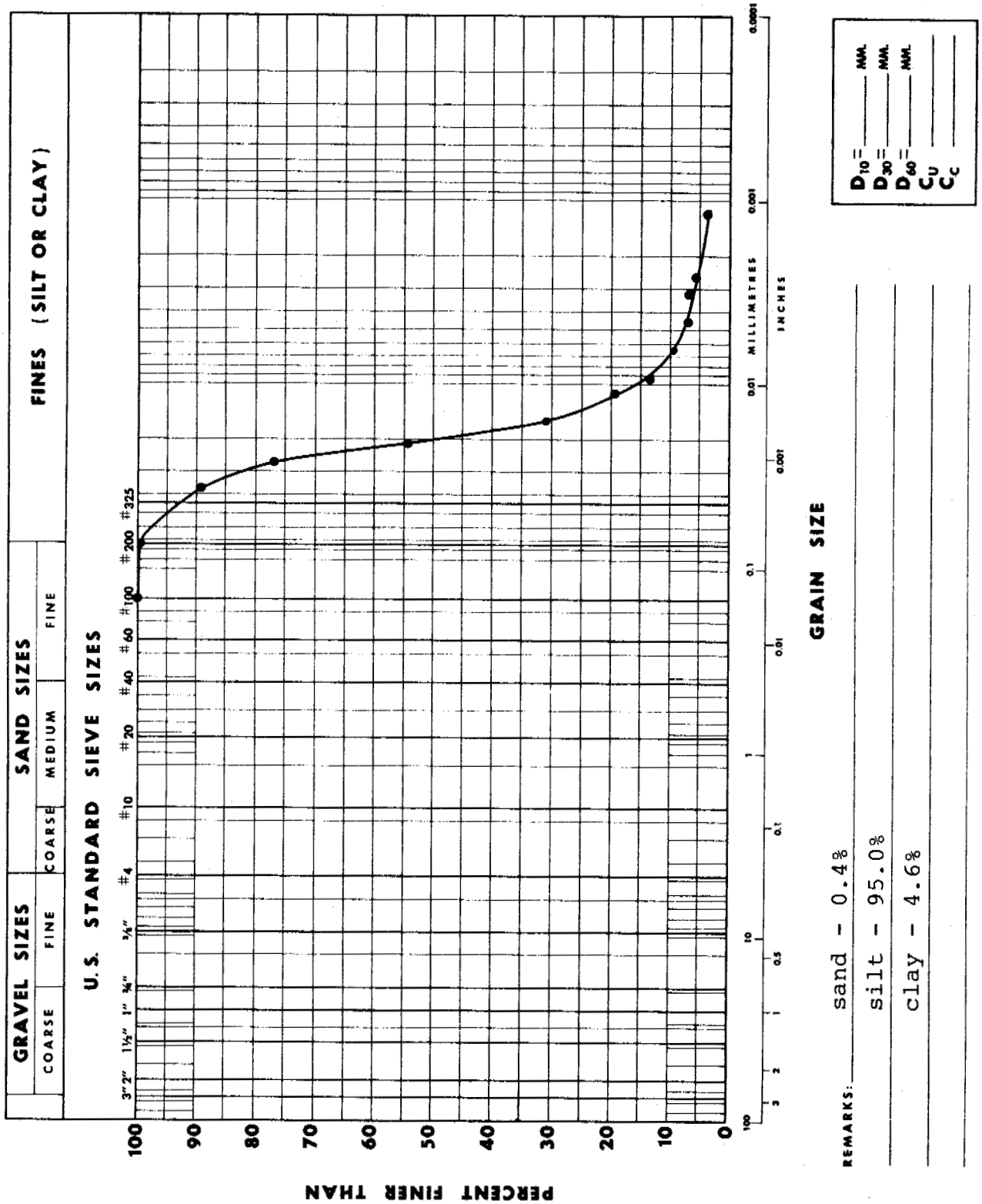
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-39

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-8, C20
SOURCE	Plant Site
HOLE PS-8 DEPTH	32.2'-33.0'
TECHNICIAN B.C.	DATE TESTED 1/5/77



REMARKS: sand - 0.4%
silt - 95.0%
clay - 4.6%

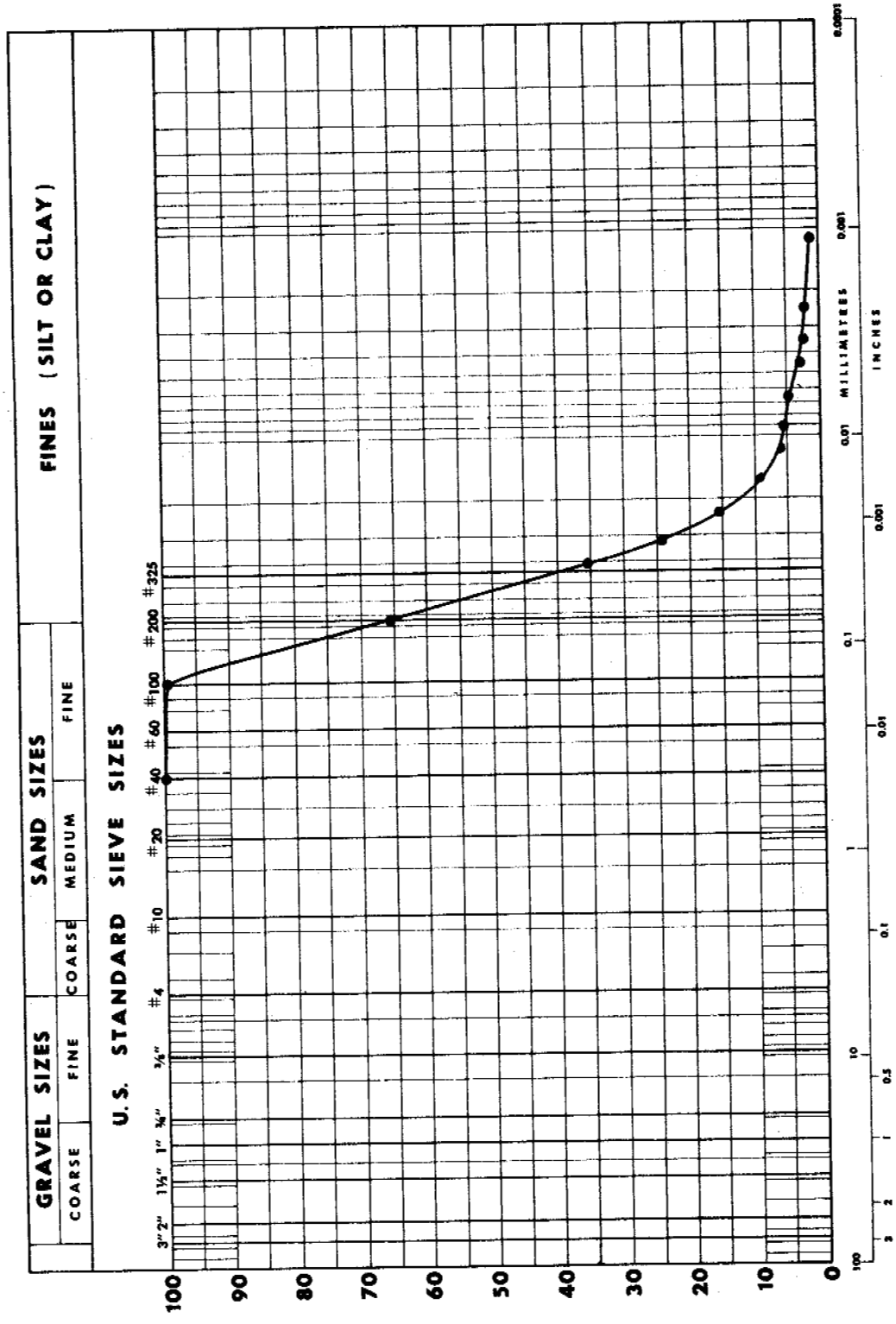
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-40

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-9, C16
SOURCE	Plant Site
HOLE PS-9 DEPTH	24.7'-25.5'
TECHNICIAN B.C.	DATE TESTED 15/4/77



D_{10} = ____ MM.
D_{30} = ____ MM.
D_{60} = ____ MM.
C_u ____
C_c ____

REMARKS: sand - 34.2%
silt - 63.8%
clay - 2.0%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

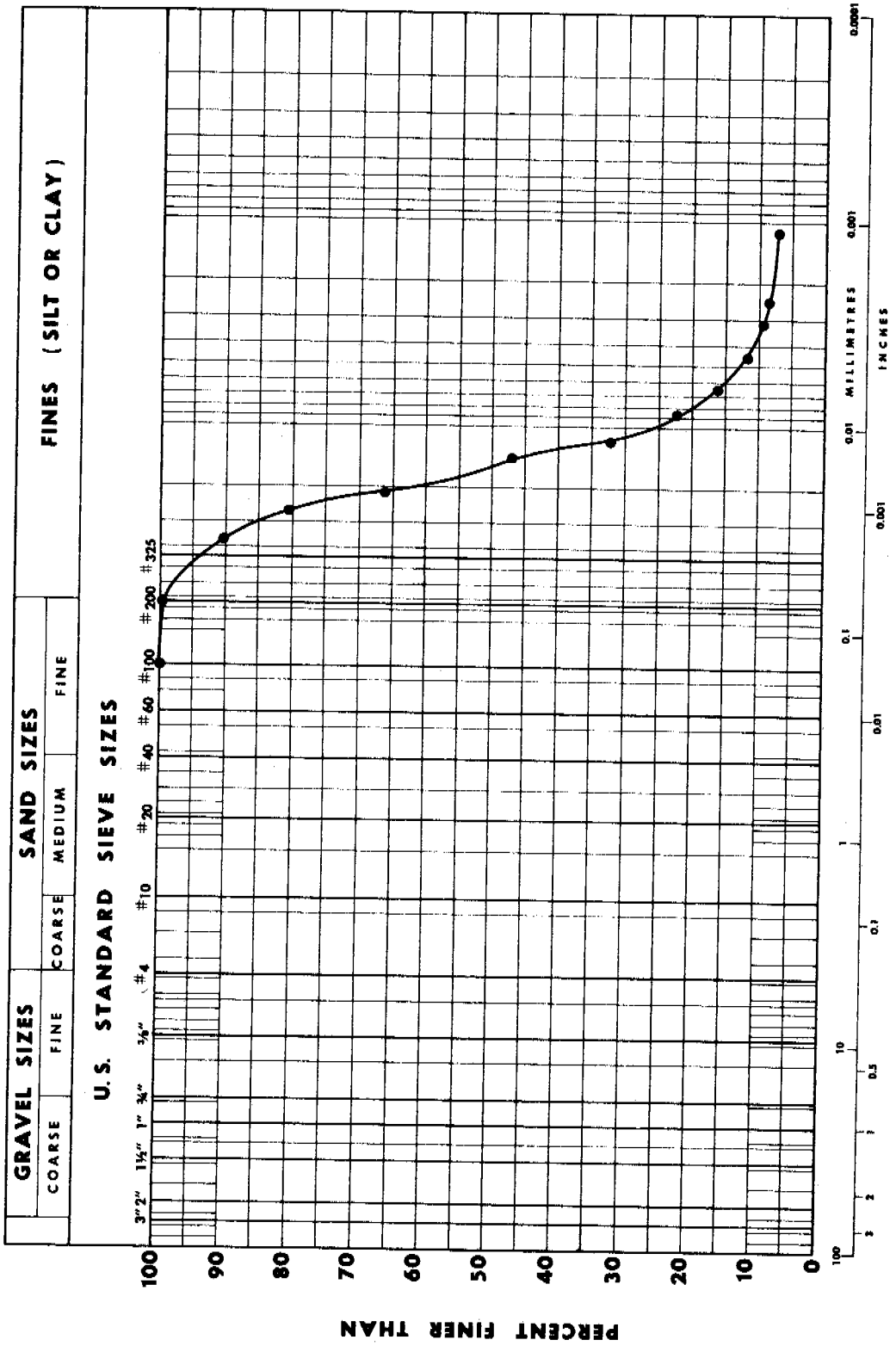
PLATE C-41

GU202-0373

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-9, C24
SOURCE	Plant Site
HOLE PS-9 DEPTH	35.5'-36.5'
TECHNICIAN B.C.	DATE TESTED 15/4/77



REMARKS: sand - 0.4%
silt - 91.7%
clay - 7.9%

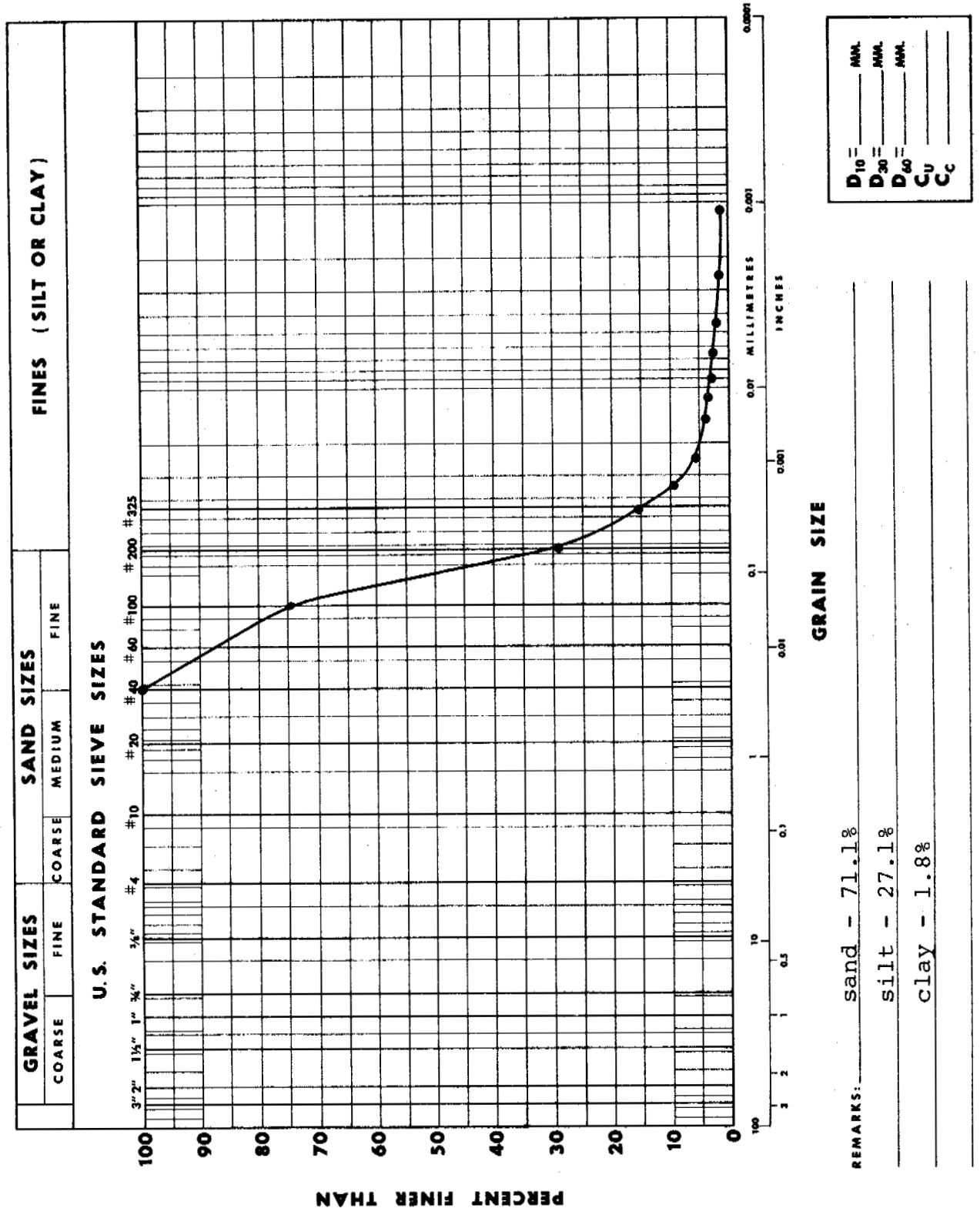
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-42

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-9, C38
SOURCE	Plant Site
HOLE PS-9 DEPTH	55.5'-56.5'
TECHNICIAN B.C.	DATE TESTED 29/4/77



REMARKS: sand - 71.1%
silt - 27.1%
clay - 1.8%

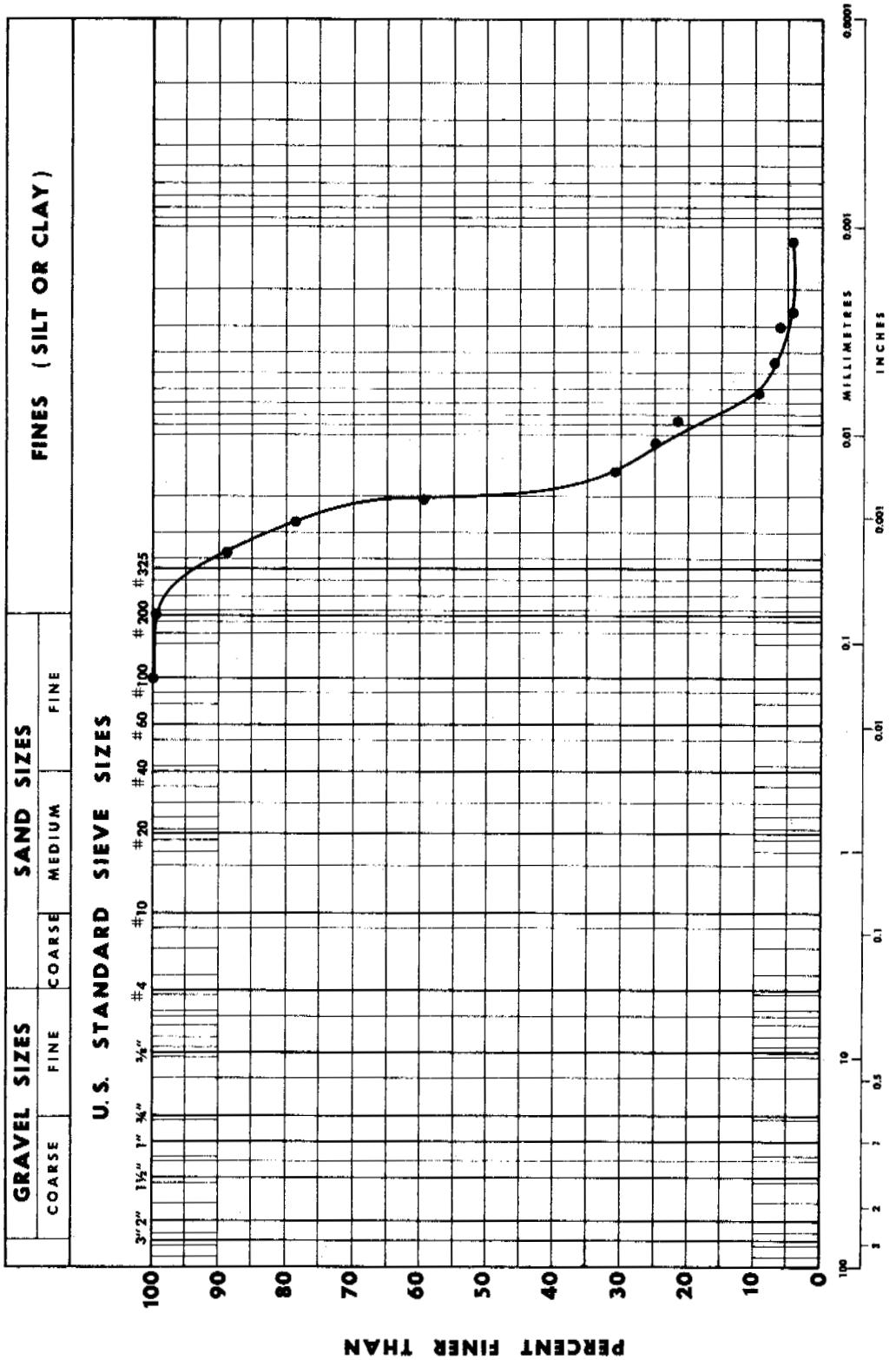
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-43

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-11, C13
SOURCE	Plant Site
HOLE PS-11 DEPTH	49.0'-50.0'
TECHNICIAN B.C.	DATE TESTED 1/5/77



REMARKS: trace fine sand

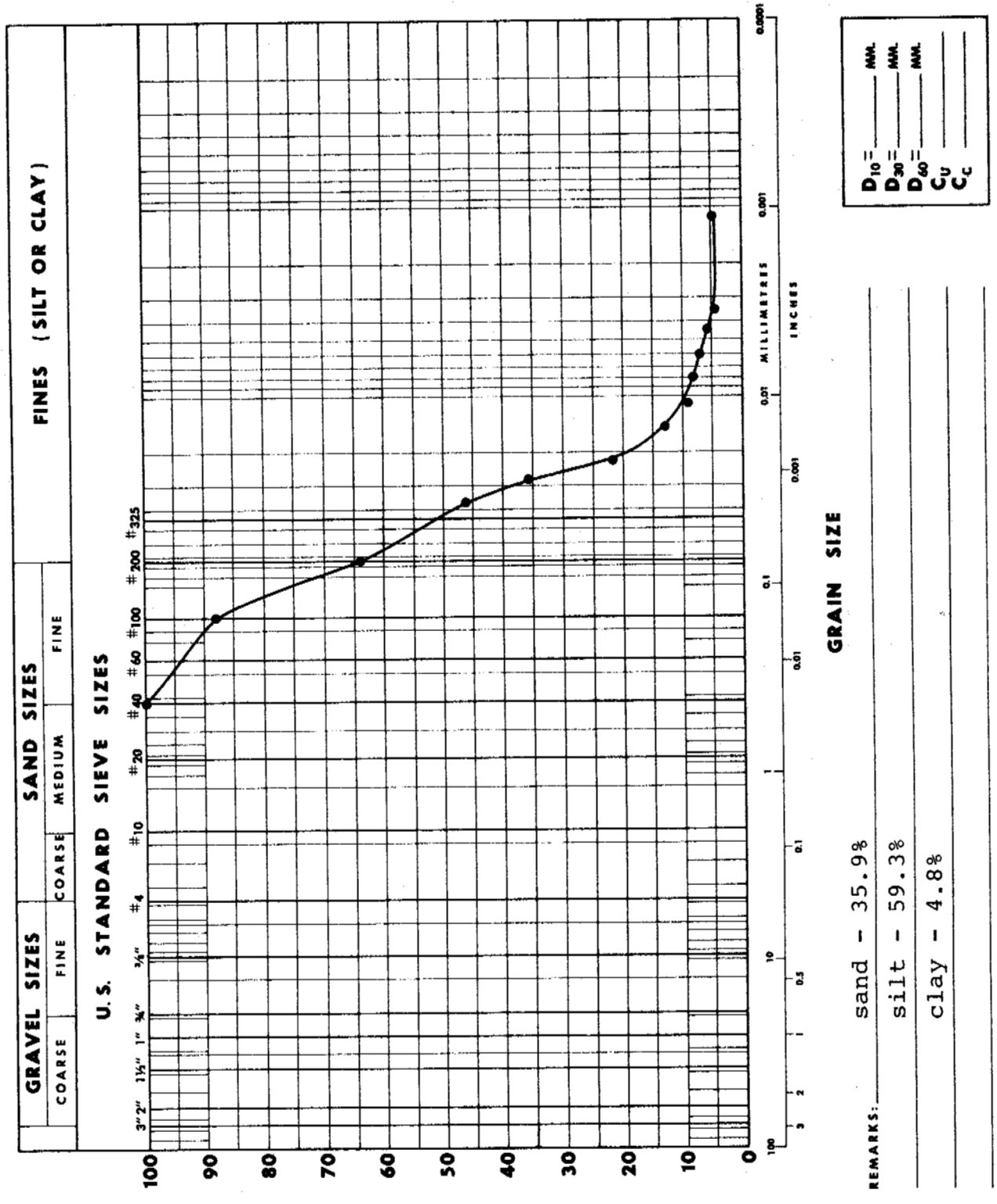
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-44

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-11, C14
SOURCE	Plant Site
HOLE PS-11 DEPTH	54.0'-55.0'
TECHNICIAN B.C.	DATE TESTED 28/4/77



REMARKS:

sand - 35.9%

silt - 59.3%

clay - 4.8%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

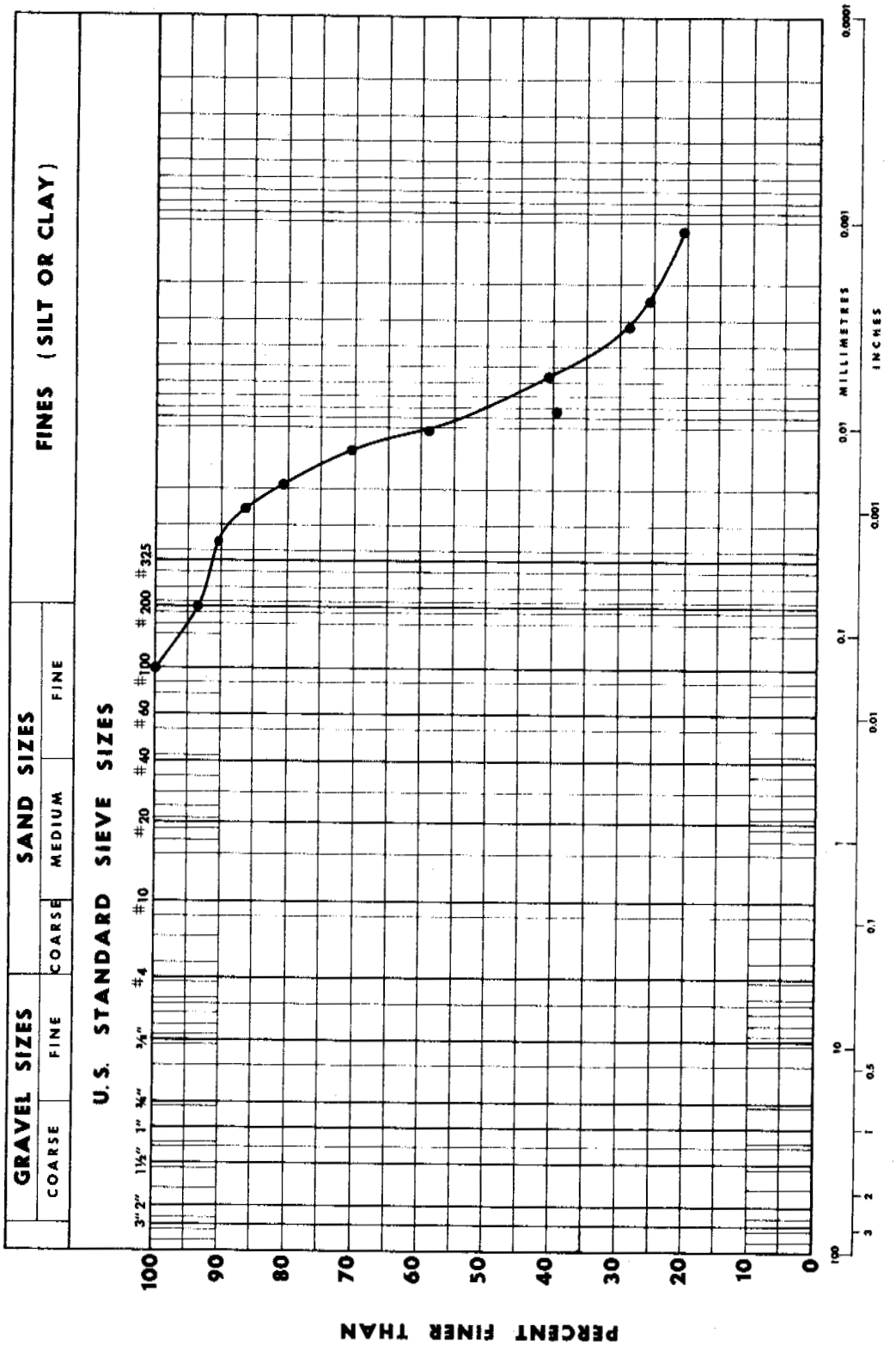
PLATE C-45

GU202-0373

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-12, C1
SOURCE	Plant Site
HOLE PS-12 DEPTH	0.5'-1.1'
TECHNICIAN B.C.	DATE TESTED 28/4/77



REMARKS: sand - 6.2%
silt - 70.1%
clay - 23.7%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

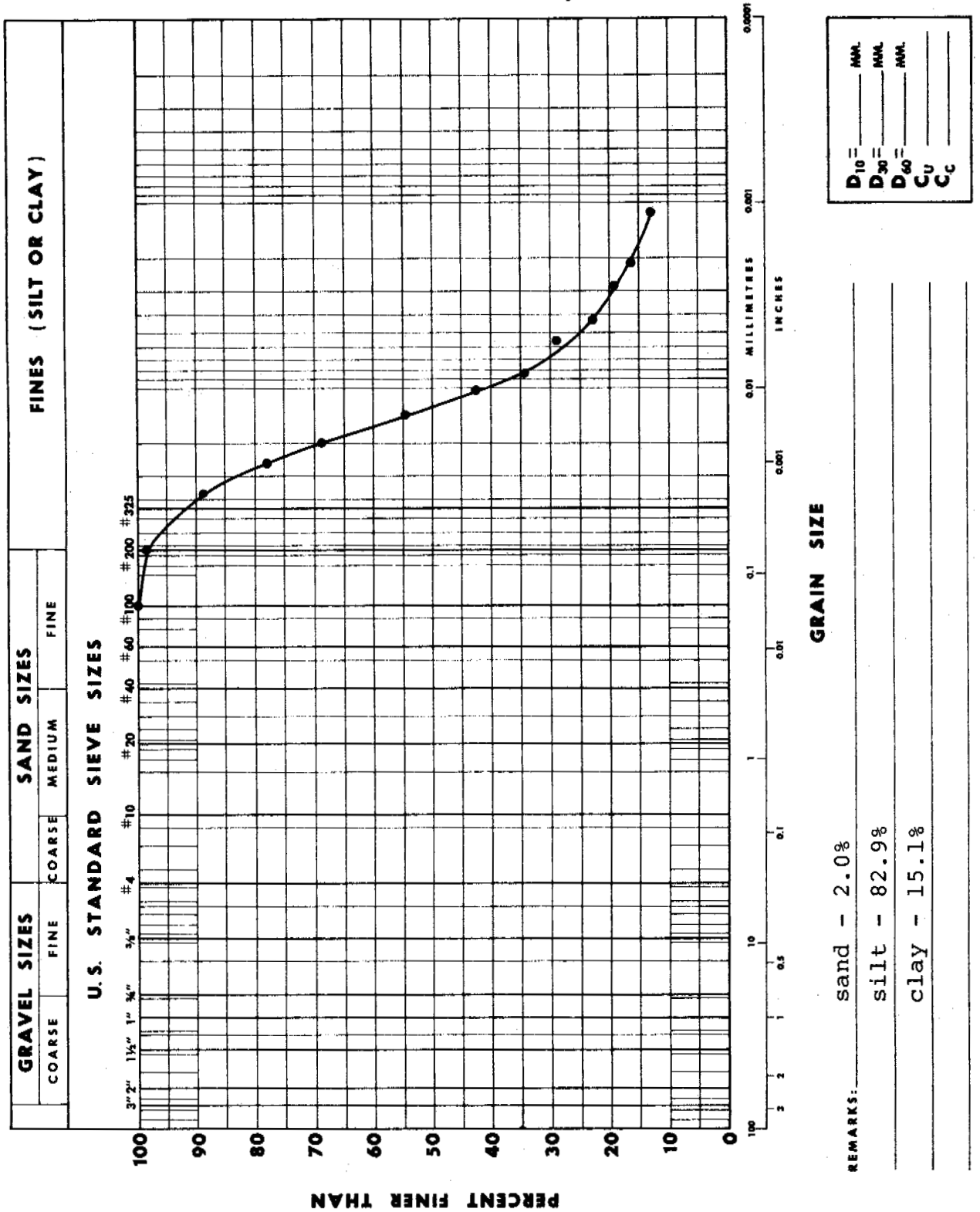
PLATE C-46

GU202-0373

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-14, C1
SOURCE	Plant Site
HOLE PS-14 DEPTH	1.5'-2.2'
TECHNICIAN B.C.	DATE TESTED 5/5/77



REMARKS:

sand - 2.0%

silt - 82.9%

clay - 15.1%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

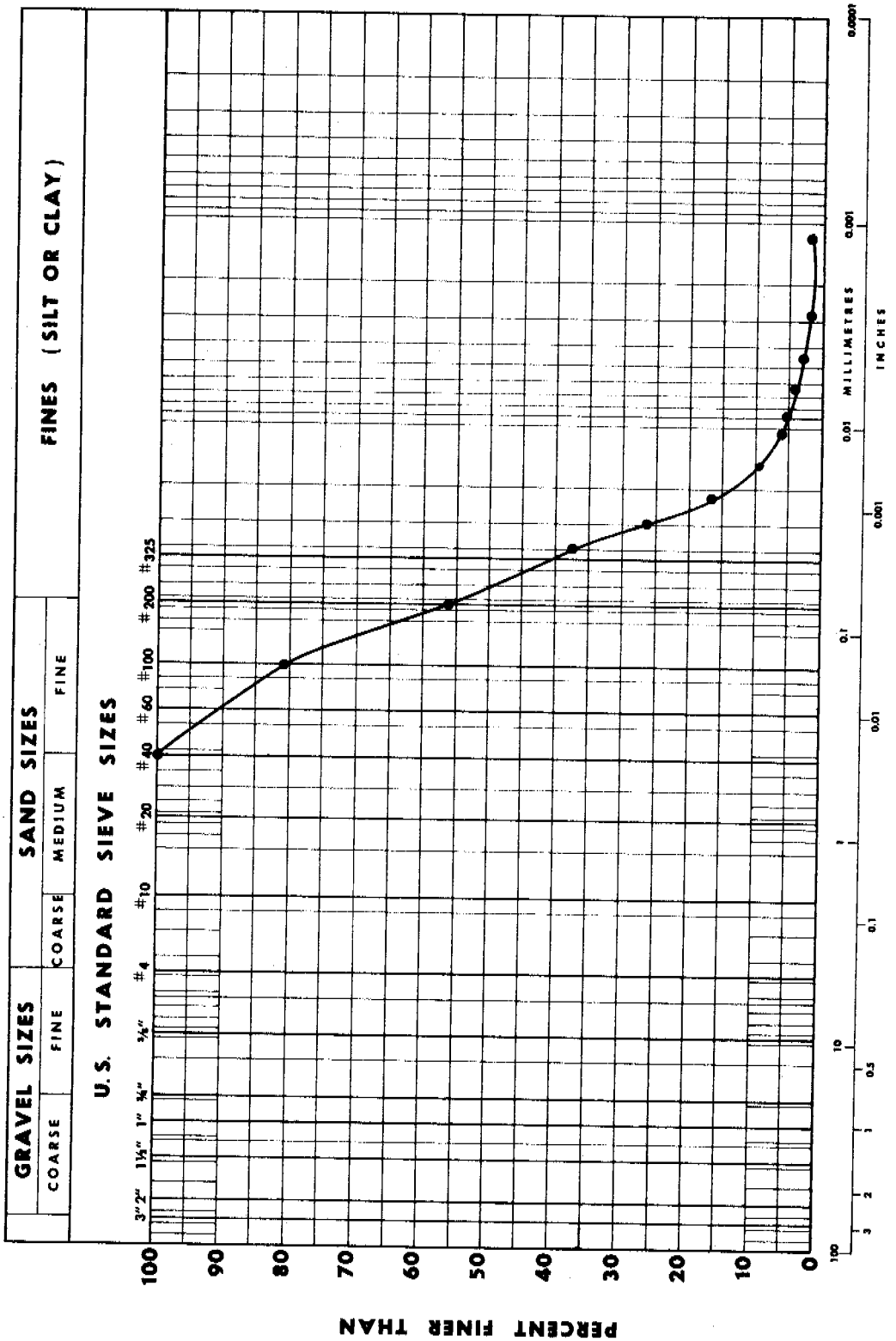
PLATE C-47

GU202-0373

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-14, C25
SOURCE	Plant Site
HOLE PS-14 DEPTH	42.7'-43.5'
TECHNICIAN B.C.	DATE TESTED 29/4/77



GRAIN SIZE

D_{10} = ____ MM.
D_{30} = ____ MM.
D_{60} = ____ MM.
C_u ____
C_c ____

REMARKS: sand - 43.8%
silt - 53.4%
clay - 2.8%

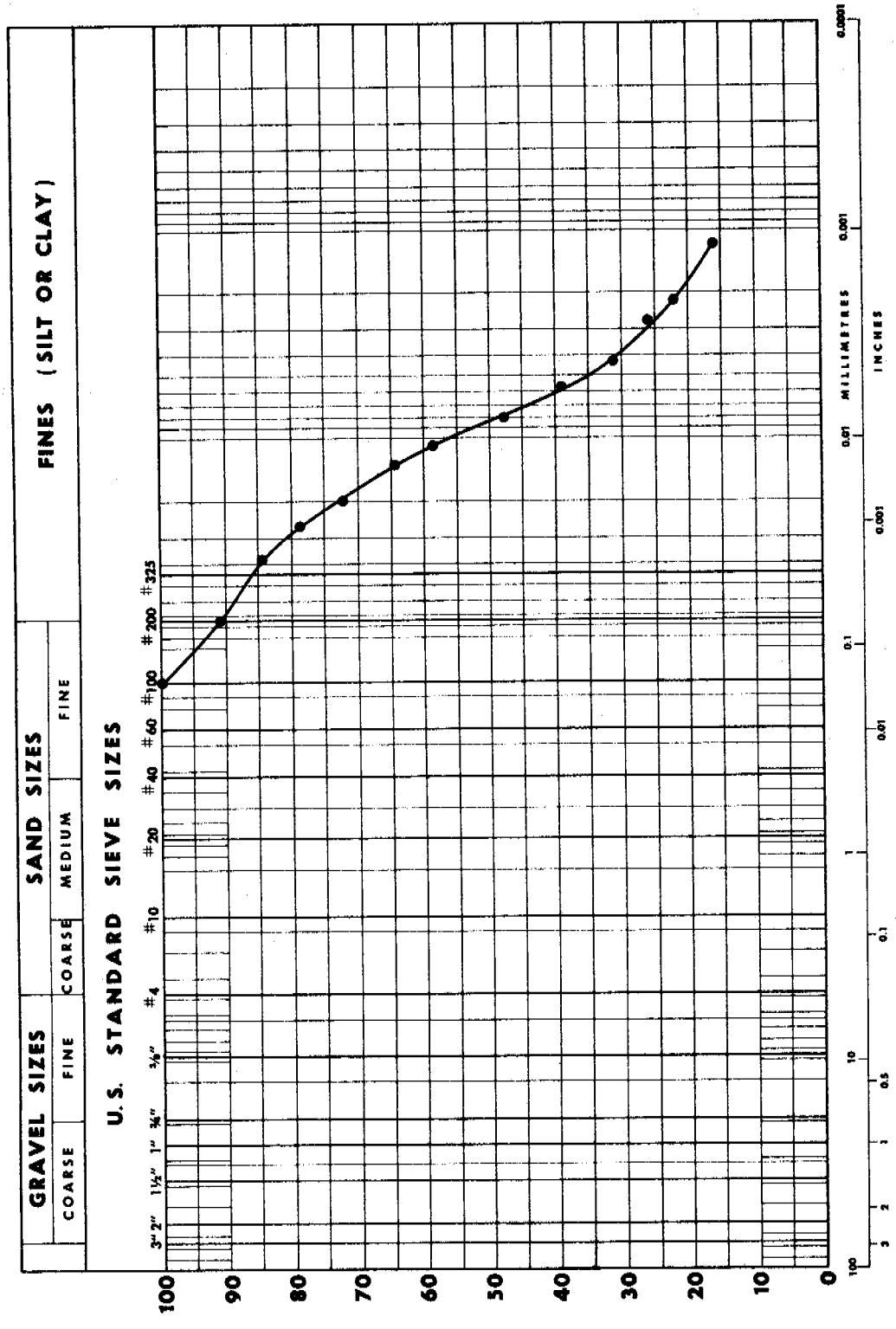
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-48

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-15, C1
SOURCE	Plant Site
HOLE PS-15 DEPTH	1.0'-1.6'
TECHNICIAN B.C.	DATE TESTED 6/5/77



D_{10} = ____ MM.
D_{30} = ____ MM.
D_{60} = ____ MM.
C_u = ____
C_c = ____

REMARKS: sand - 9.0%
silt - 70.8%
clay - 20.2%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-49

GU202-0373

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-16, C1
SOURCE	Plant Site
HOLE PS-16 DEPTH	2.1'-2.9'
TECHNICIAN B.C.	DATE TESTED 2/5/77

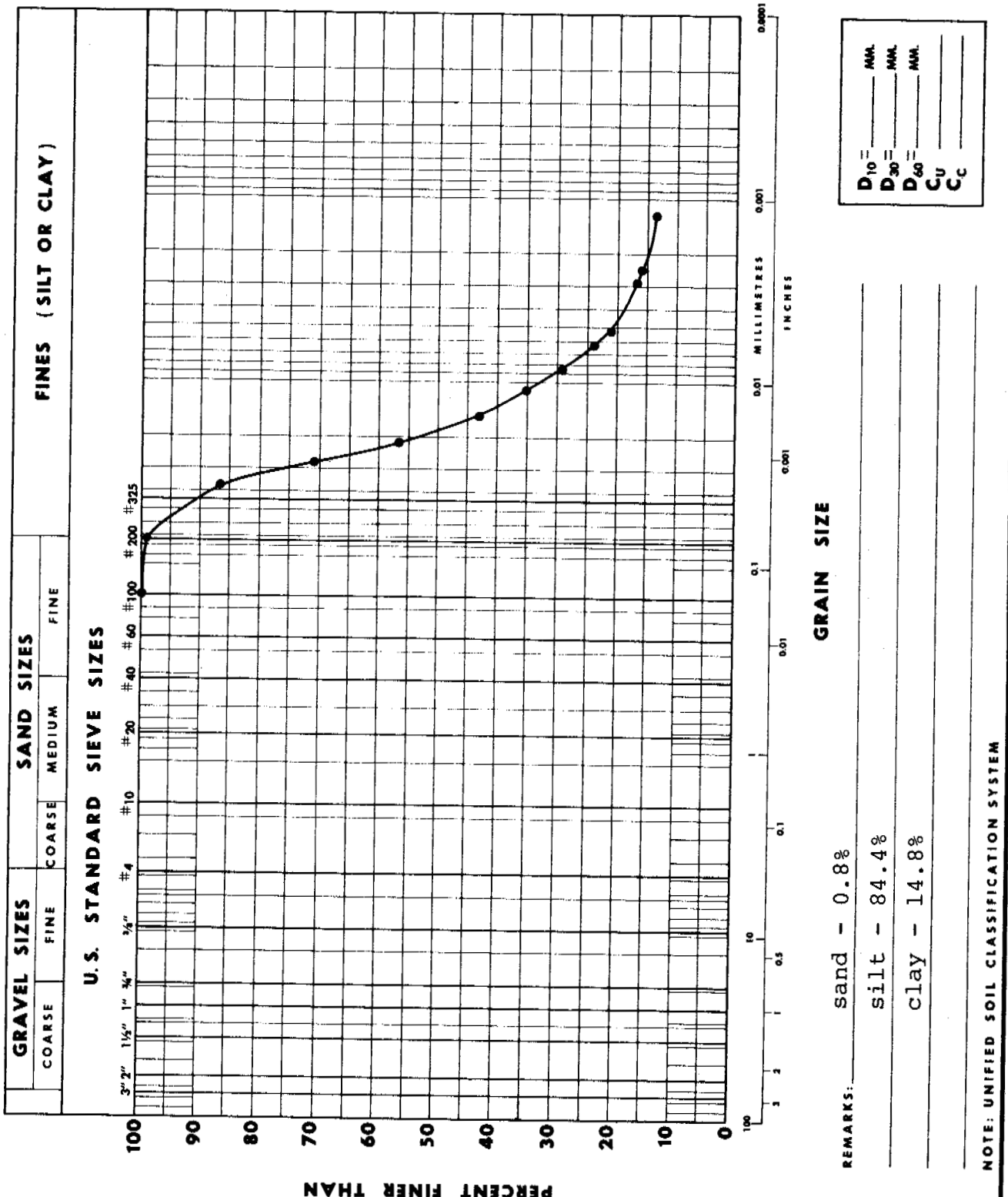
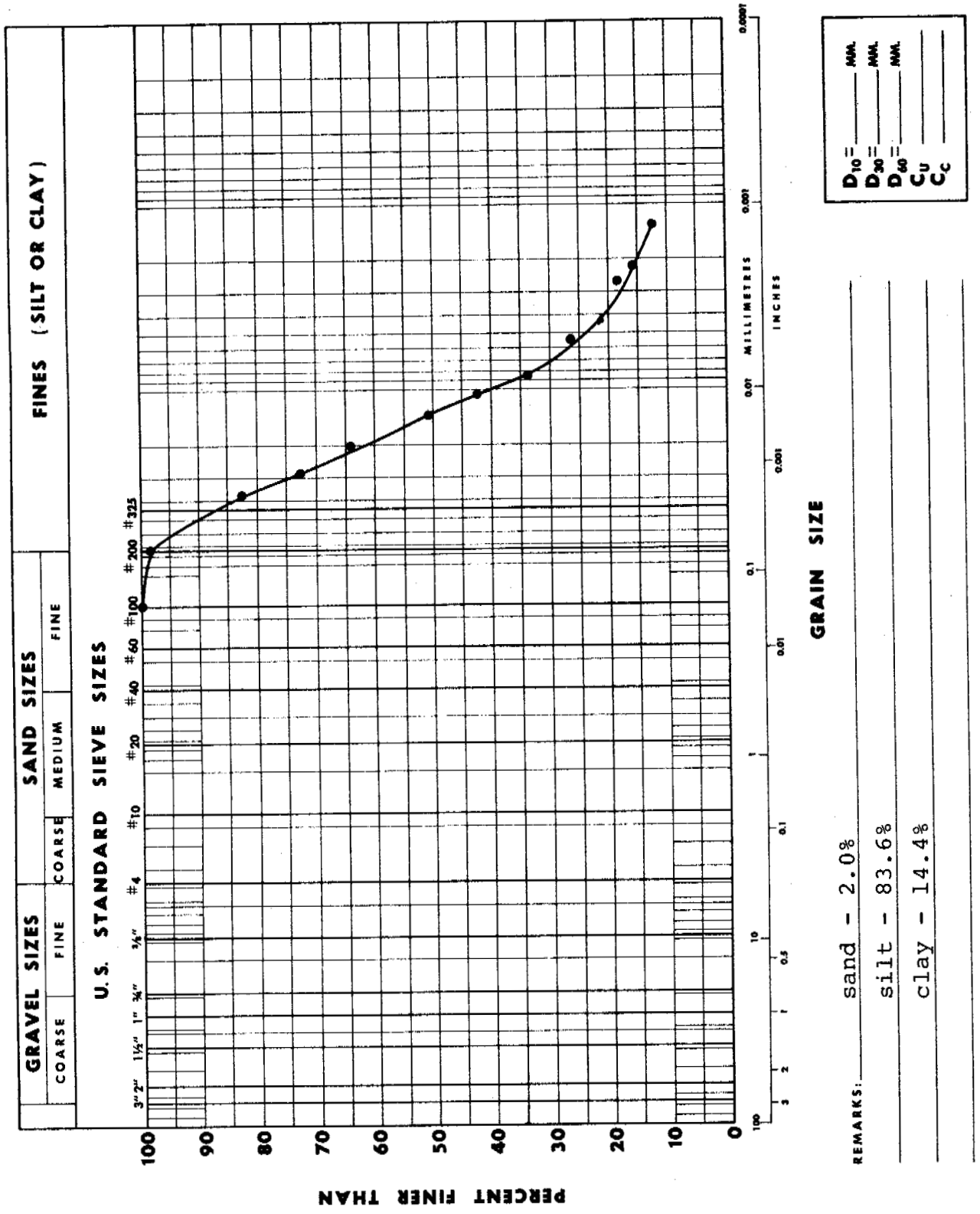


PLATE C-50

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

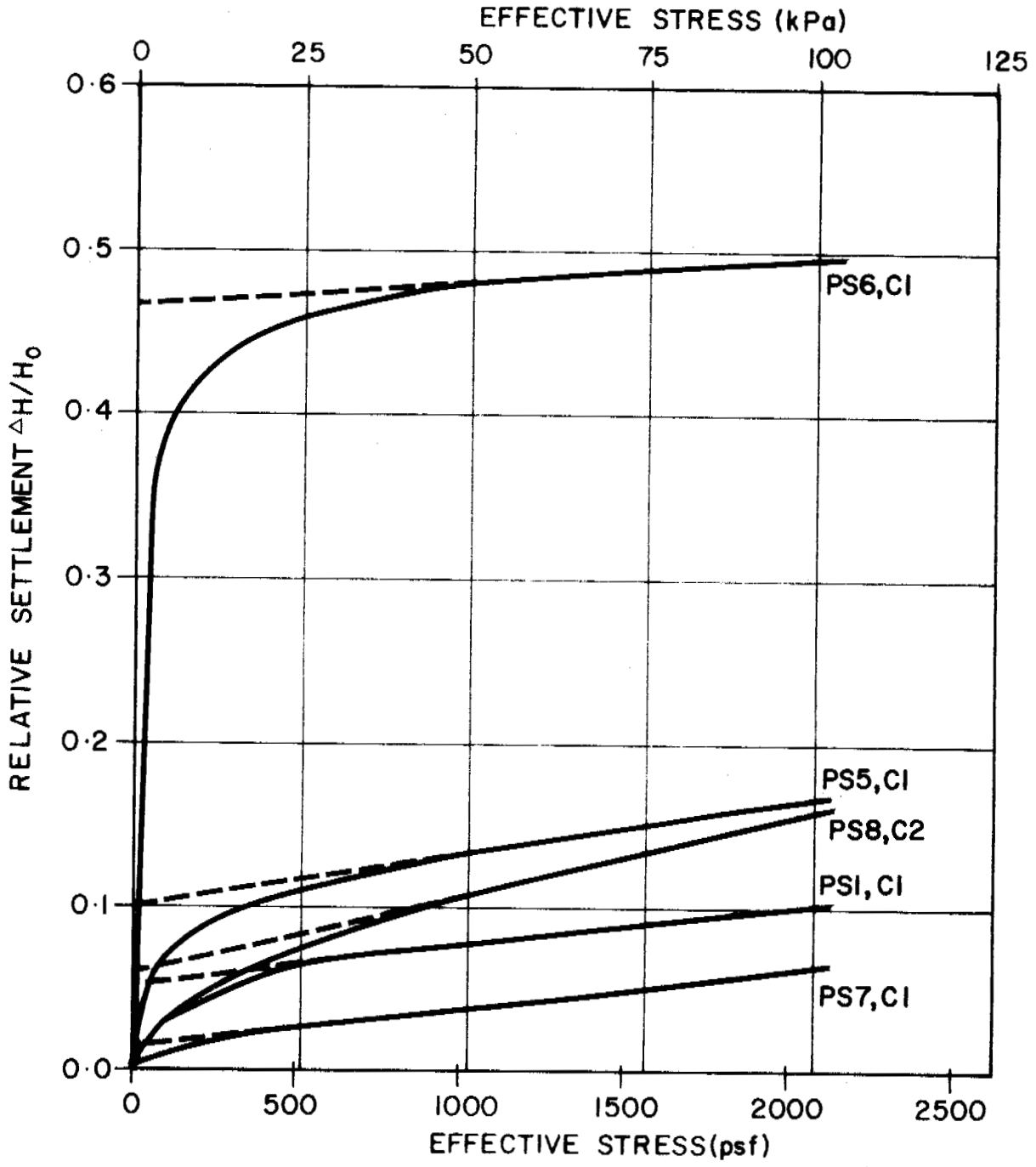
LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	PS-17, C1
SOURCE	Plant Site
HOLE PS-17 DEPTH	2.3'-3.0'
TECHNICIAN B.C.	DATE TESTED 5/5/77



REMARKS: sand - 2.0%
silt - 83.6%
clay - 14.4%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE C-51



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

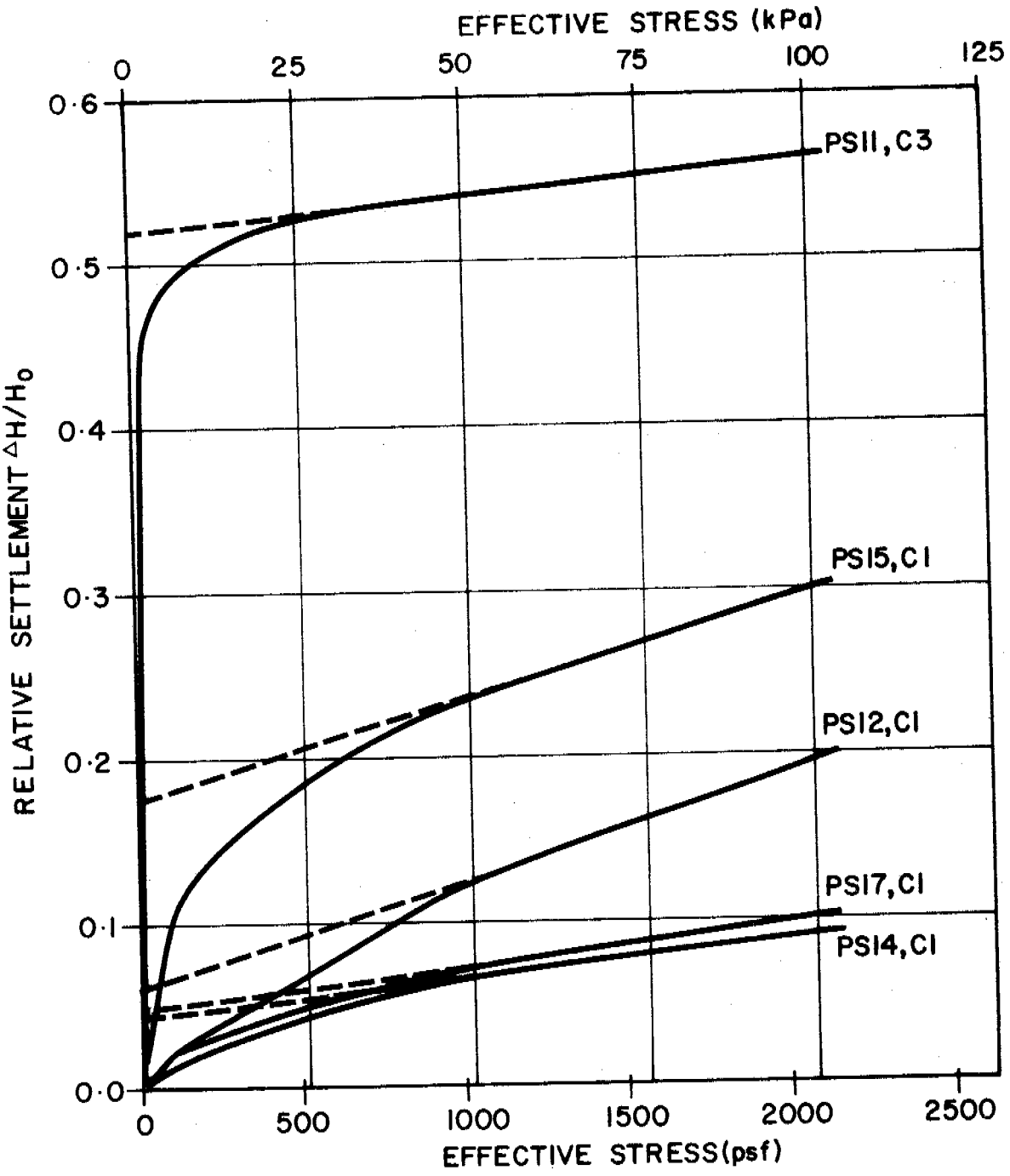
CANEP - BROWN & ROOT

R.M HARDY & ASSOCIATES LTD

THAW CONSOLIDATION TEST RESULTS - PLANT SITE

K3571-151

PLATE C-52



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

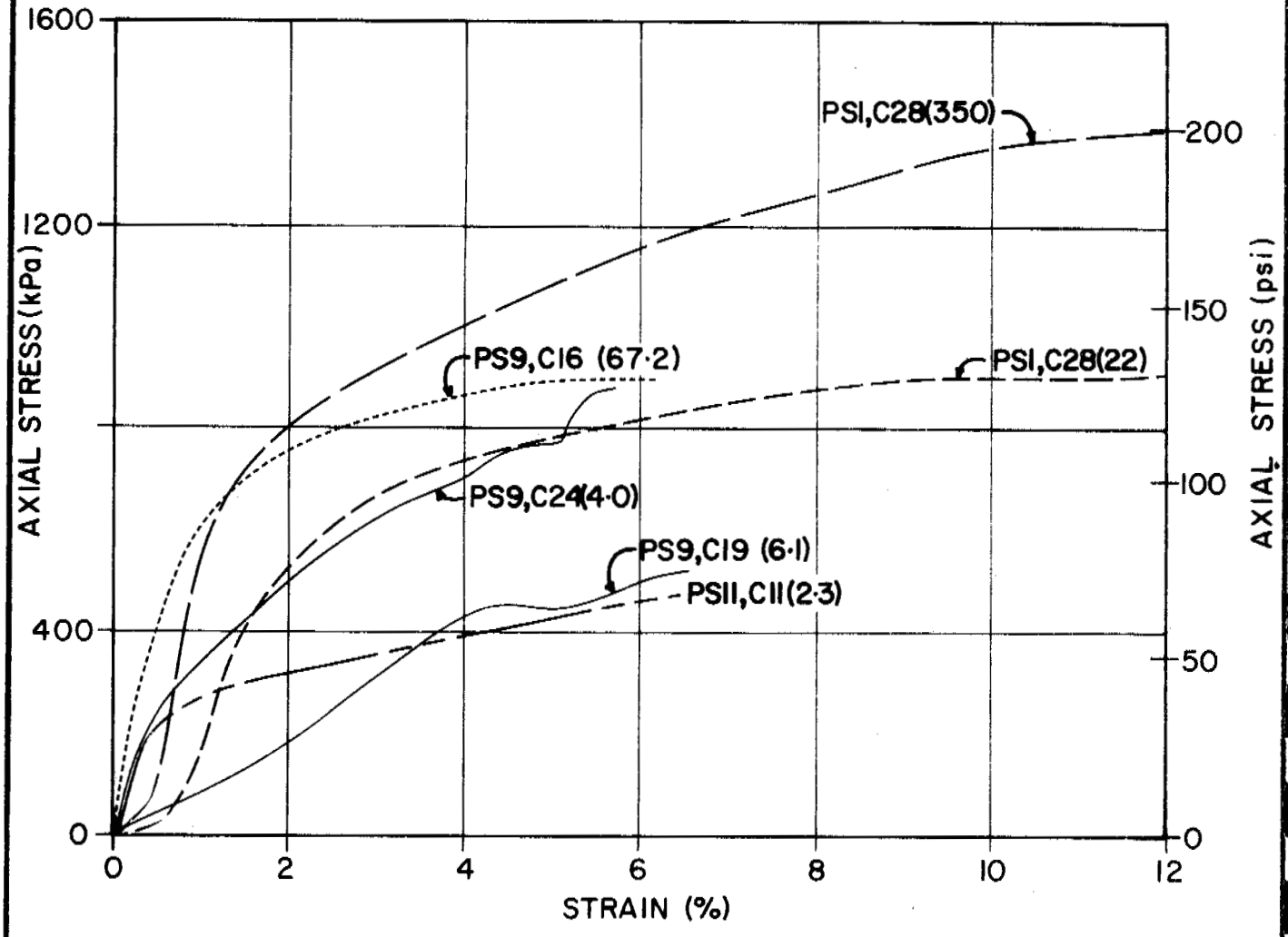
R.M. HARDY & ASSOCIATES LTD

THAW CONSOLIDATION TEST RESULTS - PLANT SITE

K3571-151

PLATE C-53

NOTE: NUMBERS ON CURVES INDICATE SAMPLE NUMBER AND STRAIN RATE IN yr^{-1}.



