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## 1. INTRODUCTION

## 1.1 Assignment

The Department of Indian Affairs and Northern Development commissioned Ripley, Klohn & Leonoff International Ltd. to undertake Stage #2 of a granular material inventory, which includes all unconsolidated material and bedrock suitable for engineering construction. The search area included the Tuktoyaktuk Peninsula, Richards Island, and the Mackenzie River Delta, south to Fort McPherson and Arctic Red River.

This report presents the results of the investigation and testing of granular materials in Zone II, as shown on the Zone Location Plan. The work was conducted in accordance with the requirements of the Stage #2 Terms of Reference provided by the Department which requested recommendations for usage, development and restoration of all sources that could be identified.

Authorization to proceed with the work was received September 5, 1972 under Contract No. OTT-72-141 and Authority Reference T.B. No. 714562.

## 1.2 Procedure

The investigation procedure entailed a study and compilation of existing geological data from the work of the Geological Survey of Canada, pipeline route studies, and other previous work conducted within the designated area by Ripley, Klohn & Leonoff International Ltd. Airphoto interpretation was carried out prior to the field reconnaissance and drilling program. This work was done in cooperation with J.D. Mollard and Associates of Regina. The field reconnaissance to ground-check potential sources was done by means of surface sampling and hand-dug test pits. At the same time, the field staff observed access roads, drainage conditions, biotic environmental concerns and source development.

The reconnaissance program identified and studied 28 sources within Zone II.

## 1.3 <u>Data Presented</u>

Information for the granular material sources is presented in the following sections:

Section Entitled "Zone II" - is the text of the report which provides a general appreciation of the surficial geology and environment in the area and recommendations with respect to use of materials, management, development and restoration of the source areas.

Section Entitled "Maps and Tables" - provides topographic maps showing the Zone and the locations of the sources within it.

A summary table giving the pertinent information relative to each source is provided in this section, together with an explanation of the symbols and terms used in this report.

Sections Entitled "Source No. \_\_\_\_ " - provide all details for each source including test pit and test hole logs, results of laboratory analyses and details of the development and restoration of each source.

## 2. ZONE II

## 2.1 Surficial Geology

Zone II is in the Mackenzie Delta, an area formed by ancient and recent fluvial, glaciofluvial, and glaciolacustrine action. Bedrock is buried beneath at least 500 feet of Quaternary and Recent unconsolidated deposits.

Thick deposits of deltaic marine sands overlie the bedrock, then glaciofluvial sands and gravels. Recent fluvial deposits cover nearly all the area, although the higher features of the earlier glacial activity are exposed in places, and some elevated remnants of ancient delta deposits can be seen near the mouths of the east and west channels.

The ancient delta deposits are primarily sand with traces of gravel and silt. Ground ice is prevalent, reducing the volume of recoverable material to a small percentage of the deposits.

The glaciofluvial features are the principal sources of granular material. Unfortunately, the coarser material is concentrated near the south end of the island, close to the retreating face of the last glaciers, and the northern deposits are primarily sand, with only traces of gravel, and contain medium to high amounts of ice.

Only one source has been related to recent fluvial activity, and this is the very large deposit at Swimming Point, an abandoned set of bars and river terraces in which the old channels can still be identified.

Probably the dominant feature in the surficial geology of this area is the ground ice and associated evidence of thermokarstic action. Certainly it is the limiting factor in the development of nearly all sources, and must always be considered in the restoration that follows.

## 2.2 Environment

Zone II is well within the barren ground, and the birch and willow growing here are dwarfed to a height of about 3 feet. The usual ground cover is moss and lichen, with some grass on the higher areas.

This is part of the Grazing Reserve of the Mackenzie Reindeer Herd and of the barren-ground caribou. Although important to both, the area is not considered to be critical. The northeastern half of Richards Island is potential summer range for both species.

The only critical areas are isolated summer habitat of various species of waterfowl, although the whole Delta area is important to great numbers of waterfowl.

Fishing plays a large part in the life of the native population, especially in the east channel of the Mackenzie River. Sports fishing in Yaya Lake is excellent.

The International Biological Programme propose to reserve a substantial area around Garry and Pelly Islands as a natural area for scientific study.

## 2.3 Sources and Materials

Twenty-eight sources were identified and studied in Zone II. Eight of these have been discarded, either because of land use or poor quality. Sources 200A, 201A, 202A, 203A, and 205A are all located within critical waterfowl refuge areas, the first 4 within the Kendall Island Migratory Bird Sanctuary. Sources 208A and 210A contain poor material, unsuitable for use in construction. Source 221A contains massive ground ice, and development is not recommended.

Of the remaining 20 sources, 4 are located in a north-central group, 5 are in a south-central group, 4 are located along the western side of the east channel of the Mackenzie River,

5 are located near the south end of Yaya Lake, and 2 are located on the mainland near the mouth of the east channel. The five groups of sources will be discussed in this order.

Sources 206, 207, 209, and 211 are all glaciofluvial deposits scattered over the north-central section of Richards Island. All contain sand and silt, with little gravel. The material from these sources is suitable for general fill, and because of the erratic nature of the deposits, the first 3 (206, 207, and 209) will be difficult to develop. The estimated recoverable volume in the four sources, is about 1,000,000 cubic yards, half of which is contained in Source 211. None of these sources has been developed.

Sources 212, 217, 218, 219, and 220 are glaciofluvial features located in a 5-mile radius near the north end of Yaya Lake. All contain sand, but many also contain substantial amounts of gravel. The silt content varies widely over each source, and further investigation is generally required to define the areas suitable for development. Source 219 contains at least 1,000,000 cubic yards and the other 4 sources contain about 800,000 cubic yards among them. Sources 212, 217, and 218 contain material suitable for general fill, but Sources 219 and 220 can be used for any purpose, including concrete. None of these sources has been developed.

Sources 204, 213, 216, and 222 are located on or near the east channel of the Mackenzie River. Source 216 is a glaciofluvial remnant on the slope overlooking the river, and the other 3 sources are terraces or terrace remnants from either ancient or recent fluvial action. All contain sand, and the gravel content varies from a trace at Source 213 to about 50% at Source 204. The silt content is variable within each source, and will require that each be investigated more thoroughly to identify areas for development. By far the largest source is 222, estimated to contain 10,000,000 cubic

yards. The other 3 contain 900,000 cubic yards among them. Source 204 contains a limited volume of sand and gravel suited to use in concrete construction, but will probably be developed for general fill. Sources 213, 216, and 222 are primarily deposits of sand with a little gravel. These sources have not been developed to any extent, although Sources 204 and 222 are adjacent to large base camps of oil companies.

Sources 223, 224, 225, 226 and 227, inclusive, are glaciofluvial features located within a 4-mile radius at the south end of Yaya Lake, and contain the largest concentration of high-quality granular material on Richards Island. Sources 223 and 224 are clean gravel and sand, whereas the material in Source 225 is finer and contains a trace of silt. Source 226 is a typical esker-kame complex, with a wide variation in material quality, poor continuity in the deposit, and more silt. Source 227 is a very erratic kame deposit with sand, some gravel, and variable silt. Sources 223 and 224 contain 8,000,000 cubic yards between them. Source 225 contains 1,000,000 cubic yards, and Sources 226 and 227 contain 400,000 cubic yards each. All 5 sources can be developed for general fill, but Sources 223 and 224 contain high-quality aggregate that can be used for any purpose. Both Sources 223 and 224 have been developed by oil companies, and the other sources are untouched.

Sources 214 and 215 are elevated terrace or delta remnants on the mainland, near the mouth of the east channel of the Mackenzie River. They are mostly sand with traces of silt, and Source 215 contains some gravel as well. Both are low-priority deposits. Source 214 contains 400,000 cubic yards of general fill, and Source 215 contains 30,000 cubic yards. These sources have not been developed.

## 2.4 Management

In general, the environmental criteria are fairly uniform across Richards Island except for the waterfowl sanctuaries near the mouth of the west channel of the Mackenzie River.

Special attention must be given to preventing siltation of the east channel, of Yaya Lake, and of other large lakes.

The main consideration in setting up a program of development will be the location and nature of new work. Certain sources will be favourably located for transportation to a given area, and the cost of hauling will probably be a controlling factor.

A considerable amount of detailed investigation is required before large-scale development starts. The glaciofluvial sources are typically erratic in nature, and must be studied carefully before either the volume or best use of a given source can be stated with confidence.

Especially in the ice-rich environment of Richards Island, the indiscriminate development of sources for small volumes should be discouraged, in order to minimize environmental problems. In all cases, restoration must follow close behind development.

## 2.5 Development

## 2.5.1 General

The very important development that is now proposed on Richards Island is an extensive system of gas wells, collecting lines, treatment plants, and gas transmission pipeline. The location of this system will dictate the priority of development of the many sources of granular material.

Undoubtedly, the sources near Yaya Lake will receive early consideration because of high quality, a proven depth of recoverable material, and favourable transportation links.

In connection with this, it is recommended that a substantial volume, at least 500,000 cubic yards, of concrete aggregate be reserved in Sources 223 and 224 for possible demands in the future.

Source 222 should be investigated more thoroughly for the large-scale production of general fill. The potential volume is very large, and transportation in almost any direction is practical.

In the northern half of the island, only Sources 211 and 213 have the potential for large-scale development of general fill, and both should be studied further to confirm this potential.

## 2.5.2 Access

Probably the major part of the gas development on Richards Island will be inland, and transportation of granular material will be primarily by truck, hauling over winter roads. In this situation, river channels and chains of lakes will continue to be important arteries, and sources located near these arteries will have an advantage. As an alternative, transport by barge to a stockpile near the project, and trucking the remaining distance during the following winter, may be more economical. The largest sources in Zone II are all located near river channels or lakes that can carry either barge traffic, or trucks.

Further planning of access routes must await detailed information about the location of the new work.

## 2.5.3 Material Uses and Handling

All 20 sources can provide a good to acceptable grade of general fill. Sources 219, 223, and 224 can also support aggregate operations on a substantial scale. Other sources, smaller or less uniform, can supply small volumes of aggregate.

Most sources contain enough moisture to necessitate ripping, stockpiling, thawing, and draining before use.

The equipment required to develop these sources is a dozer with ripper attachment, a front-end loader, and trucks. The sources producing aggregate for concrete or asphalt construction would require at least a screen to remove oversize rock, and for large-scale production would require a crushing and screening plant with a conveyor system.

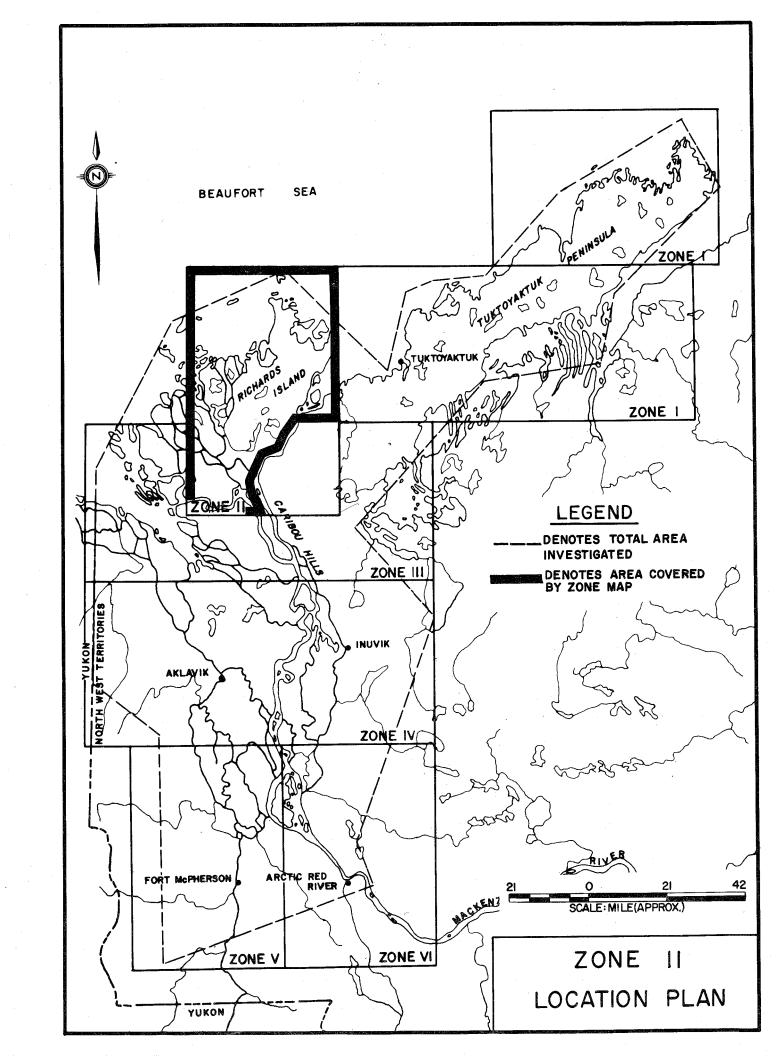
## 2.5.4 Stripping and Restoration

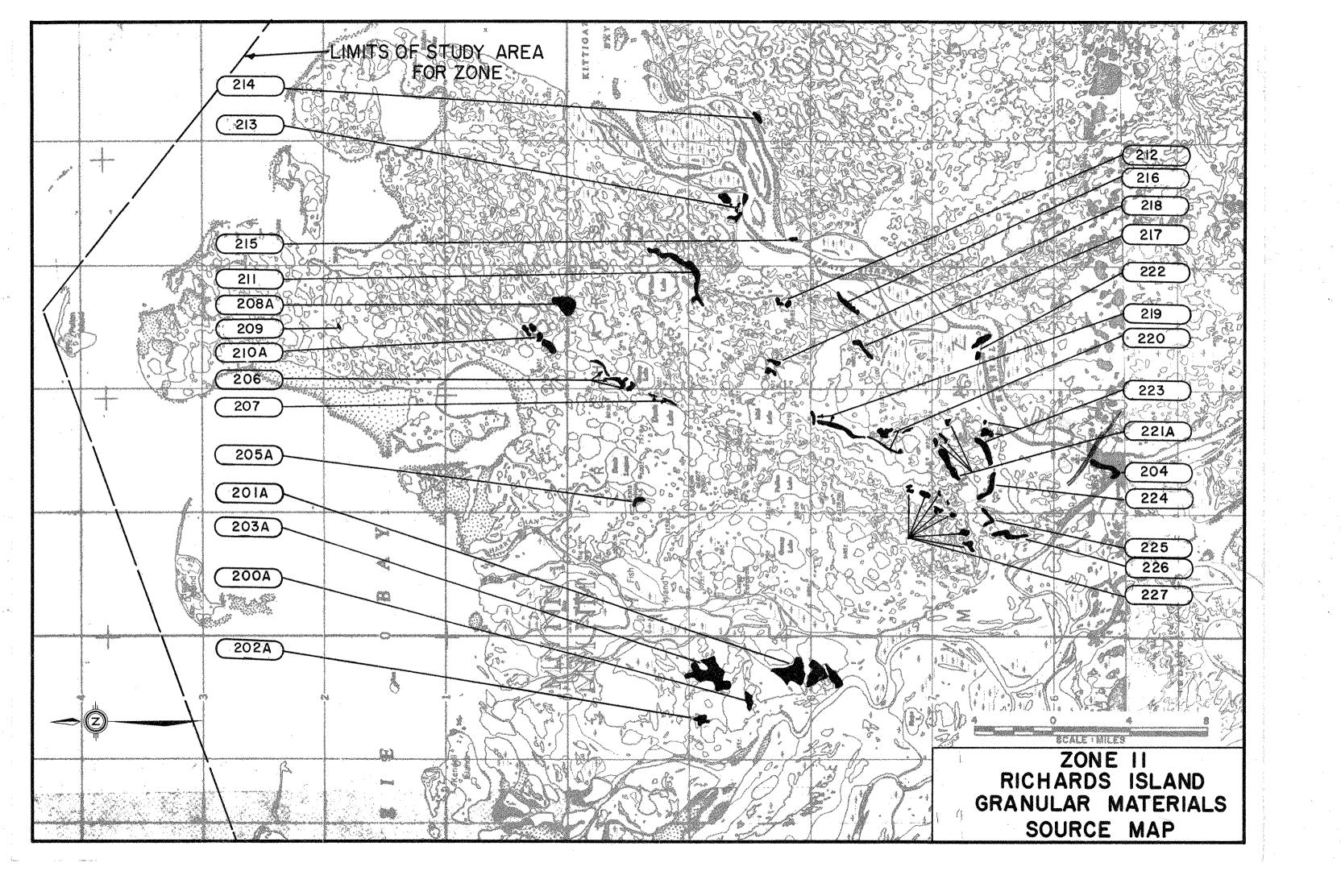
The most important consideration in the restoration of excavated areas on Richards Island is coping with massive ground ice. An expanse of ice must not be left uncovered on a slope or at the edge of a slope or it will thaw and set up an unstable condition that may require years to rectify. If the soil associated with such a situation is silty, then all streams and lakes downstream will be polluted until the area is stabilized. By a similar process, the drainage from waste piles of frozen silty soil will lead to short-term siltation of waters downstream. Such waste piles should be located away from streams.

In the operation of a gravel source, every effort must be made to avoid travelling across the ice-rich low-lying areas adjacent to the source, because the disturbance of the organic ground cover in these areas will lead to thermal erosion and subsidence.

Depleted areas must be covered with topsoil and organic material, if at all possible, in order to encourage revegetation. Particularly if the soil is silty, the revegetation should be assisted by seeding.

More detailed comments concerning the stripping and restoration of the 28 sources studied in Zone II are provided in the discussion of the different sources.





o Z	FROM	MATERIAL	VOLUME.	:					SOUI	RCE	DEV	/ELOPMENT	DATA		
SOURCE	DISTANCE FROM COMMUNITY MILES	TYPE (UNIFIED GROUP	VOLUME ESTIMATES	ENVIRONMENTAL CONCERNS	CONCLUSIONS	DRAINAGE		STRII		GRD.	REC. DEPTH	TYPE OF	MATERIAL	EQUIPMENT	STATE OF
S	DIS	SYMBOL)	CUBIC YARDS				MATERIAL	DEPTH (FT)	DISPOSAL	ICE	(FT.)	EXCAVATION	USEAGE	REQUIRED	DEVELOPMENT OF SOURCE
200A	22 by air north west Tun- unuk Point	SAND - trace gravel (SP)		Source is within Kendall Island Bird Sanctuary	Not recommended for development due to Bird Sanctuary	Good	Moss and silt	0 to 2		Med- ium to high			General fill		Undeve loped
			**									SE	EE SECTION 200A	FOR SOURCE DETA	ui s
201A	20 by air north west Tun- unuk Point	SAND - trace gravel, trace silt (SP)		Source is within Kendall Island Bird Sanctuary	Not recommended for development due to Bird Sanctuary	Good to Fair	Moss and silt	0 to 2		Med- ium to high			General fill		Undeve loped
												SE	EE SECTION 201A	FOR SOURCE DETA	ILS
202A	air north west Tun- unuk Point	SAND - trace silt (SP)		Source is within Kendall Island Bird Sanctuary	Not recommended for development due to Bird Sanctuary	Good to Fair	Moss and silt	0 to 3		Med- ium to high			General fill		Undeve loped
												SE	E SECTION 202A F	FOR SOURCE DETA	ILS
203A	25 by air north west Tun- unuk Point	SAND - trace silt (SP)		Source is within Kendall Island Bird Sanctuary	Not recommended for development due to Bird Sanctuary	Good	Moss and silt	0 to 2		Med- ium to high			General fill		Undeveloped
								•				\$E	E SECTION 203A F	OR SOURCE DETA	ILS

o Z	FROM	MATERIAL	VOLUME						SOUF	RCE	DE	/ELOPMENT	DATA		
SOURCE	TANCE FROM COMMUNITY MILES	TYPE (UNIFIED GROUP	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	DRAINAGE		STRI	PPING	GRD.	REC.	TYPE OF	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT
S	.SIQ	SYMBOL)	OODIO TAREO			·	MATERIAL	(FT)	DISPOSAL		(FT.)	EXCAVATION	UULAUL	REGOIRED	OF SOURCE
204	At Tunu- nuk Point 55 from Inu- vik	SAND - and gravel (SW)	200,000	·	Low priority for development. Suitable for local use only	Good	Moss and silt	to 2	Stockpile away from channel for later re- grading	Nil to Low in gra- vel	4	Rip and doze into piles. Thaw and drain load in trucks		Loader,	Partially dev- eloped for local use
												SE	 E SECTION 204 F 	 OR SOURCE DETAI 	LS
205A	West of Denis La- goon 25 north of Tunu-	SILT - and sand (ML)	-	fowl	Not recommended for development due to poor quality and high ice content, also critical wildlife area		Peat and silt	-		Med to High					Undeve l'oped
	nuk Point							The Property of County of				SE	E SECTION 205A	FOR SOURCE DETA	AILS I
206	north east end Denis Lake 27 north of Tunu- nuk	SAND - trace gravel, some silt (SM)			Low priority for development due to erratic nature of deposit	Good	Peat and silt	to I½	Stockpile away from drainage courses for later re- grading	Med in sand and gra- vel		into piles. Thaw and drain load in trucks	concrete and asphalt	Trucks Screen for aggregate production	
	Point											SE	E SECTION 206 F	OR SOURCE DETAI	LS
207	At east shore Denis Lake 24 north of Tunu- nuk Point	SAND - trace gravel (SP)	200,000	Area not critical	Low priority for development due to erratic nature of deposit	Good	Peat and silt	to 1½	Stockpile away from drainage courses for later re- grading	Med in sand and gra- vel	4	Rip and doze into piles. Thaw and drain load in trucks	concrete and asphalt	Trucks Screen for aggregate production	Undeveloped
				And the second s								SE	E SECTION 207 F	OR SOURCE DETA	ILS I

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o N	FROM VITY S	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME			·			SOUF	RCE	DEV	ELOPMENT	DATA		
SOURCE	TANCE	TYPE (UNIFIED GROUP	ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	DRAINAGE	L	STR IF	PING	GRD.	REC. DEPTH	TYPE OF	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT
		SYMBOL)	TARGO IARGO				MATERIAL	(FT)	DISPOSAL	102	(FT.)	EXCAVATION	OULAUL	REQUIRED	OF SOURCE
208A	3/4 east Umiak Lake 30 north of Tunu- nuk Point	SAND - some silt (SM)		Area not criti- cal	Not recommended for development due to poor quality	Good	Peat and Silt			Med to High					Undeve loped
									,			SE	E SECTION 208A	FOR SOURCE DETA	ILS
209	North end Rich- ards Is- land 41 north of Tunu-	SAND - trace silt (SP)	120,000	Area not criti- cal	Low priority for development due to low quality	Good to Fair	Topsoil and Silt	0 to 1	Stockpile away from water courses for later regrading	Med	5 to 10	Rip and doze into piles. Thaw and drain Load in trucks		Dozer-Ripper, Loader, Trucks	Undeve loped
	nuk Point											SE	E SECTION 209 F	OR SOURCE DETAI	LS
210A	North end Umiak Lake 30 north of Tunu- nuk Point	SAND - and silt (SM)		Area not criti- cal	Not recommended for development due to poor quality	Good to Fair	Peat and Silt			High					Undeveloped
												SE	E SECTION 210A	I FOR SOURCE DETA I	I ILS I
211	and east shore Will- ow Lake 25 north east	SAND - little gravel (SW) SAND - trace gravel some silt (SM)	500,000		Suitable for development but additional drill-ing required to delineate specific areas	Good	Moss and Silt	0 to 1	Stockpile for later regrading	Low to Med	5	Rip and doze into piles. Thaw and drain Load in trucks		Dozer-Loader, Trucks	Undeveloped
	Tunu- nuk Point	(Srt)						:				SE	E SECTION 211 F	OR SOURCE DETAI	LS 

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o N	FROM	MATERIAL	VOLUME						SOUF	RCE	DE	/ELOPMENT	DATA		
SOURCE	STANCE FROM SOMMUNITY MILES	TYPE (UNIFIED GROUP	ESTIMATES	ENVIRONMENTAL CONCERNS	CONCLUSIONS	DRAINAGE		STRI		GRD.	REC.	TYPE OF	MATERIAL USEAGE	EQUIPMENT	STATE OF DEVELOPMENT
S	DIS	SYMBOL)	CUBIC YARDS				MATERIAL	DEPTH (FT)	DISPOSAL	ICE	(FT.)	EXCAVATION	USEAGE	REQUIRED	OF SOURCE
212	2 north west of Lousy Point 19 north east Tunu- nuk Point	SAND - little gravel (SW)	250,000	Area not criti- cal	Suitable for limited devel-opment for local use. Additional drilling required	Good	Moss and Silt	O to l	Stockpile away from water course for later re- grading	Nil to Low	5	Doze into piles - maybe rip. Load into trucks	General fill, limited fine aggregate  E SECTION 212 F	Dozer, Loader, Trucks OR SOURCE DETAI	
213	On east chan- nel of Mack- enzie River 24 from	SAND - trace silt, fine	400,000	Major waterfowl staging area. Development must prevent silta- tion in river	Low priority for development due to fineness of the sand	Good	Topsoil and Silt	0 to 2	Stockpile away from river for later re- grading	Low to Med	5	Rip and doze into piles, thaw and drain Load in trucks	Low quality general fill	Dozer - Ripper Loader, Trucks	Undeve1oped
	Tunu- nuk Point											SE	l E SECTION 213 F	I OR SOURCE DETAI	LS
214	On east chan- nel Mack- enzie River 26 north east Tunu-	SAND - trace silt fine (SP)	400,000	Major waterfowl staging area. Development must prevent siltation in river	Low priority for development due to fineness of the sand	Good	Topsoil and Silt	0 to 2	Stockpile away from river for later re- grading	Med	2 to 5	Rip where necessary; doze into piles, thaw and drain, Load in trucks	general fill	Dozer - Ripper Loader, Trucks	
	nuk Point											SE	E SECTION 214 F	OR SOURCE DETAI	LS
215	On east chan- nel Mack- enzie River 21 north	SAND - and gravel trace silt (SW)	30,000	Major waterfowl staging area. Development must prevent siltation in river	Low priority for development due to depth of overlying silty material that probably must be wasted	Good	Topsoil, silt, and fine sand	3 to 6	Stockpile away from river for later re- grading	Low to Med	5	Rip and doze into piles. Thaw and drain. Load in trucks	General fill	Dozer - Ripper Loader, Trucks	
	east Tunu- nuk Point								·			SE	E SECTION 215 F	OR SOURCE DETAI	LS

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o z	FROM	MATERIAL	VOLUME				<u> </u>		SOUF	RCE	DEV	/ELOPMENT	DATA	<u> </u>	
SOURCE	DISTANCE FROM COMMUNITY	TYPE (UNIFIED GROUP SYMBOL)	ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	DRAINAGE		STRII		GRD.	REC. DEPTH	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT
							MATERIAL	(FT)	DISPOSAL		(FT.)	LACAVATION			OF SOURCE
216	3 south west Lousy Point 17 north east Tunu- nuk Point	trace silt (SW)	300,000	Area not criti- cal	Suitable for development but excavation areas must be delineated because of erratic nature of deposit	Good to Fair	Topsoil and Silt	0 to 1	Stockpile away from water courses for later regrading	Low	5 to 10	Rip and doze into piles. Thaw and drain. Load in trucks	Primarily general fill	Dozer - Ripper Loader, Trucks	
-												36	E SECTION 216 F	OR SOURCE DETAIL	LS
217	19 north east Tunu- nuk Point	(sw)	150,000	Area not criti- cal	Suitable for limited devel- opment	Good	Moss and Silt	0 to	Stockpile adjacent to to pit for later re- grading	Low	-	Rip and doze into piles. Thaw and drain. Load in trucks	General fill	Dozer - Ripper Loader, Trucks	
				·										·	
-												SE	 E SECTION 217 F	 OR SOURCE DETAI	LS
218	18 north east Tunu- nuk Point	(sw)	300,000 at least	Area not criti- cal	Suitable for limited devel- opment	Good	Moss and Silt	0 to 1	Stockpile adjacent to pit for later re- grading	Low	to 10	Rip and doze into piles. Thaw and drain. Load in trucks	General fill	Dozer - Ripper Loader, Trucks	
				1								SE	E SECTION 218 F	OR SOURCE DETAI	LS
219	North end Yaya Lake 14 north Tunu- nuk Point	SAND - and		Area not criti- cal	Suitable for development but requires additional drilling to delineate total volume available	Good	Topsoil and Silt	0 to 2	Stockpile away from Yaya Lake for later regrading in the pit	Med	10 to 30	Rip and doze into piles. Thaw and drain. Load in trucks	General fill fine and coarse aggregate for concrete and asphalt	Dozer - Ripper Loader, Trucks Screen plant for aggregate production	
												JL	L CLOTTON 213 F	L	L

o Z	STANCE FROM COMMUNITY MILES	MATERIAL	VOLUME						SOUF	RCE	DE\	/ELOPMENT	DATA		
SOURCE	TANCE	TYPE (UNIFIED GROUP	ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	DRAINAGE		STRI		GRD.	REC. DEPTH	TYPE OF	MATERIAL USEAGE	EQUIPMENT	STATE OF DEVELOPMENT
Š	DIS	SYMBOL)	COBIC TANDS			11	MATERIAL	DEPTH (FT)	DISPOSAL	ICE	(FT.)	EXCAVATION	USLAUL	REQUIRED	OF SOURCE
220	East side Yaya Lake 12 north Tunu- nuk Point	SAND - some gravel (SW)	100,000	Area not criti- cal	Suitable for development but additional drilling required to delineate excavation area	Good	Topsoil and Silt	0 to 1	Stockpile away from drainage courses for later regrading	Med	5	Rip and doze into piles. Thaw and drain. Load in trucks or onto barges	General fill	Dozer - Ripper Loader, Trucks maybe barges	
							,					SE	I E SECTION 220 F	I OR SOURCE DETAI	LS
221A	East side of Yaya Lake 9 north Tunu- nuk Point	SAND - and silt (SM)		Area not criti- cal	Not recommended for development due to massive ice	Fair	Moss and Silt			High					Undeveloped
			;	;								\$E	E SECTION 221A	FOR SOURCE DETA	ILS
222	At Swim- ming Point 10 north east Tunu- nuk Point	SAND - some gravel, trace silt (SW-SP)	10,000,000	Area not criti- cal	Suitable for large scale development. Additional drilling should outline an area for immediate development	Good	Moss and	0 to 5½	Stockpile away from drainage courses for later regrading	Low to Med	5 to 15	Rip and doze into piles. Thaw and drain Load in trucks or on barges		Dozer - Ripper Loader, Trucks barge	
		,										SE	EE SECTION 222 F	TOR SOURCE DETAI	LS
223	7 north Tunu- nuk Point	GRAVEL - and sand (GW)	5,500,000	Area not criti- cal	Suitable for development. Portion of pit should be reserved for aggregate production	Good	Moss and Silt	0 to 2	Stockpile away from drainage courses for later regrading	Low	20	Rip and doze into piles. Thaw and drain Load in trucks		Dozer - Ripper Loader, Trucks Screen and crush plant for aggregate production	
												SE	E SECTION 223 F	FOR SOURCE DETAI	LS

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o Z	FROM JITY S	MATERIAL	VOLUME						SOUF	RCE	DEV	ELOPMENT	DATA		
SOURCE	STANCE FROM COMMUNITY MILES	TYPE (UNIFIED GROUP SYMBOL)	ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	DRAINAGE		STRIE		GRD.	REC. DEPTH	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT
S	DIS	STMBUL)					MATERIAL	(FT)	DISPOSAL		(FT.)	LXCAVATION			OF SOURCE
224	South shore of Yaya Lake 7 north Tununuk Point	GRAVEL - and sand (GW)	2,500,000	Area not criti- cal	Suitable for development. Portion of pit should be reserved for aggregate production	Good	Peat and Silt	0 to 2	Stockpile away from drainage courses for later regrading	Low	20	Rip and doze. Thaw and drain. Load in trucks or on barge	coarse aggre- gate for asphalt and concrete General fill	Dozer - Ripper Loader, Trucks Screen and crush plant for aggregate production	and in use by oil company
												SE	E SECTION 224 F	OR SOURCE DETAI	LS L
225	South shore of Yaya Lake 7 north Tunu-nuk Point	SAND - and gravel trace silt (SW)	1,000,000	Area not criti- cal	Suitable for development but more variable in quality than Sources 223 and 224	Good	Peat and Silt	0 to 3	Stockpile away from drainage courses for later regrading	Low to Med	10 to 20	Rip and doze. Thaw and drain. Load in trucks or on barge	General fill	Dozer - Ripper Loader, Trucks maybe barge	
												SE	E SECTION 225 F	OR SOURCE DETAI	LS L
226	6 north west of Tunu- nuk Point	SAND - some gravei trace silt (SM) GRAVEL - and sand	400,000	Area not criti- cal	Suitable for development but more variable in quality than Sources 223 and 224	Fair to Good	Peat and Silt	0 to 3	Stockpile away from drainage courses for later re- grading	Low to Med	10	Rip and doze. Thaw and drain. Load in trucks or on barge	General fill	Dozer-Ripper Loader, Trucks maybe barge	Undeveloped
		(4)										SE	E SECTION 226 F	OR SOURCE DETAI	LS
227	West of Yaya Lake 8 north of Tunu- nuk Point	SAND - some gravel trace silt (SW)	400,000	Area not criti- cal	Low priority for development because of var- iation in quali- ty and the mass- ive ice that can be encountered	Good	Peat and Silt	0 to 2	Stockpile away from drainage courses for later re- grading	Med		Rip and doze. Thaw and drain. Load in trucks or on barge	General fill	Dozer-Ripper Loader, Trucks maybe barge	Undeveloped
												;SE	I E SECTION 227 F I	I FOR SOURCE DETAI I	LS <u> </u>

## EXPLANATION OF SYMBOLS AND TERMS USED IN THIS REPORT

	GEN				YSTEM FOR SOILS
	MAJOR DIVISIO		Group SYMBOL	Graph SYMBOL	TYPICAL DESCRIPTION
	BOULDI	ERS	N/A		LARGER THAN 8 INCHES DIAMETER
sieve)	COBBLI	ES	N/A		3 TO 8 INCHES DIAMETER
200	coarse an No.4 11er ameter	CLEAN GRAVELS	G W		WELL GRADED GRAVELS, LITTLE OR NO FINES
SOILS ger than	C M • 1	(little or no fines)	GΡ		POORLY GRADED GRAVELS, AND GRAVEL-OSAND MIXTURES, LITTLE OR NO FINES
ધ	GRAVELS than half larger th & 100% sm inches di	DIRTY GRAVELS (with some	G M		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
COARSE-GRAINED f by weight la:	more t grains sieve & than 3	fines)	G C		CLAYEY GRAVELS, GRAVEL-SAND CLAY MIXTURES
COARS half by	an an	CLEAN SANDS (little or no fines)	<b>.</b>		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
than ha	i > 1	,	S P		POORLY GRADED SANDS, LITTLE OR NO FINES
(more t	SANDS than half ns smaller No. 4 sie	DIRTY SANDS (with some	S M		SILTY SANDS, SAND-SILT MIXTURES
)	gmore tha	fines)	s c		CLAYEY SANDS, SAND-CLAY MIXTURES
\$ 200	SILTS bw "A" e negli- le orga- content	W <sub>L</sub> 50%	ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY
passe	SIL below line n gible nic co	W <sub>L</sub> 50%	МН		INORGANIC SILTS, MICACEOUS OR DIATO- MACEOUS, FINE SANDY OR SILTY SOILS
SOILS	S line on chart orga-	W <sub>L</sub> 30%	CL		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS
GRAINED half by sieve)	CLAYS "A" 1i icity c jible c	30% W <sub>L</sub> 50%	CI		INORGANIC CLAYS OF MEDIUM PLASTI- CITY, SILTY CLAYS
FINE-GRAINED than half by sieve	CLAYS above "A" li plasticity c negligible o	W <sub>L</sub> 50%	СН		INORGANIC CLAYS OR HIGH PLASTICITY, FAT CLAYS
F (more t	ا ا	W <sub>L</sub> 50%	O L		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	ORGANIC SILTS & CLAYS below "A" line on	W <sub>L</sub> 50%	ОН		ORGANIC CLAYS OF HIGH PLASTICITY
H]	HIGHLY ORGANIC SOILS				PEAT AND OTHER HIGHLY ORGANIC SOILS

SUPPLEMENTARY TERM	MS IDENTIFYING T	THE COMPOSITION OF GR	RANULAR SOILS
Component	Identification	Terms Identifying Proportions	Defining Range Percentage by Weight
Principal Component(	GRAVEL SAND SILT	•••	50 or more
( Minor Component(	Gravel Sand Silt	and some little trace	35 to 50 20 to 35 10 to 20 1 to 10

## CLASSIFICATION SYSTEM FOR ICE

N <b>o</b> n Visible Ice	Nf Nbn Nbe	Poorly bonded Well bonded Excess Ice
Visible Ice Less than l inch thick	Vx Vc Vr	Individual ice crystals or inclusions Ice coatings or particles Random or irregularly oriented ice formation Stratified or distinctly oriented ice formations
Visible Ice Greater Than 1 inch thick	ICE+ ICE	Ice with soil inclusions Ice without soil inclusions

GROUND ICE CONTENT - % BY VOLUME

Low -<10% Med - 10% to 20% High ->20%

## DESCRIPTIVE SOIL TERMS

Well graded .... having wide range of grain sizes and substantial amounts of all intermediate sizes.

Poorly graded .. predominantly of one grain size.

Coarse Aggregate .. Gravel retained on  $\frac{1}{4}$  inch screen.

Fine Aggregate . Sand passing  $\frac{1}{4}$  inch screen.

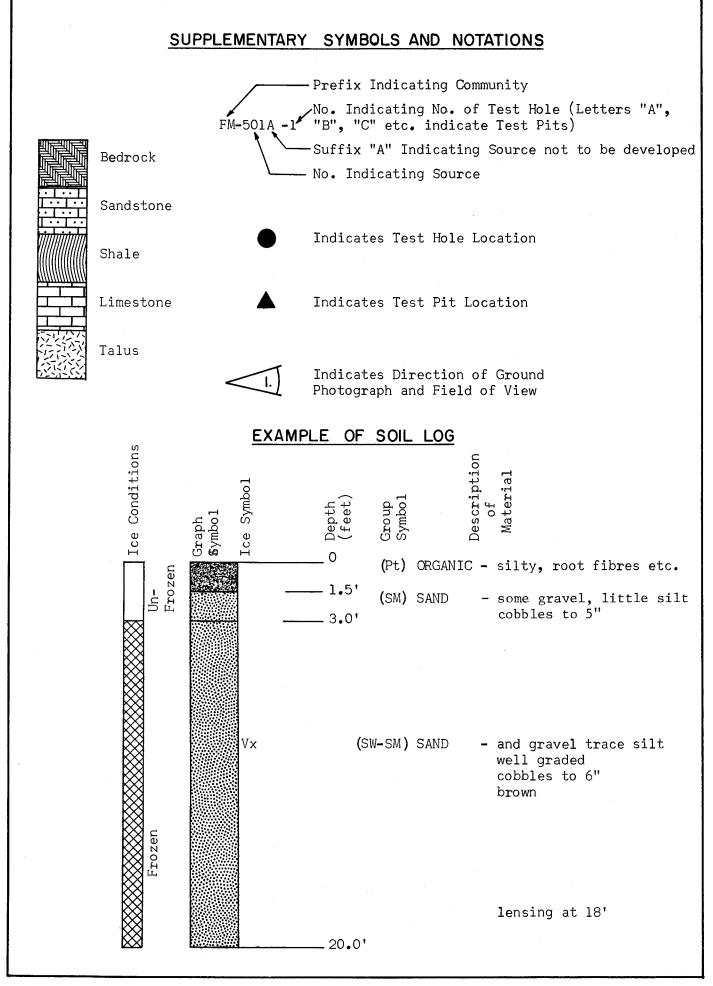
Interbedded .... composed of alternate layers of different soil or rock types.

Calcareous .... containing appreciable quantities of calcium carbonate.

Organic ...... containing organic matter; may be decomposed or fibrous.

Peat ..... a fibrous mass of organic matter in various stages of decomposition. Generally dark brown to black in colour and of spongy

consistency.



Ripley, Klohn & Leonoff International Ltd.

## ZONE II SOURCE No. 200A

LANDFORM AND LOCATION:

Beach and delta deposit located 22 miles

by air northwest of Tununuk Point.

MATERIAL:

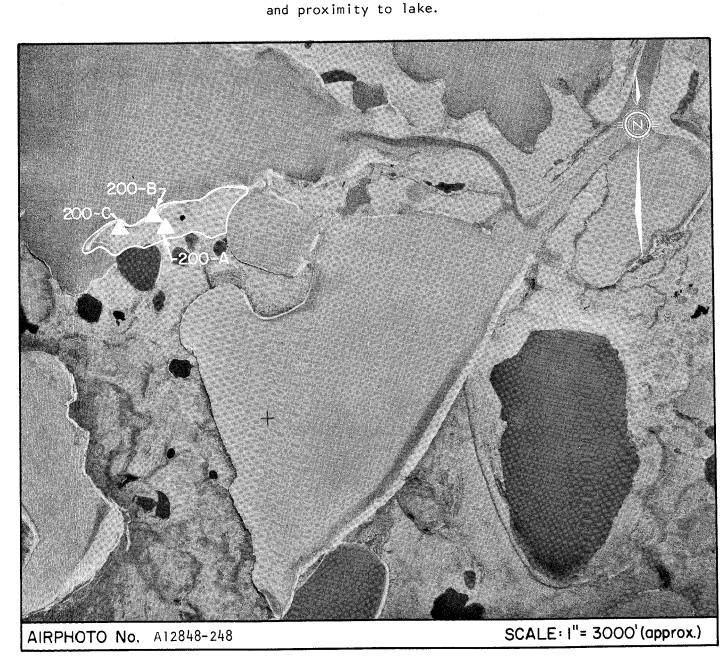
SAND - trace gravel

**VOLUME:** 

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**CONCLUSION:** 

Not recommended for development as source is within a bird sanctuary. Also, source would present problems in operation and restoration due to high ice and silt contents



## 200A ENVIRONMENT

## **Physical**

This source is a long, narrow beach associated with an ancient elevated delta deposit in the Mackenzie Delta, located 22 miles northwest of Tununuk Point and 5 miles west of Camp Farewell. The source area is about 5,000 feet long by 500 to 1,000 feet wide, with the old delta plain standing from 10 to 30 feet above water level.

Drainage over the source area is good, although evidence of permafrost can be seen in the elevated delta plain. The source has not been developed.

### Biotic

Vegetative cover in this area consists of moss, lichen, grasses, and dwarf shrubs up to 3 feet high. The beach area is bare of vegetation.

This source lies within a critical waterfowl sanctuary, the Kendall Island Migratory Bird Sanctuary, an important area for the breeding, staging, and moulting of large numbers of waterfowl.

The source also lies within the Mackenzie Reindeer Grazing Reserve.

#### 200A MATERIALS AND QUANTITIES

The material in this source is mainly sand with varying amounts of fine gravel. A surface layer of organic silt about 2 feet thick lies over the elevated delta area. Test Pit 200A-C is a log of the exposure on the lakeshore which shows a total depth of 30 feet of granular material. On the top of the elevated plain, permafrost is only 2 feet below the surface.

If this source could be developed, the only material easily excavated is the surface veneer of unfrozen sand from the beach. This volume is estimated to be about 15,000 cubic yards.

