Public Works Canada
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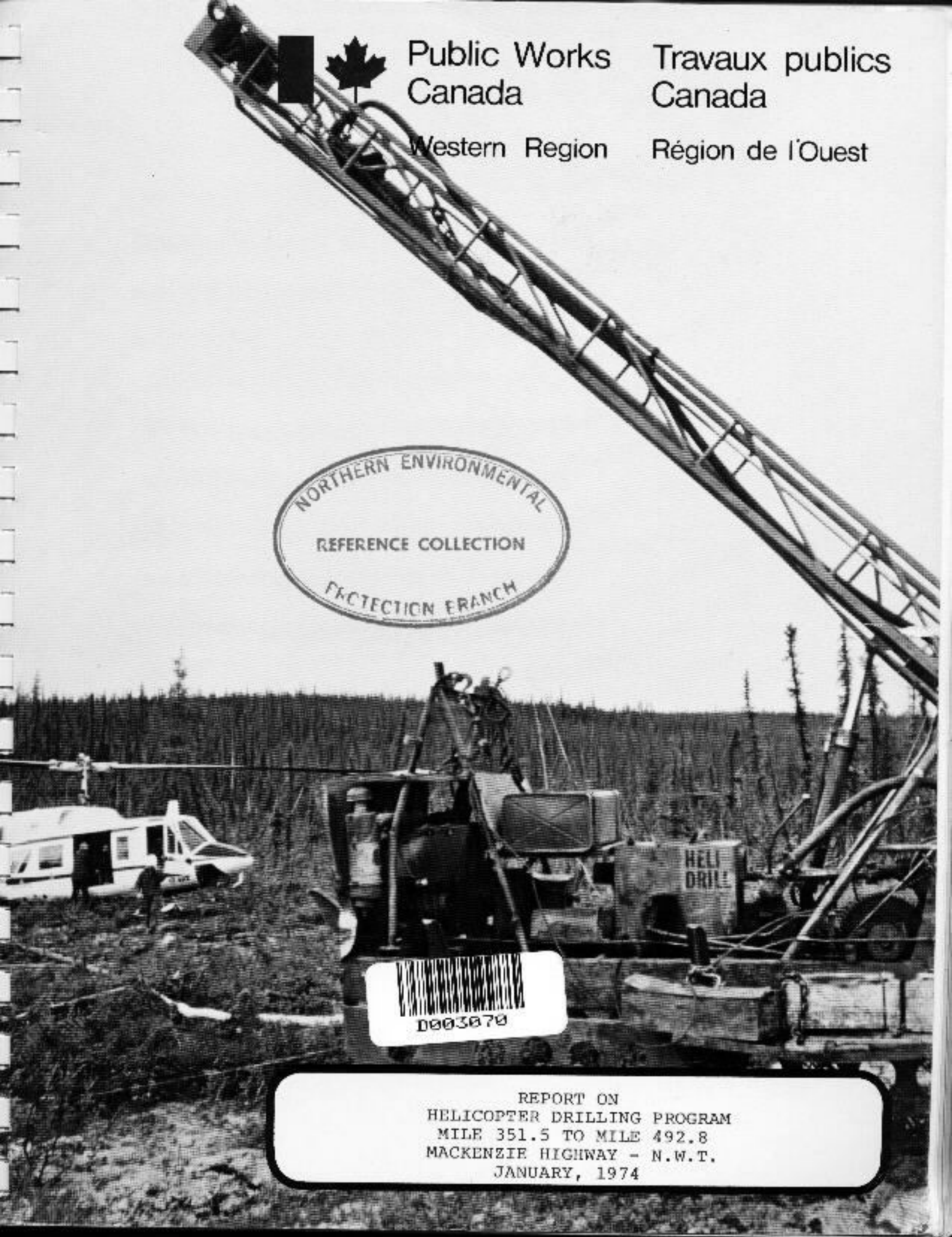

REPORT ON HELICOPTER DRILLING PROGRAM MILE 351.5 TO MILE 492.8 MACKENZIE HIGHWAY - N.W.T. JANUARY, 1974

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

SECURITY - CLASSIFICATION – *DE SÉCURITÉ*	
	OC0033
OUR FILE – *N/RÉFÉRENCE*	9305-52-300
YOUR FILE – *V/RÉFÉRENCE*	
DATE	February 1, 1974

TO / *À*
Mr. G. D. Reid
Ass't. Director Resources (Civil)
OTTAWA, Ontario

FROM / *DE*
J. W. Twach
A/Project Manager NWT Roads
Western Region

SUBJECT / *OBJET* "Report on Helicopter Drilling Program - Mile 351.5 to Mile 492.8 - Mackenzie Highway, N.W.T. - January, 1974."

This report contains the additional soils information which we indicated as deficient on the Final Design Submissions, Camsell Bend to Blackwater River.

The review of the Final Design Submission should take this report into account.

J. W. Twach
A/Project Manager NWT Roads
Western Region

REPORT ON

HELICOPTER DRILLING PROGRAM

M. 351.5 (CAMSELL BEND) TO M. 492.8 (BLACKWATER RIVER)

MACKENZIE HIGHWAY, N.W.T.

JANUARY, 1974

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I INTRODUCTION

I INTRODUCTION

This report summarises field exploration carried out on the Mackenzie Highway between Camsell Bend and the Blackwater River in October/1973. The drilling program was directed toward providing some subsoil data on proposed route revisions, and toward investigation of potential borrow sources in areas where insufficient borrow was proven during previous geotechnical work.

A helicopter borne Mayhew 250 "air" drill (Heli-drill) was used for all borings. This rig was adequate in all but unfrozen cohesionless deposits where sloughing materials prevented drill advance. Sampling was limited to 'grab' samples of air blown cuttings.

Borehole locations were pre-selected by highway designers and landing sites cleared by field personnel. Because of time and cost limitations each area of concern, such as proposed cut sections and potential borrow sources, could be investigated with only one borehole.

Borehole locations are shown on 1"= 1000' airphoto mosaics in Appendix II, and borehole logs with laboratory test results are included in Appendix I. The subsequent pages of this report include comments on each site and/or feature investigated.

II SITE COMMENTS

II SITE COMMENTS

Hole #1 - Approx. Mile 351.5 - Borrow Area - approx. 800 to 1300; Rt. ℄
Area is poplar treed and slightly higher than surrounding terrain. Borehole shows low-medium plastic silty sandy clay with pebbles - probably glacial till. No evidence of permafrost to 15' and moisture contents are below plastic limit. Considered to be a good borrow source.

Hole #2 - Approx. Mile 352.2 - Borrow Area - approx 600' Lt. ℄.
Area is poplar treed and slightly higher than surrounding terrain. Borehole reveals low-medium plastic silty, sandy clay with pebbles to 26' - probably glacial till. No evidence of permafrost and moisture contents are near 10%. Considered to be a good borrow source.

Hole #3 - Approx. Mile 353.5 - Borrow Area - approx. 800 - 1000' Rt. ℄.
Small, elongated poplar treed ridge (approx 1200' x 500') parallel to highway route. Borehole reveals low-medium plastic silty, sandy clay with pebbles to approx. 15' over silty sand. Upper clay material is at moisture content below plastic limit, but free water encountered at 17'. No permafrost reported. Considered to be usable borrow to approx. 15'.

Hole #4 - Approx. Mile 355.5 - on ℄ @ Sta. 448 + 00. Borehole is on a small treed rise which is one of several in the area. Subsoil consists of sand-silt to approx. 9' over low plastic sand-silt-clay with pebbles to 16'. No permafrost evident and moisture contents are below 10%. Boulders are evident on the surface. This rise is suitable for a cut section if required - although upper sand-silt is not good fill material in low-lying terrain.

Hole #5 - Approx. Mile 355.4 - Borrow area 400 - 500' Rt. ℄.
Area is small elongate treed rise roughly 800' x 300', parallel to the route, and is dissected from the feature at hole #4 by a narrow drainage channel. Borehole reveals low plastic sandy clay-silt to 16'. Permafrost was not encountered and moisture contents range from 12 to 20%. This area is considered to be borderline as a borrow source - sandy zones may be above optimum moisture and low plastic silts are poor fill material especially in low lying areas.

Hole #6 - Approx. Mile 364.2 - Borrow Area - 700' - 900' Lt. ℄.
Borehole is located on a small rise approximately 700' x 300'. Subsoil is very low plastic silty sand to 16'. Moisture contents are low. This area is considered to be a usably borrow source if more acceptable material is not available nearby in sufficient quantity.

Hole #7 - Approx. Mile 364.8 - Borrow Area - 600' - 800' Rt. ℄.
Borehole is located on one end of a long narrow ridge which intersects the highway route and is dissected by small stream channels. Subsoil consists primarily of low-medium plastic, sandy, silty clay with pebbles with a sand layer from 22' to 24'. Permafrost was encountered below 10', however the temp is near 32° and the subsoil is slightly plastic in the frozen state-no ice lenses were evident. Moisture contents are at or below the plastic limit. This feature is considered to be a usable borrow source, although it is anticipated that more extensive permafrost does exist in the low areas adjacent to the

ridge and probably in isolated pockets within the ridge itself. Ridge area available for borrow measures roughly 1500' x 500' and more drilling prior to opening a pit is recommended here to determine most suitable pit area and shape.

Hole #8 - Mile 368.0 - Borrow Area - approximately 1000' Rt.

Hole is located in treed area between two drainage channels, - proposed borrow area is only slightly above general terrain but is above drainage channels. Subsoil is low-medium plastic sandy silty clay with pebbles and cobbles below 8'. No permafrost was evident and moisture contents are below the plastic limits. Material is considered to be good borrow however the available area is limited by the drainage channels. Similar features are available in the area and other possible borrow sources do exist with slightly longer haul distances should the proposed area be of insufficient size.

Hole #9 - Mile 370.4 - Borrow Area approx. 600 - 800' Lt - &.

Borehole is located on a portion of an elongate ridge dissected by drainage channels, the shape of which suggests sandy or semi-granular subsoil. Test hole reveals silty sands with some gravel and cobbles below 3'. Bottom of hole @ 10' is near the level of surrounding terrain. Moisture content is low and no permafrost was encountered. This area considered to be a good borrow source.

Hole #10 - Mile 376.6 - Borrow Area - approx. 500 - 600' Rt. &.

Proposed borrow is in a small (600' x 600') poplar treed area adjacent to a creek. Subsoil consists primarily of sandy silty

clay with pebbles. Material is low to medium plastic and moisture contents are below the plastic limit - appears to be glacial till. Considered to be a good borrow source. No permafrost evident.

Hole #11 - Mile 378.1 - Borrow Area - approx. 600 - 700' Lt. ℄.

Borehole is in a treed area which is at or very near the same elevation as the surrounding terrain. Subsoil is low-medium plastic sandy silty clay with pebbles - probably glacial till. Permafrost is present below 3' and ice lenses were evident below 13' - however moisture (ice) contents are low and below the plastic limit. This area could probably be developed as a borrow source if borrow is scarce in the vicinity.

Material will provide a good road embankment following thawing and re-distribution of moisture.

Hole #12 - Mile 382.5 - Borrow Area 600' Rt ℄.

Proposed borrow area is a poplar clump approx. 700' x 250' very slightly higher than surrounding terrain. Subsoil to 16' is low to medium plastic sandy silty clay with pebbles - glacial till. Permafrost was not encountered and moisture contents are near or below the plastic limit. Considered to be a good borrow source.

Hole #13 - Mile 398.3 - Station 179 + 00 on ℄.

Hole located on top of steep rise in proposed cut area. Subsoil consists of low to medium plastic sandy silty clay with pebbles to 33', over sandy clay-silt from 33' to 36'. Permafrost was

noted from 5 to 11' and from 33 to 35', however no ice lenses were evident and moisture contents in the clay were below the plastic limits to a depth of 30'. No serious problems are indicated in a cut section to approx. 30' by this borehole, however, as this hole is located on the edge of a south-facing slope, more drilling is recommended back from the slope to confirm the absence of ice lenses throughout the entire cut area prior to excavation.

Hole #14 - Mile 395.1 - Borrow Area - approx. 1500' Rt. & Sta. 997 + 00
Hole is located on bluffs or terrace above a former channel of the Mackenzie River. Borehole encountered silty sands with some gravel, cobbles and boulders, however hole would not remain open and drill results were inconclusive below 5 - 6'. These deposits are probably only a thin veneer of outwash granular materials from the Willow Lake River and glacial till is expected at depth. The area drilled is well above the proposed roadway and a borrow pit can probably be developed in the general area, however the immediate area of the test hole may be too close to the edge of the bluffs for a pit, and drilling should be carried out farther back from the edge to confirm the subsoil at depth, and to establish the preferred pit area.

Hole #15 - Mile 401.0 - Borrow area - 500 - 600' Lt. &
Hole is located on small elongate ridge parallel to route - approx. 1200' x 400'. Subsoil is glacial till - low to medium plastic, sandy, silty clay with pebbles and occasional cobbles. No permafrost evident and moisture contents are consistent near 10 - 12% to depth of hole at 23'. Good borrow source to at least 20'.

Hole #16 - Mile 403.8 - Borrow area - 500' - 600' Rt. b

Hole is located on elongate ridge parallel to route. Subsoil is glacial till - low to medium plastic, sandy clay with pebbles and occasional cobbles. Moisture contents to 26' are below plastic limit. No permafrost evident. Considered to be a good borrow source.

Hole #17 - Mile 405.0 - Borrow area - 500' Lt. b

Hole is located on a treed area which is part of a large elongate ridge suggesting ground moraine. Subsoil is glacial till - low plastic sandy clay with pebbles with moisture contents below 10% to depth of hole @ 26'. - No permafrost evident. Good borrow source.

Hole #18 - Mile 415.7 - Borrow Area - 1600 - 1700' Rt. b

Hole is located on a portion of one of a series of long ridges which appear to be ground moraine. Subsoil to 21' consists of low plastic sandy clay with some gravel throughout and with a concentration of gravel and cobbles from 14' to 18'. Moisture contents are below 10% and no permafrost was evident. Considered to be a good borrow source.

Hole #19 & #20 - Mile 420 - 422 - on b.

Both holes are located on a treed area which is part of what appears to be a terrace of the Mackenzie River. Drilling in both holes was inconclusive as drill advance was impossible below 6' due to sloughing of cohesionless materials - sands with gravels & cobbles. Surface features on terrace suggests semi-granular or cohesionless materials and a creek gully

through the terrace, plus the steep face of the terrace, indicate the same materials extend for significant depths (40-50') especially near the River. On centerline the depth of these materials is probably less and estimated at approx. 15'. If advantageous, a cut section could be included here and a usable borrow pit can probably be developed toward the river if required.