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

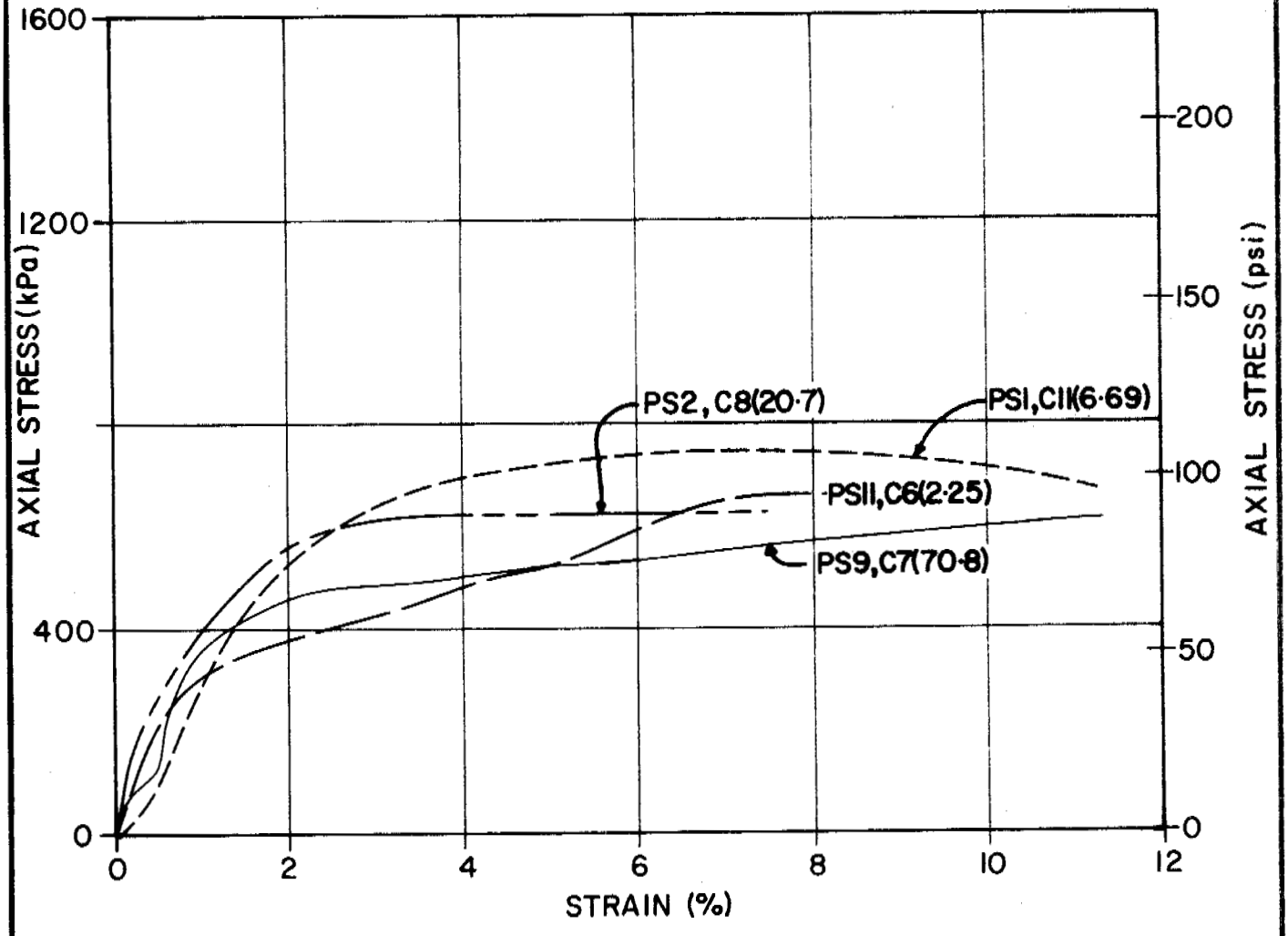
R M HARDY & ASSOCIATES LTD

STRESS-STRAIN CURVES FOR TRIAXIAL TESTS

K3571-151

PLATE C-54

NOTE: NUMBERS ON CURVES INDICATE SAMPLE NUMBER AND STRAIN RATE IN yr^{-1}.



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

R M HARDY & ASSOCIATES LTD

STRESS-STRAIN CURVES FOR TRIAXIAL TESTS

K3571-151 PLATE C-55

APPENDIX "D"

STAGING AREA AND BARGE SLIP

SECTION D.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE D-1

Test Hole Locations and Elevations
Staging Area and Barge Slip

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
SA-1	7 688 794.16	489 007.17	1.759	99.503
SA-2	7 688 867.34	489 023.41	1.731	99.475
SA-3	7 688 940.52	489 039.66	1.817	99.561
SA-4	7 688 777.91	489 080.36	1.786	99.530
SA-5	7 688 851.09	489 096.60	1.801	99.545
SA-6	7 688 924.28	489 112.84	1.856	99.600
SA-7	7 688 761.99	489 152.08	1.865	99.637
SA-8	7 688 833.48	489 175.93	1.969	99.713
SA-9	7 688 908.03	489 186.03	1.893	99.609
BS-1	7 688 966.48	489 199.52	1.978	99.722
BS-2	7 689 010.28	489 209.76	1.871	99.615
BS-3	7 688 974.71	489 162.44	2.039	99.783
BS-4	7 689 018.62	489 172.19	2.051	99.795
BS-5	7 688 982.83	489 125.85	1.679	99.423
BS-6	7 689 026.74	489 135.59	1.661	99.405
BS-7	7 688 990.96	489 089.25	1.530	99.274
BS-8	7 689 034.86	489 099.00	1.594	99.338
BS-9	7 688 999.08	489 052.66	1.838	99.582
BS-10	7 689 042.99	489 062.40	1.463	99.207
BS-11	7 689 086.91	489 072.16	1.548	99.292
TF-1	7 689 174.73	489 091.65	1.506	99.250
TF-2	7 689 181.23	489 062.38	1.494	99.238
FS-1	7 688 647.78	488 974.67	1.896	99.640

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "D"

SECTION D.2 TEST HOLE LOGS: STAGING AREA

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:15	FINISH: 23:30
PROJECT NO.: K 3571	ELEVATION: 99.50 m	LOCATION: Staging Area	

W_p - ▫ W - ⊙ W_L - ▵
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace fine sand, low plastic, brown		Vx Vr 10%	W			Pilot hole to 1.0'
					C1			
					C2		C2	Thaw Consolidation Test - See Plate D-51
				ICE+	C3		C3	Thaw Consolidation Test - See Plate D-51
5				Vr Vs 40%	C4			
					C5			
				5%	C6			
				Nb	C7		C7	
10				Vr Vs 5%	C8		C8	
		11.5' trace of organic laminations		Vs 5%	C9			
				Nb	C10		C10	
15					C11			
					C12			
					C13		C13	
20					C14		C14	
		22.0' --- - sandier, grey			C15			
					C16		C16	
		23.5' - trace fine sand, trace of organic laminations			C17			
25					C18		C18	
		27.2' piece of root			C19			
					C20		C20	
30					C21			

Plate D-1
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:15	FINISH: 23:30
PROJECT NO.: K 3571	ELEVATION: 99.50 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, trace of organic laminations, low plastic, grey		Nb	C21			
						C22		C22	
						C23			
						C24		C24	
			1/16" ice lens 34.5'			C25			
35			35.5' - some fine sand			C26		C26	
			36.5'			C27			
			38.0' - clayey			C28			
					Vr <5%	C29			
					Nb	C30		C30	
40			Bottom of Hole at 40.0'						
45									

Plate D-2
Sheet 2 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-2

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 19 February 1977
RIG: NORTHLAND	METHOD: 3" CRREL	START: 13:30	FINISH: 16:25
PROJECT NO.: K 3571	ELEVATION: 99.48 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace fine sand, trace of organics, slight plasticity, brown	Vr Vs 40%	W C1	C1	Pilot hole to 1.0'
						Thaw Consolidation Test - See Plate D-51
				C2 C3	C2	
5			60% 30%	C4	C4	
		8.7' 1/4" ice lens		C5		
10			15%	C6	C6	
		12.2' - little sand, non plastic, grey to brown	40% 10%	C7 C8	C8	
15				C9	C9	
			Nb	C10 C11		
		19.0' 1/8" ice lens	Vr Vs <5%	C12 C13	C12	
20				C14	C14	
		23.5' - and fine sand, non plastic, grey	Nb	C15 C16		
25		26.5' - trace of organics		C17 C18	C17	
		29.0' - wood chips		C19	C19	
30		Bottom of Hole at 30.0'				

Plate D-3
Sheet 1 of 1

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-3

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17, 18 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:15	FINISH: 6:30
PROJECT NO.: K 3571	ELEVATION: 99.56 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace of organic laminations, low plastic, grey - brown		Vs 50%	W			Pilot hole to 1.0'
				Nb	C1		C1	
				Vx 5%	C2			
5				15%	C3		C3	
				Nb	C4			
		8.5' - clayey, trace fine sand, grey			C5		C5	
10				Vx 5%	C6			
		12.0' - little fine sand		Vr 20%	C7		C7	
				Nb	C8			
		14.4' - trace fine sand, clayey, trace organic laminations, grey - brown		Vs 30%	C9		C9	
15				Nb	C10			
					C11		C11	
					C12			
		19.6' 1/4" ice lens		Vs <5%	C13		C13	
20					C14			
					C15			
					C16		C16	
					C17			
25					C18		C18	
		26.7' - wood chips		Vx 5%	C19			
					C20			
					C21		C21	
		29.0' 1/4" Vx ice lens		<5%	C22			
30					C23			

Plate D-4
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

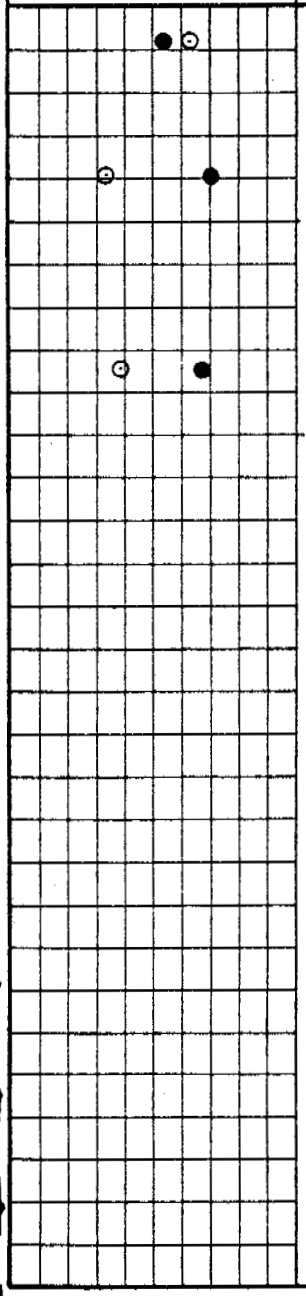
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-3

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17, 18 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:15	FINISH: 6:30
PROJECT NO.: K 3571	ELEVATION: 99.56 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - clayey, trace fine sand, trace of organic laminations, low plastic, grey-brown		Vx <5%	C24		C24	
					C25			
				Nb	C26			
					C27		C27	
					C28			
35					C29			
		36.2' - little gravel, rounded		Vx10%	C30			
		37.0' - grey		Vs <5%	C31			
		38.0' 1/8" ice lenses 38.8'			C32		C32	
		39.6'			C33			
40		40.0' 1/4" ice lens						
		Bottom of Hole at 40.0'						

Plate D-5
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-4

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 12:30	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 99.53 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, low plastic, brown		Nb	W			Pilot hole to 1.0'
						C1			
						C2		C2	
			4.0' - current bedded		Vr Vs 5%	C3			
5						C4		C4	
						C5			
					Nb	C6		C6	
10						C7			
					Vr Vs 5%	C8		C8	
						C9			
15			15.0' - little fine sand		10%	C10			
			17.0'		Nb	C11		C11	
			Bottom of Hole at 17.0'						CRREL Barrel stuck in hole. Hole abandoned at 17.0' depth. Barrel removed February 24.
20									

Plate D-6
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-5

LOGGED BY: GCD/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 4:15	FINISH: 8:20
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace fine sand, trace of organic laminations, low plastic, current bedded, grey-brown		Vr Vs 5%	C1			
					C2		C2	
				Vs 30%	C3			
5				5%				
				Vr Vs 25%	C4		C4	
				<5%	C5			
					C6		C6	
				30% 10%	C7			
10				<5%	C8		C8	
				Vr <5%	C9			
					C10		C10	
							C11	
15					C11			
				Vs <5%	C12		C12	
					C13		C13	
		21.0' - wood chips			C14			
							C15	
				Nb	C15			
					C16		C16	
					C17			
					C18		C18	
25				Vs <5%	C19			
				Nb	C20		C20	
30					C21			

Plate D-7
Sheet 1 of 2

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-5

LOGGED BY: GCD/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 4:15	FINISH: 8:20
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - little fine sand, slight plasticity, grey		Nb	C21		C21	
						C22			
						C23		C23	
35						C24			
			35.7' - trace organic lamination			C25			
						C26		C26	
						C27			
			39.4'			C28		C28	
40			Bottom of Hole at 39.4'						

Plate D-8
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-6

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 7:15	FINISH: 11:10
PROJECT NO.: K 3571	ELEVATION: 99.60 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace fine sand, trace of organics to 4.0' depth low plastic, laminated, grey and brown	Vr Vs 5%	W C1		C1	Pilot hole to 0.5' Thaw Consolidation Test - See Plate D-51
			50% 20%	C2 C3 C4		C2	Thaw Consolidation Test - See Plate D-51
5			Vs 15%	C5		C5	
			25% Vr Vs 10%	C6 C7		C7	
10		1" ice lens 11.3'	15%	C8			
		3/4" wide vertical ice wedge from 12.2' to 14.0' depth 12.2' 14.0'	30%	C9 C10		C9	
15		1.5" wide vertical ice wedge from 15.0' to 22.0' depth 15.0'	35%	C11 C12		C11	
		19.0' - little fine sand, trace of organics	25%	C13 C14		C13	
20			15%	C15		C15	
		22.0' - very sandy layer 22.0'	5%	C16			
		23.0' - sand pockets	Nb	C17 C18		C17	
25				C19		C19	
30		Bottom of Hole at 30.0'.		C20			

Plate D-9
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-7

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1, 2 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 21:30	FINISH: 3:00
PROJECT NO.: K3571	ELEVATION: 99.61 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace of organics and rootlets to 1.5' depth, low plastic, brown-grey		Nb				4" CRREL
				40% Vs 60%	C1			
				UF	C2			Changed to Dynamic Cone
5								
10								
		13.0' - trace fine sand, grey		Nb				Changed to VTM
15		14.4' - 1/2" organic layer			C3		C3	
					C4		C4	
		18.0' - trace fine sand, low plastic, current bedded, grey					C4	
20		21.0' - clayey, little fine sand			C5		C5	
25							C6	
		28.0' - 3/8" organic layer			C6		C6	
30								

Plate D-10
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-7

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1, 2 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 21:30	FINISH: 3:00
PROJECT NO.: K 3571	ELEVATION: 99.61 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, little fine sand, occasional wood chips and organic laminations, low plastic, grey		Nb	C6			
						C7		C7	
35			34.5' 1/8" Vs ice lens						
						C8			
			38.0' 1" of 50% Vr, Vs ice					C8	
40			40.5'						
			Bottom of Hole at 40.5'						
45									

Plate D-11
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-7A

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 3:15	FINISH: 3:45
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, trace of organics, low plastic, brown to grey at 2.0' depth		Nb				4" CRREL
					Vx Vr 15%	C1			
					Nb				
					UF				Changed to Dynamic Cone
			4.5'		F				
5			Bottom of Hole at 4.5'						Located 50.0' west of SA-7.

Plate D-12
Sheet 1 of 1

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-8

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 4:35	FINISH: 7:00
PROJECT NO.: K 3571	ELEVATION: 99.71 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, some organics to 3.5' depth, low plastic, grey-brown		Vr25%				4" CRREL
					ICE+	C1		C1	
					Vs 30%	C2			Changed to Dynamic Cone
					UF				
5									
10									
			12.0'		F				
			Bottom of Hole at 12.0'						Abandoned hole because of loss of Pit Seal.
15									

Plate D-13
Sheet 1 of 1

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-8A

LOGGED BY: AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE 4" CRREL	START: 8:00	FINISH: 9:00
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace sand, organics - roots, leaves, branches, low plastic, non laminar, dark brown		Nb	C1			
					Vr Vs 10%	C2 C3			
			3.5' - layered, no organics, brown		Vx <5%	C4			
5			5.0' - grey		Vs 20%	C5			
					Nb	C6			
			6.5' - organic layer		Vx Vr Vs 10%	C7 C8 C9 C10			
10					F				
			13.0'						
15			Bottom of Hole at 13.0'						Located 50.0' west of SA-8.

Plate D-14
Sheet 1 of 1

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-8B

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 15:30	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, medium plastic, brown with grey		Vr Vs 10%	W			Pilot hole to 1.0'
						C1		C1	Thaw Consolidation Test - See Plate D-51
5			5.0' - sandy, low plastic, grey		Vs 5%	C2		C2	
					10%	C3			
					30%	C4			
					5%	C5			
10						C6			
					Nb	C7		C7	
						C8			
15					Vs 5%	C9		C9	
			16.7'			C10			
			Bottom of Hole at 16.7'						Located 25.0' west of SA-8.
20									

Plate D-15
Sheet 1 of 1

TEST HOLE LOG

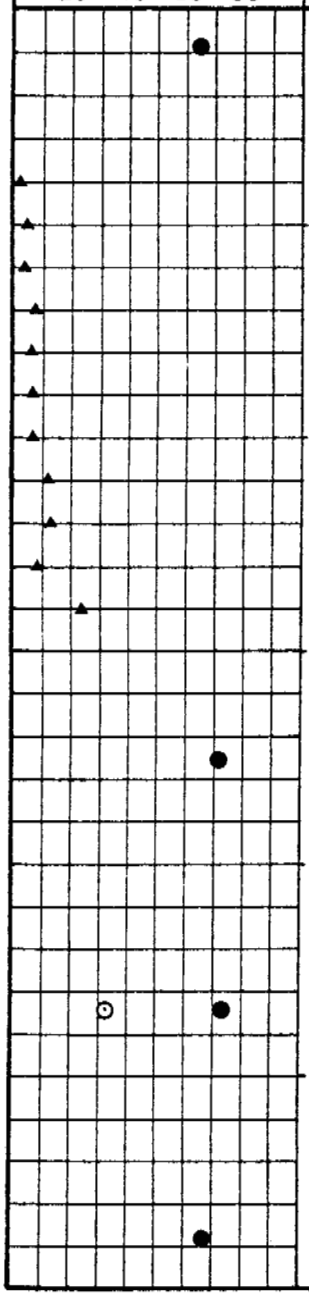
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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-9

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 8:30	FINISH: 13:15
PROJECT NO.: K 3571	ELEVATION: 99.64 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - ▲
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace fine sand, trace of organics to 3.0' depth, low plastic, grey-brown		Vr Vs 15%	C1		C1	4" CRREL
				5%	C2			
					C3			Changed to Dynamic Cone
				UF				
14.0'		- trace fine sand, low plastic, grey		Nb	C4		C4	Changed to VTM
19.0'		- occasional 1" silt and sand lenses			C5		C5	
24.0'		- some fine organic laminations			C6		C6	
					C7			

Plate D-16
Sheet 1 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-9

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 8:30	FINISH: 13:15
PROJECT NO.: K 3571	ELEVATION: 99.64 m	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, occasional organic laminations, low plastic, grey		Nb	C7		C7	
35						C8		C8	
			39.0'						
40			Bottom of Hole at 39.0'						

Plate D-17
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. SA-9A

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:30	FINISH: 17:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Staging Area	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, medium plastic, grey-brown		Vr 5%	W			Pilot hole to 1.0'
						C1			
5					UF	C2			
					Nf	C3			
					Vs 20%				
			ice wedge of 9.2' 1" width from 9.2' depth to bottom of hole		Vs Vr 50%	C4			
10			10.5' - clayey, trace fine sand, low plastic, grey		10%	C5			
						C6			
						C7			
15						C8			
			17.0'			C9			
			Bottom of Hole at 17.0'						
20									

Plate D-18
Sheet 1 of 1

APPENDIX "D"

SECTION D.3 TEST HOLE LOGS: BARGE SLIP

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

TEST HOLE NO. BS-1

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 19:30	FINISH: 22:30
PROJECT NO.: K 3571	ELEVATION: 99.72 m	LOCATION: Barge Slip	

W_P - □ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace organics, low plastic, grey-brown		Vr 50%	C1		C1	4" CRREL
					Vr Vs 20%				
					Vs 15%	C2		C2	
					UF				Changed to Dynamic Cone at 4.0'
5									
10									
15									
			17.5'		F				Assumed frozen at 17.3'
			Bottom of Hole at 17.5'						Lost Pit Seal, abandoned hole.
20									

Plate D-19
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-1A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 22:55	FINISH: 2:15
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION ▲ (blows/foot) 20 40 60 80
BULK DENSITY (pcf) ● 60 80 100 120
MOISTURE CONTENT 20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, little peat and roots to 2.7' depth, grey - brown		Vx Vs 15%	C1		C1	4" CRREL
					Vs 10%	C2			
5					UF				Changed to Dynamic Cone at 3.5'
10									
15			16.0' - sandy, trace of organic lenses to 1/8" thickness, slight plasticity		Nf	C3		C3	Changed to VTM at 16.0'
20			20.0' - and sand, trace of organic laminations, non plastic, layered, grey			C4		C4	
			22.5' - wood chips						
25					Vs 5%			C4	
			26.7' - black silt pocket		Nf	C5			
30					Nbn			C5	Plate D-20 Sheet 1 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-1A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 22:55	FINISH: 2:15
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and sand, trace of organic laminations, non plastic, layered, grey		Nf				
			32.0' - sandy, little organic laminations and inclusions, slight plasticity grey			C6		C6	
35								C7	
			37.5' - 5" layer of gravel and sea shells			C7			
			39.0'						
	CL		CLAY silty, low plastic, grey		Vs 20%			C7	
40			40.0'						
			Bottom of Hole at 40.0'						Located 25.0' west of BS-1.

Plate D-21
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-1B

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:30	FINISH: 18:15
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, brown		F	W			Pilot hole to 1.0'
						C1			
					UF				
5						C2			
						C3			
						C4			
10						C5			
			12.0'		F				
15			Bottom of Hole at 12.0'						Hole sloughing in at 6 foot level. Located 30.0' west of BS-1A.

Plate D-22
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-1C

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:25	FINISH: 21:20
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - □ W - ⊙ W_L - △
BULK DENSITY(pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - low plastic, grey and rusty colored, some organic inclusions, wood chips		Vx Vr <5%	W C1			Pilot hole to 1.0'
3.0'			- clayey, trace of organics low plastic, grey-brown		UF	C2		C2	
5					Nb UF	C3			
					Nb UF	C4			
8.0'			- current bedded		Nb	C5			
10					Vx <5% Nb	C6 C7			
						C8		C8	
						C9 C10		C10	
17.0'			- grey			C11			
18.5'			- sand layers						
19.0'			- wood chips			C12		C12	
20 20.0'			Bottom of Hole at 20.0'						Located 30.0' west of BS-1B.

Plate D-23
Sheet 1 of 1

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-2

LOGGED BY: AN	DRAWN BY: GCD/PD	CHECKED: AJH	DATE: 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:20	FINISH: 17:50
PROJECT NO.: K 3571	ELEVATION: 99.62 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, organic inclusions, low plastic, grey - brown		Vr Vs Vx 15%	W C1		C1	Pilot hole to 0.5'
3.5'			- moist, grey		UF	C2 C3			
5									
7.0'			Bottom of Hole at 7.0'						Hole abandoned. Unable to core unfrozen ground with Northland Rig. Redrilled with S.D.S. Rig as BS-2A.
10									

Plate D-24
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-2A

LOGGED BY: GCD	DRAWN BY: GCD/PD	CHECKED: AJH	DATE: 27, 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM 4" SHELBY, SPT	START: 21:30	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - roots and wood chips, low plastic, brown	Vx 10%	C1			4" CRREL
			Nb				
			UF	U2		U2	Changed to 4" Shelby easy to push
		3.5' - little fine sand		U3		U3	
5				U4			
		6.0' - trace fine sand, dry		U5			
		7.8' - clayey, sensitive to quicking, moist, grey		U6			
		9.8' - saturated		U7			
10				U8			
		12.0' - medium dense, little fine sand		U9			Changed to SPT
				S10		S10	N=18
			Nbe	S11		S11	N=50
15							Changed to VTM
		16.8' - trace fine sand, current bedding		C12			
		18.0' - some fine sand					
20		20.5' - 3/8" organic layer		C13		C13	
		23.0' - trace fine sand	Nbn	C14			
		25.0' - clayey	Nbe				
		27.0' - little organic inclusions to 30.0' depth		C15		C15	
30						C15	Plate D-25
							Sheet 1 of 2

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GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-2A

LOGGED BY: GCD	DRAWN BY: GCD/PD	CHECKED: AJH	DATE: 27, 28 February 1977
RIG: S. D. S.	METHOD: VTM	START: 21:30	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, low plastic, current bedding, grey		Nbe	C16		C16	
35						C17		C16	
40			40.0'					C17	
			Bottom of Hole at 40.0'					C17	

Plate D-26
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-2B

LOGGED BY: GCD	DRAWN BY: GCD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, DYNAMIC CONE	START: 4:30	FINISH: 5:35
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - ▵
DYNAMIC CONE PENETRATION ▲ (blows/foot) 20 40 60 80
BULK DENSITY (pcf) ● 60 80 100 120
MOISTURE CONTENT 20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, roots and coal chips, low plastic, orange mottling (oxidized)		Vx 5%	C1			8" snow cover 4" CRREL to 2.5' Changed to Dynamic Cone
					UF				
5									
10			11.5'		F				Assumed frozen at 10.5' depth.
			Bottom of Hole at 11.5'						
15									

Plate D-27
Sheet 1 of 1

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-2C

LOGGED BY: GCD	DRAWN BY: GCD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, DYNAMIC CONE	START: 5:50	FINISH: 6:15
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION ▲ (blows/foot) 20 40 60 80
BULK DENSITY (pcf) ● 60 80 100 120
MOISTURE CONTENT 20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - roots and organic inclusions, low plastic, brown		Vr 5% Vx 10% UF	C1			4" CRREL to 2.0'
2.0'			- orange mottling (oxidized)						Changed to Dynamic Cone
5									
9.0'					F				Assumed frozen at 8.5' depth
10			Bottom of Hole at 9.0'						

Plate D-28
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-2D

LOGGED BY: GCD	DRAWN BY: GCD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, DYNAMIC CONE	START: 6:20	FINISH: 6:40
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ○ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, roots and organic inclusions, low plastic		Vx,Vr 10%	C1			4" CRREL to 2.5'
					Nbe				
					UF				Changed to Dynamic cone
5									
			7.5'		F				Assumed frozen at 6.5' depth
			Bottom of Hole at 7.5'						
10									

Plate D-29
Sheet 1 of 1

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-2E

LOGGED BY: CPM	DRAWN BY: GCD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, DYNAMIC CONE	START: 7:30	FINISH: 8:20
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, little organics, low plastic, grey		Vx Vr 5%	C1 C2			4" CRREL to 3.0'
					UF				Changed to Dynamic Cone
5			5.0'		F				Assumed frozen at 4.5' depth
			Bottom of Hole at 5.0'						

Plate D-30
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-3

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:15	FINISH: 15:35
PROJECT NO.: K 3571	ELEVATION: 99.78 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace sand, little organics to 6.5' depth, low plastic, grey-brown		Vx Vc 20%	W C1		C1	Pilot hole to 0.5'
				Vx 10%	C2		C2	
5				Vs Vx 50%				
		6.5' - slight plasticity		Vr Vs 20%	C3			
				Vs 10%	C4		C4	
		9.5' - sandy, non plastic, grey			C5			
10				Nb	C6		C6	
				Vx Vs 5%	C7			
					C8		C8	
15					C9			
				<5%	C10			
		19.2' trace of organics			C11			
20				Nb	C12		C12	
		21.1' wood chips			C13			
		22.3' trace of organics			C14			
					C15		C15	
25				Vx Vs 5%	C16		C16	
				Nb	C17			
30					C18			

Plate D-31
Sheet 1 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-3

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:15	FINISH: 15:35
PROJECT NO.: K 3571	ELEVATION: 99.78 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, non plastic, grey		Nb Vs <5%	C18		C18	
			32.7' trace of organics		Nb	C19 C20			
35			35.5' wood chips			C21 C22		C21	
			37.5' trace of organics		Vs Vx <5%	C23 C24		C23 C24	
40			40.0'						
			Bottom of Hole at 40.0'						
45									

Plate D-32
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

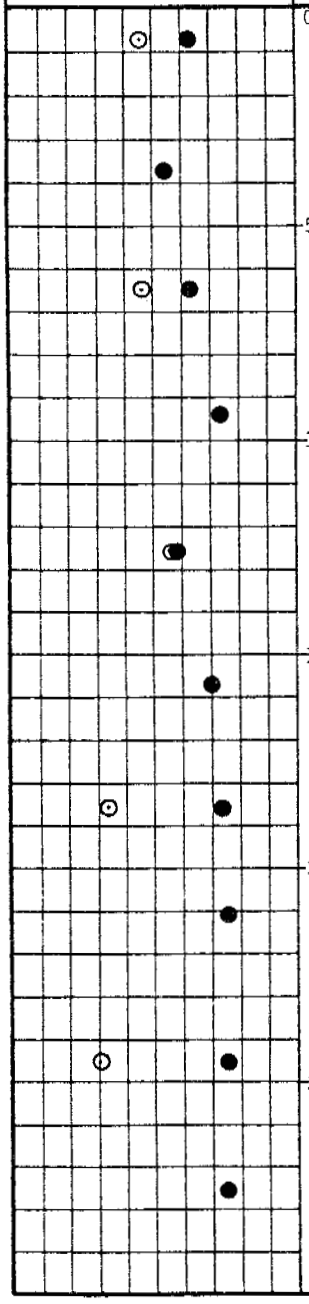
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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-4

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 22 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 14:00	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 99.80 m	LOCATION: Barge Slip	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL	ORGANIC SILT - low plastic, brown	Vs Vx 50%	W		C1	Pilot hole to 0.6'
1.5'	ML	SILT - clayey, trace fine sand, trace of organics to 5.0' depth, low plastic, brown	10%	C1			
			50%	C2		C2	
			15%	C3			
5				C4		C4	
				C5			
			Vs <5%			C5	
10			Nb	C6			
				C7		C7	
			Vr Vs 20%	C8			
			10%				
15		15.0' - sandy, slight plasticity grey	5%	C9		C9	
			<5%				
		18.2' - trace of organics		C10		C10	
20		20.0' - 6" sand layer	Nb	C11			
		20.5'		C12		C12	
		21.0' - and sand, trace of organic laminations, non plastic, grey	Vc,Vs <5%	C13			
			Nb	C14		C15	
25		24.7' - little sand, slight plasticity, grey	Vs <5%	C15			
			Nb	C16		C17	
				C17			
30		Bottom of Hole at 30.0'		C18			

Plate D-33
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-5

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 15:55	FINISH: 18:30
PROJECT NO.: K 3571	ELEVATION: 99.42 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

125.0 ⊙
113.0 ⊙

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, trace of organics to 6.5' depth, low plastic, grey-brown		Vx Vs 20%	W C1		C1	Pilot hole to 1.0'
					50%	C2		C2	
5					Vs 20% 40%	C3		C3	
			6.5' - slight plasticity		70% Vx Vs 25%	C4 C5		C5	
					5%	C6 C7			
10			13.2' - sand pockets			C8		C8	
			15.0' 2 ice lenses of 1/4" thickness	14.7'		C9		C9	
15			- sandier, non plastic, grey		Vx <5% Nb	C10		C10	
			19.4' - sand pockets		Vs <5% Nb	C11 C12		C12	
20			22.2' - 1/4" root			C13			
			23.5' - rusty colored sand pockets			C14		C14	
			24.5' - trace of organics			C15			
25			25.2' - 1" silt layer			C16		C16	
						C17			
30			Bottom of Hole at 30.0'			C18		C18	

Plate D-34
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-6

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 22 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 9:40	FINISH: 13:50
PROJECT NO.: K 3571	ELEVATION: 99.41 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace fine sand, little organics to 2.5' depth, low plastic, grey	Vx Vs 20%	W			Pilot hole to 1.0'
			Vr Vs 5%	C1		C1	
				C2			
			Vs, Vx 40%	C3		C3	
5			70%				
			Vs 40%	C4		C4	
			Vr Vs 20%	C5			
			35%	C6		C6	
			15%				
10			60%	C7			
			15%				
				C8	X	C8	
				C9		C9	
15			Vx Vs 5%	C10			
		17.0' - sandier, fine grained, non plastic		C11		C11	
			Vs <5%	C12			
20			Nb	C13		C13	
		22.0' - and sand, non plastic, grey	Vs <5%	C14			
				C15		C15	
			Nb	C16			
25		25.7' - trace of organics		C17		C17	
				C18			
30				C19			

Plate D-35
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

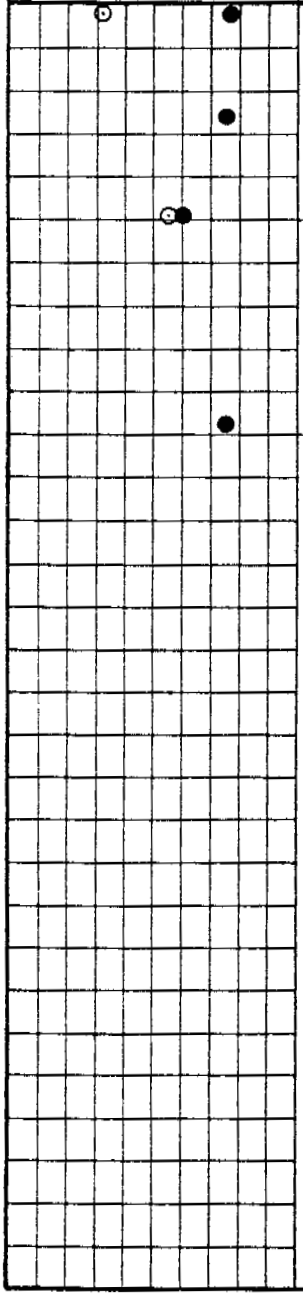
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-6

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 22 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 9:40	FINISH: 13:50
PROJECT NO.: K 3571	ELEVATION: 99.41 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) 60 80 100 120
MOISTURE CONTENT 20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and sand, non plastic, grey		Nb	C19		C19	
						C20		C20	
						C21			
34.5'			- some organic laminations to 1/2" thickness		Vc < 5%	C22		C22	
35					Nb	C23			
38.5'			- trace of fine sand, low plastic, grey		Vs < 5%	C24		C24	
40.0'									
40			Bottom of Hole at 40.0'						

Plate D-36
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-7

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:20	FINISH: 23:30
PROJECT NO.: K 3571	ELEVATION: 99.27 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey-brown		Vx 20%	W			Pilot hole to 3.0'
					Nb			C1	
					Vr 30%	C1			
5					Vr Vs 20%	C2			
						C3		C3	
					Vs 15%	C4			
					50%	C5		C5	
			8.5' - current bedded, trace of organic laminations to 1/4" thickness		<5%	C6			
10			10.6' - trace of fine sand, trace of organic laminations		Nb	C7		C7	
						C8			
					Vx Vs <5%	C9		C9	
					Nb	C10			
						C11		C11	
15			19.0' - current bedded		Vr <5%	C12			
						C13		C13	
					Nb	C14			
			22.5' - wood pieces			C15		C15	
20			23.0' - little fine sand, non plastic		Vs <5%	C16			
						C17			
					Nb	C18		C18	
						C19			
25						C20			
30									

Plate D-37
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-7

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:20	FINISH: 23:30
PROJECT NO.: K 3571	ELEVATION: 99.27 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - little fine sand, little organic laminations and inclusions, non plastic, current bedded, grey-brown		Nb	C20		C20	
						C21			
						C22		C22	
35			35.5' - some organic layers		Vx 5%				
					Nb	C23			
			37.0' - little organic layers			C24		C24	
			38.5' - trace organic layers		Vr <5%	C25			
40			40.5'					C25	
			Bottom of Hole at 40.5'						
45									

Plate D-38
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-8

LOGGED BY: GCD/CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 22 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 5:50	FINISH: 9:05
PROJECT NO.: K 3571	ELEVATION: 99.34 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey		Vx 10%	W			Pilot hole to 3.0'
			2.0' - low plastic, brown		Vr 5%	C1		C1	
5					Vs 50%	C2		C2	
			6.5' - clayey, trace fine sand, brown		20%	C3			
					5%				
					40%	C4			
					10%	C5		C5	
10			9.5' - grey		20%	C6			
					Vr Vs 20%	C7			
					15%	C8		C8	
						C9			
15			15.0' - little fine sand, non plastic, current bedding, grey		Vs <5%	C10		C10	
					5%	C11		C11	
20						C12			
			21.3' trace of organics		<5%	C13		C13	
					Vr Vs 5%	C14			
						C15		C15	
25					Nb	C16			
			27.7' trace of organics		Vs <5%	C17		C17	
30			BOTTOM OF HOLE AT 30.0'			C18			

Plate D-39
Sheet 1 of 1

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-9

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 20 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:25	FINISH: 16:00
PROJECT NO.: K 3571	ELEVATION: 99.58 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, trace of organics to 4.0' depth, low plastic, laminated, brown		Vr Vs 30%	W C1		C1	Pilot hole to 1.0'
					<5%	C2			
					65%	C3		C3	
5			5.5' -little sand, non plastic, current bedded, grey		Vx Vr 10%	C4			
					Nb	C5		C5	
10					Vr Vs 10%	C6			
						C7		C7	
			13.2' - 1" organic layer		Vr Vx <5%	C8			
						C9		C9	
15			15.7' - 1/2" organic layer		Vr Vs 5%	C10			
						C11		C11	
20						C12			
						C13		C13	
						C14			
						C15		C15	
25					Vx Vr 10%	C16			
			27.0' - trace fine sand, low plastic		<5%	C17		C17	
30						C18			

Plate D-40
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-9

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 20 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11: 25	FINISH: 16:00
PROJECT NO.: K 3571	ELEVATION: 99.58 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and sand, non plastic, grey		Vr <5%	C19		C19	
						C20			
					Nb	C21		C21	
35						C22			
						C23			
						C24			
			38.7' - clayey, trace fine sand, trace organics, slight plasticity, grey		Vr Vs 10%	C25		C25	
40			40.0' Bottom of Hole at 40.0'						

Plate D-41
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-10

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 21, 22 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:40	FINISH: 5:30
PROJECT NO.: K 3571	ELEVATION: 99.21 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

142.0

DEPTH (feet): 0, 5, 10, 15, 20, 25, 30

SOIL GROUP SYMBOL: ML

SOIL GRAPHIC LOG

DESCRIPTION

SILT - clayey, trace fine sand, trace of organic laminations, low plastic, brown and grey

6.0' - fine current bedding

15.5'
16.3' - oxidized silt layers

26.0' - little fine sand, slight plasticity, current bedded

ICE GRAPHIC LOG

NRC ICE TYPE VISUAL ICE %

Vx 10%
Nb
Vr 30%
ICE+
Vr, Vs 50%
Vs 20%
5%
Vr <5%
Vs 5%
15%
10%
5%
Nb

SAMPLE TYPE & NO.

W
C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19

SAMPLE CONDITION

SAMPLE RETAINED

C1 C3 C5 C7 C9 C11 C13 C15 C17 C19

OTHER INFORMATION

Pilot hole to 2.0'

Plate D-42
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

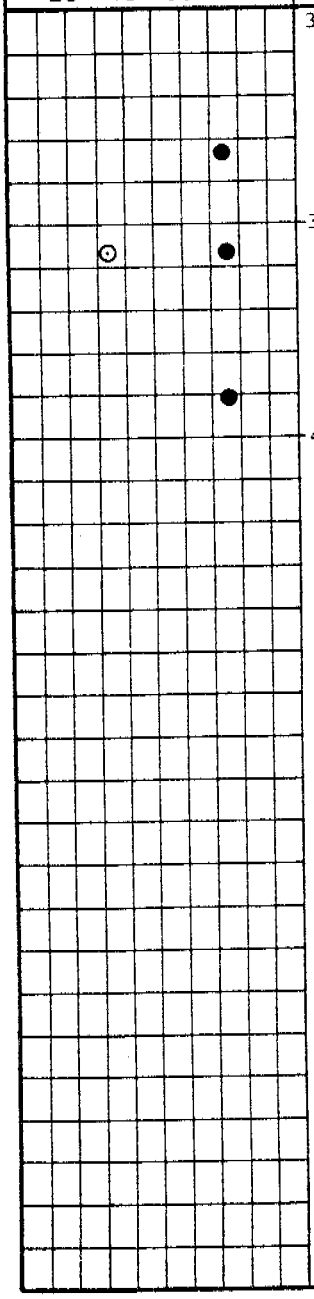
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-10

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 21, 22 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:40	FINISH: 5:30
PROJECT NO.: K 3571	ELEVATION: 99.21 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		30.8' **SILT** - slight plasticity - and fine sand, non plastic, grey		Nb	C19			
						C20			
						W			
			33.3' - clayey, little fine sand, slight plasticity, current bedded, grey			C21		C21	
35						C22			
						C23		C23	
			37.0' - trace fine sand			C24			
						C25		C25	
40			40.0'						
			Bottom of Hole at 40.0'						

Plate D-43
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. BS-11

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 22 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:10	FINISH: 20:20
PROJECT NO.: K 3571	ELEVATION: 99.29 m	LOCATION: Barge Slip	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, little organics to 5.0' depth, low plastic, grey		Vx Vs 30%	W			Pilot hole to 0.7'
					Vs 70%	C1		C1	
						C2			
5					ICE+	C3		C3	
					Vs 20%	C4			
					Vx Vs 5%	C5		C5	
					50%	C6			
					Vs 30%	C7		C7	
10						C8			
					Vx Vs 15%	C9			
					Nb	C10		C10	
					Vx Vs 5%	C11			
						C12		C12	
15					Vr Vs 10%	C13			
						C14		C14	
					<5%	C15			
20			20.7' - little fine sand		Nb	C16		C16	
			22.2' - trace fine sand, occasional organic layers, fine current bedding			C17			
						C18		C18	
25						C19			
			26.5' - organic pocket			C20		C20	
						C21			
30			Bottom of Hole at 30.0'			C22		C22	

Plate D-44
Sheet 1 of 1

APPENDIX "D"

SECTION D.4 TEST HOLE LOGS: TANK FARM AND FLARE STACK

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

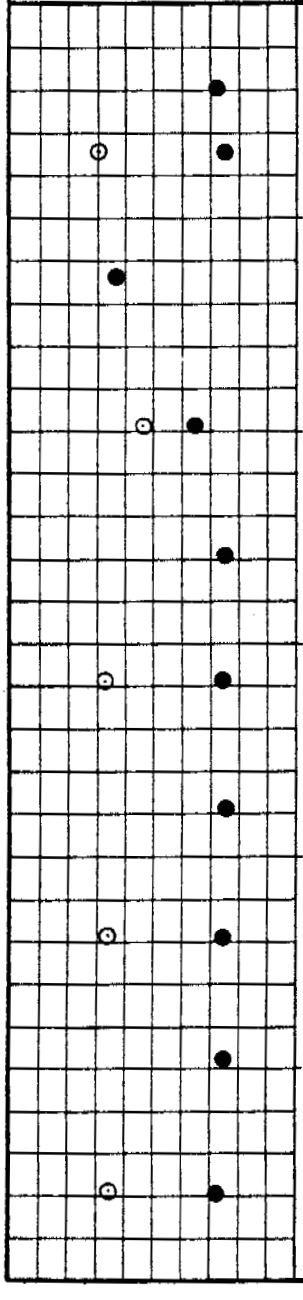
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. TF-1

LOGGED BY: GCD/CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 2:30	FINISH: 7:50
PROJECT NO.: K 3571	ELEVATION: 99.25 m	LOCATION: Tank Farm	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	CL	CLAY - silty, low plastic, grey		Vx 40%	W			Pilot hole to 1.5'
		ice crystals to 1/8" dia.			C1		C1	
2.5'								
	ML	3.0' SILT - low plastic, yellow-brown, powdery, brown		Nf				
3.5'		below 3.0' depth		Nb	C2		C2	
	I+	ICE + SILT		ICE+ 60%	C3			
5.0'								
5	ML	SILT - low plastic, brown		Vs 40%	C4		C4	
				20%	C5			
7.5'								
	I+	8.0' ICE + SILT		ICE+ 70%	C6			
	ML	SILT - clayey, low plastic, dark brown		Vs 40%				
				20%	C7		C7	
10								
11.0'		current bedding, occasional 1/16" brown organic laminations, light and dark grey		10%	C8			
				Nb				
				Vs <5%	C9		C9	
13.5'		occasional 1/16" ice lens		Nb	C10			
		trace fine sand						
15		occasional 1/16" ice lens		Vx <5%	C11		C11	
17.0'		occasional organic laminations to 1/8" thickness to 22.5' depth		Nb	C12			
					W			
					C13		C13	
20					C14			
				Vr <5%	C15		C15	
23.5'		little fine sand		Nb	C16			
25					C17		C17	
25.5'		some fine sand			C18			
					C19		C19	
28.5'								
	SM	SAND - silty, fine, current bedding			C20			
29.5'	ML	SILT - continued on page 2						
30								

Plate D-45
Sheet 1 of 2

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. TF-1

LOGGED BY: GCD/CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 2:30	FINISH: 7:50
PROJECT NO.: K 3571	ELEVATION: 99.25 m	LOCATION: Tank Farm	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - little fine sand, clayey, low plastic, current bedded, occasional 1/16" organic laminations		Nb	C21		C21	
						C22			
			occasional 1/16" ice lenses		Vs <5%	W			
35						C23		C23	
					Nb	C24		C24	
						C25			
						C26		C26	
40			Bottom of Hole at 40.0'.						

Plate D-46
Sheet 2 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

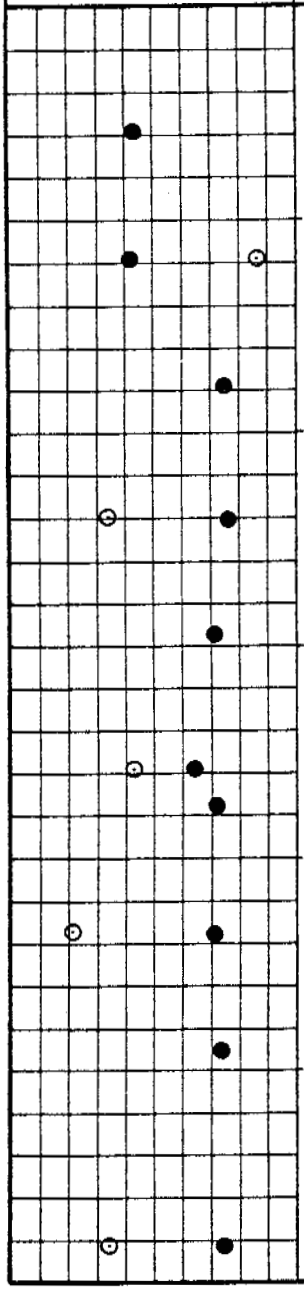
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. TF-2

LOGGED BY: DC/CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 18/21 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 20:15	FINISH: 10:40
PROJECT NO.: K 3571	ELEVATION: 99.24 m	LOCATION: Tank Farm	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - rootlets, low plastic, light brown		Vx 40%	W C1			Pilot hole to 1.0'
		3.0' - 3.5' - sandy, dry, light brown		Nf	C2		C2	
5		clear ice 1/8" lenses		Vs 15%	C3			
		- low plastic, light brown 1/32" ice lenses		Vx 10% 50%	C4 C5		C4	
	I+	ICE + SILT fine lenses		ICE+ 70%	C6			
	ML	SILT - trace fine sand, low plastic, grey		Vs 10%	C7 C8		C7	
10					C9		C9	
				Nb	C10			
15				Vx 10% Nb	C11		C11	
		ice in 1/2" - 1" lenses		Vs 30%	C12			
				10%	C13 C14		C13 C14	February 18, 2400 hrs., barrel frozen down hole, abandoned at 19'. February 21, 7.55 hrs., blew down to 18' and continued 10' north of original hole.
20				Vr Vs <5%	C15 C16			
					C17		C17	
				Nb	C18 C19		C19	
25				Vr <5%	C20			
				Nb	C21			
30					C22 C23		C22	

Plate D-47
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. TF-2

LOGGED BY: DC/CPM	DRAWN BY: GD/PD.	CHECKED: AJH	DATE: 18/21 February 197
RIG: NORTHLAND	METHOD: 4" CRREL	START: 20:15	FINISH: 10:40
PROJECT NO.: K 3571	ELEVATION: 99.24 m	LOCATION: Tank Farm	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, low plastic, grey		Nb	C23			
						C24		C24	
						C25			
						C26			
35						C27		C27	
						C28			
						C29		C29	
			Bottom of Hole at 38.0'						
40									

Plate D-48
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FS-1

LOGGED BY: AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 10:10	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: 99.64 m	LOCATION: Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	CL		CLAY - silty, low plastic, brown - grey		Vx Vr Vs 20%	W C1		C1	Pilot hole to 0.25'
			ice lenses to 1/16" thickness			C1		C1	
2.5'	ML		SILT - clayey, low plastic		Vs 50%	C2			
					10%	C3			
5			ice lenses to 1/64" thickness		ICE+ 70%			C3	
6.0'			- trace clayey fines, grey ice lenses to 1/8" thickness		Vs Vx 35%	C4			
					20%	C5		C5	
9.0'			1" lenses clear ice	9.0' 9.3' 9.8'	Vx Vr Vs 50%	C6		C6	
10					Vr Vs 30%	C7		C7	
11.5'			- trace sand			C8			
13.0'			- trace organic inclusions to 17.0' depth	13.5'	Vs 20%	C9		C9	
			1/2" Vs 50%		<5%	C10			
15						C11		C11	
18.5'			- current bedded, sandy			C12			
20			lens Vs 30%	20.5'		C13		C13	
21.5'			- 1/16" thick sand layers		Nb	C14			
						C15		C15	
25			lens Vs	25.8'		C16			
						C17		C17	
29.0'			6" lens Vr Vs	29.0'		C18			
30			- decreasing sand content to trace sand						

Plate D-49
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FS-1

LOGGED BY: AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 10:10	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: 99.64 m	LOCATION: Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - trace sand, occasional organic inclusions, low plastic, current bedded, grey		Nb Vs <5%	C18 C19		C19	
		32.0' - little sand to 34.0' depth		Nb	C20			
		34.0' - trace sand		Vr Vs 10%	C21		C21	
35					C22			
		37.7' - organic layers, becoming sandier		Nb	C23		C23	
40		40.3' 1/2" organic layer			C24			
		41.3' - trace sand in layers, trace organics			C25		C25	
					C26			
45					C27		C27	
					C28			
					C29		C29	
50					C30			
					C31		C31	
					C32			
					C33			
55		55.5' - 50% organics in 1/16" layers 56.5'			C34		C34	
	SM	SAND - with non plastic silty layers, grey			C35			
					C36			
60		Bottom of Hole at 60.5'			C37			

Plate D-50
Sheet 2 of 2

APPENDIX "D"

SECTION D.5 SUMMARY OF LABORATORY TESTING

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

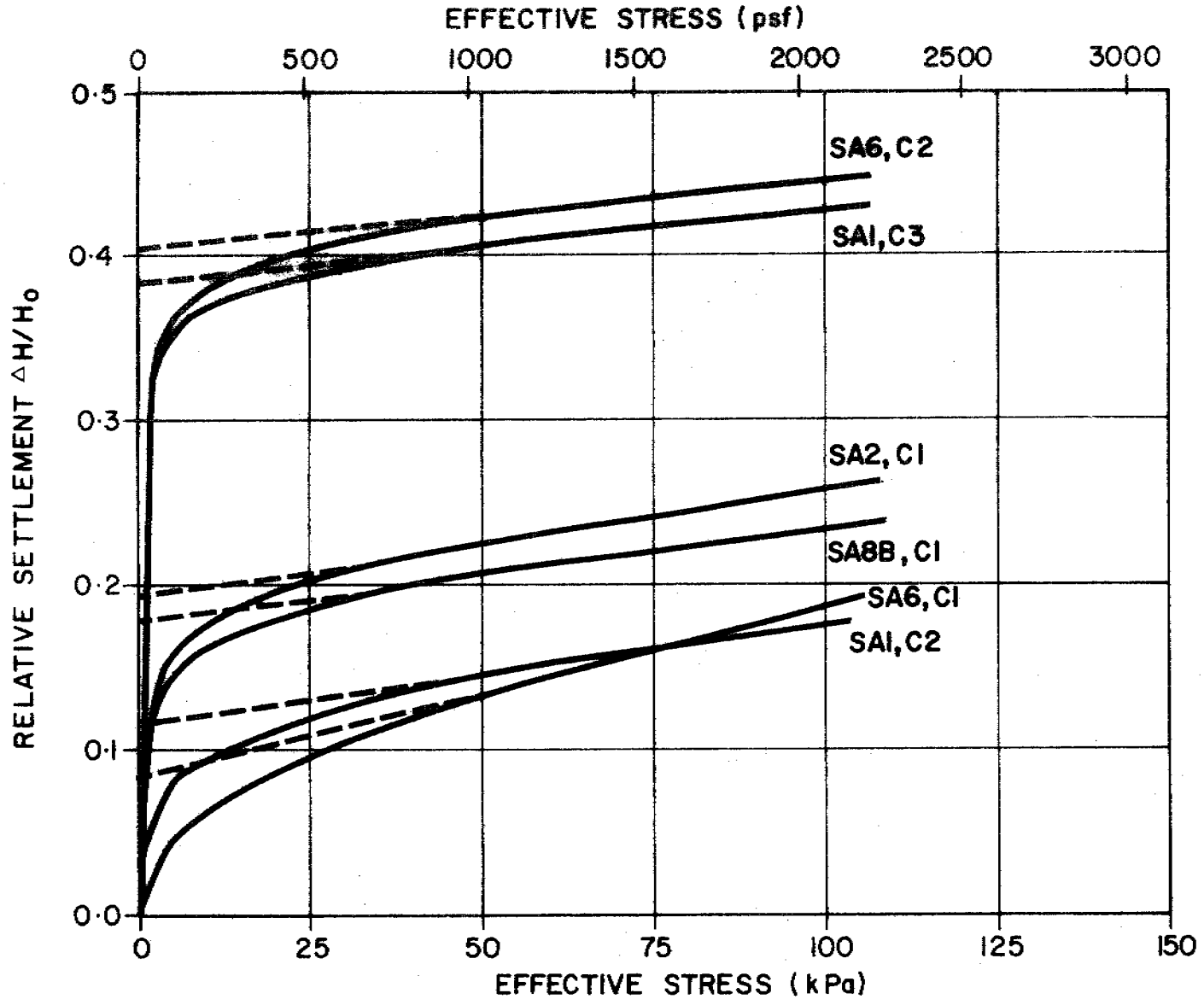
PROJECT Niglintgak Gas Project
LOCATION Staging Area
DATE February/March 1977
JOB NO. K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
SA-1	2.4' -2.9'	C2	ML	SILT - clayey, trace fine sand, low plastic, brown - frozen, Vx Vr 10%							103.1	71.1	37.2	Thaw Consolidation Test Plate D-51
SA-1	3.8' -4.2'	C3	ML	SILT - clayey, trace fine sand, low plastic, brown - frozen, Vr Vs 40%							93.1	54.0	33.4	Thaw Consolidation Test Plate D-51
SA-2	1.5' -2.0'	C1	ML	SILT - trace fine sand, trace organics, slight plasticity, brown - frozen, Vr Vs 40%							101.7	65.4	37.5	Thaw Consolidation Test Plate D-51
SA-6	0.8' -1.2'	C1	ML	SILT - trace fine sand, trace organics, low plastic, laminated, grey and brown - frozen, Vr Vs 5%							98.0	62.4	42.2	Thaw Consolidation Test Plate D-51
SA-6	3.0' -3.5'	C2	ML	SILT - trace fine sand, trace organics, low plastic, laminated, grey and brown - frozen, Vr Vs 50%							89.5	50.1	36.5	Thaw Consolidation Test Plate D-51
SA-8B	3.0' -3.7'	C1	ML	SILT - clayey, some organics, low plastic, grey-brown - frozen, Vs 30%							98.0	64.4	38.9	Thaw Consolidation Test Plate D-51

TABLE D-2

APPENDIX "D"

SECTION D.6 SPECIAL TEST RESULTS



R.M. HARDY & ASSOCIATES LTD.