## 200A DEVELOPMENT

### General

This source cannot be developed because it lies within the Kendall Island Migratory Bird Sanctuary, a critical wildlife area.

If the environmental problem could be overcome, development of the full area of the source presents serious problems in operation and restoration because of the ground ice, the silt cover, and the fine sand contained in it. Development of the beach area could lead to erosion of the banks behind. The source would be marginal quality, at best.

### Access

This source could be reached only during winter, by trucking over the lakes and channels of the Delta. The channels adjacent to the source would not permit summer access by barge.

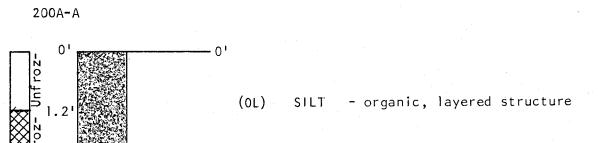
## Material Use and Handling

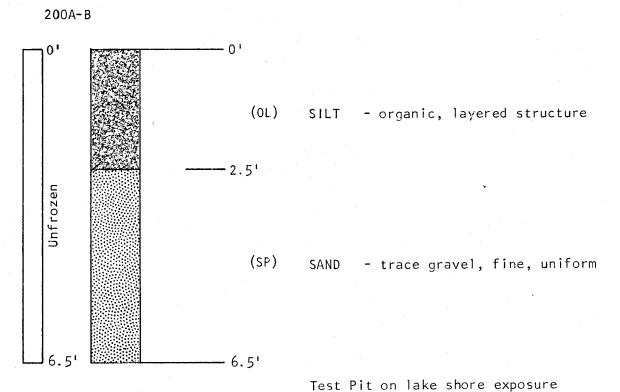
If the source could be developed, the material would be only suitable for general fill.

## Stripping and Restoration

This beach area would require no stripping, but excavation of the sand could lead to exposure of the ground ice in the steep banks and serious problems of stability and restoration of the area.

## TEST PIT LOGS SOURCE No. 200 A

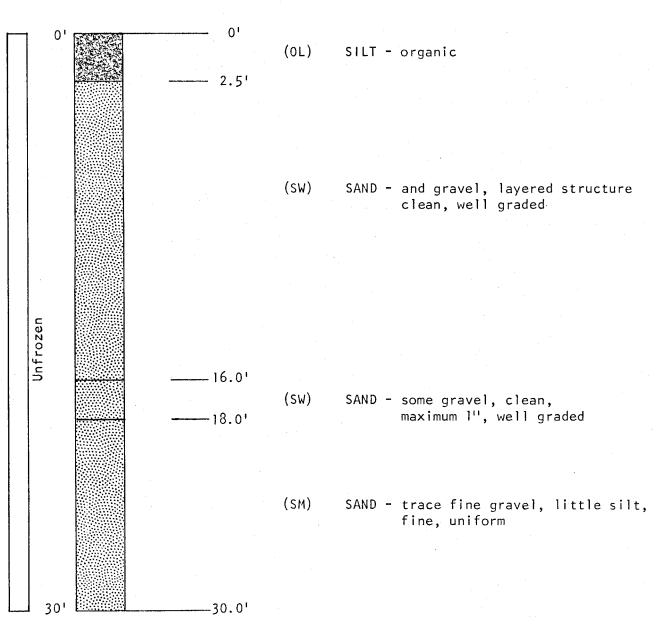




Moisture Content
Sample B depth 2.5' - 6.5' 6.8%

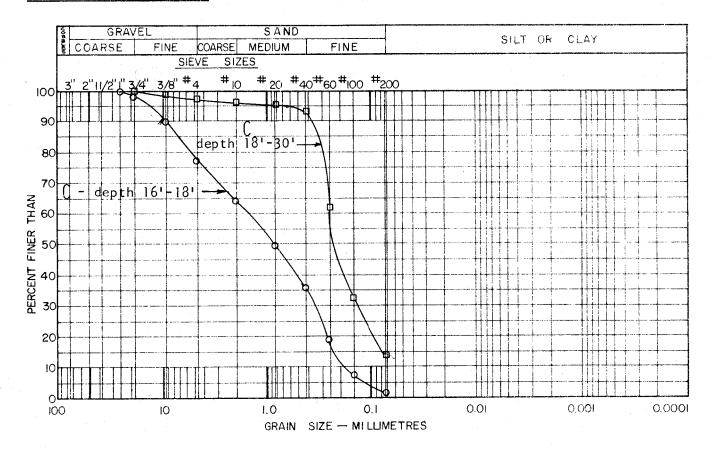
## TEST PIT LOGS SOURCE No. 200A





# LABORATORY TEST DATA TEST PIT-SOURCE No. 200A

## GRAIN SIZE DISTRIBUTION



## MOISTURE CONTENT

Sample C depth 16' - 18' 5.1% Sample C depth 18' - 30' 11.4%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

## ZONE II SOURCE No. 201A

LANDFORM AND LOCATION:

Delta plain remnants and beach 20 miles by

air northwest of Tununuk Point.

MATERIAL:

SAND - trace gravel, trace silt.

**VOLUME:** 

\_\_\_

CONCLUSION:

Not recommended for development as source

is within bird sanctuary.



#### 201A ENVIRONMENT

### Physical

This source is the elevated remnant of an ancient delta plain, separated into 4 parts by erosion channels, together with an associated beach. The source is located 20 miles northwest of Tununuk Point and 4 miles southwest of Camp Farewell. The source area is about  $3\frac{1}{2}$  miles by 2 miles and stands 15 to 20 feet above water level.

Drainage of the plain is good, although adjacent low-lying ground gives indications of ice-rich soils and the area is almost surrounded by lakes and channels. The source has not been developed.

## Biotic

The vegetative cover is primarily moss and lichen, with considerable dwarf birch and willow.

This source lies within a critical waterfowl sanctuary, the Kendall Island Migratory Bird Sanctuary, an important area for the breeding, staging, and moulting of large numbers of waterfowl.

The source also lies within the Mackenzie Reindeer Grazing Reserve.

## 201A MATERIALS AND QUANTITIES

The material in this source is primarily sand with a trace of gravel and variable amounts of silt, up to 20%. Exposures around the edge of the deposit indicate that the stratified sand and gravel extend vertically to water level. A silt layer up to 3 feet thick covers the sand. Test Pit 201A-B encountered permafrost at less than 1 foot depth.

Because of the prevalent ground ice the only granular material that could be excavated is the surface of the beach on the north side of the source. The volume is estimated to be about 50,000 cubic yards.

#### 201A DEVELOPMENT

#### General

This source cannot be developed because it lies within the Kendall

Island Migratory Bird Sanctuary, a critical wildlife area.

If the environmental problem could be overcome, development of the full area of the source presents serious problems in operation and restoration because of the ground ice, the silt cover, and the fine sand contained in it. Development of the beach area could lead to erosion of the banks behind. The source would be marginal quality, at best.

## Access

This source could be reached only during winter, by trucking over the lakes and channels of the Delta. The channels adjacent to the source would not permit summer access by barge.

## Material Use and Handling

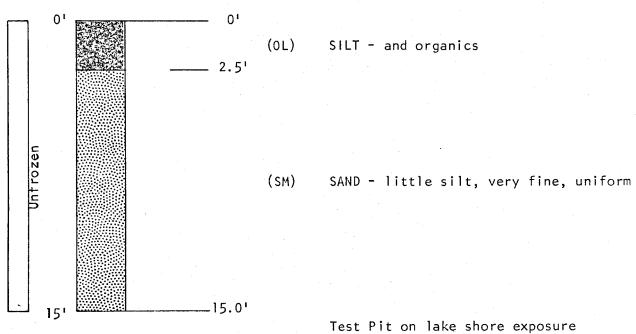
If the source could be developed the material from the beach at the north side of the source would be suitable for general fill.

## Stripping and Restoration

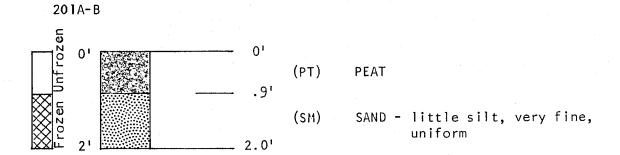
The excavation of the beach would require no stripping, but excavation of the sand would lead to exposure of the ground ice in the steep banks and serious problems of stability and restoration of the area.

## TEST PIT LOGS SOURCE No. 201A

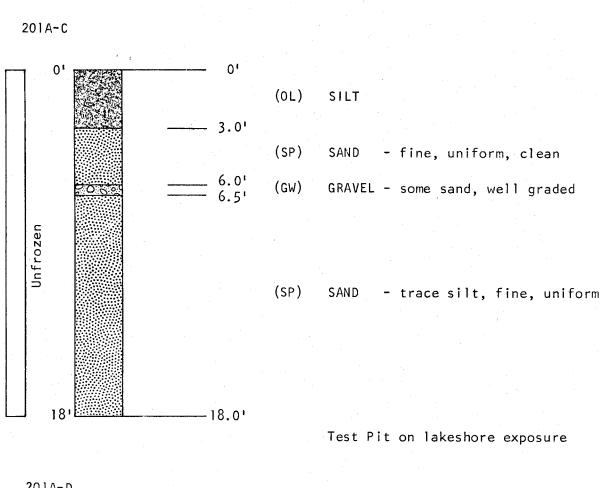


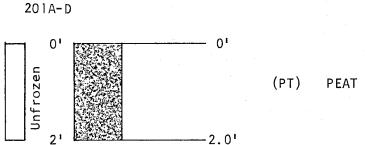


## Test it on take shore exposure



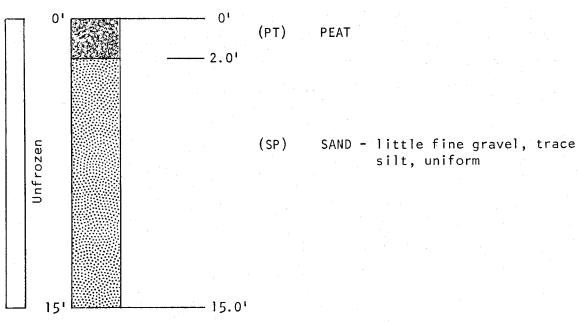
## TEST PIT LOGS SOURCE No. 201A





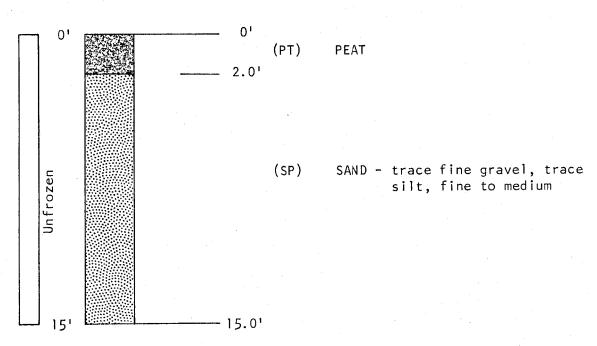
## TEST PIT LOGS SOURCE No. 201A

201A-E



Test Pit on lake shore exposure

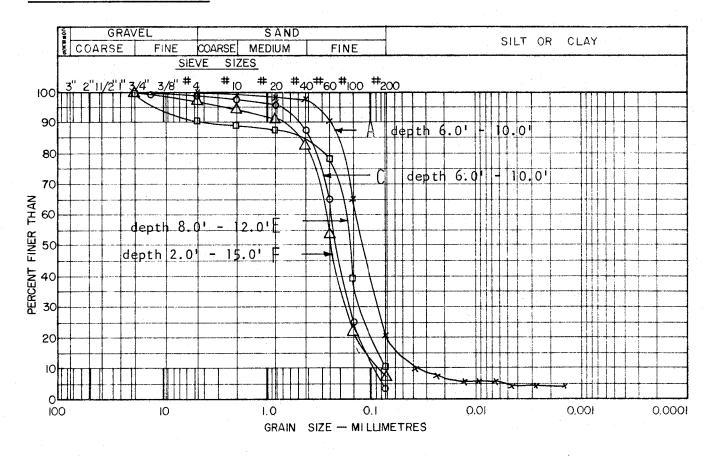
201A-F



Test Pit on lake shore exposure

# LABORATORY TEST DATA TEST PIT-SOURCE No. 201A

## GRAIN SIZE DISTRIBUTION



## MOISTURE CONTENT

Pit	Α	depth	6.0 -	10.01	9.1%
Pit	С	depth	6.0 -	10.0'	6.3%
Pit	Ε	depth	8.0 -	12.0'	8.5%
Pit	F	depth	2.0 -	15.0'	7.4%

## ORGANIC CONTENT

HARDNESS TEST

## PETROGRAPHIC ANALYSIS

### ZONE II SOURCE No. 202A

LANDFORM AND LOCATION:

Delta remnant and beach located 23 miles by

air northwest of Tununuk Point.

MATERIAL:

SAND - trace silt.

**VOLUME:** 

\_\_\_

CONCLUSION:

Not recommended for development as source

is within bird sanctuary.



#### 202A ENVIRONMENT

#### Physical

This source is an elevated remnant of an ancient delta, located 23 miles northwest of Tununuk Point and 4 miles west of Camp Farewell. The source is about 2,000 feet by 1,500 feet in area and stands 10 to 15 feet above water level.

Drainage over the source is good, and the source has not been developed.

#### Biotic

The vegetative cover is primarily moss and lichen, with considerable dwarf birch and willow.

This source lies within a critical waterfowl sanctuary, the Kendall Island Migratory Bird Sanctuary, an important area for the breeding, staging, and moulting of large numbers of waterfowl.

The source also lies within the Mackenzie Reindeer Grazing Reserve.

#### 202A MATERIALS AND QUANTITIES

The material in this source is primarily fine sand with a trace of silt. A silt layer about 3 feet deep covers the sand. Permafrost is only 12 to 15 inches deep over this elevated area.

Clean sand is exposed in narrow strips of beach on the north and west sides of the source, and this material represents the easily recoverable material. The beaches are too narrow to excavate without danger of exposing the ground ice in the banks, so the recoverable volume is very small.

#### 202A DEVELOPMENT

#### General

This source cannot be developed because it lies within the Kendall Island Migratory Bird Sanctuary, a critical wildlife area.

If the environmental problem could be overcome, development of the full area of the source presents serious problems in operation and restoration because of the ground ice, the silt cover, and the fine sand contained in it. Development of the beach area could lead to erosion of the banks behind. The source would be marginal quality, at best.

#### Access

This source could be reached only during winter, by trucking over the lakes and channels of the Delta. The channels adjacent to the source would not permit summer access by barge.

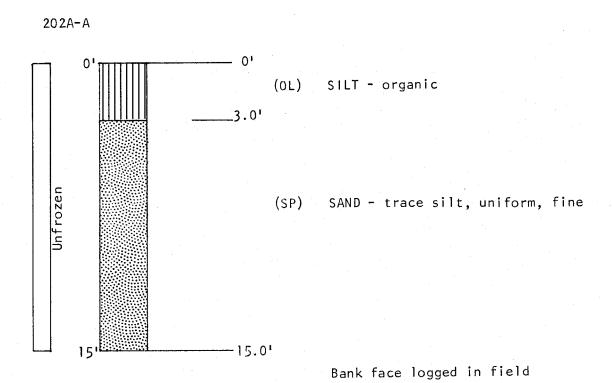
#### Material Use and Handling

If the source could be developed, the material would be only suitable for general fill.

#### Stripping and Restoration

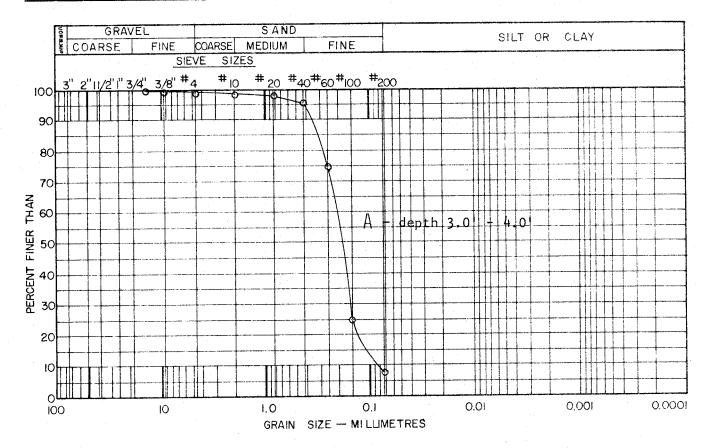
The excavation of the beach would require no stripping, but excavation of the sand would lead to exposure of the ground ice in the steep banks and serious problems of stability and restoration of the area.

## TEST PIT LOGS SOURCE No. 202A



# LABORATORY TEST DATA TEST PIT-SOURCE No. 202A

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Pit A depth 3.0' - 4.0' 9.5%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

### ZONE II SOURCE No. 203A

LANDFORM AND LOCATION:

Delta remnant and beach located 25 miles

by air southwest of Tununuk Point.

MATERIAL:

SAND - trace silt

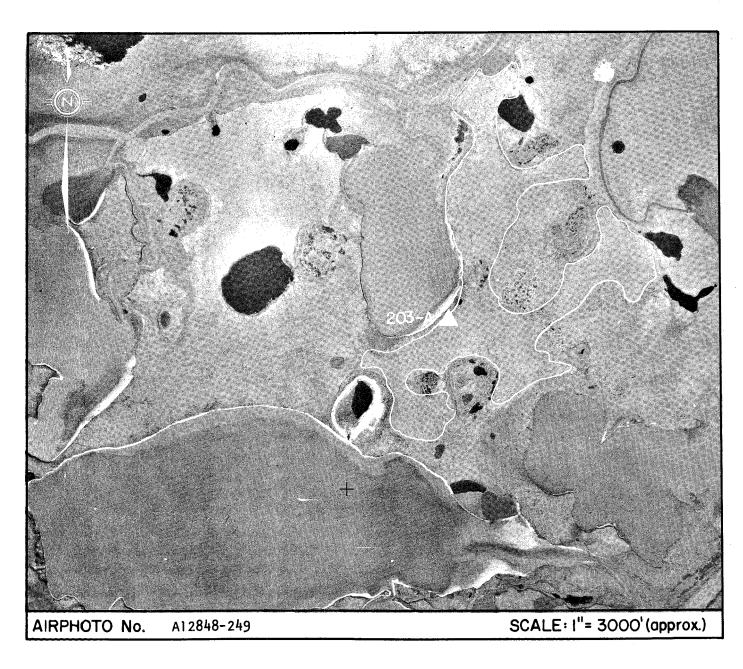
**VOLUME:** 

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CONCLUSION:

Not recommended for development as source

is within bird sanctuary.



#### 203A ENVIRONMENT

#### Physical Physical

This source is an elevated remnant of an ancient delta and an associated beach located 25 miles northwest of Tununuk Point and 7 miles west of Camp Farewell. The source area is about  $2\frac{1}{2}$  miles long and 1 mile wide and stands about 10 feet above water level. The old delta is broken up by low-lying lake deposits of ice-rich silt, many of them displaying a polygonal ground pattern and thermokarst characteristics.

Drainage over the source is good, and the source has not been developed.

#### Biotic

The vegetative cover is primarily moss and lichen, with considerable dwarf birch and willow.

This source lies within a critical waterfowl sanctuary, the Kendall Island Migratory Bird Sanctuary, an important area for the breeding, staging, and moulting of large numbers of waterfowl.

The source also lies within the Mackenzie Reindeer Grazing Reserve.

#### 203A MATERIALS AND QUANTITIES

The material in this source is primarily sand with a trace of silt. The top surface of the elevated delta is organic silt about 2 feet thick, with permafrost at the 12 to 15 inch depth.

The only easily recoverable material lies on the narrow beach fronting on the lake on the western side of the source. This beach is so narrow that very little granular material could be excavated without exposing the ground ice in the steep bank, so the volume of recoverable sand is negligible.

#### 203A ENVIRONMENT

#### Physical

This source is an elevated remnant of an ancient delta and an associated beach located 25 miles northwest of Tununuk Point and 7 miles west of Camp Farewell. The source area is about  $2\frac{1}{2}$  miles long and 1 mile wide and stands about 10 feet above water level. The old delta is broken up by low-lying lake deposits of ice-rich silt, many of them displaying a polygonal ground pattern and thermokarst characteristics.

Drainage over the source is good, and the source has not been developed.

#### Biotic

The vegetative cover is primarily moss and lichen, with considerable dwarf birch and willow.

This source lies within a critical waterfowl sanctuary, the Kendall Island Migratory Bird Sanctuary, an important area for the breeding, staging, and moulting of large numbers of waterfowl.

The source also lies within the Mackenzie Reindeer Grazing Reserve.

#### 203A MATERIALS AND QUANTITIES

The material in this source is primarily sand with a trace of silt. The top surface of the elevated delta is organic silt about 2 feet thick, with permafrost at the 12 to 15 inch depth.

The only easily recoverable material lies on the narrow beach fronting on the lake on the western side of the source. This beach is so narrow that very little granular material could be excavated without exposing the ground ice in the steep bank, so the volume of recoverable sand is negligible.

#### 203A DEVELOPMENT

#### General

This source cannot be developed because it lies within the Kendall Island Migratory Bird Sanctuary, a critical wildlife area.

If the environmental problem could be overcome, development of the full area of the source presents serious problems in operation and restoration because of the ground ice, the silt cover, and the fine sand contained in it. Development of the beach area could lead to erosion of the banks behind. The source would be marginal quality, at best.

#### Access

This source could be reached only during winter, by trucking over the lakes and channels of the Delta. The channels adjacent to the source would not permit summer access by barge.

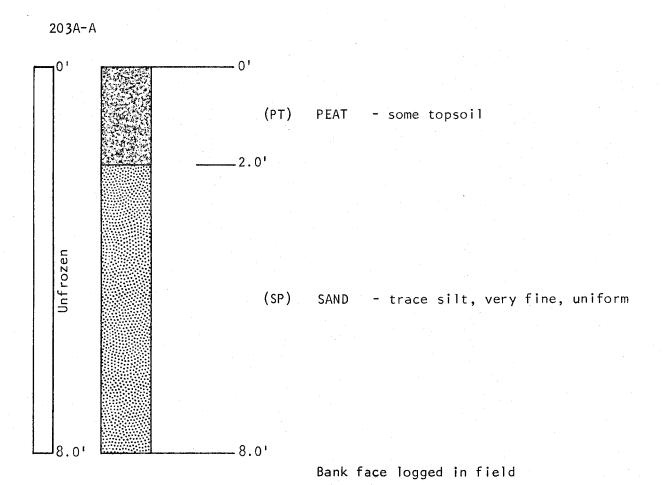
#### Material Use and Handling

If the source could be developed, the material would be only suitable for general fill.

#### Stripping and Restoration

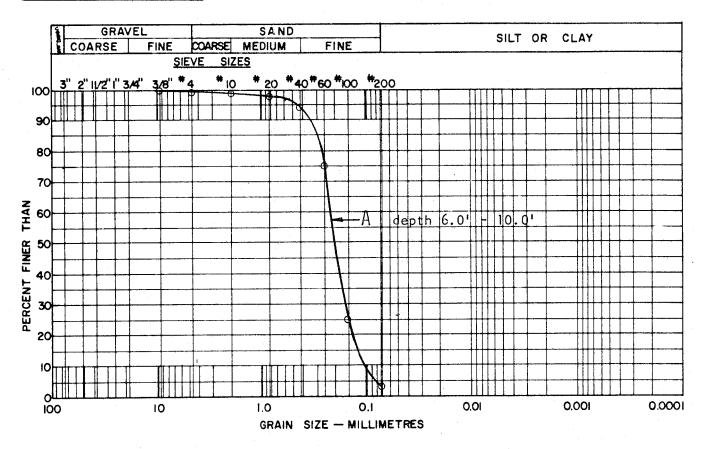
The excavation of the beach would require no stripping, but excavation of the sand would lead to exposure of the ground ice in the steep banks and serious problems of stability and restoration of the area.

## TEST PIT LOGS SOURCE No. 203A



# LABORATORY TEST DATA SOURCE No. 203A

#### GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Pit A depth 6.0' - 10.0'

6.8%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

### ZONE II SOURCE No. 204

LANDFORM AND LOCATION:

Terrace along western bank of the east

channel of the Mackenzie River at Tununuk

Point.

MATERIAL:

SAND - and gravel

**VOLUME:** 

200,000 cubic yards approximately

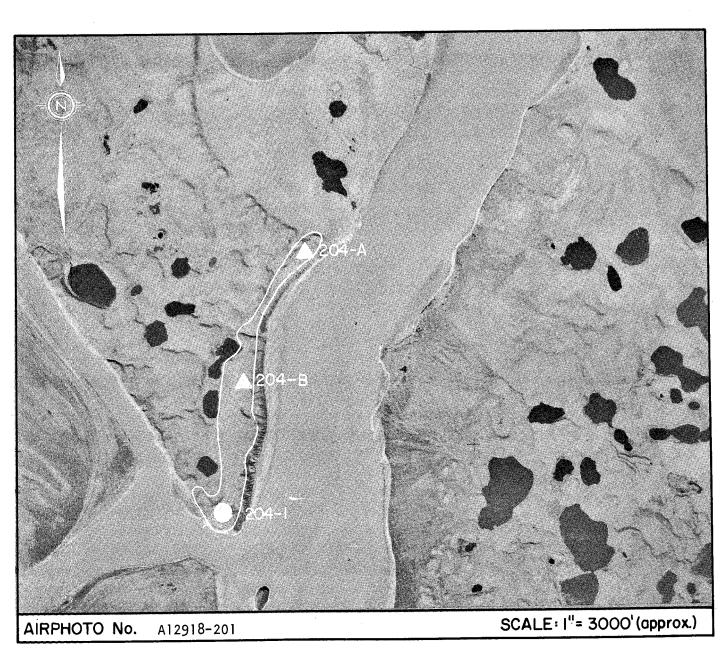
CONCLUSION:

Low priority for development. Suitable

for local use only. Care must be taken in

development to prevent exposure of the ground

ice and to prevent siltation in the River Channel.



#### 204 ENVIRONMENT

#### Physical

This source appears to be the remnant of a fluvial terrace which stands on the western bank of the east channel of the Mackenzie River at Tununuk Point and extends for about 9,000 feet to the north. The ridge falls steeply for 40 to 60 feet to the river, and on the western side slopes gradually to the level of the Delta. The ridge is from 150 to 1,000 feet wide.

An oil company maintain a large base camp and airstrip at Tununuk Point, and occupy the southern half of the source.

Drainage is good over the source area. The source has not been developed to any scale for the production of granular materials.

#### Biotic

The top surface of the source area is generally covered with moss, lichen, and scattered dwarf shrubs, although some areas are bare, exposing oxidized gravel. The slopes of the ridge are covered with dwarf shrubs about 4 feet high and some small spruce in the erosion gullies.

The channels of the Mackenzie River are valuable to the native population as a source of fish, especially at certain seasons when anadromous species are migrating to or from their spawning grounds. The source lies within an important, but not critical, waterfowl breeding area, and also within the Mackenzie Reindeer Grazing Reserve.

Tununuk Point has been identified as an archaeological site.

#### 204 MATERIALS AND QUANTITIES

The material contained within this source is sand and gravel with a trace of silt. The gravel is graded to a maximum size of 1 inch. The samples from Test Hole #1 graded from 40% to 60% gravel, 38% to 58% sand, and about 2% silt.

The petrographic analysis of a sample of gravel from Test Pit A

indicates a very sound material composed of quartzite, chert, granite, hard sandstone, and soft porous sandstone (3%), of which the last is the only unsound component.

The moisture content of 2 samples from Test Hole #1 range from  $3\frac{1}{2}\%$  to  $4\frac{1}{2}\%$  at a depth of 5 feet. No ice was observed on the particles of the samples, although the drilling encountered massive ice with some gravel inclusions at a depth of 8 feet, continuing to 30 feet, the bottom of the hole.

Allowing for the oil company's occupation of one-half the area of the source, the recoverable volume is estimated to be approximately 200,000 cubic yards.

#### 204 DEVELOPMENT

#### General

This source is considered low priority, suitable only for local supply of general fill and aggregate for concrete and asphalt construction.

The development would have to avoid the thawing of massive ground ice adjacent to the steep slope near the river, because instability would lead to siltation of the east channel.

Other sources such as Nos. 223 and 224 which are located nearby should be considered for any large scale development in this area, reserving Source 204 for small scale development.

#### Access

This source is accessible by truck in winter and by barge in summer. The distance to Inuvik along the east channel of the Mackenzie River is about 55 miles.

#### Material Use and Handling

This material is suitable for general fill, road construction, and for concrete and asphalt construction.

The sand and gravel can probably be excavated at any season of the year without ripping, and would not require thawing and draining before use.

The equipment required for development of this source is the usual assembly of dozer, front-end loader, and trucks.

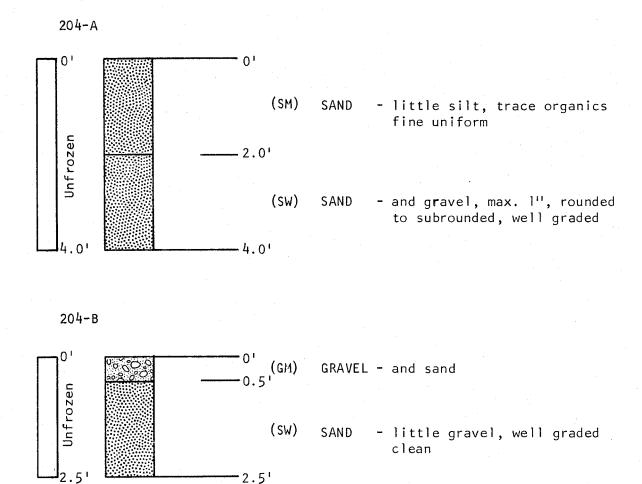
#### Stripping and Restoration

The stripping required over this source will vary from nothing to about 2 feet, and this material with the organic ground cover must be stockpiled for replacement after the granular material has been removed. All banks must be graded to a stable slope before the topsoil is replaced over them.

The excavation should be kept away from the steep bank leading to the east channel of the Mackenzie River, otherwise the thawing of ground ice near the bank could lead to instability that would be difficult or impossible to correct, and would lead ultimately to the siltation of the river.

After an area has been covered with topsoil, it should be seeded for speedy revegetation, using plants and methods of preparation recommended by a specialist in Arctic horticulture.

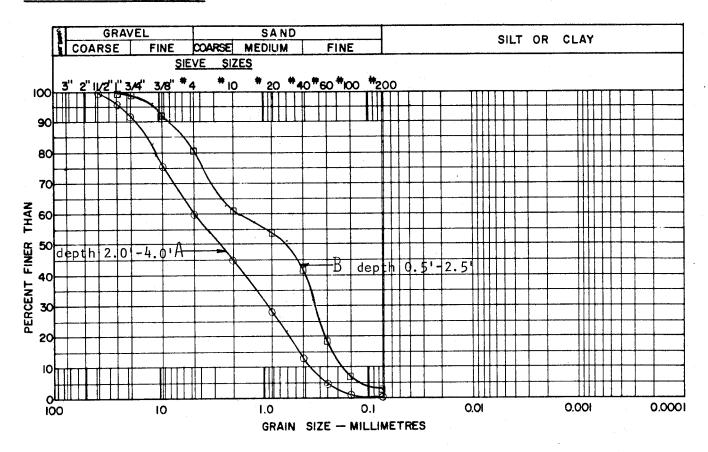
## TEST PIT LOGS SOURCE No. 204



# LABORATORY TEST DATA

### SOURCE No. 204

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Pit A depth 2.0' - 4.0' 2.3% Pit B depth 0.5' - 2.5' 12.1%

#### ORGANIC CONTENT

#### HARDNESS TEST

1

#### PETROGRAPHIC ANALYSIS

 Sample A depth 2.0' - 4.0'

 Quartzite
 - 75%

 Chert
 - 15%

 Granite
 - 6%

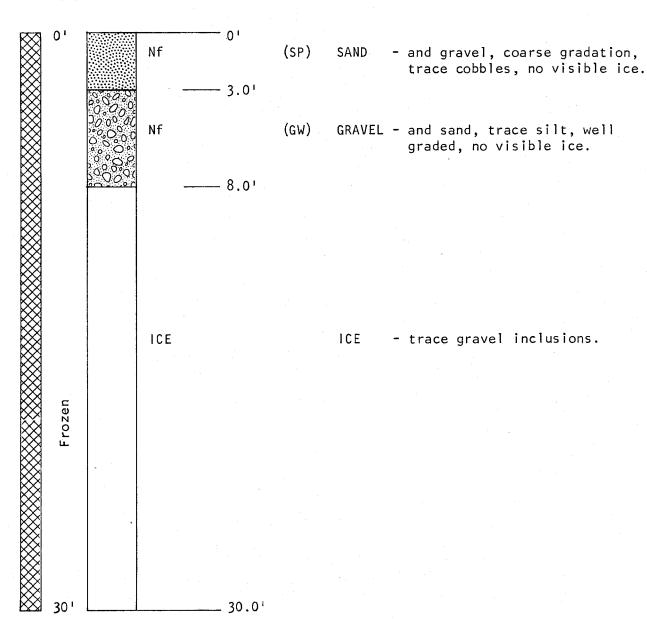
 Sandstone (soft)
 - 3%

 Sandstone (hard)
 - 1%

 Total
 100%

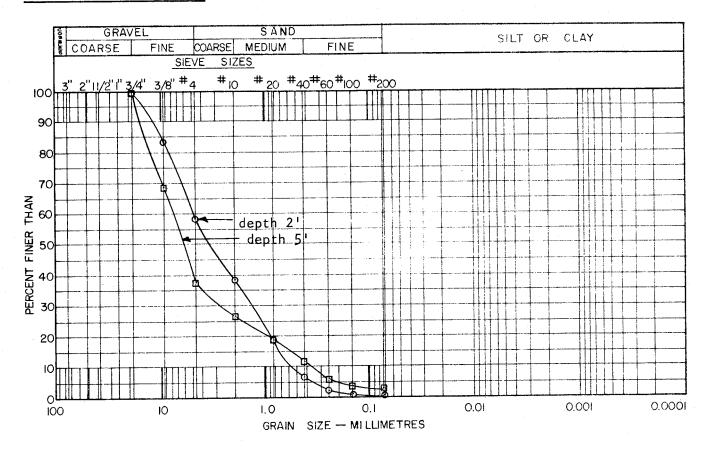
## TEST HOLE LOGS SOURCE No. 204

204-1



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 204-1

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Sample 1 depth 2' 3.4% Sample 2 depth 5' 4.6%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

### ZONE II SOURCE No. 205A

LANDFORM AND LOCATION:

Kame remnants located west of Denis

Lagoon about 25 miles north of Tununuk

Point.

MATERIAL:

SILT - and sand, trace gravel

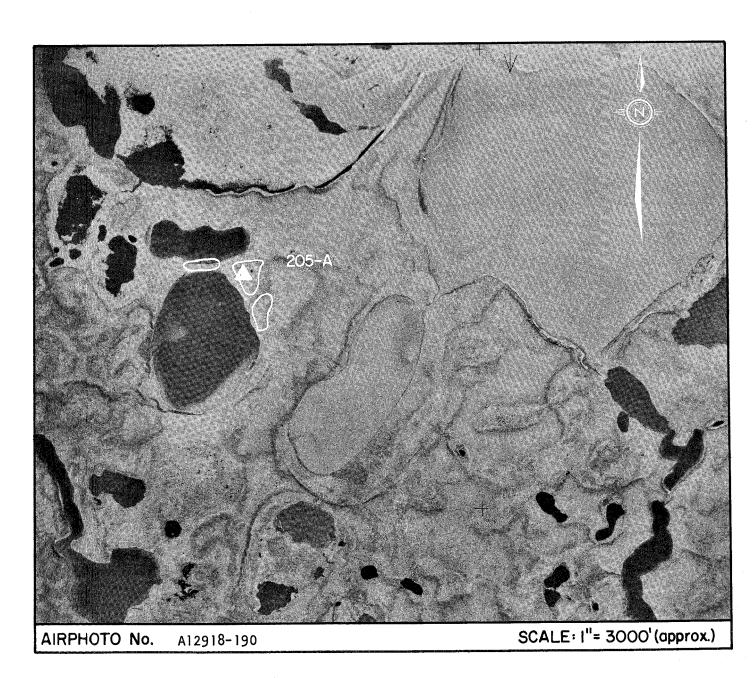
VOLUME:

\_\_

CONCLUSION:

Source is not recommended for development

due to poor quality and high ice content.



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#### 205A ENVIRONMENT

#### Physical

This source may be the remnant of a kame field located west of Denis Lagoon, about 25 miles north of Tununuk Point. It consists of three small hillocks spaced over a distance of 4,000 feet around the northern edge of a small lake and standing from 10 to 100 feet above lake level.

Drainage is good, and the source has not been developed.

#### Biotic

Vegetative cover is moss and lichen, with some dwarf birch and willow to a height of 3 feet.

The source lies within a critical wildlife area, important for the breeding and moulting of waterfowl through each summer. It also lies within the Mackenzie Reindeer Grazing Reserve and may be part of the summer range of the Reindeer Herd and of barren-ground caribou in the future.

#### 205A MATERIAL AND QUANTITIES

The surface of this source does not reveal any gravel, although the adjacent lake shore contains gravel and boulders. The only test pit excavated in the surface penetrated 1 foot of organic soil, then silt and sand with a trace of gravel to a depth of 2.3 feet. Permafrost was located 1 foot below the surface.

The source is a very low-quality granular material, probably underlain at a shallow depth with massive ground ice.

#### 205A DEVELOPMENT

#### General

This source is not suitable for development because of poor quality and high ice content.

#### Access

The source area can be reached by winter road.

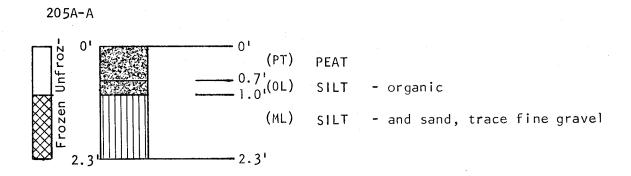
#### Material Use and Handling

This material is not suitable for use in construction because of the high silt content.

### Stripping and Restoration

The source could not be developed without widespread disruption of the permafrost regime, making restoration difficult and costly.

## TEST PIT LOGS SOURCE No. 205A



### ZONE II SOURCE No. 206

LANDFORM AND LOCATION:

Ridges, possibly esker remnants, at northeast

end of Denis Lake, about 27 miles by air north

of Tununuk Point.

MATERIAL:

SAND - trace gravel, some silt

**VOLUME:** 

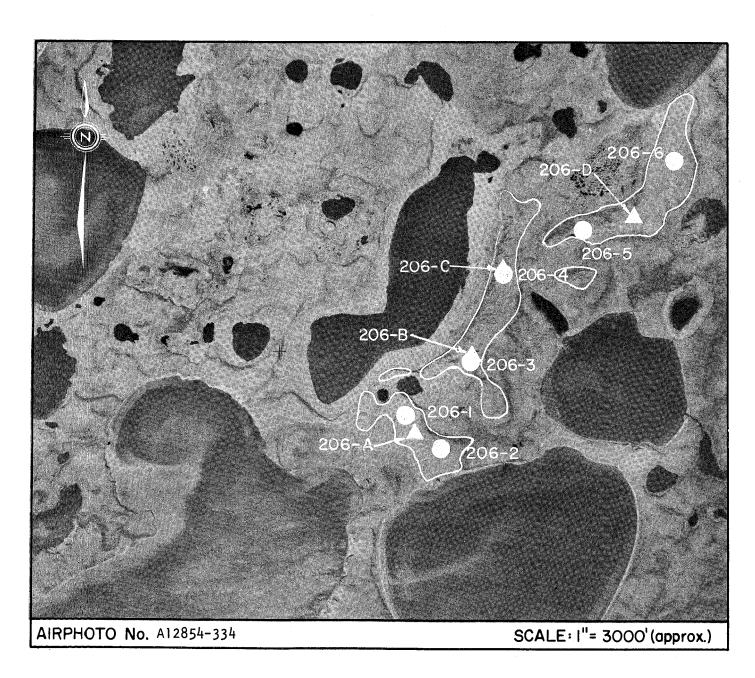
200,000 cubic yards

CONCLUSION:

Source is low priority for development due to

variable nature of deposit. Probably

suitable for local use only.



#### 206 ENVIRONMENT

#### Physical

The source is an area of rounded ridges, possibly esker remnants, located at the northeast end of Denis Lake, about 27 miles north of Tununuk Point. The area is irregular, about  $2\frac{1}{2}$  miles long by a maximum of 4,000 feet wide, and the ridges stand from 50 to 75 feet above lake level. The surrounding low-lying area displays the polygonal ground pattern and thermokarstic melt ponds associated with massive ground ice.

Drainage of the ridges is good, and the source has not been developed.

#### Biotic

The ridges are generally covered with moss and lichen, with scattered dwarf birch and willow about 2 feet high, but some areas of gravel are bare of any cover.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barrenground caribou at some time in the future.

#### 206 MATERIALS AND QUANTITIES

The investigation of this source includes 4 test pits dug to a depth of 4 feet and 6 test holes from 14 to 20 feet deep. The principal conclusion is that the deposit is extremely erratic.

Materials in the different samples range from gravel, clean and well-graded, to fine uniform sand. The silt content varies from nothing to about 30%.

Four of the 6 test holes encountered massive ice at depths of 8 feet or less, and two of them penetrated only ice and silt. Only Test

Holes #4 and #5 penetrated gravel with low ice content, the remainder penetrating ice lenses and inclusions.

The material from Test Pit B was subjected to petrographic analysis, and contains primarily quartzite (48%), chert (30%), and quartz (12%), with fine sandstone (4%), opal (3%), limestone, granite, and porous sandstone making up the remainder. Due to the high chert content, this gravel should be studied for reactivity before it can be recommended for concrete aggregate, and pending such studies, it should be used only with cement containing less than 0.6% alkali.

More drilling would be required to define the areas of suitable recoverable material. Without additional work, the volume of granular material is very difficult to estimate, but the recoverable volume should be about 200,000 cubic yards.

#### 206 DEVELOPMENT

#### <u>Ge</u>neral

This source is considered low priority because of the erratic nature of the deposit--probably suitable only for local work.

#### Access

This source can be reached only during winter months, trucking across the lakes and tundra. The nearest point on the east channel of the Mackenzie River is about 10 miles away by air.

### Material Use and Handling

Material from selected parts of this source is suitable for general fill. Possibly further investigation will identify a deposit of material suitable for use in concrete and asphalt construction, but such a deposit is likely to be small, because of the erratic nature of the source.