Hole #21- & #22 Mile 422-424 - on b

Both holes are located on a continuation of the terrace on which holes #19 and #20 were bored. Hole #21 is in an area which has been partially eroded by a tributary stream flowing into the Mackenzie, and hole #22 is on higher ground outside the erosion area of this stream. Both holes encountered sands with gravels and cobbles and drilling results were inconclusive due to sloughing of dry cohesionless materials. In holes #21 the depth of the cohesionless materials was roughly 10-11' and appeared to be underlain by clay. Hole #22 was terminated at 6' in sands with gravels and cobbles, however the depth of these materials in the area of hole #22 is estimated at 20 to 25'. No permafrost was reported and the entire terrace area should be suitable for roadway cuts or borrow pits. The very limited drilling results indicate materials are primarily sandy in nature and probably lack sufficient aggregate for use as surfacing. Test pitting is suggested here.

Hole #23- Mile 424.6 - station 1560 on b

This hole is located on a continuation of the terrace investigated in holes #19 to #22 but near the edge of the surface features which suggest granular or cohesionless

materials. Subsoil consists of sands to a depth of 20' with permafrost below 5'. Moisture contents in the frozen material are near 20% and some free water can be expected upon thawing. This material is not recommended for borrow unless it can be piled and allowed to drain before use. Also the presence of permafrost at depth here suggests the possibility of permafrost zones or pockets throughout the terrace between holes #19 and #23.

Hole #24 Mile 429.2 - Borrow Area approx 500 - 600' Rt. ℄

Borehole is located on a well drained treed ridge adjacent to the highway. Drilling results were inconclusive - subsoil to 6' consisted of sand or silty sand-further penetration was not possible. No permafrost reported to 6'. This area can probably be developed as a borrow pit although extent and type of material cannot be estimated. Area immediately north of ridge appears to be ice rich silts or clays - maximum depth of borrow estimated at 15 - 20 if no permafrost encountered.

Holes #25 & #26 Mile 429 - 430 - Smith Creek Realignment

Both holes located on Northfacing slope on approach to Smith Creek. Subsoil in both holes is low to medium plastic silty clays with permafrost and ice lenses throughout. The general area appears to be susceptible to sliding upon thawing and cuts are not recommended here.

Holes #27 #27A & 28 These holes located adjacent to Smith Creek - Holes 27A & #27 on South side and #28 on North side. South slope adjacent to the creek appears to be sliding toward the creek as

permafrost thaws, and the North bank has numerous cracks about 10 - 12' above water level extending 25 - 30' back from the edge of the stream where small slumps occur. A sandy gravel face is exposed on the North bank of Smith Creek roughly 300' upstream from this proposed crossing site.

All holes encountered permafrost and ice lenses. Holes 27 and 27A revealed 10 - 11' of sand and gravel over silty clay - hole #28 was inconclusive.

The entire south approach slope and the 'flood plain' areas on both sides of the creek appear to be ice rich. The steep North approach appears to be better material but this program did not include drilling on this bench. The South slope is not suitable for cut sections. Insufficient data was obtained to evaluate the foundation condition at the crossing site.

Hole #32 Mile 442.3 - Borrow Area 900' Rt. &

Borehole is located in a well-treed area which is only slightly above the surrounding wet terrain. The subsoil is medium to highly plastic silty clay with no permafrost evident. Moisture contents are at or below the plastic limit to depth of hole @ 16'. A silt layer was evident near 10 - 11'. This area can provide usable borrow.

Hole #33A Mile 443.4 - Borrow Area 600 - 700' Rt. &

Borehole is located on a treed rise which is very slightly higher than surrounding wet terrain. Subsoil is low to medium plastic silty clay with low plastic clay-silt zones. Permafrost was encountered below 8' with ice lenses. Moisture (ice) contents in permafrost zone may be sufficiently above optimum for this low plastic material to create problems on thawing. Not recommended for borrow.

Hole #34 Mile 444.7. Borrow Area - 1200' Rt. ♭

Borehole located in treed area with little relief. Subsoil is low plastic silty clays or clay-silts. Permafrost is present below 11' however temp is close to 32° and ice crystals only are present. Moisture contents below 5' are in the 22 - 25% range and may average above the optimum moisture content. This area considered to be borderline for borrow and should be developed only after more drilling.

Hole #35 Mile 461.8 - Sta 994 on ♭

Borehole is located on terrace of Mackenzie River adjacent to tributary creek. Subsoil to 8' is clay-silt with some cobbles or boulders. Further drill advance was not possible. Permafrost is present with ice lenses. This area is not recommended for cut or borrow.

Hole #36 Mile 478.3 on ♭

Borehole is located on the top of North facing slope of a small stream valley in a proposed cut area. Subsoil is medium to highly plastic silty clay. No permafrost was evident to the depth of hole @ 16'. Moisture contents are below the plastic limit. This immediate area is suitable for cut section at least to the depth of the borehole. If permafrost is encountered in the area it likely will be to the south of hole #36 rather than toward the stream valley on the North. Based upon this hole a cut section should be o.k. here however more drilling is recommended throughout the entire cut section prior to excavation.

Hole #37
& #38 Mile 492.8 - Blackwater River on b

Both holes are located in a proposed cut area on the North side of the Blackwater River Valley. Hole #37 near the edge of the valley slope did not encounter permafrost to a depth of 37' - hole #38, 600 feet back from #37 encountered permafrost below 3'. Subsoil in both holes consisted of medium to highly plastic silty clay. Moisture contents in both holes were near the plastic limit @ approx. 20%. More drilling with core sampling in the permafrost zone is recommended to assess potential sloughing problems in a cut section. The low moisture contents suggest that sloughing problems would be minor and associated only with random large ice lenses, however this can be better evaluated after more drilling.

R.D. Cook
Quality Control Engineer

APPENDIX I

BOREHOLE LOGS

HELICOPTER DRILLING - OCT/1973

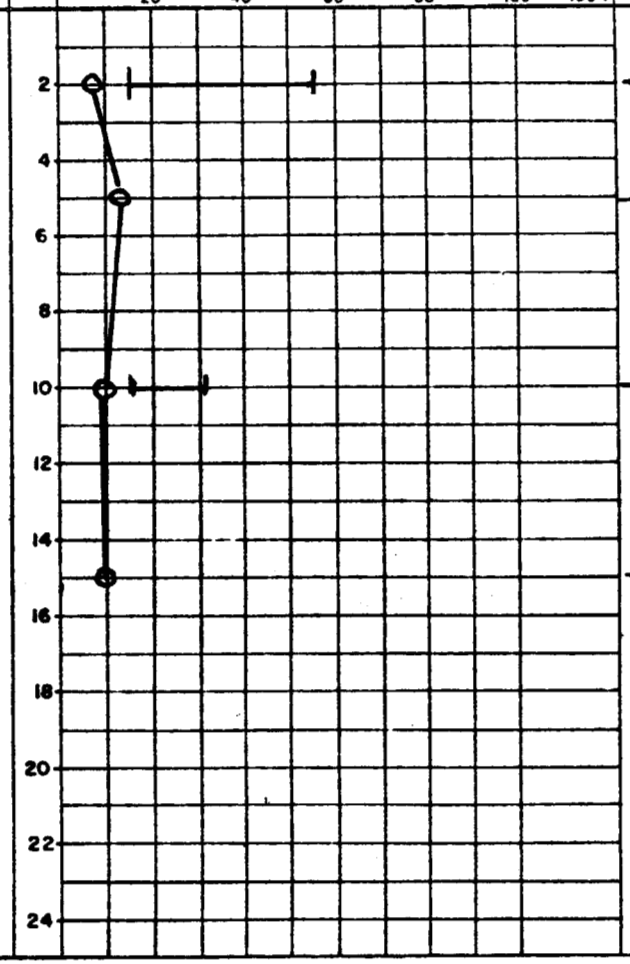
DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN: FIELD ENG	DATE DRILLED:	AIRPHOTO NO:	CHAINAGE: 244	OFFSET: 1500' Rt. ℄	TEST HOLE
CKD: TECH	RIG:	SURFACE DRAINAGE:	VEGETATION:	ELEV:	MILE: 351.6 · B,C,S: B · NUMBER: 1

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0–2						4" ORGANIC MTL		
2–4					CL	SILTY SANDY CLAY		No Visible Frost.
4–6					CI	- LOW - MEDIUM PLASTIC		
6–8						- DAMP		
8–10						- PEBBLES		
10–12								
12–14								
14–15.5						HIT BOULDER @ 15.5' 15.5'		
15.5						BOTTOM OF HOLE - 15.5'		
16–24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)



GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
CLAY %	SILT %	SAND %	GRAVEL %		
49	33	17			
75	20	6			
71	15	4			
66	25	9			

REMARKS

- APPEARS TO BE GOOD BORROW SOURCE.
- POSSIBLY TILL.

Helicopter Drilling - Oct/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE 281	OFFSET 600' Lt. &
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

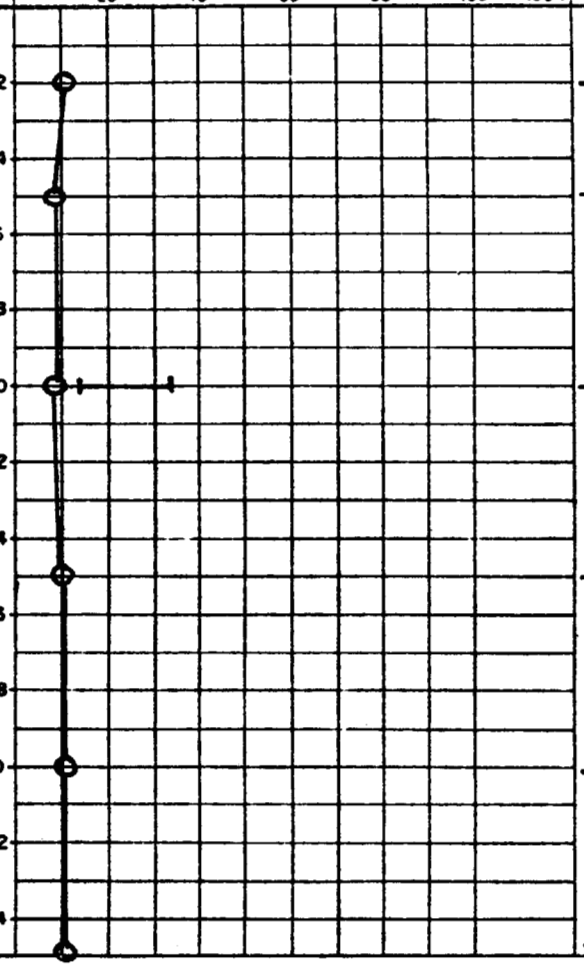
TEST HOLE

MILE	B,C,S	NUMBER
352.2	B	2

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2						4" ORGANIC MTL		
4						Silty Sandy CLAY		
6						- Low - Medium Plastic		
8					CI	- Damp		No Visible Frost.
10					CL	- Pebbles		
12								
14								
16								
18								
20								
22								
24						Bottom of Hole - 26'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	65	30	5			
4	63	29	8			
10	68	25	7			
14	68	30	2			
20	62	30	8			
24	72	17	1			

REMARKS

Good Borrow Source
- Appears to be Glacial Till.

R073

HELICOPTER DRILLING Oct/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE 347+50	OFFSET 850' RT
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
353.5	B	3

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
						ORGANICS 4"		
2					ML	Silt, Cloyey LP 1½'		
4					CL	CLAY, SILTY SANDY		
6					CI	PEBBLES		No Evidence of Frost
8						LOW PLASTICITY		
10								
12								
14								
16					SM	SAND, SILTY CLAYEY 15% PEBBLES, MOIST,		
18						FREE WATER @ 17'		
20						Bottom of Hole 17'		
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (PCF)	DRY DENSITY (PCF)
2	-63-	33	4			
4	-54-	39	7			
6						
8						
10	-57-	30	11			
12						
14						
16	-34-	60	6			
18						
20						
22						
24						

REMARKS

Appears to be usable Borrow to Approx 15'

Note water table @ 17'

RD73

HELICOPTER DRILLING - OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 448	OFFSET: ℄
CKD	TECH	RIG:	SURFACE DRAINAGE:	VEGETATION:	ELEV

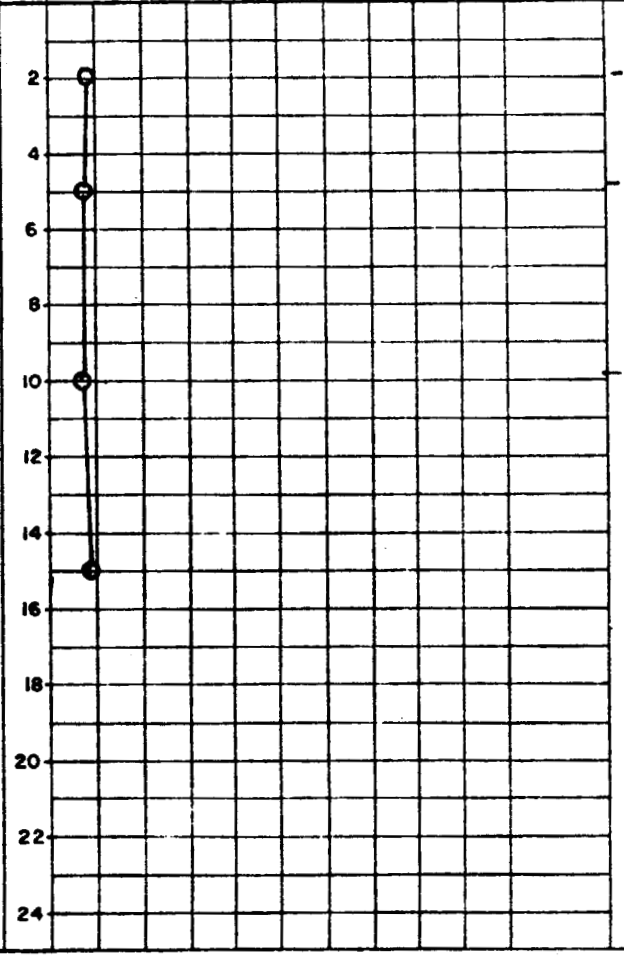
TEST HOLE

MILE	B,C,S	NUMBER
355.5	C	4

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2						4" ORGANIC MTL		
4					SM	SAND SILTY, PEBBLES BROWN NO PLASTICITY		NO EVIDENCE OF FROST
6								
8						9'		
10						CLAY		
12					CL	SANDY SILTY LOW - PLASTIC DAMP		
14								
16						16'		
18						VARYING DEGREES OF SAND & GRAVEL		
20						BOTTOM OF HOLE @ 16'		
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (PCF)	DRY DENSITY (PCF)
2	41		46	12		
4	45		53	2		
10	58		32	10		

REMARKS

BOULDERS ON SURFACE

O.K. FOR CUT OR BORROW

R073

HELICOPTER DRILLING - Oct / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

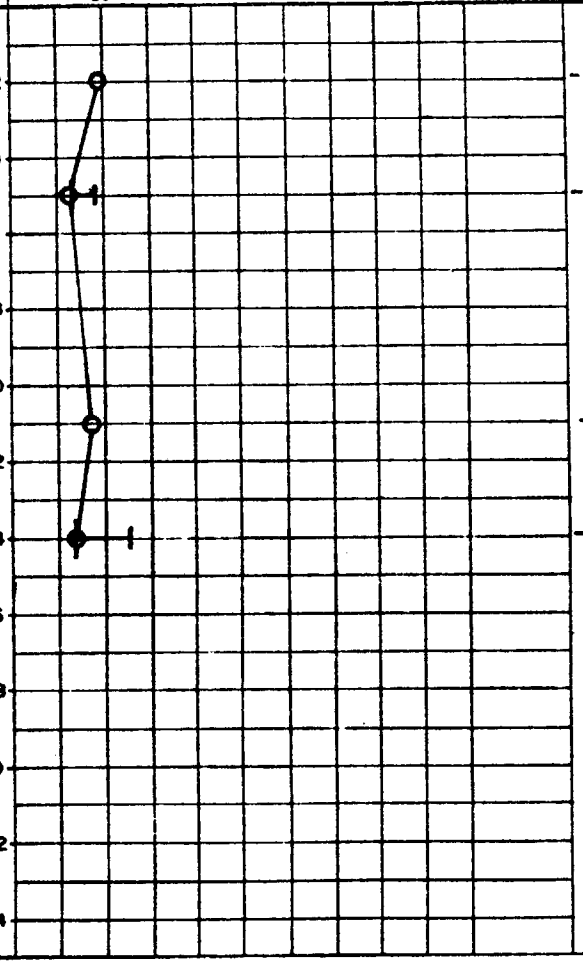
DWN: FELD ENG | DATE DRILLED: | AIRPHOTO NO: | CHAINAGE: 443 | OFFSET: 600' RT
CKD: TECH | RIG: | SURFACE DRAINAGE: | VEGETATION: | ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
355.5	B	5

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0						4" ORGANIC MTL		
2					ML	SILT Sandy, clayey Low plastic Moist, Brown Some silty sand		No Evidence of frost
16						Bottom of hole @ 16'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)
PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+



GRAIN-SIZE ANALYSIS	CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
	93	5	2			
	48	42	10			
	78	22	-			
	65	32	3			

REMARKS

BORDERLINE AS BORROW SOURCE.
-SAND-SILT ZONES MAY BE ABOVE OPTIMUM MOISTURE.