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

THAW CONSOLIDATION TEST RESULTS - STAGING AREA

K3571-151

PLATE D-51

APPENDIX "E"

DOCK SITE

SECTION E.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE E-1

Test Hole Locations and Elevations
Dock Site

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
DS-1	7 688 758.41	489 168.19	0.972	98.716
DS-2	7 688 755.16	489 182.82	1.122	98.866
DS-3	7 688 748.66	489 212.10	1.021	98.765
DS-4*	7 688 742.16	489 241.37	1.039	98.783
DS-5	7 688 831.59	489 184.42	1.064	98.808
DS-6	7 688 828.34	489 199.06	0.936	98.680
DS-7	7 688 821.84	489 228.34	1.024	98.768
DS-8*	7 688 815.34	489 257.61	1.025	98.769
DS-9	7 688 904.78	489 200.67	0.957	98.701
DS-10	7 688 901.53	489 215.31	0.902	98.646
DS-11	7 688 895.03	489 244.58	1.009	98.753
DS-12	7 688 888.53	489 273.86	1.018	98.762
DS-13	7 688 963.34	489 213.67	0.847	98.591
DS-14	7 688 960.09	489 228.31	0.879	98.623
DS-15	7 688 953.59	489 257.58	1.042	98.786
DS-16	7 688 947.09	489 286.86	0.939	98.683
DS-17	7 689 007.24	489 223.42	0.850	98.594
DS-18	7 689 003.99	489 238.06	0.880	98.624
DS-19	7 688 997.49	489 267.33	1.030	98.774
DS-20	7 688 991.00	489 296.61	1.111	98.855

* not drilled

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "E"

SECTION E.2 TEST HOLE LOGS

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

TEST HOLE NO. DS-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 17:00	FINISH: 21:00
PROJECT NO.: K 3571	ELEVATION: 98.72 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.0'						
	W		WATER		UF				
5									
10									
15									
20									
			21.5'						River Bed
	ML		SILT - very loose, little fine sand, low plastic, saturated, grey			S1		S1	N=1
25						W			
						S2		S2	N=1
30						W			

Plate E-1
Sheet 1 of 2

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 17:00	FINISH: 21:00
PROJECT NO.: K 3571	ELEVATION: 98.72 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - loose, little fine sand, low plastic, grey		UF	W			
						S3		S3	N=7 Grain Size Analysis See Table E-2
35						W			
						S4		S4	N=6
40						W			
			43.0' - clayey, trace fine sand, sensitive to quicking			S5		S5	N=7
45						W			
			47.5'						
	CI		CLAY (TILL-like) - silty, medium plastic, grey						
			49.3' - trace of gravel			S6		S6	N=38, hit stone
50			50.0'						
			Bottom of Hole at 50.0'						

Plate E-2
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-2

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 15:10	FINISH: 16:50
PROJECT NO.: K 3571	ELEVATION: 98.87 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
10									
40			41.5'						River Bed
	CI		CLAY - very soft, silty, medium plastic, grey			S1		S1	N=1
45						W			
50			50.0' - very stiff, till-like			S2		S2	N=19
			51.5'						
55			Bottom of Hole at 51.5'						

Plate E-3
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-3

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 13:50	FINISH: 14:45
PROJECT NO.: K 3571	ELEVATION: 98.77 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION ▲ (blows/foot) 10 20 30 40
BULK DENSITY (pcf) ● 60 80 100 120
MOISTURE CONTENT 20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
40			41.0'						
			RIVER SEDIMENTS - loose						River Bed Dynamic Cone not representative due to length of unsupported rod.
			43.5'						
45			Bottom of Hole at 43.5'						Water depth too great to continue testing.

Plate E-4
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-5

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, DYNAMIC CONE	START: 3:30	FINISH: 4:25
PROJECT NO.: K 3571	ELEVATION: 98.81 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE 1.0'		ICE	C			4" CRREL
	ML		SILT - clayey, low plastic, grey to brown		Vr,Vs 10%	C1		C1	Changed to Dynamic Cone
					UF				
5									
10									
15			17.5'						Assumed frozen at 17.5' depth
20			Bottom of Hole at 17.5'.						

Plate E-5
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-6

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 7, 8 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 22:00	FINISH: 2:50
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE	ICE				
		3.5'					
	W	WATER	UF				
5		7.7'					
	ML	SILT - very loose, little fine sand, low plastic, grey		U1	U1	U1	Grain Size Analysis See Table E-2
				W			
		13.0' - trace fine sand		S2	S2	S2	N=2 Grain Size Analysis See Table E-2
15				W			
		18.0' - loose, sandier		S3	S3	S3	N=5
				W			
20		23.0' - loose, trace fine sand, slight plasticity, grey		S4	S4	S4	N=2 Grain Size Analysis See Table E-2
				W			
25		28.0' - loose		S5	S5	S5	N=8
30							

Plate E-6
Sheet 1 of 3

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-6

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 7, 8 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 22:00	FINISH: 2:50
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - loose, some fine sand, slight plasticity, grey		UF	W			
						S6	S6	S6	N=9
35						W			
			38.0' - loose, clayey, trace fine sand, low plastic, grey			S7	S7	S7	N=10
40						W			
						S8	S8	S8	N=10 Grain Size Analysis See Plate E-43
45						W			
						S9	S9	S9	N=9
50						W			
			53.4'			S10	S10	S10	N=50 Grain Size Analysis See Plate E-44
55	CI		CLAY (TILL-like) - hard, silty, little sand, trace gravel, medium plastic, grey 55.7' - some fine to coarse sand, trace fine gravel			C11		C11	Grain Size Analysis See Plate E-45
60									

Plate E-7
Sheet 2 of 3

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-6

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 7, 8 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 22:00	FINISH: 2:50
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
60	CI		CLAY (TILL-like) - hard, silty, some fine to coarse sand, trace fine gravel, medium plastic, grey		UF				
65						W			
70									
75						S12	X	S12	N=42 Grain Size Analysis See Plate E-46
			78.0'						
			Bottom of Hole at 78.0'						
80									

Plate E-8
Sheet 3 of 3

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-6A

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 9:30	FINISH: 11:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) 20 40 60 80 ▲
BULK DENSITY (pcf) ● 60 80 100 120
MOISTURE CONTENT 20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			9.0'						
10			RIVER SEDIMENTS						River Bed
15									
20									
25									
30									

Plate E-9
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-6A

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 9:30	FINISH: 11:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30			RIVER SEDIMENTS		UF				
35									
40									
45									
50			51.0' - till-like deposits?						
			53.0'						
55			Bottom of Hole at 53.0'						

Plate E-10
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-7

LOGGED BY: AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: 4" CRREL	START: 11:30	FINISH: 11:45
PROJECT NO.: K 3571	ELEVATION: 98.77 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICF TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
10									
40									
			44.0'						
45			Bottom of Hole at 44.0' (River Bed)						Soil not drilled due to depth.

Plate E-11
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-9

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 13:00	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: 98.70 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
2,0 4,0 6,0 8,0
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	C1			
			1.5'			C2			
	ML		SILT - clayey, trace fine sand, low plastic, grey		Vr Vs 20%	C3			
						C4			
5					UF				
10									
15									
			18.0'		NB				Changed to VTM
20			- sandy, laminated, grey			C5		C5	
			23.0'						
25			- sandy, organic laminations, laminated, grey			C6		C6	
30						C7		C7	

Plate E-12
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-9

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 13:00	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: 98.70 m	LOCATION: Dock Site	

W_p - ▫ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, low plastic, laminated, grey		Nb	C7		C7	
35						C8		C8	
40			40.0' - clayey, low plastic			C9		C9	
			43.0' Bottom of Hole at 43.0'						
45									

Plate E-13
Sheet 2 of 2

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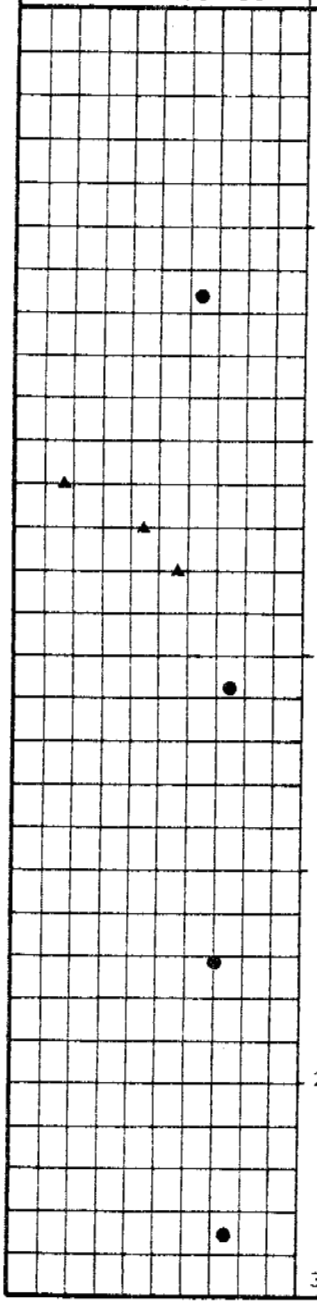
TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-9A

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 7:30	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	C1			
			1.5'			C2			
	ML		SILT - sandy, low plastic, grey		Vs 50%	C3			
					10%	C4			
			4.0'		Nb	C5			
5			- and sand, slight plasticity, grey		Vs 5%	C6			
					Nb	C7		C7	
					Vs 5%	C8			
					UF	C9			
					Vs	C10			
10					UF	W			
					Nb				
15			15.0' - current bedded			C11		C11	
						C12		C12	
20			21.0' - trace of organic laminations, current bedded			C13		C13	
25									
30									

Plate E-14
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-9A

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 7:30	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - fine sand, slight plasticity, current bedded, grey		Nb	C14		C14	
35						C15			
			39.0' - clayey, trace fine sand, low plastic						
40						C16			
45			47.0'			C17			
	CL		CLAY (TILL-like) - firm, trace fine to coarse sand, trace fine gravel, low plastic, grey		UF	W			
50									
			54.0' - hard			S18		S18	N=40
55								C19	
						C19			
60			Bottom of Hole at 60.0'						

Plate E-15
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-9B

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: 4 " CRREL	START: 8:40	FINISH: 9:50
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE 1.2'		ICE	C1			
	ML		SILT - trace fine sand, low plastic, grey		Vs 15%	C2			
					5%	C3			
					Nb	C4			
5					Vs 5%	C5			
					Nb	C6			
					UF	C7			
						C8			
10			12.0'			C9			Frozen at 12.0'.
			Bottom of Hole at 12.0'						
15									

Plate E-16
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-10

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 3:15	FINISH: 7:50
PROJECT NO.: K 3571	ELEVATION: 98.67 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	C			4" CRREL
			1.5'						
	ML		SILT - trace fine sand, low plastic, grey		Vr 10%	C1			
						C2		C2	
					15%				
5						C3			
					UF				Changed to Dynamic Cone
10									
15									Changed to VTM
					Nb	C4			
20									
						C5			
25					UF				
						C6			
30					Nb				

Plate E-17
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-10

LOGGED BY: CCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 3:15	FINISH: 7:50
PROJECT NO.: K 3571	ELEVATION: 98.67 m	LOCATION: Dock Site	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, low plastic, grey		Nb	C6			
								C7	
						C7			
35								C7	
						C8			
40			41.0'						
			Bottom of Hole at 41.0'						
45									

Plate E-18
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-10A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT 4" SHELBY, WASH	START: 1:45	FINISH: 6:20
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE	ICE			
		4.5'				
5	W	WATER	UF			
		9.0'				
10	ML	SILT - loose, clayey, trace fine sand, non plastic, grey		U1	U1	Grain Size Analysis See Table E-2
				W		
15		15.0' - increasing to little fine sand		S2	S2	N=3 Grain Size Analysis See Table E-2
				W		
20		20.0' - loose, increasing to some fine sand, non plastic, grey		S3	S3	N=3
				W		
25				S4	S4	N=6 Grain Size Analysis See Table E-2
				W		
30						

Plate E-19
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-10A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT 4" SHELBY, WASH	START: 1: 45	FINISH: 6:20
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - loose, some fine sand, grey		UF	U5			
		32.0' - little fine sand			U6		U6	Direct Shear Test See Plate E-56
					S7		S7	N=7 Grain Size Analysis See Table E-2
35		35.0' - loose to medium dense, and fine sand, grey			W			
					U8		U8	
					S9		S9	N=10
					W			
40					U10		U10	Direct Shear Test See Plate E-57
					S11		S11	N=18 Grain Size Analysis See Table E-2
					W			
45		45.7' - very loose, clayey, low plastic			S12		S12	N=2
		49.0'			W			
	CI	CLAY (TILL-like) - very stiff to hard, silty, and fine to coarse sand, trace gravel to 1/2" size, low plastic, grey			S13		S13	N=33 Grain Size Analysis See Plate E-47
50					W			
55		55.0' - some fine to coarse sand	+ + + + +	Vx <5%	S14		S14	N=45 Grain Size Analysis See Plate E-48
		56.5'						
60		Bottom of Hole at 56.5'						

Plate E-20
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-11

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 28 February, 1 March 1977
RIG: S. D. S.	METHOD: SPT, WASH	START: 22:30	FINISH: 2:50
PROJECT NO.: K 3571	ELEVATION: 98.75 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.0'						
5	W		WATER		UF				
10									
15			15.5'						
	ML		SILT - very loose, trace fine sand, low plastic, grey						SPT penetrated from 15.5' to 22.5' by its own weight.
						S1			
20									
						S2		S2	N=1
25						W			
						U3			
						W			N=10
30			29.6' - occasional organic layers			S4		S4	

Plate E-21
Sheet 1 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-11

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 28 February 1 March 1977
RIG: S. D. S.	METHOD: SPT, WASH	START: 22:30	FINISH: 2:50
PROJECT NO.: K 3571	ELEVATION: 98.75 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - loose, trace fine sand, low plastic, grey		UF	S4		S4	N=10
						W			
35			35.4' - increasing to little fine sand, sensitive to quicking			S5		S5	N=4 Grain Size Analysis See Table E-2
						W			
40						S6		S6	N=16
						W			
45			45.0' - medium dense, clayey, trace fine sand			S7		S7	N=17 Grain Size Analysis See Plate E-49
						W			
	CI		49.0' CLAY - hard, silty, trace sand, medium plastic, grey			S8		S8	N=37
50			50.5' Bottom of Hole at 50.5'						
55									

Plate E-22
Sheet 2 of 2

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-12

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 21:00	FINISH: 22:05
PROJECT NO.: K 3571	ELEVATION: 98.76 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - ▵
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.0'						
5	W		WATER		UF				
40			44.0'						
45			RIVER SEDIMENTS						NOTE: Dynamic Cone values not representative due to length of unsupported BW rod.
			51.5'						
50			Bottom of Hole at 51.5'						
55									

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Plate E-23
Sheet 1 of 1

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-13

LOGGED BY: RGC	DRAWN BY: CPM/ PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: 4" CRREL	START: 7:30	FINISH: 8:30
PROJECT NO.: K 3571	ELEVATION: 98.59 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, low plastic, laminated, grey		Vs 10%	C1			
						C2			
					Nb	C3			
			4.5' - clayey						
5			5.5' - sandy			C4			
						C5			
			8.0' - trace of organic laminations to 1/8" thickness			C6			
						C7			
			9.7' - fine sand layers			C8			
10						C9			
			12.0'			C10			
			Bottom of Hole at 12.0'						
15									

Plate E-24
Sheet 1 of 1

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-13A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 15 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 2:40	FINISH: 3:10
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_P - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey		Vr 60%	C1		C1	4" CRREL
					Vs 40%	C2			
					10%				Changed to Dynamic Cone
					UF				
13.0'					F				Assumed frozen at 12.0' depth
			Bottom of Hole at 13.0'						Located 25.0' west of DS-13.

Plate E-25
Sheet 1 of 1

TEST HOLE LOG

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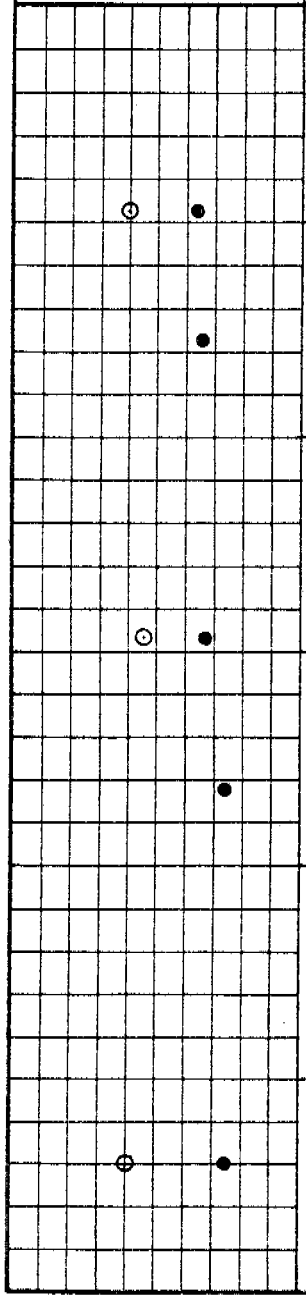
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-14

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 15:00	FINISH: 18:50
PROJECT NO.: K 3571	ELEVATION: 98.62 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE 1.0'		ICE	C1			4" CRREL
	ML		SILT - trace fine sand, low plastic, current bedded, grey		Vx 10%	C2			
						C3			
					Vs 5%	C4			
5						C5		C5	Changed to VTM
					5%				
						C6		C6	
10			10.0' - clayey 10.2' 1/4" ice lens		20%				
					5%				
			13.0' - fine sand, non plastic, current bedded, grey		Nb	C7		C7	
15									
						C8		C8	
20									
						C9			
25						C10		C10	
30									

Plate E-26
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-14

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 15:00	FINISH: 18:50
PROJECT NO.: K 3571	ELEVATION: 98.62 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and fine sand, fine grained, non plastic, current bedded, grey		Nb	C11		C11	
			33.5'						
	SM		SAND - and silt, fine grained, non plastic, current bedded, grey			C12		C12	
35									
40			40.0'						
			Bottom of Hole at 40.0'						

Plate E-27
Sheet 2 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-14A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 3:00	FINISH: 5:45
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE 1.0'		ICE	C1			4" CRREL
	ML		SILT - clayey, slight plasticity, grey		Vs 60%			C2	
					Vr Vs 50%	C2			
5			5.0' - very sandy		20%	C3		C3	Changed to VTM
			7.4' - 3/16" organic layer		Vs 20%	C4		C4	
10					Nf				
					Uf				Changed to Dynamic Cone
						W			
			13.0' - sandy, slight to non plastic		Vs 20%				Changed to VTM
15			16.0' - trace shells		Nb	C5		C5	
			17.5' - organic laminations 18.5'						
20			Bottom of Hole at 18.5'						Located 25.0' east of DS-14.

Plate E-28
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-15

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: SPT, WASH 4" SHELBY	START: 10:30	FINISH: 14:50
PROJECT NO.: K 3571	ELEVATION: 98.79 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE	ICE				
		4.7'					
5	W	WATER	UF				
		9.5'					
10	ML	SILT - and fine sand to 15.0' depth, trace of organics, non plastic, grey		U1		U1	Changed to wash boring and SPT
				W			
15		15.0' - very loose, clayey, trace of organics, non plastic, grey		S2		S2	N=1
				W			
20		20.0' - increasing to some fine sand		S3		S3	N=1 Grain Size Analysis See Table E-2
				W			
25		25.0' - loose		S4		S4	N=5
				W			
30							

Plate E-29
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-15

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: SPT, WASH 4" SHELBY	START: 10:30	FINISH: 14:50
PROJECT NO.: K 3571	ELEVATION: 98.79 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - loose, some fine sand, uniform, sensitive to quicking, non plastic, grey		UF	S5		S5	N=5 Grain Size Analysis See Table E-2
						W			
35						S6		S6	N=5
						W			
40						S7		S7	N=10 Grain Size Analysis See Table E-2
						W			
45						S8		S8	N=7
			47.0' - loose, clayey, low plastic, grey			W			
50	CL		50.0' CLAY (TILL-like) - very stiff to hard, and fine to coarse sand, trace gravel to 3/4" size, low plastic, grey			S9		S9	N=27 Grain Size Analysis See Plate E-50
						W			
55			56.5'			S10		S10	N=35 Grain Size Analysis See Plate E-51
60			Bottom of Hole at 56.5'						

Plate E-30
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-15A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 3:30	FINISH: 4:45
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - □ W - ○ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				4" CRREL
			4.0'						
5	W		WATER		UF				
			7.0'						Changed to Dynamic Cone
			RIVER SEDIMENTS						
10									
15									
20									
25									
30									

Plate E-31
Sheet 1 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-15A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 3:30	FINISH: 4:45
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30			RIVER SEDIMENTS		UF				
35									
40									
45									
50			50.0'						
			Bottom of Hole at 50.0'						

Plate E-32
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-16

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY	START: 9:20	FINISH: 10:00
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
10									
35			37.0'						
	ML		SILT - loose, clayey, trace fine sand, trace of organics, low plastic, grey			U1		U1	Grain Size Analysis See Table E-2
40			41.0' - some fine sand			U2		U2	Grain Size Analysis See Table E-2
			41.5'						
			Bottom of Hole at 41.5'						
45									

Plate E-33
Sheet 1 of 1

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-17

LOGGED BY: CPM	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 8:40	FINISH: 9:35
PROJECT NO.: K 3571	ELEVATION: 98.59 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, low plastic, grey		Vf Vs 30%	C1			4" CRREL
					Vs 50%	C2			
					10%	C3			
					Nb	C4			
5						C5			Changed to Dynamic Cone
					UF				Assumed Frozen at 5.5' depth
			6.0'		F				
			Bottom of Hole at 6.0'						
10									

Plate E-34
Sheet 1 of 1

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-17A

LOGGED BY: GNL/AC	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 1:00	FINISH: 1:25
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic		Vr65%	C1		C1	4" CRREL
					Vs 25%	C2			
					10%			C2	Changed to Dynamic Cone
					Nf				
5			7.0'		UF				
			Bottom of Hole at 7.0'						Assumed Frozen at 7.0' depth
10									

Plate E-35
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-18

LOGGED BY: GCD/CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: S. D. S.	METHOD: 4" CRREL VTM	START: 5:45	FINISH: 20:15
PROJECT NO.: K 3571	ELEVATION: 98.62 m	LOCATION: Dock Site	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		0.4' ICE		ICE				4" CRREL to 15.0' (Individual core runs not logged where no sample retained)
	ML		SILT - trace fine sand, low plastic, grey		Vs 20%				
			2.0' - little fine sand, clayey to 17.0' depth		Vx <5%	C			
5									
					Vr Vs 10%	C1	C1	C1	
10						C			
						C2	C2	C2	
						C3			Changed to VTM
15						C4			
			16.0'				C5		
			17.0' - organic layers to 1/4" thickness		Nb				
			- trace fine sand			C5			
20									
							C6		
						C6			
25									
						C7	C7	C7	
30			29.5' - little fine sand						

Plate E-36
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-18

LOGGED BY: GCD/CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 5:45	FINISH: 20:15
PROJECT NO.: K 3571	ELEVATION: 98.62 m	LOCATION: Dock Site	

W_p - ⊡ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - little sand, low plastic, grey		Nb	C7			
						C8		C8	
35									
								C9	
						C9			
40			40.0' - 40.5' - and medium to coarse sand 41.5' - little sand					C9	
			Bottom of Hole at 41.5'						Gravel at 41.5' inferred from drilling
45									

Plate E-37
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

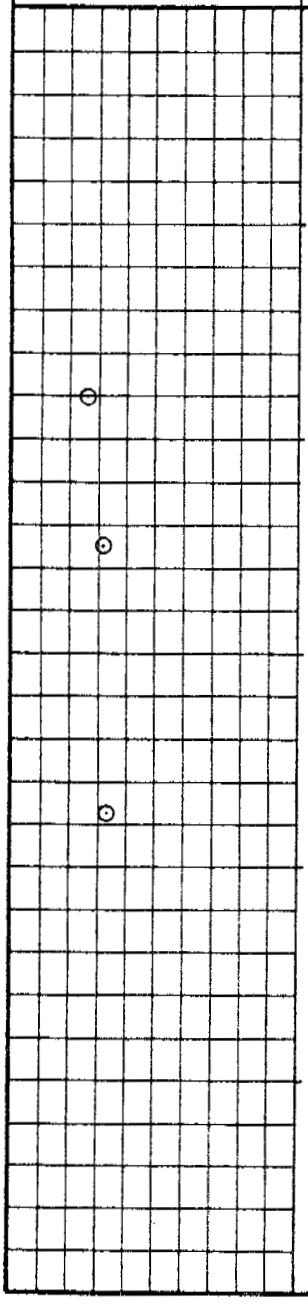
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-19

LOGGED BY: CPM/GCD	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 26, 27 February 1977
RIG: S. D. S.	METHOD: 4" CRREL 4" SHELBY	START: 10:20	FINISH: 4:30
PROJECT NO.: K 3571	ELEVATION: 98.77 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE		ICE				4" CRREL to 4.5'
		4.5'						
5	W	WATER		UF				Changed to Piston sampler with 4" shelby
		6.0'						
	ML	SILT - trace fine sand, low plastic, saturated, grey			U1			
					U2		U2	Grain Size Analysis See Table E-2
10					U3		U3	
					U4		U4	Grain Size Analysis See Table E-2
					U5		U5	
15		15.0' - little sand			U6		U6	
		16.5' - trace sand			U7		U7	
		18.0' - some fine sand			U8		U8	Grain Size Analysis See Table E-2
20					U9		U9	
					U10			
25					W			
30								

Plate E-38
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-19

LOGGED BY: CPM/GCD	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 26, 27 February 1977
RIG: S. D. S.	METHOD: 4" CRREL 4" SHELBY	START: 10:20	FINISH: 4:30
PROJECT NO.: K 3571	ELEVATION: 98.77 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - loose, and fine to medium sand, low plastic, grey		UF	U11		U11	Grain Size Analysis See Table E-2
			32.0' - some fine sand, low plastic, grey			U12		U12	Changed to Split-spoon
						S13		S13	N=14 Grain Size Analysis - See Table E-2
						U14		U14	Changed to 4" Shelby
35									Changed to Split-spoon alternating with wash boring
						W			
40			40.0' - medium dense, sensitive to quicking			S15		S15	N=13 Grain Size Analysis See Table E-2
			41.5' - 1/4" organic layer			W			
45			45.0'			S16		S16	N=36
						W			
						S17		S17	N=36
50						W			
			53.0' - dense, clayey, trace fine sand, medium plastic			S18		S18	N=36
55						W			
			58.0'						N=35 Grain Size Analysis See Plate E-52
	CI		CLAY (TILL-like) - silty, some fine to coarse sand, medium plastic 59.0'			S19		S19	
60			Bottom of Hole at 59.0'						

Plate E-39
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-19A

LOGGED BY: CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 9:40	FINISH: 11:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Dock Site	

W_p - □ W - ○ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	C1			
			1.7'			C2			
	ML		SILT - trace sand, low plastic, grey		Vr Vs 40%	C3			
					10%	C4		C4	
5					20%	C5			
						C6			
					10%	C7			
					20%	C8			
			8.0' - friable to 11.0' depth		Vx 5%	C9			
10						C10			
					UF				
15					F				Assumed frozen at 15.0' depth.
			17.0'						
			Bottom of Hole at 17.0'						
20									

Plate E-40
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-20

LOGGED BY: CPM/GCD	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT 4" SHELBY	START: 11:30	FINISH: 20:15
PROJECT NO.: K 3571	ELEVATION: 98.86 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				4" CRREL
			4.5'						
5	W		WATER		UF				Changed to Piston sampler with 4" shelby alternated with wash boring and splitspoons.
			24.5'						
25	ML		SILT - little fine sand, non plastic, saturated, grey			U1		U1	Grain Size Analysis See Plate E-53
						W			
30			31.0'			S2		S2	N=4
			- trace fine sand, low plastic, grey			W			
35			36.0'			U3		U3	Grain Size Analysis See Table E-2
			- some fine sand			W			
40									

Plate E-41
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DS-20

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT 4" SHELBY	START: 11: 30	FINISH: 20:15
PROJECT NO.: K 3571	ELEVATION: 98.86 m	LOCATION: Dock Site	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY(pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
40	ML		SILT - medium dense, trace fine sand, low plastic, grey		UF	W			
			41.0' - sandy, non plastic, grey			S4		S4	N=18
45						W			
			46.0'						
	CL		CLAY (TILL-like) - very stiff to hard, silty, and fine to coarse sand, trace gravel to 1/4" size, low plastic, grey			S5		S5	N=23 Grain Size Analysis See Plate E-54
50						W			
						S6		S6	N=35
55						W			
			56.0' - some fine to coarse sand			S7		S7	N=34 Grain Size Analysis See Plate E-55
60						W			
			64.5'			S8		S8	N=48
65			Bottom of Hole at 64.5'						

Plate E-42
Sheet 2 of 2

APPENDIX "E"

SECTION E.3 SUMMARY OF LABORATORY TESTING

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

PROJECT Niglintgak Gas Project
LOCATION Dock Site
DATE February/March, 1977
JOB NO. K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
DS-1	22.5' -24.0'	S1	ML	SILT - very loose, little fine sand, low plastic, saturated, grey - unfrozen				16.2	-83.8-					
DS-1	32.5' -34.0'	S3	ML	SILT - loose, little fine sand, low plastic, grey - unfrozen				12.6	-87.4-					
DS-1	48.5' -50.0'	S6	CI	CLAY (TILL-like) - silty, trace gravel below 49.3' depth, medium plastic, grey - unfrozen	32	23	9							
DS-6	7.7' -9.0'	U1	ML	SILT - very loose, little fine sand, low plastic, grey - unfrozen				12.6	-87.4-					
DS-6	13.0' -14.5'	S2	ML	SILT - very loose, trace fine sand, low plastic, grey - unfrozen				4.7	-95.3-					
DS-6	23.0' -24.5'	S4	ML	SILT - loose, trace fine sand, slight plasticity, grey - unfrozen				9.5	-90.5-					
DS-6	43.0' -44.5'	S8	ML	SILT - loose, clayey, trace fine sand, low plastic, grey - unfrozen	32	26	6	0.7	84.9	14.4				
DS-6	53.0' -54.5'	S10	CI	CLAY (TILL-like) - hard, silty, little sand, trace gravel, medium plastic, grey - unfrozen	35	19	16	17.9	43.4	32.4				6.3% gravel
DS-6	55.7' -56.3'	C11	CI	CLAY (TILL-like) - hard, silty some sand, trace gravel, medium plastic, grey - unfrozen	32	17	15	26.4	46.0	27.0				0.6% gravel
DS-6	76.5' -78.0'	S12	CI	CLAY (TILL-like) hard, silty, some fine to coarse sand, trace fine gravel, medium plastic, grey - unfrozen	32	16	16	27.5	43.4	27.8				1.3% gravel
DS-10A	9.5' -11.0'	U1	ML	SILT - loose, clayey, trace fine sand, non plastic, grey - unfrozen				8.6	-91.4-					
DS-10A	15.0' -16.5'	S2	ML	SILT - loose, clayey, little fine sand, non plastic, grey - unfrozen	non plastic			12.5	-87.5-					
DS-10A	25.0' -26.5'	S4	ML	SILT - loose, clayey, some fine sand, non plastic, grey - unfrozen	non plastic			27.1	-72.9-					
DS-10A	31.5' -33.0'	U6	ML	SILT - loose, some fine sand, grey - unfrozen										Direct Shear Tests (4) Plate E-56

TABLE E-2

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

PROJECT: Niglintgak Gas Project
LOCATION: Dock Site
DATE: February/March, 1977
JOB NO. K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
DS-10A	33.0' -34.5'	S7	ML	SILT - loose, little fine sand, grey - unfrozen	26			15.9	-84.1-					
DS-10A	40.0' -41.5'	U10	ML	SILT - loose to medium dense, and fine sand, grey - unfrozen										Direct Shear Tests (3) Plate E-57
DS-10A	41.5' -43.0'	S11	ML	SILT - loose to medium dense, and fine sand, grey - unfrozen				49.9	-50.1-					
DS-10A	50.0' -51.5'	S13	CI	CLAY (TILL-like) - very stiff to hard, silty, and fine to coarse sand, trace fine gravel - unfrozen low plastic, grey				31.2	40.5	27.3				1.0% gravel
DS-10A	55.0' -56.5'	S14	CI	CLAY (TILL-like) - very stiff to hard, silty, some fine to coarse sand, trace fine gravel, low - frozen Vx <5% plastic, grey	36	16	20	23.6	42.6	33.3				0.5% gravel
DS-11	35.0' -36.5'	S5	ML	SILT - loose, little fine sand, low plastic, sensitive to quicking, grey - unfrozen				19.8	-80.2-					
DS-11	45.0' -56.5'	S7	ML	SILT - medium dense, clayey, trace fine sand	non 27	plastic		6.8	82.5	10.7				
DS-15	20.0' -21.5'	S3	ML	SILT - very loose, clayey, some fine sand, trace organics, non plastic, grey - unfrozen	non	plastic		22.9	-77.1-					
DS-15	30.0' -31.5'	S5	ML	SILT - loose, some fine sand, unfrozen, sensitive to quicking, non plastic, grey - unfrozen	non 24	plastic		27.9	-72.1-					
DS-15	40.0' -41.5'	S7	ML	SILT - loose, some fine sand, uniform, sensitive to quicking, non plastic, grey - unfrozen	non 24	plastic		26.2	-73.8-					
DS-15	50.0' -51.5'	S9	CL	CLAY (TILL-like) - very stiff to hard, and fine to coarse sand, trace fine gravel, low plastic, - unfrozen grey	27	15	12	38.9	36.1	21.5				3.5% gravel
DS-15	55.0' -56.5'	S10	CL	CLAY (TILL-like) - very stiff to hard, and fine to coarse sand, trace fine gravel, low plastic, - unfrozen grey	27	16	11	35.3	40.4	24.0				0.3% gravel
DS-16	37.0' -38.0'	U1	ML	SILT - loose, clayey, trace fine sand, trace organics, low plastic, grey - unfrozen				1.2	-98.8-					
DS-16	40.0' -41.5'	U2	ML	SILT - loose, clayey, trace fine sand to 41.0' depth, some fine sand below 41.0' depth, trace organics, - unfrozen low plastic, grey				20.1	-79.9-					

TABLE E-2

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

PROJECT: Niglintgak Gas Project
LOCATION: Dock Site
DATE: February/March, 1977
JOB NO.: K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
DS-19	8.0' -10.0'	U2	ML	SILT - trace fine sand, low plastic, saturated, grey - unfrozen				5.6	94.4					
DS-19	12.0' -13.5'	U4	ML	SILT - trace fine sand, low plastic, saturated, grey - unfrozen				2.4	97.6					
DS-19	18.0' -19.5'	U8	ML	SILT - some fine sand, low plastic, saturated, grey, - unfrozen				21.2	78.8					
DS-19	30.0' -31.2'	U11	ML	SILT - and fine to medium sand, low plastic, grey - unfrozen				41.0	59.0					
DS-19	32.0' -33.5'	S13	ML	SILT - loose, some fine sand, low plastic, grey - unfrozen				27.2	72.8					
DS-19	40.5' -42.0'	S15	ML	SILT - medium dense, some fine sand, low plastic, sensitive to quicking, grey, ¼" organic layer at - unfrozen 41.5' depth				28.8	71.2					
DS-19	57.5' -59.0'	S19	CI	CLAY (TILL-like) - silty, some fine to coarse sand, medium plastic - unfrozen	34	18	16	23.2	45.4	31.2				0.2% gravel
DS-20	24.5' -26.0'	U1	ML	SILT - little fine sand, non plastic, saturated, grey - unfrozen	non plastic 26			11.1	83.0	5.9				
DS-20	36.0' -37.5'	U3	ML	SILT - some fine sand, low plastic, grey - unfrozen				35.1	64.9					
DS-20	46.0' -47.5'	S5	CL	CLAY (TILL-like) - very stiff to hard, silty, and fine to coarse sand, trace fine gravel, low plastic, - unfrozen grey				39.6	36.9	21.9				1.6% gravel
DS-20	56.0' -57.5'	S7	CL	CLAY (TILL-like) - very stiff to hard, silty, some fine to coarse sand, trace fine gravel, low plastic, - unfrozen grey				33.5	39.7	26.4				0.4% gravel

TABLE E-2

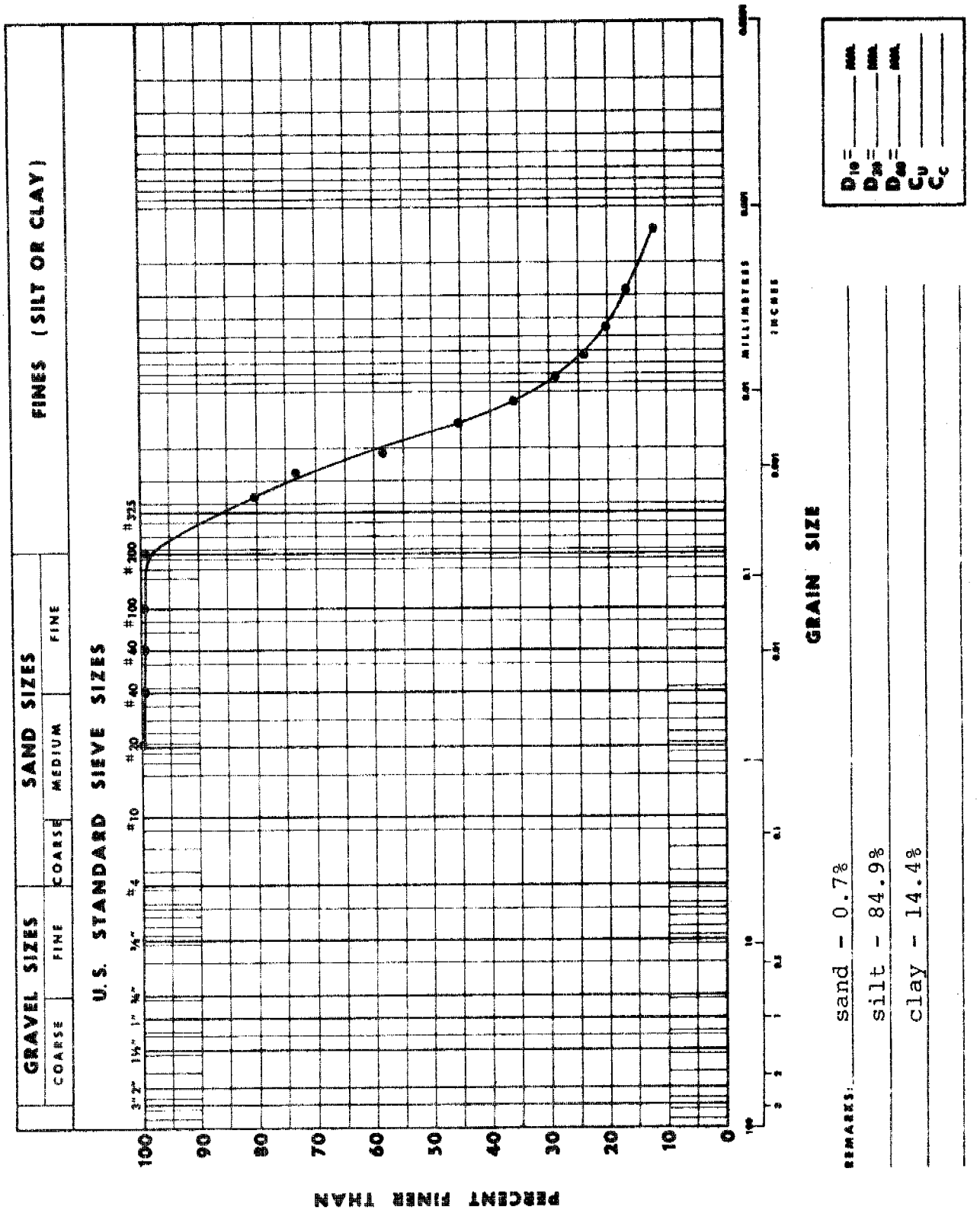
APPENDIX "E"

SECTION E.4 PARTICAL SIZE ANALYSIS AND SPECIAL TEST RESULTS

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	DS-6, S8
SOURCE	Dock Site
HOLE: DS-6	DEPTH: 43.0'-44.5'
TECHNICIAN M.L.	DATE TESTED 25/4/77



REMARKS: sand - 0.7%
silt - 84.9%
clay - 14.4%

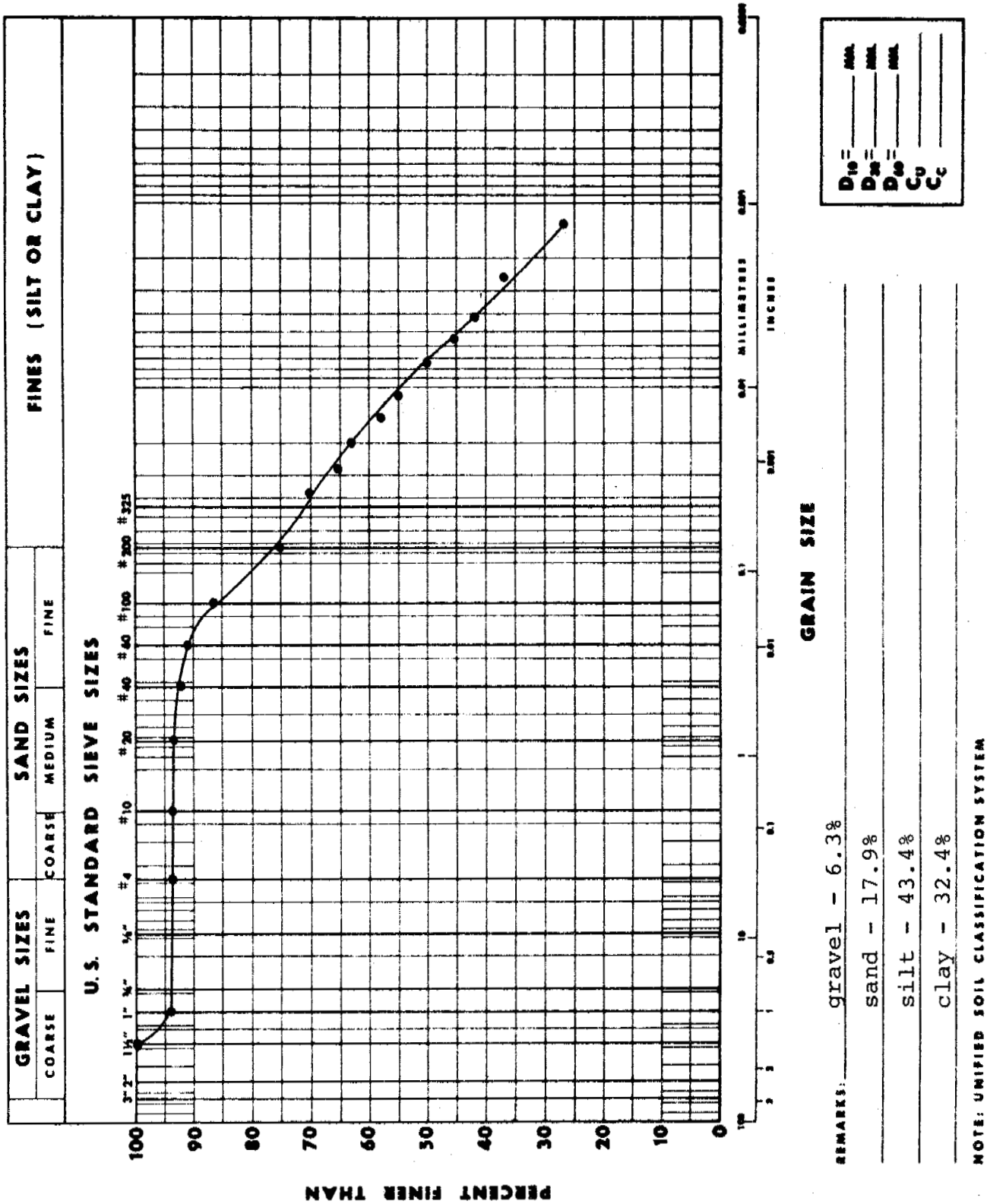
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE E-43

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	D56, S10
SOURCE	Dock Site
HOLE: DS-6	DEPTH: 53.0'-54.5'
TECHNICIAN M.L.	DATE TESTED 25/4/77



REMARKS:

gravel - 6.3%

sand - 17.9%

silt - 43.4%

clay - 32.4%

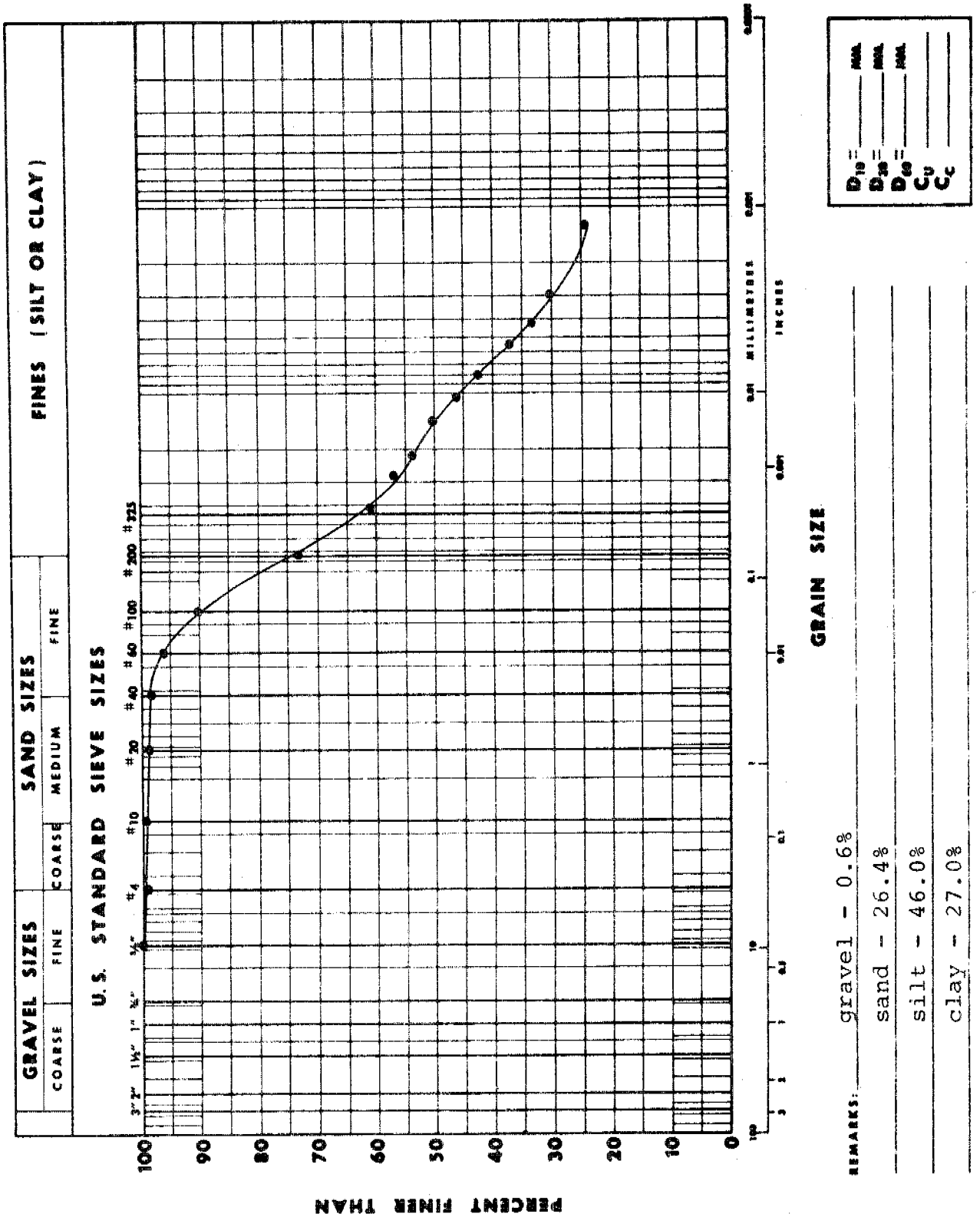
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE E-44

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	DS-6, C11
SOURCE	Dock Site
HOLE: DS-6	DEPTH: 55.7'-56.3'
TECHNICIAN M.L.	DATE TESTED 12/5/77



REMARKS: gravel - 0.6%
sand - 26.4%
silt - 46.0%
clay - 27.0%

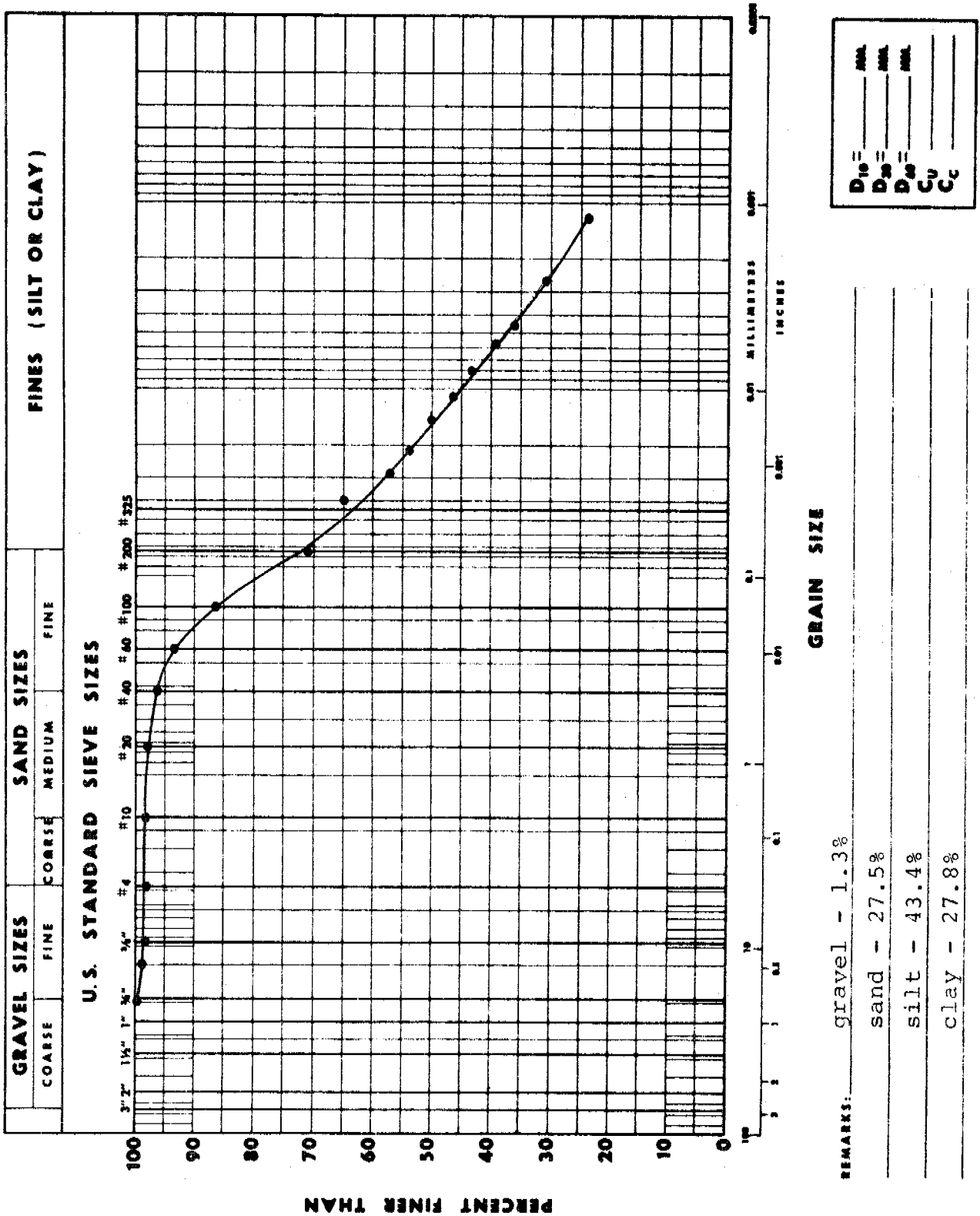
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE E-45

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	DS-6, S12
SOURCE	Dock Site
HOLE: DS-6	DEPTH: 76.5'-78.0'
TECHNICIAN M.L.	DATE TESTED 25/4/77



REMARKS:
gravel - 1.3%
sand - 27.5%
silt - 43.4%
clay - 27.8%

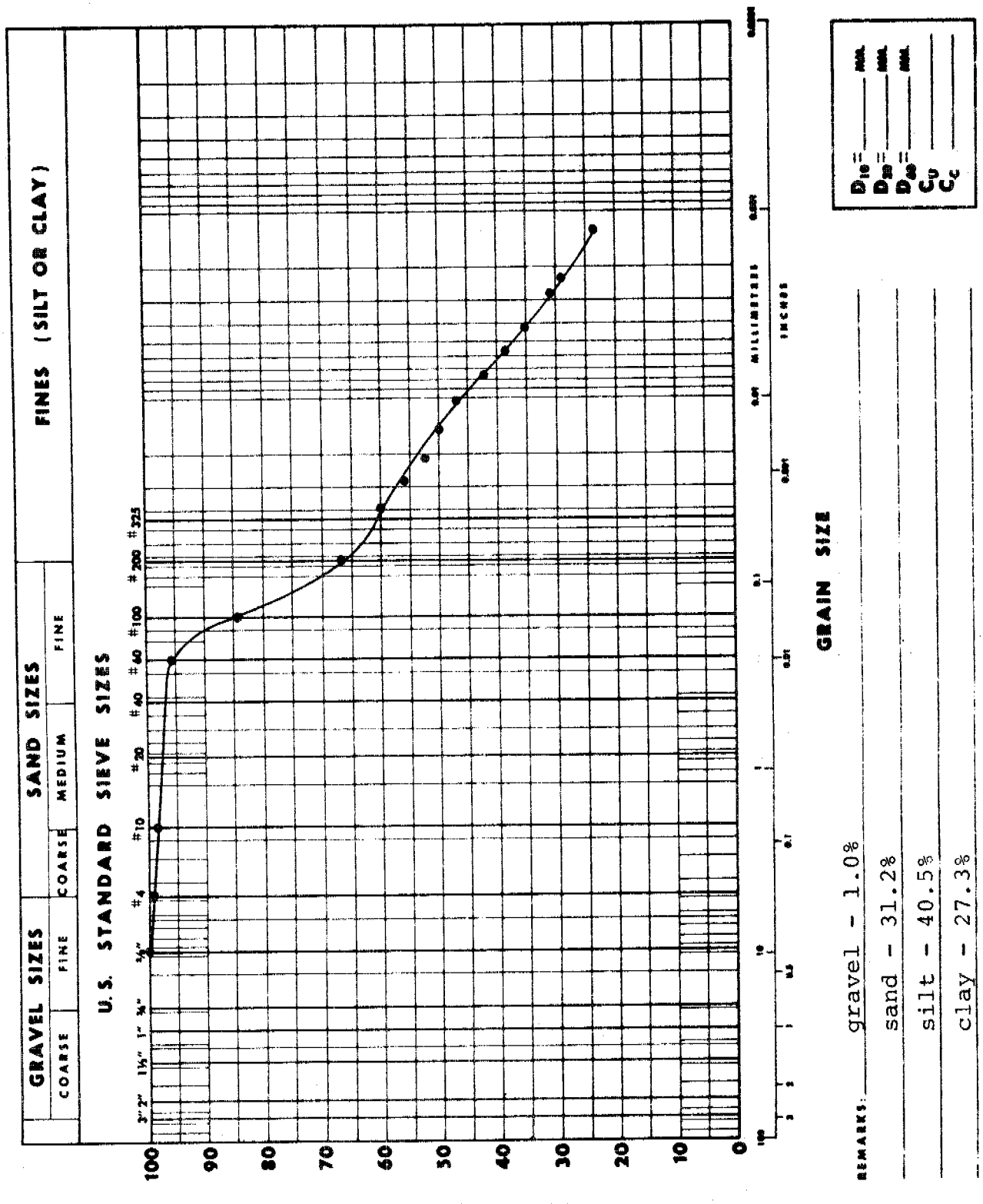
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE E-46

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

GRAIN SIZE CURVE

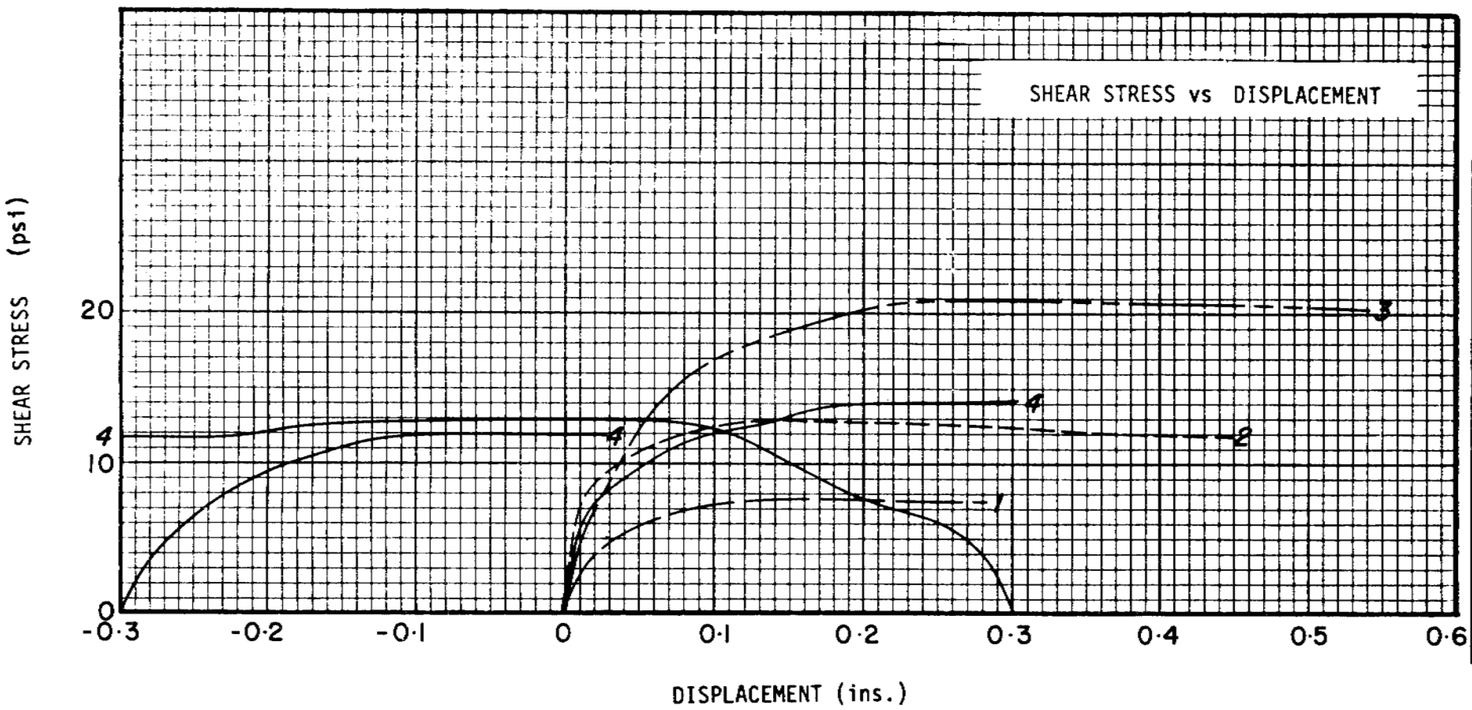
LAB ORDER NO.	K3571
CLIENT	CBR - SHELL
SAMPLE	DS-10A, S13
SOURCE	Dock Site
HOLE: DS-10A	DEPTH: 50.0'-51.5'
TECHNICIAN M.L.	DATE TESTED 25/4/77

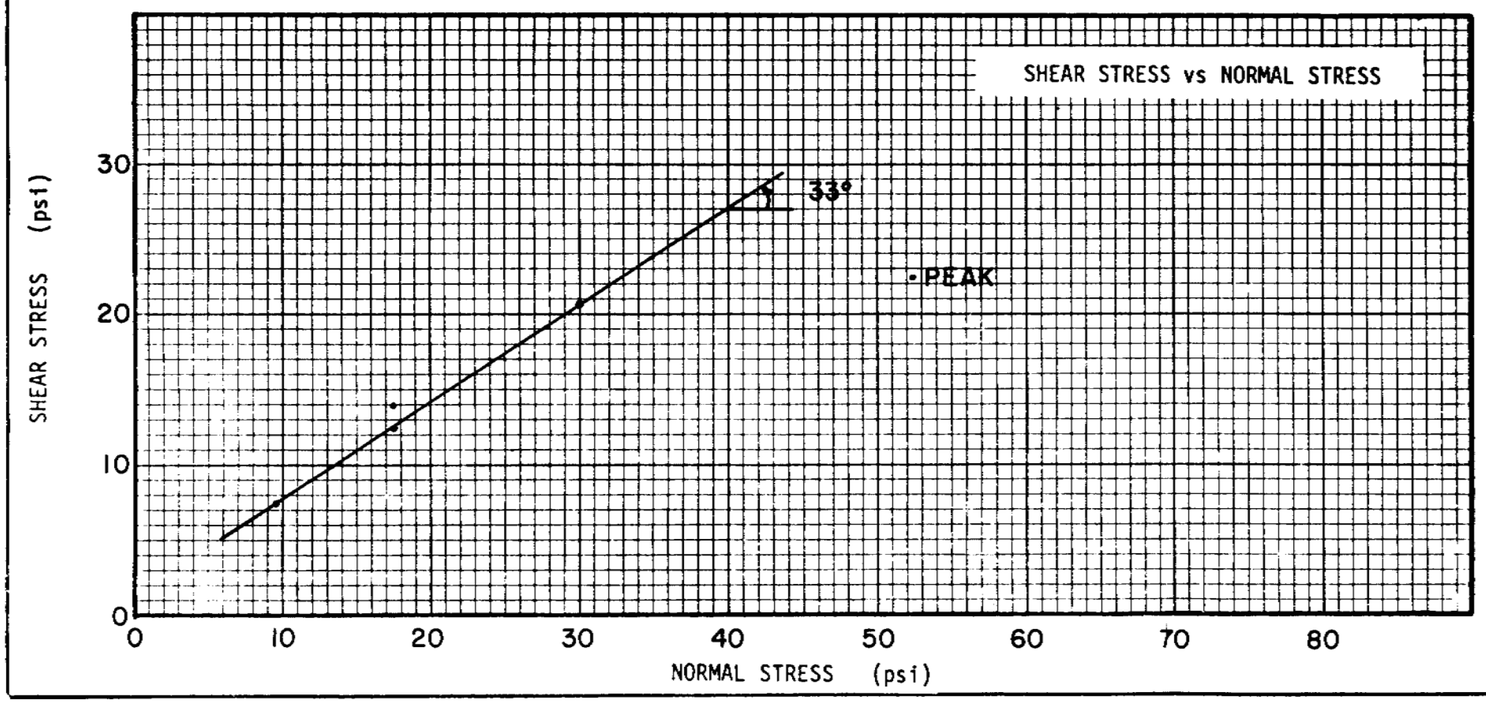


REMARKS:
gravel - 1.0%
sand - 31.2%
silt - 40.5%
clay - 27.3%

NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE E-47





TEST HOLE		DS-10A				
SAMPLE NUMBER		U6				
DEPTH (feet)		31.5-33.0				
SPECIMEN NUMBER		1	2	3	4	
HEIGHT (ins.)		0.775	0.775	0.775	0.775	
AREA (sq. ins.)		5.584	5.584	5.584	5.584	
DRY UNIT WEIGHT (p.c.f.)		92.0	96.0	95.2	93.1	
MOISTURE CONTENT	INITIAL %	27.9	27.6	26.8	27.1	
	FINAL %	28.3	28.1	27.7	28.5	
NORMAL STRESS	INITIAL (psi)	9.65	17.55	31.8	17.55	
	FINAL (psi)	9.65	17.55	31.8	17.55	
RATE OF STRAIN (ins./min.)		.0048	.0048	.0048	.0048	

SAMPLE DESCRIPTION: sand, silty, med dense, non plastic, grey, fine grain, Med to High plastic clay inclusions.