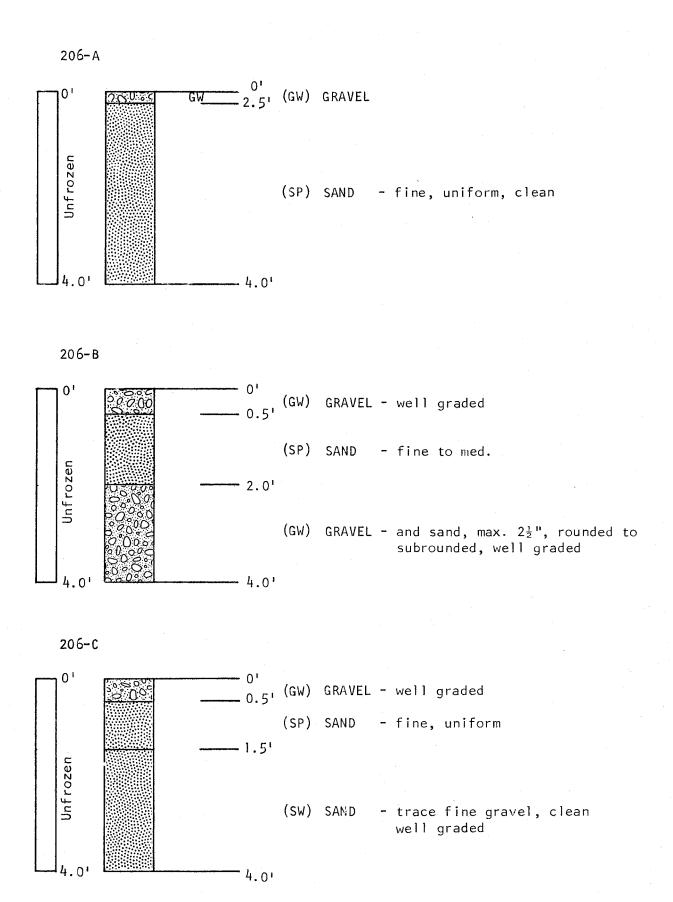
The equipment required for the development of this source is the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

#### Stripping and Restoration

The depth of organic topsoil overlying granular material varies up to  $l\frac{1}{2}$  feet. This soil and the organic ground cover must be stripped from an area to be developed and stockpiled away from drainage courses for replacement after the granular material has been removed.

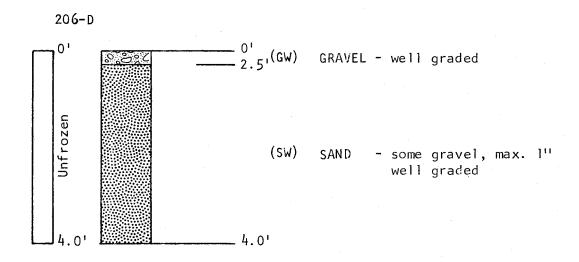
Because of the thermokarstic nature of the low-lying ground around the ridges, these areas must be disturbed as little as possible.

### TEST PIT LOGS SOURCE No. 206



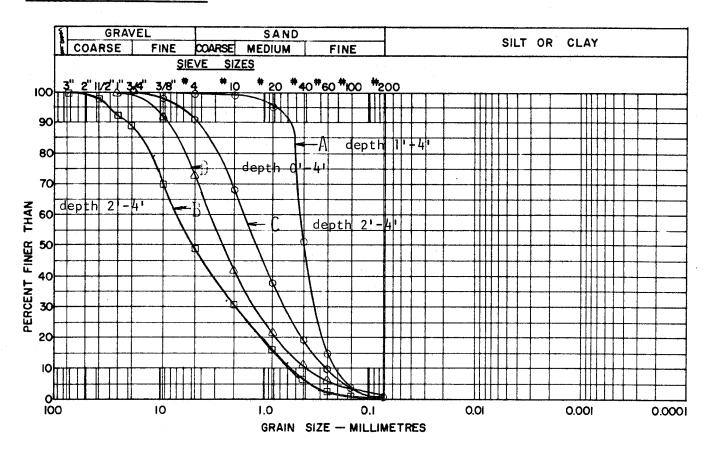
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## TEST PIT LOGS SOURCE No. 206



# LABORATORY TEST DATA SOURCE No. 206

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

A (1' - 4') M/C = 4.0%

B(2'-4') M/C = 1.7%

C(2'-4') M/C = 2.3%

D (0' - 4') M/C = 2.9%

#### ORGANIC CONTENT

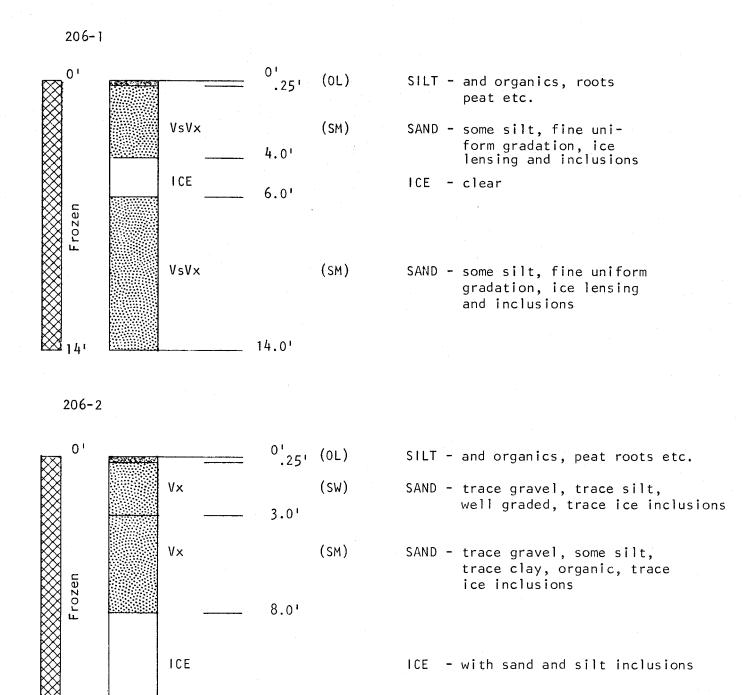
#### HARDNESS TEST

#### PETROGRAPHIC ANALYSIS

Test Pit B depth 2' - 4' Quartzite - 48% Opal 3% Chert - 30% Sandstone (soft)-1% Quartz - 12% Limestone 1% Sandstone (hard) Granite 1%

Total 100%

### TEST HOLE LOGS SOURCE No. 206

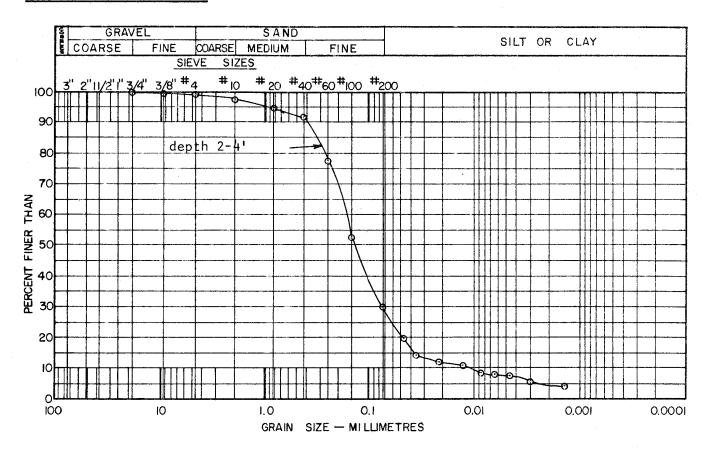


14.0'

141

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 206-1

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Sample 1 depth 2' 26.4% Sample 2 depth 10' 30.5% Sample 3 depth 14' 106.7%

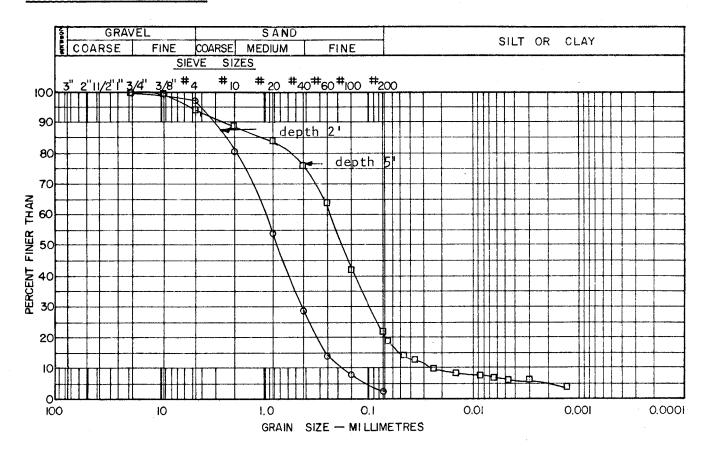
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 206-2

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

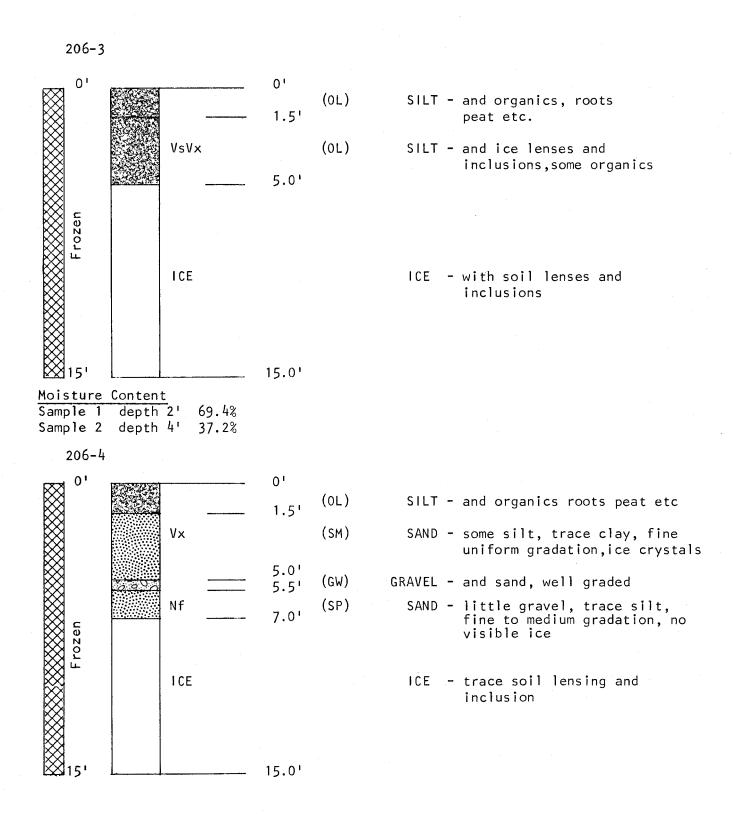
Sample 1 depth 2' 7.3% Sample 2 depth 5' 32.0%

ORGANIC CONTENT

HARDNESS TEST

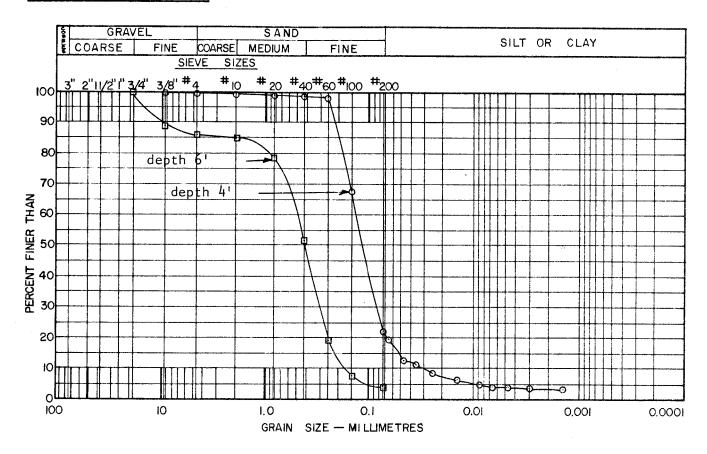
PETROGRAPHIC ANALYSIS

## TEST HOLE LOGS SOURCE No. 206



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 206-4

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

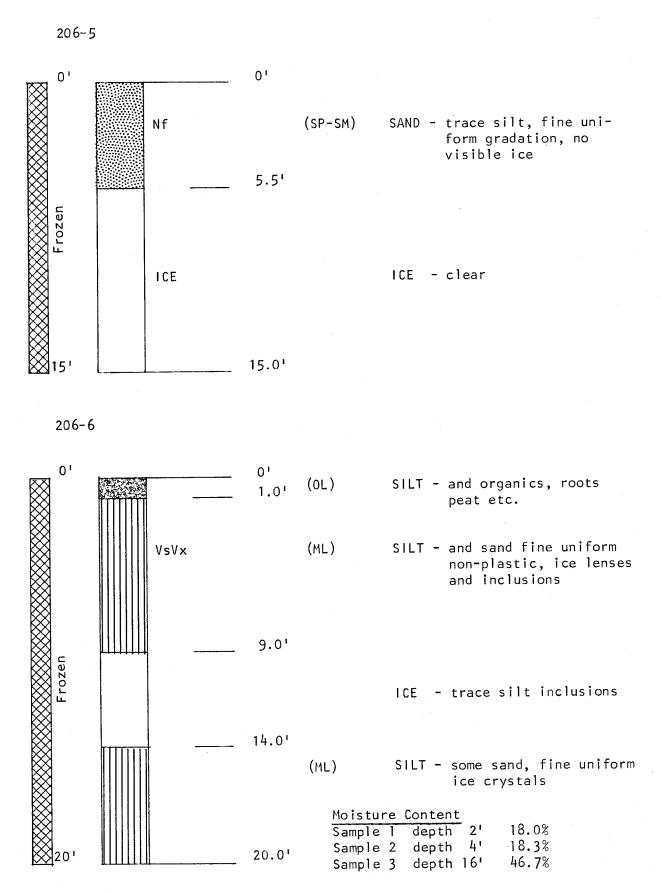
Sample 1 depth 2' 59.5% Sample 2 depth 4' 31.6% Sample 3 depth 6' 28.4%

#### ORGANIC CONTENT

HARDNESS TEST

#### PETROGRAPHIC ANALYSIS

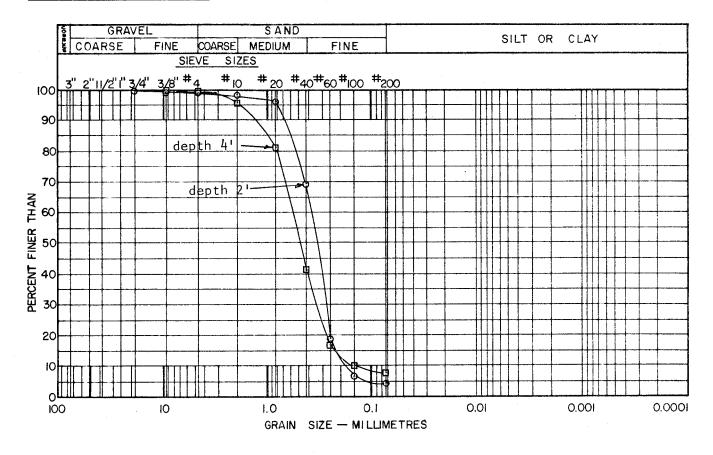
## TEST HOLE LOGS SOURCE No. 206



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# LABORATORY TEST DATA TEST HOLE-SOURCE No. 206-5

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

Sample 1 depth 2' 10.7% Sample 2 depth 4' 16.0%

ORGANIC CONTENT

HARDNESS TEST

# ZONE II SOURCE No. 207

LANDFORM AND LOCATION:

Kame-esker complex on east shore of Denis

Lake about 24 miles by air north of Tununuk

Point.

MATERIAL:

SAND - trace gravel

VOLUME:

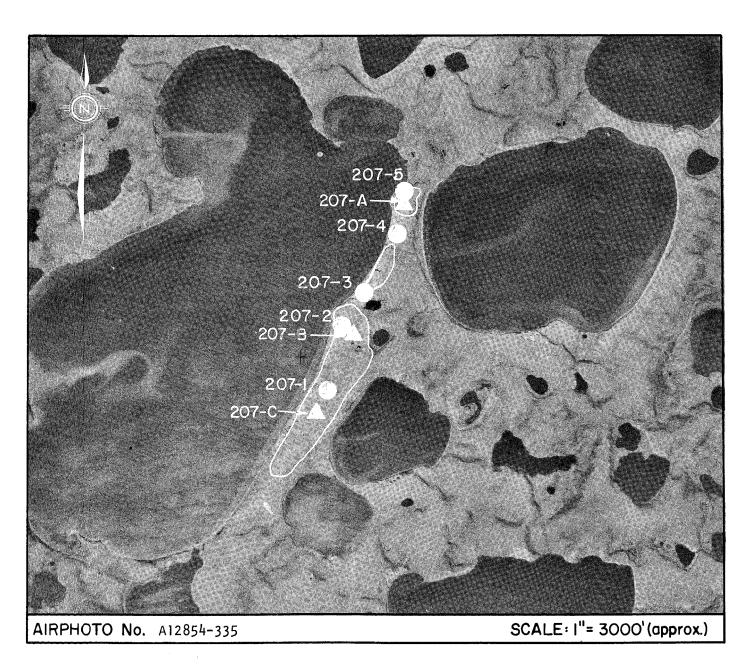
200,000 cubic yards

CONCLUSION:

Source is low priority for development due to

variable nature of deposit. Probably suitable

for local use only.



#### 207 ENVIRONMENT

# Physical

The source is a kame-esker complex, probably an extension of Source 206, located on the east shore of Denis Lake about 24 miles north of Tununuk Point. The area is about 9,000 feet long and 1,000 feet wide.

Drainage over the elevated features is good, although the surrounding low-lying areas display the polygonal ground pattern and numerous small ponds of thermokarstic activity. The source is surrounded by lakes, and has not been developed.

# Biotic

The area is generally covered by moss, lichen, and dwarf shrubs as much as 2 feet high, although many gravel and sand deposits are bare of any vegetation.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barren-ground caribou at some time in the future.

#### 207 MATERIALS AND QUANTITIES

The material in this source is variable, generally ranging from sand with a trace of gravel, to silt.

The ice content of this deposit varies with depth and from one hole to another. Two of the five test holes struck massive ice at depths less than 8 feet, and one at a depth of 13 feet.

Assuming an average recoverable depth of 4 feet, the volume of granular material available in this source is about 200,000 cubic yards.

# 207 DEVELOPMENT

### General

This source is considered low priority for development due to its variable nature. It is probably only suitable for local projects.

### Access

Access is practical only during winter months. The east channel of the Mackenzie River is 10 miles away by air, and probably haulage on this route will not be feasible. If this sand were required for a specific purpose, for example as a blending sand, the material could be trucked over a winter road to the channel and then carried to a project either by truck in winter or by barge in summer.

# Material Use and Handling

This material is satisfactory for general fill, and selected parts of the deposit may be used as fine aggregate in concrete.

The coarser deposits can probably be excavated without ripping, but most of the material must be ripped, stockpiled, thawed, and drained before shipping.

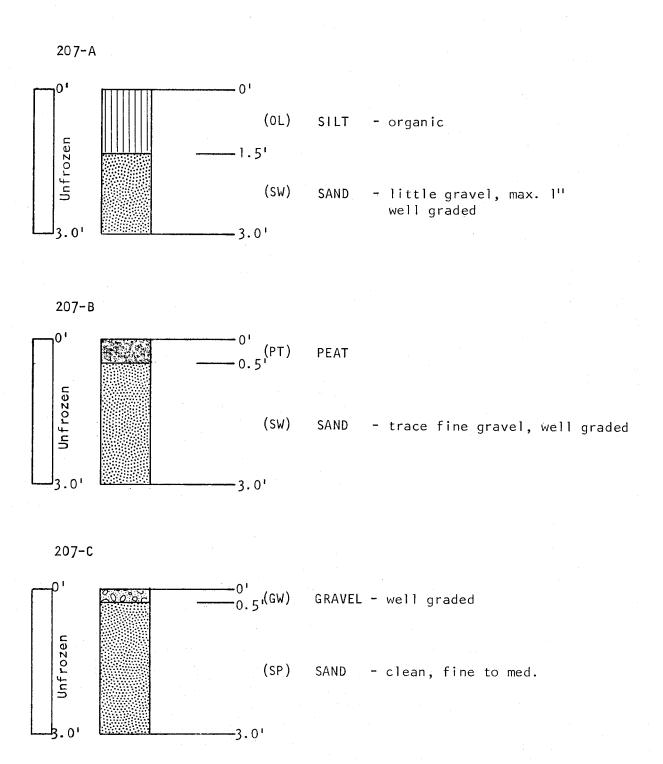
The equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

# Stripping and Restoration

The depth of organic topsoil overlying granular material varies up to  $l\frac{1}{2}$  feet. This soil and the organic ground cover must be stripped from an area to be developed and stockpiled away from drainage courses for replacement after the granular material has been removed.

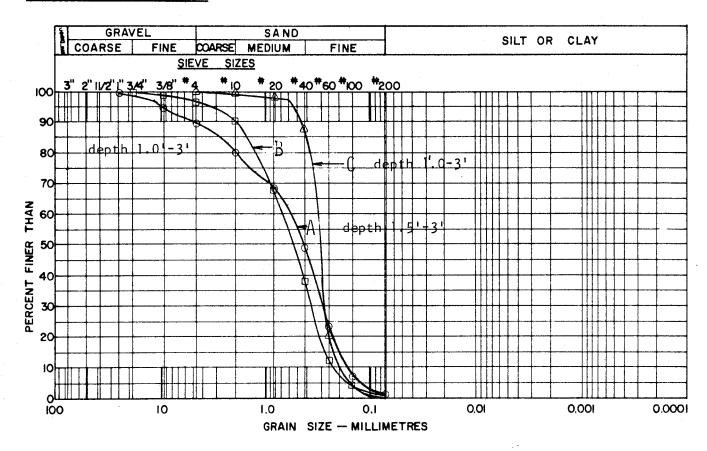
Because of the thermokarstic nature of the low-lying ground around the ridges, these areas must be disturbed as little as possible.

# TEST PIT LOGS SOURCE No. 207



# LABORATORY TEST DATA SOURCE No. 207

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

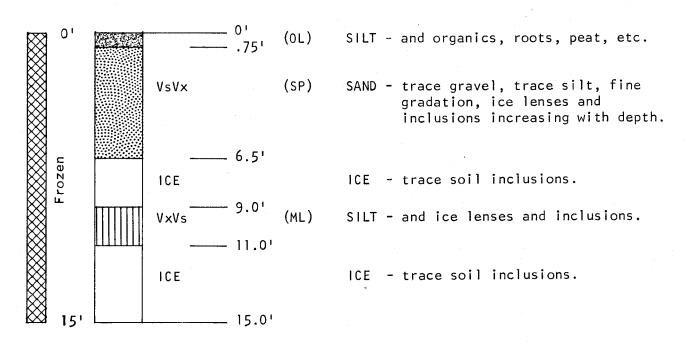
Pit A depth 1.5' - 3' 1.8% Pit B depth 1.0' - 3' 4.0% Pit C depth 1.0' - 3' 3.6%

# ORGANIC CONTENT

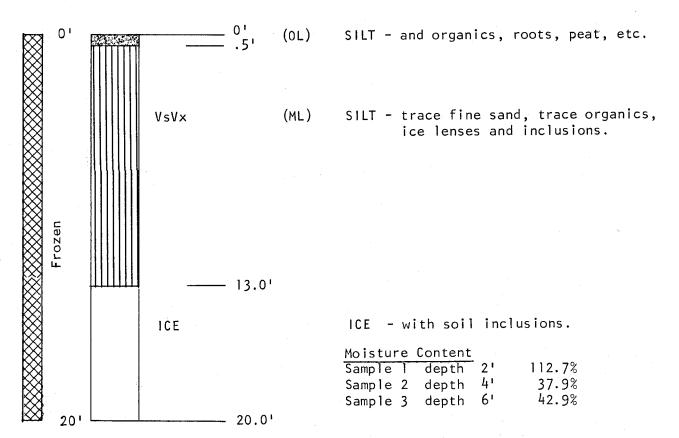
HARDNESS TEST

# TEST HOLE LOGS SOURCE No. 207

207-1



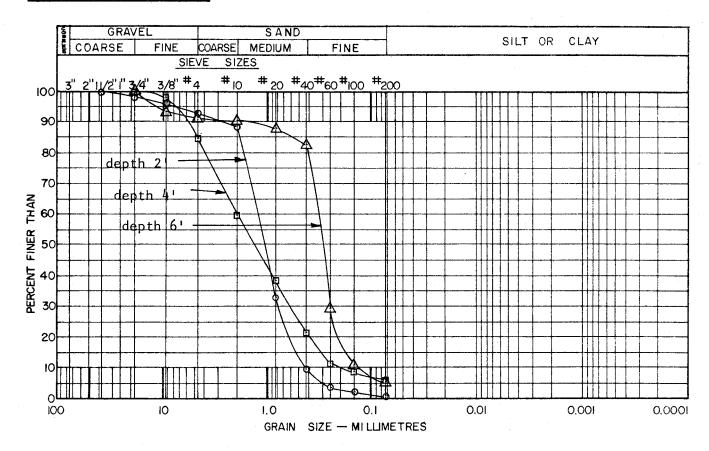
207-2



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# LABORATORY TEST DATA TEST HOLE-SOURCE No. 207-1

# GRAIN SIZE DISTRIBUTION



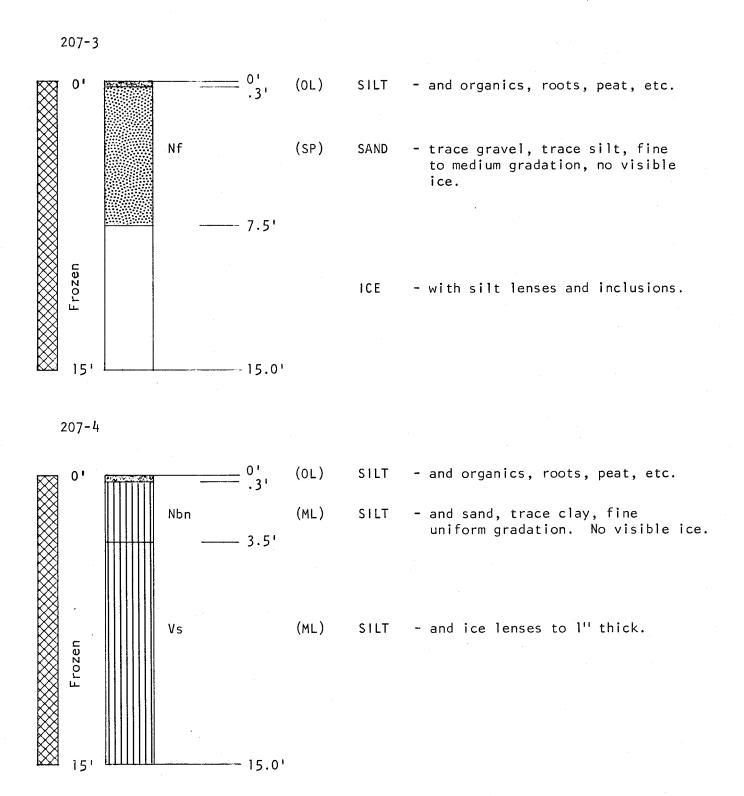
# MOISTURE CONTENT

Sample 1 depth 2' 4.9% Sample 2 depth 4' 14.5% Sample 3 depth 6' 28.0%

# ORGANIC CONTENT

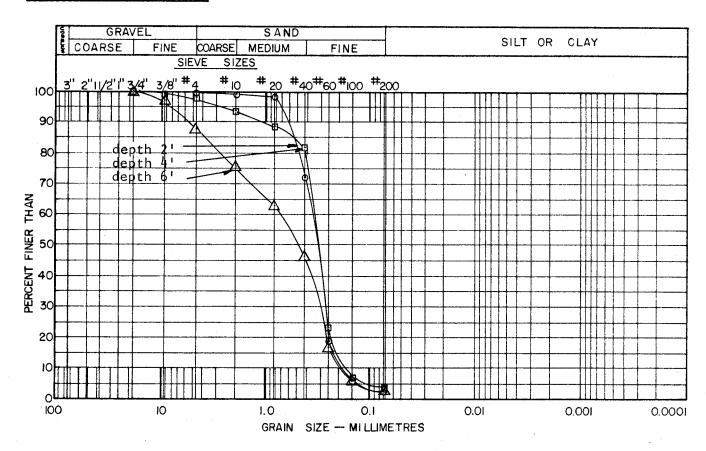
HARDNESS TEST

# TEST HOLE LOGS SOURCE No. 207



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 207-3

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

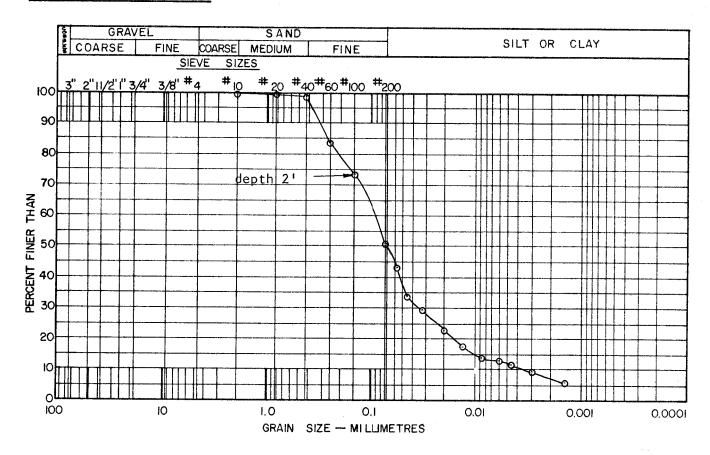
Sample 1 depth 2' 4.9% Sample 2 depth 4' 13.4% Sample 3 depth 6' 18.7%

ORGANIC CONTENT

HARDNESS TEST

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 207-4

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

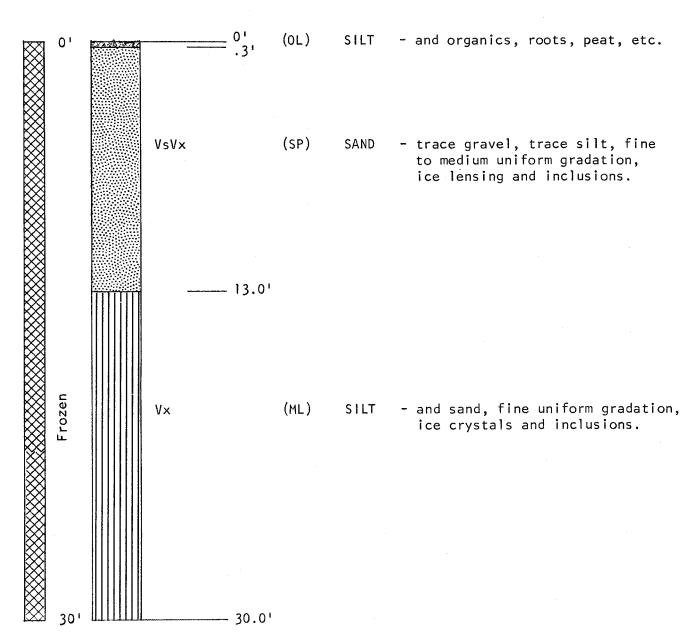
Sample 1 depth 2' 22.6% Sample 2 depth 6' 43.3%

ORGANIC CONTENT

HARDNESS TEST

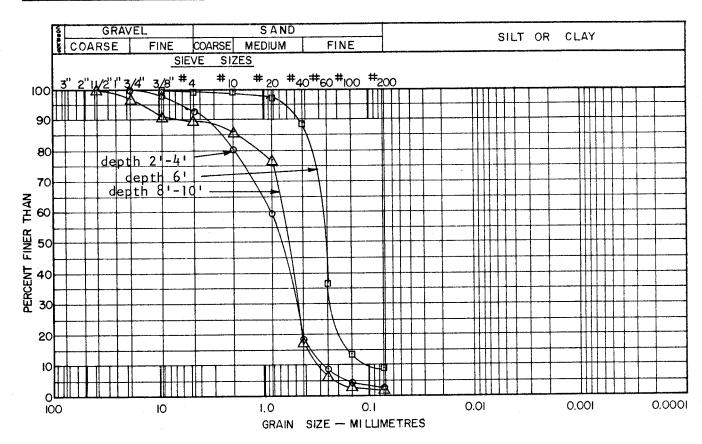
# TEST HOLE LOGS SOURCE No. 207





# LABORATORY TEST DATA TEST HOLE-SOURCE No. 207-5

# GRAIN SIZE DISTRIBUTION



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Sample 1	depth 2'	6.3%
Sample 2	depth 4'	14.5%
Sample 3	depth 6'	41.3%
Sample 4	depth 8'	17.6%
Sample 5	depth 10'	19.3%
Sample 6	depth 201	30.4%
	CONTENT	

HARDNESS TEST

# ZONE II SOURCE No. 208A

LANDFORM AND LOCATION:

Terrace remnant located 3/4 mile east of

Umiak Lake and 30 miles by air north of

Tununuk Point.

MATERIAL:

SAND - some silt

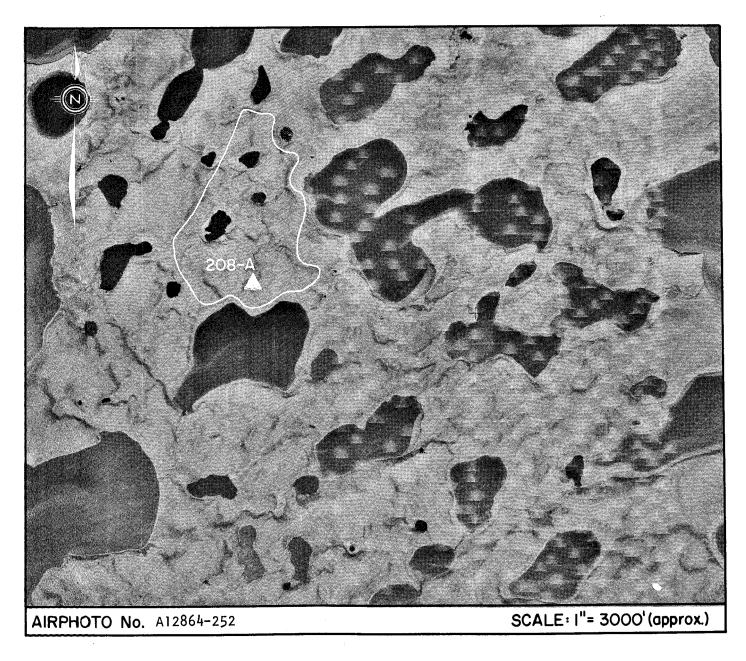
**VOLUME:** 

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CONCLUSION:

Source is not recommended for development

due to poor quality.



## 208A ENVIRONMENT

# Physical

This source is probably a terrace remnant located 3/4 mile east of Umiak Lake, 30 miles north of Tununuk Point. Three small lakes lie within the source area, and many others, both large and small, surround it. The source area is about 1 mile long and 3,000 feet wide.

Drainage over the elevated parts of the source area is good, and the source has not been developed.

# Biotic

Vegetative cover in this area is moss and lichen, with dwarf birch and willow about 18 inches high.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barrenground caribou at some time in the future.

# 208A MATERIALS AND QUANTITIES

The area does not display any exposures of granular material. A test pit dug 1 foot into permafrost penetrated fine sand with 23% silt.

Permafrost was struck only I foot below the surface, and massive ground ice must be expected at a shallow depth.

#### 208A DEVELOPMENT

### General

This source is not recommended for development because of the poor quality of material and expected high ice content.

Perhaps further investigation and drilling will reveal a small volume of suitable material between the ground ice and the topsoil, but this source can be of interest only to small local projects.

### Access

This source is accessible only during the winter months. The east channel of the Mackenzie River is about II miles away by air.

# Material Use and Handling

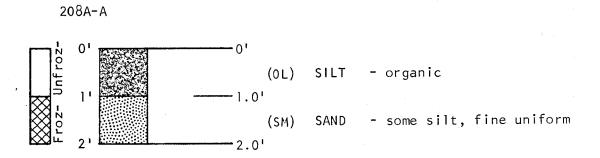
The material sampled in the one test pit is not suitable for construction. It lies below the permafrost table, and would have to be ripped, stockpiled, thawed, and drained before use, and this operation is not feasible with a material containing over 90% silt and fine sand.

# Stripping and Restoration

The reclamation of this source would be difficult and costly for a number of reasons. Firstly, the granular material is believed to be ice-rich and high in silt, and melt-water would have to be contained. Secondly, a large area must be disturbed to excavate a given volume of granular material, thus magnifying the problems of restoration. Thirdly, massive ground ice must be expected at a shallow depth, and cannot be permitted to thaw near the steep banks of these terrace remnants, otherwise the slopes would become unstable and the nearby lakes will be silted.

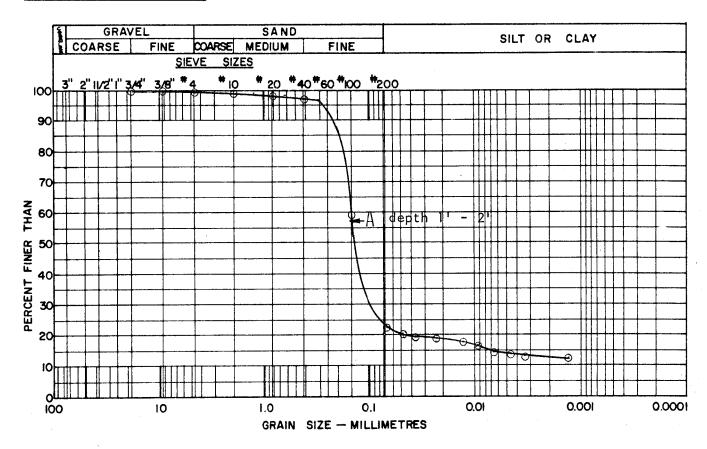
This source should not be disturbed unless for a compelling reason, and then only with technical and environmental control applied to the operation.

# TEST PIT LOGS SOURCE No. 208A



# LABORATORY TEST DATA SOURCE No.208A

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

Pit A depth 1' - 2' 29.1%

ORGANIC CONTENT

HARDNESS TEST

# ZONE II SOURCE No. 209

LANDFORM AND LOCATION:

Kame-like deposit, 1,500 feet long by 1,000 feet wide, located 41 miles by air north of Tununuk Point near north end of Richards Island.

MATERIAL:

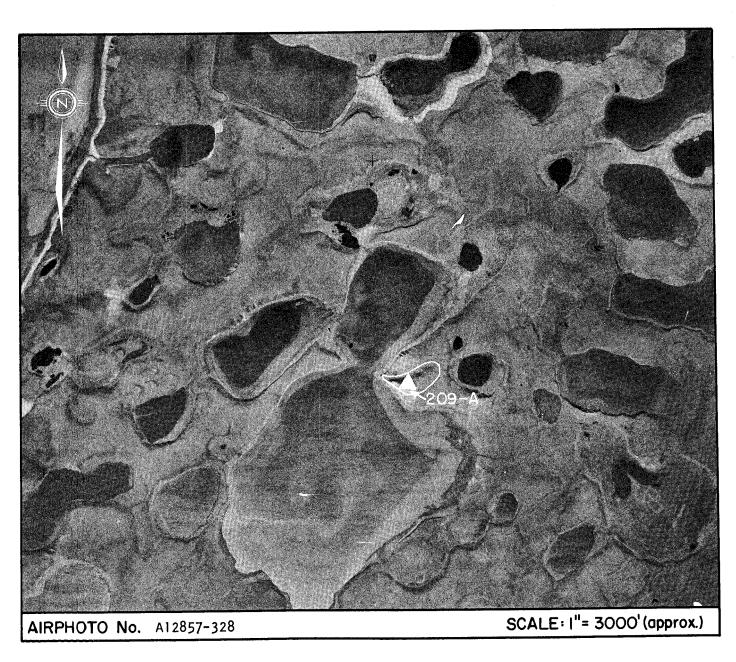
SAND - trace silt, fine

**VOLUME:** 

120,000 cubic yards

CONCLUSION:

Source is low priority for development due to high percentage of fine sand. Suitable only as a low quality general fill for local projects.



# 209 ENVIRONMENT

# Physical

This source is a kame-like deposit of uncertain origin located near the north end of Richards Island, about 41 miles north of Tununuk Point and 31 miles northwest of Tuktoyaktuk. The source is about 1,500 feet long and 1,000 feet wide and stands 50 to 75 feet above a small lake. The slopes of the formation are sand, but the top stratum contains some gravel. The exposed southwesterly face appears to be shaped by the wind.

Drainage over the source is good, and the source has not been developed.

# Biotic

Most of the surface of the source is bare, but part is covered by scattered tufts of grass and some dwarf shrubs.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barrenground caribou at some time in the future.

# 209 MATERIALS AND QUANTITIES

The large exposed face is primarily fine sand with a trace of silt, and a trace of gravel on the surface. No test pit was excavated, but the surface sample contains over 90% sand passing #40 mesh and retained on #200 mesh, and 6% silt.

The deposit can be expected to contain permafrost and massive ground ice at shallow depths.

The volume of recoverable material is estimated to be about 120,000 cubic yards.

# 209 DEVELOPMENT

### General

This source is low priority for development, suitable only as a poor quality general fill for small local projects. The sand should be removed from the eastern side of the knoll in order to avoid siltation of the adjoining lake.

## Access

This area is accessible by truck only during winter months, and lies about 3 miles from the open sea, either to the east or to the west.

# Material Use and Handling

The material from this source is a poor class of general fill because of the fine grading.

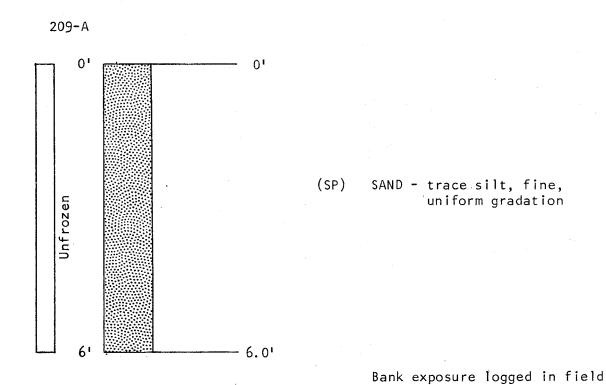
The equipment required for development is the usual assembly of dozer, front-end loader, and trucks.

# Stripping and Restoration

Any organic ground cover and topsoil that must be stripped from the area must be stockpiled for replacement after the sand has been removed.

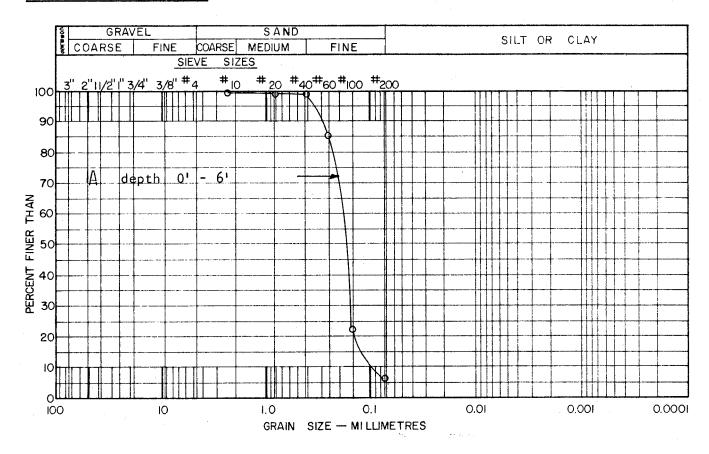
Frozen material should be stockpiled where drainage from the piles will not drain directly to the lake. Large areas of ground ice must not be exposed on the slope because of the problems of restoration.

# TEST PIT LOGS SOURCE No. 209



# LABORATORY TEST DATA TEST PIT-SOURCE No. 209

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

Pit A depth 0' - 6' 2.5%

ORGANIC CONTENT

HARDNESS TEST

# ZONE II SOURCE No. 210A

LANDFORM AND LOCATION:

Glaciofluvial terrace located at north end

of Umiak Lake about 30 miles by air north

of Tununuk Point.