R073

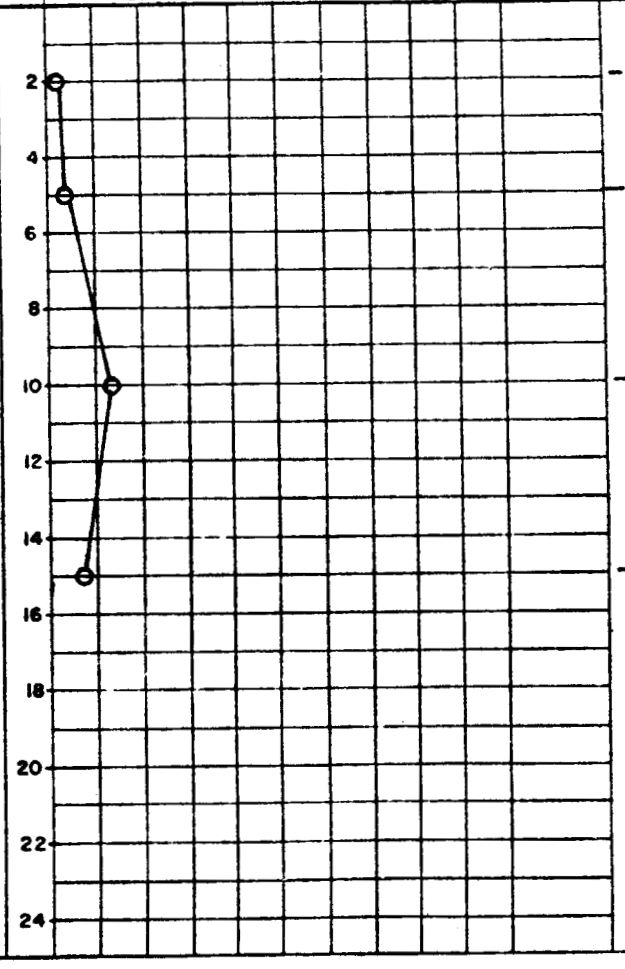
HELICOPTER DRILLING OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE | OFFSET BP LEFT | TEST HOLE
CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION | ELEV | MILE 364.2 | B,C,S B | NUMBER 6

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					CL	4" ORGANIC MTL CLAY SILTY, BROWN DAMP 1½'		
4						SAND - SILTY FINE - MED GRAINED DAMP, BROWN		
6					SM	PEBBLES		
8						NO PLASTICITY		
10								
12								
14								
16						Bottom of hole @ 16'		
18								
20								
22								
24								



GRAIN-SIZE ANALYSIS	CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
	24	65	11			
	13	83	4			
	27	73	-			
	34	65	1			

REMARKS

LOST CIRCULATION @ 13'

-USABLE BORROW SOURCE

R073

HELICOPTER DRILLING - OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE:	OFFSET: B.P. RT.
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV:

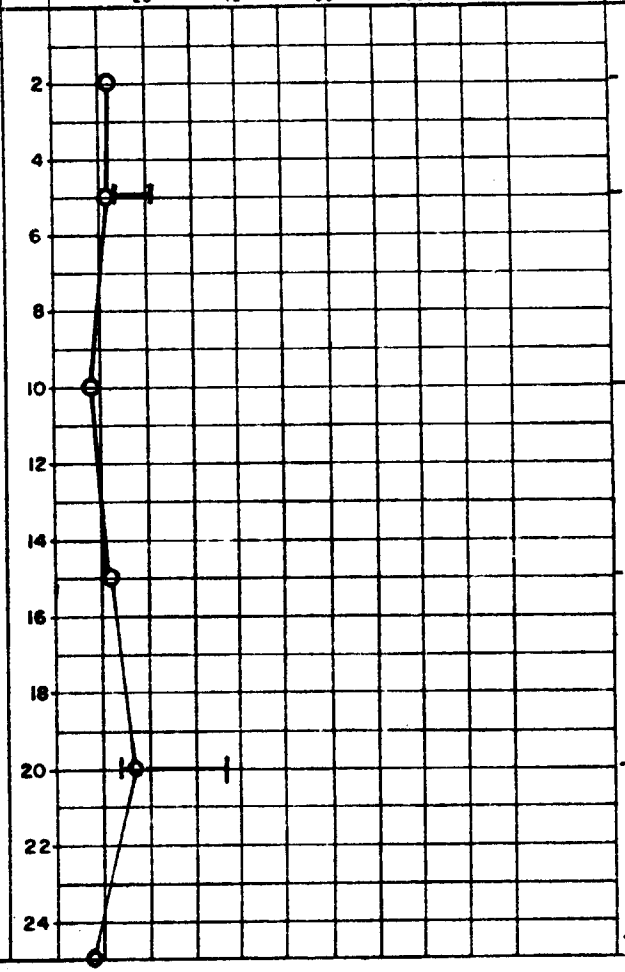
TEST HOLE

MILE	B,C,S	NUMBER
364.8	B	7

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
2					CL	4" ORGANIC MTL. CLAY SILTY SANDY LOW PLASTICITY DAMP, BROWN			55	35	10				PROBABLE BORROW SOURCE -APPEARS TO BE GLACIAL TILL FROZEN ZONES BELOW 10'
4									56	32	12				
6															
8															
10					CL	CLAY SILTY LOW PLASTICITY PEBBLES, DAMP BROWN		FROZEN BELOW 10' BUT TEMP NEAR 32°	56	30	14				
12															
14									73	25	2				
16															
18															
20									86	13	1				
22					SM	SAND FINE - MEDIUM GRAINED, PEBBLES DAMP									
24					CI	CLAY SILTY, GREY, PEBBLES			58	34	8				

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+



R073

BOTTOM OF HOLE @ 26'

HELICOPTER DRILLING - OCT/1973

DRILL HOLE REPORT

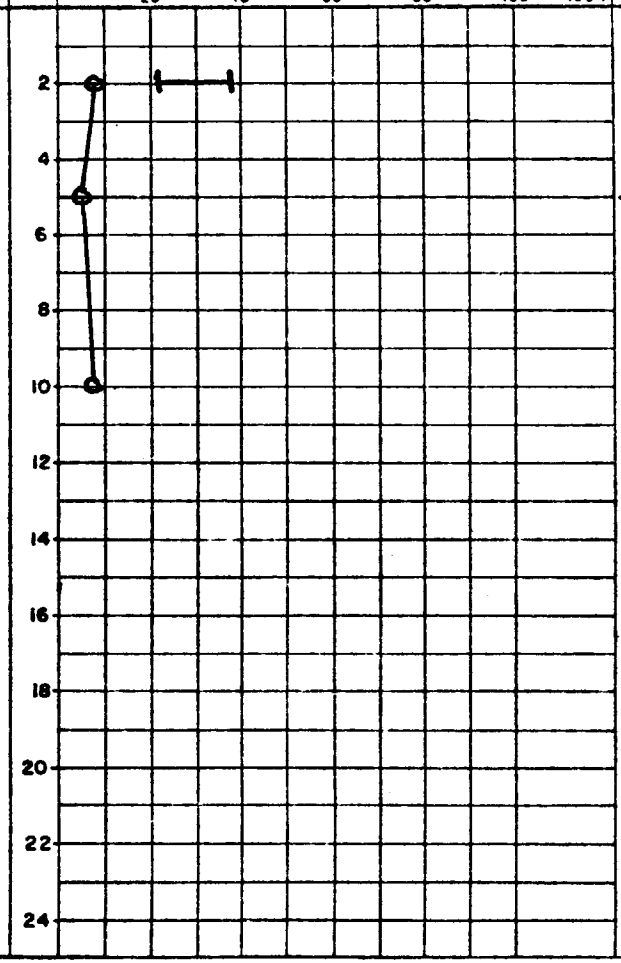
DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN: FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 1109+00 | OFFSET: 1000' Rt.
CKD: TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
368	B	8

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					CL	6" ORGANIC MTL OVER SILTY SANDY CLAY WITH PEBBLES		No EVIDENCE OF FROST
						3'		
4						SANDY SILTY CLAY WITH PEBBLES		
6						-LOW PLASTIC		
8						-COBBLES START @ 8'		
					CL			
10						-LAYER OF COBBLES 11½-12½		
12						-DAMP		
14						14'		
						Bottom of Hole - 14'		
16								
18								
20								
22								
24								



GRAIN-SIZE ANALYSIS	CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (PCF)	DRY DENSITY (PCF)
	47	37	16			
	49	46	5			
	35	61	4			

REMARKS

Poor Returns After 11'

O.K. For Borrow.

8073

HELICOPTER DRILLING - Oct 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 1238+00	OFFSET 600' RT
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
370.4	B	9

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					SM	6" ORGANIC MTL SAND SILTY, BROWN NO PLASTICITY DAMP GREY @ 1' COBBLES @ 3' GRAVELLY @ 3' SAND WITH GRAVEL & LOOSE COBBLES		No Evidence of Frost
10						BOTTOM OF HOLE @ 10'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT: 20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	19	73	8			

REMARKS

No returns after 3'
- in sand with gravel & cobbles
Below 10'
- Good Borrow
- Unable to sample to determine suitability for surfacing

DRILL HOLE REPORT

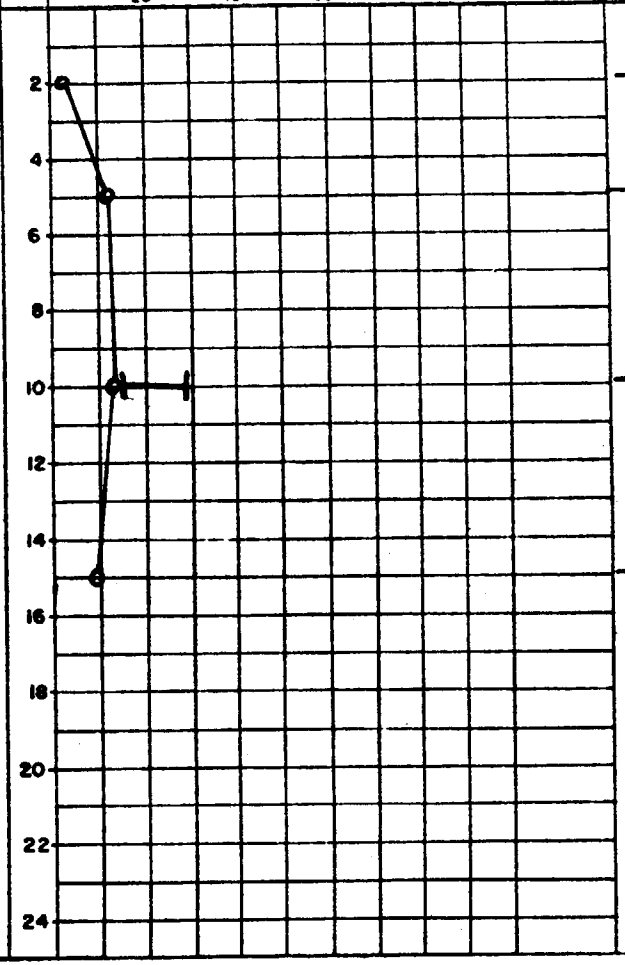
DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

HELICOPTER DRILLING OCT/1973

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE:	OFFSET BP RT. ℄	TEST HOLE
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV	MILE 376.6 · B,C,S B · NUMBER 10

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
0–2					PT	4" ORGANIC MTL									
					SW	SAND, GRAVELLY, BROWN FINE - COARSE, GRAINED, DAMP — 2½'			14	67	19				O.K. FOR BORROW
4–10					CL I CI	CLAY SANDY SILTY PEBBLES, DAMP, GREY LOW-MED PLASTIC — 11'		No Evidence of Frost	59	37	4				APPEARS TO BE GLACIAL TILL
10–12					CL	CLAY SILTY, PEBBLES, LOW PLASTIC — 13'			63	34	3				
12–16					CL I CI	CLAY SILTY SANDY PEBBLES, DAMP, GREY LOW-MED PLASTIC			61	31	8				
16–24						BOTTOM OF HOLE @ 16'									

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)



HELICOPTER DRILLING OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

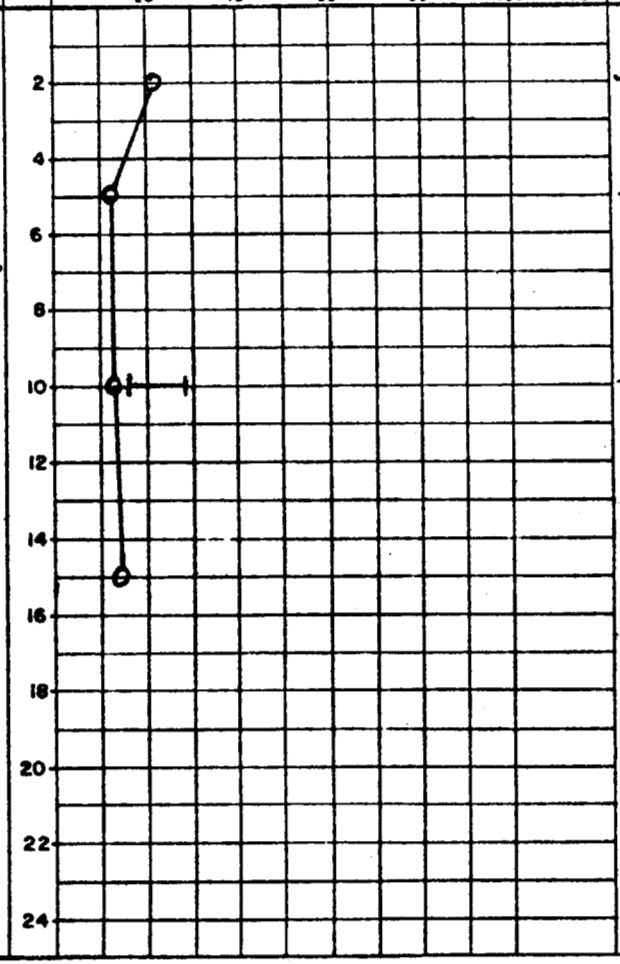
DWN | FIELD ENG. | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: | OFFSET B.P. LT. ℄
CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV

TEST HOLE

MILE	B,C,S	NUMBER
378.1	B	11

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0						6" ORGANIC MTL		
2					CL	CLAY SILTY, DAMP, GREY LOW PLASTIC		FROZEN
3½'								BELOW 3'
4						CLAY		
6						SILTY SANDY		ICE LENSES
8					CL - CI	LOW-MED PLASTIC		START @ 13'
10						GREY DAMP		
12								
14								
16						BOTTOM OF HOLE @ 16'		
18								
20								
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	95	4	1			
6	64	32	4			
10	56	30	14			
14	84	15	1			

REMARKS

FROZEN
- NOT RECOMMENDED FOR BORROW
- HOWEVER AS MOISTURE CONTENT IS LOW COULD BE INVESTIGATED FURTHER AS BORROW SOURCE IF NECESSARY
- APPEARS TO BE GLACIAL TILL

R073

HELICOPTER DRILLING OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

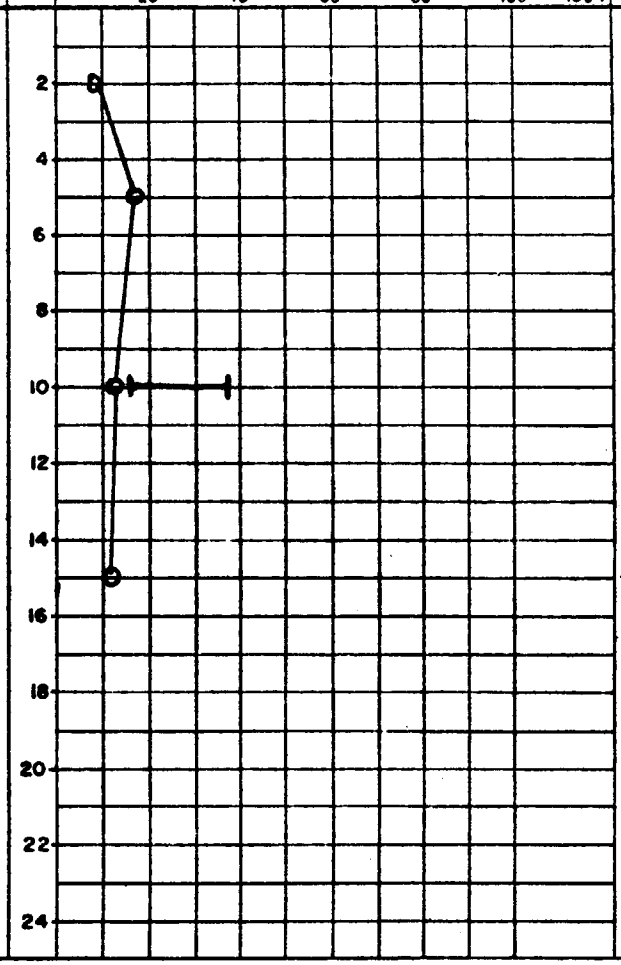
DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: | OFFSET: B.P. RT ℄

CKD | TECH | RIG: | SURFACE DRAINAGE: | VEGETATION | ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
382.5	B	12

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0						4" ORGANIC MTL		
2					CL	CLAY, SILTY, MOIST 1'		
						SAND, GRAVELLY, SILTY NON PLASTIC, DAMP, MOIST 3'		
4						CLAY		
6					CL	SANDY SILTY PEBBLES, DAMP LOW PLASTIC		No EVIDENCE OF FROST
8								
10								
12					CL-CI	LOW - MED PLASTIC AFTER 10'		
14								
16						BOTTOM OF HOLE @ 16'		
18								
20								
22								
24								



GRAIN-SIZE ANALYSIS	CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
							POOR RETURNS AFTER 12'
	-37-	52	11				
	-65-	34	1				TOP 10' SOFT
							POSSIBLE BORROW SOURCE
	-76-	23	1				
	-72-	28	-				GLACIAL TILL

HELICOPTER DRILLING - OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 179+00 | OFFSET: ℄
CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
398-399		13

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT: 20, 40, 60, 80, 100, 100+

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
2						8" ORGANIC MTL									ORIGINAL # 13
4						CLAY SILTY, SANDY									CANCELLED
6						PEBBLES, DAMP		FROZEN 5'-11'							# 13 MOVED TO NEW LOCATION
8						COBBLES 7'-10'									FROZEN 5'-11'
10					CL				64	29	7				ALSO ICE CRYSTALS @ 35'
12					I										
14					CI										
16									64	28	6				
18															
20									59	38	3				OK FOR CUT OR BORROW
22															
24									72	27	1				
									70	26	4				
									77	21	2				

R073

HELICOPTER DRILLING - OCT 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN: FIELD ENG: | DATE DRILLED: | AIRPHOTO NO: | CHAINAGE: 179+00 | OFFSET: ℄

CKD: TECH: | RIG: | SURFACE DRAINAGE: | VEGETATION: | ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
398-399		13

REMARKS

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
33'					ML	SILT SANDY NON PLASTIC		ICE CRYSTALS FROZEN 33-36'
36'						BOTTOM OF HOLE @ 36'		NO VISIBLE ICE LENSES

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT

20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
30	73	24	3			
34	78	22	-			

R073

HELICOPTER DRILLING - OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 997+70	OFFSET: 1600' Rt. ℄
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

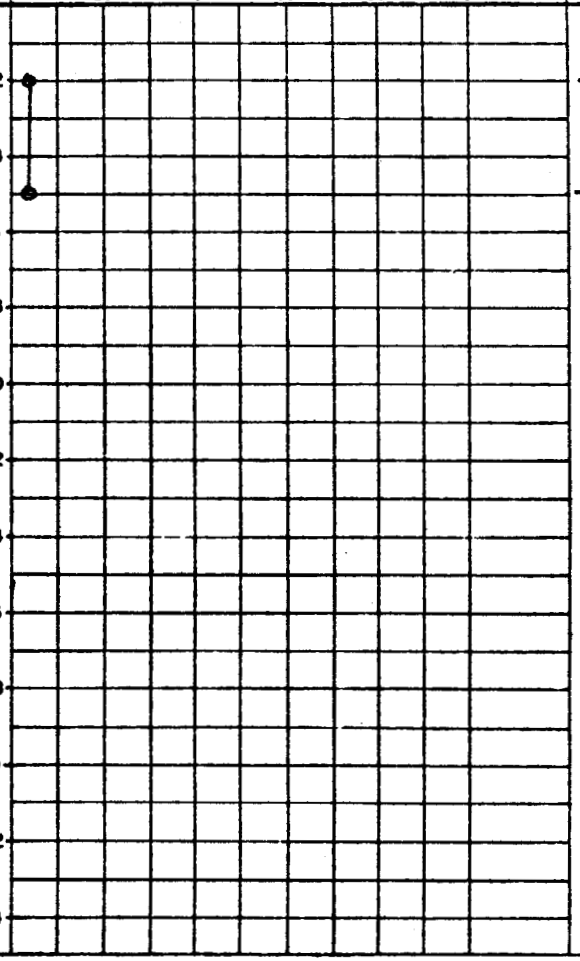
TEST HOLE

MILE	B,C,S	NUMBER
395.0	B	14

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
					PT	4" ORGANIC MTL		
2								
4					SM	SAND SILTY, BROWN NON-PLASTIC GRAVELLY @ 6' OCCASIONAL COBBLES		No EVIDENCE OF FROST
6								
8								
10						BOTTOM OF HOLE @ 9'		
12								
14								
16								
18								
20								
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT ⟷ LIQUID LIMIT
20 40 60 80 100 100+



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	38	-	59	3		
4	33	-	53	14		

REMARKS

ABBANDONED HOLE @ 9'
UNABLE TO KEEP HOLE OPEN
GOOD BORROW TO DEPTH OF HOLE

R073

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

HELICOPTER DRILLING - OCT / 1973

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 316+00	OFFSET: BP 600' LT
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
401.0	B	15

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0					PT	4" ORGANIC MTL		
						CLAY		
						-SILTY		
						LOW-MED PLASTIC		No
					CL			
						PEBBLES START @ 18"		EVIDENCE
					I			
					CI	DAMP		OF
								FROST
						OCCASIONAL COBBLES		
						11'-14'		
						BOTTOM OF HOLE @ 23'		

O = WATER CONTENT (% OF DRY WEIGHT)
Δ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT

20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	61	35	4			
4	75	23	2			
6						
8						
10	74	22	4			
12						
14	76	24	←			
16						
18	76	22	2			
20						
22						
24						

REMARKS

- LOST CIRCULATION @ 23'
- GOOD BORROW
- APPEARS TO BE GLACIAL TILL

R073

Helicopter Drilling, - Oct/1973

DRILL HOLE REPORT

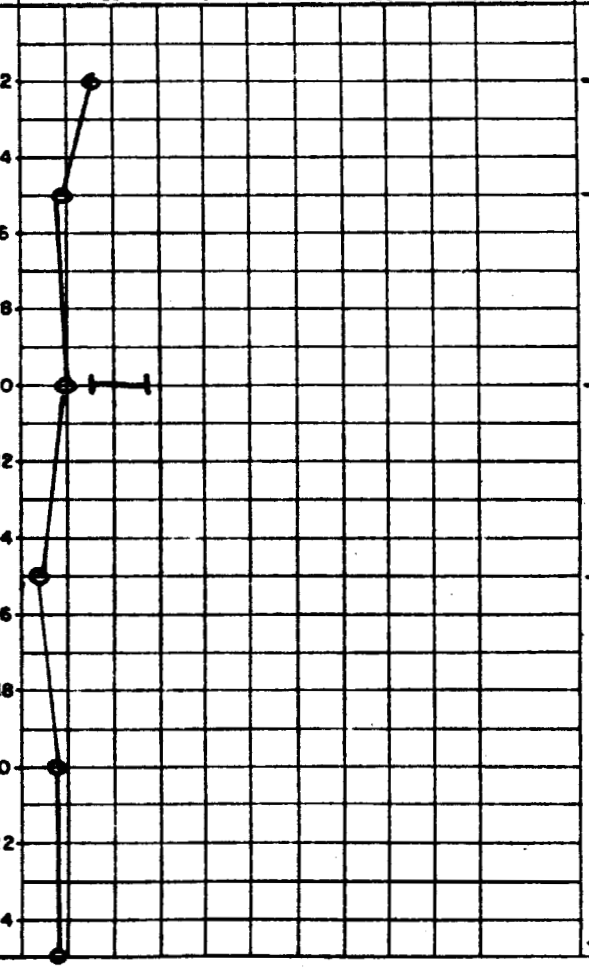
DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN: | FIELD ENG: | DATE DRILLED: | AIRPHOTO NO: | CHAINAGE: 463 | OFFSET: 600' Rt. ℄
CKD: | TECH: | RIG: | SURFACE DRAINAGE: | VEGETATION: | ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
403.8	B	16

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2						4" ORGANIC MTL.		
4						SANDY SILTY CLAY		No Evidence of Frost
6						WITH PEBBLES AND OCCASIONAL COBBLES		
8					CL	-LOW-MED PLASTIC		
10					CI	-DAMP.		
12								
14								
16								
18								
20								
22								
24						BOTTOM OF HOLE - 26'		



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	59	34	7			
4	58	33	9			
10	51	36	13			
14	43	34	23			
20	51	39	10			
24	47	47	6			

REMARKS

- 4000 Borrow
- Appears to be Glacial Till.

R073

HELICOPTER DRILLING - OCT 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

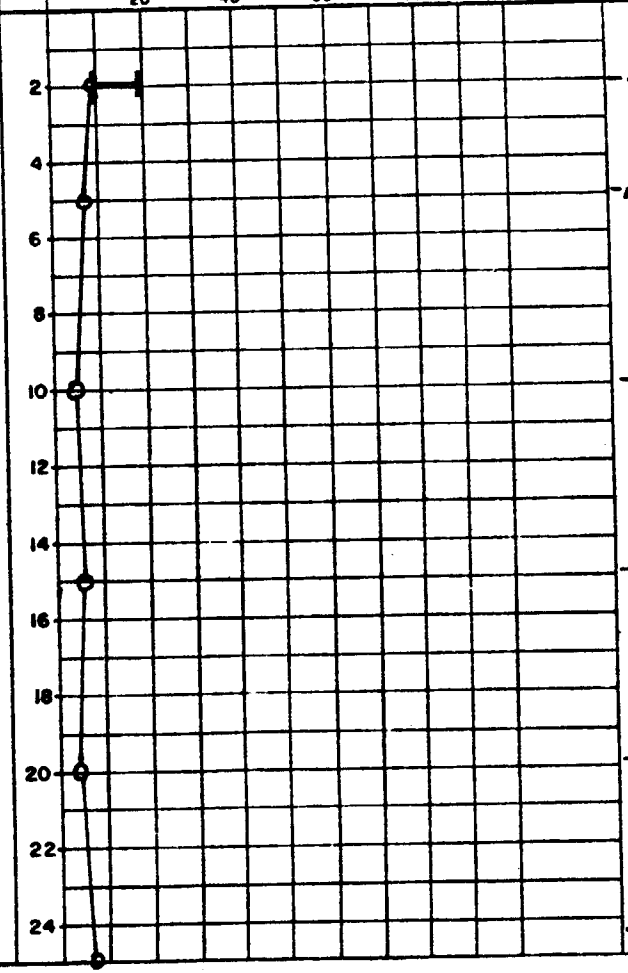
DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 528+00 | OFFSET BP 600' LT.
CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV

TEST HOLE

MILE	B,C,S	NUMBER
405	B	17

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0					PT	4" ORGANIC MTL		
2						CLAY		
4						SILTY SANDY		No
6						PEBBLES, DAMP		EVIDENCE
8						LOW-MED PLASTIC		OF
10						GRAVELLY @ 18"		FROST
12						GRAVEL CONTENT		
14						INCREASES @ 4½'		
16								
18								
20								
22								
24						BOTTOM OF HOLE 26'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	47	47		6		
4	45	38		17		
10	33	45		22		
14	49	40		11		
20	37	44		19		
24	48	38		14		

REMARKS

Good Borrow

RD73

HELICOPTER DRILLING, - OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 1094 + 00 | OFFSET: 1600' Rt. ℄

CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV

TEST HOLE

MILE	B,C,S	NUMBER
415.7	B	18

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0						2" ORGANIC MTL OVER		
2						SANDY SILTY CLAY WITH PEBBLES		
4						- LOW - MEDIUM PLASTIC		
6						- OCCASIONAL COBBLES		
8								
10					CL CI			
12								
14								
16						- SILTY SANDY GRAVEL & COBBLES FROM 14'-18'		
18								
20						21		
22						BOTTOM OF HOLE - 21'		
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	54	39	7			
4	54	37	9			
10	58	37	5			
16	56	41	3			
20	51	46	3			

REMARKS

HOLE ON LOW RIDGE
- 6-10' HIGH
- MATERIAL PRIMARILY SANDY CLAY TILL
- SOME GRAVEL & COBBLE ZONES

R073

HELICOPTER DRILLING OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 1340+00	OFFSET: ℄
CKD	TECH	RIG:	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
420 421	C	19

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0					CL	6" ORGANIC MTL CLAY SILTY SANDY		
2					SW	SAND SILTY PEBBLES, DAMP, BROWN FINE - COARSE GRAINED OCCASIONAL COBBLES LOOSE NON-PLASTIC		
4								
6						BOTTOM OF HOLE @ 6'		
8								
10								
12								
14								
16								
18								
20								
22								
24								

DEPTH (FEET)

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT ⟷ LIQUID LIMIT
20 40 60 80 100 100+

GRAIN-SIZE ANALYSIS

CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
12		83	5		

REMARKS

HOLE BADLY SLOUGHING
NO RETURN AFTER 3'

PROBABLY OK FOR CUT OR BORROW

R073

HELICOPTER DRILLING - OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 1393+00	OFFSET: ℄
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
421 422	C	20

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
0					PT	4" ORGANIC MTL			0							- No Returns After 4' Due To Sloughing of Cobbles
2					SW	SAND COARSE - FINE GRAINED DAMP, LOOSE COBBLES NON - PLASTIC			2	-10-		87	3			- Probably OK For Cut or Borrow
4						BOTTOM OF HOLE @ 4'			4							
6									6							
8									8							
10									10							
12									12							
14									14							
16									16							
18									18							
20									20							
22									22							
24									24							

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)
PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+

R073

HELICOPTER DRILLING - OCT./1973

DRILL HOLE REPORT

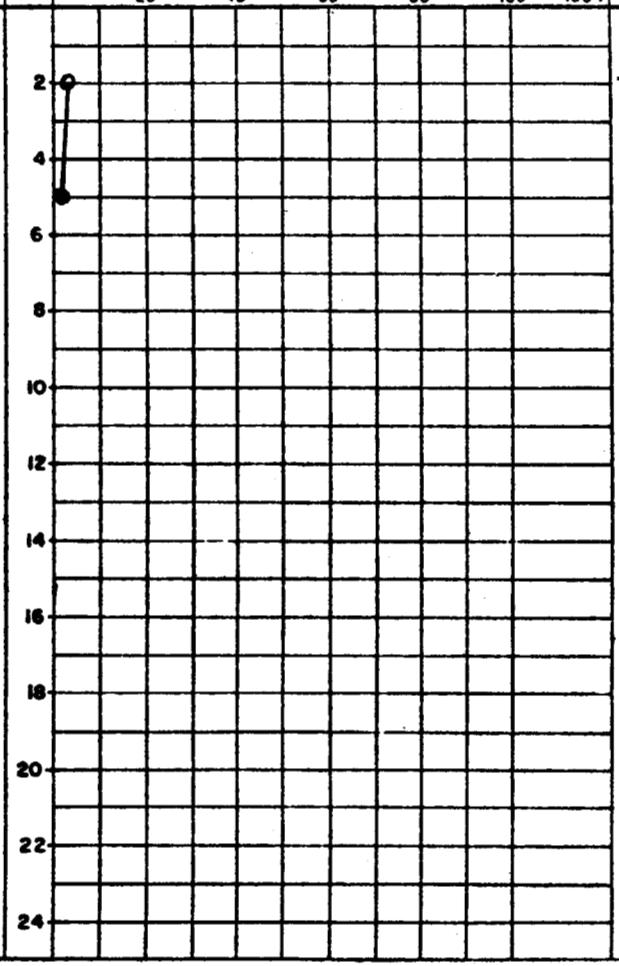
DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 1452+00	OFFSET: ℄
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
422 423		21

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					PT	2" ORGANIC MTL		No Evidence of Frost
4					SW	SAND FINE - COARSE GRAINED GRAVELY, COBBLES DAMP, BROWN NON - PLASTIC 5½		
6					GP	SAND WITH GRAVEL, COBBLES BOULDERS		
8								
10					—	NON - PLASTIC		
12						CHANGE IN FORMATION		
14						UNABLE TO GET RETURN		
16						APPEARS TO BE CLAY		
18						BOTTOM OF HOLE @ 16'		
20								
22								
24								



GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
CLAY %	SILT %	SAND %	GRAVEL %			
6	—	82	12		—	Rock Bit Used From 5½'
15	—	77	8		—	No Sample @ 10' Due To Only Rock Chips & Dust Returning
					—	Good Borrow
					—	May Be Some Surfacing Mtl.

ROPS

HELICOPTER DRILLING - OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN: FIELD ENG: | DATE DRILLED: | AIRPHOTO NO: | CHAINAGE: 1515+00 | OFFSET: ℄

CKD: TECH | RIG: | SURFACE DRAINAGE: | VEGETATION: | ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
423		22
424		

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0					PT	4" ORGANIC MTL.		
2						SAND		
4					SW	COARSE - FINE GRAINED		
6						COBBLES, BROWN		
8						DAMP		
10						NON - PLASTIC		
12								
14						BOTTOM OF HOLE @ 6'		
16								
18								
20								
22								
24								

DEPTH (FEET)

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT ⟷ LIQUID LIMIT
20 40 60 80 100 100+

GRAIN-SIZE ANALYSIS

CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
—	8	91	1		

REMARKS

- HOLE BADLY SLOUGHING
- NO RETURNS AFTER 3'
- DISCONTINUED @ 6'
- PROBABLY OK FOR CUT OR BORROW

R073

HELICOPTER DRILLING OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG.	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 1560+00	OFFSET: ℄
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

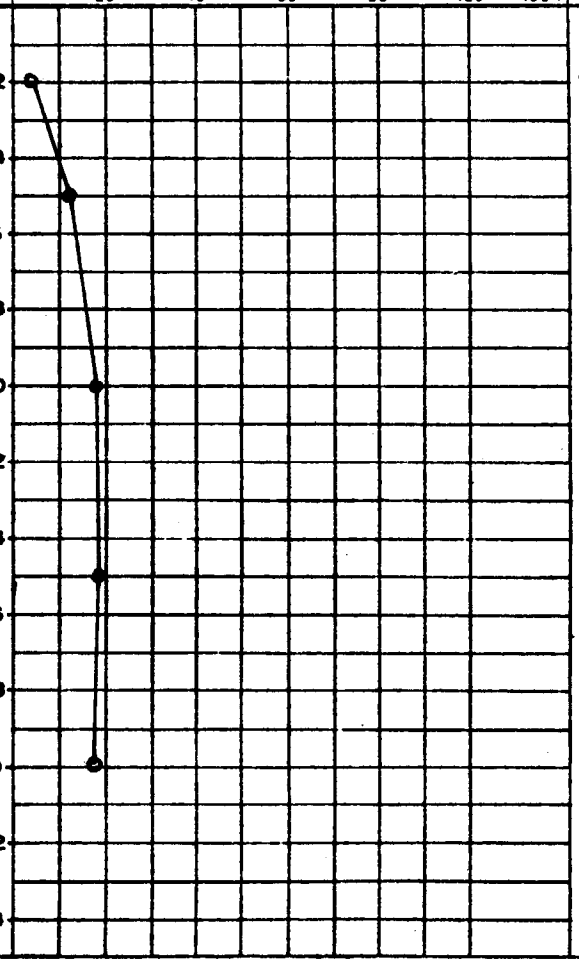
TEST HOLE

MILE	B,C,S	NUMBER
424 425		23

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0–12					SP	4" ORGANIC MTL SAND FINE - MED GRAINED NON - PLASTIC MOIST @ 4'		FROZEN BELOW 5½'
12–20					SW	SAND COARSE - FINE GRAINED GRAVELLY, COBBLES NON - PLASTIC		
20						BOTTOM OF HOLE @ 20'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (PCF)	DRY DENSITY (PCF)
2	7		90	3		—
4	3		97	-		
6						
8						
10	8		92	-		—
12						
14	8		90	2		
16						
18						
20	10		82	8		
22						
24						

REMARKS

NOTE MOISTURE CONTENT BELOW 10' - PROBABLY SOME FREE WATER ON THAWING NOT RECOMMENDED FOR CUT

IF USED AS BORROW. SHOULD BE PILED AND ALLOWED TO DRAIN BEFORE USE

RD73

HELICOPTER DRILLING - OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 1805+00 | OFFSET: 3P 600' RT.

CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV

TEST HOLE

MILE	B,C,S	NUMBER
429.2		24

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
					PT	3" ORGANIC MTL		
2					SW	SAND FINE - MED GRAINED PEBBLES, DAMP NON - PLASTIC		
4								
6						BOTTOM OF HOLE @ 6'		
8								
10								
12								
14								
16								
18								
20								
22								
24								

DEPTH (FEET)

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT ⟷ LIQUID LIMIT
20 40 60 80 100 100+

GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
CLAY %	SILT %	SAND %	GRAVEL %		
9	89	2			

REMARKS

- LOST CIRCULATION AT 3'
- RETURNING FINES ONLY
- ABBANDONED DRILLING @ 6'
- SAND
- PROBABLY OK FOR BORROW

8073

HELICOPTER DRILLING - OCT 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: | OFFSET: ℄
CKD | TECH | RIG: | SURFACE DRAINAGE: | VEGETATION: | ELEV:

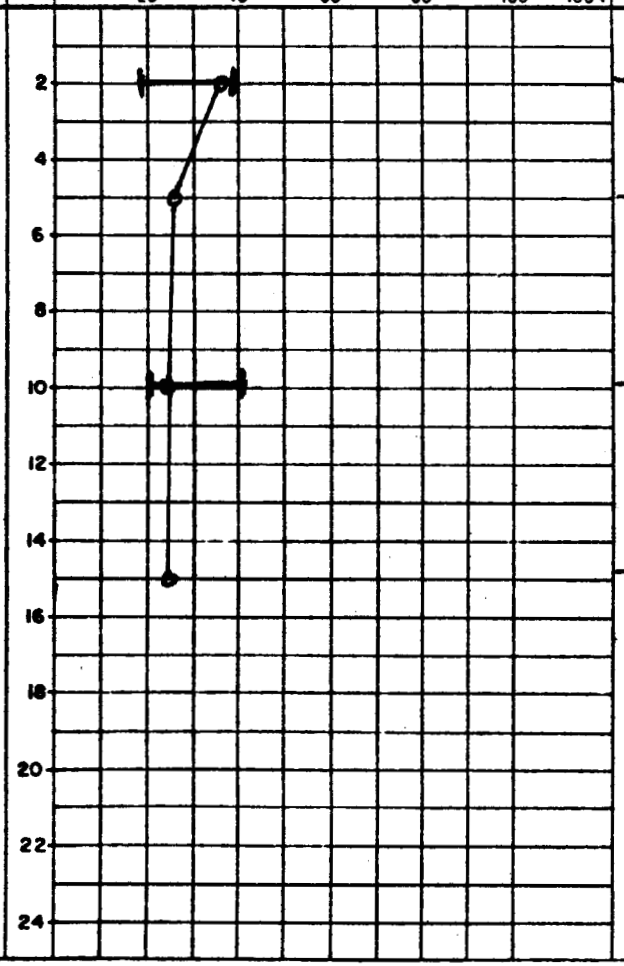
TEST HOLE

MILE	B,C,S	NUMBER
		25

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					PT	14" ORGANIC MTL		FROZEN
4					CL	CLAY SILTY		AFTER
6					I	LOW - MED PLASTIC		1½'
8					CI	BROWN		ICE
10						8'		LENSES
12						CLAY SILTY		
14					CI	MED - PLASTIC		
16						GREY		
18						BOTTOM OF HOLE @ 16'		
20								
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT ⟷ LIQUID LIMIT
20 40 60 80 100 100+



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	80	18	2			
4						
6	100	-	-			
8						
10	92	8	-			
12						
14						
16	93	7	-			
18						
20						
22						
24						

REMARKS

PROPOSED SMITH CREEK RE-ALIGNMENT

FROZEN TO DEPTH OF HOLE WITH ICE LENSES CUT NOT RECOMMENDED CAN ANTICIPATE BACKSLOPE SLOUGHING PLOBLEMS

HOLE IN MUSKEG AREA

HELICOPTER DRILLING - SEPT/1973

DRILL HOLE REPORT

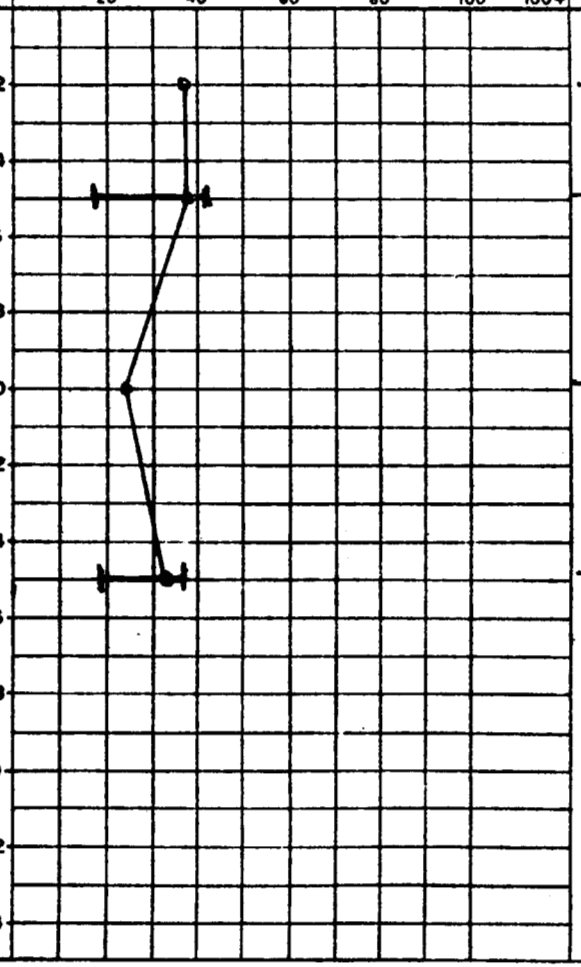
DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE:	OFFSET:
CKD	TECH	RIG:	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
		26