NOTES: Shear stress is calculated using a constant shearing area (Lambe, 1951)

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

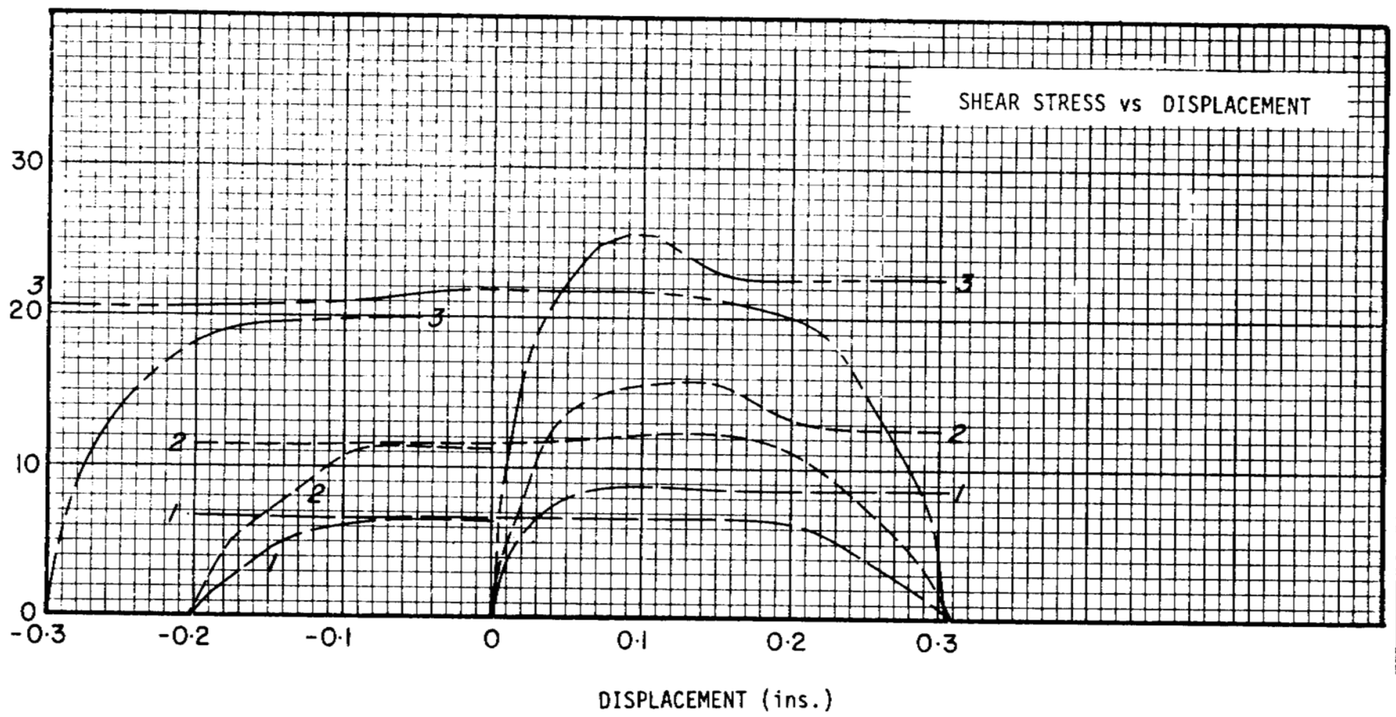
CANEP - BROWN & ROOT

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

DIRECT SHEAR TEST

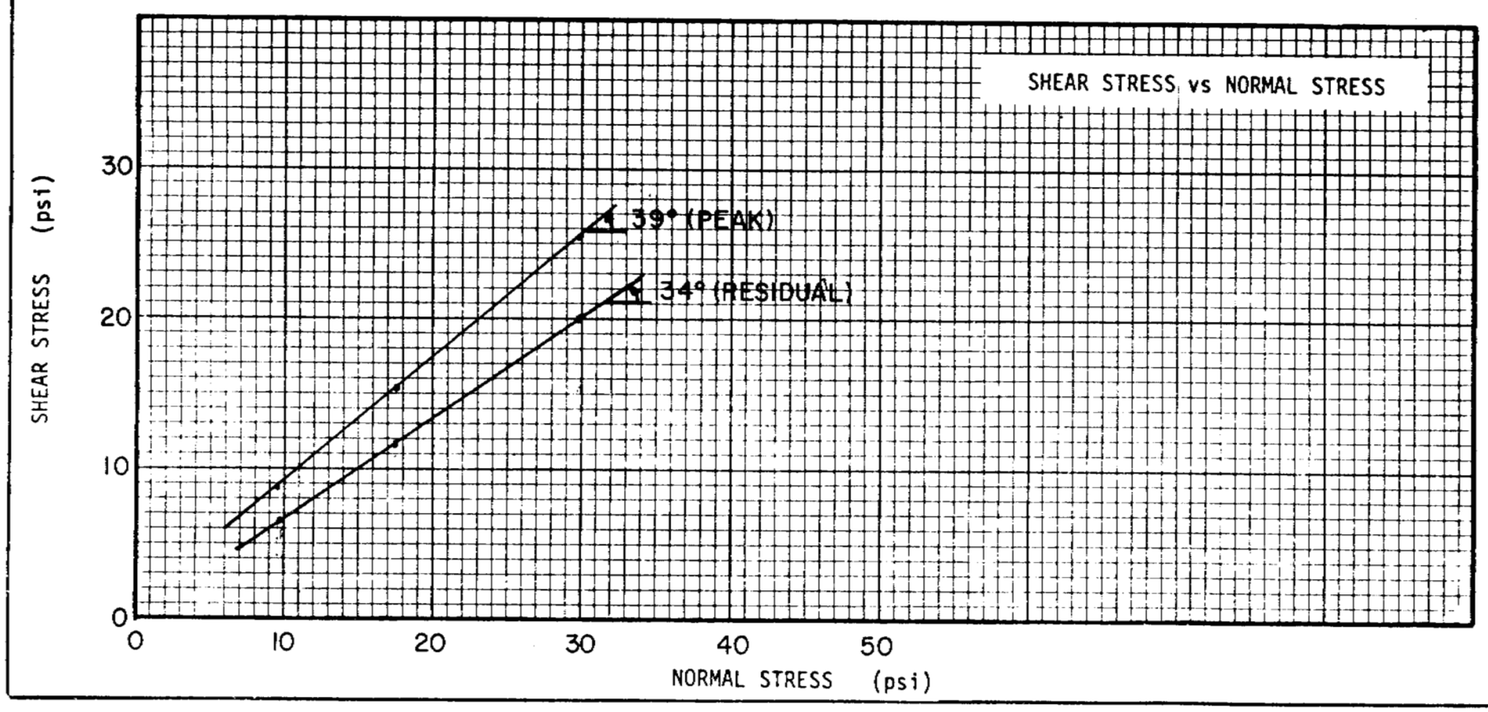
K3571-151

PLATE E-56



TEST HOLE		DS-10A				
SAMPLE NUMBER		U10				
DEPTH (feet)		40.0-41.5				
SPECIMEN NUMBER		1	2	3		
HEIGHT (ins.)		0.775	0.775	0.775		
AREA (sq. ins.)		5.584	5.584	5.584		
DRY UNIT WEIGHT (p.c.f.)		92.4	96.0	93.7		
MOISTURE CONTENT	INITIAL %	28.0	26.4	29.2		
	FINAL %	28.7	27.8	28.2		
NORMAL STRESS	INITIAL (psi)	9.65	17.55	31.8		
	FINAL (psi)	9.65	17.55	31.8		
RATE OF STRAIN (ins./min.)		.0048	.0048	.0048		

SAMPLE DESCRIPTION: sand, some silt, med dense, grey to rust brown.



NOTES: Shear stress is calculated using a constant shearing area (Lambe, 1951)

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & TESTING

DIRECT SHEAR TEST

K3571-151

PLATE E-57

APPENDIX "F"

ALTERNATE FLARE STACK

SECTION F.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE F-1

Test Hole Locations and Elevations
Alternate Flare Stack

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
FSL-1	7 689 652.07	488 215.44	1.475	99.219
FSL-2	7 689 741.57	488 206.33	1.475	99.219
FSL-3	7 689 688.40	488 297.74	1.475	99.219
FSL-4	7 689 585.02	488 275.42	1.475	99.219
FSL-5	7 689 574.30	488 170.21	1.475	99.219
FSL-6	7 689 671.06	488 127.50	1.475	99.219

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "F"

SECTION F.2 TEST HOLE LOGS

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-1

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 17:10	FINISH: 19:20
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - ▲
DYNAMIC CONE PENETRATION (blows/foot)
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.0'						
5	W		WATER		UF				
			9.0'						
10			LAKE SEDIMENTS 10.0' - very loose						
			13.0' - very loose to loose						
15									
20									
25									
30									

Plate F-1
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-1

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 17:10	FINISH: 19:20
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - ▲
DYNAMIC CONE PENETRATION (blows/foot)
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30			LAKE SEDIMENTS		UF				
			31.0' - dense						
35									
			40.0'						
40			Bottom of Hole at 40.0'						
45									

Plate F-2
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-2

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 19:40	FINISH: 20:32
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			7.5'						
			LAKE SEDIMENTS						
			8.5' - very loose						
10									
15			15.5' - very loose to loose						
20			20.5' - medium dense						
25			24.5' - dense						
30			29.5'						
			Bottom of Hole at 29.5'						

Plate F-3
Sheet 1 of 1

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-3

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: WASH, VTM	START: 13:15	FINISH: 14:40
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			9.5'						
10			LAKE SEDIMENTS - very loose			W			Wash Bore Relative densities inferred from drilling progress
15									
20									
25									
30									

Plate F-4
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-3

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: WASH, VTM	START: 13:15	FINISH: 14:40
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30			LAKE SEDIMENTS		UF				
			31.0' - medium dense						
35			35.0' - loose to medium dense			W			
40			42.5' - medium dense						
45			45.0' - loose to medium dense						
			46.0' - dense						
			49.0'						
50	ML		SILT - some sand, slight plasticity, fine grained, current bedded, grey		F Vs 30% Nb	Cl			Changed to VTM
			54.0'						
55			Bottom of Hole at 54.0'						

Plate F-5
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-4

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, VTM WASH	START: 23:25	FINISH: 24:00
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			9.0'						
10	ML		SILT - clayey, low plastic, layered, grey, grass-like organic layer from 9.0' to 9.2' depth			U1		U1	
						W			
15			15.5' sensitive to quicking			U2		U2	
20						W			
25									
30									

Plate F-6
Sheet 1 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-4

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, VTM WASH	START: 23:25	FINISH: 24:00
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey layers, low plastic, grey		Nb	W			Changed to VTM
					Vx 5%	C3		C3	
					Vr 10%				
35			35.5'					C3	
			Bottom of Hole at 35.5'						
40									

Plate F-7
Sheet 2 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-5

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 21:00	FINISH: 21:40
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.3'						
5	W		WATER		UF				
			8.8'						
			LAKE SEDIMENTS						Changed to Dynamic Cone
10			- very loose						
			15.0'						
15			- very loose to loose						
20			21.0'						
			- loose to medium dense						
25									
30			Bottom of Hole at 30.0'						

Plate F-8
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-5A

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. 9.	METHOD: WASH, VTM	START: 15:00	FINISH: 20:45
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.3'						
5	W		WATER		UF				
			8.8'						
			LAKE SEDIMENTS			W			
10									
			57.5'						
	ML		SILT - sandy, slight plasticity, sensitive to quicking, grey			C1			
60									
					F				
65						W			
70			70.5'						
			- sandy, clayey laminations to 3/4" thickness, low plastic, grey		Nb	C2			
75			75.5'						
			Bottom of Hole at 75.5'						
80									

Plate F-9
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-6

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: WASH BORE	START: 15:00	FINISH: 15:55
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
	W		WATER		UF				
			9.5'						
10			LAKE SEDIMENTS very loose to loose			W			Relative densities inferred from drilling progress
45			47.0' - very loose						
			57.0' - medium dense						
60									
			76.5' - harder, probable permafrost		F				
80									
90									
			94.5' - hit gravel						
			Bottom of Hole at 94.5'						
100									

Plate F-10
Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-7

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16, 17 March 1977
RIG: S. D. S.	METHOD: WASH, SPT, VTM, 4" SHELBY	START: 22:25	FINISH: 4:30
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			8.0'						
	ML		SILT - loose, clayey, trace fine sand, low plastic, grey			W			
10									
15						S1		S1	N = 5 Grain Size Analysis - See Table F-2
						W			
			20.0'						
20			- medium dense, sandier, slight plasticity, grey			U2		U2	
						S3		S3	N = 11
						W			
25						U4		U4	
			27.5'			S5		S5	N = 9
			- clayey, low plastic			W			
30									

Plate F-11
Sheet 1 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-7

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 16, 17 March 1977
RIG: S. D. S.	METHOD: WASH, SPT, VTM, 4" SHELBY	START: 22:25	FINISH: 4:30
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - medium dense, clayey, sandy, low plastic, dark grey		UF	U6		U6	
			32.5' - medium dense, sandy, slight plasticity, grey			S7		S7	N = 24
						W			
35			35.0' - clayey, low plastic			U8		U8	
						S9		S9	N = 16
						W			
40			40.0' - and sand, medium dense, clayey, slight plasticity, grey			U10		U10	
						S11		S11	N = 28
						W			
45			45.0' - medium dense, clayey, sandy, slight plasticity, grey		Vx <5%	S12		S12	N = 14
			48.0' organic laminations 49.0'			W			
50	SM		SAND - silty, non plastic, fine to medium grained, laminated, grey		10%	S13		S13	N = 74
	ML		SILT - calyey, slight plasticity, sandy		<5%	C14		C14	
55			55.0' organic laminations 57.0'			C15		C15	
	SM		SAND - silty, non plastic, fine to medium grained, grey		Nf				
					Nb			C15	
60			Bottom of Hole at 60.0'						

Plate F-12
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-8

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: S. D. S.	METHOD: WASH, 4" SHELBY SPT, VTM	START: 5:30	FINISH: 14:30
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.8'						
5	W		WATER		UF	C			
			8.7'						
	ML		SILT - and sand, loose, non plastic, grey			W			
10									
15						S1	S1		N = 5
						W			
			20.0'						
20			SILT - loose, clayey, sandy, slight plasticity, grey			U2	U2		
						S3	S3		N = 6
						W			
			24.5'						
25			- sandier			U4	U4		
			26.5'						
	SM		SAND - medium dense, silty, non plastic, grey			S5	S5		N = 24
						W			
30									

Plate F-13
Sheet 1 of 3

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

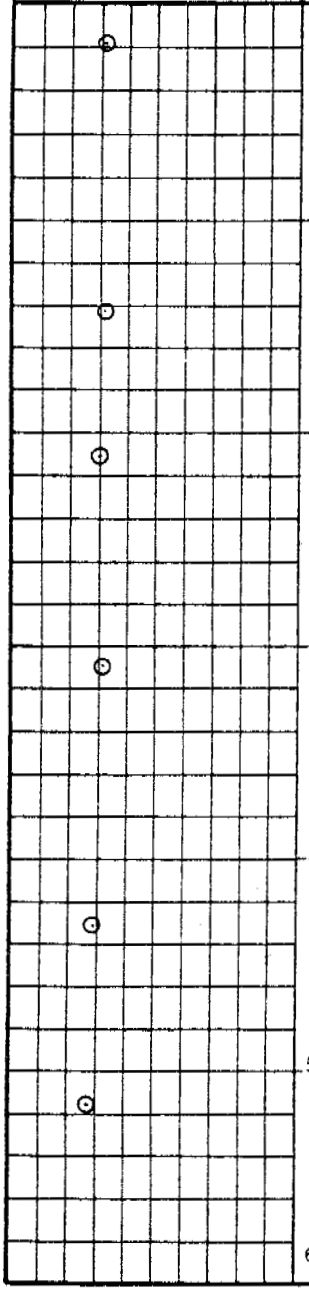
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-8

LOGGED BY: AGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: S. D. S.	METHOD: WASH, 4" SHELBY SPT, VTM	START: 5:30	FINISH: 14:30
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - medium dense, non plastic, grey		UF	S6		S6	N = 14 Grainsize Analysis - See Table F-2
						W			
35			35.0' - sensitive to quicking			U7		U7	
						S8		S8	N = 17
						W			
40						S9		S9	N = 13
						W			
45			45.0' clayey laminations			S10		S10	N = 10 Grainsize Analysis - See Table F-2
						W			
50						S11		S11	N = 18
						W			
55			55.0' - sandier			S12		S12	N = 40
						W			
60									

Plate F-14
Sheet 2 of 3

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-8

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: S. D. S.	METHOD: WASH, 4" SHELBY SPT, VTM	START: 5:30	FINISH: 14:30
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
60	ML		SILT - dense, some fine sand, non plastic, sensitive to quicking, grey		UF	S13		S13	N = 33 Grainsize Analysis - See Table F-2
						W			
						C14			
65			65.0' - sandier						
						C15			
70			72.0'						
			Bottom of Hole at 72.0'						
75									

Plate F-15
Sheet 3 of 3

TEST HOLE LOG

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GEOTECHNICAL DIVISION

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-9

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 14 :50	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			10.0'						
10			LAKE SEDIMENTS			W			
			45.0'						
45	ML		SILT - compact, clayey, sandy, low plastic, grey			S1	S1	S1	N=10
50						W			
65			65.0' - and sand, dense, non plastic, fine grained		F	S2	S2	S2	N=41
			66.5'						
			Bottom of Hole at 66.5'						
70									

Plate F-16
Sheet 1 of 1

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-10

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: WASH, VTM	START: 20:30	FINISH: 21:25
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.0'						
5	W		WATER		UF				
			9.5'						
10			LAKE SEDIMENTS - very loose			W			Wash Bore Relative densities inferred from drilling progress
35			35.0' - loose						
40			42.5'						Changed to VTM
	ML		SILT - sandy layers, trace of organic laminations, low plastic, grey		Vx <5%			C1	
45					Nb	C1		C1	
			47.5'		Vr 5%				
50			Bottom of Hole at 47.5'						

Plate F-17
Sheet 1 of 1

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-11

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: WASH, VTM, 4" SHELBY	START: 21:30	FINISH: 23:15
PROJECT NO.: K 3571	ELEVATION:	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			9.0'						
	ML		SILT - very loose, low plastic, grey			U1		U1	Relative densities inferred from drilling progress
10									
						W			
15			15.5'						
			- sensitive to quicking			U2		U2	
20									
						W			
25									
30									

Plate F-18
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. FSL-11

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 18 March 1977
RIG: S. D. S.	METHOD: WASH, VTM 4" SHELBY	START: 21:30	FINISH: 23:15
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Alternate Flare Stack	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - medium dense		UF				
40						W			
45									
50									
53.5'			- sandy, non plastic		Nb				
55					Vx 5%				Changed to VTM
59.0'			- sand and clay layers					C3	
60						C3			
61.0'			- wood chips					C3	
62.0'			Bottom of Hole at 62.0'						
65									

Plate F-19
Sheet 2 of 2

APPENDIX "F"

SECTION F.3 SUMMARY OF LABORATORY TESTING

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

PROJECT: Niglintgak Gas Project
LOCATION: Alternate Flare Stack
DATE: February/March 1977
JOB NO. K3571

SAMPLE DATA				SOIL DESCRIPTION	CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION		LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
FSL-7	15.0' -16.0'	S1	ML	SILT - loose, clayey, trace fine sand, low plastic, grey - unfrozen				6.8	93.2	-				
FSL-8	30.0' -31.5'	S6	ML	SILT - medium dense, non plastic, grey - unfrozen				0.9	99.1	-				
FSL-8	45.0' -46.5'	S10	ML	SILT - medium dense, clayey laminations, non plastic, grey - unfrozen				1.6	98.4	-				
FSL-8	60.0' -61.5'	S13	ML	SILT - dense, some fine sand, non plastic, sensitive to quicking, grey - unfrozen				22.9	77.1	-				

TABLE F-2

APPENDIX "G"

WELL SITES

SECTION G.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE G-1

Test Hole Locations and Elevations
Well Sites

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
J-30-1	7 690 579.22	486 196.50	1.661	99.405
J-30-2	7 690 609.22	486 166.50	1.859	99.603
J-30-3	7 690 549.22	486 226.50	1.844	99.588
J-30-4*	7 690 609.22	486 226.50	1.707	99.451
J-30-5*	7 690 549.22	486 166.50	1.728	99.472
H-30-1	7 690 151.28	486 492.97	1.951	99.695
H-30-2	7 690 181.28	486 462.97	2.042	99.786
H-30-3	7 690 121.28	486 522.97	1.951	99.695
H-30-4*	7 690 181.28	486 522.97	2.225	99.969
H-30-5*	7 690 121.28	486 462.97	1.606	99.350
M-19-1	7 689 222.33	487 258.88	2.225	99.969
M-19-2	7 689 252.33	487 228.88	2.286	100.03
M-19-3	7 689 192.33	487 288.88	2.158	99.902
M-19-4*	7 689 252.33	487 288.88	2.234	99.978
M-19-5*	7 689 192.33	487 228.88	2.256	100.00
K-19-1	7 688 874.12	487 564.48	2.009	99.755
K-19-2*	7 688 881.62	487 552.48	2.033	99.777
K-19-3*	7 688 821.62	487 612.48	1.999	99.743
K-19-4	7 688 881.62	487 612.48	1.908	99.652
K-19-5	7 688 821.62	487 552.48	2.246	99.990
G-19-1	7 688 254.11	487 700.21	2.259	100.003

* not drilled

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

TABLE G-1

Test Hole Locations and Elevations
Well Sites

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
B-19-1	7 687 841.29	488 003.50	2.073	99.817
B-19-2	7 687 871.29	487 973.50	2.228	99.972
B-19-3	7 687 811.29	488 033.50	2.204	99.948
B-19-4*	7 687 871.29	488 033.50	1.807	99.551
B-19-5*	7 687 811.29	487 973.50	2.304	100.048
P-18-1	7 687 585.29	488 244.16	2.091	99.835
E-09-1	7 688 132.56	488 542.55	1.942	99.686
E-09-2	7 688 162.56	488 512.55	1.795	99.539
E-09-3	7 688 102.56	488 572.55	1.533	99.277
E-09-4	7 688 162.56	488 572.55	1.868	99.612
E-09-5	7 688 102.56	488 512.55	1.881	99.625
J-08-1	7 687 092.21	489 404.35	1.881	99.625
J-08-2	7 687 122.21	489 374.35	1.829	99.573
J-08-3	7 687 062.21	489 434.35	1.960	99.704
J-08-4	7 687 122.21	489 434.35	1.747	99.491
J-08-5	7 687 062.21	489 374.35	1.893	99.637
J-08(2)-1	7 686 931.25	489 767.84	1.673	99.417
E-58-1	-	-	-	-

* not drilled

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "G"

SECTION G.2 TEST HOLE LOGS: WELL SITE J-30

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-30-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 9:00	FINISH: 16:10
PROJECT NO.: K 3571	ELEVATION: 99.41 m	LOCATION: Well Site J-30	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, brown		Vs 20%	W			Pilot hole to 0.5'
1.5'						C1		C1	
	I+		ICE+ SILT		ICE+ 70%	C2			
						C3		C3	
4.5'						C4			
5	ML		SILT - clayey, low plastic, brown		Vs 30%	W			
7.0'			- grey			C5		C5	
10			10.0' - laminated			C6			
						C7		C7	
						C8			
15						C9		C9	
					40%				
					Vr Vs 40%	C10			
						C11		C11	
20						C12			
						C13		C13	
						C14			
25						C15		C15	
						C16			
30						C17			

Plate G-1
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-30-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 9:00	FINISH: 16:10
PROJECT NO.: K 3571	ELEVATION: 99.41 m	LOCATION: Well Site J-30	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - low plastic, laminated, grey		Vr Vs 40%	C17 C18		C17	
					Vs 20%	C19 C20		C20	
35						C21 C22		C21 C22 C22	
40						C23		C23	
					10%	C24 C25		C24 C25	
45						C26 C27		C27 C27	
50						C28			
					5%	C29 C30		C29 C30	
55						C31 C32		C32	
60			Bottom of Hole at 60.0'						

Plate G-2
Sheet 2 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-30-2

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:30	FINISH: 22:15
PROJECT NO.: K 3571	ELEVATION: 99.60 m	LOCATION: Well Site J-30	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - some organics to 2.0' depth, low plastic, grey	Vx 5%	W			Pilot hole to 1.0'
			50%	C1		C1	
			30%	C2		C2	
			50%				
		4.5' porous	Vx Vr	C3			
5			25%	C4			
			Vx Vs 20%	C5		C5	
			<5%	C6		C6	
		10.0' - current bedded		C7		C7	
			Vs 15%	C8		C8	
			10%	C9		C9	
			Vx <5%	C10		C10	
15			Vs 20%	C11		C11	
		17.0' - clayey, low plastic, grey		C12			
			25%	C13		C13	
			30%				
			Vx Vs 35%	C14			
20			Vs 15%	C15		C15	
				C16		C16	
			Vx Vs 35%	C17		C17	
				C18			
		2" ice layer 25.7'		C19		C19	
			45%				
		1/2" ice lens 27.7'		C20		C20	
			25%				
30		Bottom of Hole at 30.0'		C21		C21	

Plate G-3
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

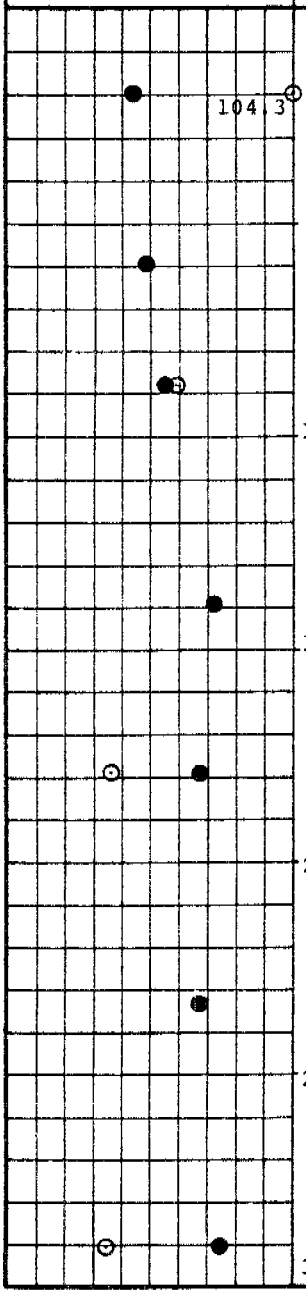
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-30-3

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:30	FINISH: 19:40
PROJECT NO.: K 3571	ELEVATION: 99.59 m	LOCATION: Well Site J-30	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, low plastic, brown	Vr Vs 50%	W C1		C1	Pilot hole to 0.5'
			ICE+				
		layered	Vr Vs 10%	C2 C3		C2	
5			50%	C4		C4	
			10% 50% 10%	C5			
			50% 10%	C6		C6 C6	
10			Vs 10%	C7			
		- laminated, grey	50%	C8		C8	
			10%	C9			
15			50% 10%				
		- clayey, low plastic, grey	Nb	C10		C10 C10	
			Vs <5%	C11			
20		- sandy, low plastic	Nb	C12			
			Vs 30%	C13		C13 C13	
			20%	C14			
25				C15		C15	
30		Bottom of Hole at 30.0'		C16		C16	Plate G-4 Sheet 1 of 1

APPENDIX "G"

SECTION G.3 TEST HOLE LOGS: WELL SITE H-30

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

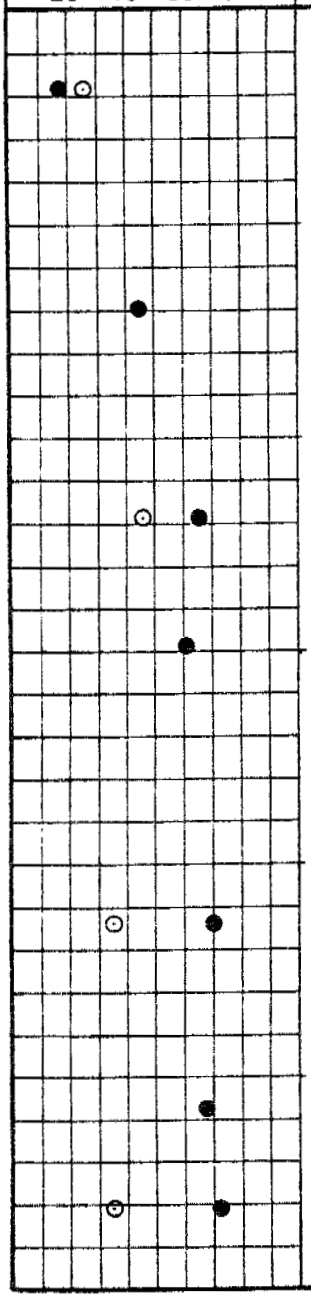
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. H-30-1

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 14:30	FINISH: 22:30
PROJECT NO.: K 3571	ELEVATION: 99.70 m	LOCATION: Well Site H-30	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - highly organic to 2.0' depth, medium plastic, grey	Nb	W			Pilot hole to 1.0'
		2.5'		C1		C1	
	I+	ICE+ SILT	ICE+ 70%	C2		C1	
		5.0'		W			
5	ML	SILT - wood particles, medium plastic	Vs 30%	C3			
		6.0'					
	I+	ICE+ SILT	ICE+ 70%			C3	
		8.0'		W			
		SILT - clayey, low plastic, grey	Vs 30%	C4		C4	
				C5			
10				C6			
			10%			C6	
			30%	C7			
				C8		C8	
				C9		C9	
15							
		17.0'	20%	C10			
		- sandy, low plastic		C11		C11	
			Nb	C12		C12	
20				C13			
				C14		C14	
			Vr Vs 10%	C15		C15	
				C16			
25				C17		C17	
				C18			
30							

Plate G-5
Sheet 1 of 2

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. H-30-1

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 14:30	FINISH: 22:30
PROJECT NO.: K 3571	ELEVATION: 99.70 m	LOCATION: Well Site H-30	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, low plastic, grey		Vr Vs 10%	C18 C19		C19	
					Nb	C20 C21			
35			36.7' organic lamination		Vs <5%	C22		C22 C22	
						C23		C23	
40						C24			
					Vr Vs 10%	C25		C25	
						C26			
45					Nb	C27			
						W			
						C28		C28	
					Vx Vs <5%	C29			
50			51.0' - clayey, low plastic			C30		C30	
						C31		C31	
						C32		C32	
					Nb	C33			
55						C34		C34	
						C35		C35	
						C36			
60			Bottom of Hole at 60.0'		Vs <5%			C36	

Plate G-6
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. H-30-2

LOGGED BY: IGJ	DRAWN BY: GPM/PD	CHECKED: AJH	DATE: 1, 2 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:30	FINISH: 4:55
PROJECT NO.: K 3571	ELEVATION: 99.79 m	LOCATION: Well Site H-30	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - organic to 1.2' depth, low plastic, greyish brown		Vx <5%	W C1 C2 C3		C1 C2 C3	Pilot hole to 0.5'
1.5'			- trace of organic laminations to 1/2" thickness						
5					Vx Vr 70%	W			
10					<5%	C4		C4	
					Vs <5%	C5		C5	
					35%	C6		C6	
15					Nb	C7 W C8 C9 C10 C11 C12 C13		C7 C8 C9 C11 C13	
17.0'			- low plastic, grey						
20									
25					Vs <5%	C14 C15		C15	
30			Bottom of Hole at 30.0'						

Plate C-7
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

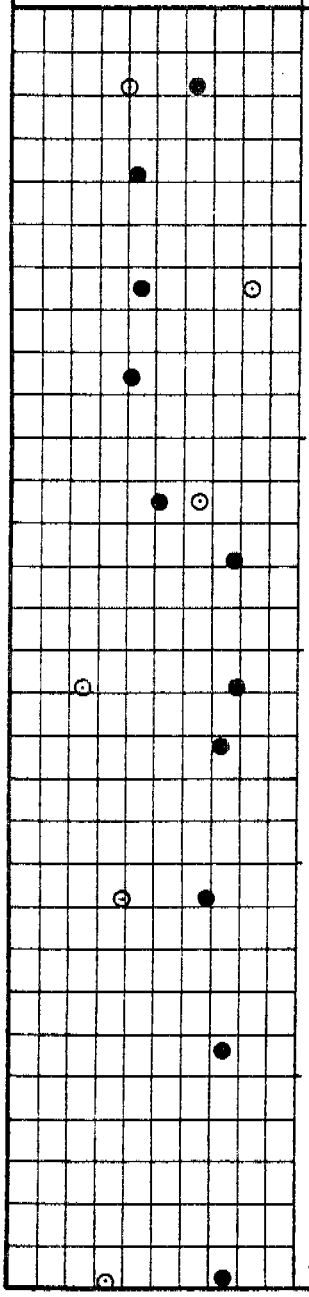
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. H-30-3

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 9:00	FINISH: 12:00
PROJECT NO.: K 3571	ELEVATION: 99.70 m	LOCATION: Well Site H-30	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, low plastic, grey	Nb	W C1 C2		C1	Pilot hole to 1.0'
			Vs 20%	C3 C4		C3 C4	
5		5.5' porous	30%	C5 C6 C7 C8 C9		C7 C8	
		9.0' - very clayey	50%	C10 C11 C12		C11	
10		11.0'					
	CI	CLAY - silty, medium plastic, black 12.5'	20%	C13 C14		C13 C14	
	ML	SILT - clayey, medium plastic, brown 14.0'	5%	C15		C15	
15		- sandy, low plastic, brown	Nb	C16 C17		C16 C17	
		18.5' - grey		C18 C19		C19	
20				C20 C21		C20 C21	
25				C22 C23 C24		C23 C24	
30		Bottom of Hole at 30.0'					

Plate G-8
Sheet 1 of 1

APPENDIX "G"

SECTION G.4 TEST HOLE LOGS: WELL SITE M-19

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. M-19-1

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 27, 28 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:00	FINISH: 8:30
PROJECT NO.: K 3571	ELEVATION: 99.67 m	LOCATION: Well Site M-19	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL	ORGANIC SILT - low plastic, grey-brown	Vx Vr 20%	W C1 C2		C1 C2	Pilot hole to 0.5'
3.0'							
	ML	SILT - low plastic	30%	C3 C4		C3	
5			Vs Vx 50%	C5		C5	
			80%	C6			
7.5'			50%				
	I+	ICE+ SILT	ICE+ 90%	C7 C8 C9 C10			
12.5'				C11 C12			
		SILT - low plastic	Vr Vs 10%	C13		C13	
10			Nb	C14		C14	
15				C15		C15	
17.0'		- trace fine sand, trace of organic laminations, low plastic, grey		C16		C16	
20				C17		C17	
				C18		C18	
				C19		C19	
25				C20			
				C21		C21	
			Vs <5%	C22			
			Nb	C23		C23	
30			Vs <5%				

Plate G-9
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. M-19-1

LOGGED BY: GCD/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 27, 28 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:00	FINISH: 8:30
PROJECT NO.: K 3571	ELEVATION: 99.67 m	LOCATION: Well Site M-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, trace of organic laminations, low plastic, grey		Nb	C24		C24	
						C25		C25	
					Vx Vr 10%	C26			
						C27		C27	
35					Nb				
						C28		C28	
						C29		C29	
						C30		C30	
40			40.2' organic laminations to 1/2" tickness			C31		C31	
					Vs 20%	C32			
					Nb				
						C33		C33	
45					Vx Vs <5%	C34			
						C35		C35	
					Nb				
						C36		C36	
						C37		C37	
						C38		C38	
50						C39		C39	
					Vs <5%	C40		C40	
			54.5' - little fine sand, low plastic, laminated, grey			C41			
55						C42		C42	
						C43			
60			Bottom of Hole at 60.0'						

Plate G-10
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

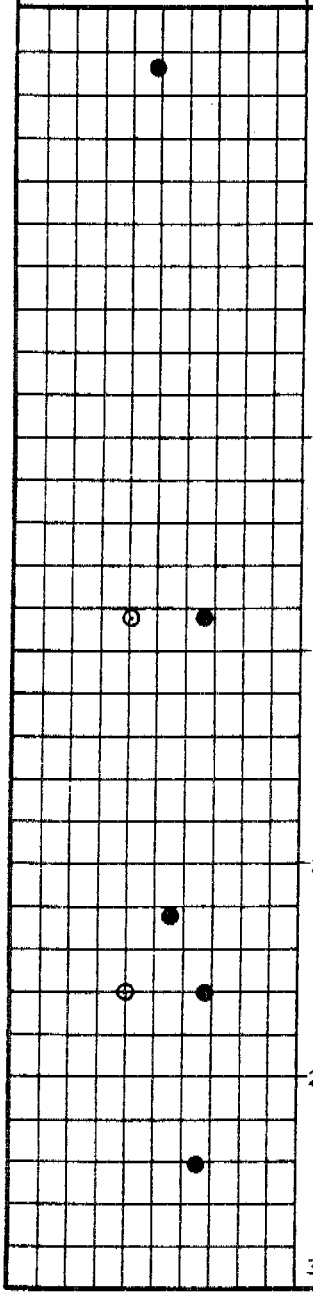
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. M-19-2

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:30	FINISH: 11:30
PROJECT NO.: K 3571	ELEVATION: 100.03 m	LOCATION: Well Site M-19	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - low plastic, current bedded, brown		Vx Vs 10%	W C1		C1	Pilot hole to 1.0'
3.5'	I+		ICE + SILT		ICE+ 70%	C2 C3 C4 C5 C6 C7 C8 C9 C10		C2	
11.5'			- clayey, some organics, medium plastic						
14.0'			SILT - low plastic, brown		Vs 10%	C11 C12 C13 C14		C11 C13	
19.3'			gravel to 1" size		Nb				
21.0'			- sandy, trace of organic laminations, low plastic, current bedded, grey		Vx Vs 10%	C15 C16 C17 C18 C19 C20		C16 C17 C19	
					Vs 5%				
30			Bottom of Hole at 30.0'						

Plate G-11
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

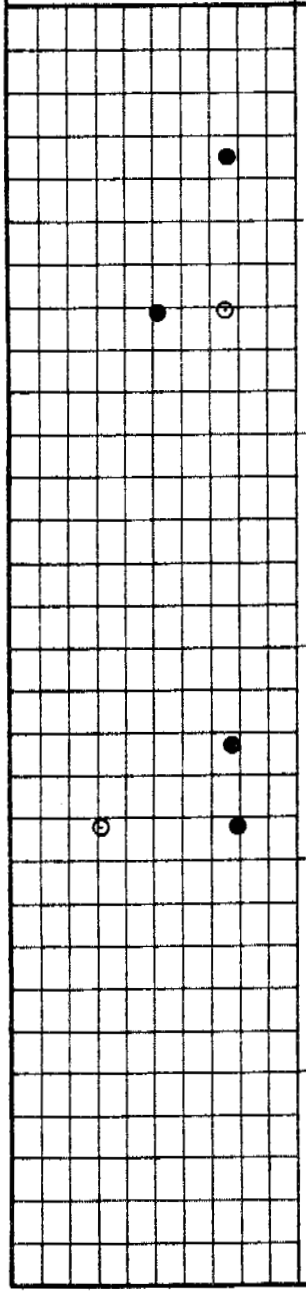
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. M-19-3

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 25 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:30	FINISH: 15:00
PROJECT NO.: K 3571	ELEVATION: 99.90 m	LOCATION: Well Site M-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, medium plastic, brown		Vs 10%	W C1		C1	Pilot hole to 1.0'
3.5'		- low plastic, laminated, grey		50%	C2		C2	
				Nf	C3		C3	
				Vs 50%	C4			
7.5'		shells			C5		C5	
8.5'	I+	ICE + ORGANIC CLAY - silty, low plastic, black		ICE+	C6 C7 C8			
12.5'	ML	SILT - sandy, low plastic, brown		Nb	C9 C10			
14.5'		- grey			C11 C12 C13 C14 C15		C11 C12 C13 C14	
				Vs <5%	C16			
24.0'		2" sand layer		Nb	C17		C17	
				Vs 10%	C18 C19 C20			
30		Bottom of Hole at 30.0'						

Plate G-12
Sheet 1 of 1

APPENDIX "G"

SECTION G.5 TEST HOLE LOGS: WELL SITE K-19

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

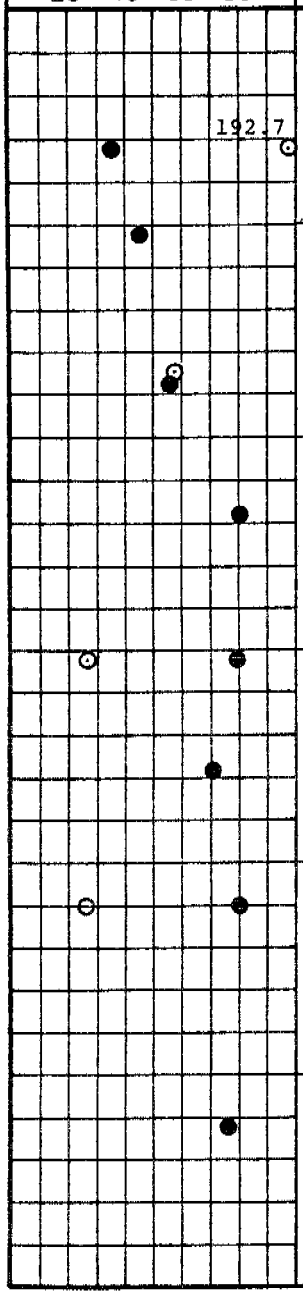
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. K-19-1

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 15:00	FINISH: 22:00
PROJECT NO.: K 3571	ELEVATION: 99.75 m	LOCATION: Well Site K-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, brown		Vr 20%	W			Pilot hole to 1.0'
						C1		C1	
						C2		C2	
					Vr Vs 40%	C3		C3	
5						C4		C4	
						C5		C5	
			9.0' - clayey, little fine sand, low plastic, brown		Vs 60% 20%	C6		C6	
						C7		C7	
10					Nb			C7	
						C8			
						C9		C9	
15								C9	
			17.0' - sandy, clayey, low plastic, current bedded, brown			C10			
						C11		C10	
								C11	
20			20.0' - sandier, grey			C12		C12	
					Vs 5%	C13			
						C14			
25						C15		C15	
						C16		C16	
						C17			
30						C18			

Plate G-13
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. K-19-1

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 15:00	FINISH: 22:00
PROJECT NO.: K 3571	ELEVATION: 99.75 m	LOCATION: Well Site K-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, low plastic, current bedded, grey		Vs 5%	C18			
						C19			
					Nf	C20			
					Vs 5%	C21			
35					Nb	C22		C22	
						C23			
			40.0' 1/2" ice lense 39.9' - trace fine sand			C24		C24	
						C25		C25	
					Vs 5%	C26		C26	
					Nb	C27		C27	
45			46.0' 1" medium sand layer			W			
						C28		C28	
			47.5' 1/2" ice lenses 47.9'			C29			
						C30		C30	
50			51.0' 1/4" ice lense 50.5' - occasional sand layers to 1.0" thickness, low plastic, grey			C31		C31	
						C32			
						C33		C33	
55						C34		C34	
			56.5' Bottom of Hole at 56.5'						
60									

Plate G-14
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. K-19-4

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 3:20	FINISH: 6:00
PROJECT NO.: K 3571	ELEVATION: 99.65 m	LOCATION: Well Site K-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, low plastic grey	Vx Vs 10%	W			Pilot hole to 1.0'
				C1		C1	
				C1		C1	
5			Vx Vr 65%	W			
10							
			Vs <5%	C2		C2	
						C2	
			Nb	C3			
15				C4		C4	
						C4	
				W			
				C5			
				C6		C6	
		occasional Vs ice lenses to 1/16" thickness 19.0'				C6	
20				C7			
		22.0' - occasional organic laminations to 1/4" thickness, low plastic, current bedded, grey		C8		C8	
				C9		C9	
				C10		C10	
25				C11			
						C11	
				C12		C12	
				C13			
						C13	Plate G-15
30		Bottom of Hole at 30.0'		C14			Sheet 1 of 1

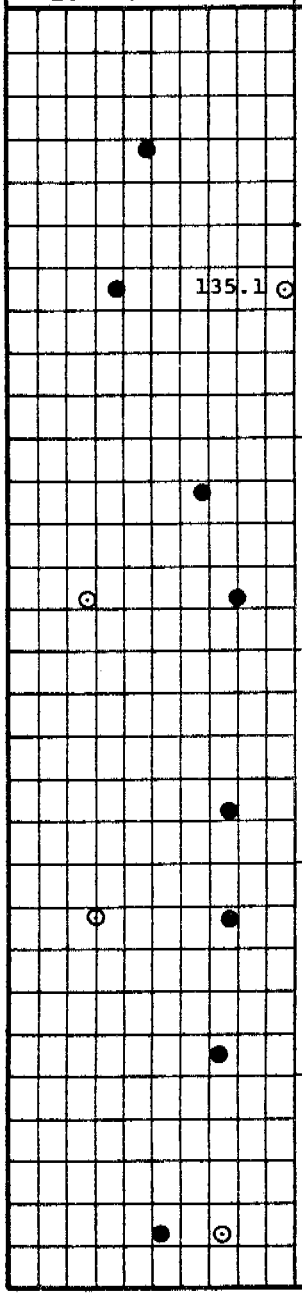
TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. K-19-5

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 2, 3 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:15	FINISH: 2:45
PROJECT NO.: K 3571	ELEVATION: 99.99 m	LOCATION: Well Site K-19	



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - organic to 2.0' depth, low plastic, mottled grey and brown		Vx <5%	W			Pilot hole to 1.0'
			2.0' - low plastic, grey			C1			
					Vx Vs 50%	C2		C1	
						C3		C2	
5					Vx 65%	C4		C3	
					Vs 20%	C5		C5	
					5%	C6			
					Vx Vr 40%	C7		C7	
10					Vs 35%	C8		C8	
					<5%	C9		C9	
					Nb	C10		C10	
						C11			
15						W			
						C12		C12	
						C13		C13	
						C14		C14	
20								C14	
						C15		C15	
			1/4" ice lenses 23.2'						
			1/4" ice lenses 25.0'			C16		C16	
25					Vs <5%	C17			
						C18		C18	
					Nb	C19		C19	
30			Bottom of Hole at 30.0'			C20			

Plate G-16
Sheet 1 of 1

APPENDIX "G"

SECTION G.6 TEST HOLE LOG: WELL SITE G-19

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. G-19-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:00	FINISH: 14:30
PROJECT NO.: K 3571	ELEVATION: 100.00 m	LOCATION: Well Site G-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED
0	ML	SILT - clayey, some organics, low plastic, brown	Vx 10%	W		
		2.0'		C1		C1
	OL	2.5' ORGANIC SILT				
	ML	SILT - clayey, trace of organics, low plastic, brown	UF	C2		C2
5			Vs Vr 30%	C3		C3
		6.0' layered	Vs 50%			
				C4		
		8.5'				
	I+	9.0' ICE + SILT	ICE+ 70%	C5		C5
10		ICE + CLAY - organic, medium plastic, black		C6		C6
		10.5'				
	ML	SILT - sandy, low plastic, brown	Vs 40%	C7		C7
			Nb	C8		C8
15				C9		
		17.0' - current bedded, grey		C10		C10
		19.5' - sandier		C11		
20						
		23.0' - clayey		C12		C12
		25.0' organic laminations	Vs <5%	C13		
25				C14		
			Nb	C15		
30				C16		

112.0 ⊙

OTHER INFORMATION: Pilot hole to 1.0'

Plate G-17
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. G-19-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:00	FINISH: 14:30
PROJECT NO.: K 3571	ELEVATION: 100.00 m	LOCATION: Well Site G-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION
30	ML	SILT - clayey, little sand, trace of organic laminations, low plastic, current bedded, grey
35		
40		39.0' - clayey, low plastic, layered
45		43.2' - sandier
50		46.5' - very sandy, trace of organic laminations, current bedded, grey
55		51.7' - less sand
60		56.5' - no current bedding Bottom of Hole at 60.0'

ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
	Nb	C16			
	Vs 10%	C17		C17	
		C18		C18	
		C19		C19	
		C20			
		C21			
		C22			
	<5%	C23		C23	
		C24			
		C25			
		C26			
	Nf	C27			
		C28		C28	
	Vs <5%	C29		C29	
		C30			
		C31			
	Nf	C32		C32	
	Vs <5%	C33		C33	
		C34		C34	

Plate G-18
Sheet 2 of 2

APPENDIX "G"

SECTION G.7 TEST HOLE LOGS: WELL SITE S-19

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. B-19-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 26 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:00	FINISH: 18:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Well Site B-19	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace of organics, low plastic, brown	Vx 5%	W, C1, C2		C1	Pilot hole to 1.2'
			Vx Vs 40%	C3, C4		C4	
		1/2" ice lense 6.0'	Vs 60%	C5, C6, C7		C6, C7	
		7.4' organic laminations					
			Vr Vs 15%	C8, C9, C10, C11		C8, C9, C11	
		12.0' - sandy, low plastic, grey					
			Vs <5%	C12		C12	
		1/8" ice lenses 17.0'	Nb	C13, C14, C15, C16, C17, C18, C19, C20		C13, C14, C15, C16, C17, C18, C19	
		1/8" ice lense 20.0'					
		27.5' organic laminations	Vr Vs Vx 10%				

159.5

Plate G-19
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

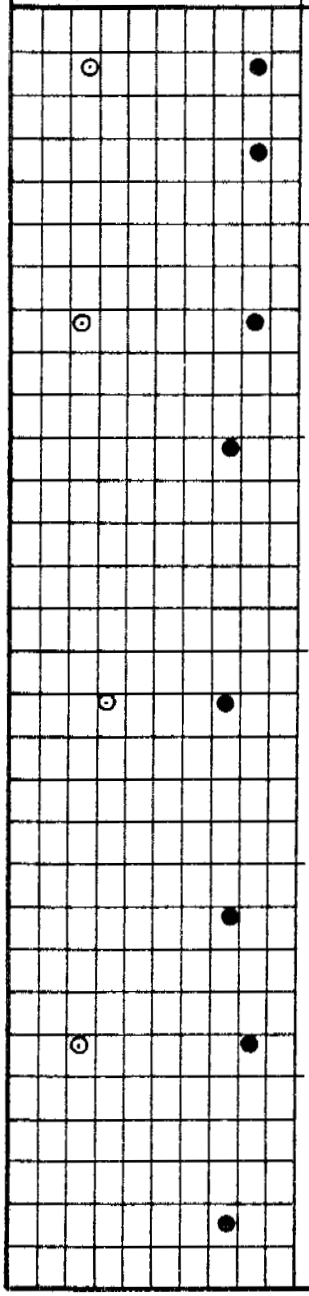
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. B-19-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 26 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:00	FINISH: 18:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Well Site B-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED
30	ML	SILT - sandy, trace of organics, low plastic, grey	Vr Vs Vx 10%	C21		C21
			Nb	C22		
				C23		C23
35				C24		C24
				C25		C25
				C26		
40				C27		C27
			Vs <5%	C28		
				C29		C29
45				C30		C30
		46.0'				
	SM	SAND - silty, fine grained, non plastic, grey	Nb	C31		
		48.5'		C32		
	ML	SILT - sandy, low plastic grey		C33		
50						
				C34		C34
				C34		C34
				C35		
				C36		C36
55				C37		
				C38		C38
				C39		C39
60		1/8" ice lenses 59.0' Bottom of Hole at 60.0'		C40		