MATERIAL:

SAND - and silt

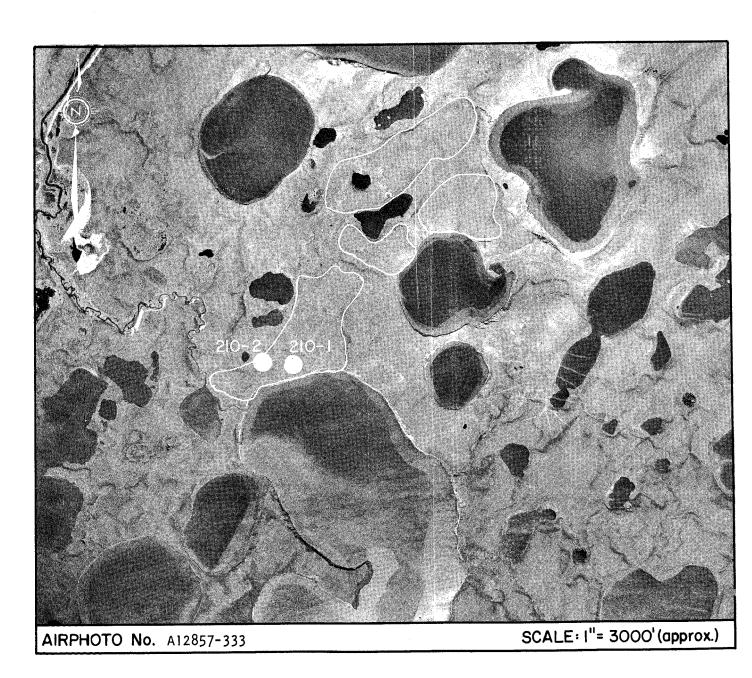
VOLUME:

\_\_

CONCLUSION:

Not recommended for development because of

high silt and ice contents.



## 210A ENVIRONMENT

# Physical

This source is a glaciofluvial terrace located at the north end of Umiak Lake, 30 miles north of Tununuk Point. The source area is about 2 miles long and 1 mile wide, the relief is hillocky, and the many ponds and lakes indicate a thermokarstic environment. The source is divided into four separate parts by low-lying ice-rich areas.

Drainage of the elevated areas is good, and the source has not been developed.

# Biotic

Vegetative cover in this area is moss and lichen, with dwarf birch and willow about 18 inches high.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barrenground caribou at some time in the future.

# 210A MATERIALS AND QUANTITIES

One of 2 test holes at this source encountered granular material, but only after penetrating 3 feet of organic silt and 5 feet of ice. The material is silty sand, not suitable for construction.

#### 210A DEVELOPMENT

#### General

This source is not recommended for development because of the poor quality of granular material and the high ice content.

#### Access

This area is accessible by vehicles only during the winter months.

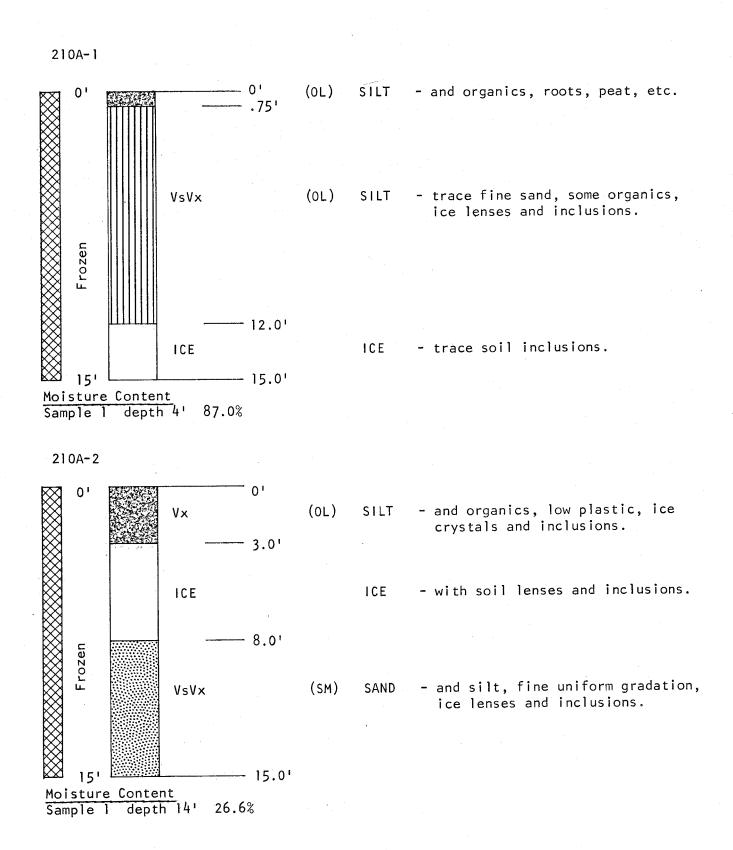
# Material Use and Handling

The material from this source is not suitable for any construction use.

# Stripping and Restoration

A deposit such as this, containing several feet of ice-rich silt at the surface, would be very difficult, if not impossible, to restore if development were attempted.

# TEST HOLE LOGS SOURCE No. 210A



# ZONE II SOURCE No. 211

LANDFORM AND LOCATION: Esker approximately 5 miles long along

southern and eastern shores of Willow Lake,

about 25 miles northeast of Tununuk Point.

MATERIAL: SAND - little gravel

SAND - trace gravel, some silt

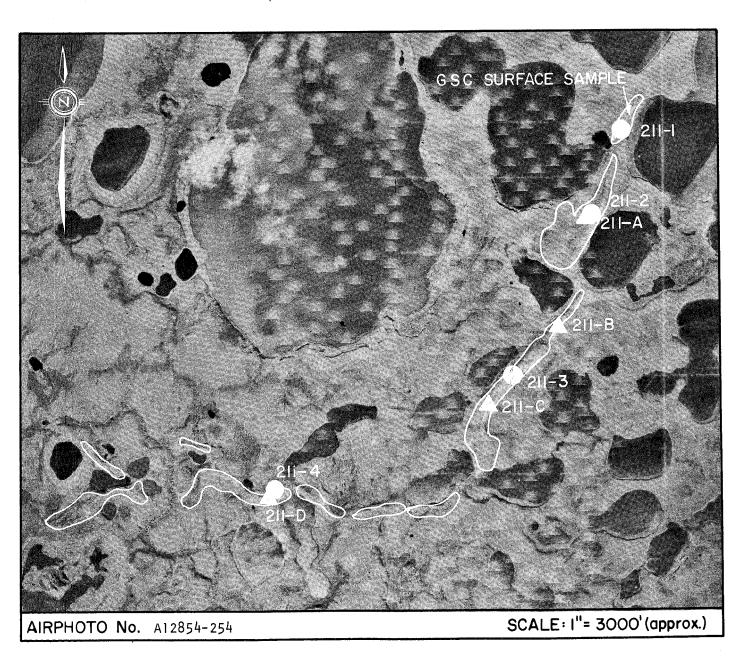
VOLUME: 500,000 cubic yards

CONCLUSION: Source is suitable for development, but

due to variability, additional drilling

is required to delineate areas for

specific use.



#### 211 ENVIRONMENT

# Physical

This source is an esker that can be traced for over 5 miles around the southern and eastern shores of Willow Lake, about 25 miles north northeast of Tununuk Point.

The esker is from 100 to 500 feet wide and stands 50 feet above the surrounding plain.

Drainage over the esker is good, with 4 test pits dug to 4 foot depth without encountering ice in September. The source has not been developed.

### Biotic

Much of the surface of this source is bare of vegetation, and the rest is covered by moss and dwarf shrubs.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barrenground caribou at some time in the future.

# 211 MATERIALS AND QUANTITIES

The granular material at and near the surface of this source is sand with some fine gravel and about 1% to 2% silt. Below about 5 feet, the material grades towards sand and silt, with a trace of gravel.

Test Pit D contained 40% gravel grading to 3 inches maximum size, about 60% sand, and 1% silt. The petrographic analysis of this gravel indicates a relatively sound material containing quartzite (50%), chert (37%), quartz (4%), and granite (3%), with soft sandstone and limestone making up the remaining 6%. With such a high chert content, the material should be tested for reactivity before it can be recommended for use in concrete, and pending these tests, the

material should be used only with cement containing no more than 0.6% alkali.

Based on a recoverable depth of 5 feet, the volume of useable material contained in this source is estimated to be about 500,000 cubic yards.

The Geological Survey of Canada removed Sample LV100-72 from the northern portion of this source and report well-graded sand and gravel with a trace of silt.

#### 211 DEVELOPMENT

### General

This source is suitable for development, although it requires further drilling to identify the best materials. Probably drilling below 15 feet depth is not significant because of the prevalent ground ice.

Most material from the source is suitable for general fill. The surface deposits of granular material may be processed for concrete, and will require only the removal by screening of oversize gravel.

## Access

The source is accessible by winter road, and lies about 5 miles from the east channel of the Mackenzie River. The distance to Tuktoyaktuk is about 31 miles.

# Material Use and Handling

Selected parts of this source can be developed to produce granular material for any need.

In 3 of the 4 test holes on this source, granular material can probably be excavated to a depth of 5 feet with little ripping, because the indicated moisture contents are 4%, 10%, and  $2\frac{1}{2}$ %, with no visible ice crystals. The moisture content increases rather rapidly below this level, and possibly another 5 feet can be excavated with rippers.

During winter months, this material can be excavated and hauled to stockpiles on the bank of the Mackenzie River, to be loaded on barges during the following summer.

The equipment required for the development of this source is the usual assembly of dozer with ripper attachment, front-end loader, and trucks, with the addition of a screen for aggregate production.

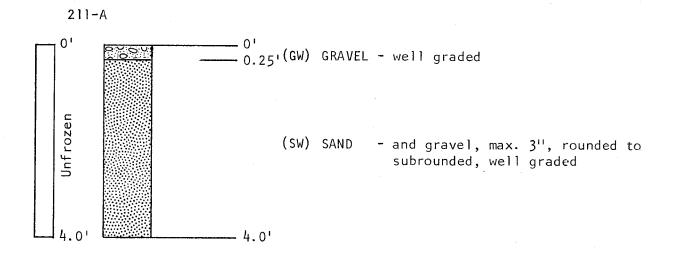
# Stripping and Restoration

Very little organic cover and topsoil will be stripped from this deposit, but that must be stockpiled for replacement after the granular material has been removed.

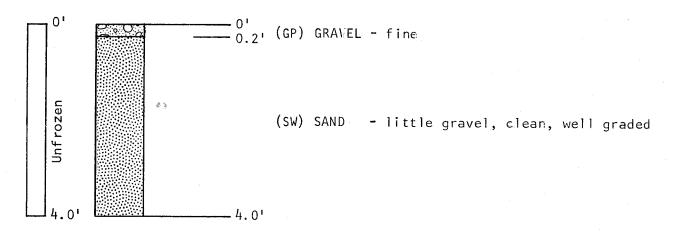
All banks must be graded to a stable slope, and depleted areas graded to a smooth contour, before topsoil is replaced.

Traffic should avoid the low-lying ground if possible because of the likelihood of thawing if the organic ground cover is disturbed.

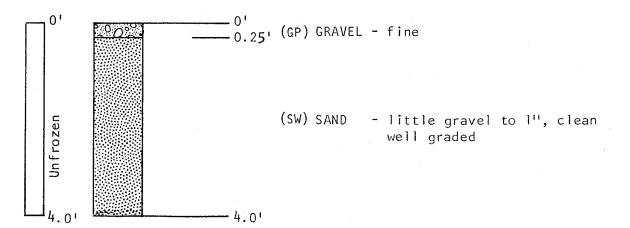
# TEST PIT LOGS SOURCE No. 2II





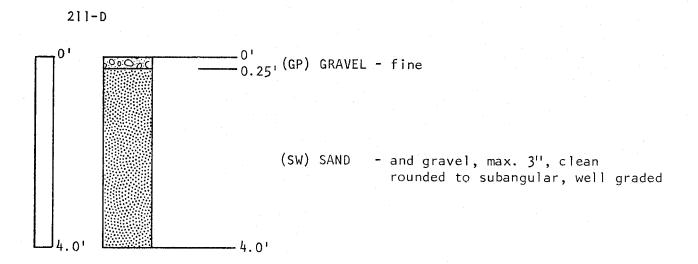


211-C



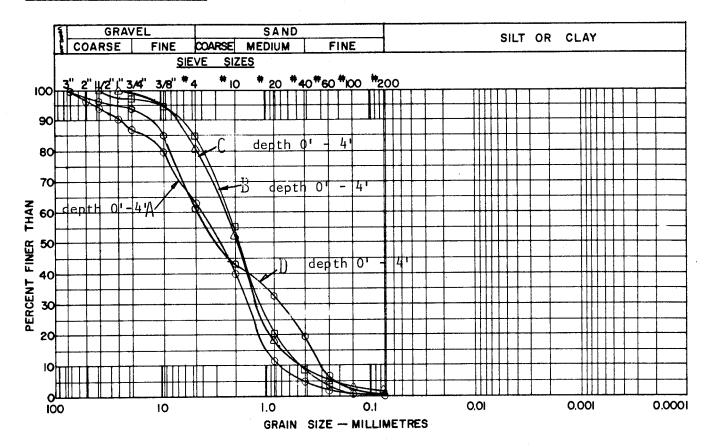
Ripley, Klohn & Leonoff International Ltd.

# TEST PIT LOGS SOURCE No. 211



# LABORATORY TEST DATA SOURCE No. 211

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

A 
$$(0' - 4')$$
 M/C = 2.3%

$$B (0' - 4') M/C = 2.0%$$

$$C (0' - 4') M/C = 2.7\%$$

$$D (0' - 4') M/C = 2.4\%$$

# ORGANIC CONTENT

# HARDNESS TEST

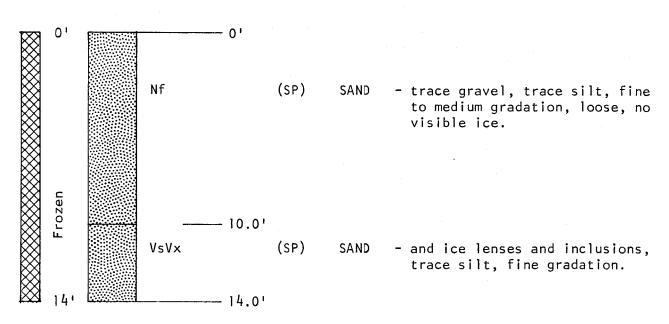
# PETROGRAPHIC ANALYSIS

Test Pit D depth	01	- 41
Quartzite	-	50%
Chert	-	37%
Sandstone(soft)	-	5%
Quartz	-	4%
Granite	-	3%
Limestone(soft)	***	1%
Total		100%

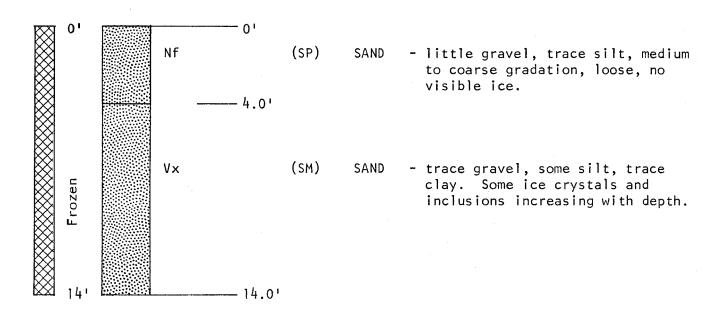
Ripley, Klohn & Leonoff International Ltd.

# TEST HOLE LOGS SOURCE No. 211



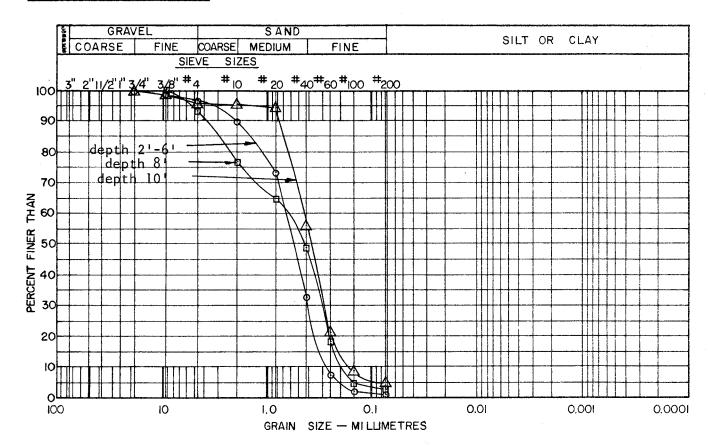


# 211-2



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 211-1

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

Sample	1	depth	2 '	3.2%
Sample	2	depth	4 1	3.3%
Sample	3	depth	61	5.7%
Sample	4	depth	8 '	13.9%
Sample	5	denth	141	22 6%

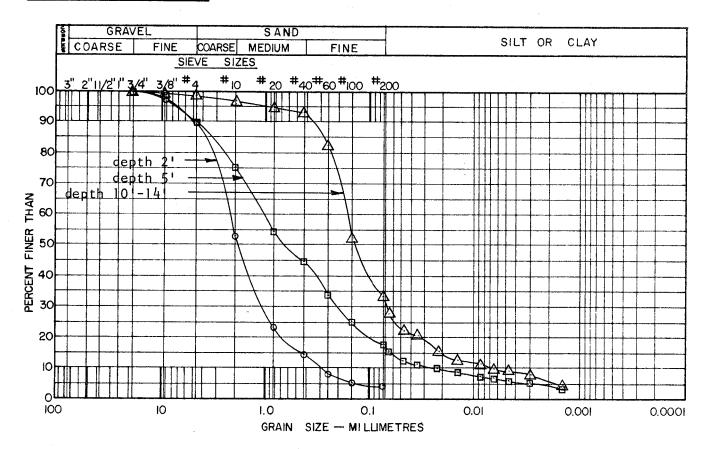
# ORGANIC CONTENT

HARDNESS TEST

## LABORATORY TEST DATA

### TEST HOLE-SOURCE No. 211-2

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

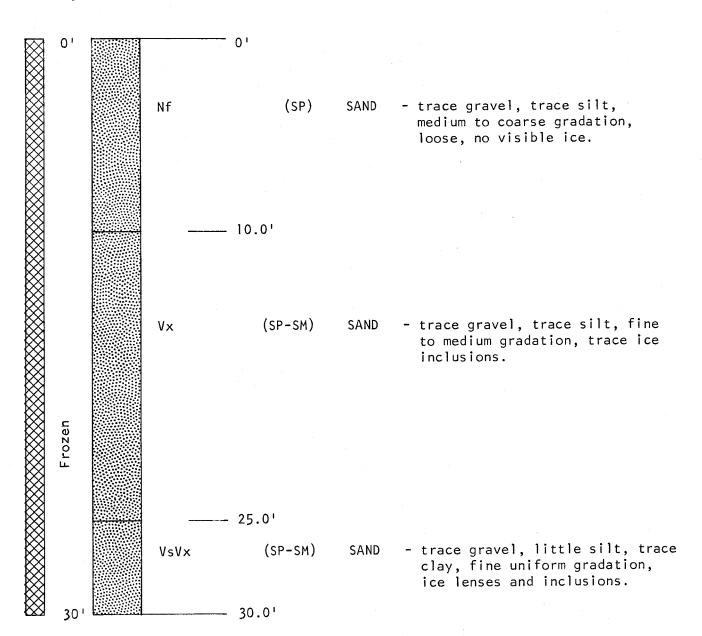
Sample 1	depth	2'	2.7%
Sample 2	depth	5'	10.0%
Sample 3	depth	10'	27.1%
Sample 4	depth	141	26.1%

#### ORGANIC CONTENT

HARDNESS TEST

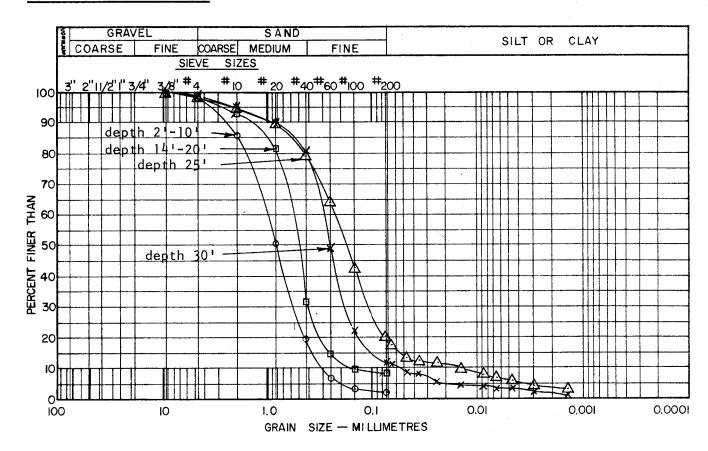
## TEST HOLE LOGS SOURCE No. 211

211-3



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 211-3

#### GRAIN SIZE DISTRIBUTION



MOIS	TUF	化	CON	IENI	

Sample	]	depth	2 '	3.2%
Sample	2	depth	5'	2.4%
Sample	3	depth	10!	11.4%
Sample	4	depth	141	18.5%
Sample	5	depth	20'	19.9%

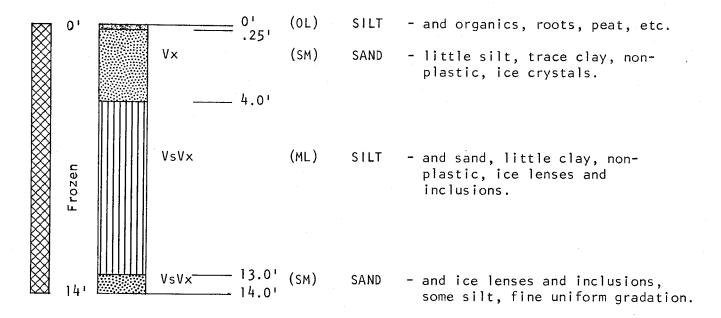
Sample 6 depth 25' 45.4% Sample 7 depth 30' 23.6%

#### ORGANIC CONTENT

HARDNESS TEST

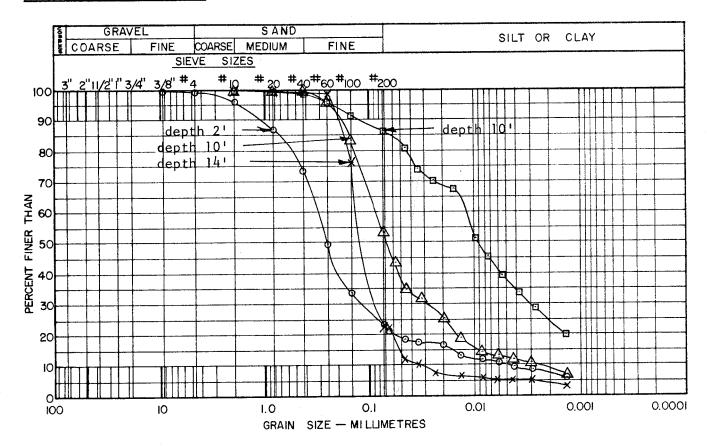
## TEST HOLE LOGS SOURCE No. 211





# LABORATORY TEST DATA TEST HOLE-SOURCE No. 211-4

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

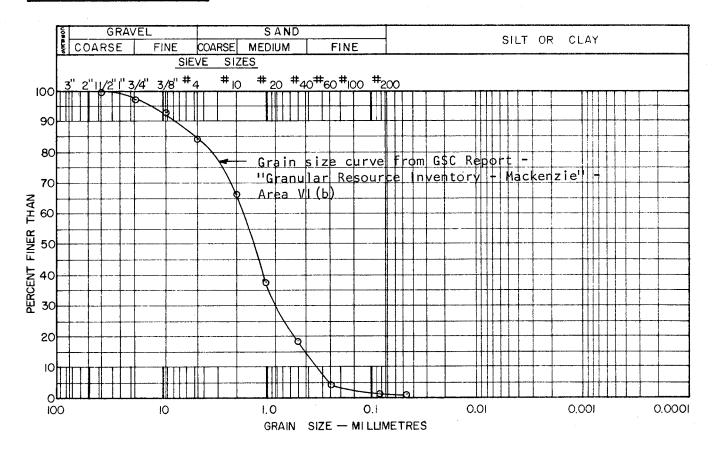
Sample 1 depth 2' 12.8% Sample 2 depth 5' 196.7% Sample 3 depth 10' 34.6% Sample 4 depth 14' 28.0%

ORGANIC CONTENT

HARDNESS TEST

# LABORATORY TEST DATA TEST PIT-SOURCE No. 211-GSC

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

## ZONE II SOURCE No. 212

LANDFORM AND LOCATION:

Outwash remnant located 2 miles northwest of

Lousy Point and 19 miles northeast of

Tununuk Point.

MATERIAL:

SAND - little gravel

VOLUME:

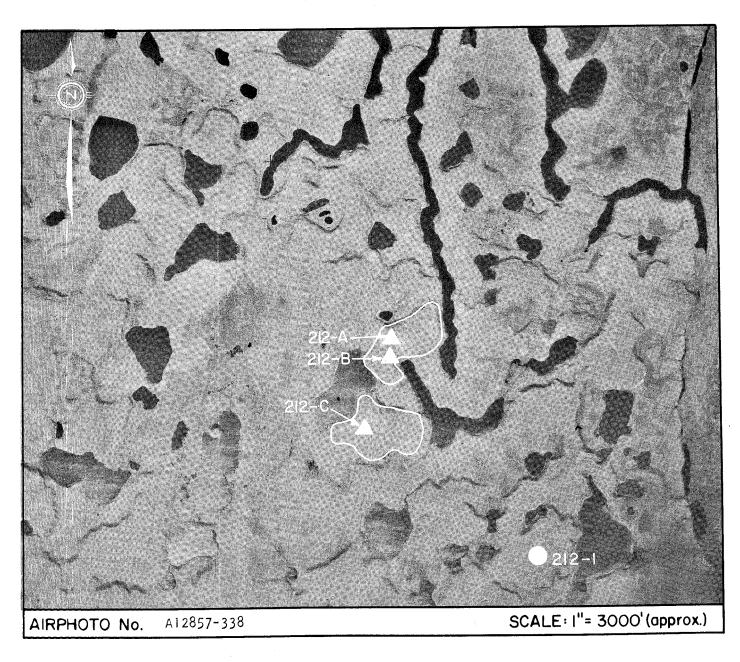
250,000 cubic yards

CONCLUSION:

Source is suitable for limited development,

but additional drilling required to delineate

area.



#### 212 ENVIRONMENT

#### Physical

This source is a remnant of an outwash area located 2 miles northwest of Lousy Point, and 19 miles northeast of Tununuk Point, on Richards Island. The source consists of two elevated features in an area about 1 mile long by  $\frac{1}{2}$  mile wide. The surrounding low-lying land shows the polygonal ground pattern of ice-rich soils.

Drainage is good over the elevated deposits, and test pits up to  $4\frac{1}{2}$  feet deep were excavated in September before encountering permafrost. The source has not been developed.

#### Biotic

The southern part of the source is covered with heavy moss and some dwarf shrubs up to  $l\frac{1}{2}$  feet high. The northern part of the source is partly bare, partly covered with thin vegetation.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barren-ground caribou at some time in the future.

Grizzly bears were observed in this area in September, 1972.

#### 212 MATERIALS AND QUANTITIES

The three test pits excavated in this source contained clean sand with a little gravel in one, and sand with some silt in the other two. The better material is located on the northern deposit, and contains 20% gravel grading to 1 inch size, 80% well-graded sand, and about 1% silt.

During the winter of 1972-73, a drill attempted to reach the source by land but found the terrain to be too irregular for easy access. Finally, a hole was drilled in a nearby feature that appeared to be similar, but this hole penetrated only silt and ice and is not considered to be significant in evaluating Source 212.

Assuming that suitable granular material covers one-half of the area of the northern part of this source, and assuming a recoverable depth of  $4\frac{1}{2}$  feet, the volume of granular material is about 250,000 cubic yards.

#### 212 DEVELOPMENT

#### General

This source is suitable for development for local use. More drilling will be required to identify the area containing the best material.

#### Access

This source is accessible only during the winter months. A winter road could probably be built from the source to the east channel of the Mackenzie River, about  $2\frac{1}{2}$  miles away, but the ground is very irregular so that a route must be carefully planned.

#### Material Use and Handling

The material from this source is suitable for general fill and could be used as aggregate for concrete construction.

Up to 5 feet of this deposit may be removed with little ripping, and drilling may indicate a greater depth of suitable material which would require ripping.

The equipment required to develop this source is the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

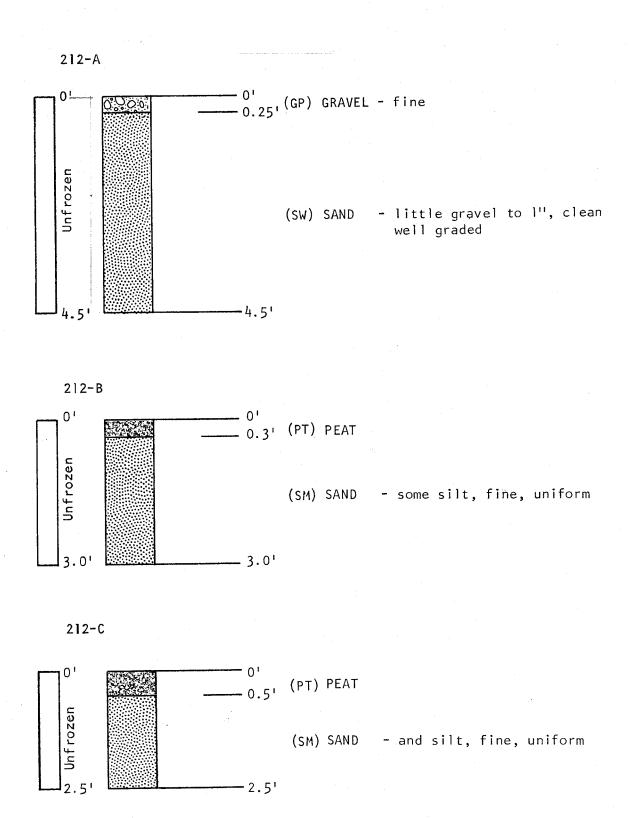
#### Stripping and Restoration

Very little organic cover and topsoil will be stripped from this deposit, but that must be stockpiled for replacement after the granular material has been removed.

All banks must be graded to a stable slope, and depleted areas graded to a smooth contour, before topsoil is replaced.

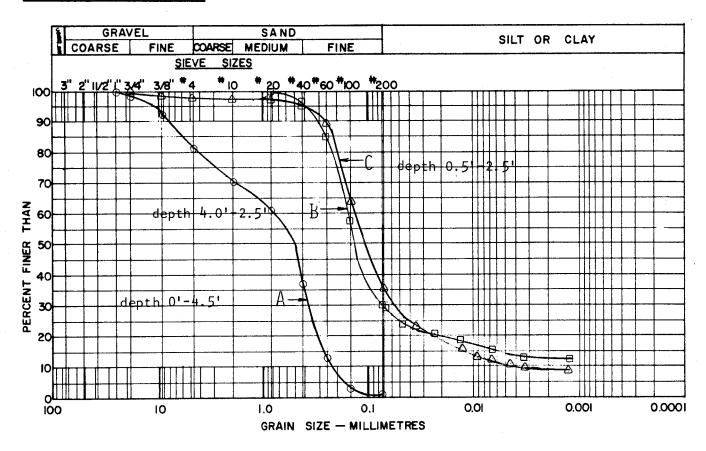
Traffic should avoid the low-lying ground if possible because of the likelihood of thawing if the organic ground cover is disturbed.

# TEST PIT LOGS SOURCE No. 212



# LABORATORY TEST DATA SOURCE No. 212

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

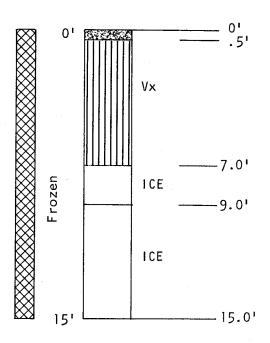
Pit A depth 0 - 4.5' 3.3% Pit B depth 4.0 - 2.5' 15.7% Pit C depth 0.5 - 2.5' 21.3%

#### ORGANIC CONTENT

HARDNESS TEST

# TEST HOLE LOGS SOURCE No. 212

212-1



- (OL) SILT and organics, roots, peat, etc.
- (ML) SILT some fine sand, uniform gradation, low plastic, ice crystals and inclusions

ICE - clear

ICE - with soil lenses and inclusions

#### Moisture Content

Sample	1	depth	2 '	19.3%
Sample	2	depth	41	63.6%
Sample	3	depth	61	37.9%

### ZONE II SOURCE No. 213

LANDFORM AND LOCATION:

Terrace remnants on east channel of

Mackenzie River, 24 miles northeast of

Tununuk Point.

MATERIAL:

SAND - trace silt, fine

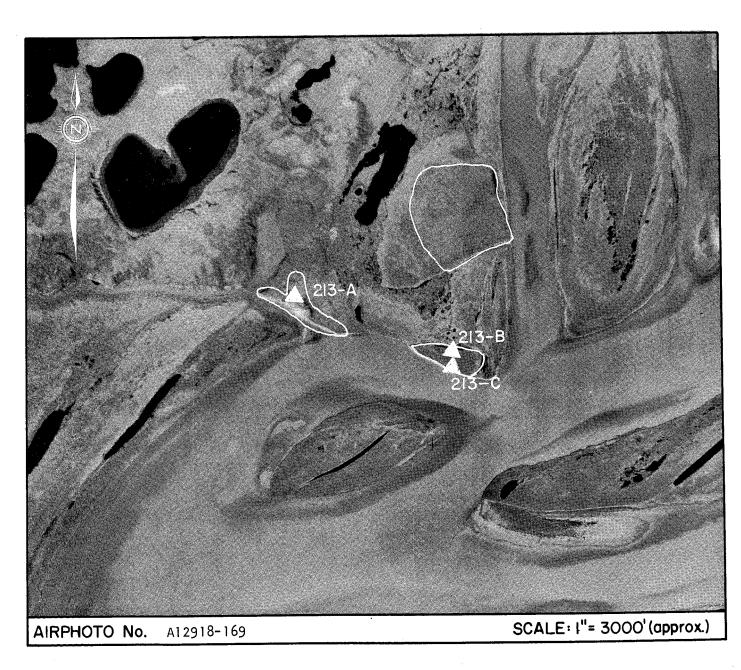
VOLUME:

400,000 cubic yards

CONCLUSION:

Source is low priority for development due to fine gradation of sand. It will give a

low quality material for general fill.



#### 213 ENVIRONMENT

#### Physical

This source is a group of 3 glaciofluvial features on the east channel of the Mackenzie River, 24 miles northeast of Tununuk Point and 30 miles southwest of Tuktoyaktuk.

Two features are probably outwash terrace remnants standing 15 to 20 feet above the river, and the third is of uncertain origin and stands 75 feet high. All three are enclosed within an area about 8,000 feet long by 6,000 feet wide and are separated by low-lying ground containing thermokarstic melt ponds and a pingo.

Drainage over the features is good, and the area has not been developed.

#### Biotic

The top surface of these features is covered by tufts of grass and some dwarf birch and willow. The steeper banks are mostly bare, but support some clumps of grass and shrub.

This source lies within the Mackenzie Reindeer Grazing Reserve, and may become part of the summer range of the Reindeer Herd and of the barren-land caribou.

The source lies in a major waterfowl staging area, and of course the whole Delta is occupied each year for breeding.

The east channel of the Mackenzie River is important to the native population as a source of fish, especially during certain seasons when anadromous species migrate to and from their spawning grounds.

Grizzly bears were seen on the northern terrace in September, 1972, during the reconnaissance conducted for this Report.

### 213 MATERIALS AND QUANTITIES

Two test pits were excavated in the southern terrace feature, and the high bank facing the river was examined and sampled.

The material is primarily fine, uniform sand with a trace of silt.

Some thin strata of gravel were noted in the bank exposure.

Permafrost and ground ice was not observed, but is expected at a shallow depth because of the fine grading of the sand.

Assuming a recoverable depth of 5 feet, the volume of material in this source is estimated to be 400,000 cubic yards.

#### 213 DEVELOPMENT

#### General

Due to fineness of the material, this source is rated as low priority for development. It is suitable only as general fill for local projects.

#### Access

This source is accessible by barge in summer and by truck in winter.

#### Material Use and Handling

This material is suitable for general fill. The grading is very fine, and ice-rich sand would be difficult to contain while thawing, hence the recoverable volume is probably limited to the surface of the deposit.

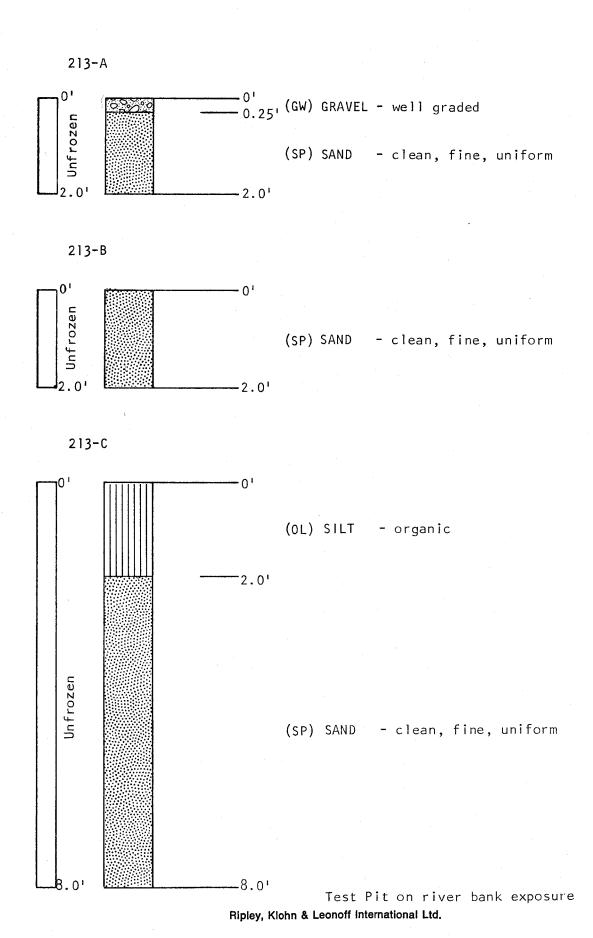
This sand could be loaded onto a barge at the riverbank, using either a front-end loader, trucks, or a conveyor.

The equipment required for this development is a dozer, front-end loader, and trucks or barge, depending on the season.

### Stripping and Restoration

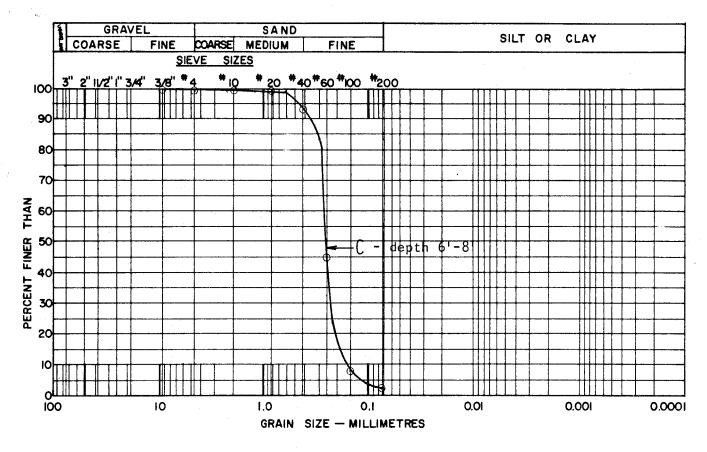
Surface organic cover and topsoil must be stripped and stockpiled for replacement after the sand has been removed. The excavation should be kept away from the riverbanks in order to avoid the melting of ground ice within the banks and subsequent instability and siltation of the River.

# TEST PIT LOGS SOURCE No. 213



# LABORATORY TEST DATA SOURCE No. 213

### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Pit A depth 6' - 8'

3.9%

ORGANIC CONTENT

HARDNESS TEST

### ZONE II SOURCE No. 214

LANDFORM AND LOCATION:

Terrace remnant on east bank of east

channel of Mackenzie River about 26 miles

northeast of Tununuk Point.

MATERIAL:

SAND - trace silt

VOLUME:

400,000 cubic yards

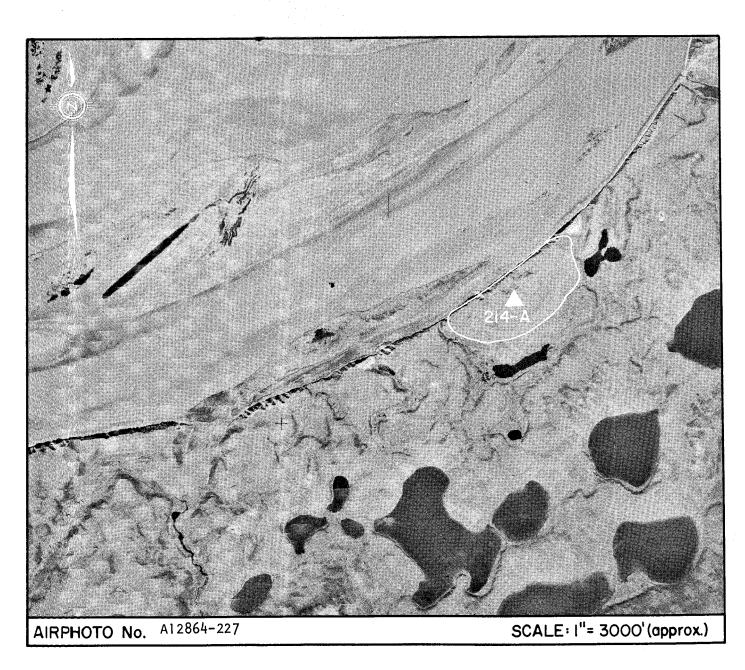
CONCLUSION:

This source is rated low priority for

development because of low quality and fine

grading. The source will be useful only for

local projects.



#### 214 ENVIRONMENT

#### Physical

This source is a terrace remnant on the mainland, located on the east bank of the east channel of the Mackenzie River, about 26 miles north of Tununuk Point and 26 miles southwest of Tuktoyaktuk.

The source extends 4,500 feet along the river bank and inland as much as 1,500 feet. The bank stands 75 feet above river level.

Drainage is good over the source, the surface sloping to the southeast where there is a channel with thermokarstic melt ponds. The source has not been developed.

#### Biotic

The area is generally covered by moss and lichen, with some scattered dwarf shrubs, but some gravel exposures are bare of any vegetation.

The source lies within the Mackenzie Reindeer Grazing Reserve, and moose are hunted nearby through the winter.

Waterfowl gather in this area from mid-May to mid-June, and the whole Delta area is the breeding ground of many species.

#### 214 MATERIALS AND QUANTITIES

The material exposed on the steep bank facing the river is fine to medium sand. Gravel is exposed on the top surface of the source, but this is a false indication of the material below. The one test pit excavated here contained only 2% gravel, 95% sand, and 3% silt. The sand is very fine, with 75% passing the #40 mesh and retained on the #100 mesh sieve.

No permafrost was observed during the investigation, but both the active zone and massive ground ice are expected to be encountered at a shallow depth because of the fine grading.

Assuming a recoverable depth of 2 feet, the volume of material in this source is about 400,000 cubic yards.