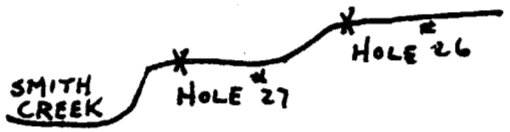
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					PT	6" ORGANIC MTL		
						CLAY		
4					CL	SILTY		FROZEN @ 2'
					I	LOW - MED PLASTIC		
6					CI	GREY @ 6½'		ICE LENSES
8								
10								TO BOTTOM
12								OF HOLE
14								
16						BOTTOM OF HOLE @ 16'		
18								
20								
22								
24								



GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
CLAY %	SILT %	SAND %	GRAVEL %		
-88-	11	—			
-93-	7	—			
-94-	6	—			
-96-	4	—			

REMARKS

PROPOSED SMITH CREEK RE-ALIGNMENT FROZEN WITH ICE LENSES NOT RECOMMENDED FOR CUT



HELICOPTER DRILLING - SEPT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE	OFFSET
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
		27

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0					Pt	2" ORGANIC MTL		
2					CL	CLAY, SILTY MED PLASTIC, BROWN SOFT, SANDY @ 2½'		
4					SW	SAND, FINE-COARSE GRAINED 4'		
6					GW	GRAVEL SANDY		
8								SLIGHTLY FROZEN
10						10'		11'-13½'
12					CL-CI	CLAY SILTY		ICE CRYSTALS
14						LOW-MED PLASTIC		
16						GREY SOFT-FIRM		
18								
20								
22								
24						BOTTOM OF HOLE @ 26'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
4	9		66	25		
8	17		69	14		
10	93		7	—		

REMARKS

SMITH CREEK CROSSING

HOLE ADVANCED TO 26' BLIND DRILLED, NO RETURNS

ABANDONED

HOLE MOVE BACK 25' TO 27A

HELICOPTER DRILLING - SEPT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG.	DATE DRILLED	AIRPHOTO NO:	CHAINAGE:	OFFSET:
CKD	TECH	RIG:	SURFACE DRAINAGE:	VEGETATION:	ELEV:

TEST HOLE

MILE	B,C,S	NUMBER
		27A

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					PT	2" ORGANIC MTL		
					CL	CLAY, SILTY MED PLASTIC MOIST, BROWN, SOFT 3'		
4					SW	SAND, FINE-COARSE GRAINED		
6					GW	GRAVEL SANDY OCCASIONAL COBBLES & BOULDERS		FROZEN FROM 3-4'
8								
10								
12						11½'		
14						CLAY SILTY		FROZEN BELOW 11½'
16						LOW - MED PLASTIC		ICE CONTENT
18						DAMP, GREY		INCREASES
20								WITH DEPTH
22								
24						BOTTOM OF HOLE @ 26'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+

GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)

REMARKS

- SMITH CREEK CROSSING
- LOST CIRCULATION & NO RETURNS AFTER 15'
- ICE MELTING IN HOLE
- APPEARS FROZEN MATERIAL ENDS @ 23'
- SOUTH BANK VISUAL DATA SPRING APPROX 75' RT OF HOLE # 27
- BANK IS SLIDING INTO CREEK
- HOLE # 27 DRILLED APPROX 30' BACK FROM EDGE OF BANK
- APPROX ELEV. ABOVE WATER = 8'

HELICOPTER DRILLING - SEPT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE:	OFFSET
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
		28

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					PT	6" ORGANIC MTL		
4					CL	CLAY SILTY LOW- MED PLASTIC GREY, OCCASIONAL PEBBLES		
6					I	SAND LAYERS		
8					CI	COARSE - FINE GRAINED DAMP, BROWN @ 2'-2½', @ 5½'-6½'		
10								
12						SAND & GRAVEL LENSE @ 8' APPROX 3"		
14								
16						BOTTOM OF HOLE @ 16'		
18								
20								
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT ⟷ LIQUID LIMIT
20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2						
4						
6						
8						
10						
12						
14						
16						
18						
20						
22						
24						

REMARKS

SMITH CREEK
NORTH BANK
NO RETURNS
AFTER 7'
ICE MELTING
IN HOLES
BLIND DRILLED
TO 16' IN FROZEN
MATERIAL

HOLE # 28
APPROX 12'
ABOVE WATER
LEVEL

BANK HAS
NUMEROUS CRACKS
EXTENDING BACK
25'-30' WHERE
IT IS SLIDING
INTO THE CREEK

R073

HELICOPTER DRILLING - OCT 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN | FIELD ENG. | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 427+00 | OFFSET 900' RT | TEST HOLE

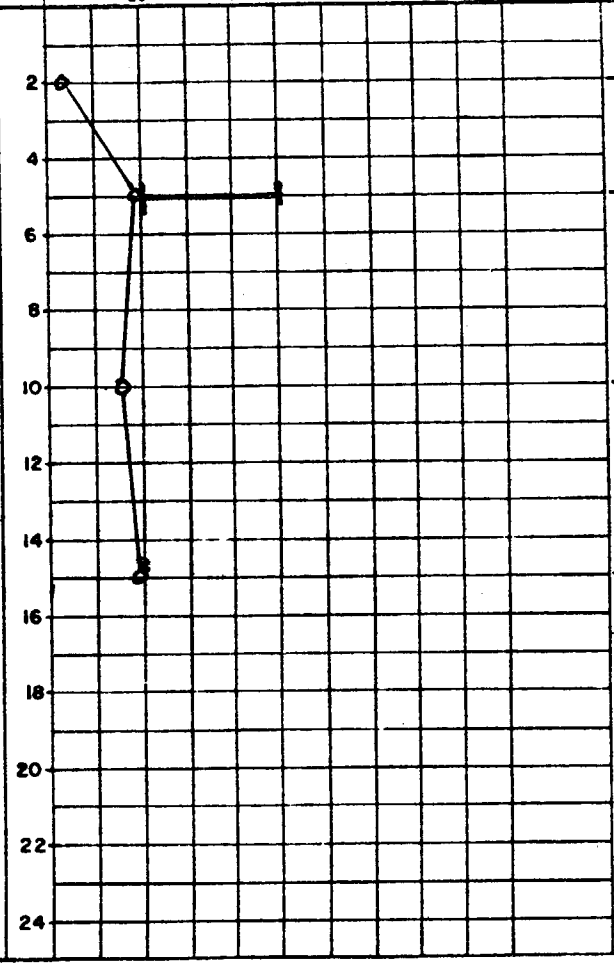
CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV | MILE 422-3 | B,C,S B | NUMBER 32

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0					PT	2" ORGANIC MTL		
2					CL	CLAY SILTY DAMP, BROWN LOW PLASTIC		No
4						4'		
6					CI	CLAY SILTY DAMP GREY MED PLASTIC		EVIDENCE OF FROST
8								
10						10½'		
					ML	SILT - NON PLASTIC 11½'		
12					CI	CLAY SILTY DAMP, GREY MED PLASTIC		
14								
16						BOTTOM OF HOLE 16'		
18								
20								
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT ⟷ LIQUID LIMIT

20 40 60 80 100 100+



DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
2	93	7	—				POOR RETURNS AFTER 10'
4	100	—	—				
6							PROBABLE BORROW SOURCE
8							
10	99	1	—				
12							
14	99	1	—				
16							
18							
20							
22							
24							

HELICOPTER DRILLING - OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 494+00	OFFSET 600' RT
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
443.6		33A

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
					PT	4" ORGANIC MTL		
						CLAY		
						SILTY		FROZEN
					CL	DAMP, BROWN		BELOW
					I			8'
					CI			
						CONTAINS SILTS & SAND		ICE
						LENSES OR POCKETS		LENSES
						GREY @ 12'		
						BOTTOM OF HOLE @ 16'		

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
2	100	—	—			
4	95	5	—			
6						
8						
10	96	4	—			
12						
14						
16						
18						
20						
22						
24						

REMARKS

REVISION OF #33

FROZEN WITH ICE LENSES BELOW 8'

NOT RECOMMENDED FOR BORROW

R073

HELICOPTER DRILLING - OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

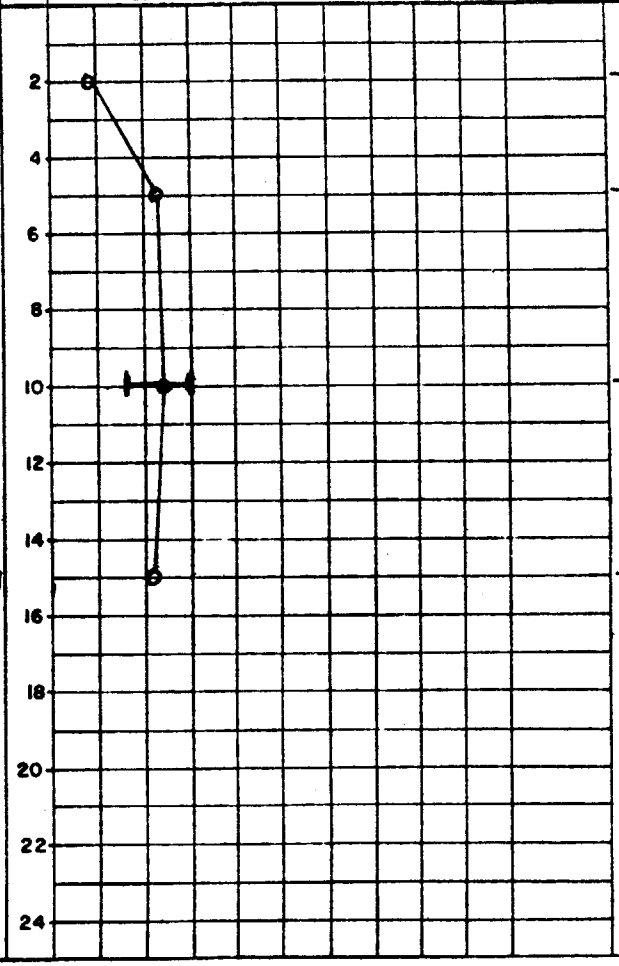
DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 91+00 | OFFSET 1200' RT
CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV

TEST HOLE

MILE	B,C,S	NUMBER
444.7	B	34

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0					PT	2" ORGANIC MTL		
					CL CI	CLAY SILTY, DAMP, GREY 1'		
2					ML	SILT DAMP, NON-PLASTIC		
4					CL I CI	CLAY SILTY LOW-MED PLASTIC DAMP GREY		SLIGHTLY FROZEN 11'-13'
12					CL	CLAY SILTY GREY LOW-PLASTIC		AFTER 13' FROZEN
16						BOTTOM OF HOLE @ 16'		ICE CRYSTALS
18								
20								
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)
PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+



GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
CLAY %	SILT %	SAND %	GRAVEL %			
						FROZEN BELOW 11'
96	4	—				
						POSSIBLE BORROW SOURCE
99	1	—				
						MOISTURE CONTENT MAY AVERAGE ABOVE OPTIMUM BELOW 5'
96	4	—				
98	2	—				

RDT3

HELICOPTER DRILLING - OCT /1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN | FIELD ENG | DATE DRILLED | AIRPHOTO NO: | CHAINAGE: 994+00 (RB-22) | OFFSET ℄

CKD | TECH | RIG | SURFACE DRAINAGE: | VEGETATION: | ELEV

TEST HOLE

MILE	B,C,S	NUMBER
461.8		35

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					PT	1' ORGANIC MTL		
					CL	CLAY SILTY BROWN MED-PLASTIC 3½		FROZEN
4								BELOW 2'
6					GP	BOULDERS, COBBLES SANDY SILT LAYER @ 4½-5'		ICE LENSES 4½-5'
8						BOTTOM OF HOLE @ 8½'		
10								
12								
14								
16								
18								
20								
22								
24								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT

20 40 60 80 100 100+

GRAIN-SIZE ANALYSIS	CLAY	SILT	SAND	GRAVEL	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
	%	%	%	%		
	93	7	—			

REMARKS

- ROCK BIT USED 3½'-4½'-5'
- MELTING OF PERMAFROST WITH SUBSEQUENT LOSS OF RETURNS AND ENLARGMENT OF HOLE TO APPROX 10" DIA.
- NOT RECOMMENDED FOR CUT.

HELICOPTER DRILLING - OCT/1973

DRILL HOLE REPORT

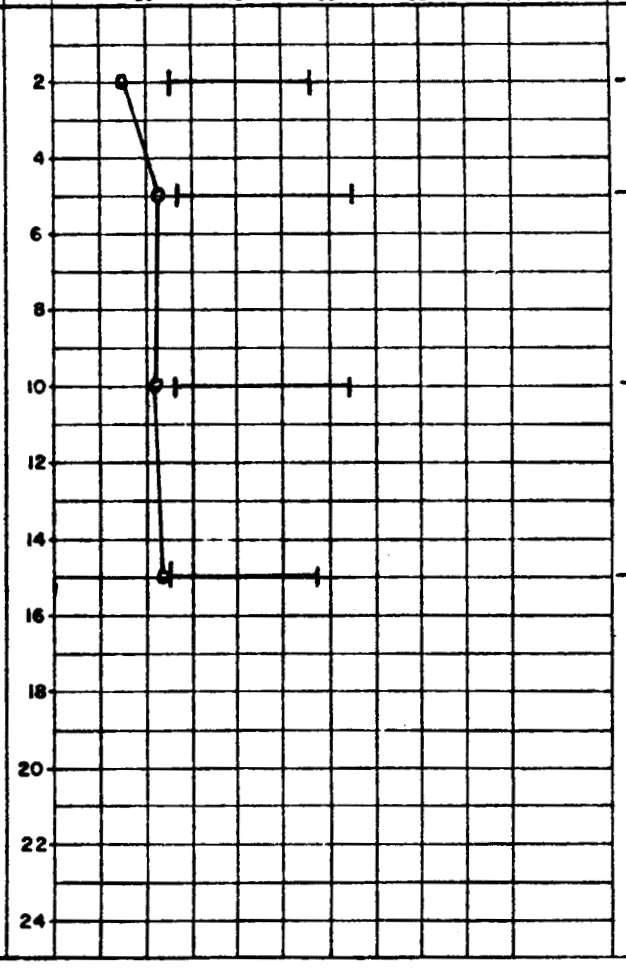
DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 648	OFFSET
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
		36

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
2					PT	2" ORGANIC MTL		
4						CLAY + SILTY		
6					CL	LOW - MED PLASTIC		
8						DAMP, BROWN		No
10					I			
12					CI	GREY @ 18"		VISUAL
14						PEBBLES START @ 2'		EVIDENCE
16								OF FROST
18						BOTTOM OF HOLE @ 16'		
20								
22								
24								



GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
CLAY %	SILT %	SAND %	GRAVEL %			
-99-	3	—				JOHNSON RIVER
-99-	1	—				BLIND DRILLED 13' - 16'
-99-	1	—				SAMPLE @ 15' TAKEN OFF END OF BIT
-99-	1	—				GOOD BORROW OR CUT AREA