OTHER INFORMATION

Plate G-20
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. B-19-2

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 26 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:00	FINISH: 23:30
PROJECT NO.: K 3571	ELEVATION: 99.97 m	LOCATION: Well Site B-19	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, little organics to 3.0' depth, low plastic, greyish brown		Vr Vs Vx 20%	W C1		C1 C1	Pilot hole to 1.0'
3.5'	I+		ICE + SILT		ICE+	C2			
5.0'	ML		SILT - clayey, low plastic, greyish brown		Vs Vx 50% 20%	C3 C4		C4	
8.0'	I+		ICE + SILT		Vs 30% ICE+ 70%	C5 C6 C7 C8		C8	
11.5'			SILT - clayey, low plastic, greyish brown		Vs Vx 25% 15% <5%	C9 C10 C11		C10	
13.0'			trace of wood particles		Nb	C12 C13 C14 C15 C16		C12 C13 C16	
17.0'			- grey			C17 C18 C19		C19	
19.0'			1/16" ice lenses			C20 C21 C22		C21 C22	
21.5'			- occasional organic laminations, trace of sand lenses to 1/2" thickness, low plastic, current bedded, grey						
30			Bottom of Hole at 30.0'						

Plate G-21
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

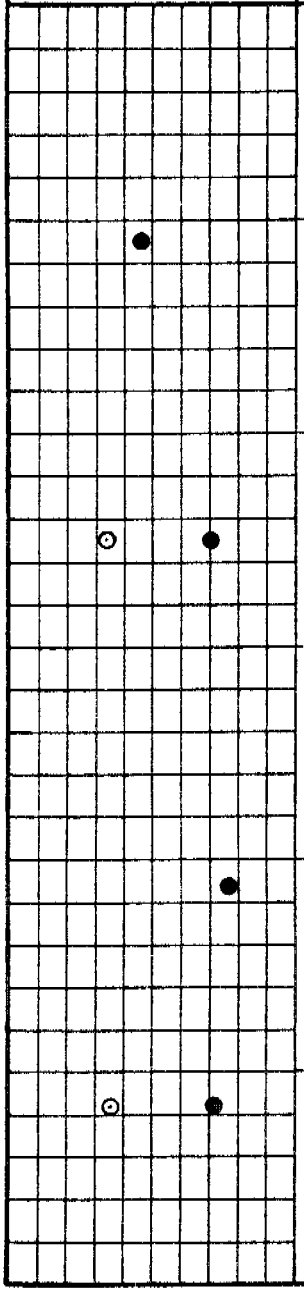
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. B-19-3

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 26 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 2:15	FINISH: 5:45
PROJECT NO.: K 3571	ELEVATION: 99.95 m	LOCATION: Well Site B-19	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL	ORGANIC SILT - some plant remains, trace fine sand low plastic, grey	Vx Vr 15%	W C1 C2		C2	Pilot hole to 1.5'
4.0'							
	ML	SILT - sandy, trace organics, low plastic, grey	40% ICE+ Vx Vr 50% ICE+	C3 C4		C1 C4	
8.0'		- sandier	Vx Vs 25%	C5 C6		C5	
10			5%	C7		C7	
			Nb	C8			
				C9		C9	
15				C10 C11			
18.0'		- little sand lenses, occasional organic laminations, low plastic current bedded, grey		C12		C12	
20				C13 C14		C14	
			Vx Vr 5%	C15			
			Nb	C16			
25				C17 C18		C17	
				C19			
30		Bottom of Hole at 30.0'				C19	

Plate G-22
Sheet 1 of 1

APPENDIX "G"

SECTION G.8 TEST HOLE LOG: WELL SITE P-16

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

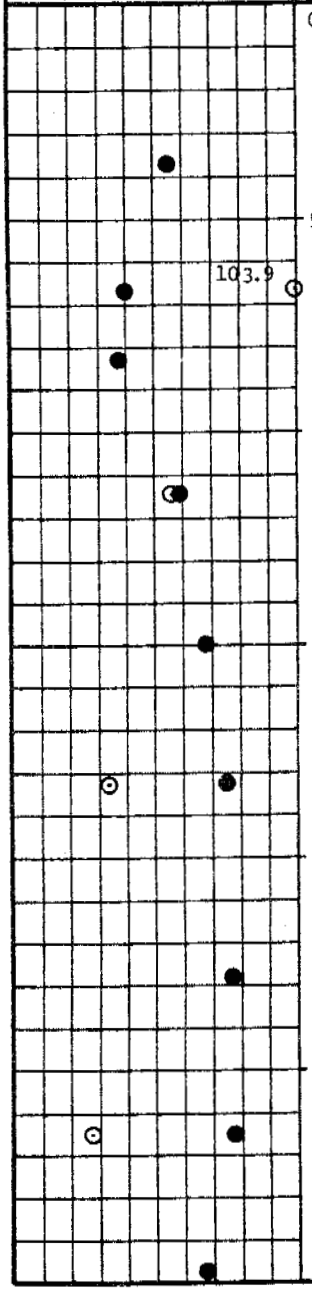
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. P-18-1

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 25 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 15:30	FINISH: 23:55
PROJECT NO.: K 3571	ELEVATION: 99.84 m	LOCATION: Well Site P-18	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, laminated, mottled grey and brown		Vr Vs 20%	W C1		C1	Pilot hole to 1.0'
3.8'						C2		C2	
	I+		ICE+ ORGANIC SILT - low plastic brown		Ice+	C3 C4			
6.0'						C5		C5	
			ICE+ SILT - sandy, slight plasticity, grey			C6		C6	
8.0'						C7		C7	
	ML		SILT - sandy, slight plasticity grey		Vr Vs 40%	C8		C8	
10.7'			sand layer			C9		C9	
					Vx Vs 20%	C10		C10	
						C11		C11	
					Vs 5%	C12		C12	
					Nb	C13		C13	
20.0'			organic laminations			C14 C15		C15	
						C16		C16	
						C17		C17	
						C18		C18	
						C19			
						C20		C20	

Plate G-23
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. P-18-1

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 25 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 15:30	FINISH: 23:55
PROJECT NO.: K 3571	ELEVATION: 99.84 m	LOCATION: Well Site P-18	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, occasional thin sand lenses, trace of organic laminations, low plastic, grey		Nb	C21		C21	
						C22		C22	
						C23		C23	
35						C24		C24	
						C25		C25	
						C26			
40						C27		C27	
			42.0' = current bedded			C28		C28	
						C29		C29	
						W			
45						C30		C30	
						C31		C31	
						C32		C32	
50					Vx Vr <5%	C33			
						C34		C34	
					Nb				
						C35		C35	
55						C36			
						C37		C37	
						C38		C38	
60			Bottom of Hole at 60.0'						

Plate G-24
Sheet 2 of 2

APPENDIX "G"

SECTION G.9 TEST HOLE LOGS: WELL SITE E-09

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-09-1

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 24 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 1:30	FINISH: 10:10
PROJECT NO.: K 3571	ELEVATION: 99.69 m	LOCATION: Well Site E-9	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL	ORGANIC SILT - mottled grey and brown	Vx Vr 5%	C1			
1.0'	ML	SILT - clayey, low plastic, grey	Vs 30%	C2		C2	
			Vr Vs 40%	C3			
4.6'		6" organic silt layer	Vs 30%	C4		C4	
5				C5			
5.8'		trace of shells	Vx Vs 10%	C6		C6	
			5%	C7		C7	
10			10%	C8		C8	
11.5'		- trace of organics, mottled grey and brown	Vs 25%	C9			
			20%	C10			
			<5%	C11		C11	
15				C12			
			Nb	C13		C13	
						C13	
				C14			
						C14	
19.0'		- trace fine sand, trace of organics, greyish brown		C15		C15	
20				C16		C16	
				C17			
						C17	
24.0'		- little organics		C18		C18	
				C19		C19	
25				C20		C20	
25.9'		- little organics, current bedded, greyish brown		C21			
						C21	
30				C22		C22	
				C23			

Plate G-25
Sheet 1 of 2

TEST HOLE LOG

R.M. HAROY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-09-1

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 24 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 1:30	FINISH: 10:10
PROJECT NO.: K 3571	ELEVATION: 99.69 m	LOCATION: Well Site E-9	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace organic laminations, low plastic, current bedded, grey		Nb	C23			
						W			
			33.5' - little organic laminations			C24		C24	
						C25		C25	
35						C26		C26	
						C27		C27	
			38.0' - little fine sand, trace of organic laminations, slight plasticity, grey			C28		C28	
40						C29			
					Nf	C30			
					Nb	C31			
						C32		C32	
45			45.0' - current bedded			C33			
			48.0' - sandier			C34		C34	
50						C35			
						C36			
						C37		C37	
55			54.0' - clayey, some sand, low plastic, grey			C38			
						C39		C39	
			59.2'			C40			
60			Bottom of Hole at 59.2'						

Plate G-26
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

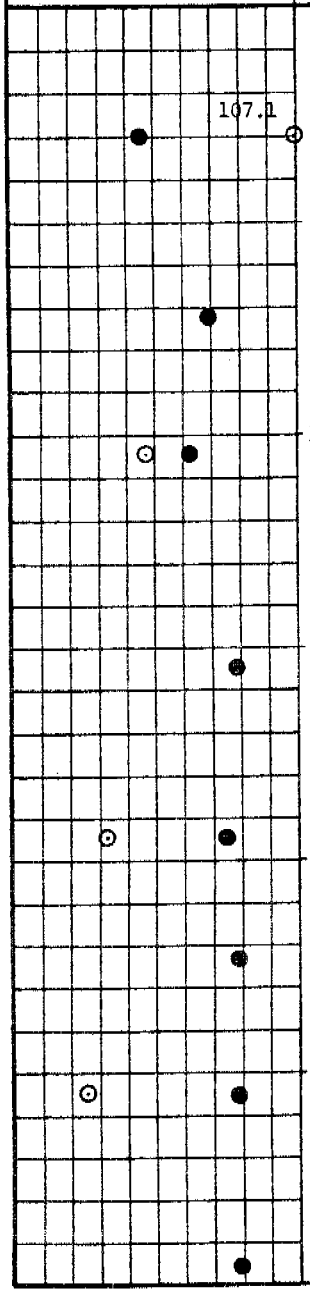
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-09-2

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 24 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:30	FINISH: 19:45
PROJECT NO.: K 3571	ELEVATION: 99.54 m	LOCATION: Well Site E-9	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0			SILT - clayey, trace of organic laminations, low plastic, grey		Vr Vs 40%	W C1		C1	Pilot hole to 1.0'
						C2		C2	
					60%	C3			
5					30%	C4		C4	
						C5		C5	
			- alternating 1" layers of soil and ice to 13.0' depth (8.0')		60%	C6		C6	
						C7		C7	
10						C8			
			13.0' - clayey, sandy, low plastic		Nb	C9		C9	
						C10		C10	
15						C11		C11	
			17.0' - sandy, occasional sand layers, low plastic, grey			C12			
						C13		C13	
20						C14			
						C15		C15	
						C16		C16	
25						C17		C17	
			27.0' - trace fine sand, low plastic, grey			C18		C18	
30			Bottom of Hole at 30.0'			C19		C19	

Plate G-27
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-09-3

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 25 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:00	FINISH: 14:20
PROJECT NO.: K 3571	ELEVATION: 99.28 m	LOCATION: Well Site E-9	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

110.9

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, some organics to 1.5' depth, low plastic, mottled grey and brown	Vr Vs 70%	W C1		C1	Pilot hole to 1.5'
			Vs 20%	C2		C2	
5			F	C3		C3	
				C4			
			Vr Vs 10%	C5		C5	
10				C6		C6	
		11.5' organic layers to 1" thickness	20%				
			Vs 5%	C7			
		14.0' - sandy, clayey, low plastic, grey	Nb	C8		C8	
15				C9		C9	
		17.0' - slight plasticity		C10		C10	
				C11		C11	
20				C12			
				C13			
				C14		C14	
		23.5' - current bedded					
25				C15			
				C16		C16	
				C17		C17	
30		Bottom of Hole at 30.0'					

Plate G-28
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

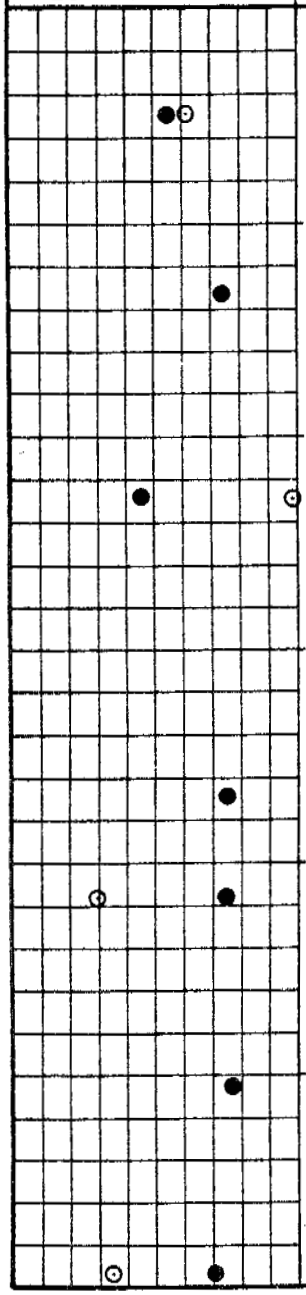
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-09-4

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 24 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 20:00	FINISH: 22:50
PROJECT NO.: K 3571	ELEVATION: 99.61 m	LOCATION: Well Site E-9	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL	ORGANIC SILT - greyish brown	Vx 5%	W C1			
1.5'	ML	SILT - trace fine sand, low plastic, grey-brown	Vx Vr 40%	C2 C3		C1 C2	
5			10%	C4		C4	
			Vx Vs 5%	C5 C6		C5	
			40%				
10			20%	C7 C8		C7 C7 C8	
			Vx <5%	C9		C9	
			Vx Vr <5% Nb	C10 C11		C10 C11	
14.5'		- trace of organic laminations to 1/2" thickness					
15				W C12 C13		C12 C13	
20.0'		- trace of organic laminations, current bedded, grey	Vx <5% Nb	C14 C15 C16 C17 C18		C14 C15 C16 C18	
25				C19		C19	
30		Bottom of hole at 30.0'					

Plate G-29
Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-09-5

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 24, 25 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 23:10	FINISH: 4:15
PROJECT NO.: K 3571	ELEVATION: 99.63 m	LOCATION: Well Site E-9	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - low plastic, grey		Vx Vr 65%	W C1		C1	Pilot hole to 0.5'
		2.5'		Vs 45%				
	OL	ORGANIC SILT - some organics, mottled grey-brown		Vx <5%	C2		C2	
4.0'	ML	SILT - low plastic, grey		Vx Vs 45%	C3			
5				Vx Vr 50%			C3	
				60%	C4			
				Nb	C5			
				Vx Vr 35%	C6		C6	
				Vx <5%	C7			
				15%	C8		C8	
					C9			
					C10		C10	
15				Nb	C11		C11	
		17.0' - trace fine sand, low plastic			C12			
				Vs <5%	C13		C13	
		19.2' trace of roots		Nb	C14			
20				Nf	C15		C15	
					C16		C16	
					C17		C18	
					C18			
25					C19			
		26.0' - occasional organic laminations, current bedded, grey			C20		C20	
				Nb	C21			
30		Bottom of Hole at 30.0'						

Plate G-30
Sheet 1 of 1

APPENDIX "G"

SECTION G.10 TEST HOLE LOGS: WELL SITE J-08

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

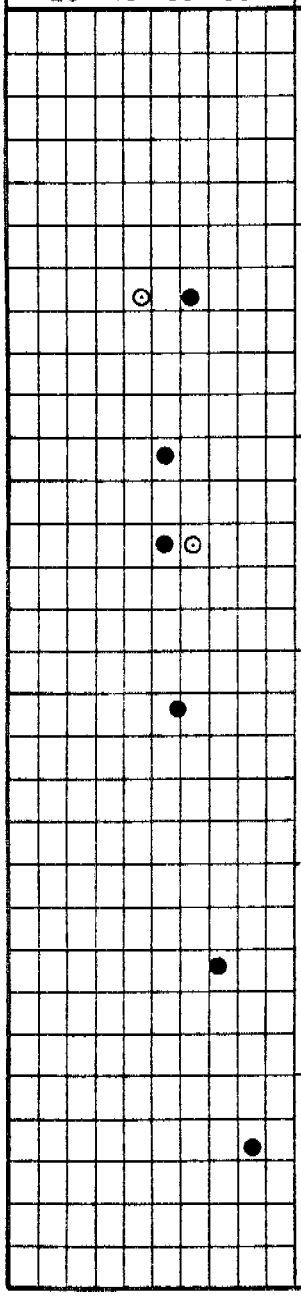
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08-1

LOGGED BY: RGC/GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9, 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:00	FINISH: 3:00
PROJECT NO.: K 3571	ELEVATION: 99.63 m	LOCATION: Well Site J-08	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, low plastic, grey	Nb	W			Pilot hole to 1.0'
		2.5' 6" dry, friable layer		C1			
				C2			
5		ice lenses to 1/4" thickness 5.5'	Vs 10%	C3			
		7.0' organic laminations	40%	C4		C4	
			10%	C5			
10			Nb	C6		C6	
			Vs 30%	C7			
				C8		C8	
		14.0' - clayey, low plastic	20%	C9			
15				C10		C10	
		17.0' - sandy, slight plasticity, grey	10%	C11			
				C12			
			Nb	C13		C13	
20				C14		C14	
		1/16" ice lenses 23.5'		C15			
				C16			
25				C17		C17	
		26.7' wood particles, organic lenses		C18			
30				C19			

Plate G-31
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08-1

LOGGED BY: RGC/GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9, 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:00	FINISH: 3:00
PROJECT NO.: K 3571	ELEVATION: 99.63 m	LOCATION: Well Site J-08	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, slight plasticity, grey		Nf	C19		C19	
						W			
						C20		C20	
35						C21			
			36.0' - sandier, non plastic			C22		C22	
						C23			
			38.3' - clayey, low plastic			C24			
			39.5' - sandy, non plastic			C25		C25	
40					Nb	C26			
						C27			
					Nf			C27	
						C28		C28	
45						C29			
			46.0' - clayey, sandy, low plastic, grey		Nb	W			
						C30		C30	
					Nf	C31			
50						C32		C32	
						C33		C33	
			52.7' - sandy, non plastic			C34		C34	
55						C35			
						C36			
						C37		C37	
						C38			
60			Bottom of hole at 60.0'			C39		C39	

Plate G-32
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08-2

LOGGED BY: GNL/RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 4:00	FINISH: 7:45
PROJECT NO.: K 3571	ELEVATION: 99.57 m	LOCATION: Well Site J-08	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	Pt		PEAT - fibrous, woody		Vr Vs 30%	W C1		C1	Pilot hole to 1.0'
			1.3'						
	ML		SILT - clayey, some sand, trace of organics, slight plasticity, grey						
					50%	C2			
5					40%	C3 C4 C5		C3 C5	
					Vx 5%	C6			
			8.7' - sandy, non plastic			C7		C7	
10					Nb	C8		C8	
					Vs 35%	C9 C10		C9	
15					15%	C11			
					Nb	W C12		C12	
20						C13 C14		C14	
			22.7' - and fine sand, non plastic, current bedded, grey			C15 C16			
25						C17 C18 C19		C17	
			Bottom of Hole at 30.0'			C20			
30									

Plate G-33
Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08-3

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:00	FINISH: 10:30
PROJECT NO.: K 3571	ELEVATION: 99.70 m	LOCATION: Well Site J-08	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey		Nb	W			Pilot hole to 1.0'
						C1		C1	
					UF				
						C2			
			4.5' - current bedded		Vx 10%	C3			
5						C4		C4	
					Nb				
						C5		C5	
					Vs 10%	C6			
10						C7		C7	
					40%				
					20%	C8		C8	
					10%	C9			
15						W			
					Nb	C10		C10	
						C11			
20						C12		C12	
					Vs 10%				
						C13			
					Nb	C14		C14	
25			25.5' - trace fine sand			C15			
			26.5' - and fine sand, non plastic current bedded, grey			C16		C16	
						C17			
30			Bottom of Hole at 30.0'			C18			

Plate G-34
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08-4

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 14:30	FINISH: 16:40
PROJECT NO.: K 3571	ELEVATION: 99.49 m	LOCATION: Well Site J-08	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, medium plastic, grey-brown	Vx 15%	W			Pilot hole to 1.0'
				C1			
			UF	C2			
4.5'		- low plastic, grey	Vx 10%	C3		C3	
5			Vs 20%				
				C4		C4	
			10%				
				C5		C5	
10		ice lenses to 1/2" thickness 10.0'		C6			
				C7			
				C8		C8	
15			Nb	C9			
				W			
18.0'		- trace fine sand, low plastic		C10		C10	
20				C11			
				C12		C12	
23.0'		fine sand laminations		C13			
25				C14		C14	
				C15			
29.0'		fine sand laminations		C16			
30		Bottom of Hole at 29.5'					

Plate G-35
Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08-5

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:45	FINISH: 14:10
PROJECT NO.: K 3571	ELEVATION: 99.64 m	LOCATION: Well Site J-08	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - some organics to 3.0' depth, low plastic, grey-brown	Nb	W, C1, C2			Pilot hole to 1.0'
3.0'		- grey	Vs 10%	C3		C3	
			30%	C4		C4	
5				C5		C5	
6.5'		- clayey, low plastic	10%	C6			
			Nb	C7			
10				C8			
			Vs 30%	C9		C9	
			10%	C10			
15				C11		C11	
			5%	C12			
18.0'		- trace fine sand, low plastic, current bedded		W, C13			
			Nb	C14			
20				C15		C15	
22.0'		- some fine sand, slight plasticity, laminated, grey		C16		C16	
				C17			
25				C18			
				C19		C19	
				C20			
30		Bottom of Hole at 30.0'		C21			

Plate G-36
Sheet 1 of 1

APPENDIX "G"

SECTION G.11 TEST HOLE LOG: WELL SITE J-28(2)

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

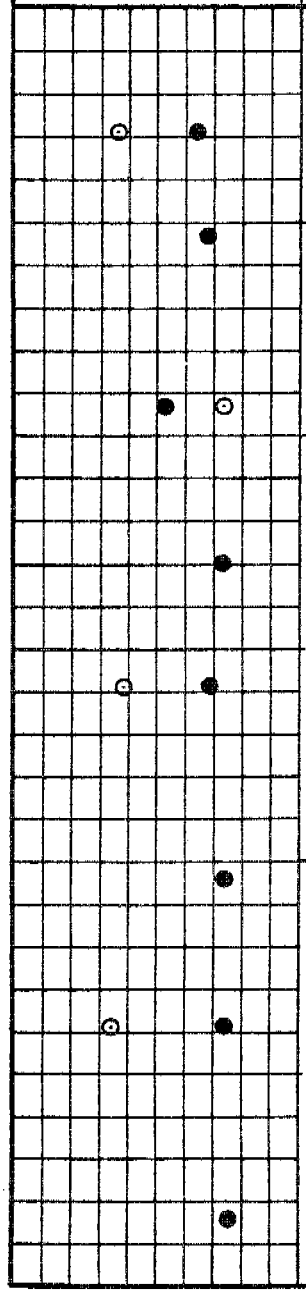
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08(2)-1

LOGGED BY: GNL/RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 4:00	FINISH: 13:15
PROJECT NO.: K 3571	ELEVATION: 99.42 m	LOCATION: Well Site J-08(2)	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, sandy, low plastic, grey		Vs 20%	W C1		C1	Pilot hole to 1.0'
				Vx Vs 15%	C2 C3 C4		C2 C4 C4	
5				Vs 40%	C5 W C6		C6 C6	
				5%	C7			
10				Nb	C8 C9 C10		C8 C8 C10	
				Vs 20% 5%	C11 W C12		C11 C12	
15		19.0' - trace fine sand, slight plasticity, current bedded, grey		Nb	C13 C14 C15 C16 C17 C18 C19		C13 C14 C16 C18 C19	
20								
25								
30								

Plate G-37
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. J-08(2)-1

LOGGED BY: GNL/RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 4:00	FINISH: 13:15
PROJECT NO.: K 3571	ELEVATION: 99.42 m	LOCATION: Well Site J-08(2)	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - trace fine sand, trace of organic laminations, low plastic, current bedded, grey		Nb	C20			
						W			
						C21		C21	
						C22		C22	
35						C23		C23	
						C24			
			38.5' - non plastic			C25		C25	
40						C26		C26	
						C27		C27	
			43.0' - clayey, low plastic			C28		C28	
45						C29		C29	
						W			
			48.5' - clayey, trace fine sand, low plastic			C30			
50						C31		C31	
			50.5' SILT (TILL-like) - trace gravel to 1.0" size, clayey, low plastic			C32			
			Bottom of Hole at 51.0'						
55									

Plate G-38
Sheet 2 of 2

APPENDIX "G"

SECTION G.12 TEST HOLE LOG: WELL SITE E-48

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-58-1

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 26 January 1977
RIG: NORTHLAND	METHOD: AIR	START: 15:00	FINISH: 15:20
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Well Site E-58	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, slight plasticity, grey		F				
5						W1		W1	
10			10.0' - brown			W2		W2	
15			15.0' trace of organics - grey-brown			W3		W3	
20						W4		W4	
25									
30						W5		W5	

Plate G-39
Sheet 1 of 3

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-58-1

LOGGED BY: AJH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 26 January 1977
RIG: NORTHLAND	METHOD: AIR	START: 15:00	FINISH: 15:20
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Well Site E-58	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace of organics, slight plasticity, greyish brown		F				
35						W6		W6	
40									
45			45.0' - some fine sand, clayey, slight plasticity, grey			W7		W7	
50	CL		50.0' CLAY - very silty, low plastic, grey			W8		W8	
55									
60						W9		W9	

Plate G-40
Sheet 2 of 3

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. E-58-1

LOGGED BY: AJH	DRAWN BY: CPM	CHECKED: AJH	DATE: 26 January 1977
RIG: NORTHLAND	METHOD: AIR	START: 15:00	FINISH: 15:20
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Well Site E-58	

W_p - ⊡ W - ⊙ W_L - △ BULK DENSITY (pcf) ● 60 80 100 120 MOISTURE CONTENT 20 40 60 80	DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
	60	CL		CLAY - very silty, low plastic, grey		F				
⊙	65						W10		W10	
⊙	70						W11		W11	
⊙	75						W12		W12	
				77.0'						
		SM		SAND - very silty, fine grained, grey						
⊙	80			80.0'			W13		W13	
				Bottom of Hole at 80.0'						
	85									

Plate G-41
Sheet 3 of 3

APPENDIX "H"

ARTIFICIAL ISLAND

SECTION H.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE H-1

Test Hole Locations and Elevations
Artificial Island

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
AI-1	7 687 482.93	488 181.62	2.204	99.948
AI-2	7 687 329.40	488 087.81	0.930	98.674
AI-3	7 687 073.50	487 931.46	0.939	98.683
AI-4	7 686 817.61	487 775.11	0.939	98.683
AI-5	-	-	0.939	98.683

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "H"

SECTION H.2 TEST HOLE LOGS

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 7 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 10:30	FINISH: 15:00
PROJECT NO.: K 3571	ELEVATION: 99.95 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE	ICE	W			
		2.0'					
	ML	SILT - clayey, trace fine sand, low plastic, grey	Vs Vr 20%	C1			
			10%	C2		C2	
5		5.2' 3" highly organic layer	Vs 20%	C3			
			Vr Vs 30%	C4			
				C5			
			10%	C6			
		8.1' - slight plasticity, brown	20%	C7		C7	
			Vs 20%	C8			
10			Vx 5%	C9			
		12.0' - slight plasticity, grey	Nb			C9	
15				C10			
		18.0' organic laminations				C10	
		20.0' - little sand, trace of organic laminations, low plastic, current bedded, grey		C11			
						C11	
25				C12			
						C12	
30							

Plate H-1
Sheet 1 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 7 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 10:30	FINISH: 15:00
PROJECT NO.: K 3571	ELEVATION: 99.95 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and sand, non plastic, grey		Nb	C13		C13	
			34.0' - trace fine sand, low plastic, grey			C14		C14	
35			37.5' - current bedded, organic laminations						
40			40.0' Bottom of Hole at 40.0'						
45									

Plate H-2
Sheet 2 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-2

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 7 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, WASH SPT	START: 4:25	FINISH: 8:26
PROJECT NO.: K 3571	ELEVATION: 98.67 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE		ICE				
5		5.8'						
	W	WATER 7.0'		UF				
	ML	SILT - clayey, low plastic, grey			U1			
		10.0'			U2		U2	
10	SM	SAND - silty, clayey, non plastic, fine grained, grey			U3		U3	
					W			
15					U4		U4	
					W			
					U5		U5	
20		20.5' - very silty						
					W			
					U6		U6	
25				F				
		27.0' - trace of organic laminations			W			
					S7			
		28.5' Bottom of Hole at 28.5'						
30								

Plate H-3
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-3

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6, 7 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, VTM SPT	START: 18:00	FINISH: 3:15
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Artificial Island	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE		ICE				
		5.0'						
5	W	5.5' WATER		UF				
	ML	SILT - soft, clayey, low plastic, grey			U1			
					W			
10					S2			
					W			
		14.0'						
15		- grey-brown		Nb				
				Vs 5%	S3			
				Nb			C4	Changed to VTM
					C4			
							C4	
20							C4	
		1/4" ice lens 21.2'					C5	
		1/8" ice lens 21.9'			C5			
		1/4" ice lens 23.5'					C5	
25							C5	
		25.5'					C6	
		- sandy, current bedded			C6			
							C6	
		29.0'						
30	SM	SAND - silty, current bedded					C6	

Plate H-4
Sheet 1 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-3

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6, 7 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, VTM SPT	START: 18:00	FINISH: 3:15
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
20	SM	SAND - silty, fine grained, non plastic, current bedded, grey	Nb	C6		C6	
						C7	
				C7			
						C7	
25						C7	
		36.0' organic laminations				C8	
		37.0' - very silty		C8			
		39.0' - silty				C8	
						C8	
30		41.0' - some organics				C9	
				C9			
						C9	
						C9	
45						C10	
		48.0' organic laminations		C10			
		49.4' 1/4" ice lens				C10	
50						C10	
		51.5'		C11			
	ML	SILT - clayey, trace fine sand, low plastic, grey				C11	
		55.0' organic laminations					
55				C12			
						C12	
		59.2' 1/2" organic laminations					
60		Bottom of hole at 60.0'					

Plate H-5
Sheet 2 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-3A

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 7 March 1977
RIG: S. D. S.	METHOD: DYNAMIC CONE	START: 3:30	FINISH: 4:15
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - ▲
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		5.0' WATER		UF				
	ML		RIVER DEPOSITS						
10									
			14.5'						Assumed frozen at 14.5' depth
15			Bottom of Hole at 14.5'						
20									

Plate H-6
Sheet 1 of 1

TEST HOLE LOG

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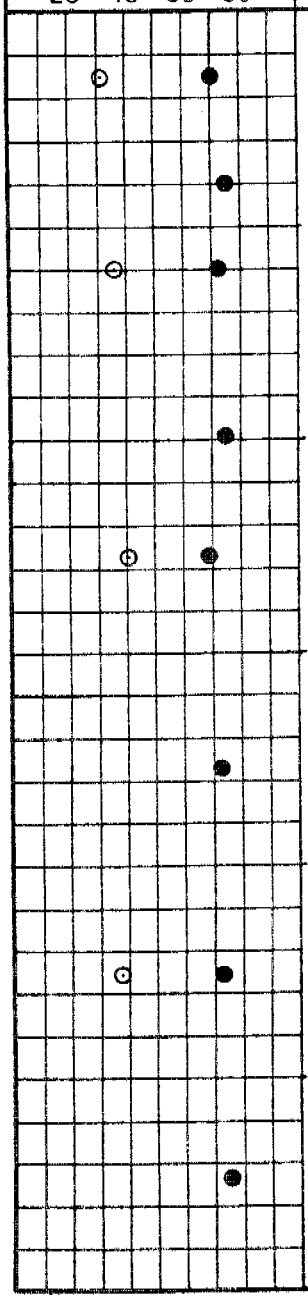
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-4

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 8:00	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace fine sand, low plastic, grey	Vr Vs <5%	C1		4" CRREL
				C2	C2	
				C3	C3	
				C4	C4	
			5%	C5		
5				C6	C6	
			10%	C7	C7	
			Nb	C8		
			Vs 30%	C9		
		9.0' thin organic lamination	<5%	C10	C10	
10			Nb	C11		Changed to VTM
			Vs <5%		C11	
		13.0' organic laminations			C11	
			Nb	C12		
15						
		17.0' - organic laminations			C12	
				C13		
20			Vs 5%		C13	
		23.0' - sandy, slight plasticity, light grey	Nb	C14	C14	
25						
					C14	
30				C15		

Plate H-7
Sheet 1 of 2

TEST HOLE LOG

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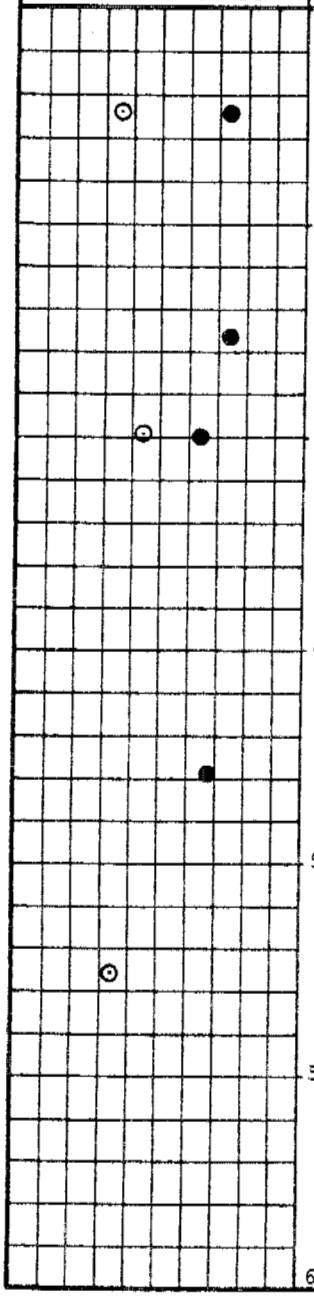
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-4

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 8:00	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, slight plasticity, grey		Nb	C15		C15	
			33.0' - sandier			C16			
35								C16	
			38.0' organic laminations						
			39.3' mica flakes			C17		C17	
40								C17	
									Hit Gas
45						C18			
			45.5' organic laminations						
			48.0' - clayey, trace of organics, low plastic, grey					C18	
50					UF	C19			
			53.0'						
			Bottom of Hole at 53.0'						
55									
60									

Plate H-8
Sheet 2 of 2

TEST HOLE LOG

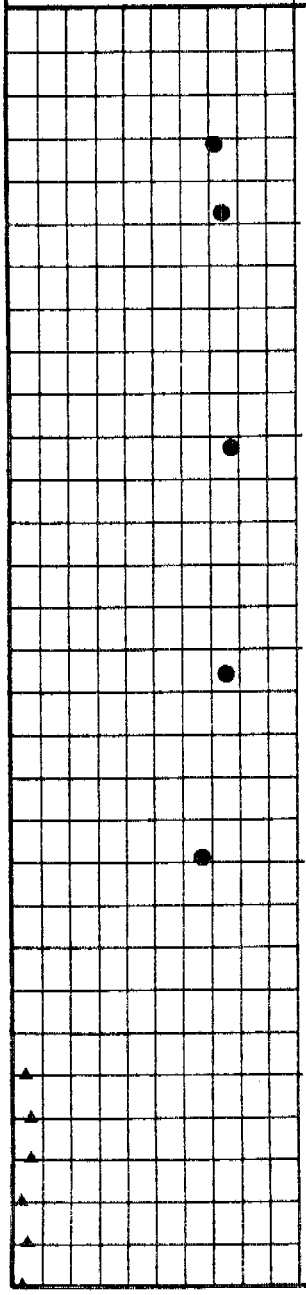
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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-5

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17, 18 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 22:15	FINISH: 1:30
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Artificial Island	

W_p - ⊡ W - ⊙ W_L - ▲
DYNAMIC CONE PENETRATION (blows/foot)
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE	ICE			4" CRREL
	ML	SILT - sandy, clayey, slight plasticity, grey	Vr Vs 50%	C1	C1	
			Nb	C2	C2	
			Vx 5%		C3	Changed to VTM
5		5.3' organic laminations	Vs 5%	C3		
			Vx Vs 5%		C3	
10		10.0' SILT - and fine sand, non plastic, grey	Vx <5%	C4	C4	
		13.2' organic lamination			C4	
15			Nf	C5	C5	
					C5	
20		20.0' - interbedded silt and sand layers		C6	C6	
			UF			Changed to Dynamic Cone
25						
30						

Plate H-9
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. AI-5

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17, 18 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 22:15	FINISH: 1:30
PROJECT NO.: K 3571	ELEVATION: 98.68 m	LOCATION: Artificial Island	

W_P - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot)
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and fine sand, inter-bedded silt and sand layers, non plastic, grey		UF				
35			35.0' Bottom of Hole at 35.0'						
40									

Plate H-10
Sheet 2 of 2

APPENDIX "I"

GATHERING SYSTEM

SECTION I.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE I-1

Test Hole Locations and Elevations
Gathering System

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
GS-1	7 690 442.59	486 383.86	1.600	99.344
GS-2	7 690 001.93	486 729.19	2.073	99.817
GS-3	7 689 765.14	486 922.54	2.070	99.814
GS-4	7 689 528.35	487 115.88	2.252	99.996
GS-5	7 689 087.84	487 475.55	2.015	99.759
GS-6	7 688 911.19	487 932.43	1.518	99.262
GS-7	7 688 938.31	488 223.44	1.786	99.530
GS-8	7 688 965.42	488 514.46	1.826	99.570
GS-9	7 688 687.83	487 683.09	1.871	99.615
GS-10	7 688 491.52	487 724.29	1.893	99.637
GS-11	7 688 069.36	487 854.16	2.230	99.974
GS-12	7 688 452.24	488 573.97	1.871	99.615
GS-13	7 688 722.38	488 689.70	1.847	99.591
GS-14	7 688 825.36	489 972.38	9.574	107.318
GS-15	7 688 562.09	489 974.01	1.231	98.975
GS-16	7 688 298.83	489 975.64	1.478	99.222
GS-17	7 688 035.56	489 977.28	1.762	99.506
GS-18	7 687 772.29	489 978.91	1.692	99.436
GS-19	7 687 509.02	489 980.54	1.460	99.204
GS-20	7 687 195.77	489 982.48	1.963	99.707
GS-21	7 686 952.26	490 080.56	1.878	99.622
LX1-1	7 689 090.97	487 940.61	1.673	99.417
LX1-2	-	-	1.673	99.417
LX1-3	-	-	1.673	99.417
LX2-1	7 688 777.74	487 854.14	1.792	99.536
LX2-2	-	-	1.792	99.536
LX2-3	-	-	1.792	99.536
LX2-4	7 688 815.35	487 801.28	1.637	99.381

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "I"

SECTION I.2 TEST HOLE LOGS

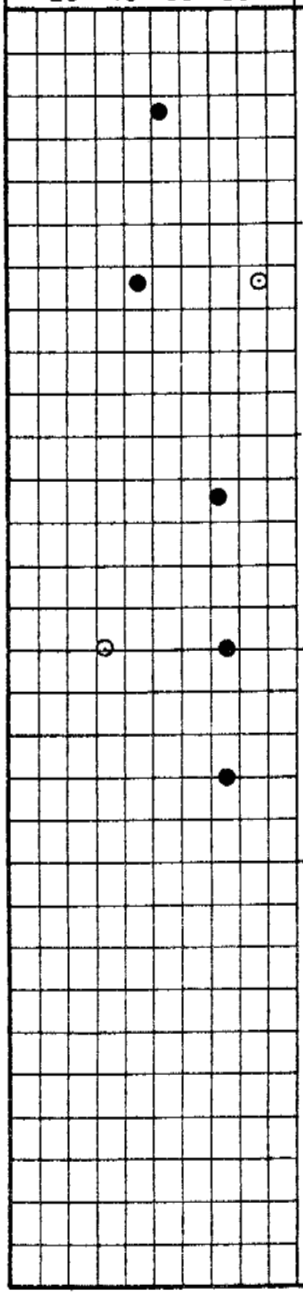
TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-1

LOGGED BY: IGJ/AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 2 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 5:15	FINISH: 8:30
PROJECT NO.: K 3571	ELEVATION: 99.34 m	LOCATION: Gathering System	



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, non-laminar, grey		Vr Vx 20%	W			Pilot hole to 1.0'
					Nb Vs 8%	C1			
						C2		C2	
3.5'					Vr Vx 75%				
	I+		ICE + SILT 1/2" ice lense 5.0'		Ice+ 90%	C3			
5.5'						C4			
	ML		SILT - clayey, low plastic, grey, ice rich and ice poor layers		Vr Vx 60%	C5		C5	
						C6			
					45%				
					Vs 8%	C7			
					10%	C8		C8	
11.5'			- sandy, current bedded			C9			
						C10			
						C11		C11	
					Nb	C12			
						C13		C13	
17.0'			- non-laminar						
						C14			
21.0'			Bottom of hole at 21.0'						

Plate I-1
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

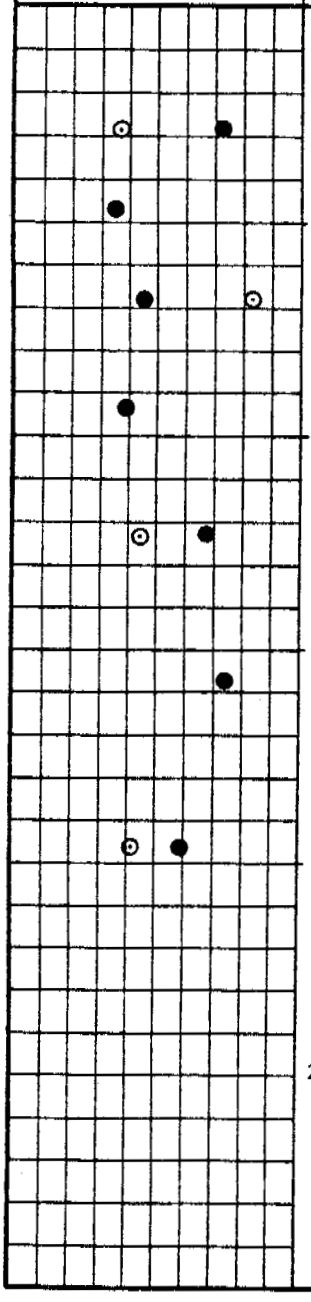
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-2

LOGGED BY: IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 1 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 02:15	FINISH: 06:30
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NkC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, low plastic, brown-grey		Vr Vx <5%	W C1		C1	Pilot hole to 1.5'
		2.5' - some organics, friable to 3.0' depth		60%	C2 C3		C3	
5				Vs 40%	C4		C4	
		1/4" ice lenses every 2" to 3" of core		<5%	C5 C6		C6	
10				10%	C7 C8		C8	
				Nb	C9			
15					C10 C11		C11	
		17.0' - clayey, grey 1" lense 17.5'			C12 C13			
20					C14		C14	
		Bottom of Hole at 20.5'						
25								

Plate I-2
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

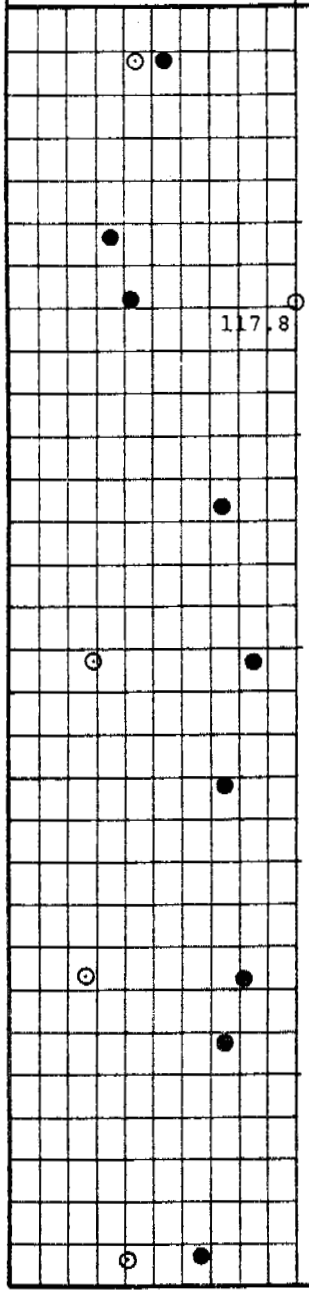
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-3

LOGGED BY: IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 28 February, 1 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 22:05	FINISH: 1:55
PROJECT NO.: K 3571	ELEVATION: 99.81 m	LOCATION: Gathering System	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL		ORGANIC SILT - medium plastic, brown		Vr Vx 10%	W C1		C1	Pilot hole to 1.0'
1.8'	ML		SILT - clayey, low plastic, grey		35%	C2 C3 C4			
5					Vx Vs 30%	C5		C4	
					Vr Vx 50%			C6	
					Ice+ 80%	C6			
					Vr Vx 40%	C7 C8			
10					Vs Vx 5%	C9		C9	
					Nb	C10 C11		C11	
15						C12			
16.5'			1/2" ice lense			C13 C14		C14	
17.0'			- more clayey			C15			
20						C16			
22.0'			becoming more friable			C17 C18		C17 C18	
25						C19			
24.0'			Vs 10%, 2" thick			C20			
30			Bottom of Hole at 30.5'			C21		C21	

Plate I-3
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-4

LOGGED BY: AN/IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 18:00	FINISH: 21:50
PROJECT NO.: K 3571	ELEVATION: 100.00 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, organic, medium plastic, non-laminar, brown	Nb	W, C1		C1	Pilot hole to 1.0'
		3.0'					
	OL	3.5' SILT - highly organic, brown	Vr Vx 10%	C2			Skidded over 3.0' north due to broken CRREL teeth down hole.
	ML	SILT - clayey, low plastic, grey-brown	40%			C3	
5		5.2'	Ice	C3			
	I+	ICE + SILT	Ice+ 80%	C4			
		7.0'					
	ML	SILT - clayey, low plastic, grey-brown	Vr Vx 40%	C5			
			Vs 40%	C6, C7			
10				C8		C8	
			<5%	C9			
			Nb	C10, C11, C12		C12	
15		17.0' - grey		C13			
				C14		C14	
20		Bottom of Hole at 20.0'					
25							

Plate I-4
Sheet 1 of 1

TEST HOLE LOG

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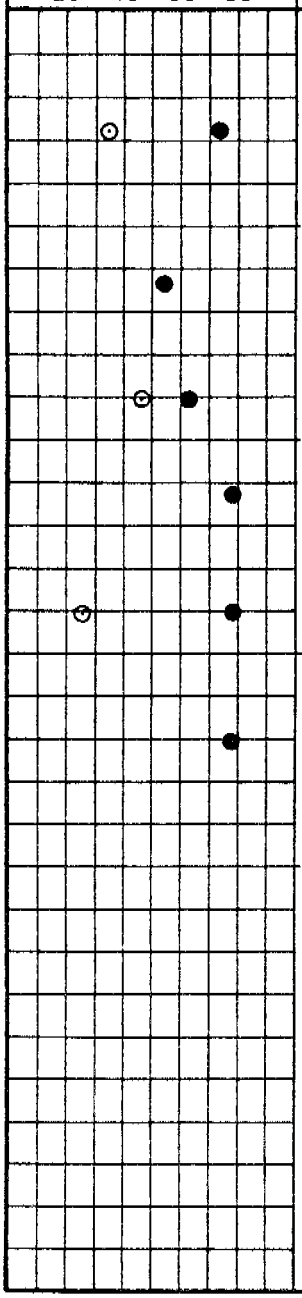
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-5

LOGGED BY: AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 28 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:00	FINISH: 18:00
PROJECT NO.: K 3571	ELEVATION: 99.76 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - low plastic, non-laminar, brown	Nb	W, C1			Pilot hole to 1.0'
		3.0' - clayey, brown	Vs 30%	C2, C3		C1	
5			Vr Vs 50%	C4, C5		C5	
	OL	7.0' CLAY - organic, medium plastic, black		C6, C7		C7	
10	ML	10.0' SILT - little sand, low plastic, non-laminar, brown	Nb	C8, C9		C8	
				C10, C11		C10	
15		17.0' - sandy, grey	Vs <5%	C12, C13		C12	
20		Bottom of Hole at 20.3'					
25							

Plate I-5
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

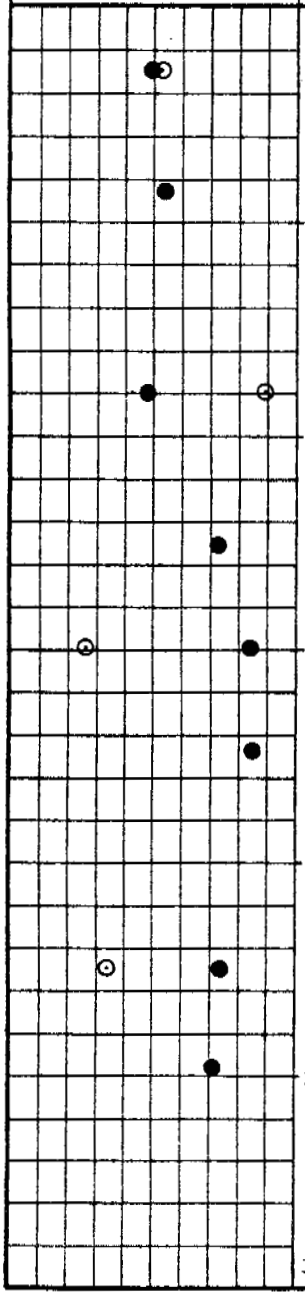
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-9

LOGGED BY: IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 4:30	FINISH: 6:45
PROJECT NO.: K 3571	ELEVATION: 99.62 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL	SILT - organic, fibrous, plant remains, brown		Vr Vx 10%	W			Pilot hole to 0.8'
		1.5'			C1		C1	
	ML	SILT - occasional red-yellow organic layer, low plastic, grey-brown		Vs Vx 5%	C2			
		occasional 1/2" ice lenses		Vr Vx 35%	C3		C3	
5				55%	C4			
					C5			
					C6			
		1/4" ice lenses 9.0'		Vs Vx 30%	C7		C7	
10				Vs 18%	C8			
				5%	C9		C9	
				Nb	C10			
15					C11		C11	
					C12			
		17.0' - clayey, grey			C13		C13	
		18.5' occasional thin organic layer			C14			
20					C15			
		21.0' - current bedding, occasional 1/4" organic layer			C16		C16	
					C17			
					C18		C18	
25					C19			
		26.0' occasional Vx to 1/16"			C20			
30		Bottom of Hole at 28.0'						

Plate I-6
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

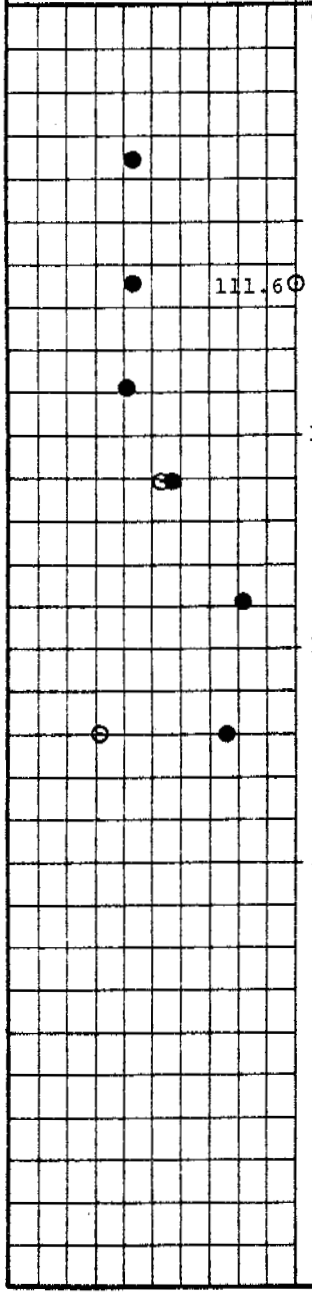
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-10

LOGGED BY: IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 27 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 2:15	FINISH: 4:15
PROJECT NO.: K 3571	ELEVATION: 99.64 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT %
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL		SILT - organic, plant remains, low plastic, mottled, yellow-grey		Vx Vs 15%	W C1			Pilot hole to 0.7'
1.0'	ML		SILT - clayey, trace organics, low plastic, grey		----- <5%	C2			
2.5'	I+		ICE + SILT		Ice+ 65%	C3 C4 C5		C3	
5					Vs Vr 5%				
6.0'	ML		SILT - clayey, trace organics, low plastic, grey		Vx Vr 50%	C6		C6	
					Vx Vs 60%	C7 C8		C8	
10					Vs 30% 10% ----- 2%	C9 C10		C9	
					Nb	C11		C11	
15						C12 C13		C13	
17.4'			1/2" organic layer Vx 3% 17.4'			C14			
						C15			
20			Bottom of Hole at 20.0'						
25									

Plate I-7
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-11

LOGGED BY: IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 26, 27 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 22:55	FINISH: 2:00
PROJECT NO.: K 3571	ELEVATION: 99.97 m	LOCATION: Gathering System	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL	SILT - organic, plant remains, low plastic, light grey	Vx Vr 15%	W C1 C2		C1	Pilot hole to 0.5'
2.0'	ML	SILT - clayey, organic inclusions, low plastic, grey with grey-yellow mottled bands	35%	C3		C3	
4.0'		- grey	50%	C4		C5	
5			Vs 50%	C5			
			30%			C6	
			Vx Vs 50%	C6			
			Vx Vr 70%	C7			
10			Nb	C8 C9		C9	
				C10 C11 C12			
15				C13		C13	
				C14			
19.0'		- thin organic layers, current bedding		C15			
20		Bottom of Hole at 20.0'					
25							

107.3

Plate I-8
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-6

LOGGED BY: RGC/AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: S. D. S.	METHOD: SPT	START: 18:00	FINISH: 21:00
PROJECT NO.: K 3571	ELEVATION: 99.26 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			10.0'						
10	ML		SILT - loose, and fine sand, clayey, low plastic, sensitive to quicking, grey			W			split spoon samples alternated with wash boring
20						S1	S1	S1	N=5
						W			
25									
30						S2	S2	S2	N=8
						W			
35									

Plate I-9
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-6

LOGGED BY: RGC/AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: S. D. S.	METHOD: SPT	START: 18:00	FINISH: 21:00
PROJECT NO.: K 3571	ELEVATION: 99.26 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
35	ML		SILT - loose, and fine sand, sensitive to quicking, low plastic, grey		UF	W			
40			40.0' - medium dense, very sensitive to quicking			S3	S3	S3	N=26
45						W			
50			50.0'						
	SM		SAND - dense, silty, fine grained, grey			S4	S4	S4	N=37
55			55.0'			W			
	ML		SILT - loose, sandy, clayey, occasional 1/16" organic layers, low plastic, grey			S5	S5	S5	N=9
60			60.0'			W			
	SM-ML		SILT and SAND - dense, fine to medium			S6	S6	S6	N=22
			Bottom of Hole at 61.5'						
65									

Plate I-10
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX1-1

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL, WASH	START: 17:00	FINISH: 18:10
PROJECT NO.: K 3571	ELEVATION: 99.42 m	LOCATION: LX1 Lake Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED
0	I	ICE	ICE	W		
2.0'	ML	SILT - some organics to 4.0' depth, low plastic, grey	Vr Vx 50%			
5			Vx 20%	C1		C1
			ICE+			
			Vx	W		
10						
13.0'		- current bedded	Vs 10%	C2		C2
15				W		
18.5'		organic laminations	Vx 5%	C3		
20				C4		
21.0'		- sandy	Nb	C5		
				C6		C6
25				C7		
25.0'	CL	CLAY - silty, low plastic, grey				
26.5'	ML	SILT - trace fine sand, low plastic, grey		C8		
				C9		
30		Bottom of Hole at 30.0'				

OTHER INFORMATION

Plate I-11
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX1-2

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: NORTHLAND	METHOD: WASH	START: 18:20	FINISH: 19:05
PROJECT NO.: K 3571	ELEVATION: 99.42 m	LOCATION: LX1 Lake Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				45' West of LX1-1
			2.0'						
	ML		SILT - ice rich		F				
5						W			
			10.0'						
10			- SILT - ice poor						
			15.0'						
15			Bottom of Hole at 15.0'						
20									

Plate I-12
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX1-3

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: NORTHLAND	METHOD: WASH	START: 19:15	FINISH: 20:00
PROJECT NO.: K 3571	ELEVATION: 99.42 m	LOCATION: LX1 Lake Crossing	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE 2.0'		ICE				45' East of LX1-1
	ML		SILT - ice rich		F				
5									
10						W			
			12.0' - ice poor						
15			16.0'						
			Bottom of Hole at 16.0'						
20									