#### 214 DEVELOPMENT

#### General

This source is suitable for development for local projects. The quality of sand permits it to be used as general fill, but is not good enough to warrant shipping very far.

#### Access

The source is accessible by barge during the summer or by truck during the winter.

#### Material Use and Handling

This material is a satisfactory grade of general fill, but is very fine.

The sand above the permafrost table has a relatively low moisture content (3.7%) which may allow it to be excavated without ripping at any season of the year. It can then be loaded to truck or barge, ready for use. Ice-rich sand would be difficult to contain while thawing, hence the recoverable volume is probably limited to the surface of the deposit.

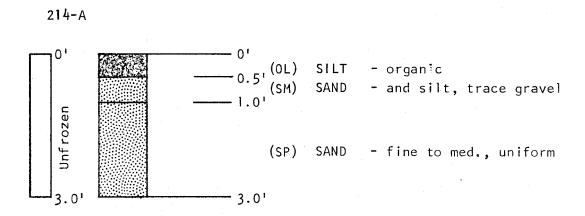
The sand could be loaded onto a barge at the riverbank, using either a front-end loader, trucks, or a conveyor.

The equipment required for this development is a dozer, front-end loader, and trucks or barge, depending on the season.

#### Stripping and Restoration

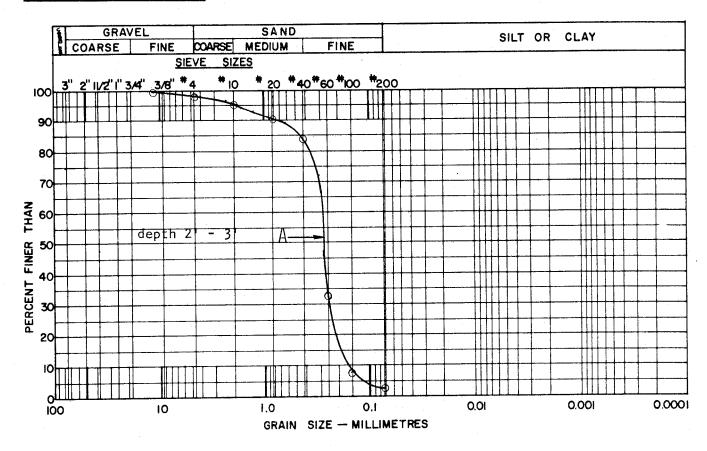
Surface organic cover and topsoil must be stripped and stockpiled for replacement after the sand has been removed. The excavation should be kept away from the riverbanks in order to avoid the melting of ground ice within the banks and subsequent instability and siltation of the River.

# TEST PIT LOGS SOURCE No. 214



# LABORATORY TEST DATA SOURCE No. 214

#### GRAIN SIZE DISTRIBUTION



### MOISTURE CONTENT

Pit A depth 2' - 3' 3.7%

ORGANIC CONTENT

HARDNESS TEST

### ZONE II SOURCE No. 215

LANDFORM AND LOCATION:

Delta remnant located on east bank of east

channel of the Mackenzie River, about 21 miles

northeast of Tununuk Point.

MATERIAL:

SAND - and gravel, trace silt

**VOLUME:** 

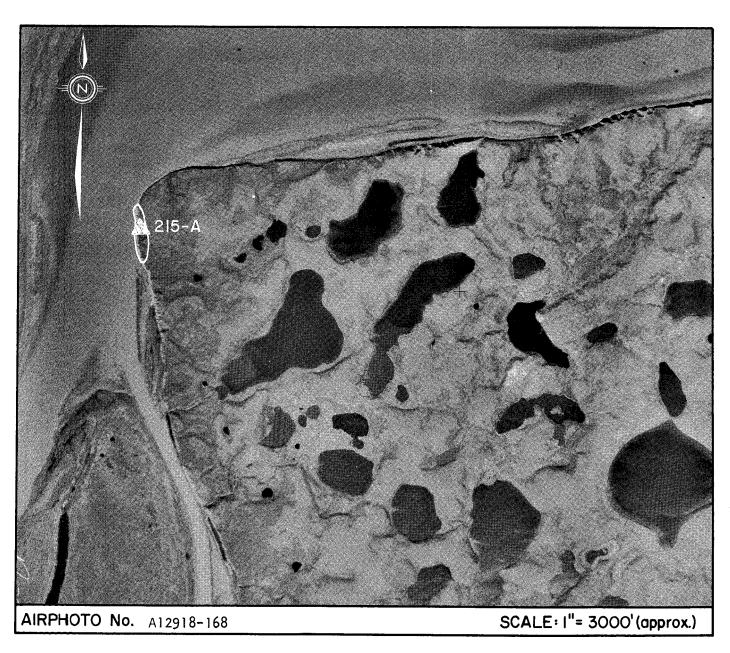
30,000 cubic yards

CONCLUSION:

Source is low priority for development due to

depth of stripping necessary to remove the

unsuitable silt and fine sand.



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#### 215 ENVIRONMENT

#### Phys ical

This source is probably an isolated remnant of an ancient delta, located on the mainland on the east bank of the east channel of the Mackenzie River, 21 miles northeast of Tununuk Point. The source area extends about 1,500 feet along the bank, 300 feet inland, and stands 75 feet above river level.

Drainage over the source area is good, and the source has not been developed.

#### Biotic

The area is generally covered by moss and lichen, with some scattered dwarf shrubs, but some gravel exposures are bare of any vegetation.

The source lies within the Mackenzie Reindeer Grazing Reserve, and moose are hunted nearby through the winter.

Waterfowl gather in this area from mid-May to mid-June, and the whole Delta area is the breeding ground of many species.

#### 215 MATERIALS AND QUANTITIES

The top of the exposed riverbank was examined and showed a layer of good sand and gravel at least 4 feet thick, underlying 6 feet of peat, sand, and silt. The granular material contains 48% gravel grading to 3 inches maximum size, 50% well-graded sand, and 2% silt.

A petrographic analysis of the gravel indicates a medium quality, containing 85% sound quartzite, chert, and granite, and 15% soft limestone, soft sandstone, and siltstone.

The riverbank exposure did not indicate the depth of frost-free soil over the area, but more detailed examination of similar deposits has shown permafrost well above the 6-foot level. Probably the granular material in this source is ice-rich and difficult to excavate.

Assuming a depth of 4 feet of granular material and an area of 1,000 feet by 200 feet, the volume of granular material on this source is

30,000 cubic yards.

#### 215 DEVELOPMENT

#### General

This source is rated very low priority for development. If the depth of low-quality material overlying the granular material is generally 6 feet, then development is not feasible. If further investigation reveals an area with less silt overlying the granular material, then development may be considered.

Probably the overlying silty material is frozen and would be difficult to excavate.

#### Access

This source is accessible by truck during the winter and by barge during the summer.

#### Material Use and Handling

The material from this source is a good grade of general fill, and could be used for low-to-medium quality concrete if no better material were available.

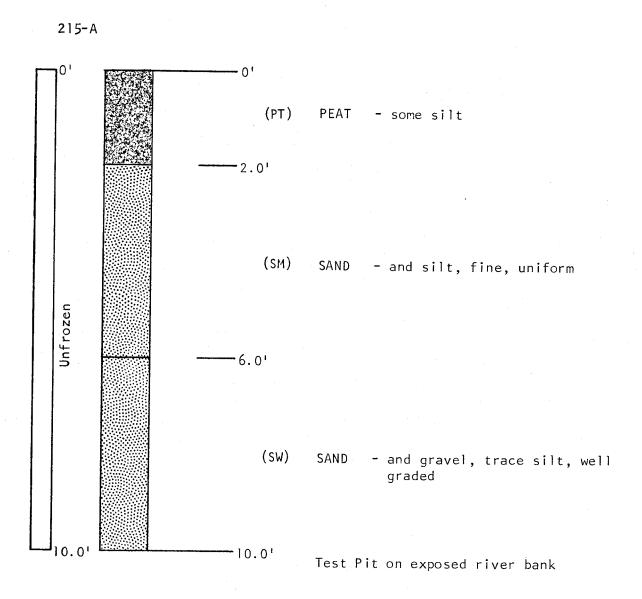
The equipment required for this source would be the usual assembly, although some pits should be dug to ensure that the granular material and the overlying silt can be ripped.

#### Stripping and Restoration

Both stripping and restoration on this source would be major undertakings, if indeed they are feasible. The silt overlying the granular material can be expected to be frozen and ice-rich, so stockpiles of this material would have to be contained and the drainage directed away from the river. Later, when the silt could be graded, this material should be replaced over the depleted area.

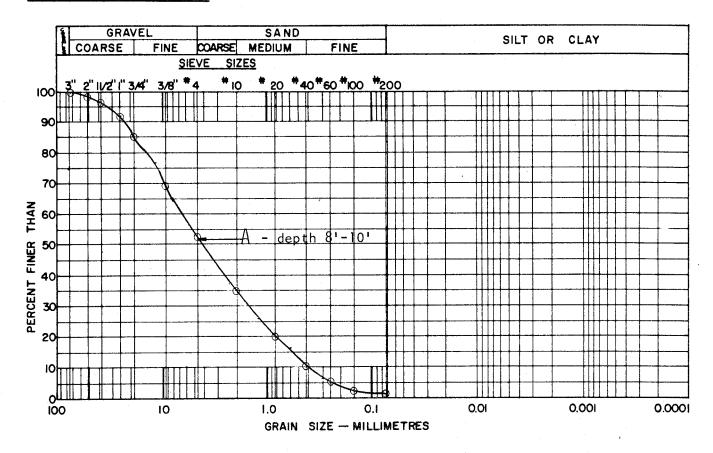
The excavation should not be permitted to approach the riverbank because of the danger of thawing ground ice within the bank, with the probability of instability and siltation to follow.

## TEST PIT LOGS SOURCE No. 215



# LABORATORY TEST DATA SOURCE No. 215

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Pit A depth 8' - 10' 3.7%

#### ORGANIC CONTENT

#### HARDNESS TEST

#### PETROGRAPHIC ANALYSIS

 Pit A depth 8' - 10'

 Quartzite)
 Sandstone(soft)
 - 6%

 Chert
 - 85%
 Shale-silt
 - 1%

 Granite
 Ironstone
 - Neg.

 Limestone(soft)
 - 8%
 Total
 100%

## ZONE II SOURCE No. 216

LANDFORM AND LOCATION:

MATERIAL:

CONCLUSION:

VOLUME:

Kame and esker remnants located about

3 miles southwest of Lousy Point and

17 miles northeast of Tununuk Point.

SAND - little gravel, variable silt

300,000 cubic yards approximately

Source is suitable for development, but

due to its erratic nature, the specific areas for excavation must be further delineated.

GSC SAMPLE SCALE: I"= 3000' (approx.) AIRPHOTO No. A12857-340

Ripley, Klohn & Leonoff International Ltd.

#### 216 ENVIRONMENT

#### Physical

This source is the remnant of a glaciofluvial feature, probably kames and eskers, located about 3 miles southwest of Lousy Point and 17 miles northeast of Tununuk Point. The source is 8,000 feet long by about 1,000 feet wide, and extends along the edge of an elevated area overlooking the lowland adjacent to the east channel of the Mackenzie River only a mile away.

Drainage over the source is good, and three test pits excavated in September to depths of  $3\frac{1}{2}$  and 4 feet encountered no ice. The source has not been developed.

#### Biotic

Most of the source area is covered with moss and lichen, with scattered dwarf shrubs, but many exposures of sand and gravel are bare of vegetation.

This source is not contained within a critical wildlife area, but the area is important to many waterfowl while breeding and moulting.

The source is within the Mackenzie Reindeer Grazing Reserve, and may be used as summer range for the Reindeer Herd and the barren-ground caribou at some time in the future.

Grizzly bears were observed in this area in September, 1972.

### 216 MATERIALS AND QUANTITIES

This source is highly erratic, with some deposits of sand and gravel scattered among ice-rich silts. The three test pits all penetrated granular material, but only 2 of the 7 test holes penetrated significant deposits of sand, and 4 encountered nothing but silt and ice.

Test Hole #4 penetrated a good deposit of sand with some gravel. To a depth of 6 feet the material averages 20% gravel, 78% well-graded sand, and 2% silt. At greater depths, the material is finer

and the silt content higher.

Test Hole #6 penetrated 19 feet of sand from the surface exposure to massive ground ice, the top 8 feet containing 15% gravel, 80% well-graded sand, and 5% silt. The deeper deposits are finer and contain more silt.

The moisture contents are related to the silt content and to the depth of the samples, and Test Holes #4 and #6 are reported at 9% and 13%, respectively, at a depth of 6 feet. The deeper deposits contain about 20% moisture.

Because of the erratic nature of this deposit, the volume of recoverable material is very difficult to estimate, but is thought to be about 300,000 cubic yards.

#### 216 DEVELOPMENT

#### General

This source is suitable for development for local projects. The material is suitable for general fill, and probably a small volume of aggregate can be excavated after a more detailed investigation.

In general, the suitable granular material is visible at the surface. Vegetated areas contain excessive amounts of silt at depth, as well as at the surface.

#### Access

The source is accessible only during the winter months. It would, however, be feasible to haul granular material to the riverbank during the winter, and load in barges for summer transport.

#### Material Use and Handling

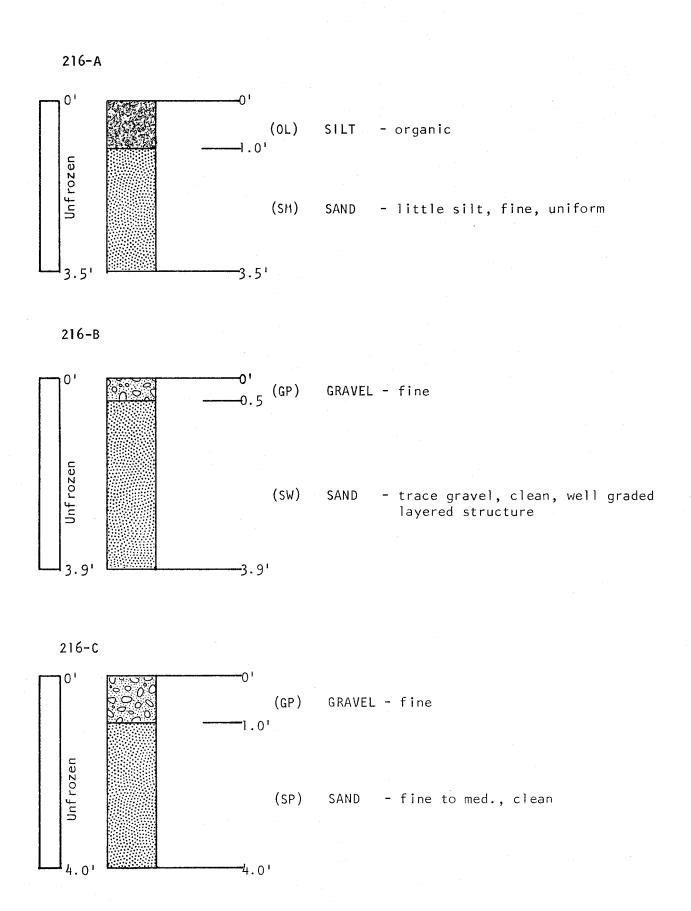
The material in a portion of the source area is an excellent grade of general fill. If no better material were available, selected sand and gravel could be processed for use as concrete aggregate, the processing amounting to separating by screening, then recombining in the proper proportions.

The equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

#### Stripping and Restoration

Because the most desirable material is found exposed at the surface, stripping will probably be minimal here. Depleted areas must be graded to a smooth contour, and banks to a stable slope before an area is abandoned.

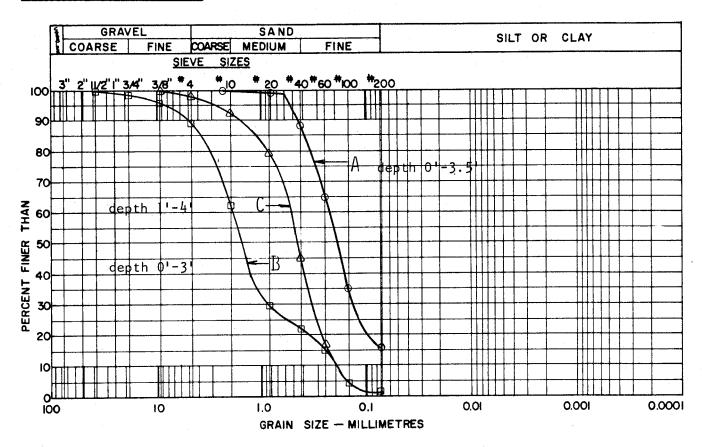
## TEST PIT LOGS SOURCE No. 216



Ripley, Klohn & Leonoff International Ltd.

# LABORATORY TEST DATA SOURCE No. 216

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

A 
$$(0' - 3\frac{1}{2}')$$
 M/C = 7.8%

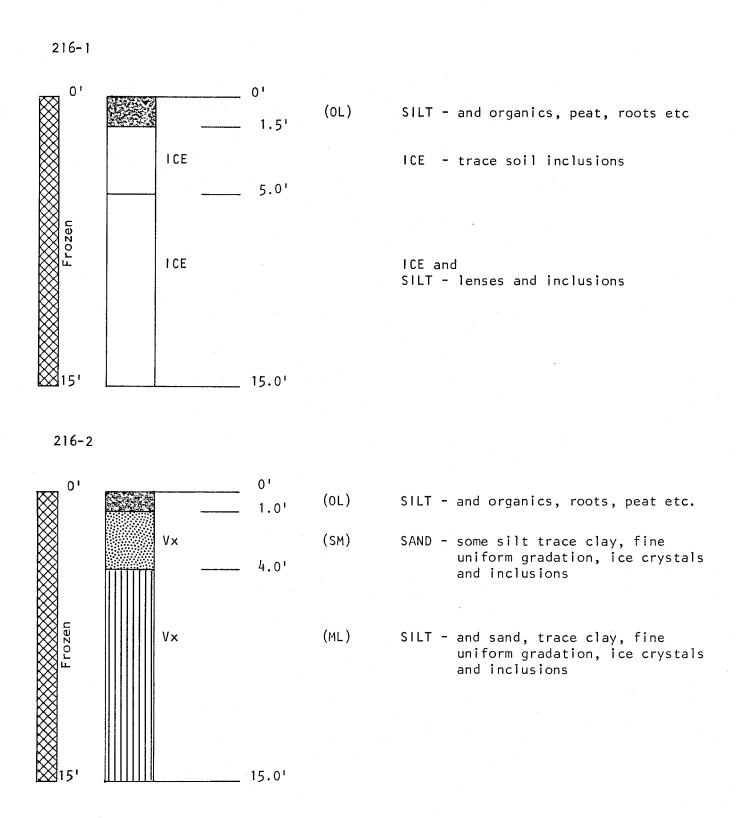
$$B (0' - 3') M/C = 2.6\%$$

$$C(1'-4')$$
 M/C = 2.7%

#### ORGANIC CONTENT

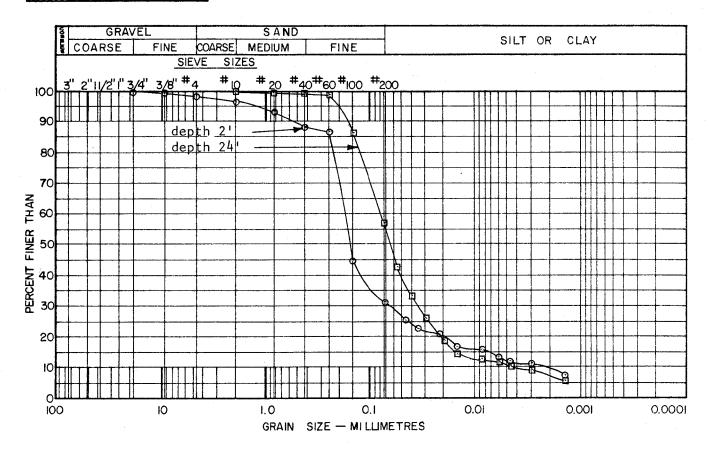
HARDNESS TEST

## TEST HOLE LOGS SOURCE No. 216



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 216-2

#### GRAIN SIZE DISTRIBUTION



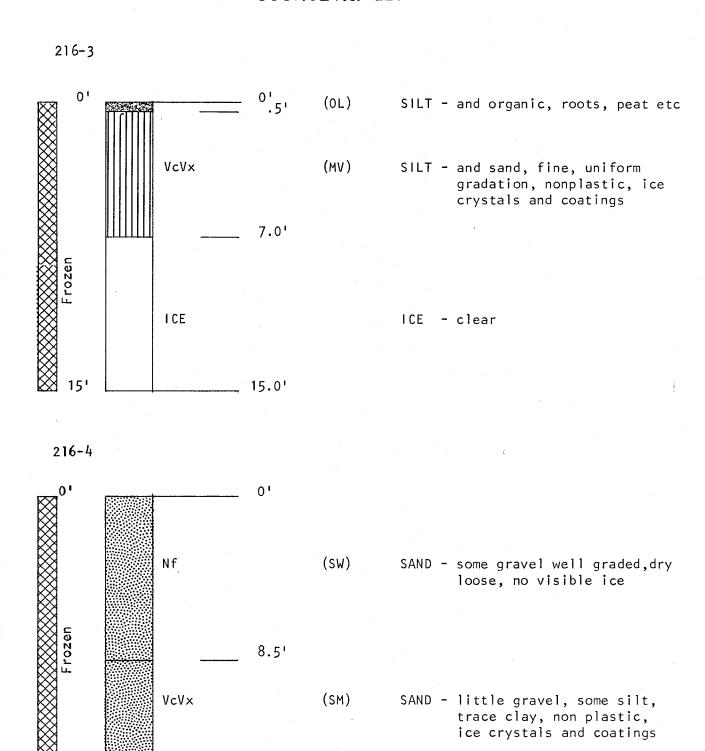
#### MOISTURE CONTENT

Sample 1 depth 2' 9.6% Sample 2 depth 14' 39.6%

ORGANIC CONTENT

HARDNESS TEST

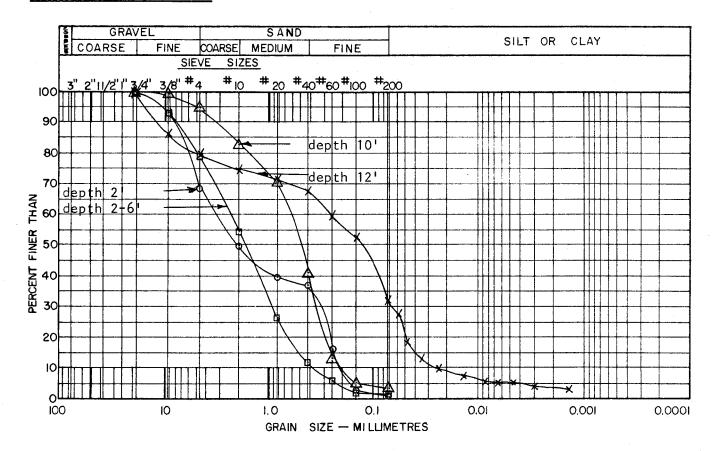
## TEST HOLE LOGS SOURCE No. 216



15.01

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 216-4

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

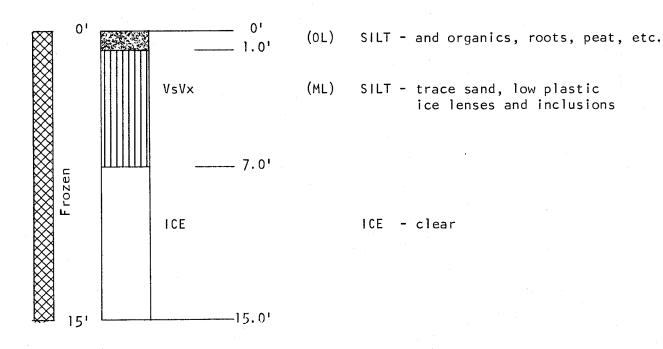
Sample 1 depth 2' 3.5% Sample 2 depth 4' 3.6% Sample 3 depth 6' 8.9% Sample 4 depth 10' 17.8% Sample 5 depth 12' 20.7%

#### ORGANIC CONTENT

HARDNESS TEST

## TEST HOLE LOGS SOURCE No. 216

216-5

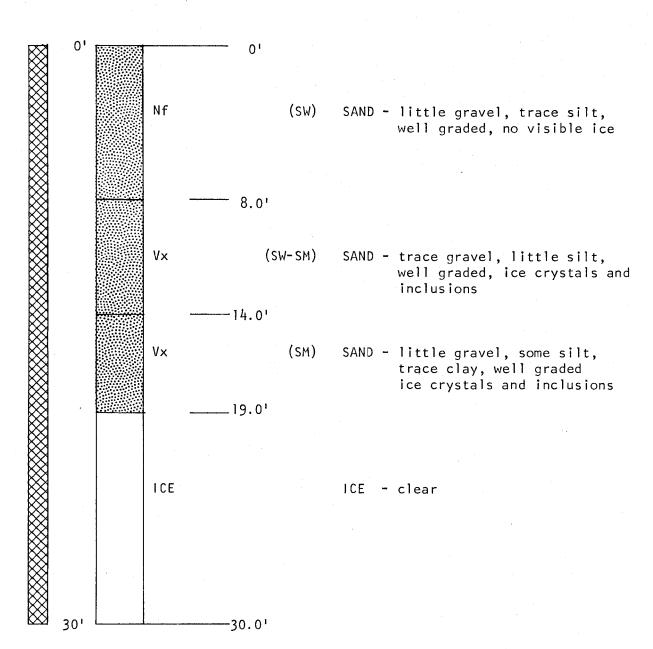


Moisture Content
Sample 1 depth 2'

35.4%

## TEST HOLE LOGS SOURCE No. 216

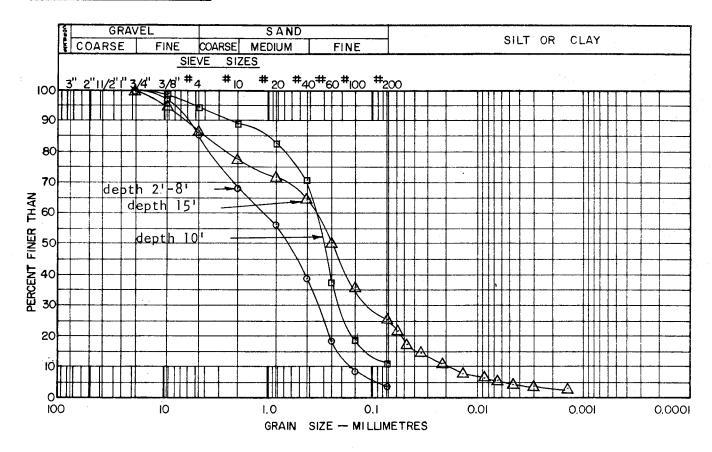




### LABORATORY TEST DATA

### TEST HOLE-SOURCE No. 216-6

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Sample 4 depth 8'

Sample 1	depth	2'	3.3%	Sample 5	depth	10!	16.0%
Sample 2	depth	4 1	8.3%	Sample 6	depth	15'	18.6%
Sample 3	depth	61	12.7%				

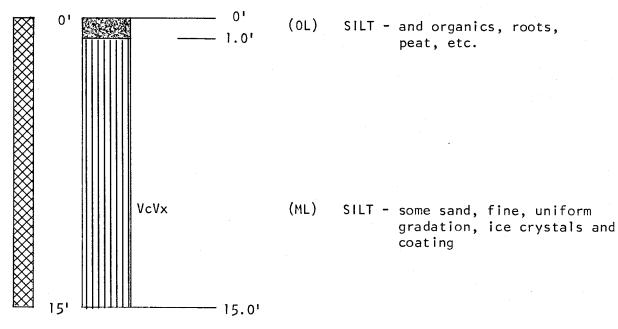
13.0%

#### ORGANIC CONTENT

HARDNESS TEST

## TEST HOLE LOGS SOURCE No. 216

216-7



Moisture Content

Sample 1 depth 2' 11.8% Sample 2 depth 4' 35.9%

### ZONE II SOURCE No. 217

LANDFORM AND LOCATION:

Esker located 19 miles northeast of Tununuk

Point.

MATERIAL:

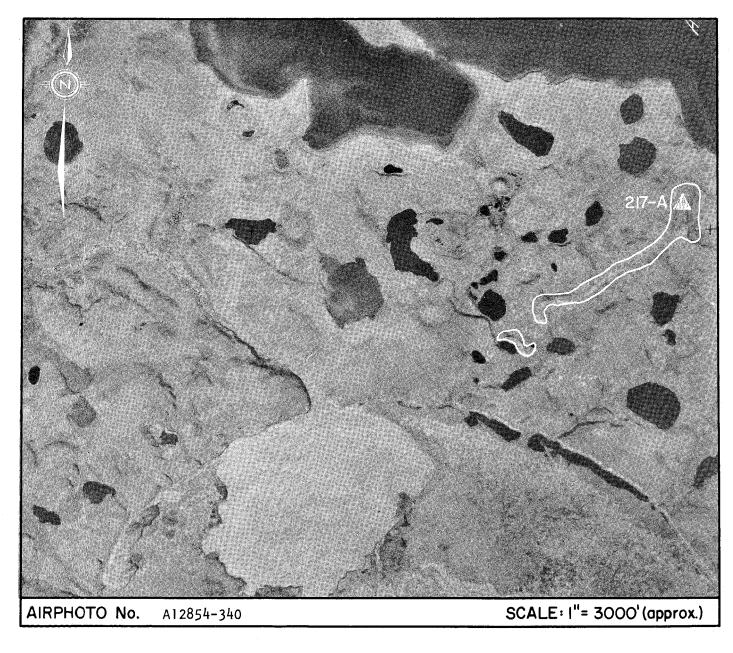
SAND - trace gravel

VOLUME:

150,000 cubic yards

CONCLUSION:

Source is suitable for limited development.



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#### 217 ENVIRONMENT

#### Physical

This source is an esker located 19 miles north northeast of Tununuk Point. It extends for about 7,000 feet in length, is about 400 feet wide, and stands 25 to 30 feet above the adjacent ground.

Drainage over the source is good, and the source has not been developed.

#### Biotic

Most of this feature is a bare exposure of coarse sand, although some patches are covered by moss and tufts of grass. The adjoining low-land is more heavily vegetated.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

#### 217 MATERIALS AND QUANTITIES

The one test pit excavated in this source contained  $2\frac{1}{2}$  feet of sand with traces of gravel and silt. The surface exposures indicate that this formation is relatively uniform.

Ice wedging noted in the esker, the thermokarstic nature of nearby ponds, and two pingos less than I mile away, all indicate the presence of massive ground ice at a shallow depth.

The recoverable volume is estimated to be about 150,000 cubic yards.

#### 217 DEVELOPMENT

#### General

This source is suitable for development for local projects. The material can be used as general fill.

#### Access

This source is accessible by truck during the winter. The distance across the tundra to the east channel of the Mackenzie River or to

Yaya Lake is about 3 miles.

#### Material Use and Handling

The material in this source is suitable for general fill.

Only the low ice content material near the surface should be excavated, and the deeper material left to protect the massive ground ice that is expected to lie at depth.

The equipment required for this development is a dozer with ripper, a front-end loader, and trucks.

#### Stripping and Restoration

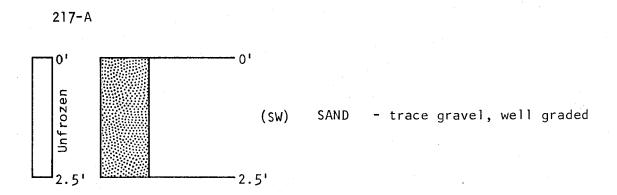
Very little stripping will be required at this source, but any stripped material must be stockpiled on adjacent high ground for replacement after the granular material has been removed.

The adjacent low-lying ground must be avoided because of the thawing and subsidence that will develop from the disturbance of the organic ground cover.

Massive ground ice must not be uncovered, or if uncovered, must be recovered quickly with a blanket of soil, in order to avoid thawing, sloughing, and widespread siltation.

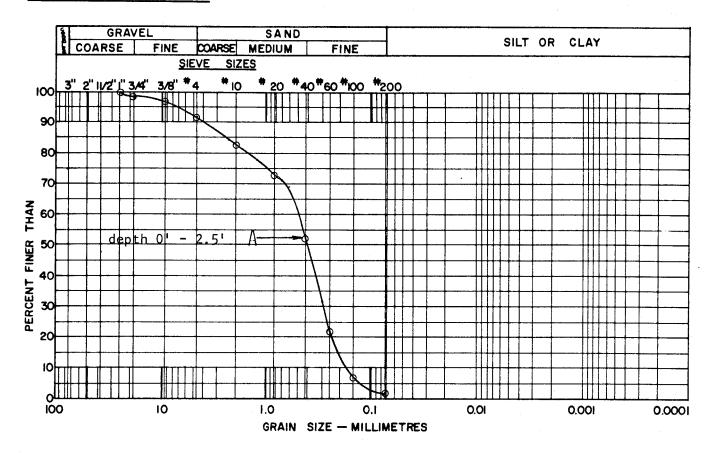
Depleted areas must be graded to a smooth contour, and banks to a stable slope, before an area is abandoned.

# TEST PIT LOGS SOURCE No. 217



# LABORATORY TEST DATA SOURCE No. 217

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Pit A depth 0' - 2.5' 4.8%

ORGANIC CONTENT

HARDNESS TEST

### ZONE II SOURCE No. 218

LANDFORM AND LOCATION:

Outwash at north end of a lake about

18 miles northeast of Tununuk Point.

MATERIAL:

SAND - little gravel

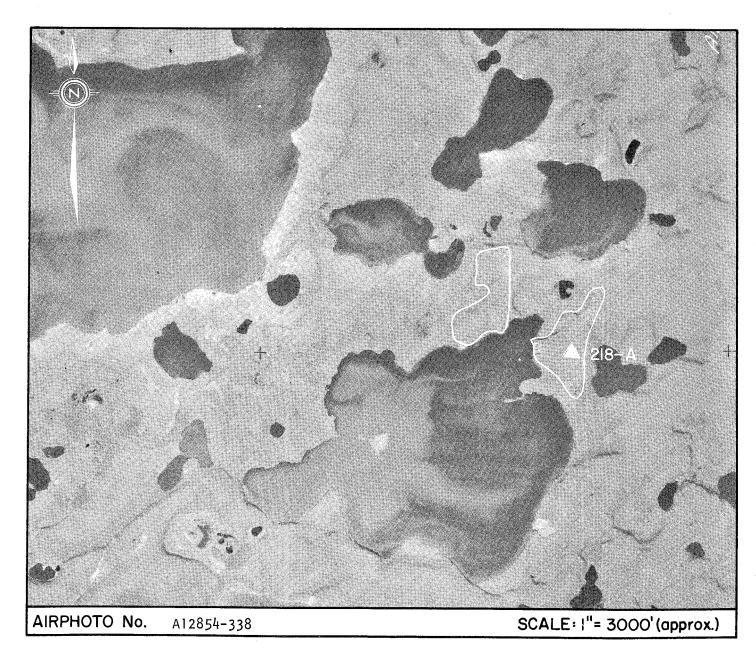
**VOLUME:** 

300,000 cubic yards at least

CONCLUSION:

Source is suitable for development as

general fill for local projects.



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#### 218 ENVIRONMENT

#### Physical

This source is a glacial outwash deposit located at the north end of a lake about 18 miles northeast of Tununuk Point and 6 miles west of Lousy Point. The source is two hillocks, each about 4,000 feet long by 1,000 feet across, and separated by the northern end of the lake, about 1,000 feet across. The hillocks stand 60 to 70 feet above lake level.

Drainage of the surface of the source is good, and a test pit was excavated in September to a depth of  $3\frac{1}{2}$  feet without encountering ice. Ice is close to the surface, however, as indicated by ice wedging on the hillocks. The source has not been developed.

#### Biotic

The slopes of these hillocks are bare exposures of sand. The top surface is partly bare, partly covered by moss and lichens, with some scattered dwarf shrubs.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

#### 218 MATERIALS AND QUANTITIES

The one test pit excavated in this source indicated 13% gravel, 85% well-graded sand, and 2% silt. The extensive surface exposure of sand indicates that this deposit covers quite a large area and the recoverable volume of granular material is estimated to be 300,000 cubic yards at least.

#### 218 DEVELOPMENT

#### General

This source is suitable for development primarily as general fill for local projects.

#### Access

This source is accessible only during the winter months, trucking across the lakes and tundra. The east channel of the Mackenzie River is about 5 miles away by air.

#### Material Use and Handling

The material from this source is a good grade of general fill. If located closer to the main traffic routes, the material could be blended with coarse aggregate to use in concrete.

The equipment required for this development is a dozer, a front-end loader, and trucks.

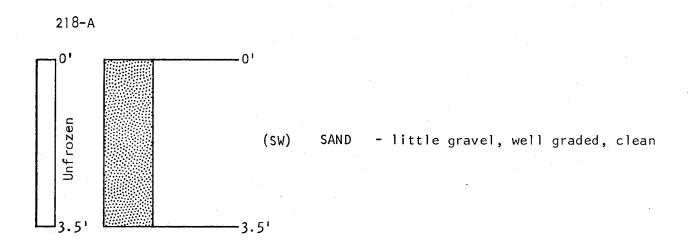
#### Stripping and Restoration

Very little material must be stripped from this source before development, but this material must be stockpiled for replacement after an area is depleted.

After depletion, an area should be graded to a smooth contour, and banks to a stable slope, before the area is covered with topsoil.

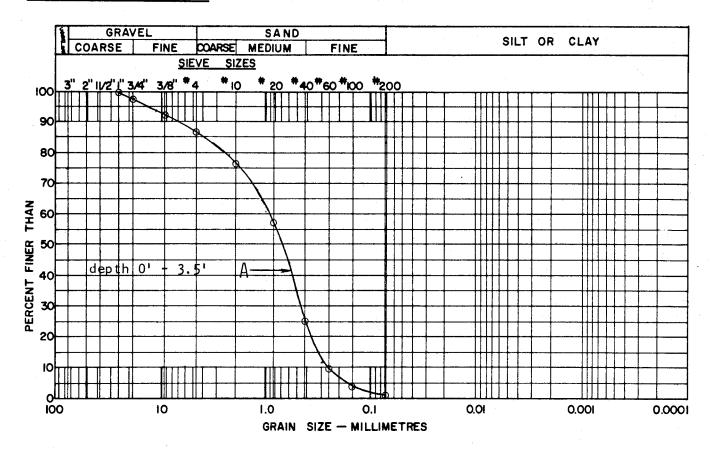
Massive ground ice should not be exposed on a slope, or if exposed, should be covered quickly, in order to avoid melting, sloughing, and siltation of the adjacent lakes.

## TEST PIT LOGS SOURCE No. 218



# LABORATORY TEST DATA SOURCE No. 218

#### GRAIN SIZE DISTRIBUTION



### MOISTURE CONTENT

Pit A depth 0' - 3.5'

3.0%

ORGANIC CONTENT

HARDNESS TEST

### ZONE 11 SOURCE No. 219

LANDFORM AND LOCATION: Flat topped ridge, possibly a crevasse

filling located near the north end of

Yaya Lake about 14 miles north of Tununuk

Point.

MATERIAL: GRAVEL - and sand, trace silt

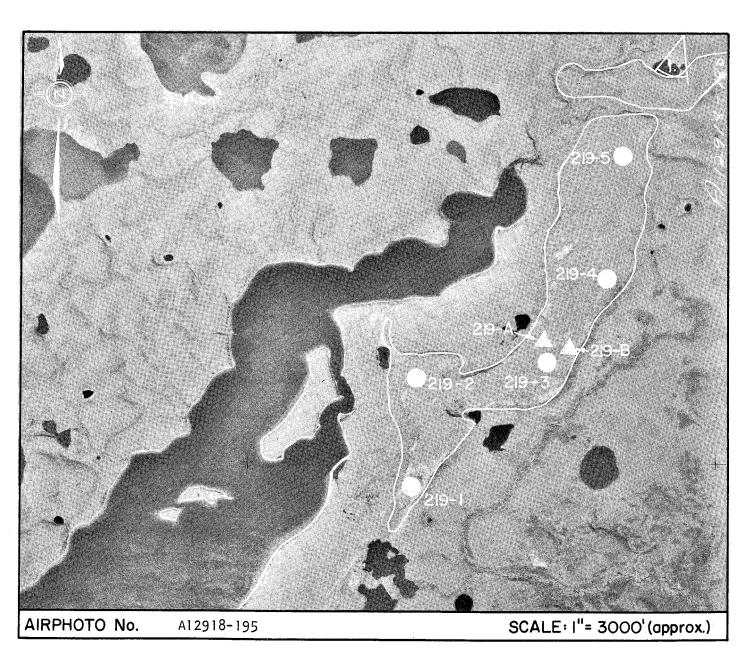
SAND - and gravel, trace silt

VOLUME: 1,000,000 cubic yards at least

CONCLUSION: Source is suitable for development, but

requires additional drilling to determine

additional qualitative and quantitative data.



#### 219 ENVIRONMENT

#### Physical

This source is a glaciofluvial deposit located near the north end of Yaya Lake, 14 miles north of Tununuk Point. The source is a broad, flat-topped ridge, possibly a crevasse filling, but the origin is debatable. It extends for over three miles with only one interruption, a channel that cuts across the ridge near the northern end, is up to  $\frac{1}{2}$  mile wide, and stands 50 feet above lake level.



Photo No. 1 - Source 219 - Aerial view from north end of source

Drainage over the surface of this source is good, and two test pits excavated in September did not encounter ice within 4 feet of the surface. The source has not been developed.

#### Biotic

Many slopes around this feature are bare of vegetation, and some of the top surface as well. Elsewhere the cover is moss and scattered shrubs.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

Yaya Lake is a popular area, used for camping, boating, and fishing. One lodge has been built on the lake, and the trout fishing is said to be excellent.

#### 219 MATERIALS AND QUANTITIES

This deposit is erratic in nature, but contains a large volume of granular material. Both test pits penetrated sand with or without gravel, but quite clean. The 5 test holes are a mixed collection. Test Hole #1 penetrated  $4\frac{1}{2}$  feet of sand, then encountered ice. Test Hole #2 penetrated  $18\frac{1}{2}$  feet of excellent gravel (50 to 55% gravel, 45 to 50% sand), then ice. Test Hole #3 penetrated  $14\frac{1}{2}$  feet of sand, then 14 feet of gravel. Test Hole #4 is a mixture of ice and sand below a frozen silt layer  $7\frac{1}{2}$  feet thick. Test Hole #5 contains 34 feet of sand below a layer of frozen silt 5 feet thick. A petrographic analysis of gravel from Test Hole #2 shows a sound material, primarily quartzite (84%), hard sandstone (8%), and quartz (4%), with a fraction of soft sandstone (4%) the only unsound component.

The moisture content in Test Hole #2 is relatively low, about  $7\frac{1}{2}$ % at 10 feet depth. The moisture content in Test Hole #3 is considerably higher with a value of about 20%.

Because of the variability in this source, additional drilling should be done before the volume of recoverable material can be calculated with confidence, but probably the figure will exceed 1,000,000 cubic yards.

#### 219 DEVELOPMENT

#### General

This source is suitable for development, for general fill and for aggregate for concrete and asphalt construction.

Investigation should concentrate on the areas with exposed granular material, because ice-rich silt removed in stripping would be difficult to contain and difficult to replace.

Yaya Lake must be kept free of silt.