R073

HELICOPTER DRILLING - OCT/1973

DRILL HOLE REPORT

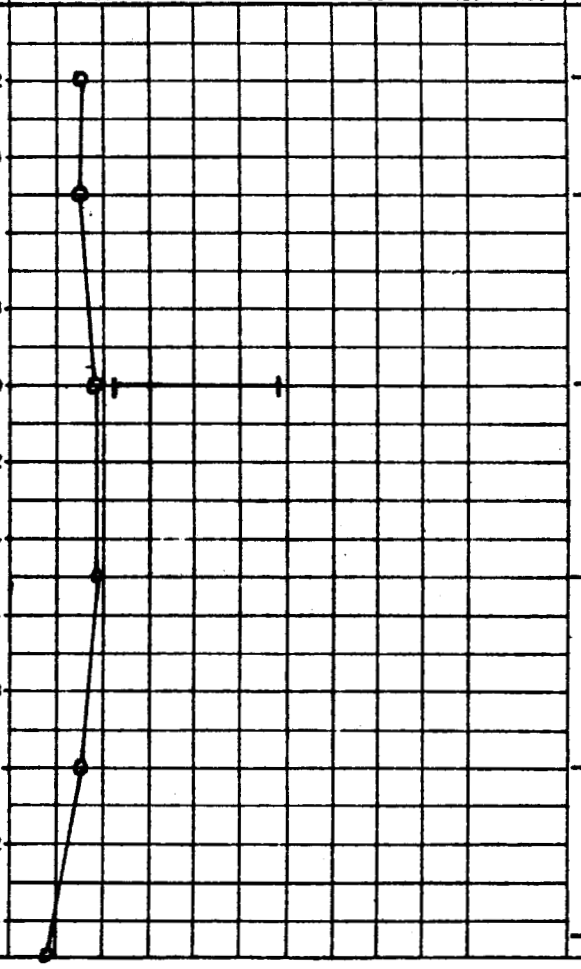
DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG.	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 104+50	OFFSET
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
		37

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
0-2					PT CL	4" ORGANIC MAT CLAY SILTY, BROWN DRY /		
2-4						CLAY - SILTY		
4-6						HIGH TO- MED PLASTIC		No
6-8								VISUAL
8-10					CI	APPROX 2% BELOW		EVIDENCE
10-12					I	OPTIMUM MOISTURE		OF FROST
12-14					CH	SILT LENSES OR		
14-16						POCKETS @ 13½'-14½'		
16-18						CONTAINS MICA		
18-20						FLAKES		
20-22								
22-24								



GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
CLAY %	SILT %	SAND %	GRAVEL %			
91	6	3				BLACK WATER RIVER
93	6	1				GOOD CUT OR BORROW AREA
90	10	—				
98	2	—				
97	3	—				
98	2	—				

HELICOPTER DRILLING - OCT /1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG.	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 104+50	OFFSET
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
		37

REMARKS

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
27					CL			
29					I			
31					CH			
33								
35								
37						BOTTOM OF HOLE @ 37'		
39								
41								
43								
45								
47								
49								
51								
53								

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT

20 40 60 80 100 100+

DEPTH (FEET)	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
27						
29						
31	97	–	3	—		
33						
35	98	–	2	—		
37						
39						
41						
43						
45						
47						
49						
51						
53						

HELICOPTER DRILLING - OCT/1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN	FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE: 110+00	OFFSET
CKD	TECH	RIG	SURFACE DRAINAGE:	VEGETATION:	ELEV

TEST HOLE

MILE	B,C,S	NUMBER
		38

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	GRAIN-SIZE ANALYSIS CLAY %	SILT %	SAND %	GRAVEL %	WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
0					PT	1' ORGANIC MTL									
2					ML	SILT CLAYEY HIGH ICE CONTENT 14%									
4						CLAY -SILTY PEBBLES, HIGH TO		FROZEN	-98-	2	—				BLACKWATER RIVER
6					CI	MED - PLASTIC		HIGH ICE	-91-	7	2				FROZEN TO DEPTH OF HOLE
8						GREY		CONTENT TO 3'							IF IN POTENTIAL CUT AREA SHOULD HAVE CORE SAMPLES BEFORE MAKING
10						OCCAIONAL COBBLES AFTER 3'		ICE LENSES AFTER 3'	-93-	6	1				DECISION TO CUT
12															
14									-94-	5	1				SLOUGHING MAY BE PROBLEM DUE TO HIGH MOISTURE AT ICE LENSES
16															
18															
20									-93-	6	1				
22															
24									-95-	5	—				

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)
PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+

HELICOPTER DRILLING - OCT / 1973

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

DWN: | FIELD ENG: | DATE DRILLED: | AIRPHOTO NO: | CHAINAGE: 110+00 | OFFSET:
CKD: | TECH | RIG: | SURFACE DRAINAGE: | VEGETATION: | ELEV:

TEST HOLE

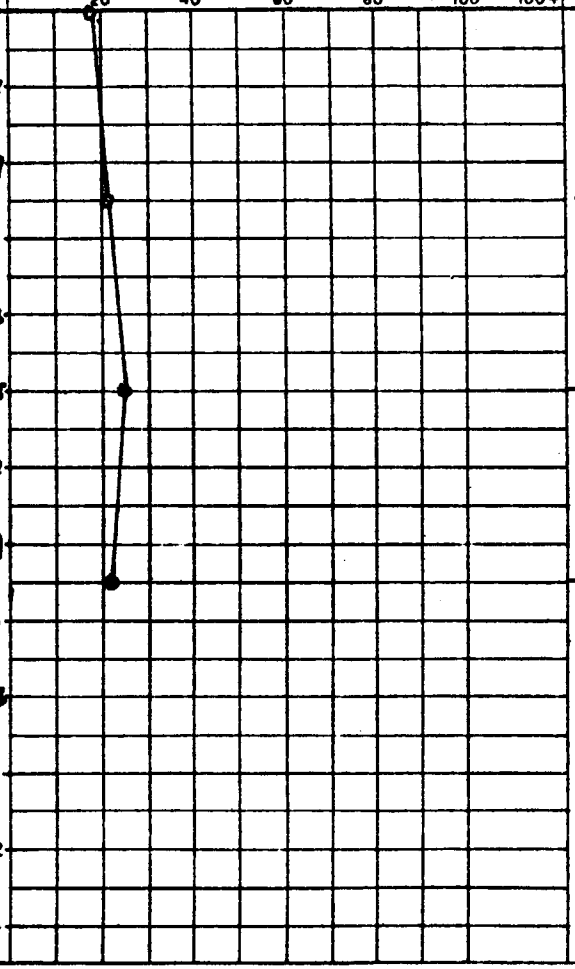
MILE	B,C,S	NUMBER
		38

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION
27								
29								ICE LENSES INCREASE WITH DEPTH AFTER 32'
31					CL			
33								
35								
37								
39								
41								
43						BOTTOM OF HOLE @ 43'		
20								
22								
24								

DEPTH (FEET)

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT — LIQUID LIMIT
20 40 60 80 100 100+



GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
CLAY %	SILT %	SAND %	GRAVEL %		
-9%-		4	—		
-95-		5	—		
-95-		5	—		

REMARKS

BLACKWATER RIVER

LOST CIRCULATION
HOLE ABANDONED @ 43'

R073

APPENDIX II

AIRPHOTO MOSAICS

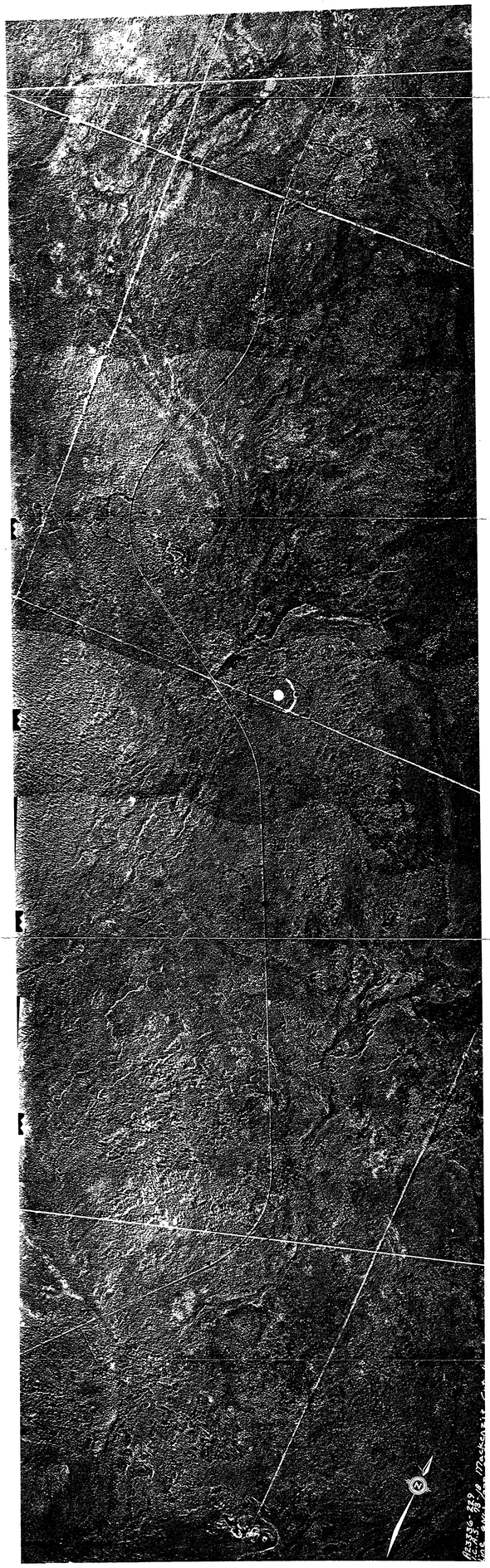
LEGEND

◉ TESTHOLES DRILLED OCT / 73
(HELICOPTER)

● TESTHOLES DRILLED AND REPORTED
PREVIOUSLY

	BY	DATE
LTION		
D IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						



	BY	DATE
RETATION		
CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

2.

	BY	DATE
RETATION		
CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

	BY	DATE
RETATION		
TATED IN FIELD		

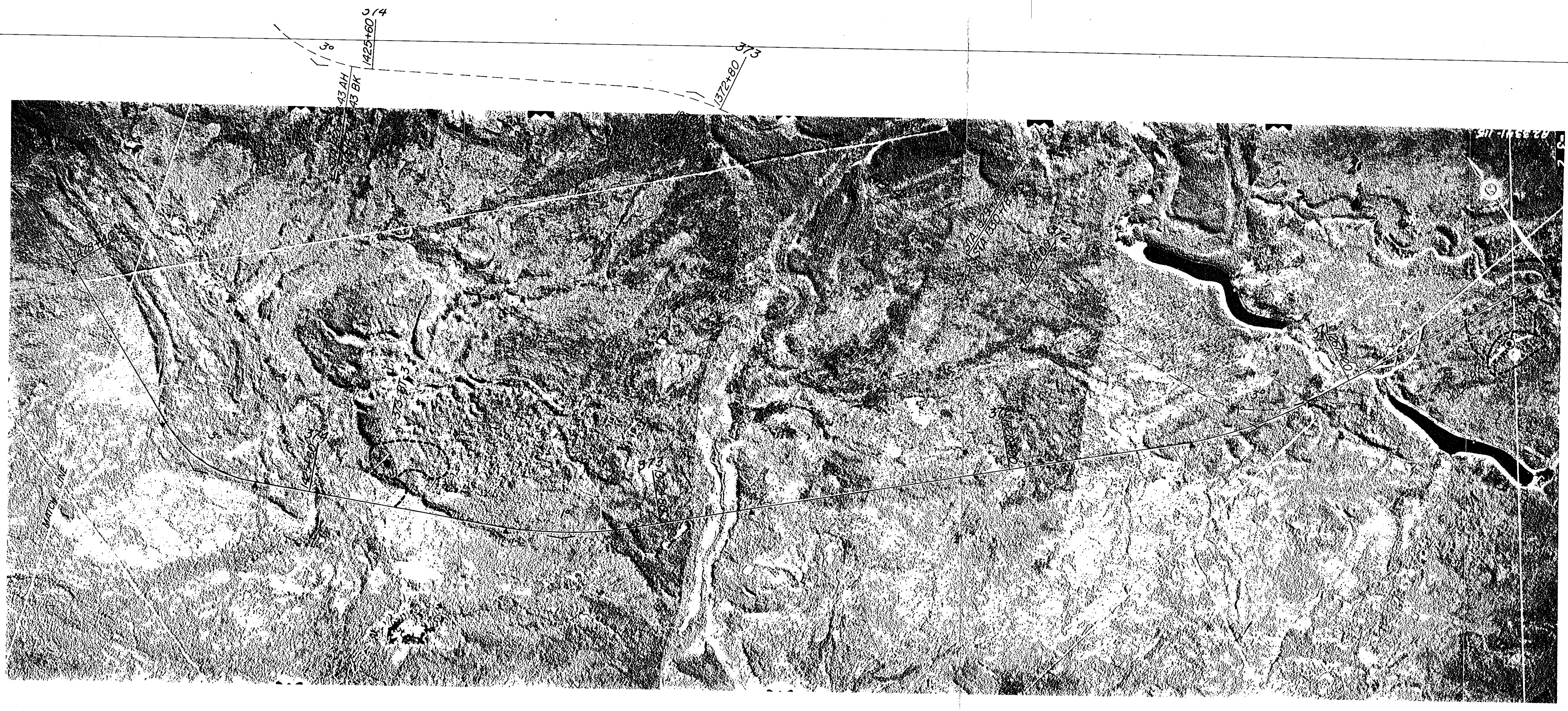
PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

4

DRAWING No.	SHEET No.	TOTAL SHEETS

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

FIELD	BY	DATE



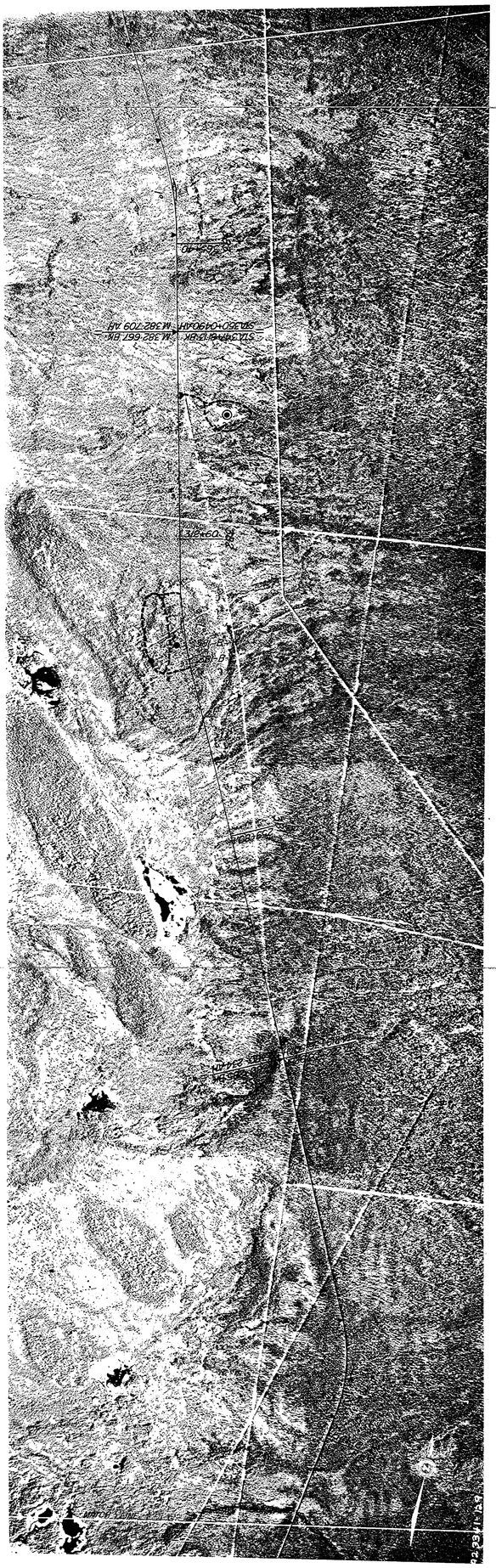
	BY	DATE
RETATION		
DATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