Plate I-13
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX2-1

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 13:45	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: 99.54 m	LOCATION: LX2 Lake Crossing	

W_p - ⊡ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	0.5' ICE	ICE	W			Pilot hole to 1.5'.
	ML	SILT - trace organic laminations, low plastic, layered, grey and brown	Vs 10%	C1			
				C2			
		4.5'	Vs Vx 50%	C3			
5	I+	ICE + SILT	ICE	C4			
			ICE+ 70%	C5		C5	
				C6			
		8.5'		C7			
	ML	SILT - trace fine sand, low plastic, grey	Vx 40%	C8			
10			Vs 15%	C9			
			30%				
15				W			
		17.0' - some fine sand, slight plasticity, laminated, grey	Nb	C10		C10	
				C11			
20				C12			
				C13			
			Vs 5%	C14		C14	
25			Nb	C15			
				C16			
30		Bottom of Hole at 29.0'					

Plate I-14
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX2-2

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: NORTHLAND	METHOD: AIR, 7 3/8" BIT	START: 16:40	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 99.54 m	LOCATION: LX2 Lake Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		0.5' ICE		ICE				
	ML		SILT - ice rich		F				
5						W			
10			10.0' - ice poor						
			14.0'						
15			Bottom of Hole at 14.0'						

Plate I-15
Sheet 1 of 1

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX2-3

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: NORTHLAND	METHOD: AIR, 7 3/8" BIT	START: 17:15	FINISH: 17:40
PROJECT NO.: K 3571	ELEVATION: 99.54 m	LOCATION: LX2 Lake Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		0.5' ICE		ICE				
	ML		SILT - ice rich		F				
5						W			
10			10.0' - ice poor						
			14.0'						
15			Bottom of Hole at 14.0'						

Plate I-16
Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX2-4

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 10:15	FINISH: 15:00
PROJECT NO.: K 3571	ELEVATION: 99.38 m	LOCATION: LX2 Lake Crossing	

W_p - ⊡ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	0.5' ICE	ICE	W			Pilot hole to 0.5'.
	OL	ORGANIC SILT - low plastic, odourous, grey-brown	F	C1		C1	
		1.7'					
	I+	ICE + SILT	ICE+ 75%	C2			
				C3			
5				C4			
				C5			
		7.5'					
	ML	SILT - low plastic, ice poor	Vs 30%	C6			
		9.0' - brown and grey, porous	Vr Vs 10%	C7		C7	
10			30%	C8			
		11.0' - little fine sand, slight plasticity, porous	Vr 5%	C9		C9	
		12.5' - non porous		C10			
		14.5' - little fine sand, trace of organic laminations, grey	Vr Vs <5%	C11			
15				C12		C12	
				C13		C13	
	SM	SAND - silty, layered, occasional oxidized layers, grey	Vs 10% <5%	C14			
		18.5'					
20				C15			
		22.0'		C16		C16	
	ML	SILT - trace fine sand, trace of organic laminations, to 1/8" thickness, slight plasticity, grey	10%	C17			
			Nb				
			Vs 5%	C18			
25			Nb	C19		C19	
			Vs 10%	C20			
30							

Plate I-17
Sheet 1 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. LX2-4

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 17 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 10:15	FINISH: 15:00
PROJECT NO.: K 3571	ELEVATION: 99.38 m	LOCATION: LX2 Lake Crossing	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPH.: LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, trace fine sand, low plastic, current bedded, grey		Vs 5%	W			
						C21		C21	
					Nb	C22			
35						C23			
			38.7' - occasional organic laminations			C24		C24	
40			41.0'		Vs <5%	C25			
			Bottom of Hole at 41.0'						
45									

Plate I-18
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

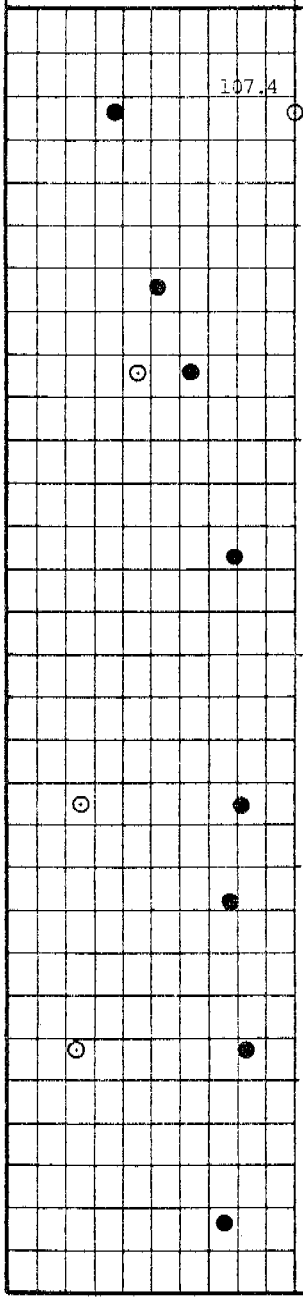
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-7

LOGGED BY: AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 2 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 9:00	FINISH: 11:00
PROJECT NO.: K 3571	ELEVATION: 99.53 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, organic layering, low plastic, dark Brown		Vs 70%	W C1		C1	Pilot hole to 1.0'
						C2			
5			5.0' - non-laminar, light brown		Vr Vs 40%	C3		C3	
					Vs 20%	C4			
						C5		C5	
10					Vr Vs 10%	C6			
						C7			
					Vs <5%	C8		C8	
			13.5' - sandy, non-laminar, grey			C9			
15									
					Nb	C10		C10	
						C11			
20			two 1/6" ice lenses 21.0'			C12		C12	
						C13			
						C14		C14	
25			two 1/16" ice lenses 26.2'			C15			
						C16		C16	
30			Bottom of Hole at 30.5'			C17			

Plate I-19
Sheet 1 of 1

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-8

LOGGED BY: AN	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 3 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:30	FINISH: 18:00
PROJECT NO.: K 3571	ELEVATION: 99.57 m	LOCATION: Gathering System	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

102.3

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, non-laminar, low plastic, brown		Vs 50%	W			Pilot hole to 1.0'
						C1		C1	
			2" lens of Vs 90% 2.8'						
						C2			
			1" lens of Vs 90% 4.2'			C3			
5					Vx Vs 10%	C4		C4	
						C5			
			occasional 1/2" lens Vs 50%						
						C6		C6	
10					Vs 5%	C7			
			11.7' layers of organics, black		20%	C8		C8	
					5%	C9			
15									
			17.0'			C10			
			- grey with brown sand and oxidized organic layers		<5%				
						C11		C11	
20			Bottom of Hole at 20.0'						
25									

Plate I-20
Sheet 1 of 1

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-L2

LOGGED BY: IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 23, 24 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 21:50	FINISH: 0:45
PROJECT NO.: K 3571	ELEVATION: 99.62 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	Pt		0.5' PEAT - moss and roots		Nf	C1		C1	
	ML		SILT - clayey, occasional wood chips, low plastic, organic, brown-grey		Vs 20%				
			2.0' - no organics, grey		30%	C2			
					50%	C3			
5					60%	C4		C4	
						C5			
					70%	C6			
						C7		C7	
			8.5' 1" layer Vs 15%		5%	C8			
					3%	C9 C10			
10			11.5' - organics and wood chips, current bedding		1%	C11		C11	
			12.8' - mottled with oxidized spots		Nb	C12			
						C13		C13	
15						W			13.8'-16.0' core not recovered by core barrel, hole reamed out by air blasting
						C14		C14	
						C15			
20			20.0' - some organics in 1/2" layers			C16			
			Bottom of Hole at 21.5'						
25									

Plate I-21
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TEST HOLE LOG

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GEOTECHNICAL DIVISION

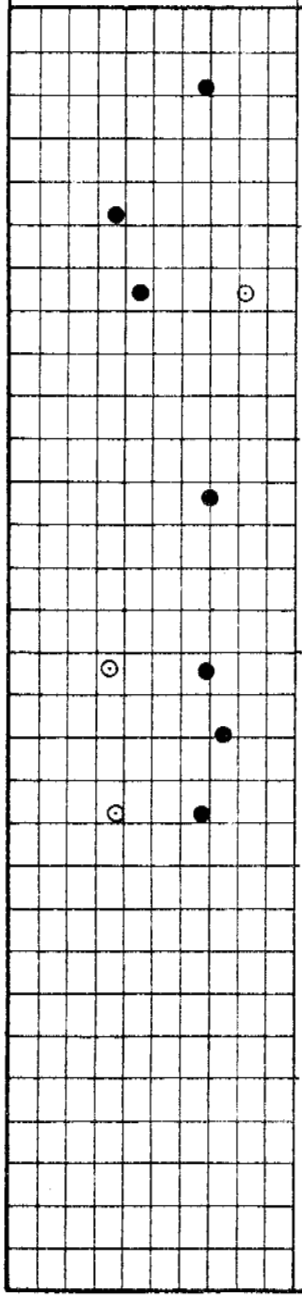
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-13

LOGGED BY: IGJ	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 23 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:30	FINISH: 21:30
PROJECT NO.: K 3571	ELEVATION: 99.59 m	LOCATION: Gathering System	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL		ORGANIC SILT - low plastic, dark brown			C1			
			2.3'			C2		C2	
	ML		SILT - trace fine sand to 2.7' depth, low plastic, yellow-brown			C3			
			4.2' - wood chips and organic inclusions			C4			
5			6.0' ice lenses to 1/16" - brown-grey			C5		C5	
						C6		C6	
			8.5' - mottled, rusty 1/2" lenses Vs 50%		Vs 8.8'	C8			
10						C9		C9	
			12.0' - current bedding, grey with brown layers		Vs <5%	C10			
						C11			
15						C12		C12	
			16.3' - clayey, trace organics			W C13		C13	
			18.0' - little organics in 1/2" layers		Nb Vs <5%	C14 C15		C14	
20			Bottom of Hole at 20.7'						
25									

Plate I-22
Sheet 1 of 1

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-14-A

LOGGED BY: AH	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 9:00	FINISH: 9:30
PROJECT NO.: K 3571	ELEVATION: 107.32 m	LOCATION: Gathering System	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I+		ICE + SILT (TILL-like) - sandy, trace gravel, gravel layer at 2.5', low plastic, brown		Ice+	W C1 C2		C1	Pilot hole to 0.5'
			Bottom of Hole at 2.5'						unable to penetrate gravel layer with CRREL techniques
5									

Plate I-23
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-14-B

LOGGED BY: GNL/JF	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: AIR BLAST	START: 23:15	FINISH: 23:40
PROJECT NO.: K 3571	ELEVATION: 107.32 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED
0	I+	ICE+ + SILT (TILL-like)	ICE +	W1		W1
2.0'	ML	SILT (TILL-like) - clayey, some sand, trace gravel to 1/4" size, low plastic	V 60%	W2		W2
5				W3		W3
10			45%	W4		W4
14.0'	SM	SAND (TILL-like) - silty, trace gravel	20%	W5		W5
15				W6		
16.0'	CL-CI	CLAY (TILL-like) - silty, gravel to 1/2" size, low to medium plastic, black		W7		W7
20				W8		W8
25			N	W9		
30				W10		W10

113.5

OTHER INFORMATION

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TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. CS-14-B

LOGGED BY: GNL/JF	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: AIR BLAST	START: 23:15	FINISH: 23:40
PROJECT NO.: K 3571	ELEVATION: 107.32 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	CL-CI		CLAY (TILL-like) - silty, gravel to 1/2" size, low to medium plastic, black		N	W11		W11	
						W12			
35						W13		W13	
						W14			
40						W15			
						W16			
45			Bottom of Hole at 47.5'						
50									

Plate I-25
Sheet 2 of 2

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-15

LOGGED BY: GNL/JF	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: NORTHLAND	METHOD: AIR BLAST	START: 2:45	FINISH: 3:00
PROJECT NO.: K 3571	ELEVATION: 99.00 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, low plastic	V 30%	W			
5		5.3' (TILL-like) - clayey, trace gravel, low plastic		W1	W1	W1	
		8.2'		W			
10	CL	CLAY (TILL-like) - silty, gravel to 1/2" size, low plastic		W2	W2	W2	
				W			
				W3	W3	W3	
				W			
15				W4	W4	W4	
		16.0'		W			
	CL-CI	CLAY (TILL-like) - low to medium plastic		W5	W5	W5	
				W			
20				W6	W6	W6	
				W			
				W7	W7	W7	
25				W			
				W8	W8	W8	
				W			
		Bottom of Hole at 30.0'		W9	W9	W9	

Plate I-26
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-16

LOGGED BY: CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 7 March 1977
RIG: NORTHLAND	METHOD: 3" CRREL	START: 9:30	FINISH: 13:50
PROJECT NO.: K 3571	ELEVATION: 99.22 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, low plastic, brown		Vx Vr Vs 20%	W			Pilot hole to 1.2'
						C1		C1	
					Vr Vs 50%				
			3.7'						
			2" lens Vs 70%		20%	C2		C2	
					30%				
5					Vs 50%	C3			
					15%				
					60%	C4		C4	
					40%				
					Vr Vs 50%	C5			
						C6		C6	
10						C7			
					Vs <5%			C7	
					Vr Vs 40%	C8		C8	
			15.0' - little fine sand, grey brown			C9			
					Vs <5%				
					Vr Vs 5%	C10		C10	
			18.0'						
15	SM		SAND - silty, laminated, grey		Vr 20%	C11		C11	
			20.5' gravel layer 21.0'			C12			
	CL		CLAY (TILL-like) - silty, trace sand, trace gravel to 1 1/4" size, very well bonded, medium plastic, grey			W			hit gravel at 20.5' drilled to 22.0' with rock bit
						C13		C13	
20						C14			
						C15		C15	
						C16			
25									
						C17		C17	
30			Bottom of Hole at 30.0'						

Plate I-27
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-17

LOGGED BY: CPM	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 7 March 1977
RIG: NORTHLAND	METHOD: 3" CRREL	START: 13:55	FINISH: 17:40
PROJECT NO.: K 3571	ELEVATION: 99.51 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED
0	ML	SILT - trace fine sand, low plastic, grey	Vr Vs 25%	C1		C1
			Ice+			C1
		3.0' trace organics, wood chips	Vr Vs 60%	C2		
			Ice+			
			Vr Vs 70%			
5		ice lenses to 1/2" thickness	Ice+	C3		C3
		5.5'	Vr Vs 50%			
	I+	ICE + SILT 7.0'	Ice+ 80%	C4		C4
	CL	CLAY - silty, low plastic, brown	Vr Vs 50%	C5		C5
10				C6		
			30%	C7		
			Vs 40%			C8
		13.5' 3" lens Vx Vr Vs 50% 12.8'		C8		
	ML	SILT - trace fine sand, low plastic, brown	10%	C9		
15		15.5' - trace organics, laminated	Nb	C10		C10
			Vs <5%	C11		
				C12		C12
20		20.0' - some sand, trace organics, laminated, grey-brown	Vs 5%	C13		C13
		21.7' 3" organic layer		C14		
		22.0' gravel layer		W		
		22.5'		C15		C15
	CI	CLAY (TILL-like) - silty, trace sand, trace gravel, medium plastic, very well bonded, grey	Vr Vs 20%	C16		C16
25				C17		
				C18		C18
30		Bottom of Hole at 30.0'				

OTHER INFORMATION

Plate I-28
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TEST HOLE LOG

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GEOTECHNICAL DIVISION

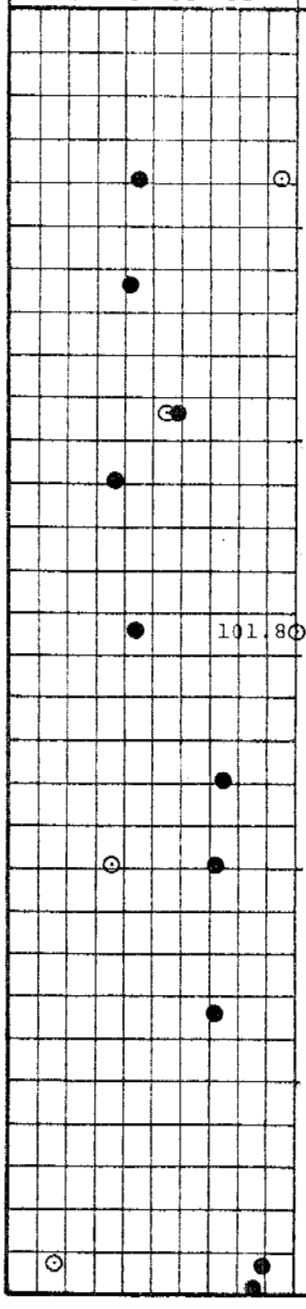
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-18

LOGGED BY: GCD	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 7, 8 March 1977
RIG: NORTHLAND	METHOD: 3" CRREL	START: 18:10	FINISH: 2:00
PROJECT NO.: K 3571	ELEVATION: 99.44 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE + SILT - grey		Ice+ 70%	W			Pilot hole to 1.0'
					C1		C1	Microscopic examination
					C2		C2	
5					C3			
	ML	SILT - low plastic, grey		Vs 50%	C4		C4	
		ice and soil in fine layers		40%	C5			
				50%				
		8.5' - grey and brown laminations to 1" thickness		40%	C6		C6	
10					C7			
		10.5' - grey, with orange oxidized mottling			C8		C8	
				35%	C9			
					C10			
				Ice+ 70%	C11		C11	
15				Vr 5%	C12			
					W			
				Vr Vs 5%	C13		C13	
		1/16" Vs per 2"-3"		Vs <5%	C14			
		19.5' - current bedding			C15		C15	
20								
		21.0' - trace fine sand		Nbn	C16			
		22.5' - no sand			C17		C17	
		24.0' gravel to 1/2", angular, 24.5' organic layers			C18 C19			
25	CI	CLAY (TILL-like) - silty, medium plastic, grey		Vr 30%				core not coming up in barrel, reamed out hole
		27.5'						
	ML	SILT (TILL-like) - little fine sand, low plastic, grey			C20		C20	
30		Bottom of Hole at 30.7'			C21		C21	

Plate I-29
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

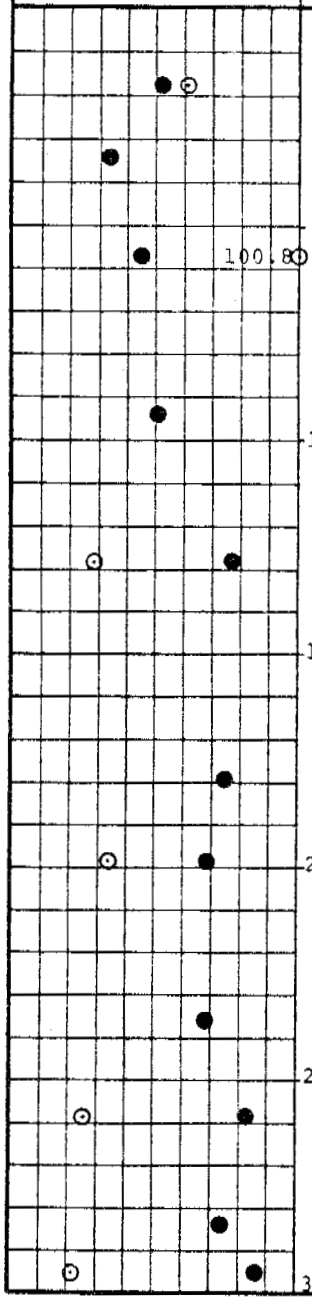
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-19

LOGGED BY: GCD	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: NORTHLAND	METHOD: 3" CRREL	START: 2:10	FINISH: 5:00
PROJECT NO.: K 3571	ELEVATION: 99.20 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	OL		SILT - organic, roots, brown		Vr 15%	W			Pilot hole to 1.0'
			1.7'			C1		C1	
	I+		ICE + SILT		Ice+ 80%	C2		C2	
			4.0'						
	ML		SILT - low plastic, orange-brown, oxidized mottling		Vr Vs 30%	C3			
5					Ice+ 60%	C4		C4	
			1/16" lenses with occasional lens to 1/2" thickness		Vr Vs 50%	C5			
			8.5' - clayey, grey			C6		C6	
10					30%				
			11.0' - current bedding		15% Nbn	C7			
						C8		C8	
			13.5' - orange mottling		Vs <5%	C9			
			14.0' - grey 1/32" Vs lenses every 3"			C10			hole reamed down to 17.0' for next section of rod
15						W			
			17.0' - trace fine organic layers to 3/8" thickness		5%	C11		C11	
						C12		C12	
			19.0' - no organics			C13			
20						C14		C14	
					Nbn	C15			
			25.0' - trace fine sand			C16		C16	
			26.5' - little fine sand			C17			
						C18		C18	Bottom of Hole at 30.5'
			28.7' 1/2" organic layer						
30			29.0' SILT (TILL-like) - clayey, little sand, trace gravel to 2" size		Vr Vs 30%	C19		C19	Plate I-30 Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-20

LOGGED BY: GNL/JF	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 19:47	FINISH: 22:55
PROJECT NO.: K 3571	ELEVATION: 99.71 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	Pt	PEAT	Vr 5%	W C1			Pilot hole to 1.0'
		1.5'		C2		C2	
	ML	SILT - clayey, trace sand, low plastic, dark grey	Vr Vs 40%	C3			
5				C4			
		7.0'		C5			
	CL-CI	CLAY - silty, fossil and wood chips, low to medium plastic	Nbe	C6		C6	
				C7			
10		10.5'	Vr Vs 5%	C8			
	CL	CLAY - very silty, low plastic, dark grey	Nbe Vs <5%	C9			
		13.0'		C10			
	ML	SILT - clayey, low plastic, dark grey	Vr Vs 70%	C11			
15				C12		C12	
		16.0' - some sand		C13			
		18.0' organic layers, woody	Vr 5%	C14			
		19.0' sandy layer		C15			
20		20.0' - clayey	Vr Vs 35%	C16			
			Vs 5%	C17		C17	
		23.0' - sandy, clayey, organic layers to 1/4" thick, woody	Vx 2%	C18			
25			Nf	C19			
			Vx 5%	C20		C20	
30		hit gravel at 29.5' depth		C21			
		Bottom of hole at 29.5'					

Plate I-31
Sheet 1 of 1

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

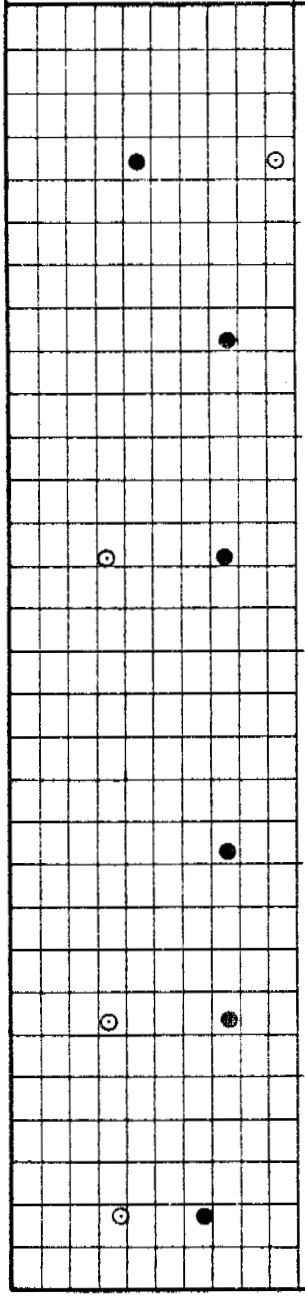
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. GS-21

LOGGED BY: GNL/JF	DRAWN BY: GD/PD	CHECKED: AJH	DATE: 8, 9 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 22:45	FINISH: 2:49
PROJECT NO.: K 3571	ELEVATION: 99.62 m	LOCATION: Gathering System	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	Pt	PEAT - fibrous, woody, brown		Vr Vs 50%	W C1 C2 C3 C4 C5 C6		C4	Pilot hole to 1.0'
		1.5'						
	ML	SILT - sandy, low plastic, dark green						
		2.5' - organic inclusions, wood chips		Vr 60%				
5		5.2' - organics - branches vertical ice to 1/10" thick		Vr Vs 10%	C7			
				Vr 5%	C8			
				Vx 2%	C9		C9	
		vertical and horizontal ice lenses		Vr Vs 8%	C10 C11			
10		ice lenses to 1/4" thick		Vs 5%	C12			
		12.1' trace (two pieces) coarse sand to 1/8" size		Vs Vr 20%	C13 C14		C13	
15				10%	C15			
				Vx 2%	C16			
				Nb	C17			
		19.4' 2" diameter pocket of peat					C18	
20		1/16" Vx inclusion 21.2'			C18 C19 C20			
		23.3' - peat inclusion, woody		Vx 5%	C21		C21	
				Nb 2%	C22 C23 C24			
25		25.8' and sand 26.8' - peat layers to 1/4" thick, woody		Vx Vc 8%	C25		C26	
					C26 C27			
30		Bottom of Hole at 29.7'						

Plate I-32
Sheet 1 of 1

APPENDIX "J"

KUMAK CHANNEL CROSSING

SECTION J.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE J-1

Test Hole Locations and Elevations
Kumak Crossing

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
KXW-1	7 689 054.45	489 218.57	2.109	99.853
KXW-2	7 689 070.66	489 145.35	1.792	99.536
KXC-1	7 689 050.05	489 232.89	1.262	99.006
KXC-2	7 689 045.69	489 247.23	0.860	98.604
KXC-3	7 689 036.97	489 275.92	1.067	98.811
KXC-4	7 689 028.29	489 304.64	1.149	98.893
KXC-5	7 689 004.08	489 384.31	1.128	98.872
KXC-6	7 688 979.87	489 463.98	1.158	98.902
KXC-7	7 688 955.66	489 543.65	1.164	98.908
KXC-8	7 688 931.45	489 623.32	1.134	98.878
KXC-9	7 688 907.23	489 702.99	1.177	98.921
KXC-10	7 688 883.02	489 782.66	0.765	98.509
KXC-11	7 688 874.30	489 811.35	0.869	98.613
KXC-12	7 688 865.58	489 840.04	1.039	98.783
KXC-13	7 688 945.12	489 826.16	0.951	98.695
KXC-14	7 688 938.93	489 855.50	0.930	98.674
KXC-15	7 688 798.41	489 795.22	0.799	98.543
KXC-16	7 688 792.22	489 824.57	0.954	98.698
KXE-1	7 688 856.86	489 868.73	0.988	98.732
KXE-2	7 688 848.14	489 897.42	1.256	99.000
KXE-3	7 688 842.33	489 916.55	1.622	99.366
KXE-4	7 688 932.74	489 884.85	1.012	98.756
KXE-5	7 688 739.72	489 782.85	0.994	98.738

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "J"

SECTION J.2 TEST HOLE LOGS

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXW-1

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 17:30	FINISH: 18:30
PROJECT NO.: K 3571	ELEVATION: 99.85 m	LOCATION: West Kumak Crossing	

W_p - ⊡ W - ○ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace organics in cracks and fissures, low plastic, layered, brown		15%	C1			4" CRREL to 4.0'
					VR 5%	C2			
						C3			
			4.0' - rootlets			C4			Changed to Dynamic Cone
5					UF				
			9.5'						Assumed frozen at 8.5' depth
10			Bottom of Hole at 9.5'						See KXW-1B, located 5.0' east.

Plate J-1
Sheet 1 of 1

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXW-1A

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 19:55	FINISH: 20:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: West Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - ▲
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, some organics, low plastic, rust specks, porous, grey		Vr Vx <5%	C1		CT	4" CRREL to 3.1'
						C2			Changed to Dynamic Cone
5					UF				
					F				Assumed frozen at 5.5' depth
			7.5'						
			Bottom of Hole at 7.5'						Located 25.0' west of KXW-1.
10									

Plate J-2
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXW-1B

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: VTM	START: 21:15	FINISH: 23:35
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: West Kumak Crossing	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace of organics, low plastic, layered, brown		Vs,Vx 15%				Wash bored to 9.0'
					Vr Vs 5%				
5					UF	W			
			9.0'		F				Assumed frozen at 8.5' depth Changed to VTM
10			- clayey, grey		Vs <5%	C1		C1	
			14.0'						
15			- sandy 15.0'		Nb	C2		C2	
			16.0' - current bedded						
			19.0'						
20	SM ML		SAND AND SILT - alternating 1' layers of medium grained, silty, grey sand and low plastic, clayey, grey silt			C3		C3	
25					Vs 5%				
					Nb	C4		C4	
					Vs15%				
			28.9'		Nb				
30	CI		CLAY - silty, some organics, medium plastic, grey			C5			

Plate J-3
Sheet 1 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXW-1B

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 8 March 1977
RIG: S. D. S.	METHOD: VTM	START: 21:15	FINISH: 23:35
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: West Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, low plastic, current bedded, grey		Nb	C5		C5	
			35.0' - sandy, fine grained					C6	
35			38.0' - trace sand			C6			
			39.3' - organic layer						
40			Bottom of Hole at 39.5'						Located 5.0' east of KXW-1.

Plate J-4
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXW-1C

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 1:00	FINISH: 1:35
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: West Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey-brown, rust stains		Vs <5% 35% 20% 70% <5%	C1 C2		C1	4" CRREL to 3.0' Thaw Consolidation Test - See Plate J-39 Changed to Dynamic Cone
			2.0' - less clay		UF				
5									
10									
			14.0'		F				Assumed frozen at 13.8' depth
15			Bottom of Hole at 14.0'						Located 25.0' east of KXW-1.

Plate J-5
Sheet 1 of 1

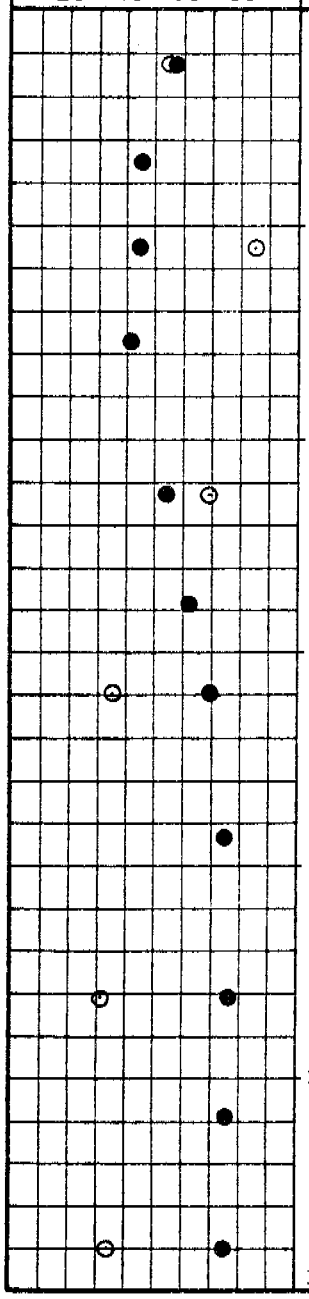
TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXW-2

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 24 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:20	FINISH: 15:30
PROJECT NO.: K 3571	ELEVATION: 99.54 m	LOCATION: West Kumak Crossing	



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, organics to 1.3' depth, low plastic, laminated, grey		Vs 50%	W			Pilot hole to 0.8'
					Vr Vs 5%	C1		C1	
					10%	C2		C2	
			4.4'			C3			
			1" ice lenses 4.6' 5.3'						
			5.8'			C4		C4	
			7.2'			C5			
			1 1/2" ice lenses			C6		C6	
			9.0'			C7			
			1 1/2" ice lens						
			10.5'			C8			
			ice lenses to 1/4" thickness		0%			C8	
			12.5'			C9			
			- sandy, fine grained, trace organic laminations, low plastic, current bedded, grey		10%	C10		C10	
						C11			
								C12	
					5%	C12			
						C13			
						C14		C14	
					Vr <5%	C15			
					Nb	C16		C16	
						C17			
						C18		C18	
			26.7'			C19			
			- 1/2" sand layer			C20		C20	
						C21			

Plate J-6
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXW-2

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 24 February 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:20	FINISH: 15:30
PROJECT NO.: K 3571	ELEVATION: 99.54 m	LOCATION: West Kumak Crossing	

W_p - ▫ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, trace organic laminations, low plastic, current bedded, grey		Nb	C21			
						C22		C22	
			33.0' - roots			C23			
35						C24		C24	
			35.5' - trace fine sand, current bedded		Vs 5%	C25			
					Vr Vs 10%	C26		C26	
40			40.8'			C27			
			Bottom of Hole at 40.8'						
45									

Plate J-7
Sheet 2 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-1

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 15 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 19:50	FINISH: 23:25
PROJECT NO.: K 3571	ELEVATION: 99.01 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ○ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, slight plasticity, ice to 3" depth	ICE	Vf Vs 60%	C1		C1	4" CRREL
		2.6' - wood inclusions		Vs 20%	C2		C2	
		4.0' - sandy		10% Nb				Changed to Dynamic Cone
		5.5' - clayey, slight plasticity		UF	W			Changed to VTM
▲▲ (for 0.4 ft.				Nf				
				Vs<5% Nf	C3		C3	
				Vs 5%				
10				Nf				
					C4		C4	
15							C5A	
		18.0' - and sand, non plastic, grey		Nb	C5		C5B	
		19.7' - wood inclusion						
20		20.0' - sandy, trace organic laminations to 1/16" thickness, slight plasticity, grey-brown		Vx 5% Nb	C6		C6	
25							C7A	
		27.0' - clayey, low plastic		Vs 5%	C7			
				Nb			C7B	
30		Bottom of Hole at 30.0'						

Plate J-8
Sheet 1 of 1

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-2A

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 15 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 13:00	FINISH: 18:50
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE 1.0'		ICE	W			Pilot hole to 1.0' 4" CRREL
	ML	SILT - and fine sand, non to low plastic, grey		Nb	C1			
					C2		C2	
					C3			
5		5.5' - current bedding		Vs 5%				Changed to VTM
				Nb	C4		C4	
10				Vs 5%				
		11.0' 1/2" ice lens		Nb				
		12.5' 1/4" ice lens			C5		C5	
15		16.0' - organic lens 1/16" thick brown			C6		C6	
20					C7		C7	
25		26.5' - organic lens, brown			C8			
30								

Plate J-9
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-2A

LOGGED BY: RGC	DRAWN BY: CPM/DD	CHECKED: AJH	DATE: 15 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 13:00	FINISH: 18:50
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and fine sand, trace of organic laminations, non to low plastic, grey		Nb	C9		C9	
35								C10	
			38.0'			C10			
	SM		SAND - and silt, fine grained, trace organics, current bedded, grey						
40			42.3' 2" unfrozen			C11			
			44.0'						
	CL		CLAY (TILL-like) - firm, silty, trace of gravel and sand, low plastic, grey		UF				Changed to Wash Boring
45						W			
50						S12	S12		Changed to Split-spoon N=27
			51.5'						
			Bottom of Hole at 51.5'						Located 50.0' east of KXC-2.
55									

Plate I-10
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-3

LOGGED BY: GNL/RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 15 March 1977
RIG: S. D. S.	METHOD: CRREL, SPT WASH	START: 5:45	FINISH: 11:30
PROJECT NO.: K 3571	ELEVATION: 98.81 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	C1			
			2.5'		ICE+				
	ML		SILT - clayey, sandy, low plastic, grey		Vr Vs 35%	C2		C2	
5						C3		C3	Thaw Consolidation Test - See Plate
			6.9'		Vr 25% 50%	C4		C4	Changed to wash boring and SPT
			- very loose, clayey, some sand, low plastic, grey		UF	W			
						S5		S5	N=3
10						W			
15						S6		S6	N=5
						W			
20			20.0'			S7		S7	N=3
			- and fine sand, very loose, quick dilatancy, non plastic, grey			W			
25						S8		S8	N=1
						W			
30									

Plate J-11
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-3

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 15 March 1977
RIG: S. D. S.	METHOD: CRREL, SPT WASH	START: 5:45	FINISH: 11:30
PROJECT NO.: K 3571	ELEVATION: 98.81 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - and fine sand, very loose, fine grained, non plastic, quick dialtancy, grey		UF	S9		S9	N=4
						W			
35						S10		S10	N=5
						W			
40						S11		S11	N=6
						W			
45			45.0'						
	CL		CLAY (TILL-like) - firm, silty, trace fine gravel and sand, low plastic, grey			S12		S12	N=23
						W			
50						S13		S13	N=32
			51.5'						
			Bottom of Hole at 51.5'						
55									

Plate J-12
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-4

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, SPT WASH	START: 1:45	FINISH: 5:30
PROJECT NO.: K 3571	ELEVATION: 98.89 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
5			5.0'						
	W		WATER		UF				
10									
15									
20			20.0'						
	ML		SILT - clayey, trace fine sand, low plastic, grey			U1			Changed to wash boring and SPT
						W			
25			26.0'			S2	S2		N=1
			- very loose, sandy, non plastic			W			
30									

Plate J-13
Sheet 1 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-4

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: WASH, 4" CRREL SPT	START: 1:45	FINISH: 5:30
PROJECT NO.: K 3571	ELEVATION: 98.89 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	SM		SAND - loose, silty, fine grained, non plastic, grey		UF	S3		S3	N=7
						W			
35						S4		S4	N=8
						W			
40			40.0' - medium dense			S5		S5	N=16
						W			
45			45.3'						
	CI		CLAY (TILL-like) - very stiff, some sand, some gravel to 1" size, medium plastic, dark grey			S6		S6	N=35
			49.0' - gravel			W			
50						S7		S7	N=37
						W			
55						S8		S8	N=44
			56.5'						
60			Bottom of Hole at 56.5'						

Plate J-14
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-5

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: 4" CRREL 4" SHELBY	START: 6:00	FINISH: 6:50
PROJECT NO.: K 3571	ELEVATION: 98.87 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.0'						
5	W		WATER		UF				
35									
40			42.0'						
	CI		CLAY (TILL-like) - trace of sand, medium plastic, dark grey			U1		U1	
			43.5'						
45			Bottom of Hole at 43.5'						

Plate J-15
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-6

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: SPT, WASH	START: 8:00	FINISH: 10:25
PROJECT NO.: K 3571	ELEVATION: 98.90 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
10									
35									
			36.5'						
	CI		CLAY (TILL-like) - stiff to very stiff, trace fine to coarse sand, trace gravel to 1.5" size, medium plastic, grey			W			
⊙ 40						S1	S1	S1	N=13
						W			
⊙ 45						S2	S2	S2	N=18
			45.0'						
			Bottom of Hole at 45.0'						
50									

Plate J-16
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-7

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: SPT, WASH 4" SHELBY	START: 10:45	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: 98.81 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE		ICE				
		4.5'						
5	W	WATER		UF				
30		33.0'						
	CL	CLAY (TILL-like) - soft, sandy, trace of gravel to 2" size, trace of organic laminations, low plastic, grey			U1		U1	P.P.=1.7 TSF
35					W			
					U2			
40								Changed to wash boring and SPT
					W			
		43.0' - very stiff			S3			N=24
45		45.5'			W			
		Bottom of Hole at 45.5'						
50								

Plate J-17
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-8

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, WASH	START: 16:00	FINISH: 22:40
PROJECT NO.: K 3571	ELEVATION: 98.88 m	LOCATION: Kumak Crossing	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
10									
20									
			22.0'						
	ML		SILT - very loose, trace fine sand, low plastic, grey			U1			
25						U2			
						U3	U3		Piston sampler pushed between Shelby tube samples
30						U4	U4		Changed to wash boring between Shelby tube samples
						W			
35									

Plate J-18
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-8

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: S. D. S.	METHOD: 4" SHELBY, WASH	START: 16:00	FINISH: 22:40
PROJECT NO.: K 3571	ELEVATION: 98.88 m	LOCATION: Kumak Crossing	

W_p - □ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
35	ML	SILT - clayey, low plastic, grey	UF	U5	U5	U5	
				W			
40		40.5'					
	CI	CLAY - silty, medium plastic, grey		U6	U6	U6	P.P.=1.0 TSF
				W			
45		45.0'					
	SM	SAND - silty, non plastic, grey		U7	U7	U7	P.P.=1.0 TSF
				W			
50		50.0' - 6" CLAY layer, medium plastic		U8	U8	U8	
				W			
55				U9	U9	U9	
		56.0'					
	GP	GRAVEL - some sand					
		57.0'					
	CI	CLAY (TILL-like) - assumed		W			
60		60.0'					
		Bottom of Hole at 60.0'					
65							

Plate J-19
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-9

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9, 10 March 1977
RIG: S. D. S.	METHOD: WASH, 4" SHELBY	START: 23:00	FINISH: 3:00
PROJECT NO.: K 3571	ELEVATION: 98.92 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.5'						
5	W		WATER		UF				
			6.5'						
	ML		SILT - clayey, some organics to 10.0' depth, low plastic, grey			U1		U1	Piston sampler pushed between Shelby tube samples
10						U2		U2	
15						U3		U3	Changed to wash boring between Shelby tube samples
						W			
20			20.0' - trace fine sand			U4		U4	
						W			
25			25.0' - clayey, low plastic, grey			U5		U5	
						W			
30									

Plate J-20
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-9

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9, 10 March 1977
RIG: S. D. S.	METHOD: WASH, 4" SHELBY	START: 23:00	FINISH: 3:00
PROJECT NO.: K 3571	ELEVATION: 98.92 m	LOCATION: Kumak Crossing	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	CL		CLAY (TILL-like) - hard, little sand, little gravel, low plastic, grey		UF	U6			
						W			
⊙			33.5'			S7		S7	N = 50
			Bottom of Hole at 33.5'						
35									
40									

Plate J-21
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-10

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 3:20	FINISH: 9:30
PROJECT NO.: K 3571	ELEVATION: 98.51 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE / VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey		ICE Nb	C1		C1	4" CRREL
			2.9' - sandy		Vs 5%	C2			At 3.1', lost teeth moved hole 5.0' west of KXC-10A.
5					60%	C3			
			6.6' - slight current bedding		50% 10% 35% 10%	C4		C4	Changed to VTM at 7.5' At 8.3', lost Pit Seal, moved east 10.0' KXC-10B.
10					35% 10%	C5		C5	
					25% 50% 25%	C6			
15					Nb Vs 15%				
					5%	C7		C7	
20			23.0'						
	CL		CLAY (TILL-like) - very dense, trace fine to coarse sand occasional gravel to 1.0" size, low plastic, grey		Vr Vs 15%	C8		C8	
25						C9		C9	
30									

Plate J-22
Sheet 1 of 2

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-10

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 3:20	FINISH: 9:30
PROJECT NO.: K 3571	ELEVATION: 98.51 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	CL		CLAY (TILL-like) - very dense, trace fine to coarse sand, occasional gravel to 1.0" size, low plastic, grey		Vr Vs 10%	C9		C9	
						C10		C10 C10	
35									
						C11		C11 C11	
40			40.2' - gravel 40.5'						
			Bottom of Hole at 40.5'						
45									

Plate J-23
Sheet 2 of 2

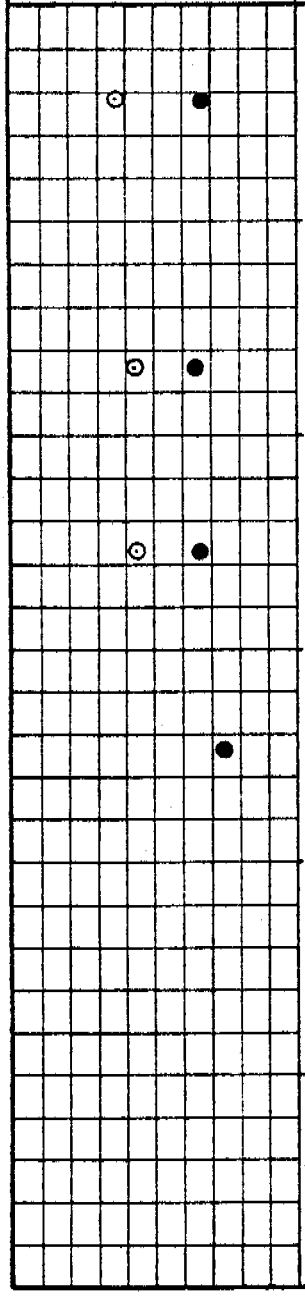
TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-11

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: S. D. S.	METHOD: VTM, 4" CRREL	START: 10:00	FINISH: 18:30
PROJECT NO.: K 3571	ELEVATION: 98.61 m	LOCATION: Kumak Crossing	



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		0.2' ICE		ICE				4" CRREL
	ML		SILT - clayey, trace fine sand, low plastic, current bedded, grey		Vr Vs 10%	W C1		C1	
					Vs 10%	C2 W			Changed to VTM
4.5'			3/4" ice lenses		50%				
5					30%	C3			
					Vx Vs 20%			C3	
					Vs 5%				
10					10%	C4			
					20%			C4	
					5%				
					20%				
					5%				
15						C5			
								C5	
18.0'									
	GP		GRAVEL - sandy						
19.0'									
20	CI		CLAY (TILL-like) - trace gravel to 1" size, trace fine to coarse sand, medium plastic, grey		20%	C6			
25						W			
30									

Plate J-24
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-11

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: S. D. S.	METHOD: VTM, 4" CRREL	START: 10:00	FINISH: 18:30
PROJECT NO.: K 3571	ELEVATION: 98.61 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	CI		CLAY (TILL-like) - trace gravel to 1" size, trace fine to coarse sand, medium plastic, grey		Vs Vr 10%	W			
					Vs < 5%	C7		C7	
35			36.6' 1/8" ice lenses			C8		C8	
			39.0'						
40			Bottom of Hole at 39.0'						

Plate J-25
Sheet 2 of 2

TEST HOLE LOG

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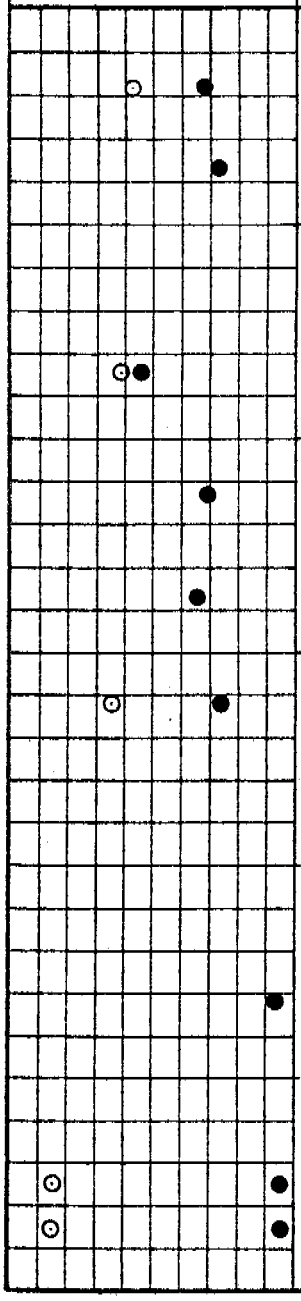
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-12

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:45	FINISH: 21:50
PROJECT NO.: K 3571	ELEVATION: 98.78 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY(pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	0.5' ICE		ICE	W			Pilot hole to 0.7' 4" CRREL
	ML	SILT - trace fine sand, low plastic, grey		Vr Vs 15%	C1		C1	
		3.7'			C2			
	SM	SAND - silty, non plastic, brown		Vx Vs <5%	C3		C3	
5		6.0'			C4			
	ML	SILT - trace fine sand, low plastic, grey		Vs 25%	C5			
				Vr Vs 40%	C6			
					C7		C7	
				15%	C8			
10					C9			
				30%	C10		C10	
					C11			
		13.5'		Vs Vx 10%	C12		C12	
	SM	SAND - fine grained, rust colored 14.2'			C13			
	ML	SILT - trace fine sand, low plastic, grey 15.3'		Vr 35%	C14		C14	Hit gravel at 15.3' depth. Could not drill through. Moved 7.0' west, blew down to 17.5' depth and continued coring.
15	GP	GRAVEL - sandy			W			
		17.5'			C15		C15	
	CI	CLAY (TILL-like) - silty, trace gravel, medium plastic, grey			C16			
				50%	C17		C17	
20					C18		C18	
					C19		C19	
		25.0'			C20		C20	
	I+	ICE + CLAY		ICE+ 70%	C21			
		27.0'						
25	CI	CLAY (TILL-like) - silty, trace gravel, medium plastic, grey		Vr 30%				
30								

Plate J-26
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-12

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6 March 1977
RIG: NOTTHLAND	METHOD: 4" CRREL	START: 16:45	FINISH: 21:50
PROJECT NO.: K 3571	ELEVATION: 98.78 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	CI		CLAY (TILL-like) - silty, trace gravel, medium plastic, grey		Vr 35%	C21			
						C22			
			34.0' - trace fine to coarse sand		Vr Vs 45%	C23		C23	
35						C24		C24	
				+	Vx 50%				
					Vr Vs 30%	C25		C25	
40			40.3'			C26		C26	
			Bottom of Hole at 40.3'						
45									

Plate J-27
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

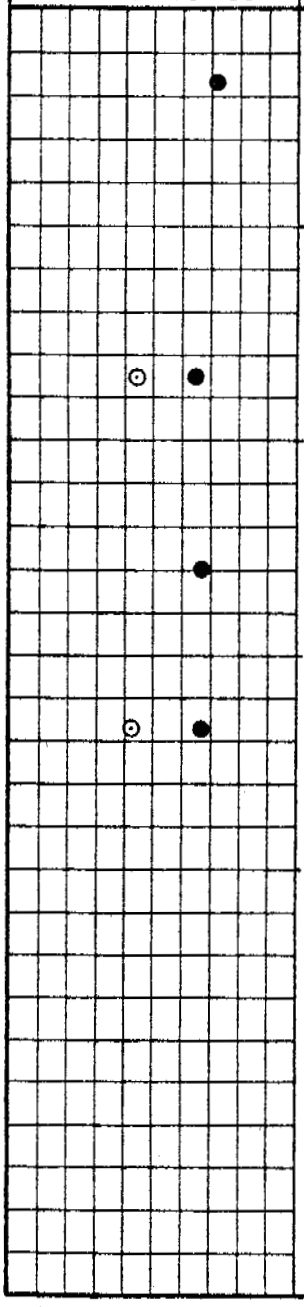
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-13

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 6:00	FINISH: 11:30
PROJECT NO.: K 3571	ELEVATION: 98.70 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey		ICE Vs <5%	W C1		C1	4" CRREL
			2.5' - current bedded, some sand lenses		5% Nb	C2			
			4.0' - non plastic, brown						Changed to VTM
5			5.0' - clayey, low plastic, grey		Vs 10% 50%	C3		C3	
					70% 30% 10%				
10					30%				
					20%	C4		C4 C4	
					5%				
15					<5%	C5		C5	
			17.5'						
	GP		GRAVEL - sandy 18.5'		F	W			
	CL		CLAY (TILL-like) - silty, sandy, trace gravel to 1.0" size, 20.0' medium plastic, grey			S6		S6	N=117 for 6"
20			Bottom of Hole at 20.0'						

Plate J-28
Sheet 1 of 1

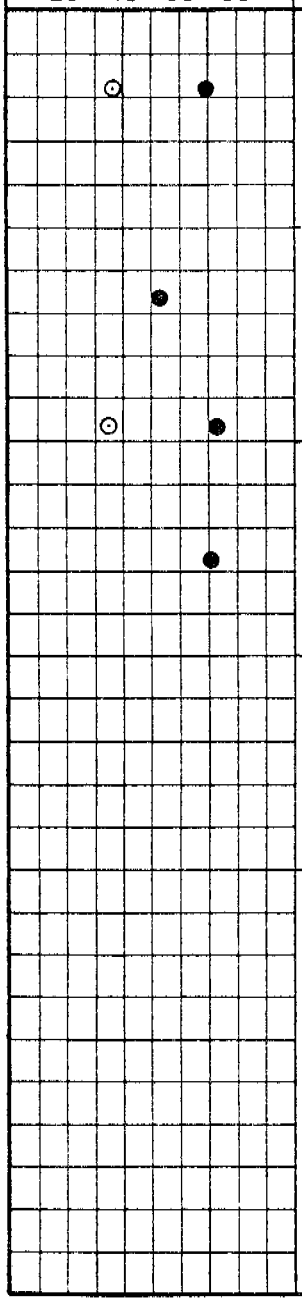
TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-14

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 10:15	FINISH: 11:45
PROJECT NO.: K 3571	ELEVATION: 98.67 m	LOCATION: Kumak Crossing	



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - low plastic, current bedded, grey	Vs 10%	W C1		C1	Pilot hole to 1.0' 4" CRREL
				C2			
				C3			
			20%	C4			
5			10%	C5			
		6.0' - clayey		C6		C6	
		7.5' 1/4" ice lenses	20%	C7			
				C8			
		9.0' 1/4" ice lenses	10%	C9		C9	
10		10.0' 1/4" ice lenses		C10			
				C11			
				C12		C12	
				C13			
		14.5' - clayey, medium plastic, grey		C14			
15				C15			
		CLAY (TILL-like) at 16.5' depth	Nb	C16			
				C17			
		Bottom of Hole at 16.5'					
20							

Plate J-29
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-15

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 11:45	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 98.54 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey		Vr Vs 15%	C1 C2			4" CRREL
2.0'			- sandy		Nb	C3 C4		C3	
5						W			Changed to VTM
5.5'			- clayey, low plastic		Vs 50%				
7.5'			1" ice lens		30%	C5			
10					15%			C5	
						C6		C6	
15					10%	C7		C7	
15.0'			- organic laminations						
20					Nb				
20.5'	CI		CLAY (TILL-like) - silty, trace gravel to 2" size, medium plastic, grey		Vr Vs 10%	C8		C8	
25					Vs <5%	C9		C8 C9	
30								C9	

Plate J-30
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-15

LOGGED BY: AH	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 11:45	FINISH: 17:00
PROJECT NO.: X 3571	ELEVATION: 98.54 m	LOCATION: Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	CI		CLAY (TILL-like) - silty, trace of gravel to 1.0" size, medium plastic, dark grey		Vs <5%	C10		C10	
			34.2' - sea shell						
35						C11		C11	
			40.0'					C11	
40			Bottom of Hole at 40.0'						

Plate J-31
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXC-16

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 13:10	FINISH: 15:40
PROJECT NO.: K 3571	ELEVATION: 98.70 m	LOCATION: Kumak Crossing	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, low plastic, current bedded, grey		Vs 10%	W C1			Pilot hole to 1.0' 4" CRREL
					Nb	C2		C2	
4.0'			- friable silt lens		Nf	C3			
5					Nb				
					ICE	C4			
6.5'			- clayey, medium plastic		Vs 10%	C5 C6			
						C7		C7	
9.5'			- low plastic, current bedded		20%	C8			
10					10%	C9 C10			
					5%	C11			
					Nb	C12 C13			
15									
15.5'	CI		CLAY (TILL-like) - trace gravel medium plastic, grey		F	W			
17.0'			Bottom of Hole at 17.0'						
20									

Plate J-32
Sheet 1 of 1

TEST HOLE LOG

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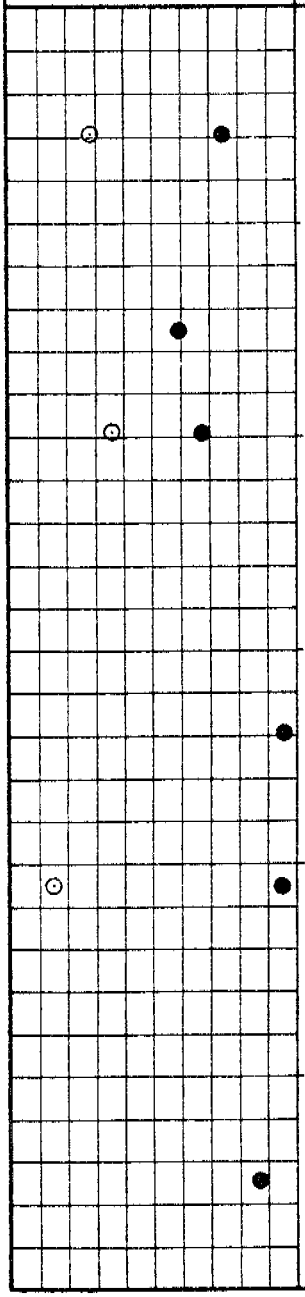
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXE-1

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6, 7 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 22:30	FINISH: 6:30
PROJECT NO.: K 3571	ELEVATION: 98.73 m	LOCATION: East Kumak Crossing	

W_p - ▫ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace fine sand, low plastic, grey-brown	Nb	W			Pilot hole to 1.5'
				C1			
		3.0' - 4" silt layer, yellow-brown		C2		C2	
				C3			
5		5.0' ice lenses to 1/2" thickness	Vs 15% 60%	C4			
			30%	C5			
				C6		C6	
			20%	C7			
		9.7' - occasional organic laminations	10%	C8		C8	
10				C9			
	GP	11.5' GRAVEL - sandy		W			
	CI	13.0' CLAY (TILL-like) - silty, trace fine sand, trace gravel to 1.5" size, medium plastic, grey	Vr Vs 30%	C10		C10	
15				C11			
				C12		C12	
			Vr 20%	C13		C13	
				W			
20				C14		C14	
				C15			
			30%	C16			
				C17			
25				C18		C18	
		27.5' ice lenses to 1/2" thickness	20%	C19		C19	
				C20			
30				C21		C21	

Plate J-33
Sheet 1 of 2

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXE-1

LOGGED BY: GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 6, 7 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 22:30	FINISH: 6:30
PROJECT NO.: K 3571	ELEVATION: 98.73 m	LOCATION: East Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	CI		CLAY (TILL-like) - silty, trace fine sand, trace gravel to 1.5" size, medium plastic, grey		Vr 10%	C22			
						W			
						C23		C23	
35			35.0' ice lenses to 1/2" thickness		25%	C24		C24	
						C25		C25	
						C26			
						C27			
			39.5'			C28		C28	
40			Bottom of Hole at 39.5'						