#### Access

This source can be reached by truck in winter and by small barge in summer. For hauling along Yaya Lake, only a very short road must be constructed in order to reach the main traffic routes. Tununuk Point is less than 20 miles away by this route.

#### Material Use and Handling

By selective excavation, material can be found in this source to suit any need, from general fill to concrete aggregate.

In selected areas, a considerable depth of gravel can be removed in summer with little ripping and this material can be loaded and used at once. The deeper material must be ripped, stockpiled on high ground nearby, thawed, and drained before shipping.

Traffic must avoid the low-lying ground around the source, otherwise the organic ground cover will be disturbed and the ground ice will thaw.

Equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader and trucks.

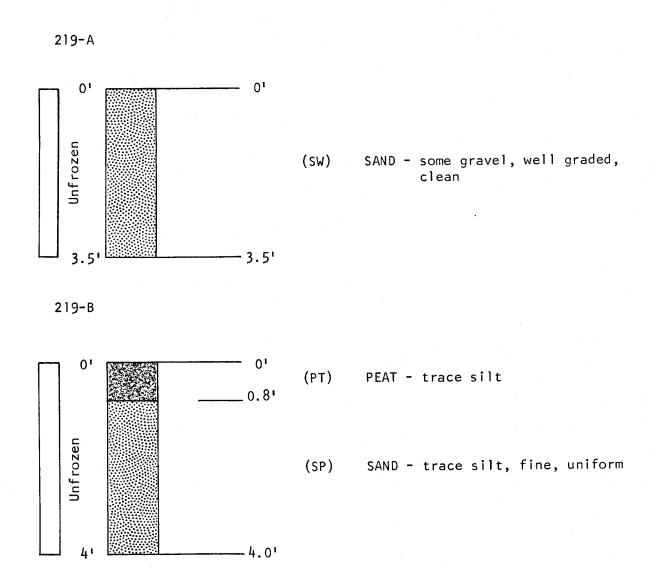
#### Stripping and Restoration

Ice-rich silt should not be stripped from this source. It may be necessary to limit the excavation of fine sand because this material, in thawing, may carry silt to Yaya Lake.

Where stripping is required, the material should be stockpiled for replacement after the granular material has been removed. Depleted areas must be graded to a smooth contour, and banks to a stable slope, before being covered by topsoil.

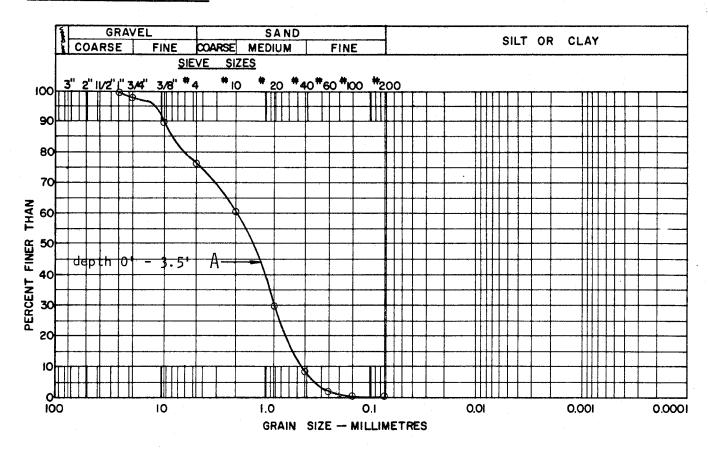
Wherever possible, stockpiles of frozen material should be located so they do not drain directly to Yaya Lake or to the streams flowing to it.

## TEST PIT LOGS SOURCE No. 219



# LABORATORY TEST DATA SOURCE No. 219

#### GRAIN SIZE DISTRIBUTION



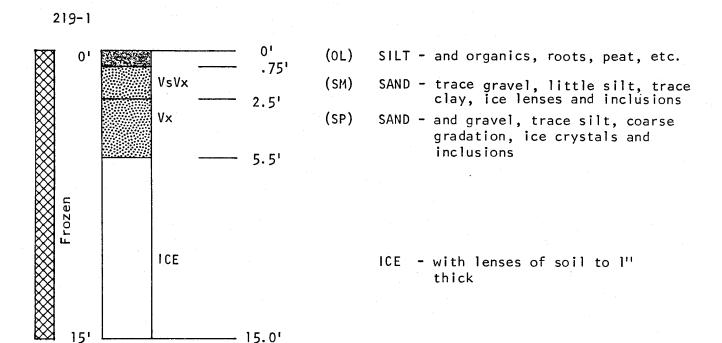
#### MOISTURE CONTENT

Pit A depth 0' - 3.5' 2.5%

ORGANIC CONTENT

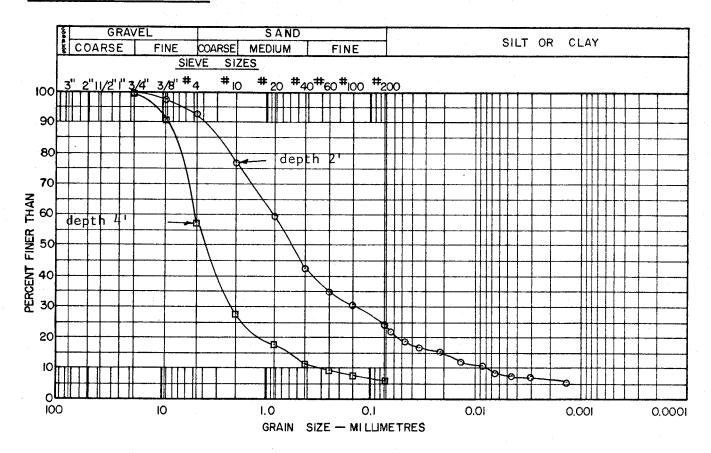
HARDNESS TEST

## TEST HOLE LOGS SOURCE No. 219



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 219-1

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

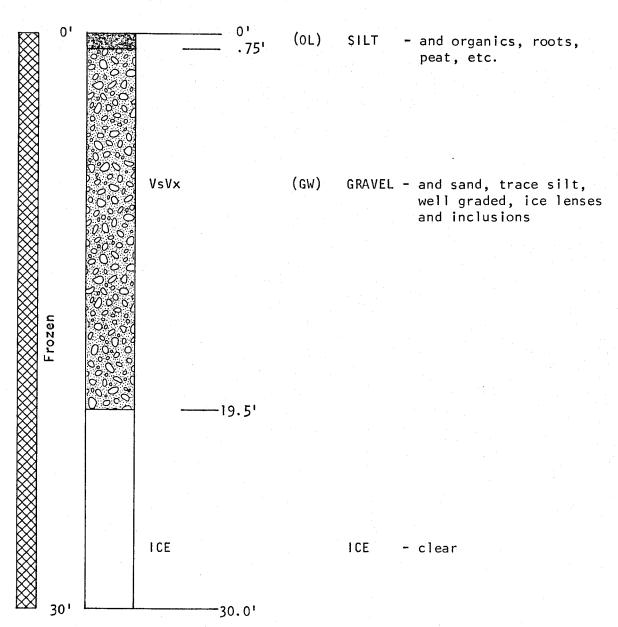
Sample 1 depth 2' Sample 2 depth 4'

ORGANIC CONTENT

HARDNESS TEST

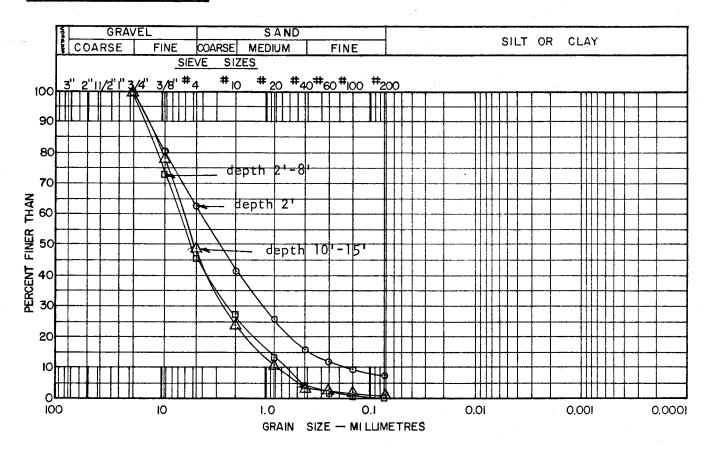
## TEST HOLE LOGS SOURCE No. 219





# LABORATORY TEST DATA TEST HOLE-SOURCE No. 219-2

#### GRAIN SIZE DISTRIBUTION



### MOISTURE CONTENT

Sample 1	depth	2'	9.3%	Sample 5	depth 10'	7.4%
Sample 2	depth	4 1	6.0%	Sample 6	depth 15'	9.4%
Sample 3	depth	61	7.4%	•	•	
Sample 4	denth	Ŗ١	7 2%			

#### ORGANIC CONTENT

#### HARDNESS TEST

#### PETROGRAPHIC ANALYSIS

Samples 2 to 6 depth 4' - 15'

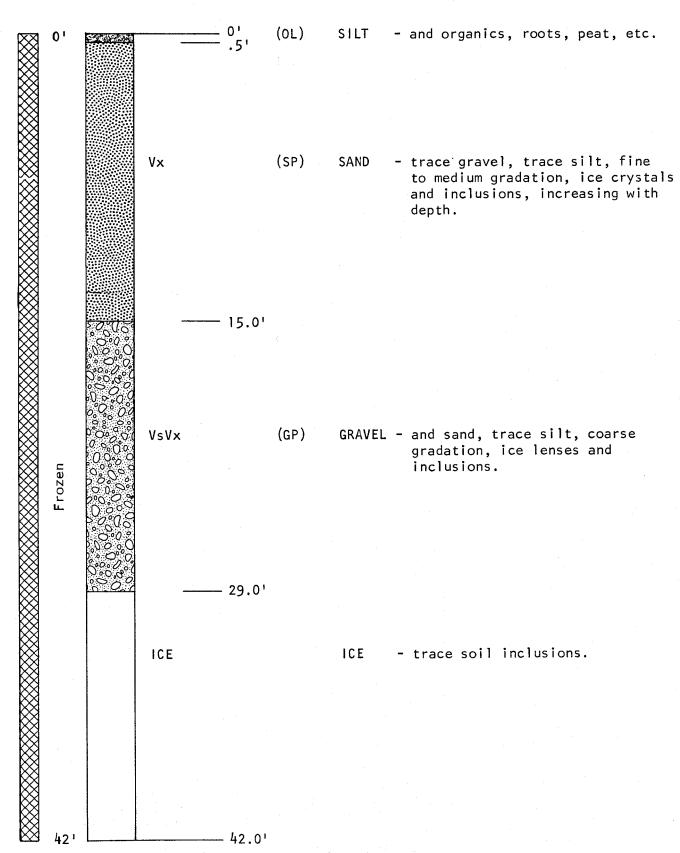
Ouartzite - 84%

Sandstone(hard) - 8%
Sandstone(soft) - 4%
Quartz - 4%

Total 100%

## TEST HOLE LOGS SOURCE No. 219

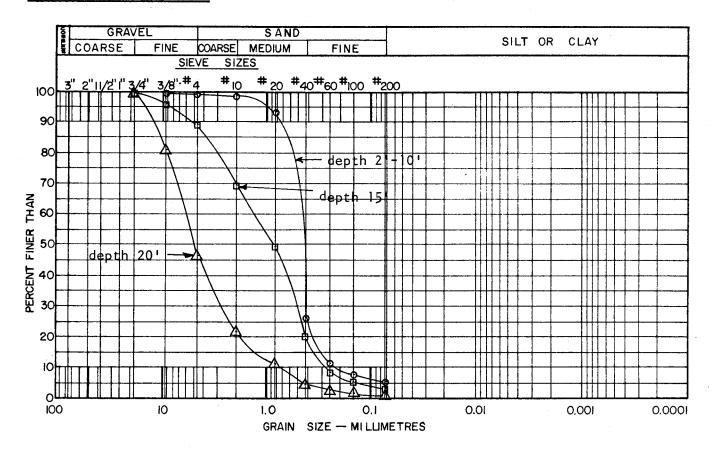
219-3



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# LABORATORY TEST DATA TEST HOLE-SOURCE No. 219-3

#### GRAIN SIZE DISTRIBUTION



MOISTURE	CONTENT	
Sample 1	depth 2'	9.6%
Sample 2	depth 4'	18.6%
Sample 3	depth 6'	23.6%
Sample 4	depth 8'	26.2%
Sample 5	depth 10'	25.8%

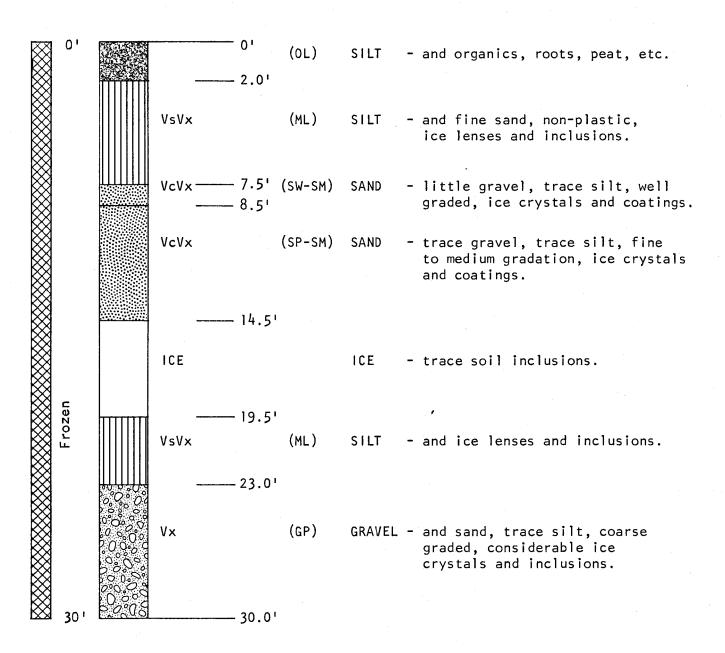
Sample 6 depth 15' 16.6% Sample 7 depth 20' 11.2%

ORGANIC CONTENT

HARDNESS TEST

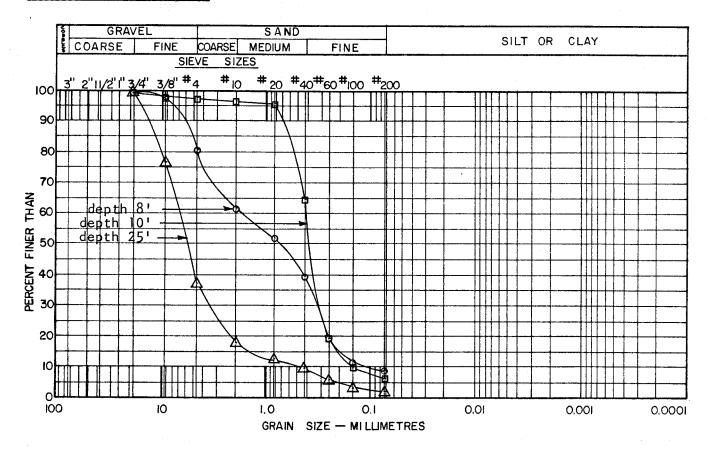
## TEST HOLE LOGS SOURCE No. 219

219-4



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 219-4

#### GRAIN SIZE DISTRIBUTION



6 depth 25' 6.9%

HARDNESS TEST

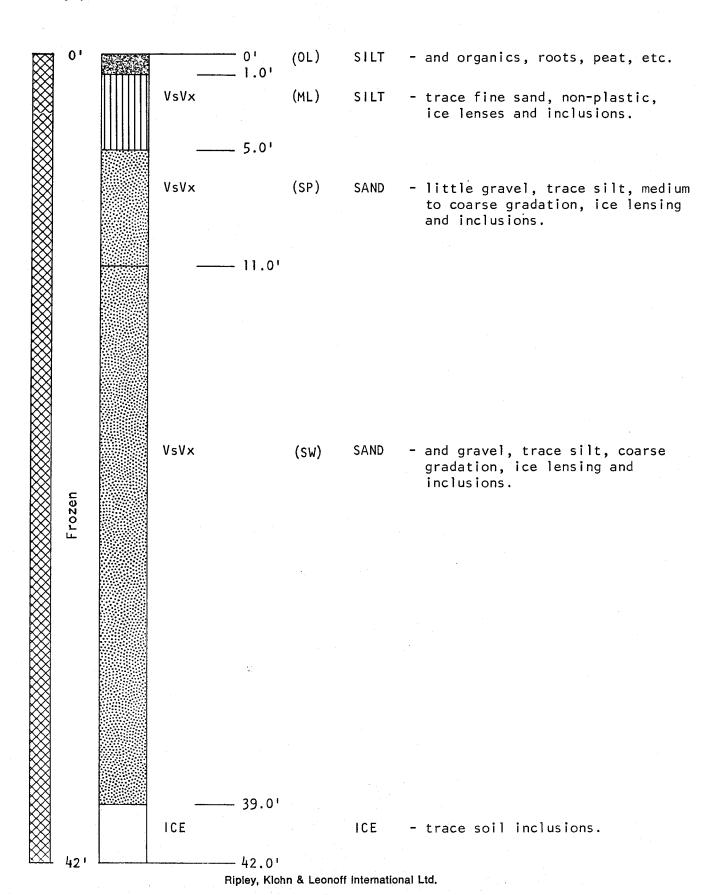
#### MOISTURE CONTENT

ORGANIC CONTENT

			(1 00	
Sample 1	depth 2	۷'	61.9%	Sample
Sample 2	donth L	4.1	15.5%	•
Jamp 16 2	acptii 4	7	17.70	
Sample 3	denth 6	ζ ι	28.9%	
, -			20.30	
Sample 4	denth 8	<b>ર</b> ા	15.3%	
Jamp IC 4	ucptii c	,	17.70	
Sample 5	denth 1	יחו	22.3%	
Jumpie	acp til 1		LL. JO	

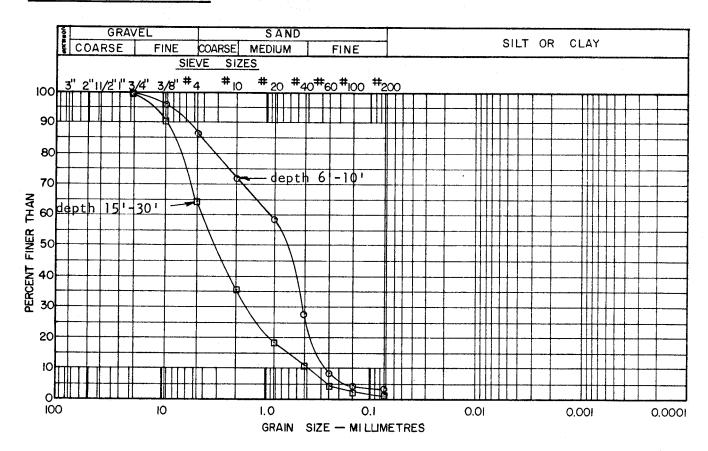
## TEST HOLE LOGS SOURCE No. 219

219-5



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 219-5

#### GRAIN SIZE DISTRIBUTION



N	ИΟ	IS"	ΓU	RE	CO	VT	EN.	Τ

	<u>v v .</u>			
Sample 1 depth 2'	45%	Sample 6	depth 15'	12.9%
Sample 2 depth 4'	24.2%	Sample 7	depth 201	14.0%
Sample 3 depth 6'	17.2%	Sample 8	depth 30'	9.1%
Sample 4 depth 8'	15.5%	•	•	-
Sample 5 depth 10	0' 20.3%			

#### ORGANIC CONTENT

HARDNESS TEST

### ZONE II SOURCE No. 220

LANDFORM AND LOCATION:

Group of ridges, either eskers or crevasse

fillings, located on east side of Yaya Lake

about 12 miles north of Tununuk Point.

MATERIAL:

SAND - some gravel

**VOLUME:** 

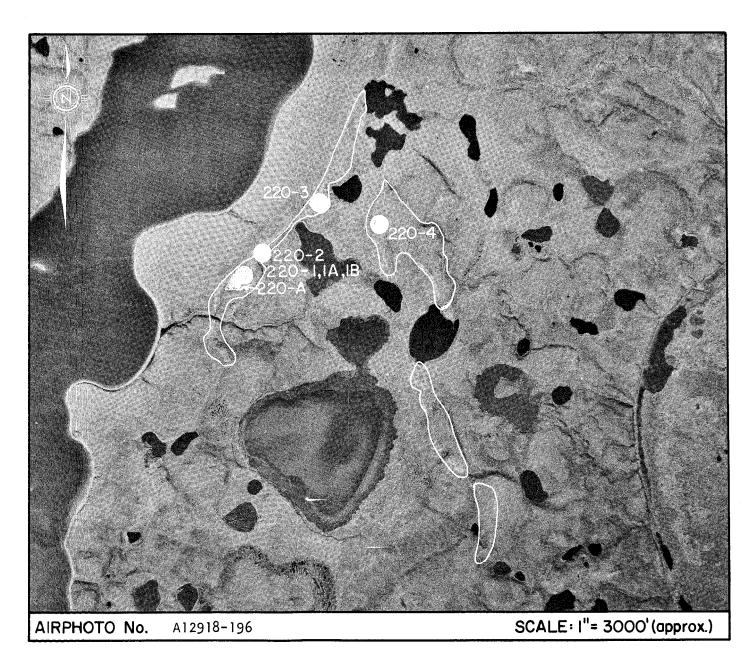
100,000 cubic yards

CONCLUSION:

Source is suitable for development, but due

to its erratic nature, additional drilling

should be done.



#### 220 ENVIRONMENT

#### Physical

This source is a group of ridges on the east side of Yaya Lake, located about 12 miles north of Tununuk Point. The ridges, either eskers or crevasse fillings, are very irregular in pattern, and extend over an area about  $2\frac{1}{2}$  miles long. They stand about 40 feet high.

Drainage over this source is good, with no ice encountered to a depth of 3 feet during the September reconnaissance. The source has not been developed.

#### Biotic

Much of the surface of this feature is bare of vegetation, but elsewhere, moss and a few dwarf shrubs are found.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

Yaya Lake is a popular area, used for camping, boating, and fishing. One lodge has been built on the lake, and the trout fishing is said to be excellent.

#### 220 MATERIALS AND QUANTITIES

This source is highly erratic.

A group of three test holes near the southern end of the main ridge, numbered #1, #1A, and #1B, indicate the variation in materials.

Test Hole numbers 1 and 1B contained only frozen silt and ice, but

Test Hole #1A penetrated 7 feet of sand with some gravel and little silt (12%).

Test Hole #2, further north on the main ridge, contained 30 feet of sand with a range of grading in gravel (10% to 35%), sand (65% to 80%), and silt (1% to 9%).

Test Holes #3 and #4, still further north, contain only frozen silt

and ice.

Because of the highly variable nature of this deposit, the recoverable volume is very difficult to estimate, but is probably about 100,000 cubic yards.

#### 220 DEVELOPMENT

#### General

This source is suitable for development, but only for local projects. The areas of development should be outlined by further investigation, to avoid the disruption of exploration pits.

The material from this source can be used for general fill, but further investigation may outline some small deposits of material suitable for use in concrete.

#### Access

This source can be reached by truck in winter and by small barge in summer. By hauling along Yaya Lake, only a short road must be constructed to reach the main traffic routes. Tununuk Point is only 14 miles away by this route.

### Material Use and Handling

By selective excavation, material can be found in this source to suit any need, from general fill to concrete aggregate.

In selected areas, a considerable depth of gravel can probably be removed in summer with little ripping and this material can be loaded and used at once. The deeper material must be ripped, stockpiled on high ground nearby, thawed, and drained before shipping.

Traffic must avoid the low-lying ground around the source, otherwise the organic ground cover will be disturbed and the ground ice will thaw.

Equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader and trucks.

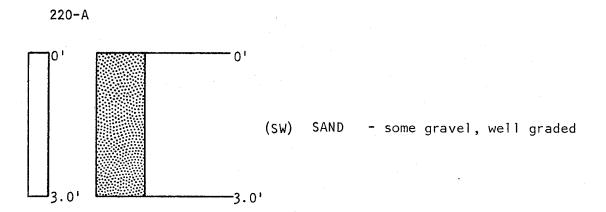
#### Stripping and Restoration

Ice-rich silt should not be stripped from this source. It may be necessary to limit the excavation of fine sand because this material, in thawing, may carry silt to Yaya Lake.

Where stripping is required, the material should be stockpiled for replacement after the granular material has been removed. Depleted areas must be graded to a smooth contour, and banks to a stable slope, before being covered by topsoil.

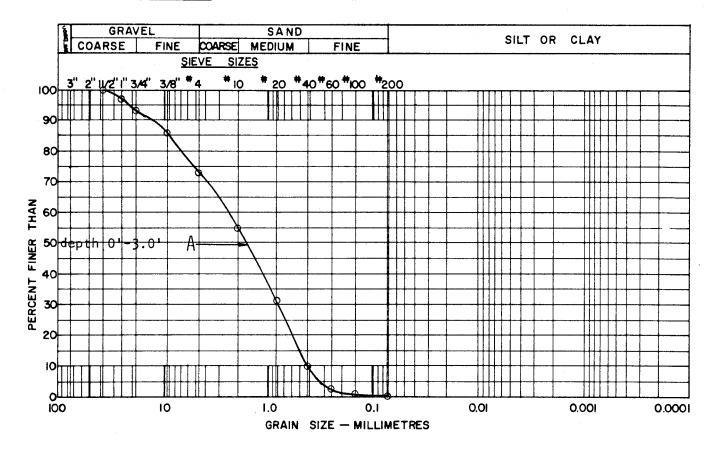
Wherever possible, stockpiles of frozen material should be located so they do not drain directly to Yaya Lake or to the streams flowing to it.

## TEST PIT LOGS SOURCE No. 220



# LABORATORY TEST DATA SOURCE No. 220

# GRAIN SIZE DISTRIBUTION



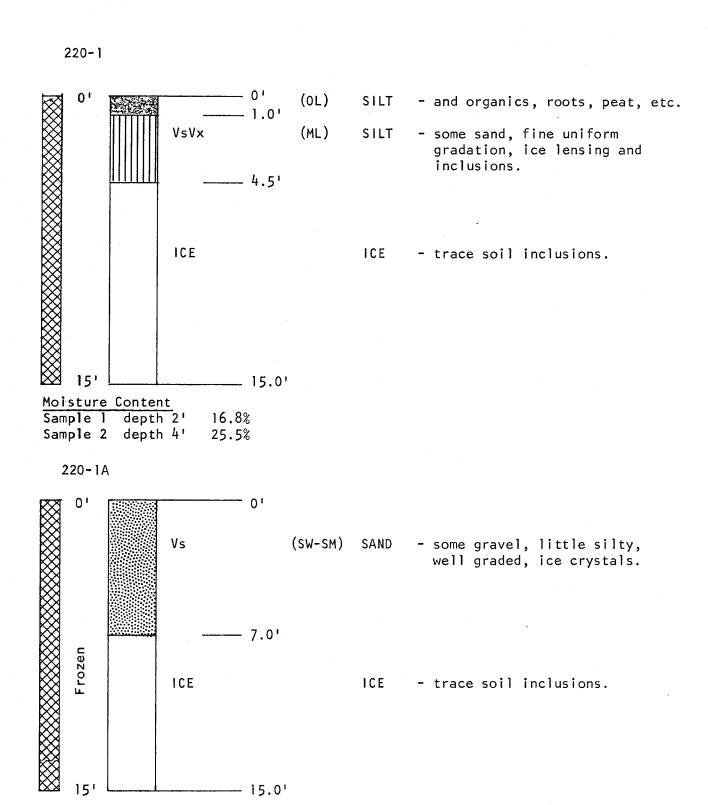
# MOISTURE CONTENT

Pit A depth 0' - 3'

2.2%

ORGANIC CONTENT

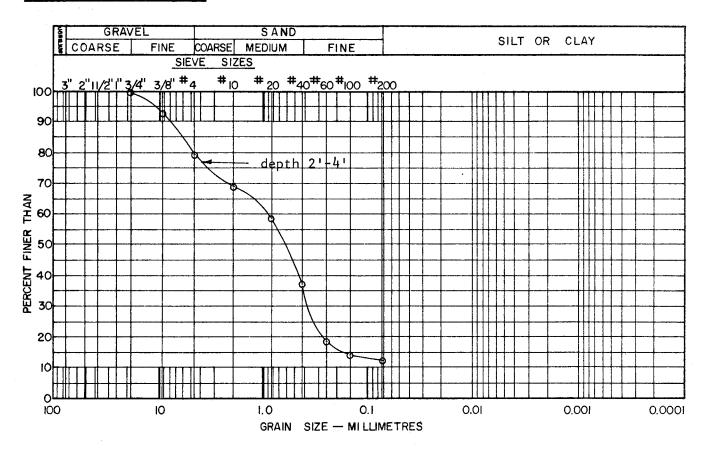
HARDNESS TEST



NOTE: 3 holes drilled in same location.

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 220-1A

# GRAIN SIZE DISTRIBUTION



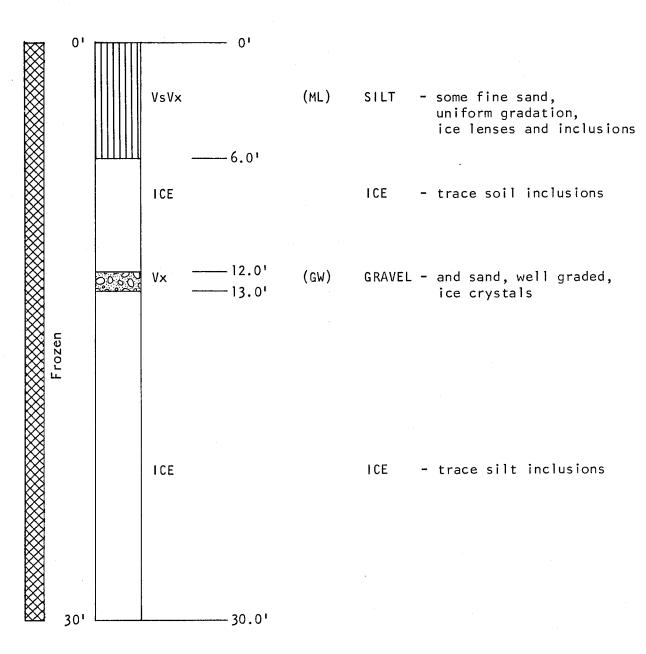
### MOISTURE CONTENT

Sample 1 depth 2' 4.9% Sample 2 depth 4' 5.6%

ORGANIC CONTENT

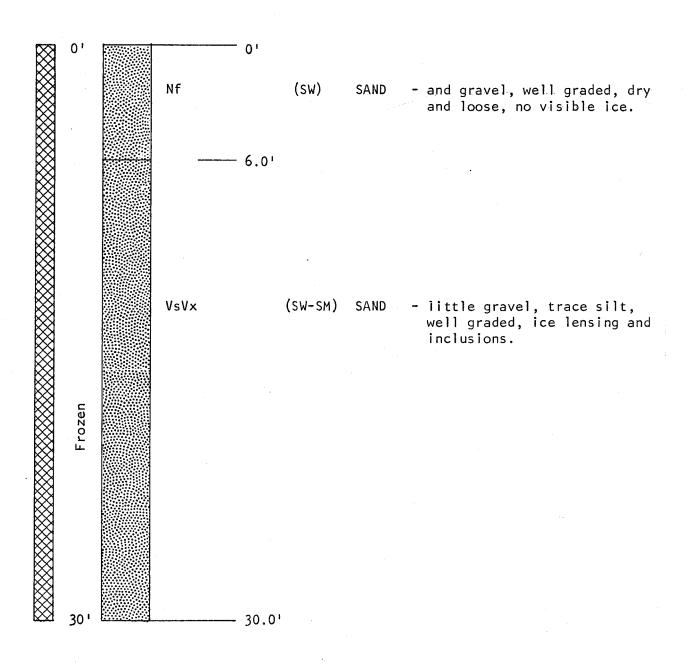
HARDNESS TEST

220-1B



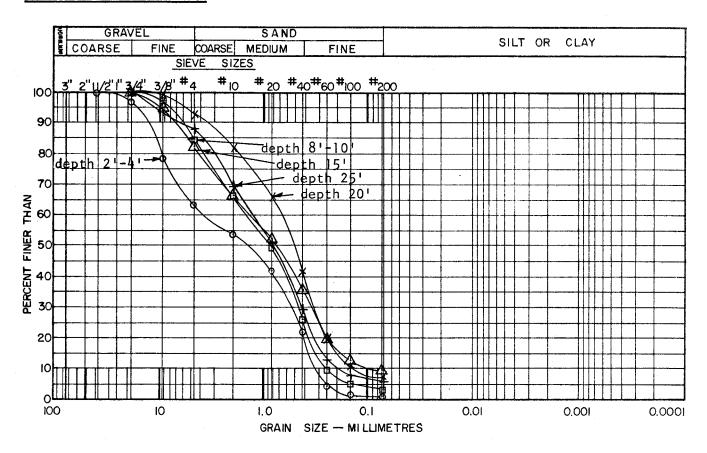
Note: No. 3 of 3 holes in same area





# LABORATORY TEST DATA TEST HOLE-SOURCE No. 220-2

# GRAIN SIZE DISTRIBUTION



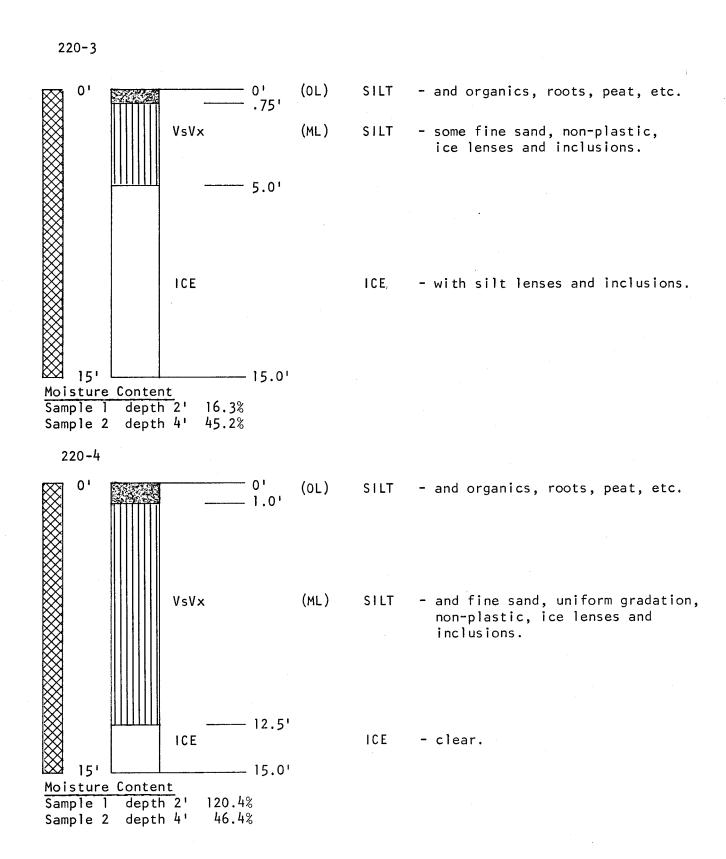
MOISTURE	CONTENT

Sample	1	depth	21	3.1%
Sample	2	depth	41	2.5%
Sample	3	depth	۱8	10.3%
Sample	4	depth	10'	10.8%
Sample	5	depth	151	10.6%

Sample 6 depth 20' 14.4% Sample 7 depth 25' 10.9%

# ORGANIC CONTENT

HARDNESS TEST



# ZONE II SOURCE No. 221A

LANDFORM AND LOCATION:

Four kames located on the east side of Yaya Lake,

about 3 miles north of Tununuk Point.

MATERIAL:

SAND - and silt

VOLUME:

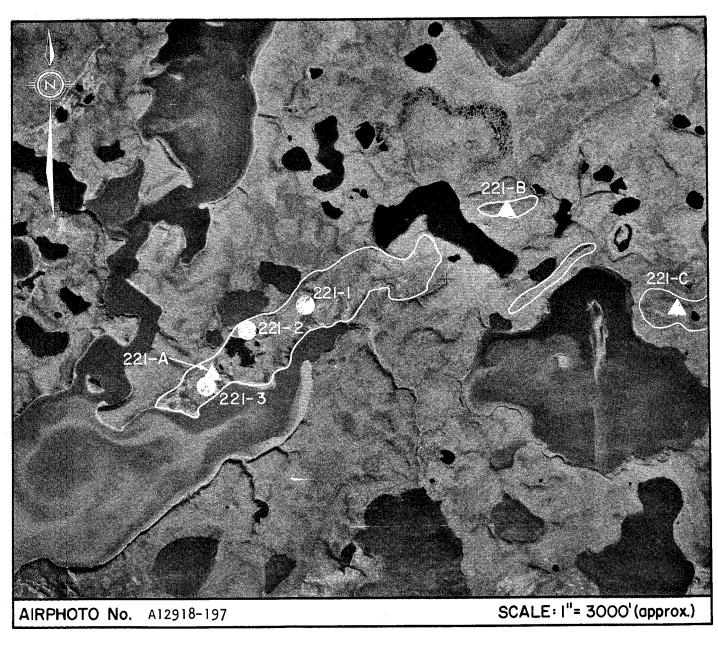
--

CONCLUSION:

Source is not recommended for development

because of massive ice encountered in the

landforms.



#### 221A ENVIRONMENT

## Phys ical

This source is a kame field located on the east side of Yaya Lake, about 9 miles north of Tununuk Point. The source area is about 3 miles long and 1 mile wide and contains 4 separate kames or kame fields, the main one being an area 1 mile long by 1,500 feet wide adjacent to the lake. The topography is hillocky, with a maximum relief above lake level of 150 feet. Some of the kames stand 75 feet high.

Drainage over the area is good, and ice was encountered at depths of 3 and  $3\frac{1}{2}$  feet during the September reconnaissance. The source has not been developed.

### Biotic

Much of the surface of this feature is bare of vegetation, but elsewhere, moss and a few dwarf shrubs are found.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

Yaya Lake is a popular area, used for camping, boating, and fishing. One lodge has been built on the lake, and the trout fishing is said to be excellent.

# 221A MATERIALS AND QUANTITIES

This source is very erratic with a prevalence of massive ice. Only 1 of the 3 test pits contains significant granular material, the other two being too silty and too fine.

Test Hole #1 penetrated ice from a depth of 3 inches to 30 feet.

Test Hole #2 encountered ice beneath 4 feet of clean sand. Test

Hole #3 penetrated 6 feet of frozen silt and silty sand before

reaching clean sand, then struck frozen silt again at 12 feet depth.

No volume of recoverable material has been calculated for this source.

#### 221A DEVELOPMENT

### General

This source is not recommended for development. In spite of many surface exposures of granular material, the deposit is generally low in quality and very high in ice content.

The environmental problems of restoring such an ice-rich area are formidable.

### Access

This area can be reached by truck in winter and by small barge in summer. Tununuk Point is only 9 miles away by a route following Yaya Lake to the channels of the Delta.

# Material Use and Handling

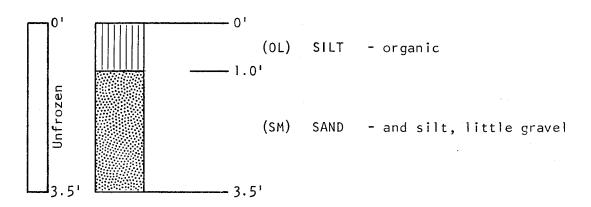
The material from this source is generally silty and unsuitable for use in construction.

# Stripping and Restoration

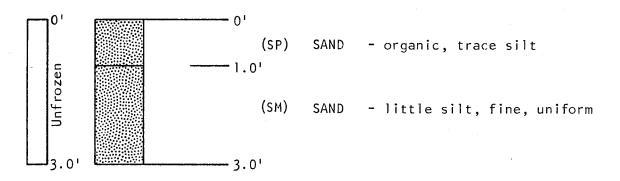
If development of this source were attempted, serious thermal erosion problems could result, necessitating costly and difficult restorative measures.