6

	BY	DATE
RETATION		
CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						



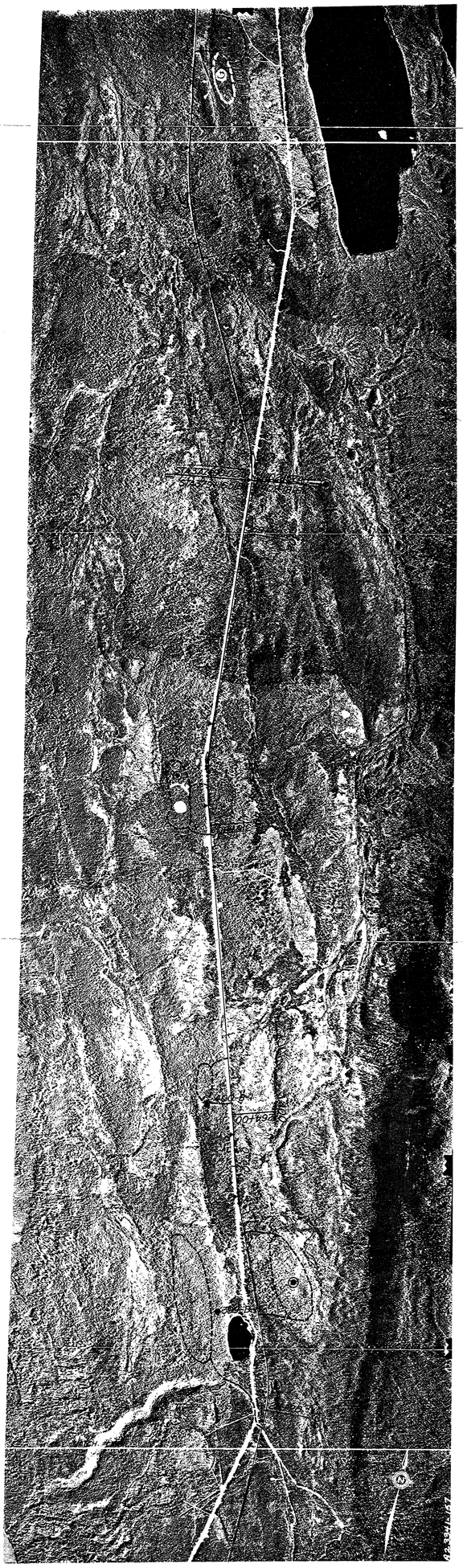
	BY	DATE
RETATION		
CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

8

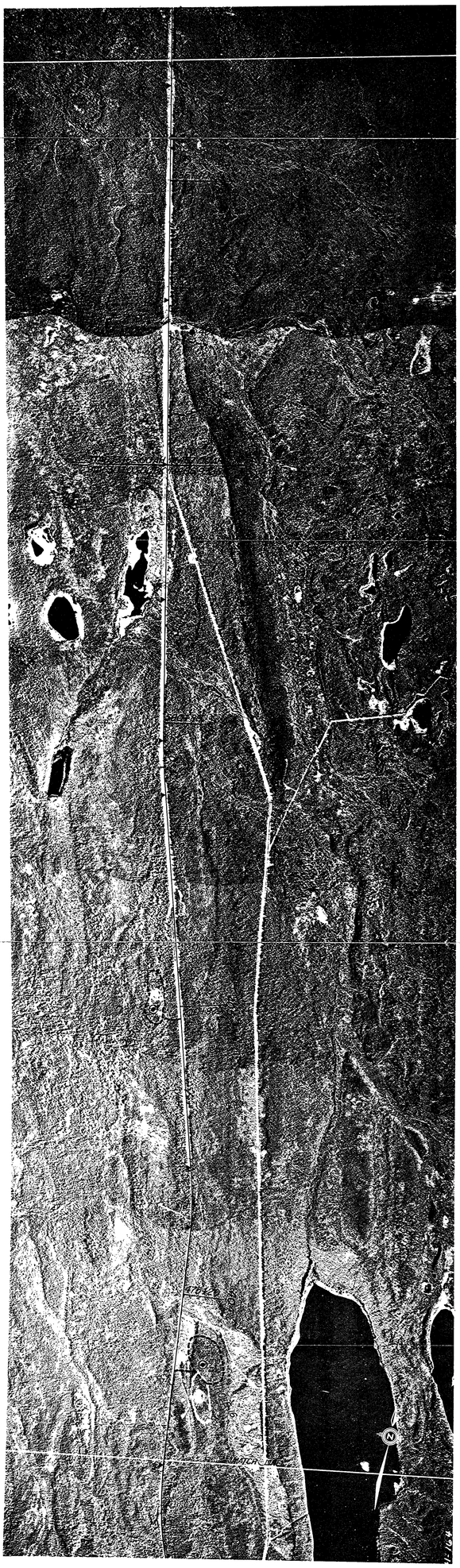
	BY	DATE
RETATION		
DATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						



	BY	DATE
RETATION CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT TOPOGR. NOTES DRAINAGE BORROW AREAS STRUCTURES NOTED						



11

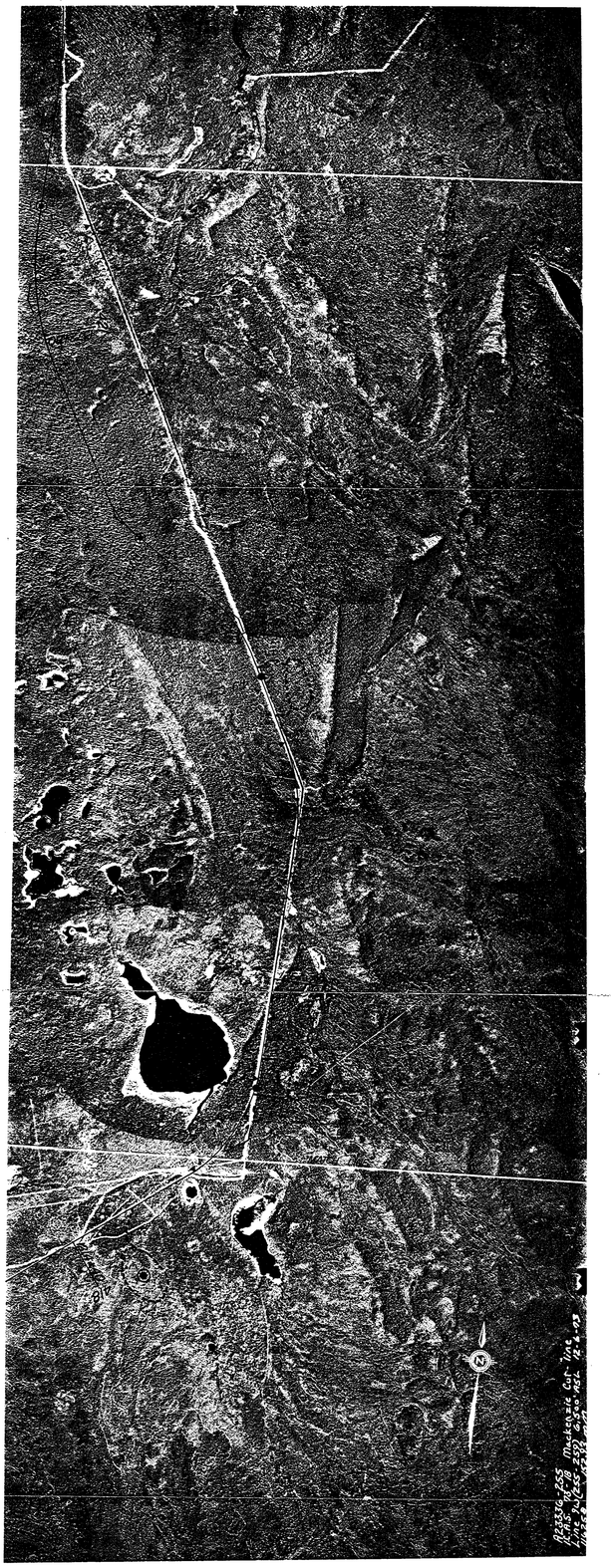
PLAN ALIGNMENT TOPOGR. NOTES DRAINAGE BORROW AREAS STRUCTURES NOTED	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE

RETATION CATED IN FIELD	BY	DATE

	BY	DATE
RETATION CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT TOPOGR. NOTES DRAINAGE BORROW AREAS STRUCTURES NOTED						

12



	BY	DATE
IN		
FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

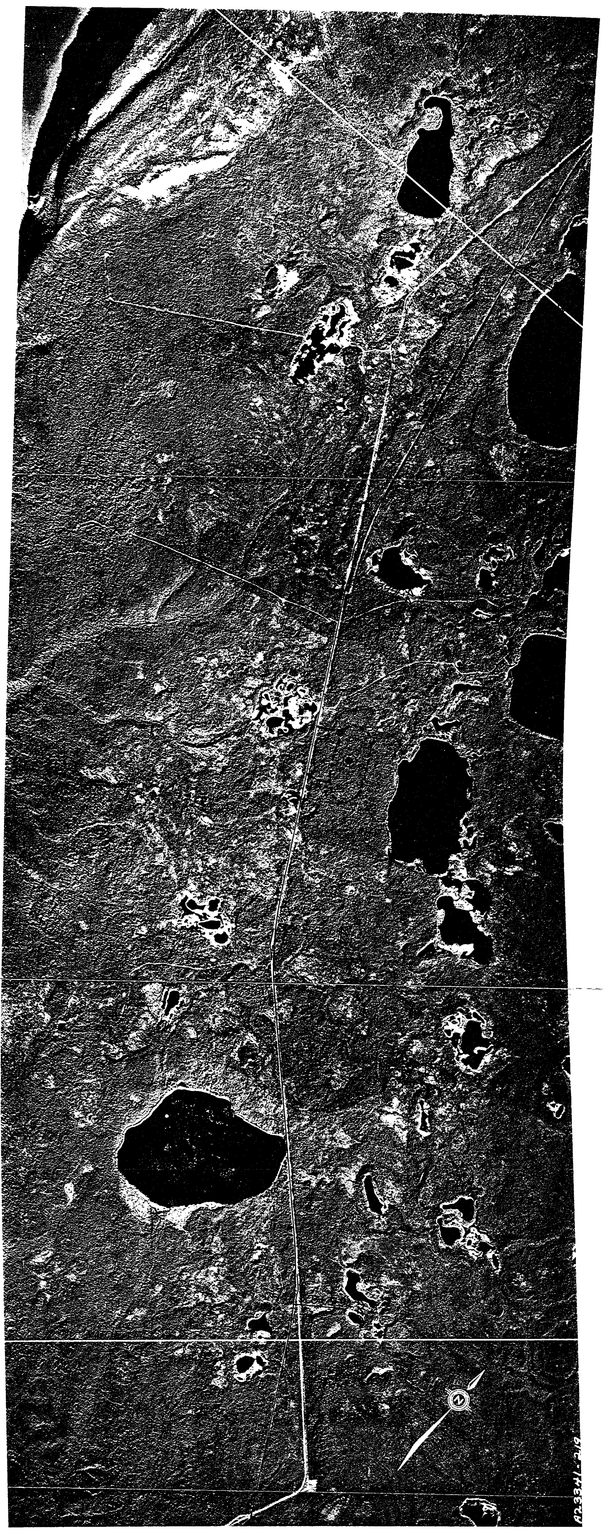
	BY	DATE
RETATION		
CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

	BY	DATE
ATION		
ED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

15



	BY	DATE
RETATION		
CATED IN FIELD		

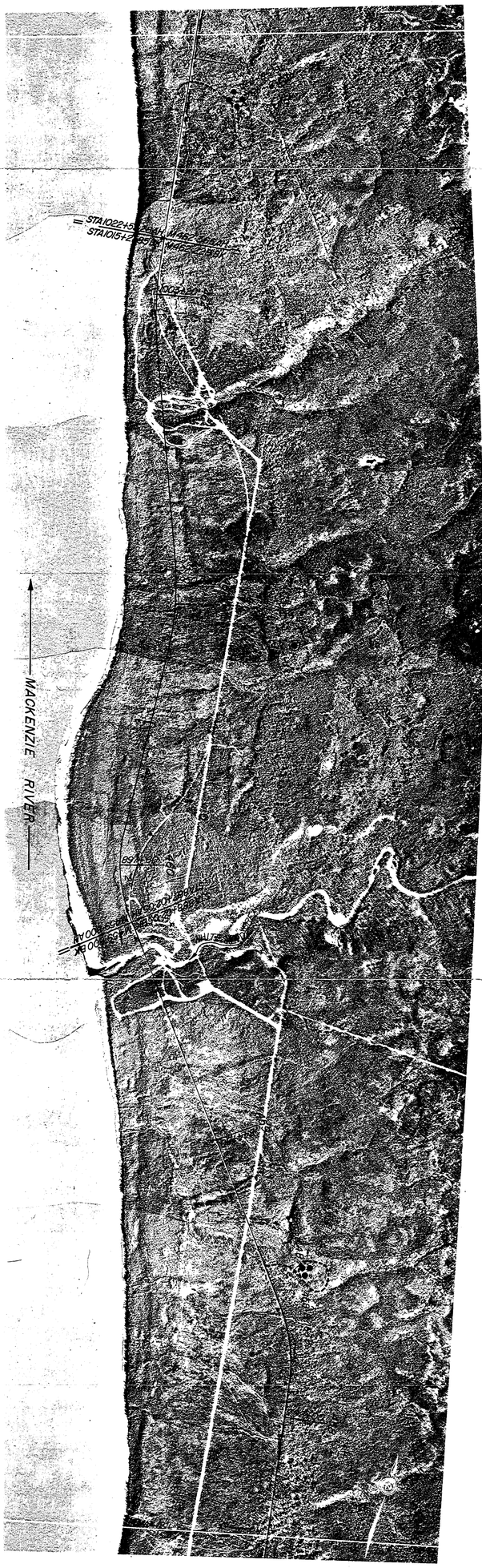
PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

9/

	BY	DATE
RETATION		
CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

17



	BY	DATE
RETATION		
CATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED						

8/

	BY	DATE
RETATION		
DATED IN FIELD		

PLAN	SURVEYED	DATE	PLOTTED	DATE	CHECKED	DATE
ALIGNMENT						
TOPOGR. NOTES						
DRAINAGE						
BORROW AREAS						
STRUCTURES NOTED