Plate J-34
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXE-2

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 1:55	FINISH: 5:30
PROJECT NO.: K 3571	ELEVATION: 99.00 m	LOCATION: East Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, current bedded, brown-grey		Vs 10%	C1			4" CRREL
			2.8' - friable		<5%	C2		C2	
					Nb / Nf				
					Vs 5%	C3		C3	
5			5.4'		15%	C4			
	GP		6.0' GRAVEL - sandy			W			Changed to VTM
	CI		CLAY (TILL-like) - sandy, little gravel to 3" size, medium plastic, grey		10%	C5			Changed to Rock Bit
						W			
10									Changed to VTM
					Vx Vr 10%	C6		C6	
									Changed to Rock Bit
15						W			
			17.0'						
			Bottom of Hole at 17.0'						
20									

Plate I-35
Sheet 1 of 1

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXE-3

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10, 11 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM WASH, SPT	START: 19:55	FINISH: 1:30
PROJECT NO.: K 3571	ELEVATION: 99.37 m	LOCATION: East Kumak Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, some organics to 3.0' depth, low plastic, mottled grey and brown		Vx Vr <5%	C1		C1	4" CRREL
					10%	C2		C2	
					<5%				
			3.5'		UF				Changed to Rock Bit
	GP		4.0' GRAVEL						
5	CI		CLAY (TILL-like) - silty, little fine gravel, medium plastic, grey			W			
10					Vs 10%	U3		U3	
						S4		S4	
15						W			
				16.0'					Changed to VTM
			from 16.0'-20.0'; ice lenses from 1/4" to 1/2" thickness		Vx Vr <5%	C5		C5	
20						C6		C6	
25			25.0'						
			Bottom of Hole at 25.0'						

Plate J-36
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

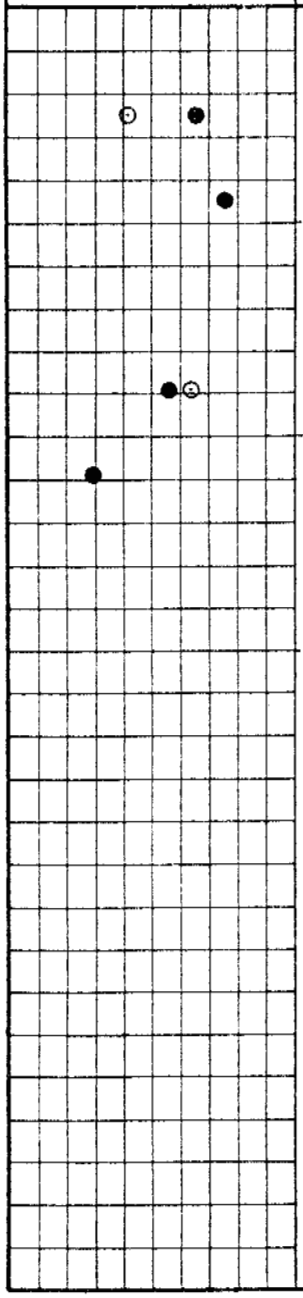
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXE-4

LOGGED BY: PGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:00	FINISH: 9:30
PROJECT NO.: K 3571	ELEVATION: 98.76 m	LOCATION: East Kumak Crossing	

W_p - □ W - ○ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace of organics, low plastic		Nb	W			Pilot hole to 1.0'
						C1		C1	
						C2			
						C3		C3	
5			5.0' 1/2" ice lens		Vs 10%	C4			
						C5			
			6.5' 1/4" ice lens		20%	C6			
			8.5' 1/4" ice lens			C7		C7	
			9.5' 1/4" ice lens			C8			
10						C9			
						C10		C10	
					Nb	C11			
					Vs 10%	C12			
			- gravel at 14.5' depth			C13			
15			Bottom of Hole at 14.5'						

Plate J-37
Sheet 1 of 1

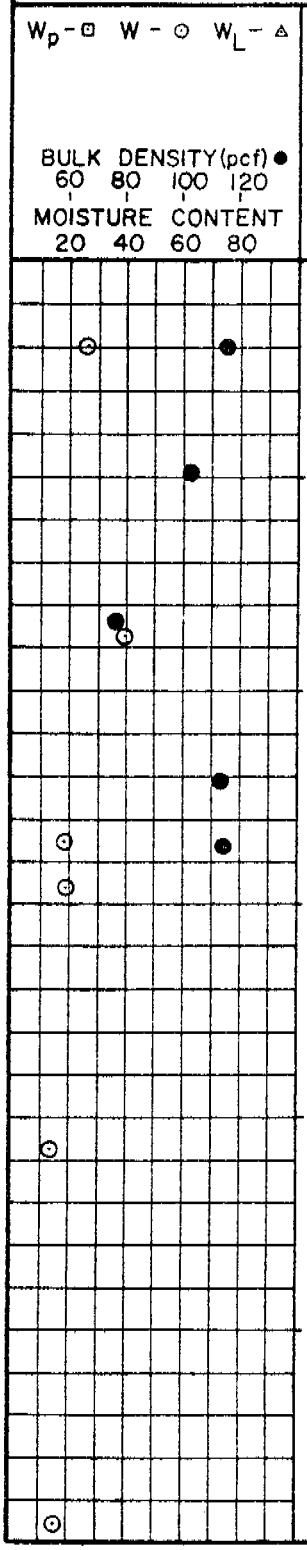
TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. KXE-5

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL, AIR	START: 4:10	FINISH: 6:10
PROJECT NO.: K 3571	ELEVATION: 98.74 m	LOCATION: East Kumak Crossing	



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace fine sand, low plastic, grey		ICE+	W			Pilot hole to 1.0'
					Vx 15%	C1		C1	
					Vs 10%	C2			
						C3		C3	
5			5.8' 2" ice layer			C4			
					50%	C5			
						C6			
					10%	C7		C7	
10			9.5' - sandier, slight plasticity			C8			
			10.7' - clayey, low plastic			C9		C9	
			12.5' - sand layer, coarse grained		25%	C10		C10	
			14.3'						
15	GP		15.0' GRAVEL		F	W			
	CI		CLAY (TILL-like) - silty, some gravel to 1.0" size, medium plastic, grey			W11		W11	
						W			
						W12		W12	
20						W			
			21.0' - trace gravel			W13		W13	
						W			
						W14		W14	
25						W			
						W15		W15	
						W			
30			Bottom of Hole at 30.0'			W16		W16	

Plate J-38
Sheet 1 of 1

APPENDIX "J"

SECTION J.3 SUMMARY OF LABORATORY TESTING

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

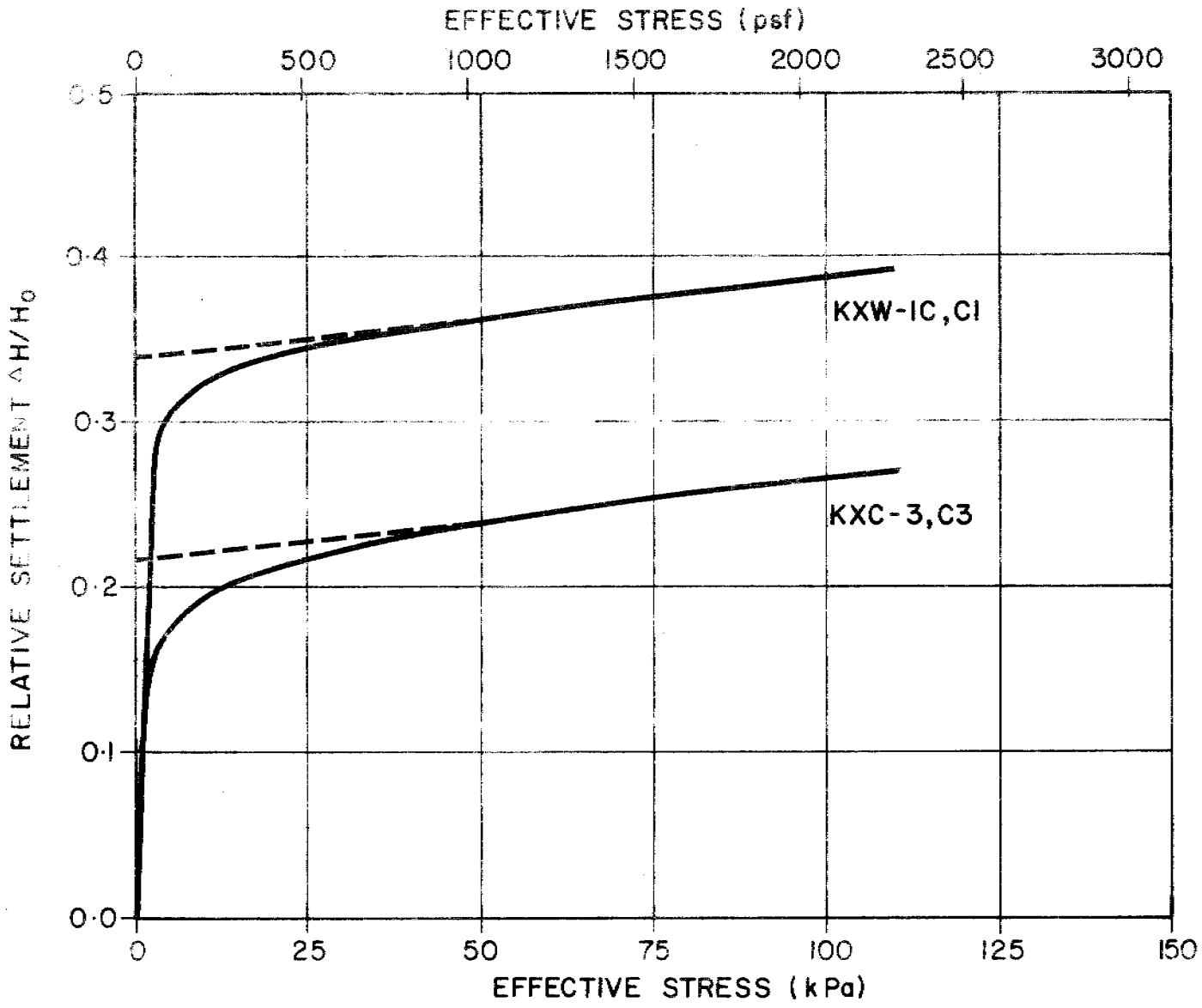
PROJECT Niglintgak Gas Project
LOCATION Kumak Crossing
DATE February/March 1977
JOB NO. K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
KXW-1C	1.1' -1.5'	C1	ML	SILT - clayey, low plastic, grey-brown, rust stains - frozen, Vs 35%							96.6	61.1	35.3	Thaw Consolidation Test Plate J-39
KXC-3	4.0' -4.8'	C1	ML	SILT - clayey, sandy, low plastic, grey - frozen, Vr Vs 35%							100.6	65.6	38.0	Thaw Consolidation Test Plate J-39
KXC-7	33.0' -34.0'	U1	CL	CLAY (TILL-like) soft, sandy, trace gravel to 2" size, trace organic laminations, low plastic, grey, unfrozen	26	18	8				124.4	101.8	22.3	PP=1.7 TSF
KXC-8	40.0' -41.5'	U6	ML	SILT - clayey, low plastic, grey - unfrozen	26	23	3				118.2	96.0	23.1	PP=1.0 TSF
KXC-8	45.0' -46.5'	U7	SM	SAND - silty, non plastic, grey - unfrozen	non plastic						45.7	37.9	20.7	PP=1.0 TSF

TABLE J-2

APPENDIX "J"

SECTION J.4 SPECIAL TEST RESULTS



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

THAW CONSOLIDATION TEST RESULTS - KUMAK CROSSING

K3571-151

PLATE J-39

APPENDIX "K"

RX1 AND RX2 CHANNEL CROSSINGS

SECTION K.1 TEST HOLE LOCATIONS AND ELEVATIONS

TABLE K-1

Test Hole Locations and Elevations
RX1 and RX2 Crossings

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
RX1-1	7 687 044.92	489 604.49	2.060	99.804
RX1-1A	7 687 051.15	489 584.73	0.262	98.006
RX1-3A	7 687 059.23	489 559.15	0.878	98.622
RX1-4	7 687 063.82	489 544.63	1.807	99.551
RX2-1	7 687 123.59	489 896.90	0.811	99.756
RX2-1A	7 687 133.41	489 908.55	2.012	98.555
RX2-2	7 687 109.41	489 880.09	0.917	98.661
RX2-3	7 687 095.23	489 863.28	0.963	98.707
RX2-4	7 687 081.05	489 846.47	0.780	98.524
RX2-5	7 687 060.98	489 822.68	1.567	98.311

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "K"

SECTION K.2 TEST HOLE LOGS: RX1 CHANNEL CROSSING

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
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GEOTECHNICAL DIVISION

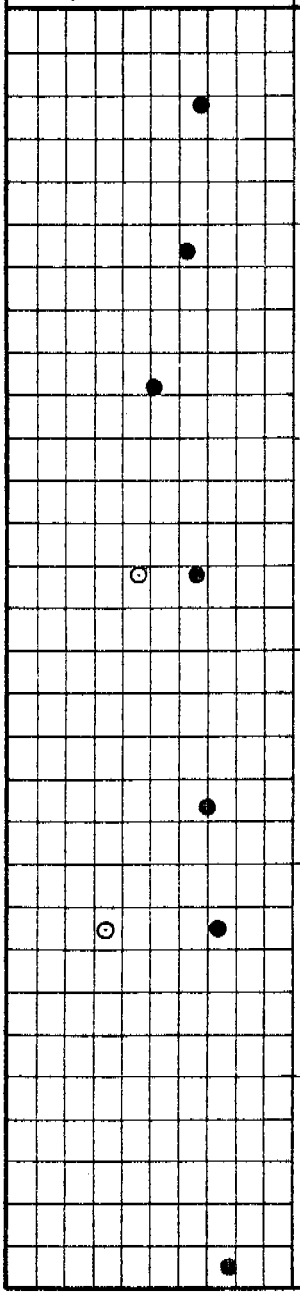
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-1

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 13:50	FINISH: 16:00
PROJECT NO.: K 3571	ELEVATION: 99.80 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - trace fine sand, low plastic, grey	Vr 40%	W			Pilot hole to 1.0'.
			Vs 10%	C1		C1	
				C2			
5				C3		C3	Thaw Consolidation Test - See Plate K-27
			20%	C4			
				C5		C5	
				C6			
			10%	C7		C7	
15		14.5' - clayey, low plastic, grey	Vx <5%	C8			
		17.5' - current bedded	Vs 5%	C9		C9	
20		20.0' 1/4" ice lens		C10		C10	
		21.5' 1/4" ice lens	Nb	C11			
				C12			
				C13			
30		Bottom of Hole at 30.0'		C14		C14	

Plate K-1
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-1A

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12,13 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM WASH, SPT	START: 20:10	FINISH: 4:30
PROJECT NO.: K 3571	ELEVATION: 98.01 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	W			Located 75.0' west of RX1-1.
			3.2'						
	ML		SILT - clayey, low plastic, grey - brown		Vx,Vr 10%	C1	C1	C1	
			5.0' - clayey, trace fine sand, slight plasticity, very loose, grey		UF	W			
5						S2	S2	S2	N=2
						W			
10			10.0' - low plastic			S3	S3	S3	N=3
						W			
15						S4	S4	S4	N=1
						W			
20						S5	S5	S5	N=2
						W			
25						S6	S6	S6	N=3
						W			
30									

Plate K-2
Sheet 1 of 3

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-1A

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12,13 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM WASH, SPT	START: 20:10	FINISH: 4:30
PROJECT NO.: K 3571	ELEVATION: 98.01 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - clayey, low plastic, loose, grey		UF	S7		S7	N=5
					W			
35		35.0' - sandy, slight plasticity, grey			S8		S8	N=8
					W			
40		40.0' - medium dense, trace of organic laminations			S9		S9	N=10
					W			
45		45.0' - medium dense			S10		S10	N=22
				F	W			
50	SM	SAND - very dense, silty, occasional silt laminations, non plastic, grey		Nb	S11		S11	N=65 Changed to VTM
		53.8'			C12		C12	
	ML	SILT - clayey, trace fine sand, trace of organics, low plastic, laminated, grey		Vx Vr <5%				
55		56.0'			W			
	GP	GRAVEL (from drilling) 57.0'						
	ML	SILT - trace fine to coarse sand, trace of organics and shells, low plastic, grey		Nb	C13		C13	
60								

Plate K-3
Sheet 2 of 3

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TEST HOLE LOG

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-1A

LOGGED BY: IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12,13 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM WASH, SPT	START: 20:10	FINISH: 4:30
PROJECT NO.: K 3571	ELEVATION: 98.01 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
60	ML		SILT - trace fine to coarse sand, trace of organics and sea shells, low plastic, grey		Nb	C13		C13	
65			67.5'			C14		C14	
			Bottom of Hole at 67.5'						
70									

Plate K-4
Sheet 3 of 3

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-2

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11,12 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 18:15	FINISH: 2:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - ▲
DYNAMIC CONE PENETRATION (blows/foot)
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	W			Located 95.0' west of RX1-1
			4.0'						
5	ML		SILT - clayey, low plastic, brown to grey		VF 5%	C1	C1		Changed to Dynamic Cone
10									
15									
20									
25									
30									

Plate K-5
Sheet 1 of 2

TEST HOLE LOG

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NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-2

LOGGED BY: AN/IGJ	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 11,12 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM DYNAMIC CONE	START: 18:15	FINISH: 2:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot)
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - clayey, low plastic, grey		UF				
35									
40									
45					Vx Vr <5%	W			Changed to VTM
						C2			
50					Nb			C3	
			53.5' - trace of organics			C3			
55			55.5'					C3	
	GP		GRAVEL - (from drilling) 56.5'			W			
	ML		SILT - little organics, trace of gravel, low plastic, grey 58.5'			S4		S4	
60			Bottom of Hole at 58.5'						

105 ▲

Plate K-6
Sheet 2 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-2A

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, WASH SPT, VTM	START: 2:45	FINISH: 8:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE		ICE	W			4" CRREL Located 33.0' west of RX1-2.
		3.5'						
	ML	SILT - clayey, some organics to 5.0' depth, low plastic, grey		UF	C1	C1		
					C2	C2		
5					W			Changed to SPT
		6.5' - loose, clayey, low plastic, saturated, grey			S3	S3	S3	N=6
					W			
10		10.0' - loose, laminated			S4	S4	S4	N=5
					W			
15		15.0' - very loose, saturated, grey			S5	S5	S5	N=1
					W			
		19.0' - loose, low plastic, clayey, grey			S6	S6	S6	N=4
20					W			
					S7	S7	S7	N=5
25					W			
					S8	S8	S8	N=5
30								

Plate K-7
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-2A

LOGGED BY: IGJ/AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, WASH SPT, VTM	START: 2:45	FINISH: 8:30
PROJECT NO.: K 3571	ELEVATION: -	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - loose, clayey, low plastic, grey		TF	S8		S8	N=5
						W			
35						S9		S9	N=3
						W			
40						S10		S10	N=4
						W			
			44.0' - medium dense, slight laminations			S11		S11	N=11
45									
					NB				
50						S12		S12	N=43
			51.0' - sandy, slight plasticity, laminated, grey to brown			W			Changed to VTM
						C13		C13	
55			56.0'						
			Bottom of Hole at 56.0'						
60									

Plate K-8
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-3

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 9 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 16:00	FINISH: 16:30
PROJECT NO.: K 3571	ELEVATION: 98.62 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, some organics to 1.0' depth, low plastic, grey		F	W			Pilot hole to 1.0'.
			2.2' 1/4" ice lenses		Vs Vx 10%	C1		C1	
5						C2			
						C3		C3	
			7.5' 1/8" ice lenses			C4			
10									Hole abandoned, Northland Rig unable to core unfrozen soil.
			12.0'		UF	C5			
			Bottom of Hole at 12.0'						Located 65.0' west of RX1-2.
15									

Plate K-9
Sheet 1 of 1

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-3A

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT WASH, VTM	START: 9:00	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 98.62 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, low plastic, grey	F	C1			4" CRREL
				C2			Located 8.0' north of RX1-3.
			Vr Vs 15%	C3		C3	
				C4			
5				C5			
		5.8' - loose, grey - brown		C6		C6	
			Nb	C7			
				C8			
				C9			
			UF				Changed to SPT
10		10.0' - grey		S10			N=4
				W			
15				S11		S11	N=4
				W			
				S12		S12	N=10
20		19.3' - medium dense, sandy		W			
		23.0'					
	SM	SAND - dense, silty, non plastic, grey	Nb	S13		S13	N=46
		25.0'					
25	ML	SILT - sandy, trace of organics, low plastic, grey					Changed to VTM
				C14			
30						C14	

Plate K-10
Sheet 1 of 2

TEST HOLE LOG

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SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-3A

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT WASH, VTM	START: 9:00	FINISH: 17:00
PROJECT NO.: K 3571	ELEVATION: 98.62 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, low plastic, grey		Nb	C15		C15	
35						C16		C16	
40						C17		C17	
45			45.0'						
			Bottom of Hole at 45.0'						

Plate K-11
Sheet 2 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

TEST HOLE NO. RX1-4

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 12 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, DYNAMIC CONE	START: 17:30	FINISH: 18:30
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, trace of organics to 3.5' depth, low plastic, brown - grey		Vs 10%	C1 C2 C3		C2	4" CRREL
					JF				Changed to Dynamic Cone
5					F				
9.5'									
10			Bottom of Hole at 9.5'						Located 50.0' west of RX1-3.

Plate K-12
Sheet 1 of 1

TEST HOLE LOG

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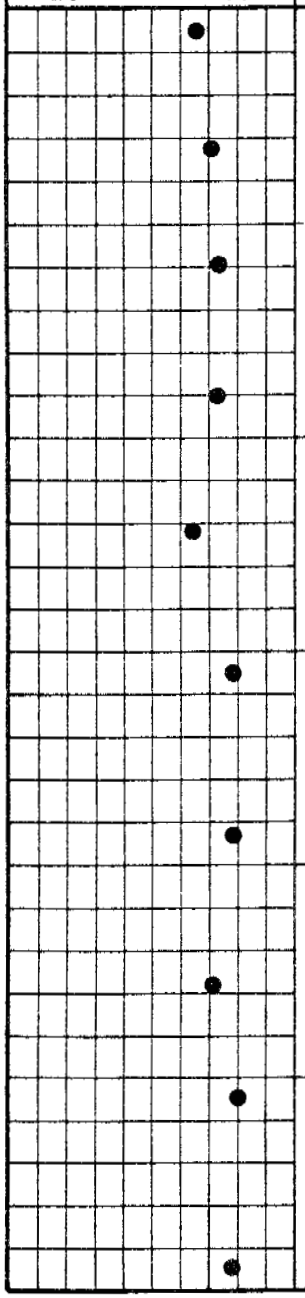
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-4A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 2:15	FINISH: 5:45
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace of organics, low plastic, grey		Vs 10%	C1		C1	4" CRREL
				Vr Vs 20%	C2		C2	
		3.2' - organic layer		UF		W		
5		5.5' - brown		Vx Vr 10%			C3	Changed to VTM
				Vs 10%				
				Nb	C3			
				Vs 5%			C3	
10		10.0' - grey		10%				
				15%				
				25%	C4		C4	
15		15.0' - sandy, clayey, slight plasticity, dark grey		Nb			C5	
				Nf	C5			
20							C5	
				Nb	C6		C6	
		23.7' - organic laminations to 1/16" thickness						
25							C7	
				Nf				
		28.0' - some organic laminations to 1/4" thickness			C7			
30				Nb			C7	

Plate K-13
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

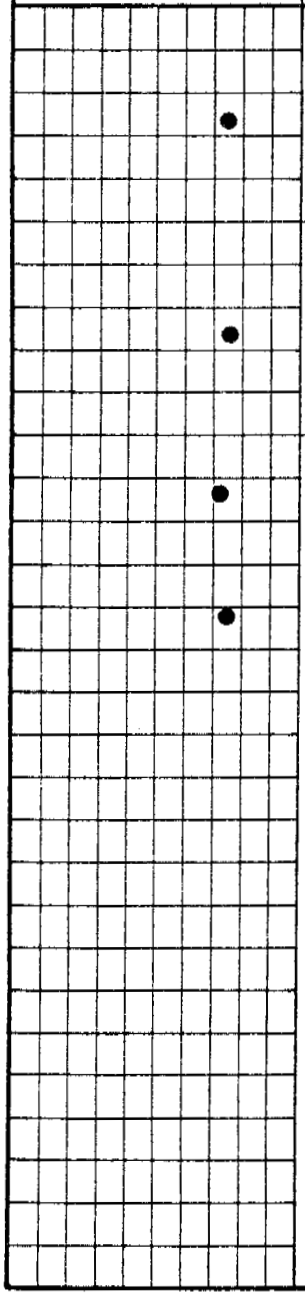
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-4A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 2:15	FINISH: 5:45
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, trace of organic laminations, low plastic, grey		Nb	C8		C8	
35					Nf	C9		C9	
40					Nb	C10		C10	
45			45.0'					C10	
			Bottom of Hole at 45.0'						Located 5.0' west and 6.0' south of RX1-4.

Plate K-14
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX1-5

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 8:00	FINISH: 10:00
PROJECT NO.: K 3571	ELEVATION: 99.55 m	LOCATION: RX1 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - clayey, low plastic, grey		F	W			Hole is 10.0' west of RX1-4.
10					Vs 5%	C1		C1	
					20%				
					Nb	C2			
			14.0' - sandy		Nf	C3			
15						C4			
			17.0' - current bedded			C5			
20						C6		C6	
						C7			
25						C8			
						C9		C9	
						C10			
30			Bottom of Hole at 31.5'			C11		C11	

Plate K-15
Sheet 1 of 1

APPENDIX "K"

SECTION K.3 TEST HOLE LOGS: RX2 CHANNEL CROSSING

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-1

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 21:40	FINISH: 22:00
PROJECT NO.: K 3571	ELEVATION: 98.56 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE 1.0'		ICE				
	W		WATER		UF				
5			6.0'						Soil at 6.0'
			Bottom of Hole at 6.0'						Could not core through water Abandoned Hole.
10									

Plate K-16
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

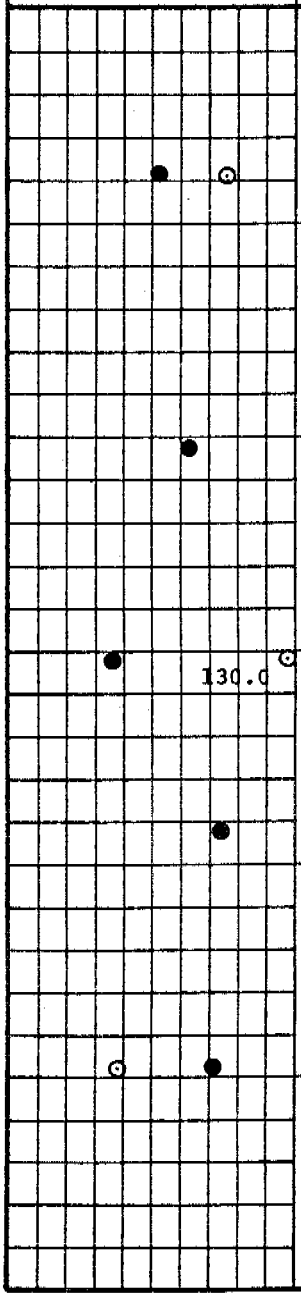
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-1A

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:00	FINISH: 16:20
PROJECT NO.: K 3571	ELEVATION: 99.76 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - ▲

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION
0	ML		SILT - clayey, low plastic, brown
			2.5' - sandy, low plastic, grey
5			
			6.5' - brown and grey
10			
			11.5' - brown
15			
			15.5' - grey
			17.0' - clayey, trace fine sand, low plastic, current bedded, grey
20			20.0' - organic laminations
25			
30			

ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
	Nb	W			Pilot hole to 1.0'
	Vr Vs 20%	C1			Located 50' east of RX2-1
		C2		C2	
	Vs 60%	C3			
		C4			
		C5		C5	
	Vx Vs 10%	C6			
	20%	C7		C7	
	Vr Vs 50%	C8			
		C9			
		C10			
		C11		C11	
	Vs 30%	C12			
	<5%	C13			
		C14		C14	
	Nb	C15			
		C16		C16	
	Vr 5%				
	Nb	C17		C17	
		C18			
	Vs 5%	C19			

Plate K-17
Sheet 1 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-1A

LOGGED BY: AN	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 11:00	FINISH: 16:20
PROJECT NO.: K 3571	ELEVATION: 99.76 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - sandy, organic laminations, low plastic, current bedded, grey		Vs 5%	C19		C19	
					Nb	C20			
						C21		C21	
35			35.5' 1/2" wood chip			C22			
			37.0' 1" organic layer, brown			C23		C23	
			38.5'			C24			
	GP		39.0' GRAVEL		F				
	CI		CLAY - trace gravel to 1.5" size, medium plastic, dark grey			C25			
40			Bottom of Hole at 40.0'						
45									

Plate K-18
Sheet 2 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-2

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 13:00	FINISH: 15:30
PROJECT NO.: K 3571	ELEVATION: 98.66 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			4.8'						
5	W		WATER		UF				
20			21.0'						
	ML		SILT - very loose, clayey, low plastic, grey			U1		U1	Changed to wash boring and SPT
			22.5' - loose, sandy, sensitive to quicking, low plastic, grey			W			
30						S2		S2	N = 3
35						W			
40									

Plate K-19
Sheet 1 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-2

LOGGED BY: RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: S. D. S.	METHOD: WASH, SPT	START: 13:00	FINISH: 15:30
PROJECT NO.: K 3571	ELEVATION: 98.66 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
40	ML		SILT - medium dense, clayey, trace of gravel to 1/2" size, low plastic, grey		UF	S3		S3	N = 16
						W			
45			45.0' CLAY - silty, trace gravel, low plastic, grey			S4		S4	N = 11
						W			
50			51.2' - silt layer, dense, non plastic			S5		S5	N = 44
			51.5' Bottom of Hole at 51.5'						
55									

Plate K-20
Sheet 2 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-3

LOGGED BY: IGJ/RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT WASH, 4" SHELBY	START: 5:00	FINISH: 10:30
PROJECT NO.: K 3571	ELEVATION: 98.71 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE				
			5.0'						
5	W		WATER		UF				
			6.5'						
			SILT - very loose, clayey, low plastic, grey			U1		U1	
						W			Changed to wash boring and SPT
			9.0'			S2		S2	N = 1
10			- trace fine sand			W			
			14.0'			S3		S3	N = 5
			- loose, clayey			W			
15									
			19.0'			S4		S4	N = 1
			- very loose			W			
20									
						S5		S5	N = 4
						W			
25									
30									

Plate K-21
Sheet 1 of 2

TEST HOLE LOG

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GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-3

LOGGED BY: IGJ/RGC	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, SPT WASH, 4" SHELBY	START: 5:00	FINISH: 10:30
PROJECT NO.: K 3571	ELEVATION: 98.71 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	SM	SAND - medium dense, silty, fine grained, non plastic, grey-brown	UF	S6		S6	N = 14
				W			
35		35.0' - loose, sensitive to quicking		S7		S7	N = 6
				W			
40							
45		45.0'		S8		S8	N = 57
	ML	SILT - very dense, little fine sand, trace rounded and subangular gravel to 1/2" size, non- to low plastic, grey-brown		W			
50		50.0'		S9		S9	N = 69
	SM	SAND - very dense, silty, fine grained, occasional small shell fragments, non plastic, dry to damp, mottled olive brown		W			
55		55.0'		S10		S10	N = 40
	ML	SILT - little fine sand, trace subrounded to subangular gravel to 1/2" size, clayey, occasional small shell fragments, non to low plastic, grey-brown					
60		Bottom of Hole at 56.5'					

Plate K-22
Sheet 2 of 2

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-3A

LOGGED BY: GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13, 14 March 1977
RIG: S. D. S.	METHOD: 4" CRREL DYNAMIC CONE	START: 23:15	FINISH: 1:25
PROJECT NO.: K 3571	ELEVATION: 98.71 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △
DYNAMIC CONE PENETRATION (blows/foot) ▲
20 40 60 80
BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I		ICE		ICE	W			4" CRREL
			4.5'			C1		C1	
5	ML		SILT - clayey, low plastic, grey		Vs 65%	C2			Changed to Dynamic Cone
			6.0' - very loose		UF				
10			11.0' - medium dense						
15									
20			23.0'						
			Bottom of Hole at 23.0'						
25									

Plate K-23
Sheet 1 of 1

TEST HOLE LOG

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GEOTECHNICAL DIVISION

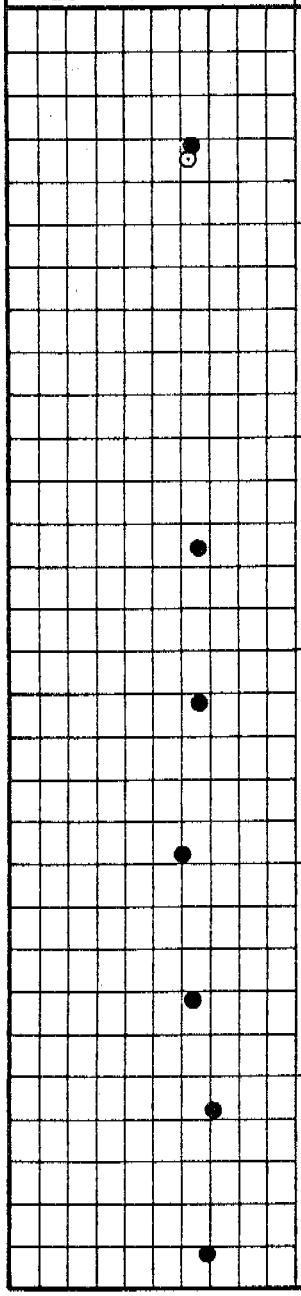
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-4

LOGGED BY: RGC/GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM, SPT, WASH	START: 16:10	FINISH: 22:45
PROJECT NO.: K 3571	ELEVATION: 98.52 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	I	ICE		ICE	W			4" CRREL
		1.8'						
	ML	SILT - clayey, low plastic, current bedded, grey		Vr Vs 40%	C1			
					C2		C2	
		4.0' - clayey, medium plastic		Nb				Changed to VTM
5					C3			
		6.0' - clayey, low plastic		Vs 10%				
				Nb				
10					C4			
				Vs 10%			C4	
		14.5' - trace of organic laminations, brown & grey			C5			
15					C6		C6	
				Nf				
		19.5' - sandy, grey					C6	
20					C7			
							C7	
		24.0' wood chips						
		25.0' - clayey, low plastic						
25		26.2' organic laminations to 1/4" thickness			C8		C8	
30							C8	

Plate K-24
Sheet 1 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-4

LOGGED BY: RGC/GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 13 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM, SPT, WASH	START: 16:10	FINISH: 22:45
PROJECT NO.: K3571	ELEVATION: 98.52 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML		SILT - some sand, clayey, slight plasticity, grey		Nf UF	C9			
			35.0'						Changed to wash boring and SPT
35	SM		SAND - loose, silty, fine grained, occasional wood chips, non-plastic, brown			S10		S10	N = 9
						W			
40						S11		S11	N = 9
			43.0'			W			
	CL		CLAY - hard, silty, trace sand, trace gravel to 3/8" size, occasional fine shell fragments, low to medium plastic, grey-brown						
45						S12		S12	N = 33
						W			
			50.0'						
50	ML		SILT - and sand, very dense, non plastic, brown, occasional shell fragments			S13		S13	N = 86
						W			
55						S14		S14	N = 54
			56.5'						
			Bottom of Hole at 56.5'						
60									

Plate K-25
Sheet 2 of 2

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

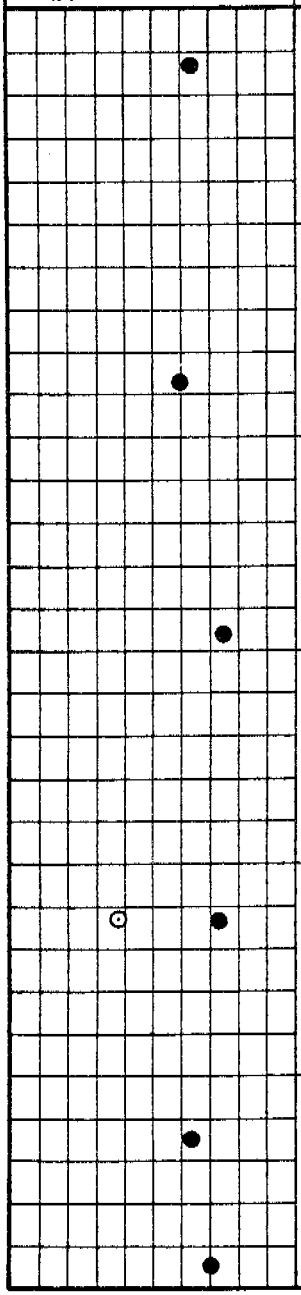
SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. RX2-5

LOGGED BY: RGC/GNL	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 10 March 1977
RIG: NORTHLAND	METHOD: 4" CRREL	START: 17:50	FINISH: 20:55
PROJECT NO.: K 3571	ELEVATION: 98.31 m	LOCATION: RX2 Channel Crossing	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80



DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML	SILT - clayey, trace fine sand, low plastic, grey		Nb	W			Pilot hole to 1.0'
					C1		C1	
				Vs 10%	C2			
					C3			
5		4.5' - trace of organic laminations, low plastic, current bedded			C4		C4	
				20%	C5			
				Vs Vx 15%	C6			
				Vs 20%	C7		C7	
					C8			
					C9			
10				10%	C10		C10	
				Nb	C11			
				Vs 5%				
					C12		C12	
15				Nb	C13		C13	
		16.5' - sandy, current bedded, occasional organic laminations to 1/8" thickness			W			
					C14		C14	
					C15			
20				Vs 5%	C16		C16	
					C17			
					C18		C18	
25				20%	C19			
					C20		C20	
				Nb				
					C21			
30		Bottom of Hole at 30.0'		Nf			C21	

Plate K-26
Sheet 1 of 1

APPENDIX "K"

SECTION K.4 SUMMARY OF LABORATORY TESTING

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES

SUMMARY OF LABORATORY TESTING

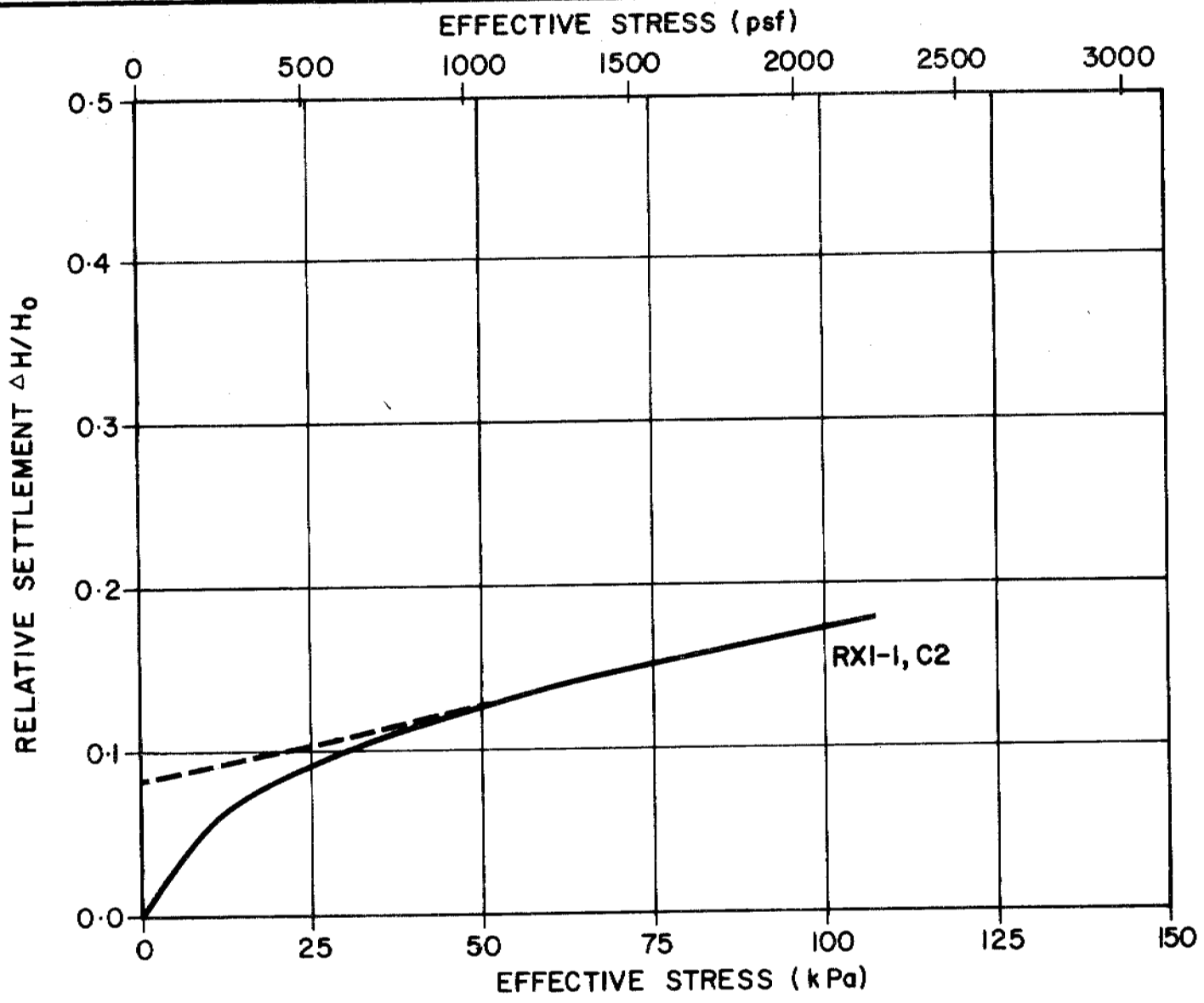
PROJECT: Niglintgak Gas Project
LOCATION: RX1 Channel Crossing
DATE: February/March 1977
JOB NO. K3571

SAMPLE DATA					CLASSIFICATION TESTS						OTHER TESTS			
					ATTERBERG LIMITS			TEXTURE (%)						
TEST HOLE	DEPTH (ft)	SAMPLE NO	CLASSIFICATION	SOIL DESCRIPTION	LIQUID	PLASTIC	PLASTICITY INDEX	SAND	SILT	CLAY	WET DENSITY (PCF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	
RX1-1	5.5' -6.5'	C3	ML	SILT - trace fine sand, low plastic, grey - frozen, Vs 10%							103.4	77.2	34.5	Thaw Consolidation Test Plate K-27

TABLE K-2

APPENDIX "K"

SECTION K.5 SPECIAL TEST RESULTS



R M HARDY & ASSOCIATES LTD

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

THAW CONSOLIDATION TEST RESULTS - RXI CROSSING

K3571-151 PLATE K-27

APPENDIX "L"

DEEP DRILL HOLE

SECTION L.1 TEST HOLE LOCATION AND ELEVATION

TABLE L-1

Test Hole Location and Elevation
Deep Hole

Test Hole	U.T.M. CO-ORDINATES[1] Northing	Easting	ELEVATIONS (m) Approx. Geodetic[2]	Project[3]
DH-1	7 687 650.22	488 113.37	2.076	99.820

Notes:

1. Co-ordinates derived from authorized monument C-235 and are U.T.M. R.M. 135° (Zone 8)
2. Datum: Lower flange on M-19 Wellhead, El. 2.590 m
3. Datum: B.M. #1, installed March 1977, El. 100.00 m

APPENDIX "L"

SECTION L.2 TEST HOLE LOG

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DH-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3, 4, 5, 6 March 1977
RIG: S. D. S.	METHOD: 4" CRREL,VTM	START: 14:15	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Deep Hole	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

290.0 ⊙

DEPTH (feet)	SOIL GROUP SYMBOL	SOIL GRAPHIC LOG	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
0	ML		SILT - trace fine sand, little organics to 4.0' depth, low plastic, brown		Vx,Vr 10% 20%	C1			
					Vr Vs Vx 65% 60%	C2			
5			5.5' - wood particles		ICE+ Vr 70%	C3		C3	
					ICE+ Vr70% ICE+	C4			
10					Vr Vs 45%	C5			
					Vs Vx 20%	C6			
			14.0' - grey		Vs 5%			C6	
15			17.0' - little sand, laminated			C7			
			19.7' 1 1/2" of 50% ice		Vr Vs 5%	C8			
20			21.3' - organic laminations to 1/4" thickness, brown		Vs <5%				
			23.5' 1" of 40% Vs ice			C9		C9	
25					Nbn	C10			
30									

Plate L-1
Sheet 1 of 7

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DH-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3, 4, 5, 6 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 14:15	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Deep Hole	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
30	ML	SILT - little fine sand, low plastic, laminated, grey		Nbn	C11		C11	
		32.0' - sandier, clayey						
35		37.0' - trace fine sand, occasional organic laminations to 1/8" thickness		Nbe	C12			
40		40.0' - no more sand, current bedded, organic laminations			C13		C13	
45		46.5' - some fine sand		Nbn	C14			
50		49.5' - 1/2" organic layer		Vs 5%	C15		C15	
55				Nbn	C16			
60								

Plate L-2
Sheet 2 of 7

TEST HOLE LOG

R.M. HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DH-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3, 4, 5, 6 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 14:15	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Deep Hole	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE RETAINED
60	ML	SILT - trace fine sand, little organic laminations to 1/2" thickness, low plastic, grey and brown	Nbn	C17	C17
		62.6'			C17
	SM	63.2' SAND - fine grained, silty			C18
	CL	CLAY - silty, low plastic		C18	C18
65		66.5'			C19
	ML	SILT - occasional organic laminations, low plastic, current bedded, grey	Vr 5%	C19	C19
			Nbn		
70					
75		75.0'			
	CL	CLAY - occasional organic laminations, low plastic, grey and brown	Nbe	C20	C20
					C20
80			Vs 5%		C21
		83.1' - rootlets		C21	C21
85			Vs Vr < 5%	C22	C22
		89.5' - silty, no organics			C22
90					

OTHER INFORMATION

Plate L-3
Sheet 3 of 7

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DH-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3,4,5,6, March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 14:15	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Deep Hole	

W_p - ⊡ W - ⊙ W_L - ▵

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE RETAINED
90	CL	CLAY - silty, low to medium plastic, laminated, grey-brown	Nbn	C23	C23
94.5'		1/4" shale layer			C23
95			Vr Vs <5%	C24	C24
100					C24
				C25	C25
105					C25
105.0'	ML	SILT - trace fine sand, low plastic, grey to brown	Nbn	C26	C26
110					C26
110.5'	SM	SAND - fine grained, silty, well bonded, grey		C27	C27
114.0'	ML	SILT - little fine sand, non plastic, grey	Vs 5%	W	
115				C28	
119.0'	SM	SAND - silty, non plastic, grey	Nbn	C29	C29
120					

OTHER INFORMATION

Plate L-4
Sheet 4 of 7

TEST HOLE LOG

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CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DH-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3, 4, 5, 6 March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 14:15	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Deep Hole	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
120	SM	SAND - fine grained, silty, non plastic, grey	Nbn	C29		C29	
125				C30		C30	
		128.5'	Vs Vr 10%			C30	
	ML	SILT - clayey, low plastic, grey					
130		132.0'		C31		C31	
	SM	SAND - silty, little organic laminations to 1/8" thickness, grey and brown	Nbn			C31	
				C32		C32	
135							
		139.0' - some organic laminations, brown		C33		C33	
140							
		144.0' - fine laminations, mica specks		C34		C34	
145							
		148.5' - wood chips		C35		C35	
150							

Plate L-5
Sheet 5 of 7

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DH-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3,4,5,6 March 1977
RIG: S. D. S.	METHOD: 4"CRREL, VTM	START: 14:15	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Deep Hole	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	ICE GRAPHIC LOG	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
150	SM	SAND - fine grained, silty, occasional organic laminations and wood chips, trace mica specks, laminated, grey		Nbn	C35		C35	
		153.0'						
	ML	SILT - and fine sand, little organic laminations, trace mica specks, laminated, grey			C36		C36	
155							C36	
		158.5'						
	SM	SAND - fine grained, silty, little organic laminations to 1/4" thickness, trace mica specks, laminated, grey			C37		C37	
160								
							C37	
		166.5' - 1/2" organic layer			C38		C38	
165		167.5' - wood chips						
							C38	
					C39		C39	
170								
		172.0' - gravel to 1 1/2" size					C39	
		174.0'						
175	CI	CLAY - silty, trace mica crystals, medium plastic, friable, occasional silt lenses, brown - grey		Vs Vr <5%	C40		C40	
							C40	
180				Nbn	C41			

Plate L-6
Sheet 6 of 7

TEST HOLE LOG

R.M.HARDY & ASSOCIATES LTD.
CONSULTING ENGINEERING & PROFESSIONAL SERVICES
GEOTECHNICAL DIVISION

SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT
CANEP - BROWN & ROOT

TEST HOLE NO. DH-1

LOGGED BY: CPM/GCD	DRAWN BY: CPM/PD	CHECKED: AJH	DATE: 3, 4, 5, 6, March 1977
RIG: S. D. S.	METHOD: 4" CRREL, VTM	START: 14:15	FINISH: 4:00
PROJECT NO.: K 3571	ELEVATION: 99.82 m	LOCATION: Deep Hole	

W_p - ⊡ W - ⊙ W_L - △

BULK DENSITY (pcf) ●
60 80 100 120
MOISTURE CONTENT
20 40 60 80

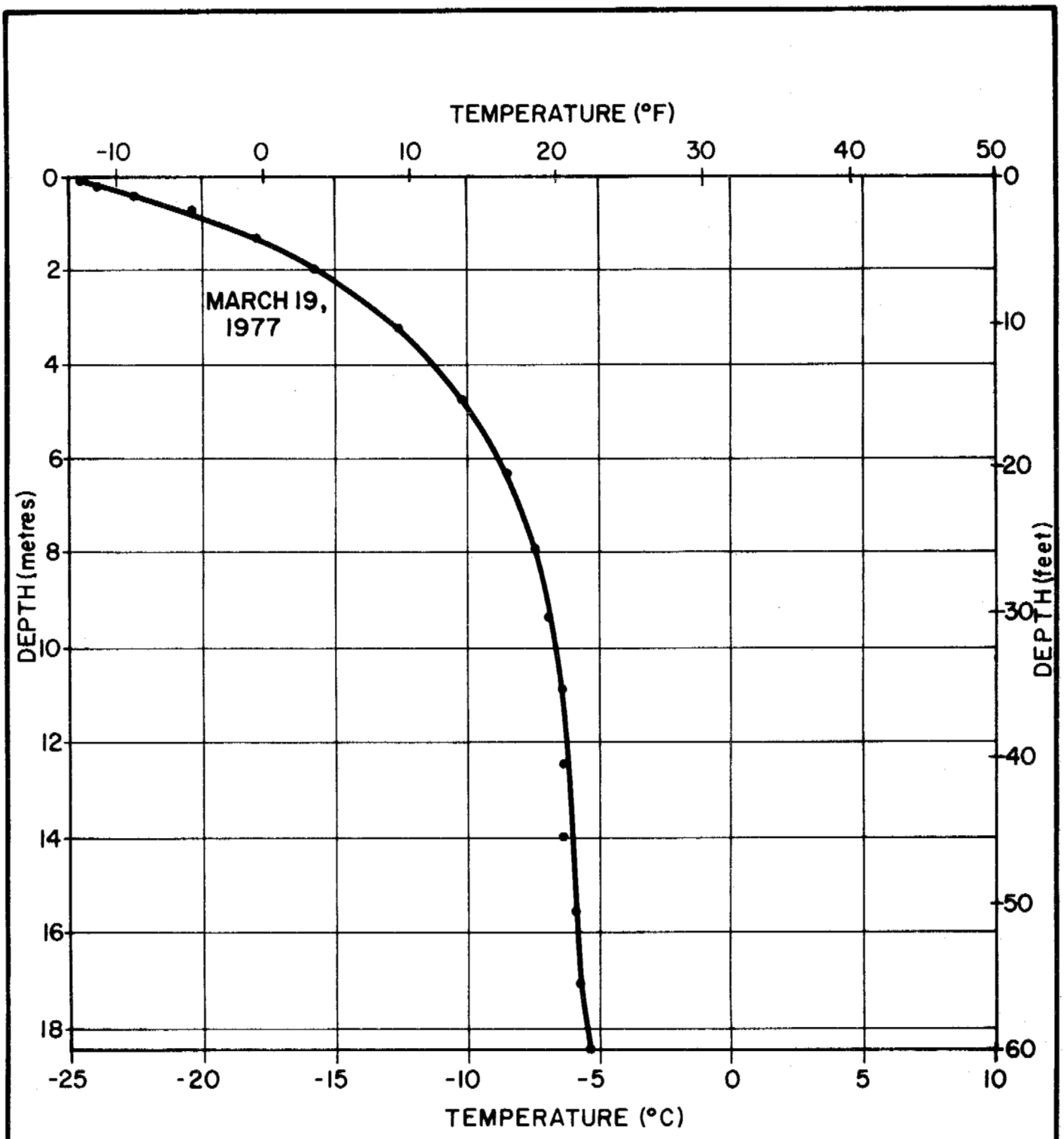
DEPTH (feet)	SOIL GROUP SYMBOL	DESCRIPTION	NRC ICE TYPE VISUAL ICE %	SAMPLE TYPE & NO.	SAMPLE CONDITION	SAMPLE RETAINED	OTHER INFORMATION
180	CI	CLAY - little silt, trace mica crystals, medium plastic, friable, occasional silt lenses, brown – grey	Nbn	C41			
185				C42			
		189.0'					
190	ML	SILT - clayey, little organics, wood chips, shells, trace mica specks, low plastic, grey		C43		C43	
		193.3' - fine organic layers				C43	
195				C44		C44	
		199.4' - trace of organic layers, trace fine sand				C44	
200				C45		C45	
		204.0'					
205		Bottom of Hole at 204.0'					

Plate L-7
Sheet 7 of 7

APPENDIX "M"

GROUND TEMPERATURE

SECTION M.1 PLANT SITE AREA



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NIGLINTGAK GAS PROJECT

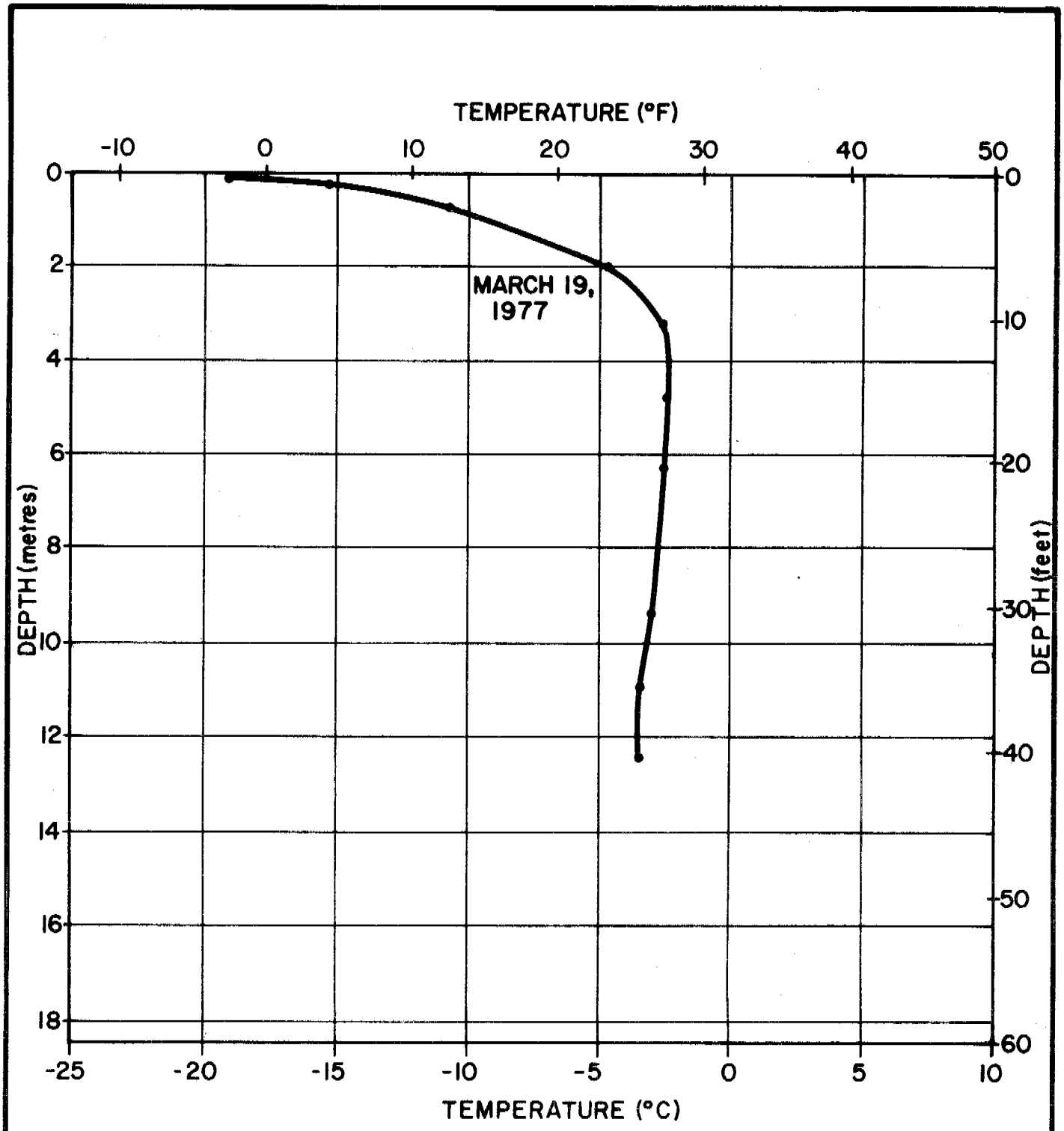
CANEP - BROWN & ROOT

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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR PS-3