# TEST PIT LOGS SOURCE No. 221A

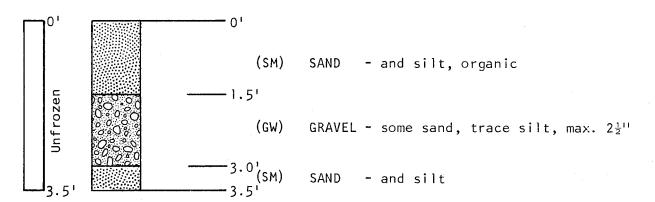




### 221A-B

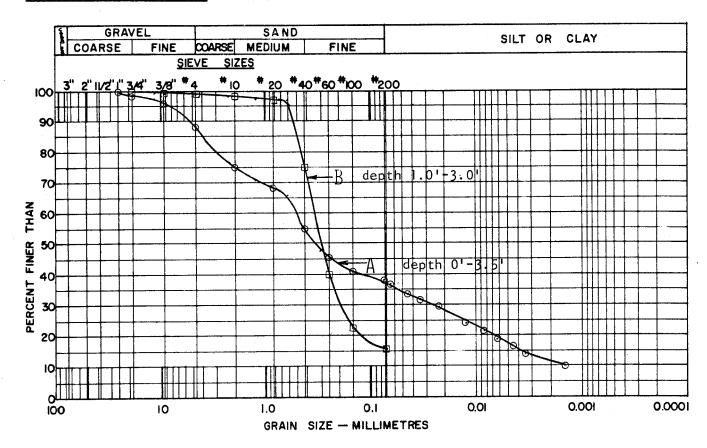


### 221A-C



# LABORATORY TEST DATA SOURCE No.221A

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

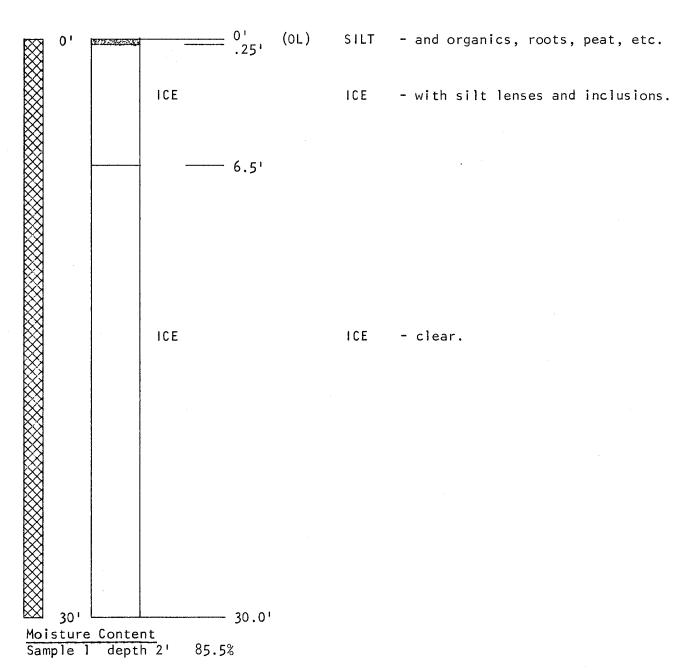
Pit A depth 0'-3.5' 11.5% Pit B depth 1'-3.0' 8.8%

ORGANIC CONTENT

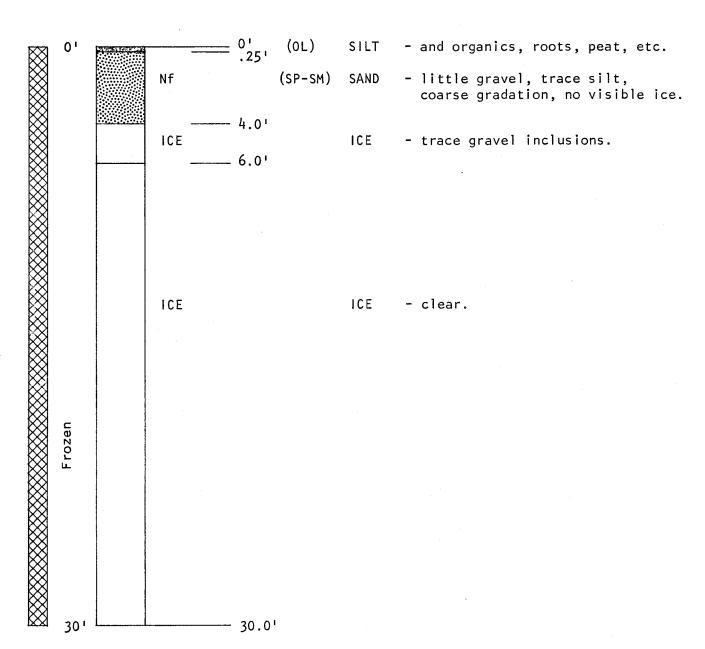
HARDNESS TEST

# TEST HOLE LOGS SOURCE No. 221A



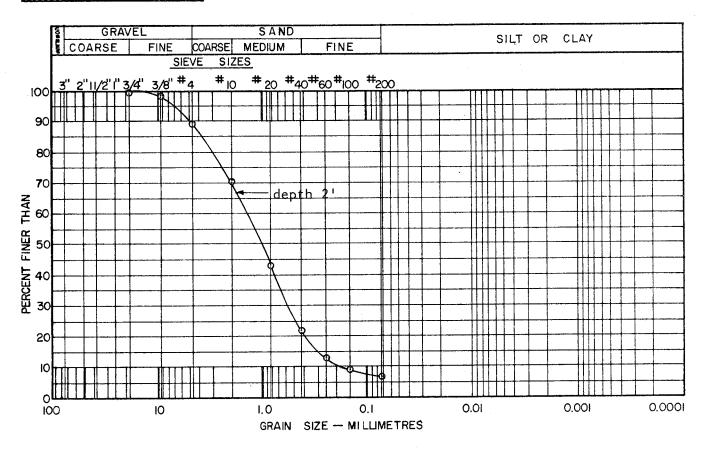


221A-2



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 221A-2

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

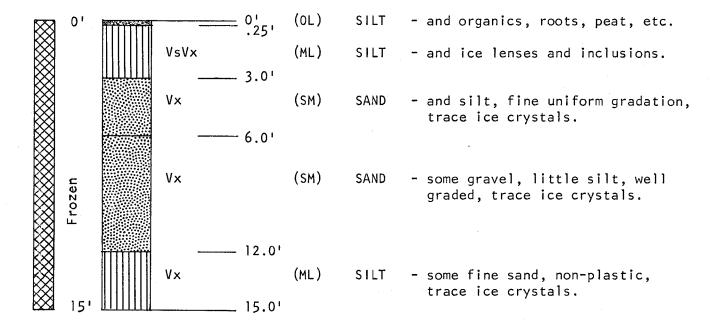
Sample 1 depth 2' 11.5%

ORGANIC CONTENT

HARDNESS TEST

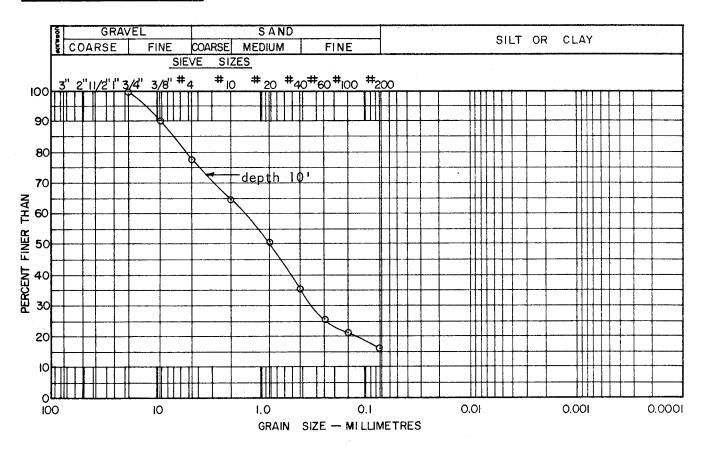
# TEST HOLE LOGS SOURCE No. 221A

221A-3



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 221A-3

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

Sample 1 depth 2' 49.5% Sample 2 depth 5' 22.7% Sample 3 depth 10' 14.0% Sample 4 depth 15' 16.7%

ORGANIC CONTENT

HARDNESS TEST

# ZONE II SOURCE No. 222

LANDFORM AND LOCATION:

MATERIAL:

VOLUME:

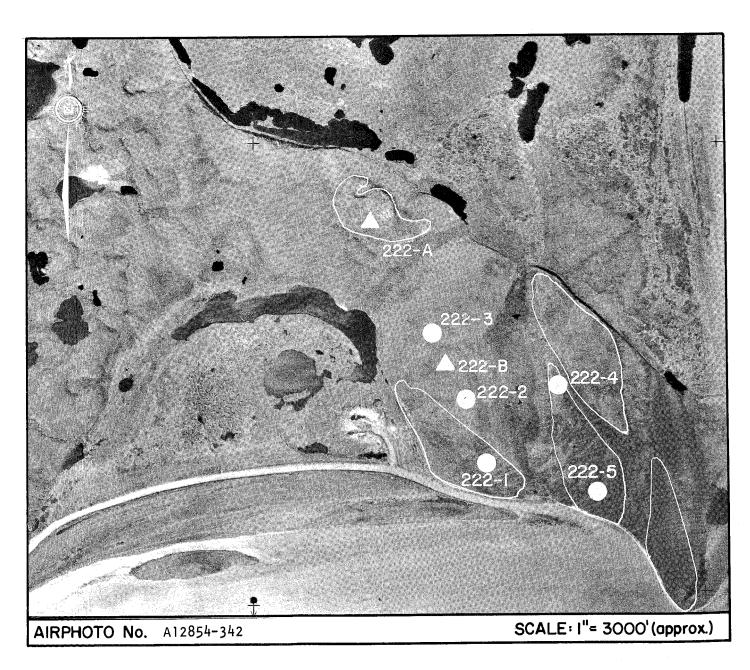
CONCLUSION:

Terrace and bar remnants at Swimming Point about 10 miles northeast of Tununuk Point.

SAND - some gravel, trace silt

10,000,000 cubic yards

Source is suitable for a large scale development. However, since the test holes indicated a variation in depth of overburden and percentage of silt, additional drilling should be carried out before a development commences.



#### 222 ENVIRONMENT

### Physical

This source is terrace and bar remnants at Swimming Point, about 10 miles northeast of Tununuk Point. The area is 3 miles long by  $1\frac{1}{2}$  miles wide, and stands 20 to 30 feet above river level.

An oil company have constructed a permanent camp and landing strip at Swimming Point. Almost all granular materials required in the construction of this base camp were obtained from Yaya Lake, at Source 223.

Drainage over the source is good, and a small volume of materials has been excavated from the riverbank in connection with the work described above. Ice wedges can be seen in this area.

### Biotic

The vegetative cover over the area is mostly moss and scattered dwarf shrubs, generally thin in exposed areas and heavier in the swales.

This source lies within the Mackenzie Reindeer Grazing Reserve, and may become part of the summer range of the Reindeer Herd and of the barren-land caribou.

The source lies in a major waterfowl staging area, and of course the whole Delta is occupied each year for breeding.

Swimming Point is the traditional crossing point in the barren-ground caribou migration, a point that was most important to the native population. A number of corrals and holding pens can still be seen in the area.

### 222 MATERIALS AND QUANTITIES

The materials in this source consist of interbedded gravel, sand, and silt as shown by the descriptions of the following test holes.

Test Hole #1 penetrated strata containing silt, sand, silt, sand, gravel, and sand in that order, a series that would be difficult to separate in a pit.

Test Hole #2 penetrated  $13\frac{1}{2}$  feet of sand with varying amounts of gravel and a trace of silt. At depth the material averages 15% gravel, 72% sand, and 8% silt.

Test Hole #3 penetrated  $5\frac{1}{2}$  feet of organic silt before reaching dirty gravel, which in turn overlies clean sand.

Test Holes #4 and #5 both contain fine sand with a trace of silt.

The petrographic analysis of a sample of gravel taken from Test Hole #5 shows that the material is primarily quartzite (82%), soft sandstone (9%), and quartz (7%), with traces of chert, granite, and ironstone. In another test the sound rock totalled over 98%, the soft sandstone about  $1\frac{1}{2}$ %.

This source is estimated to contain about 10,000,000 cubic yards, based on a recoverable depth of 15 feet over selected areas.

#### 222 DEVELOPMENT

#### General

This source is suitable for large-scale development. The material can be used as general fill if some care is taken to avoid the silt. With further care material can probably be located that is suitable for use in concrete and asphalt.

A more detailed investigation is required to define the areas of good material.

#### Access

This source is located beside the main barge route and trucking route serving the Delta, and material can be hauled from the source both summer and winter. Inuvik is about 60 miles to the south along the east channel of the Mackenzie River.

# Material Use and Handling

A large volume of general fill can be developed in this deposit by avoiding the concentrations of silt. Probably concrete aggregate can be produced also, but the volume must be determined by further investigation. In general, the deposit is sand with varying amounts of gravel and silt, and aggregate could be produced economically only in sections with a maximum amount of gravel and very little silt.

The equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader, and trucks, probably with a conveyor to load barges.

### Stripping and Restoration

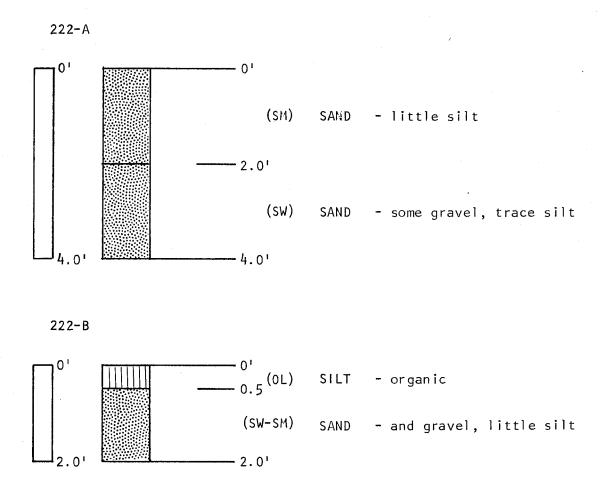
The depth of organic silt to be stripped may vary up to  $5\frac{1}{2}$  feet, and this material must be stockpiled for replacement after the granular material has been removed. The depleted areas must be graded to a smooth contour, and banks to a stable slope, before the topsoil is replaced.

The excavation should be kept back from the riverbank, in order to avoid the exposure of ground ice on a steep slope, with subsequent thawing and siltation.

Wherever necessary, strata of ice-rich silt must be removed and stockpiled where the material, on thawing, cannot drain to the River.

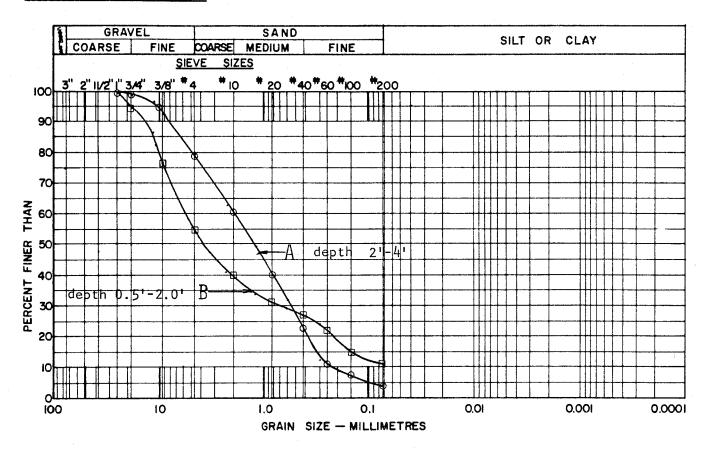
After a depleted area has been covered with topsoil it should be seeded for speedy revegetation, using a selection of plants and methods of preparation recommended by a specialist in Arctic horticulture.

# TEST PIT LOGS SOURCE No. 222



# LABORATORY TEST DATA SOURCE No. 222\_

# GRAIN SIZE DISTRIBUTION



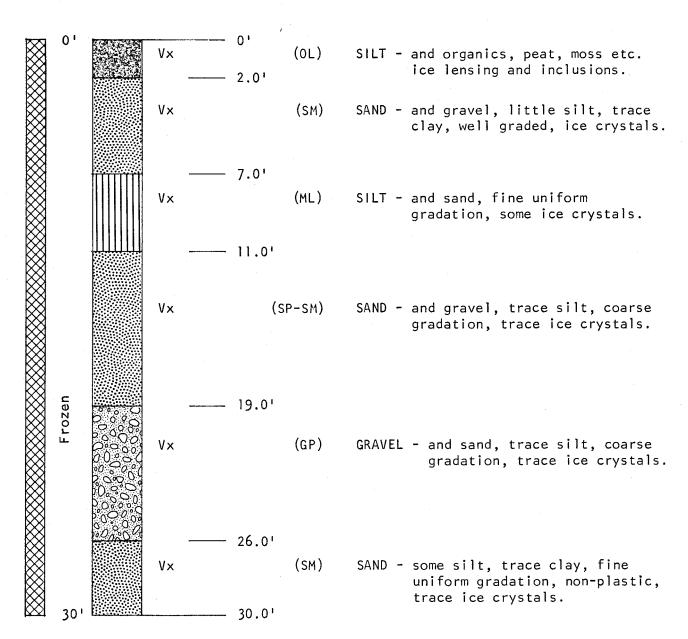
# MOISTURE CONTENT

Pit A depth 2.0' - 4.0' 3.2% Pit B depth 0.5' - 2.0' 9.0%

ORGANIC CONTENT

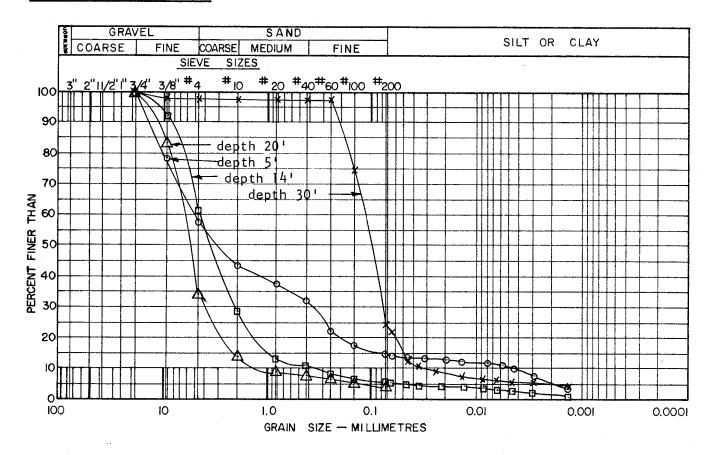
HARDNESS TEST

222-1



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 222-1

# GRAIN SIZE DISTRIBUTION



M	$\cap$	IST	UF	F	-co	Ni.	TEN	Т
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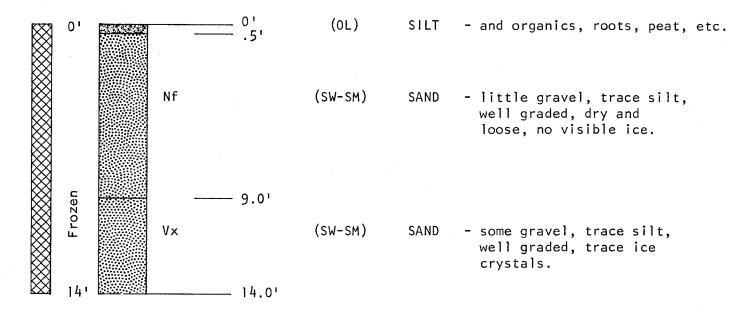
Sample	1	depth	2 '	42.9%
Sample	2	depth	5'	13.6%
Sample	3	depth	10'	20.7%
Sample	4	depth	14'	8.8%
Sample	5	depth	20'	5.7%

Sample 6 depth 30' 22.5%

# ORGANIC CONTENT

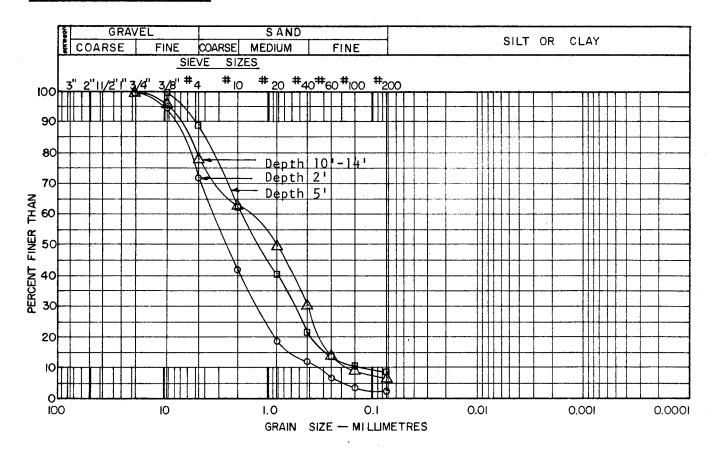
HARDNESS TEST





# LABORATORY TEST DATA TEST HOLE-SOURCE No. 222-2

# GRAIN SIZE DISTRIBUTION



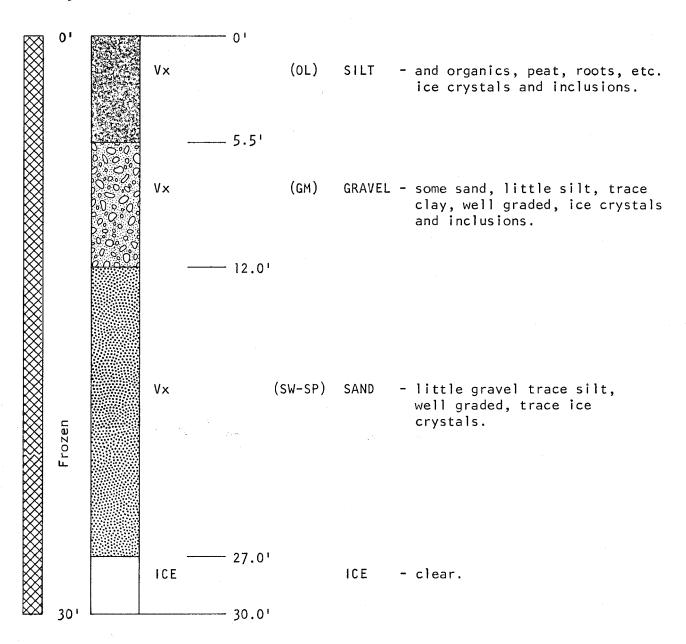
### MOISTURE CONTENT

Sample 1 depth 2' 7.6% Sample 2 depth 5' 5.3% Sample 3 depth 10' 10.8% Sample 4 depth 14' 12.1%

# ORGANIC CONTENT

HARDNESS TEST

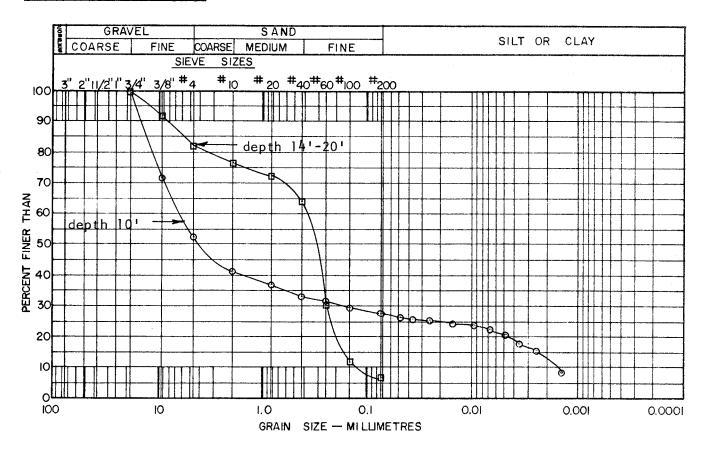




# LABORATORY TEST DATA

# TEST HOLE-SOURCE No. 222-3

# GRAIN SIZE DISTRIBUTION

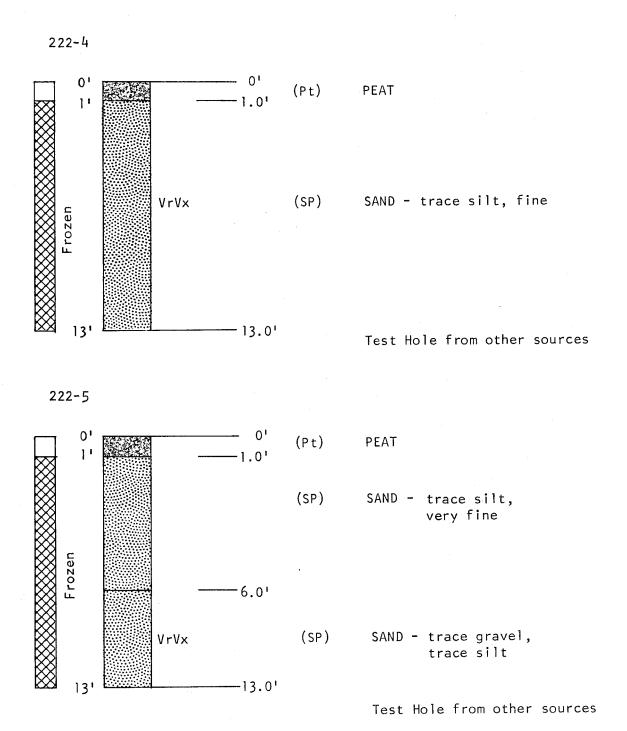


# MOISTURE CONTENT

Sample	1	depth	2 '	330.1%
Sample	2	depth	10'	12.5%
Sample	3	depth	14'	13.8%
Sample	4	depth	201	22.3%

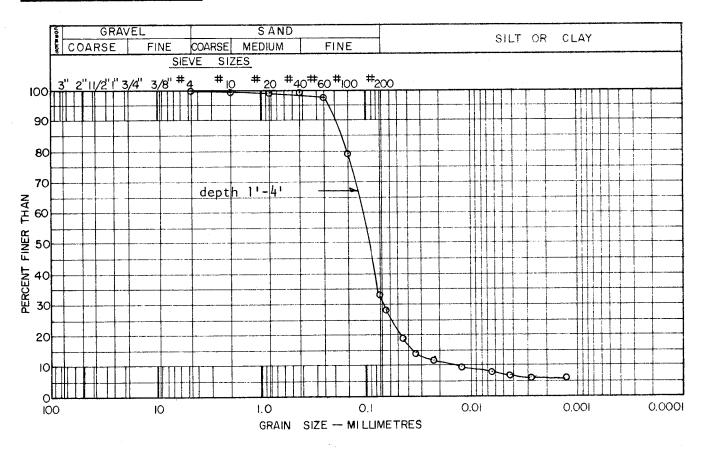
# ORGANIC CONTENT

HARDNESS TEST



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 222-4

# GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT
Sample 1 depth 1' - 4' 19.5%

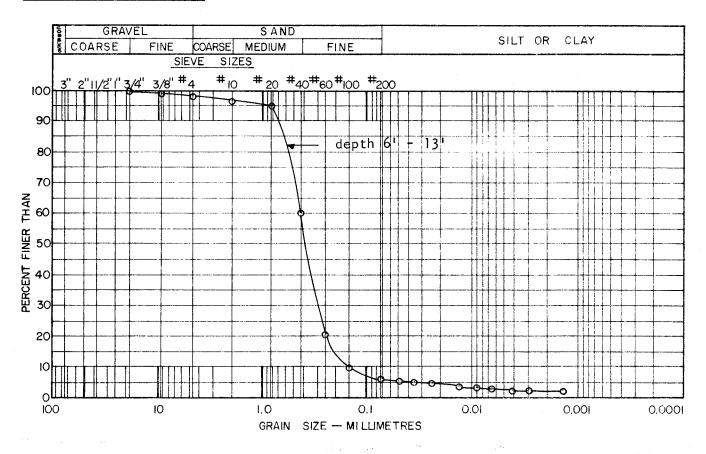
ORGANIC CONTENT

HARDNESS TEST

# LABORATORY TEST DATA

# TEST HOLE-SOURCE No. 222-5

# GRAIN SIZE DISTRIBUTION



# MOISTURE CONTENT

Sample 1 depth 6' - 13' 11%

# ORGANIC CONTENT

HARDNESS TEST

# PETROGRAPHIC ANALYSIS

Sample depth 6' - 13'

Quartzite - 82%

Sandstone - 9%

Quartz - 7%

Chert - 1%

Granite - 1%

Ironstone - neg.

Total

Ripley, Klohn & Leonoff International Ltd.

# ZONE II SOURCE No. 223

LANDFORM AND LOCATION:

CONCLUSION:

Esker-kame terrace complex between east

channel of Mackenzie River and Yaya Lake

about 7 miles north of Tununuk Point.

MATERIAL: GRA

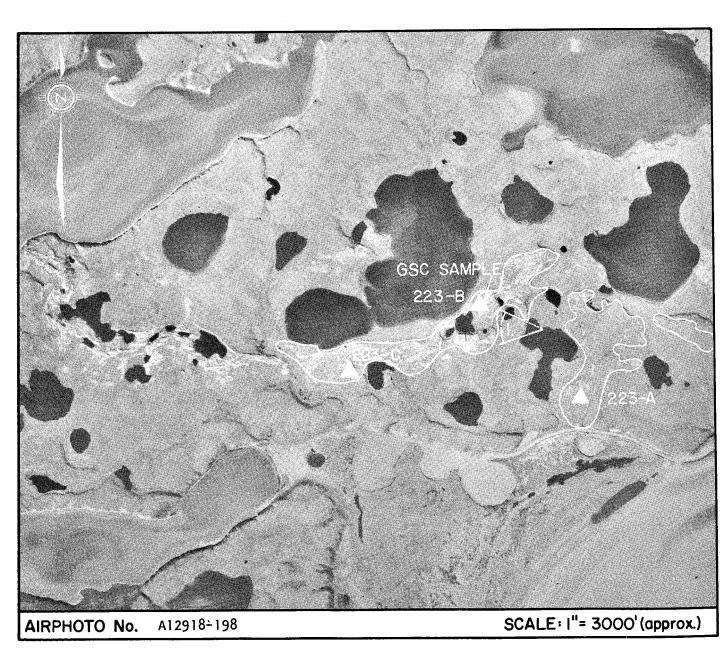
GRAVEL - and sand

VOLUME: 5,500,000 cubic yards

Source is suitable for development for

any use. A portion of the pit should be

reserved for aggregate production.



# 223 ENVIRONMENT

### Physical

This source is an esker-kame complex lying between the east channel of the Mackenzie River and Yaya Lake, 7 miles north of Tununuk Point. The source consists of three parts, an esker stretching to the west and 2 kame terraces at the eastern end. The topography should provide good surface drainage, but all three features are laced with the polygonal ground pattern indicative of high ice content.



Photo No. 1 - Source 223 - Aerial view looking west

The source has been developed for the construction of the large base camp at Swimming Point, although the volume of material removed is not known.

The pattern of polygonal ice formation can be traced in the excavated area by subsidence of the gravel.

#### Biotic

Most of this source area is bare of vegetation, but patches are covered with moss and dwarf shrub.

The source lies within the Mackenzie Reindeer Grazing Reserve, and

also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

Yaya Lake is a popular area, used for camping, boating, and fishing. One lodge has been built on the lake, and the trout fishing is said to be excellent.

# 223 MATERIALS AND QUANTITIES

The materials in this source have been tested by the Geological Survey of Canada and by Ripley, Klohn & Leonoff International Ltd. over a period of years, and all grain size data are remarkably consistent. This is a deposit of gravel and sand in almost equal quantities with a trace of silt, ranging from 1% to 3%. The gravel is graded to a maximum size of 3 inches.

A petrographic analysis of gravel from Source 224, the western extension of Source 223, shows the material to be sound, with the main components being quartzite (59%), and quartzite and pyrite in combination (33%), with soft sandstone (4%), quartz (3%), and chert (1%) making up the remainder.

The source was not drilled, so the moisture content at depth is not known. During the current pit operation, however, a substantial area has been excavated to a depth of 15 or 20 feet.

The volume of material remaining in this source is estimated to be 5,500,000 cubic yards.

#### 223 DEVELOPMENT

#### General

Part of this source should be reserved for the supply of specification granular material such as concrete and asphalt aggregate.

Large volumes of general fill can be developed elsewhere, but few deposits in the Richards Island area contain material of such high quality.

A crushing and screening plant is required to produce aggregate without wastage.

### Acces s

The source is about 6 miles by road from Swimming Point,  $l_2^{\frac{1}{2}}$  miles from the east channel, and 2 miles from a barge-loading point on Yaya Lake. Only the last point can be reached in summer as well as in winter.

# Material Use and Handling

This source contains high-quality aggregate, suitable with ordinary processing for use in concrete and asphalt construction.

Although the surface of the deposit can be excavated without ripping, most of the material must be ripped, stockpiled, thawed, and drained before processing and shipping.

The equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader, and trucks. Production of aggregate will require a crushing and screening plant, with a conveyor system for stockpiling, reclamation, and loading.

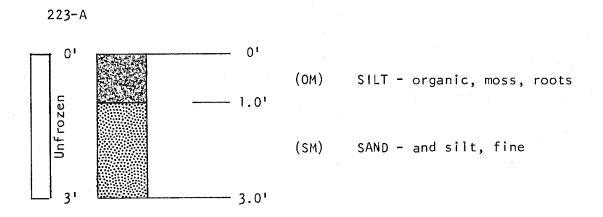
# Stripping and Restoration

Very little stripping is required at this source, but any material removed must be stockpiled for replacement after the granular material has been excavated. The depleted areas must be graded to a smooth contour and all banks to a stable slope, before topsoil is replaced and an area abandoned.

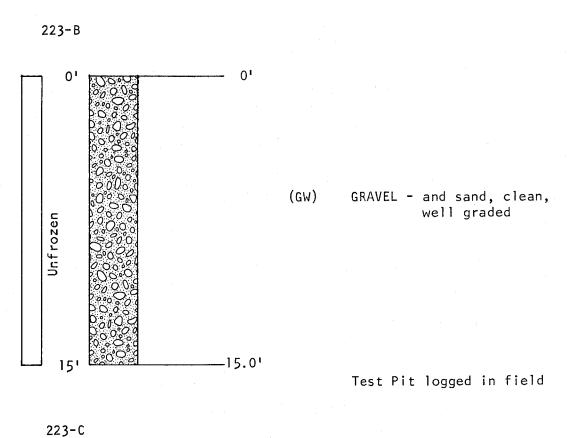
All stockpiles of frozen material must be located so that, in thawing, the drainage cannot enter Yaya Lake or streams flowing to it.

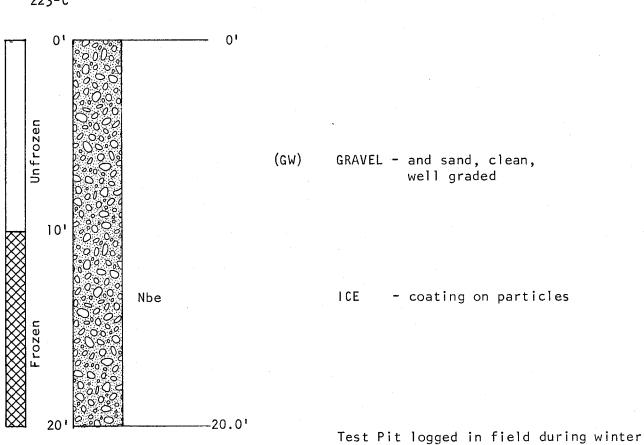
Massive ice must not be left exposed wherever the drainage could lead to the siltation of Yaya Lake.

# TEST PIT LOGS SOURCE No. 223



## TEST HOLE LOGS SOURCE No. 223

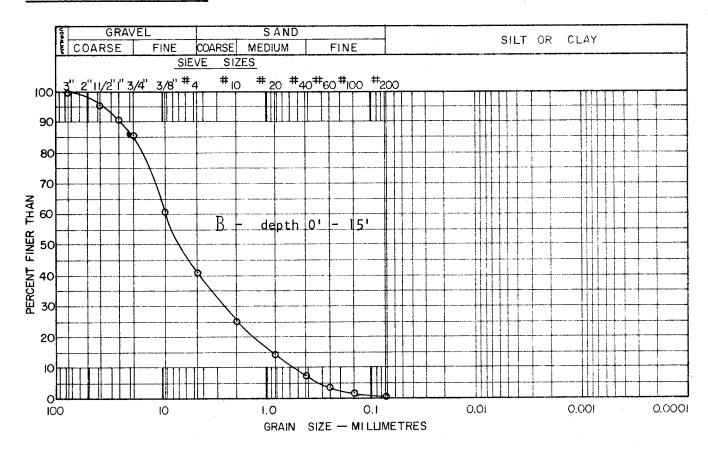




Ripley, Klohn & Leonoff International Ltd.

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 223-B

#### GRAIN SIZE DISTRIBUTION



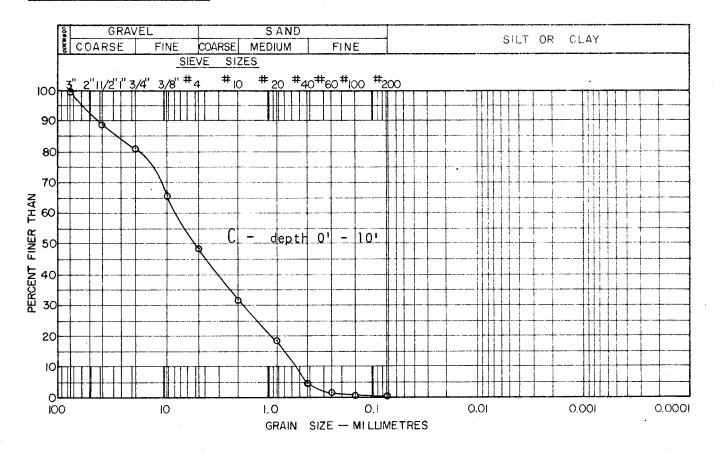
MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 223-C

#### GRAIN SIZE DISTRIBUTION



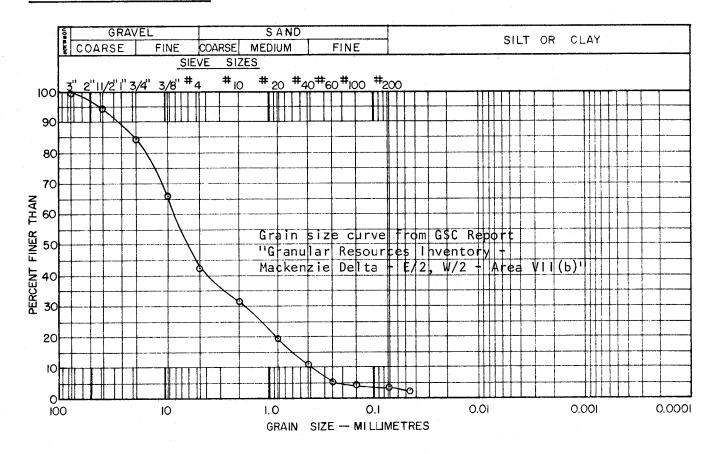
#### MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

# LABORATORY TEST DATA TEST PIT-SOURCE No. 223-GSC

#### GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

### ZONE II SOURCE No. 224

LANDFORM AND LOCATION: Esker on south shore of Yaya Lake about

7 miles north of Tununuk Point.

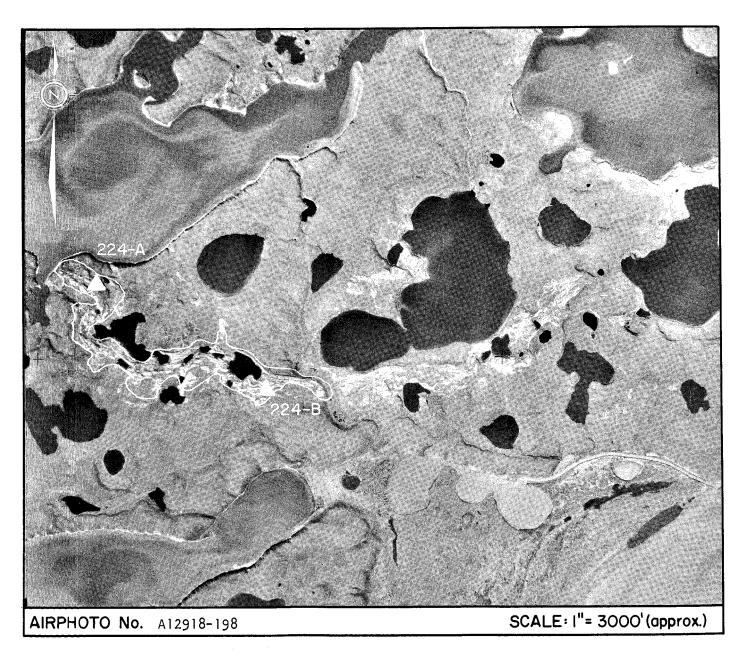
MATERIAL: GRAVEL - and sand

VOLUME: 2,500,000 cubic yards

CONCLUSION: Source is suitable for development for

any use. A portion of the pit should be

reserved for aggregate production.



#### 224 ENVIRONMENT

#### Physical

This source is an esker, the western extension of Source 223, located on the south shore of Yaya Lake 7 miles north of Tununuk Point. This esker, known locally as the Yaya Esker, extends for two miles and stands as much as 150 feet above lake level. Some kames appear to be associated with the esker.

The topography encourages good surface drainage, but the polygonal ground pattern indicates ice at a shallow depth.

The oil company based at Tununuk Point have excavated a considerable volume of gravel from this source. It is generally regarded as the best material available on Richards Island, and has been excavated for projects many miles away.

#### Biotic

Most of this source area is bare of vegetation, but patches are covered with moss and dwarf shrub.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

Yaya Lake is a popular area, used for camping, boating, and fishing. One lodge has been build on the lake, and the trout fishing is said to be excellent.

#### 224 MATERIAL AND QUANTITIES

This source was examined in an operative pit, and samples taken from a face 20 feet high. The gravel content varies from 50% to 60% and sand from 40% to 50%, with less than 2% silt. All sand and gravel are well-graded to a maximum size of 3 inches.

A petrographic analysis of this gravel shows the material to be sound, with the main components being quartzite (59%), and quartzite and pyrite in combination (33%), with quartz (3%), chert (1%), and

soft sandstone (4%) making up the remainder.

The source was not drilled, so the moisture content at depth is not known. During the current pit operation, however, a substantial area has been excavated to a depth of 15 or 20 feet.

The estimated volume of material remaining in this source is 2,500,000 cubic yards.

#### 224 DEVELOPMENT

#### General

Part of this source should be reserved for the supply of specification material such as concrete and asphalt aggregate. Large volumes of general fill can be developed elsewhere, but few deposits on Richards Island contain material of such high quality.

A crushing and screening plant is required to produce aggregate without wastage.

#### Access

Winter roads connect this source to Tununuk and to Swimming Point. Material can also be loaded to small barges in Yaya Lake for transport anywhere in the Delta.

#### Material Use and Handling

This source contains high-quality aggregate, suitable with ordinary processing for use in concrete and asphalt construction.

Although the surface of the deposit can be excavated without ripping, most of the material must be ripped, stockpiled, thawed, and drained before processing and shipping.

The equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

Production of aggregate will require a crushing and screening plant, with a conveyor system for stockpiling, reclamation, and loading.

#### Stripping and Restoration

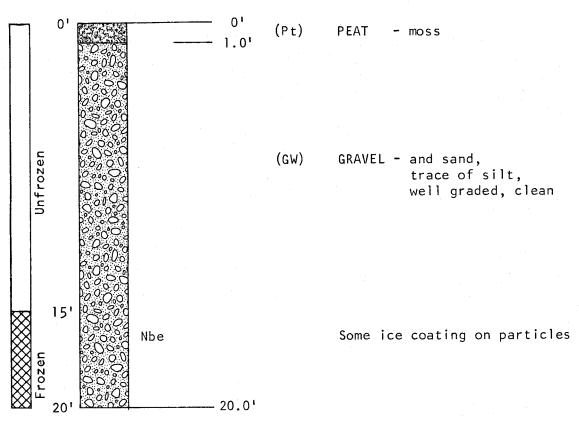
Very little stripping is required at this source, but any material removed must be stockpiled for replacement after the granular material has been excavated. The depleted areas must be graded to a smooth contour and all banks to a stable slope, before topsoil is replaced and an area abandoned.

All stockpiles of frozen material must be located so that, in thawing, the drainage cannot enter Yaya Lake or streams flowing to it.

Massive ice must not be left exposed wherever the drainage could lead to the siltation of Yaya Lake.

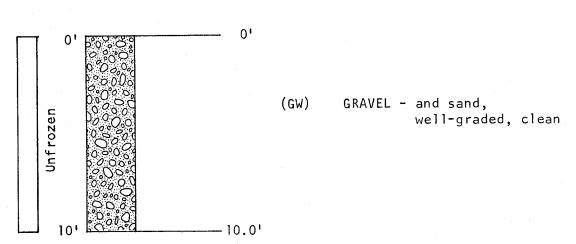
## TEST PIT LOGS SOURCE No. 224





Exposure logged in field

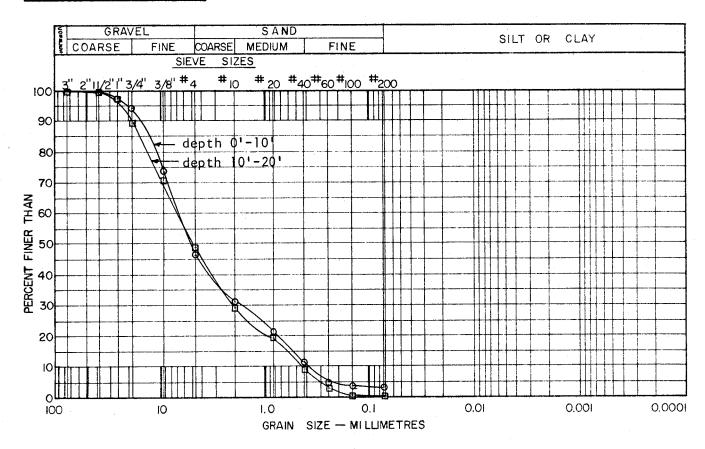
224-B



Exposure logged in field

# LABORATORY TEST DATA TEST PIT-SOURCE No. 224-A

#### GRAIN SIZE DISTRIBUTION



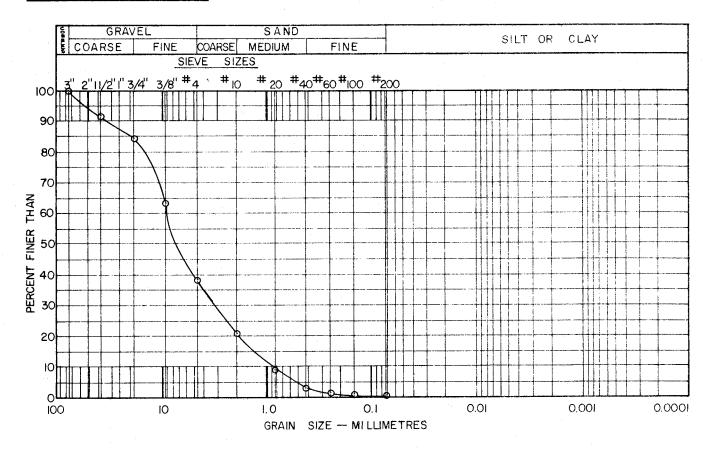
#### MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 224-B

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

ORGANIC CONTENT

HARDNESS TEST

Quartzite	-	59%
Quartzite and pyrite	-	33%
Sandstone(soft)	_	4%
Quartz	_	3%
Chert	-	1%
Takal	·	
Total		100%

### ZONE II SOURCE No. 225

LANDFORM AND LOCATION:

VOLUME:

CONCLUSION:

Esker adjacent to south shore of Yaya Lake,

about 7 miles north of Tununuk Point.