K3571-151

PLATE M-1



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

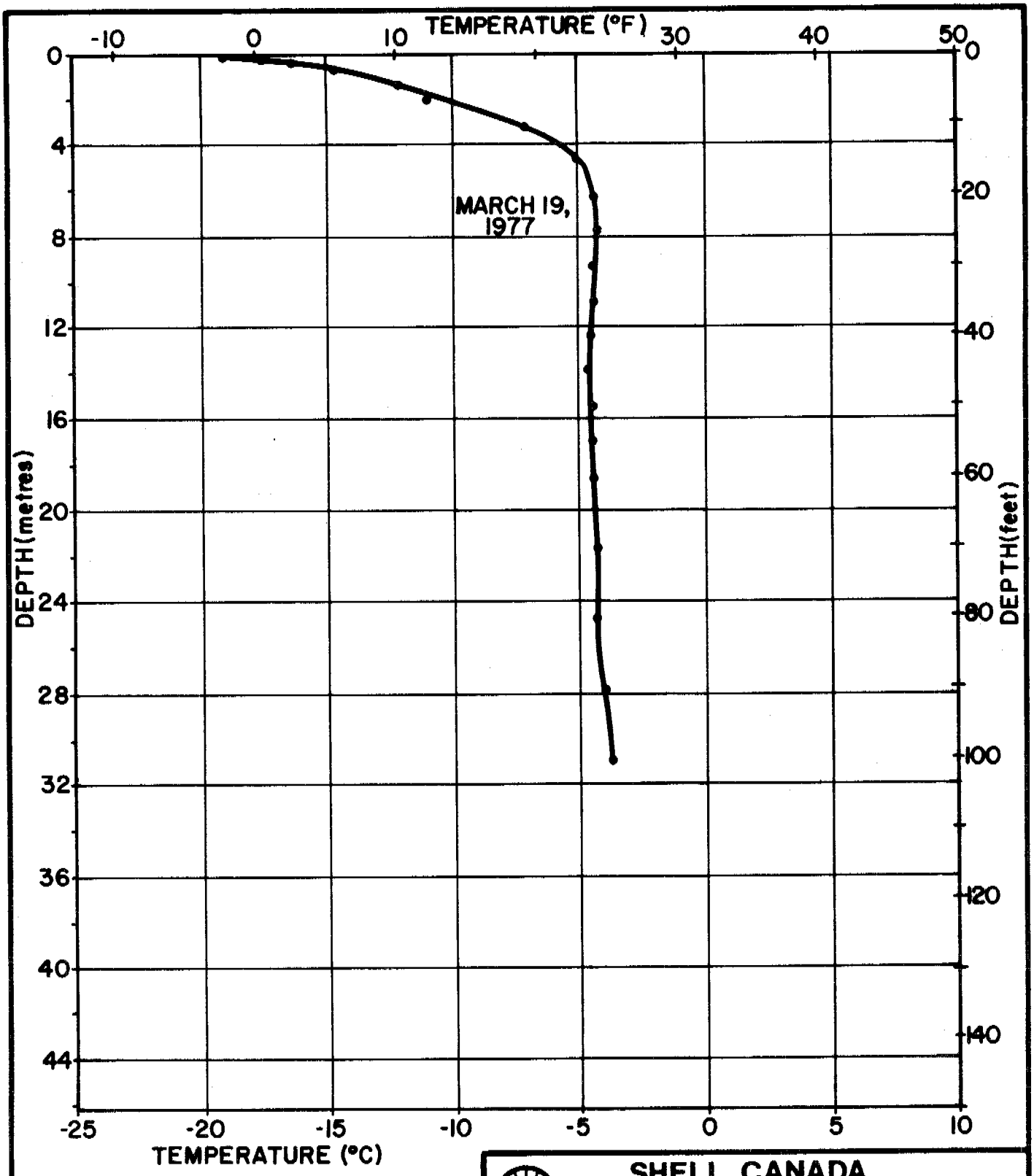
CANEP - BROWN & ROOT

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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR PS-6

K3571-151

PLATE M-2



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

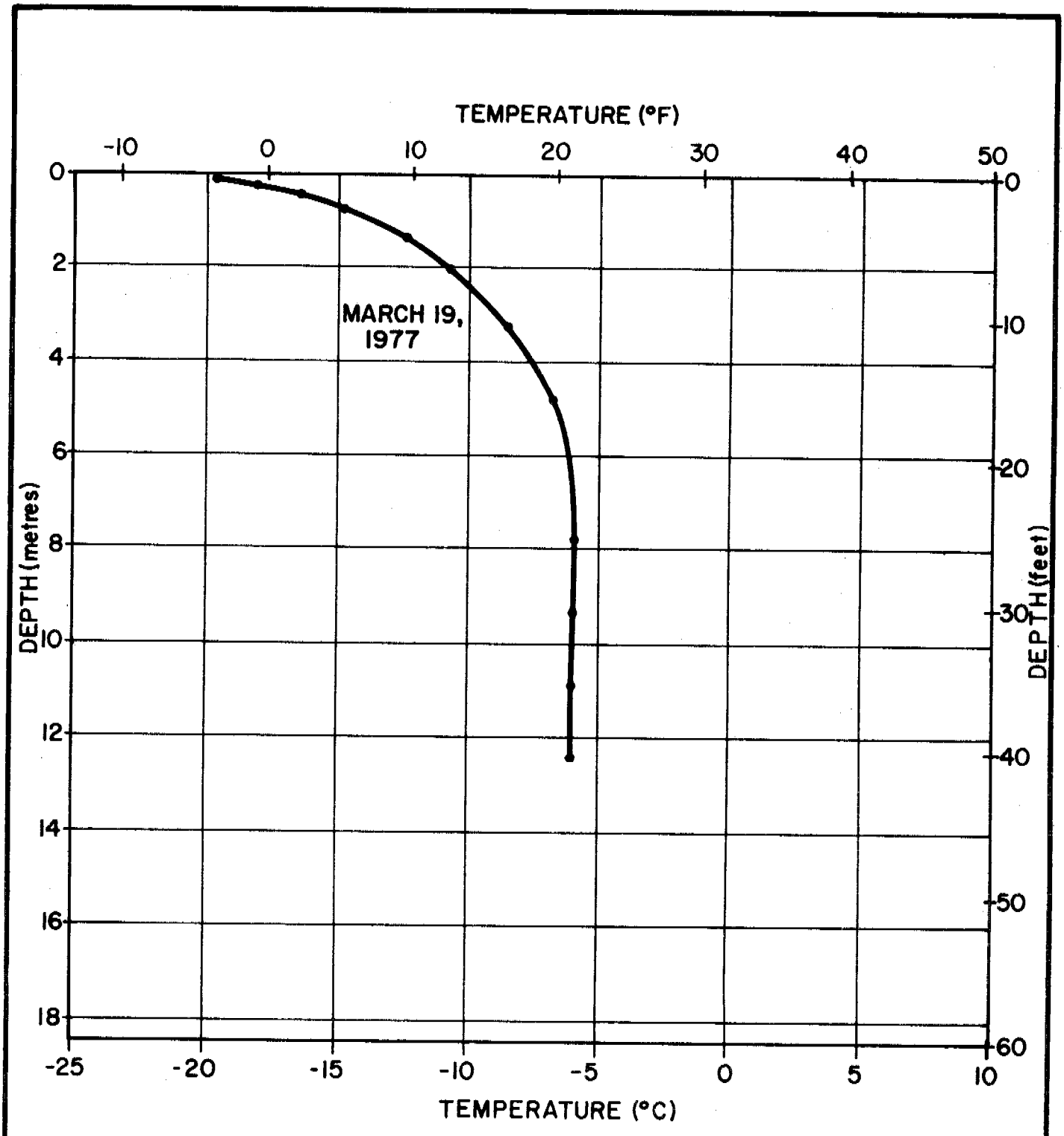
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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR PS-11

K3571-151

PLATE M-3



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

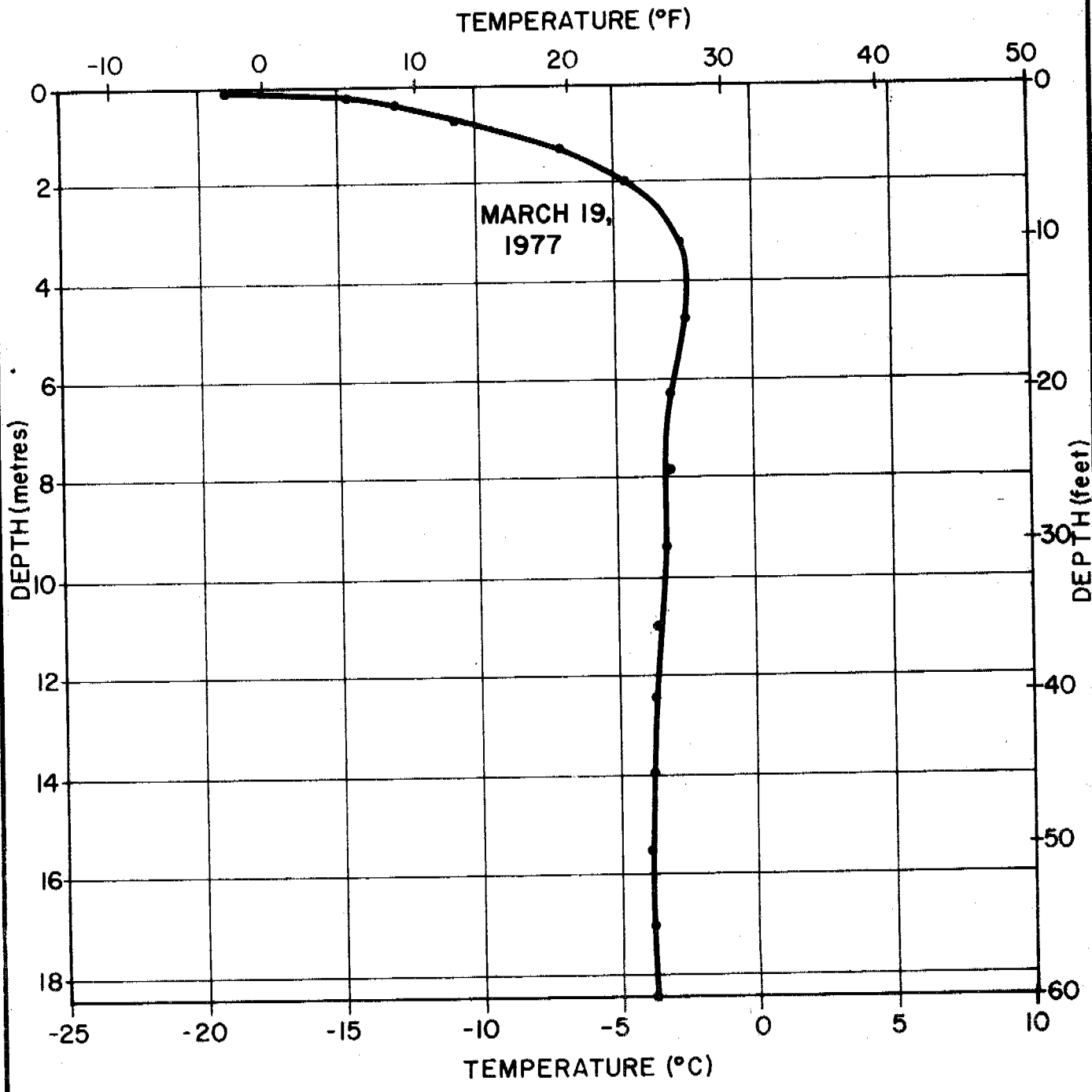
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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR PS-15

K3571-151

PLATE M-4



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NIGLINTGAK GAS PROJECT

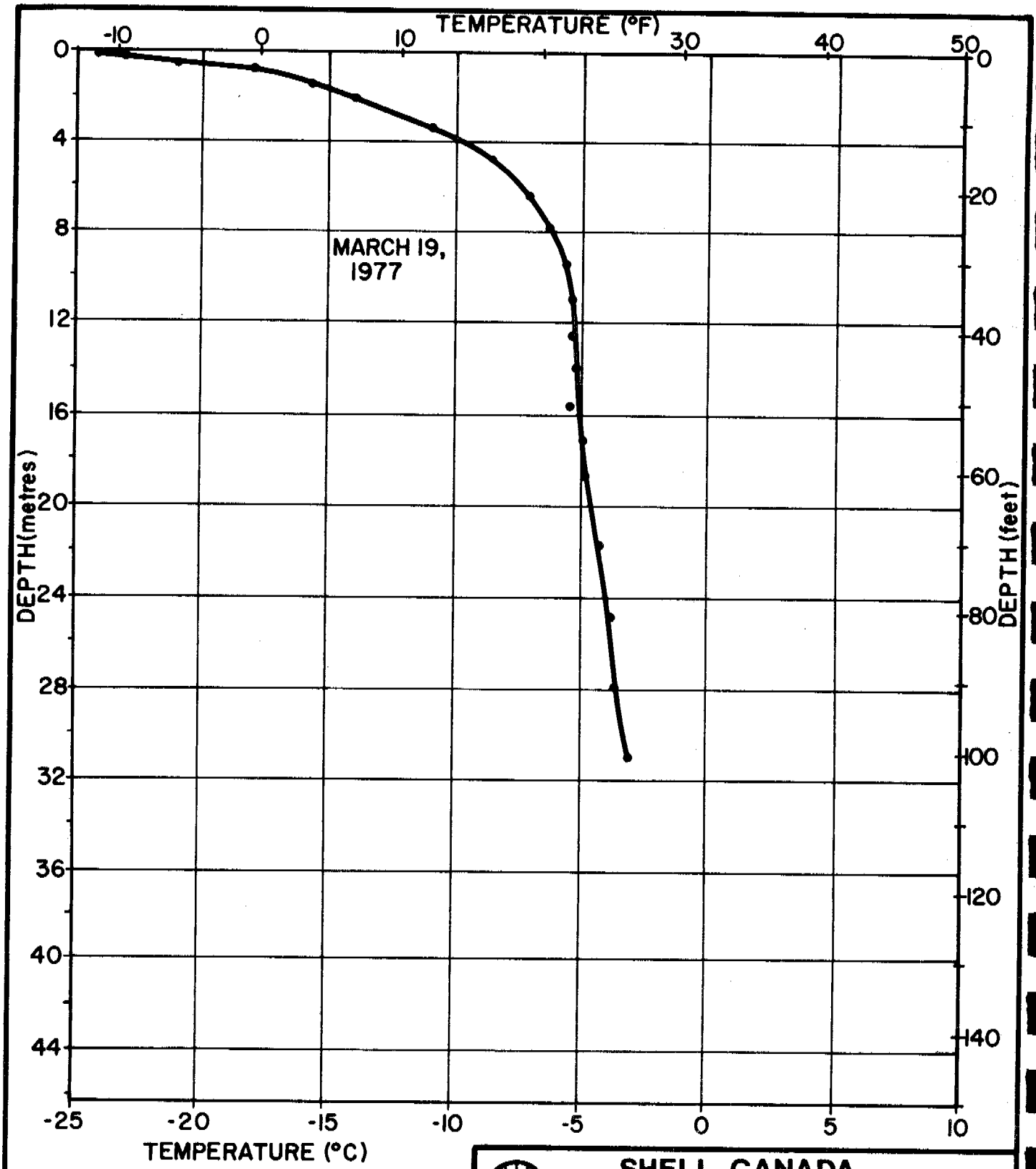
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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR PS-17

K3571-151

PLATE M-5



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

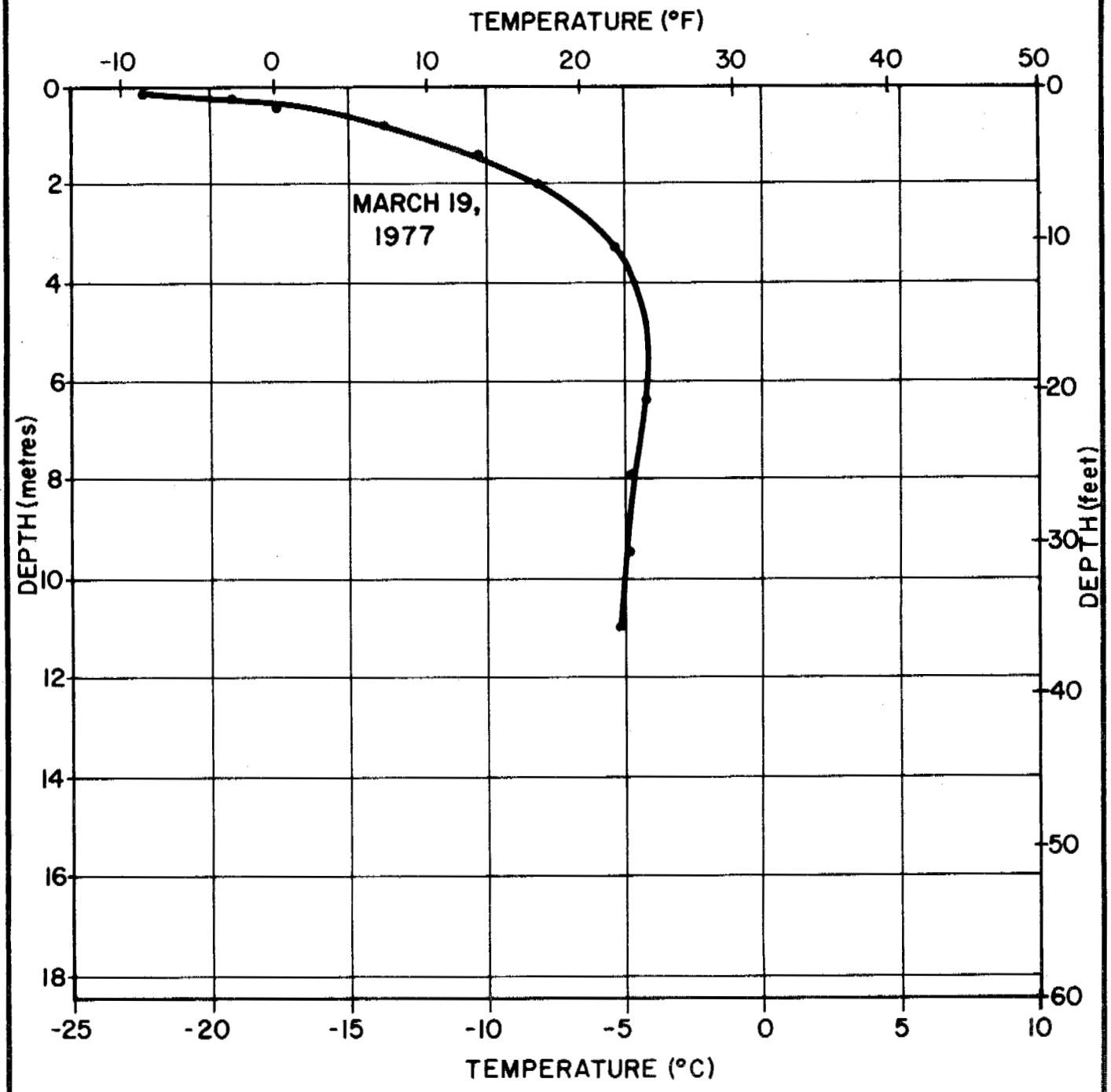
CANEP - BROWN & ROOT

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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR BS-8

K3571-151

PLATE M-6



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

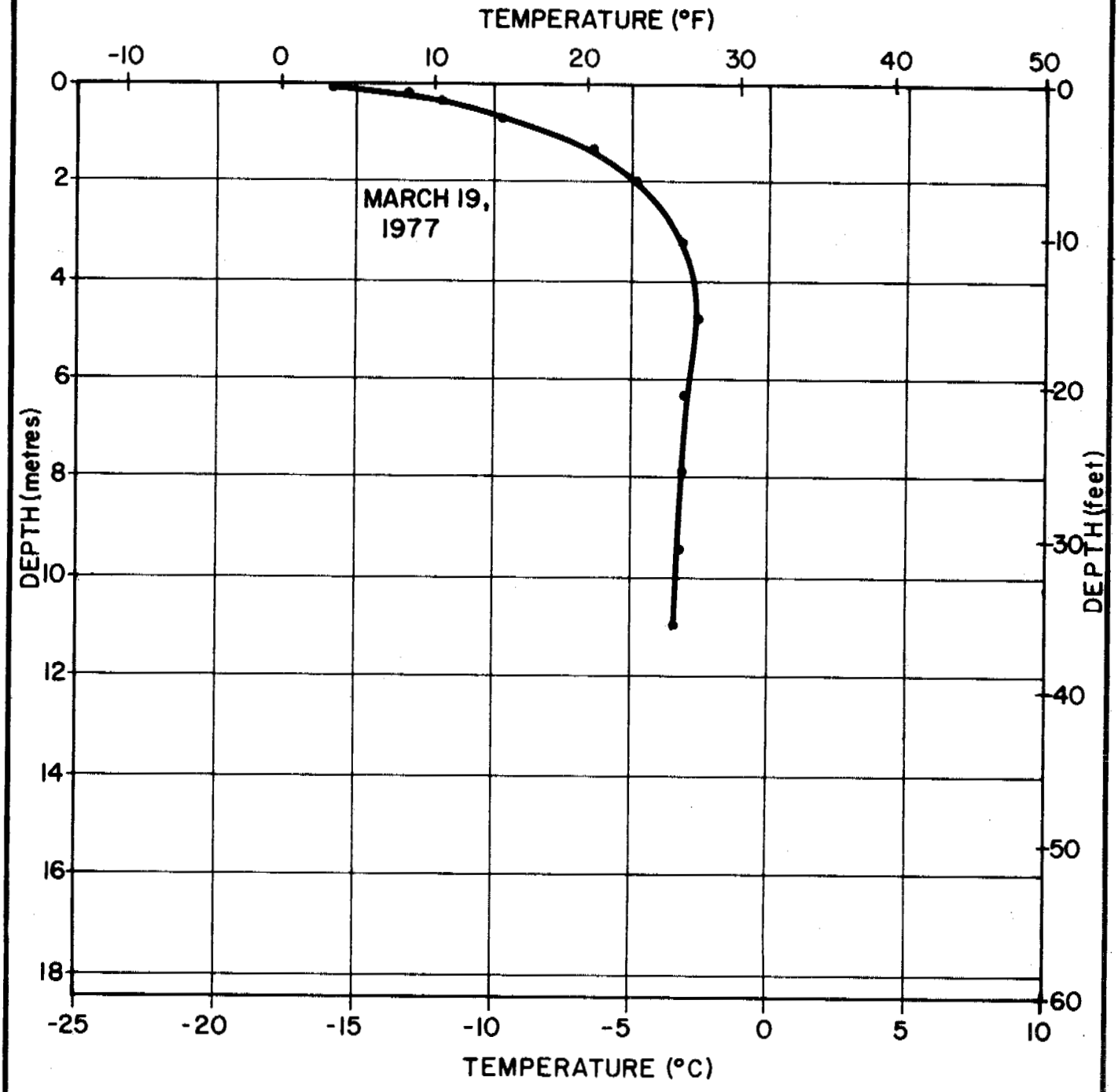
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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR BS-9

K3571-151

PLATE M-7



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NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

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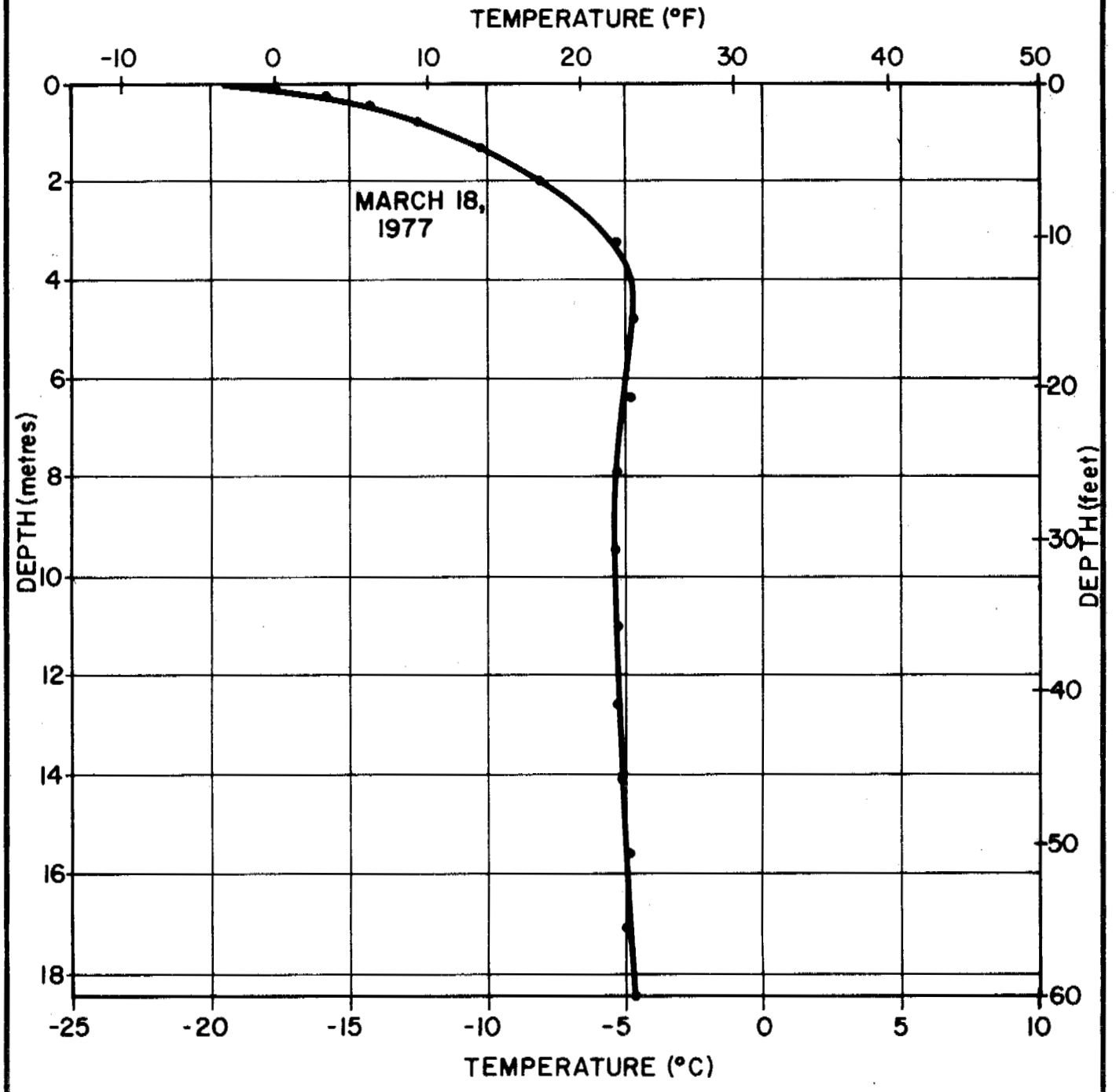
NIGLINTGAK GROUND TEMPERATURES
THERMISTOR FS-1

K3571-151

PLATE M-8

APPENDIX "M"

SECTION M.2 GATHERING SYSTEM AND WELL SITES



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

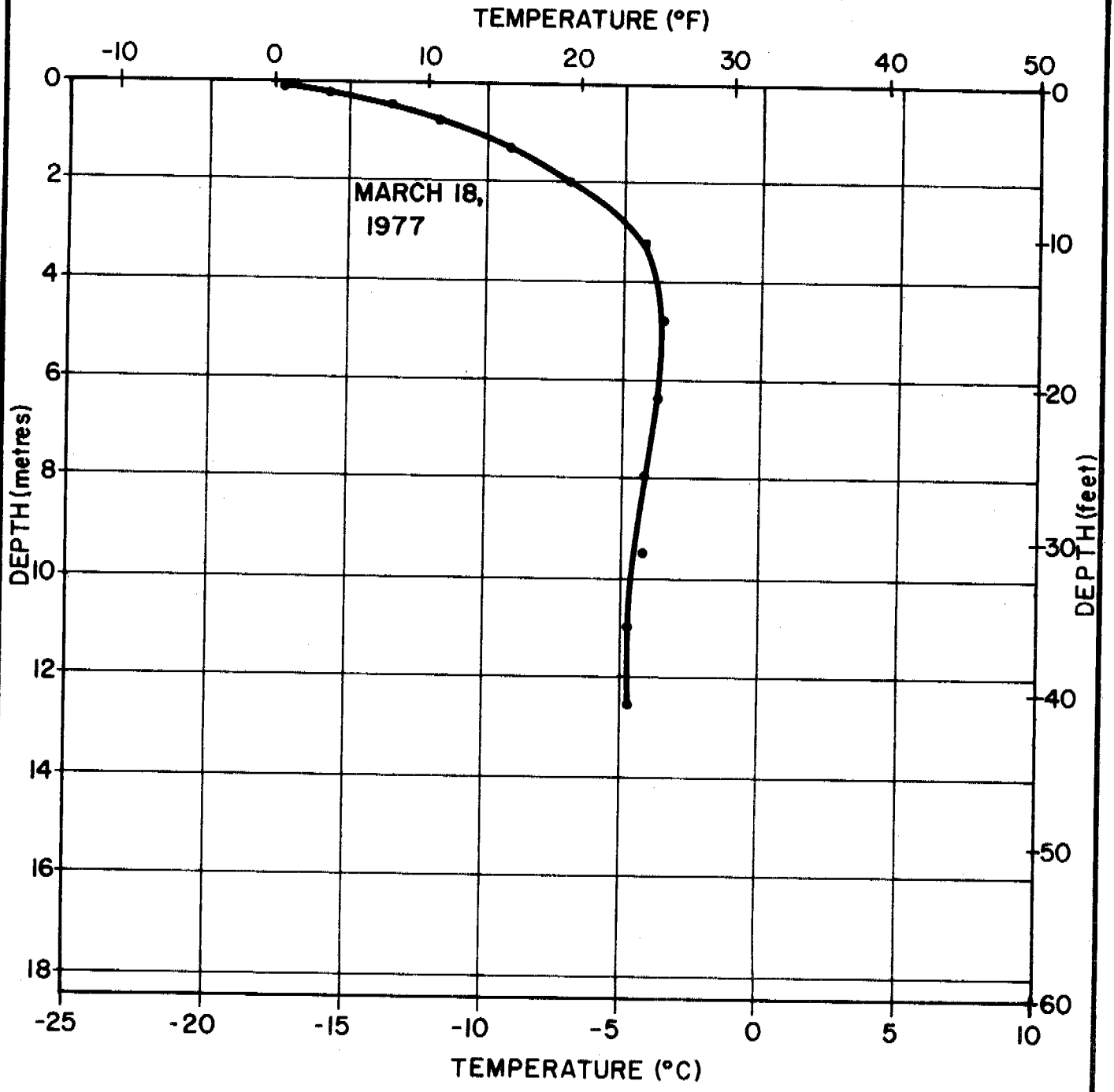
CANEP - BROWN & ROOT

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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR J-30-1

K3571-151

PLATE M-9



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

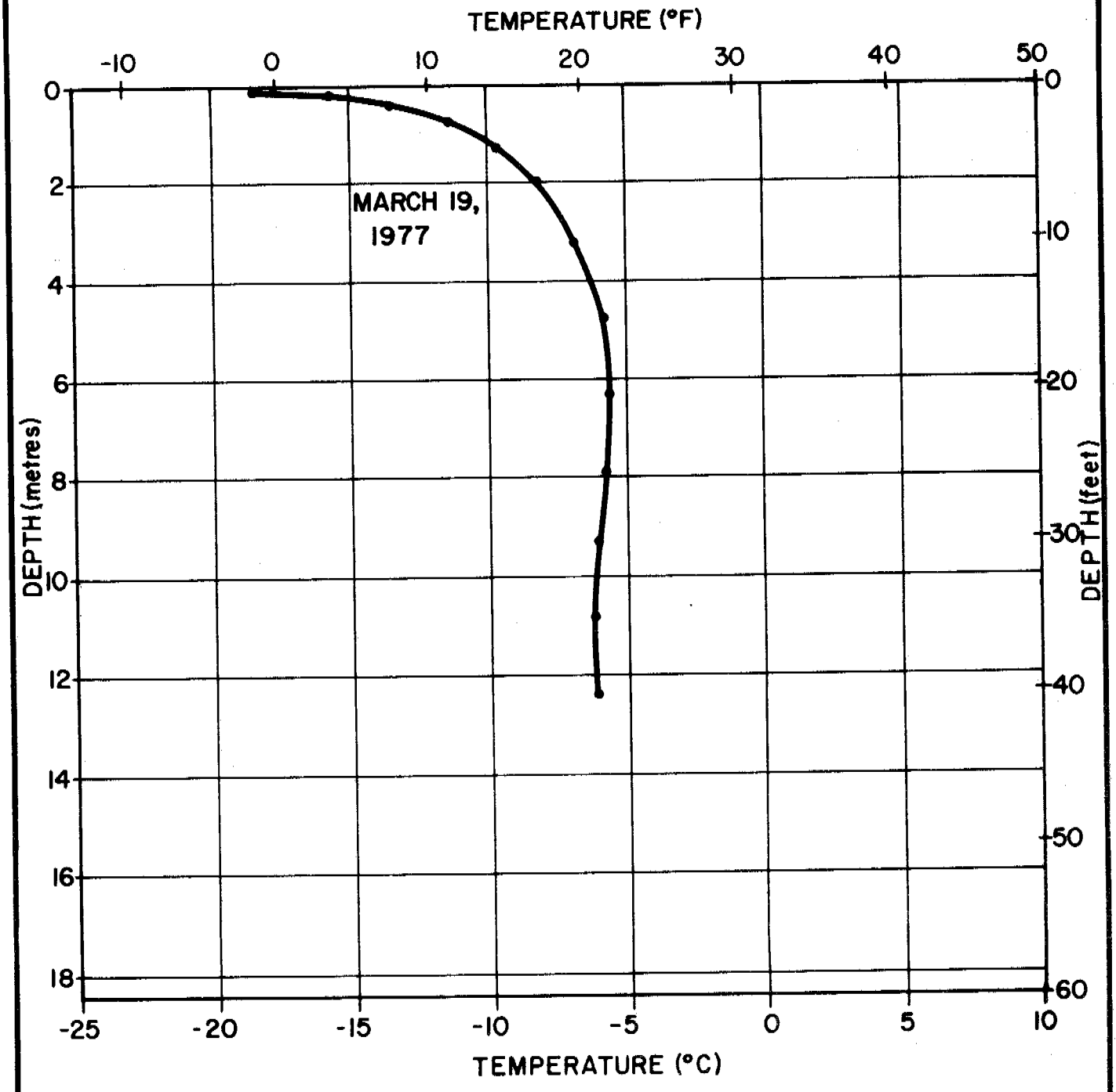
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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR GS-5

K3571-151

PLATE M-10



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

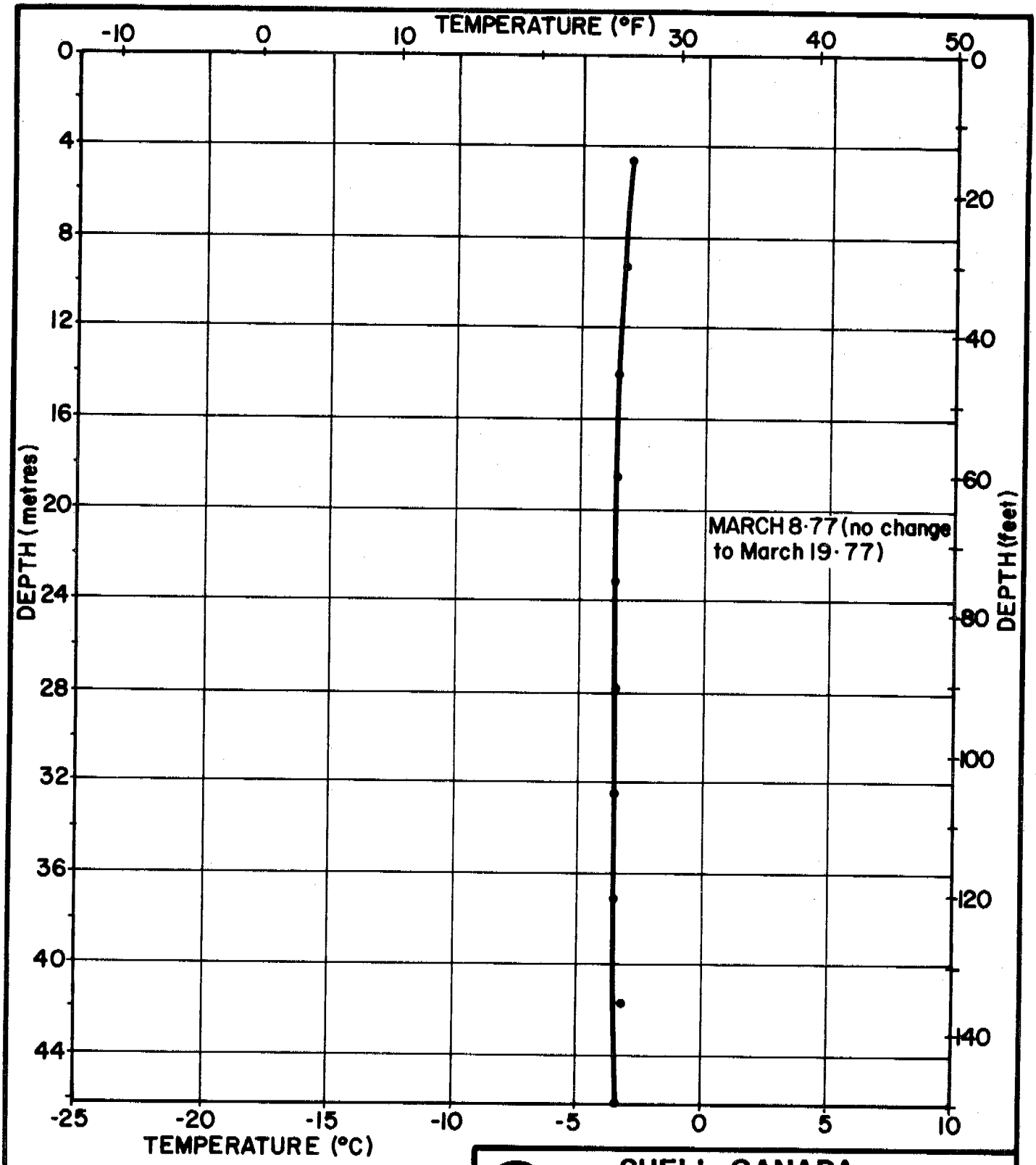
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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR LX2-4

K3571-151

PLATE M-11



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

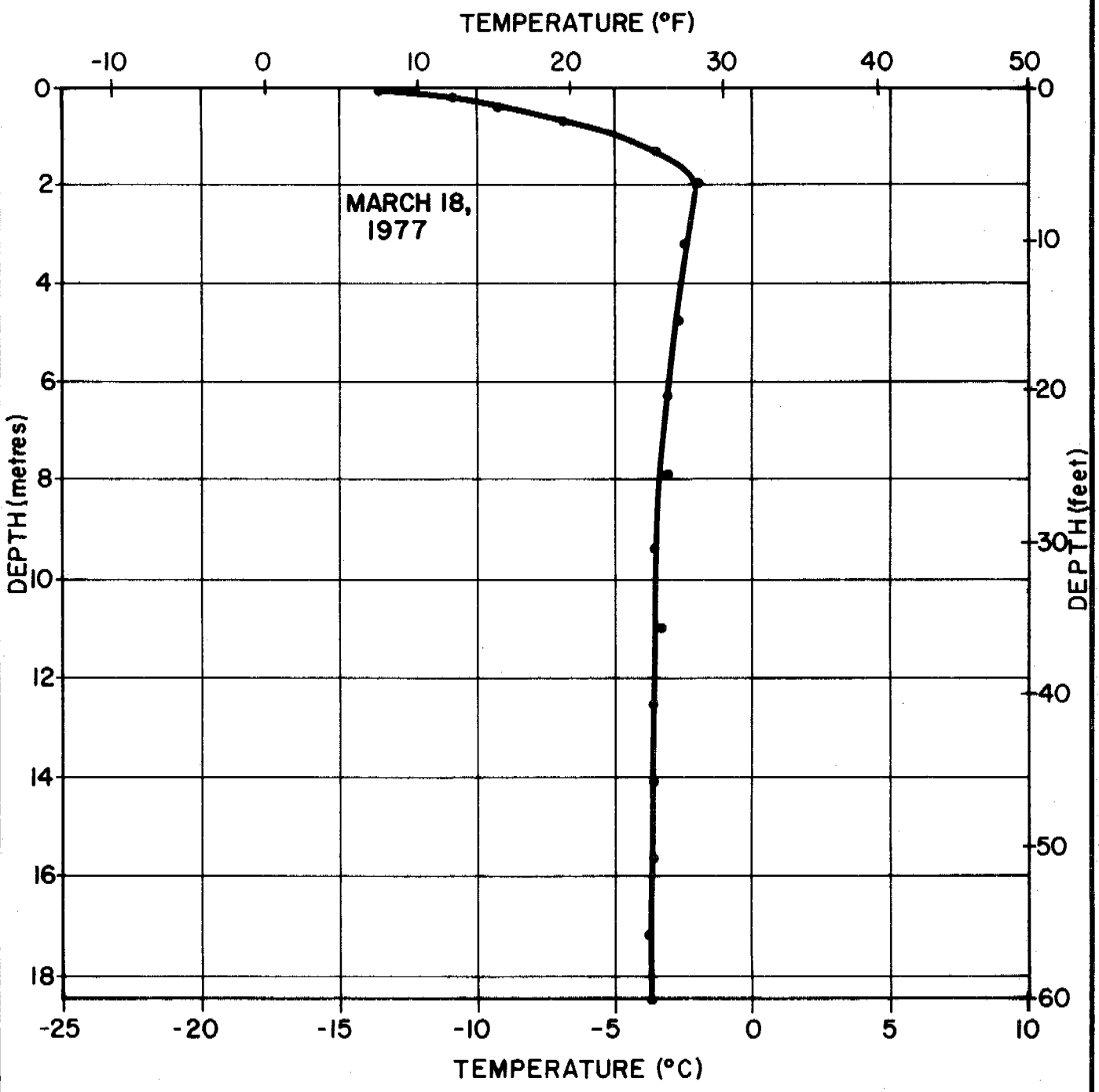
CANEP - BROWN & ROOT

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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR DH-1

K3571-151

PLATE M-12



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

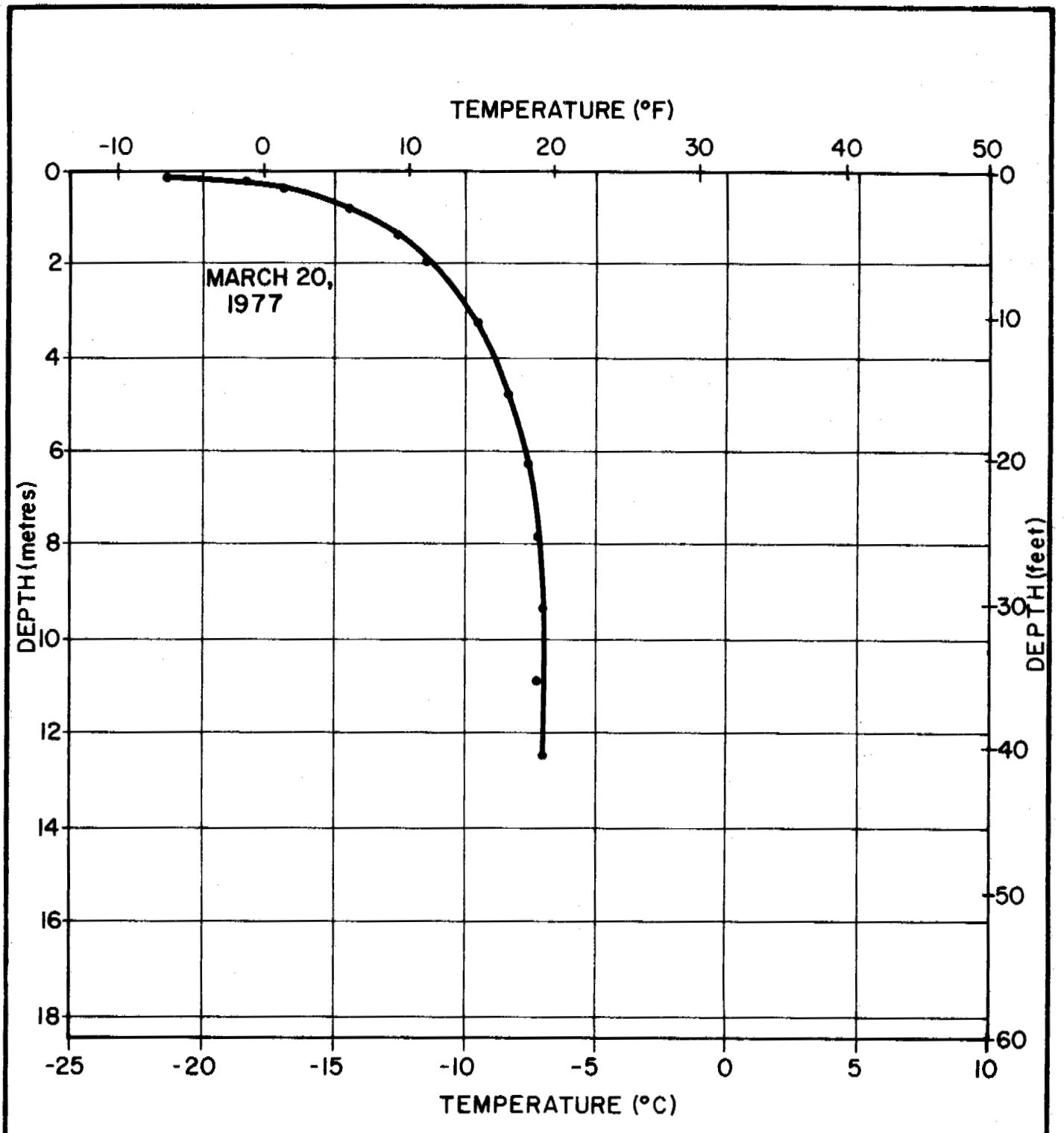
CANEP - BROWN & ROOT

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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR DH-60

K3571-151

PLATE M-13



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

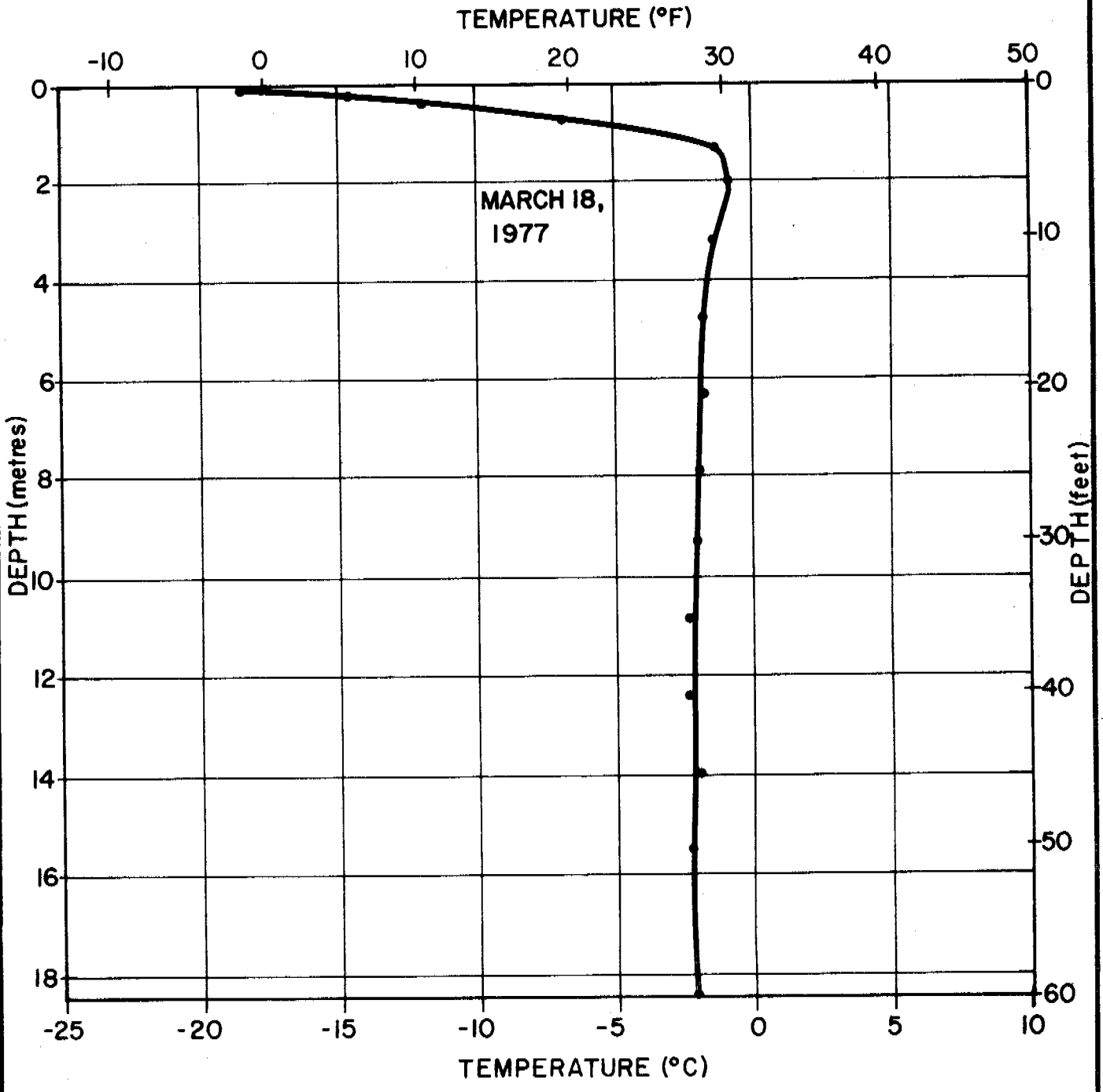
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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR GS-14

K3571-151

PLATE M-14



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

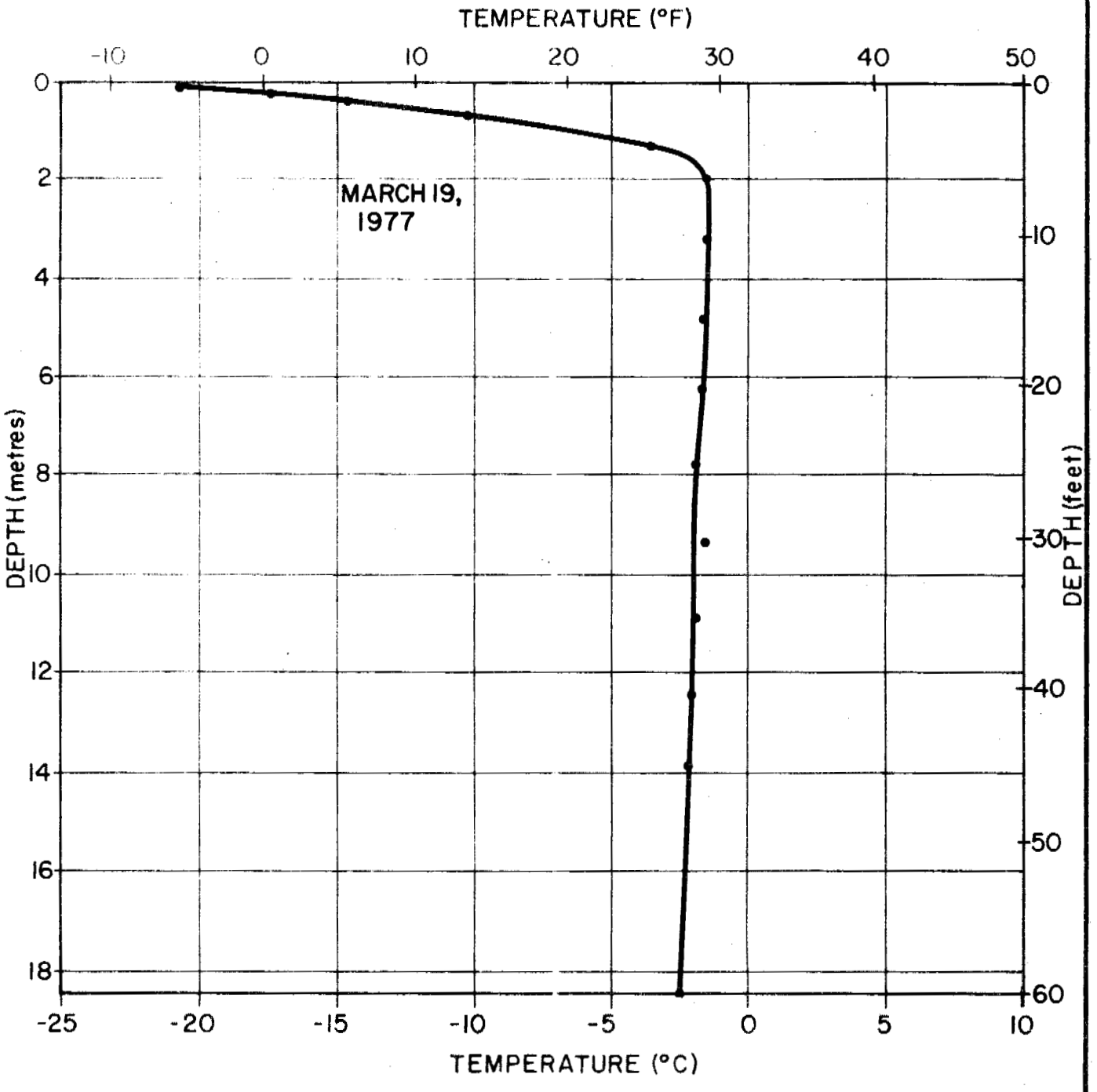
CANEP - BROWN & ROOT

R M HARDY & ASSOCIATES LTD

NIGLINTGAK GROUND TEMPERATURES
THERMISTOR J-08(2)-1

K3571-151

PLATE M-15



SHELL CANADA
RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

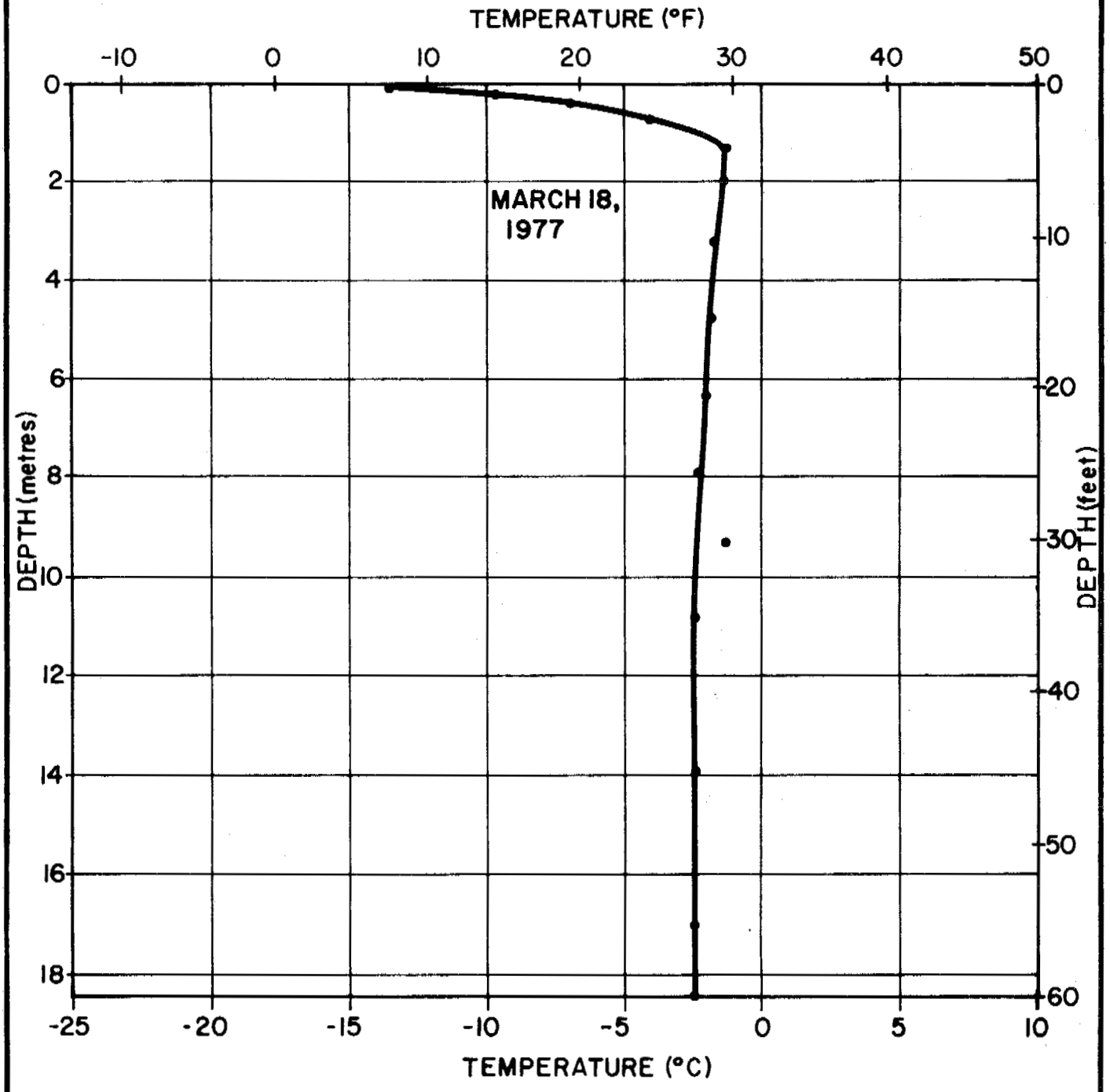
CANEP - BROWN & ROOT

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NIGLINTGAK GROUND TEMPERATURES
THERMISTOR RX1-4

K3571-151

PLATE M-16



SHELL CANADA RESOURCES LIMITED
NIGLINTGAK GAS PROJECT

CANEP - BROWN & ROOT

R.M. HARDY & ASSOCIATES LTD

NIGLINTGAK GROUND TEMPERATURES
THERMISTOR J-08-1

K3571-151

PLATE M-17