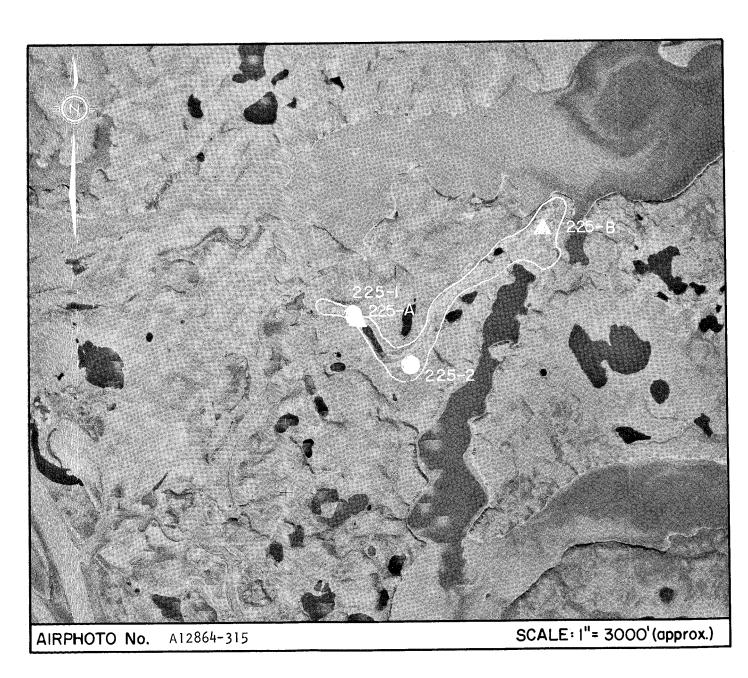
MATERIAL: SAND - and gravel, trace silt

1,000,000 cubic yards

Source is suitable for development, but

is more variable in silt content than either Source 223 or Source 224, and therefore the source should be investigated further before

excavation is attempted.



#### 225 ENVIRONMENT

#### **Physical**

This source is the western extremity of the Yaya Esker on which are located Sources 223 and 224. It is 7 miles north of Tununuk Point and close to the south shore of Yaya Lake. The esker is rounded and irregular, and about 200 to 500 feet wide.

Drainage over the source is good, and the source has not been developed.

#### Biotic

Most of this source area is bare of vegetation, but patches are covered with moss and dwarf shrub.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

Yaya Lake is a popular area, used for camping, boating and fishing. One lodge has been built on the lake, and the trout fishing is said to be excellent.

#### 225 MATERIALS AND QUANTITIES

The 2 test pits excavated in this source indicated clean sand and gravel, well-graded to a maximum size of  $2\frac{1}{2}$  inches. Test Hole #1, located near one of the test pits, penetrated 7 feet of frozen silt, then encountered massive ice.

Test Hole #2 penetrated 3 feet of silt, then 6 feet of sand and gravel, then silt once again. The sand and gravel contained variable amounts of silt to a maximum of 15%, and about 10% moisture. Another hole was attempted beside Test Hole #2 on a small hillock, but the drill encountered clean sand and gravel that sloughed badly after a few feet and the hole could not be completed.

The gravel from Test Pit A was subjected to petrographic analysis, and consists primarily of quartzite (77%), and chert (21%), with

small amounts of granite, soft sandstone and shale, and fine hard sandstone. The chert may be reactive and further tests are necessary before the gravel can be recommended for use in concrete. Pending these tests any concrete made with this gravel should be made with cement containing less than 0.6% alkali.

Gravel is exposed on nearly all hillocks on this source. The depth is unknown, but by comparison with Source 224 can be expected to be over 20 feet.

Assuming a recoverable depth of 10 feet over 75% of the area, the volume of recoverable material is about 1,000,000 cubic yards.

#### 225 DEVELOPMENT

#### <u>General</u>

This source should be developed in conjunction with Sources 223 and 224, and probably after they are depleted. The source contains satisfactory material, but the deposit is more erratic and the silt content is higher.

#### Access

This source is accessible by barge in summer and by truck in winter, in the same way as Sources 223 and 224.

#### Material Use and Handling

The material in this source is suitable for general fill, and selected parts can be developed for use in concrete and asphalt.

The maximum particle size is 3 inches, suitable for general fill.

Undoubtedly most of the material must be ripped, stockpiled, thawed, and drained before shipping.

The equipment required for this development is the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

#### Stripping and Restoration

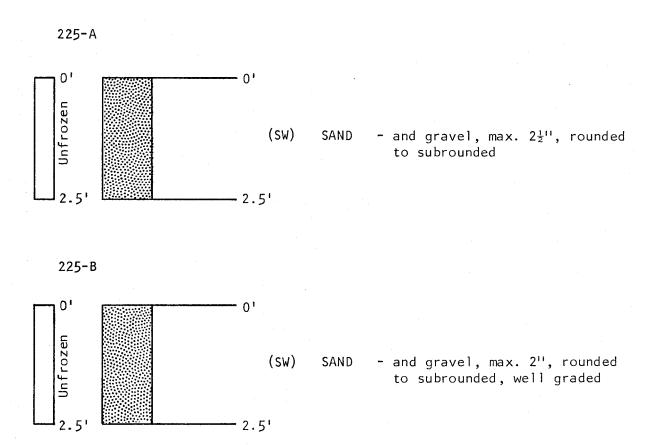
Very little stripping is required at this source, but any material removed must be stockpiled for replacement after the granular

material has been excavated. The depleted areas must be graded to a smooth contour and all banks to a stable slope, before topsoil is replaced and an area abandoned.

All stockpiles of frozen material must be located so that, in thawing, the drainage cannot enter Yaya Lake or streams flowing to it.

Massive ice must not be left exposed wherever the drainage could lead to the siltation of Yaya Lake.

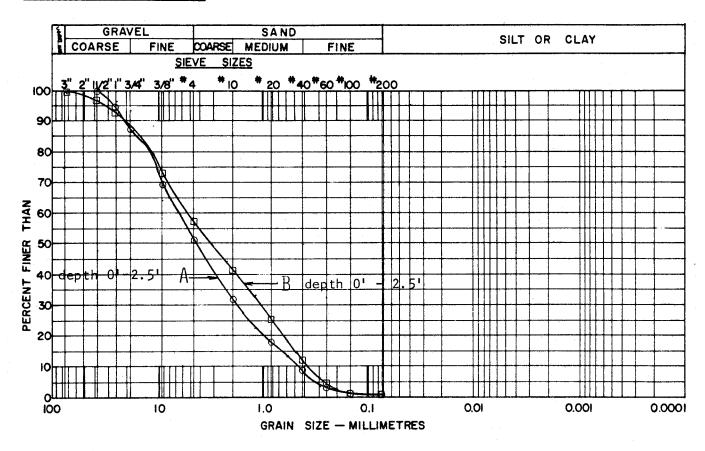
# TEST PIT LOGS SOURCE No. 225



## LABORATORY TEST DATA

### SOURCE No. 225

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Pit A depth 0'-2.5' 1.8% Pit B depth 0'-2.5' 3.2%

#### ORGANIC CONTENT

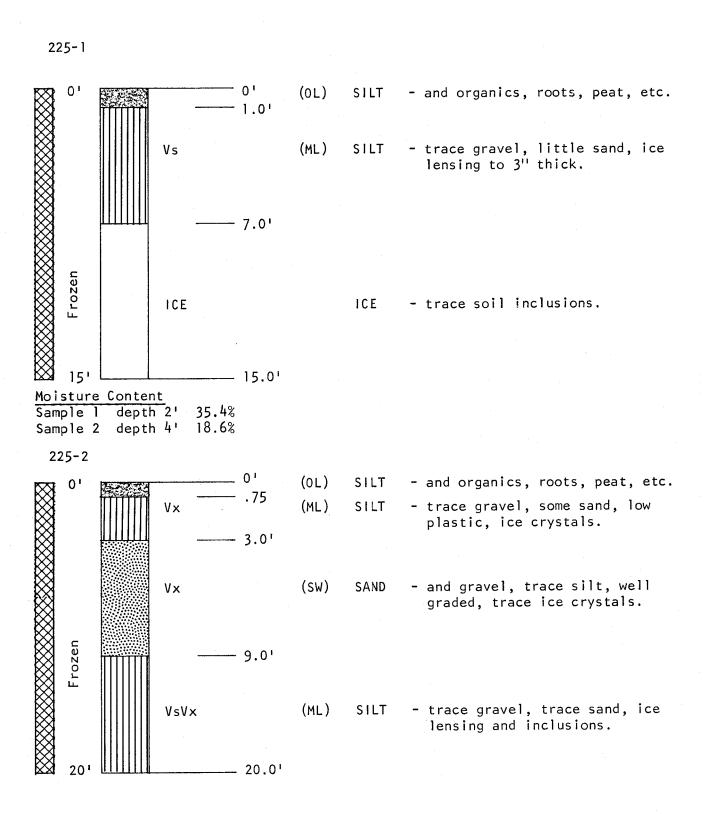
#### HARDNESS TEST

#### PETROGRAPHIC ANALYSIS

Test Pit A depth 0'-2.5'

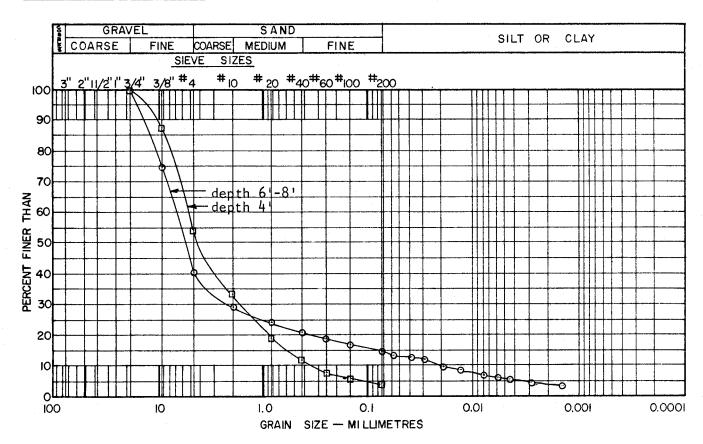
Quartzite	- 77%	Granite	Neg.
Chert	- 21%	Sandstone(soft)	Neg.
Sandstone(hard)	- 1%		1.000
Shale(soft)	- 1%	Total	100%

## TEST HOLE LOGS SOURCE No. 225



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 225-2

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Sample 1 depth 2' 17.2% Sample 2 depth 4' 8.0% Sample 3 depth 6' 9.6% Sample 4 depth 8' 10.2% Sample 5 depth 10' 58.9%

ORGANIC CONTENT

HARDNESS TEST

### ZONE II SOURCE No. 226

LANDFORM AND LOCATION:

Esker-kame complex, located 6 miles

northwest of Tununuk Point.

MATERIAL:

SAND - some gravel

GRAVEL - and sand

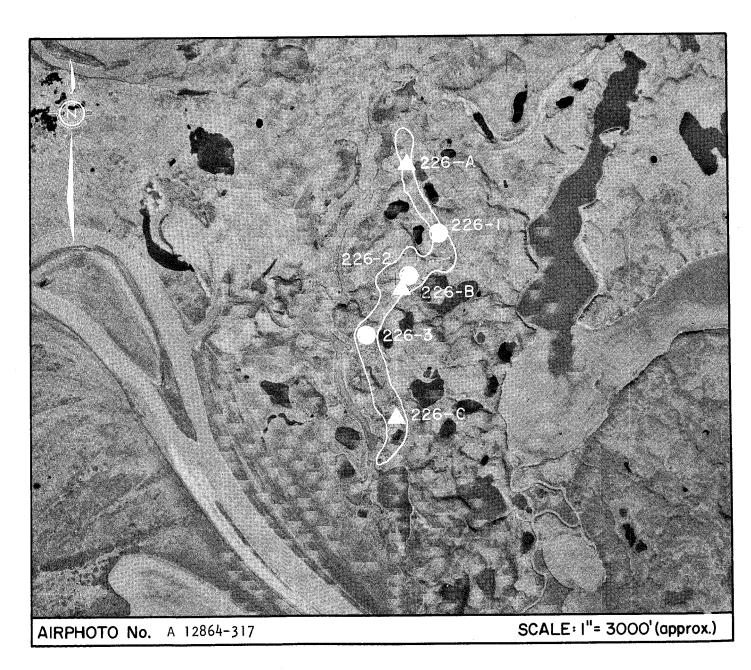
**VOLUME:** 

400,000 cubic yards

CONCLUSION:

Source is suitable for development, but

generally the material is poorer quality than is available in Sources 223 and 224.



#### 226 ENVIRONMENT

#### Physical

This source is an esker-kame complex located 6 miles northwest of Tununuk Point. The source area is about 2 miles long, extending along the east side of the narrow channel leading to Yaya Lake. The surface is irregular, with hillocks as much as 100 feet above the surrounding plain, and contains a number of perched ponds.

Drainage of the individual hillocks is good, although the ponds indicate poor drainage over the source area. The source has not been developed.

#### Biotic

Much of the area is bare of vegetation, but patches are covered by moss and grass. The margins of ponds and drainage courses also support small dwarf shrubs.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important water fowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

#### 226 MATERIALS AND QUANTITIES

Three test pits and 4 test holes were placed in this source, and the results indicate a wide variation in material quality.

Test Pit A contained a clean, well-graded mixture of gravel (60%) and sand (40%) to a depth of 4 feet.

Test Pit B penetrated 2 feet of silt and sand, then sand to a depth of 3 feet. Test Pit C penetrated sand, then gravel, to a depth of  $3\frac{1}{2}$  feet.

Of the 4 test holes, the first penetrated 17 feet of sand with varying amounts of gravel and silt.

Test Hole #2 penetrated 27 feet of good granular material, including 6 feet of sand and 21 feet of gravel containing 30% to 70% gravel,

30% to 65% sand, and 0 to 5% silt.

Test Hole #3 penetrated 6 feet of silty gravel before striking massive ice, but Test Hole #4 was all sand and gravel, grading 35% gravel, 60% sand, and 5% silt, to a depth of 15 feet.

The gravel from Test Pit A was subjected to a petrographic analysis, and was found to be mostly quartzite (48%), chert (34%), and quartz (12%), with opal (3%), dolomite (2%), and sandstone making up the remainder. This material cannot be recommended for use in concrete without extensive tests for the reactivity of the large content of chert and opal.

The moisture content at depth varied from 5% to 10% in the sand and gravel.

Because of the erratic nature of this source, the volume of recoverable material is difficult to calculate, but will probably exceed 400,000 cubic yards.

#### 226 DEVELOPMENT

#### General

This source should be considered in conjunction with Sources 223, 224, and 225. Although it contains some good material, the source is more erratic than any of the other three.

Probably the source should be developed for the supply of general fill, as the gravel that was tested is probably not suitable for concrete aggregate.

#### Access

This source is accessible by barge in summer and by truck in winter. A short all-weather road can be constructed to a barge-loading point on the channel leading to Yaya Lake, from where small barges have ready access in any direction. The channel is on the most direct route from Tununuk Point to Farewell Camp.

#### Material Use and Handling

The material in this source is a good grade of general fill, generally clean or with a minor amount of silt. Some areas contain concentrations of silt, and must be avoided. The source should be investigated more thoroughly before any development is started in order to define the areas of suitable material.

The majority of material excavated in this source must be ripped, stockpiled, thawed, and drained before shipping.

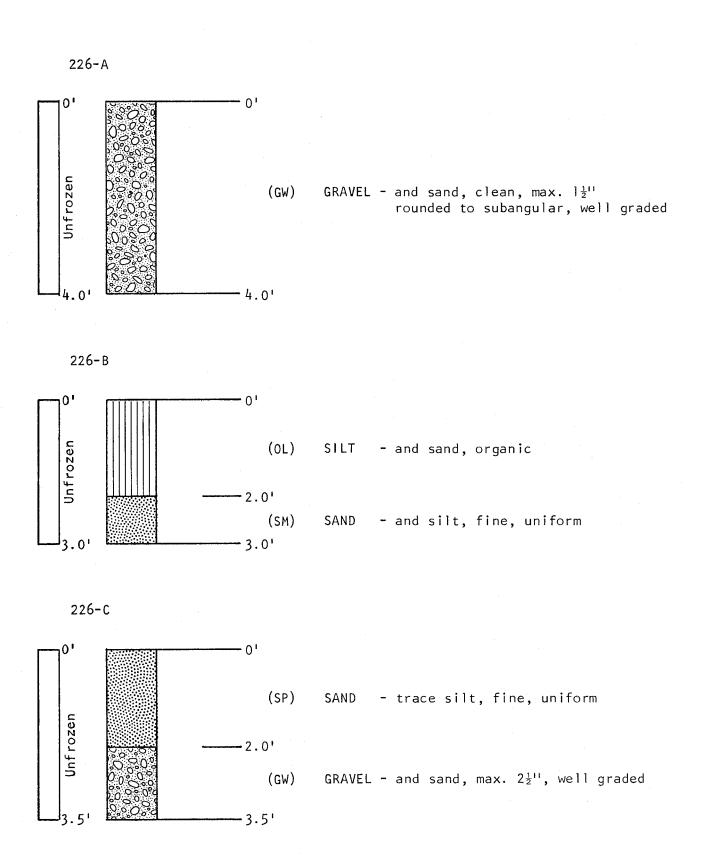
#### Stripping and Restoration

Very little stripping is required at this source, but any material removed must be stockpiled for replacement after the granular material has been excavated. The depleted areas must be graded to a smooth contour, and all banks to a stable slope, before topsoil is replaced and an area abandoned.

All stockpiles of frozen material must be located so that, in thawing, the drainage cannot enter the natural drainage system.

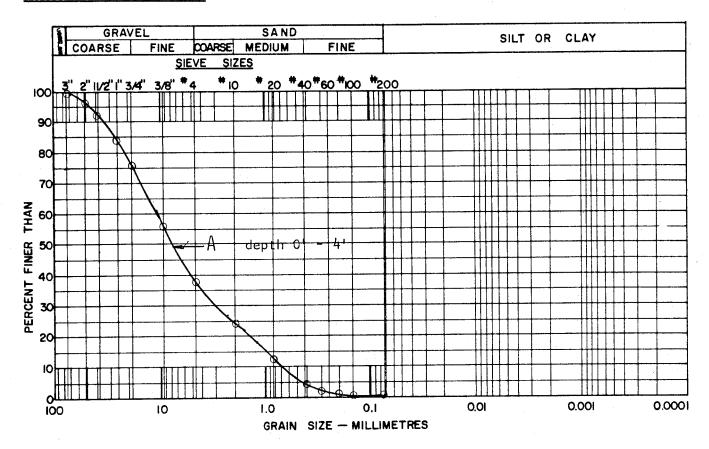
Massive ice must not be left exposed wherever the drainage could lead to the siltation of local streams.

## TEST PIT LOGS SOURCE No. 226



# LABORATORY TEST DATA SOURCE No. 226

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Pit A depth 0' - 4'

1.9%

### ORGANIC CONTENT

#### HARDNESS TEST

### PETROGRAPHIC ANALYSIS

Pit A depth 0' - 4'

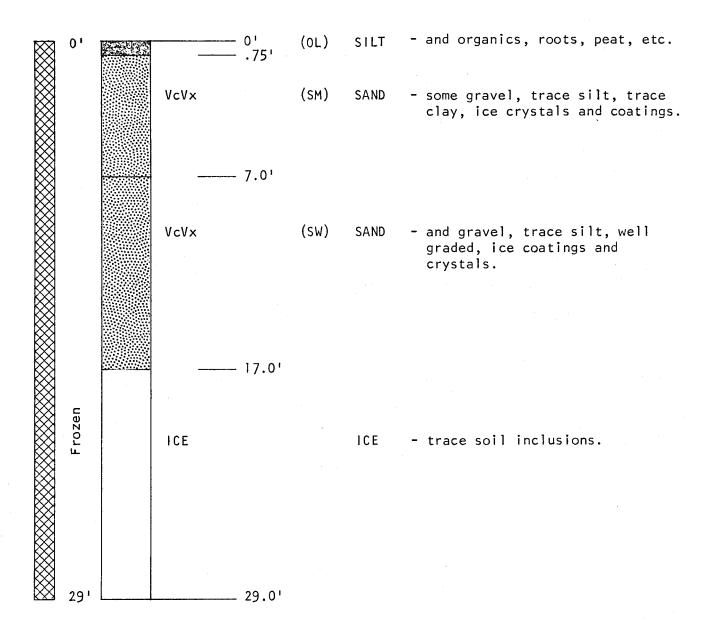
Quartzite - 48%
Chert - 34%
Quartz - 12%
Opal - 3%
Dolomite - 2%

Sandstone - 1%

Total 100%

## TEST HOLE LOGS SOURCE No. 226

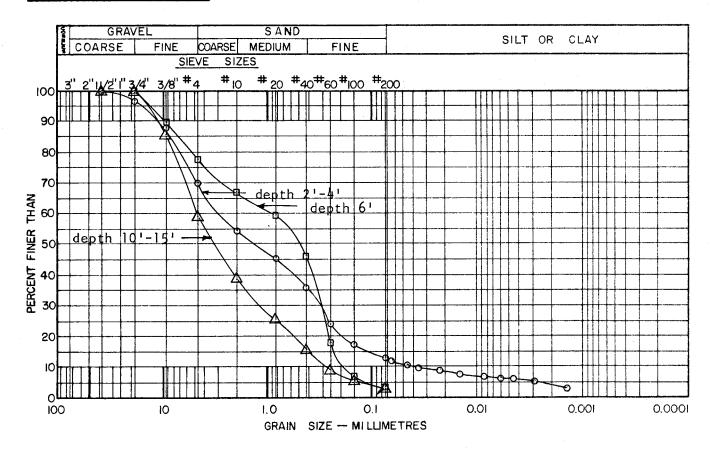
226-1



### LABORATORY TEST DATA

### TEST HOLE-SOURCE No. 226-1

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

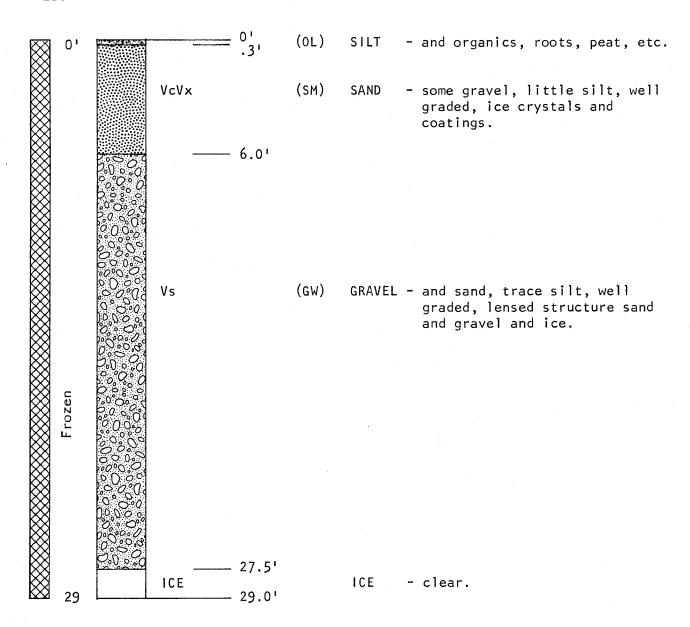
Sample	1	depth	2 '	9.4%
Sample	2	depth	4 '	10.5%
Sample	3	depth	61	16.3%
Sample	4	depth	10'	9.9%
Sample	5	denth	151	9.9%

#### ORGANIC CONTENT

HARDNESS TEST

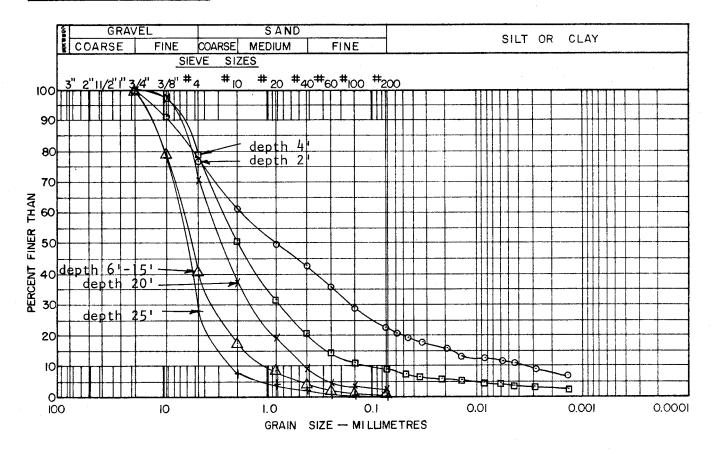
## TEST HOLE LOGS SOURCE No. 226

226-2



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 226-2

#### GRAIN SIZE DISTRIBUTION



Sample	1	depth	21	8.8%
				-
Sample	2	depth	4 '	10.0%
Sample	3	depth	61	5.4%
Sample	4	depth	ا 8	8.3%
Sample	5	depth	101	10.1%

HARDNESS TEST

Sample 6 depth 15'

Sample 7 Sample 8 depth 201

depth 25'

8.1%

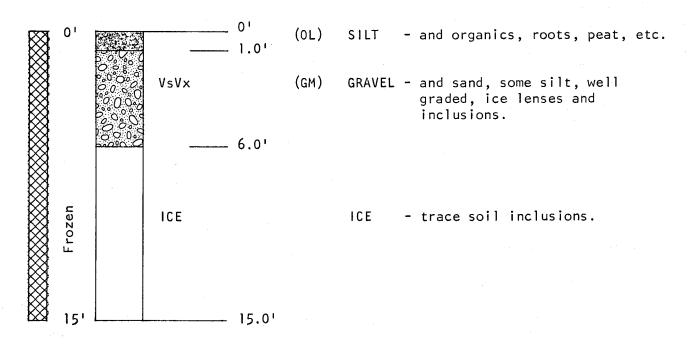
10.0%

5.7%

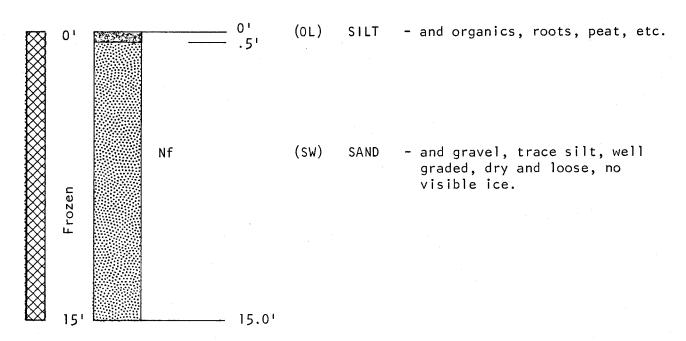
#### ORGANIC CONTENT

## TEST HOLE LOGS SOURCE No. 226

226-3

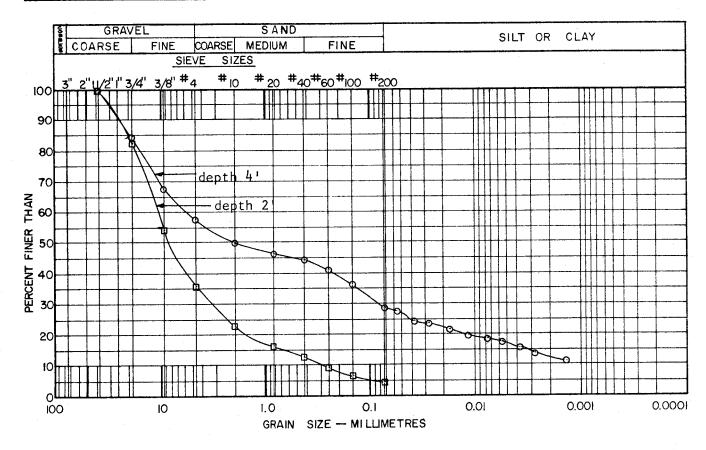


226-4



# LABORATORY TEST DATA TEST HOLE-SOURCE No. 226-3

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

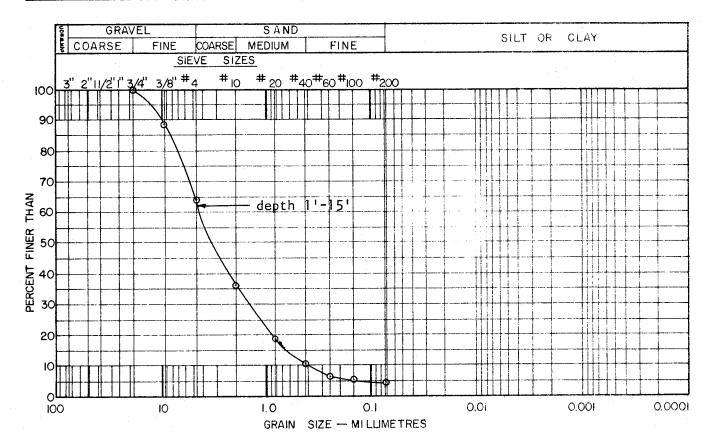
Sample 1 depth 2' 3.2% Sample 2 depth 4' 14.5%

ORGANIC CONTENT

HARDNESS TEST

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 226-4

#### GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT
Sample 1 depth 1' - 15' 4.6%

ORGANIC CONTENT

HARDNESS TEST

### ZONE II SOURCE No. 227

LANDFORM AND LOCATION:

Kame field west of Yaya Lake about 8 miles

north of Tununuk Point.

MATERIAL:

SAND - some gravel, trace silt

**VOLUME:** 

400,000 cubic yards

CONCLUSION:

AIRPHOTO No.

A12864-317

Source is rated low priority for development

because of great variation in materials and the massive ice which can be expected.

Ripley, Klohn & Leonoff International Ltd.

SCALE: 1"= 3000'(approx.)

#### 227 ENVIRONMENT

#### Physical

This source is a kame field on the west side of Yaya Lake, about 8 miles north of Tununuk Point. The source consists of a number of separate kames in typical hillocky topography within an area about 5 miles long by 1 mile wide. The individual kames are 25 to 50 feet high and up to 100 feet across at the base. Some ponds in the midst of the kames are bordered by very steep erosion slopes.

The drainage of individual kames is good, and this source has not been developed.

#### Biotic

Many slopes around this feature are bare of vegetation, and some of the top surface as well. Elsewhere the cover is moss and scattered shrubs.

The source lies within the Mackenzie Reindeer Grazing Reserve, and also within the important waterfowl breeding area of the Mackenzie Delta. The area is not, however, critical to wildlife or fish.

Yaya Lake is a popular area, used for camping, boating, and fishing. One lodge has been built on the lake, and the trout fishing is said to be excellent.

#### 227 MATERIAL AND QUANTITIES

This source is a collection of small sources, with the quality of material varying from one to another. The 2 test pits both contained good sand and gravel, with very little silt. The gravel content varied from 10% to 25%, and the sand from 75% to 90%.

Five of the 7 testholes penetrated sand or sand and gravel from the surface to depths of 5 to 30 feet. Generally the gravel varied from 15% to 30%, and the silt up to 20%.

Test Hole #5 penetrated silt to encounter massive ice at 3 feet, and Test Hole #6 struck a sand deposit beneath 8 feet of ice-rich silt.

The petrographic analysis of gravel from Test Hole #2 shows the material to be primarily quartzite (83%) and soft sandstone (12%) with smaller amounts of quartz (5%) and chert. The unsound component of sandstone is quite high for a concrete aggregate.

The moisture content of this material ranges from 10% to 20% at depth in sand and gravel.

The volume of material in this source is difficult to estimate, but is probably about 400,000 cubic yards.

#### 227 DEVELOPMENT

#### General

This source is considered low priority for development as general fill. It is located near many other sources, some of them larger and containing better material, and the schedule of development must take these into consideration.

#### Access

This source is accessible by barge in summer and by truck in winter. A system of haul roads within the source area should be planned carefully in order to minimize the disruption of the organic cover over the ice-rich low-lying ground adjacent to Yaya Lake, or else the operation would be limited to the winter months.

#### Material Use and Handling

This material is suitable for general fill, but not for use in concrete or asphalt construction because of generally high silt content, erratic formation of deposits, and unsound component in the gravel.

The majority of material excavated from this source must be ripped, stockpiled, thawed, and drained before shipping.

The equipment required for the development is the usual assembly of dozer with ripper attachment, front-end loader, and trucks.

#### Stripping and Restoration

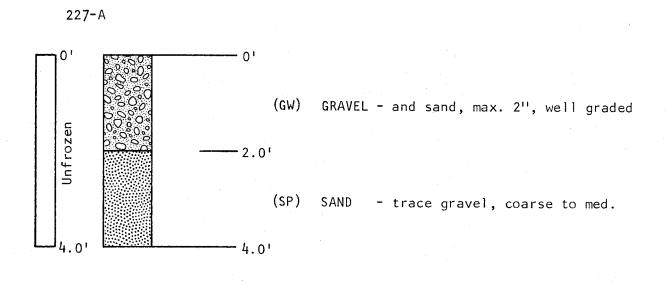
Very little stripping is required at this source, but any material removed must be stockpiled for replacement after the granular material has been excavated. The depleted areas must be graded to a smooth contour, and banks to a stable slope, before topsoil is replaced and an area abandoned.

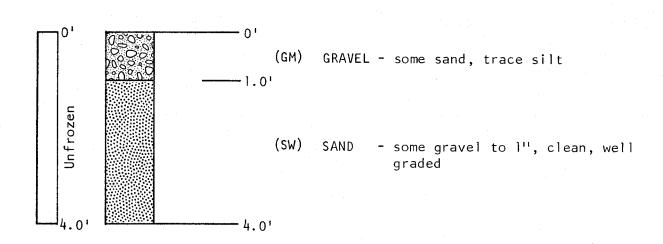
The development should avoid areas that require the stripping of substantial volumes of ice-rich silt because of the problems of containing this material as it thaws, especially where the drainage could reach Yaya Lake.

Massive ice should not be exposed on slopes, and if exposed should be covered at once, in order to avoid thawing, sloughing, and siltation of the drainage system leading to Yaya Lake.

All stockpiles of frozen material must be located so that, in thawing, the drainage cannot enter the natural drainage system.

### TEST PIT LOGS SOURCE No. 227

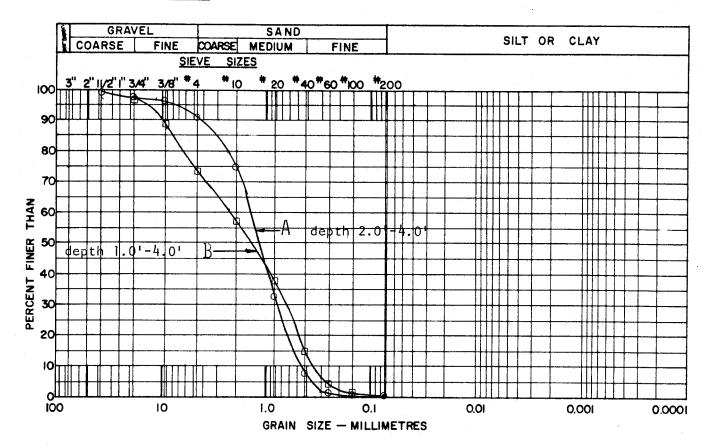




227-B

## LABORATORY TEST DATA SOURCE No. 227

#### GRAIN SIZE DISTRIBUTION

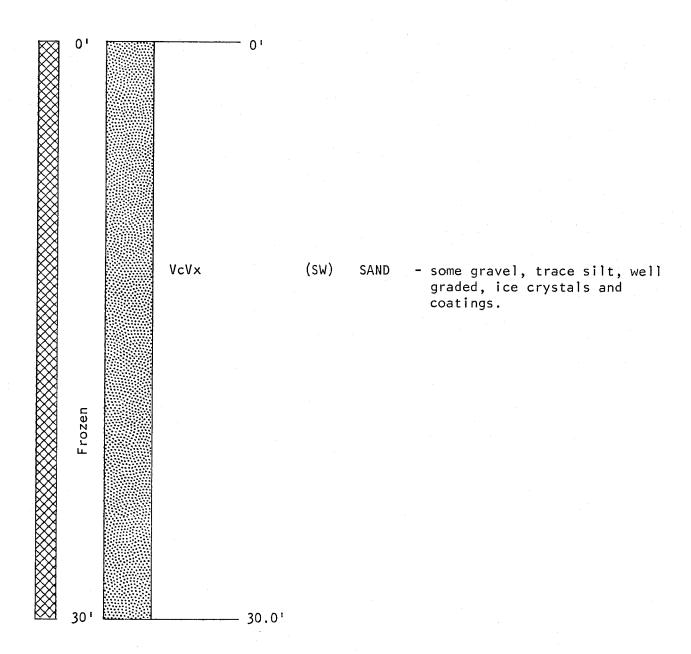


#### MOISTURE CONTENT

Pit A depth 2.0' - 4.0' 2.6% Pit B depth 1.0' - 4.0' 6.2%

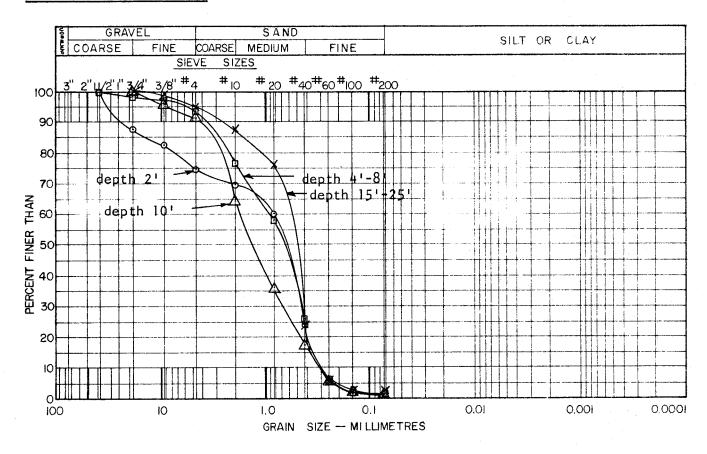
ORGANIC CONTENT

HARDNESS TEST



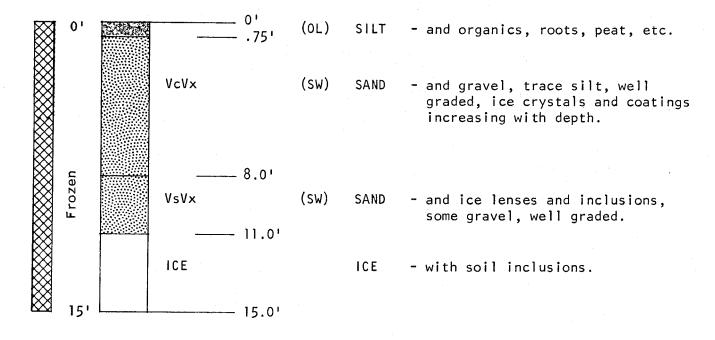
# LABORATORY TEST DATA TEST HOLE-SOURCE No. 227-1

#### GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT		
Sample 1 depth 2'	5.3%	Sample 6 depth 15' 20.3%
Sample 2 depth 4'	4.7%	Sample 7 depth 20' 19.9%
Sample 3 depth 6'	11.8%	Sample 8 depth 25' 13.1%
Sample 4 depth 8'	14.8%	
Sample 5 depth 10'	12.2%	
ORGANIC CONTENT		HARDNESS TEST

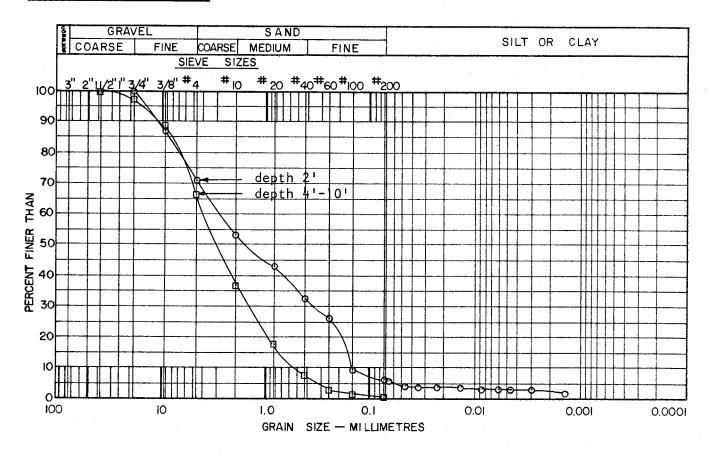




#### LABORATORY TEST DATA

#### TEST HOLE-SOURCE No. 227-2

#### GRAIN SIZE DISTRIBUTION



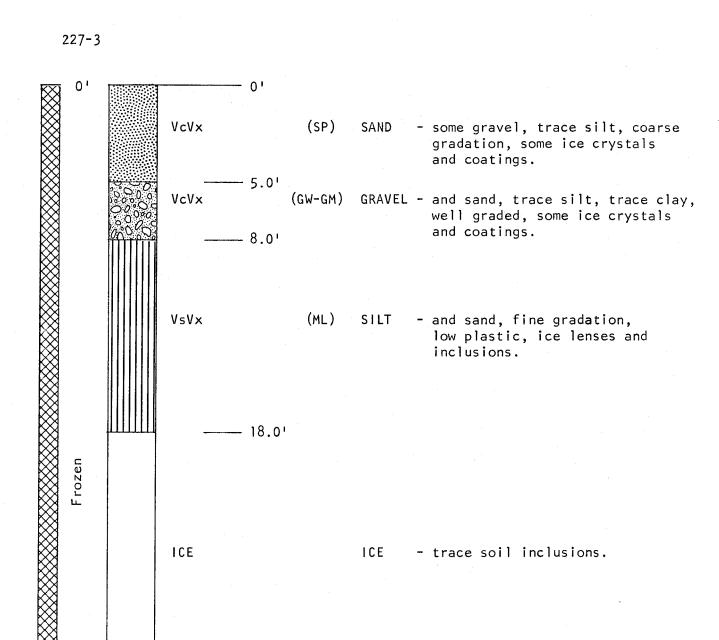
#### MOISTURE CONTENT

• . • . •				
Sample	1	depth	21	11.6%
Sample	2	depth	4 '	11.6%
Sample	3	depth	61	10.3%
Sample	4	depth	۱8	14.8%
Sample	5	denth	יחו	<u> </u>

#### ORGANIC CONTENT

HARDNESS TEST

Sample	depth	4'-10'
Quartzite Sandstone( Quartz Chert	soft)	- 83% - 12% - 5% Neg.
Total		100%

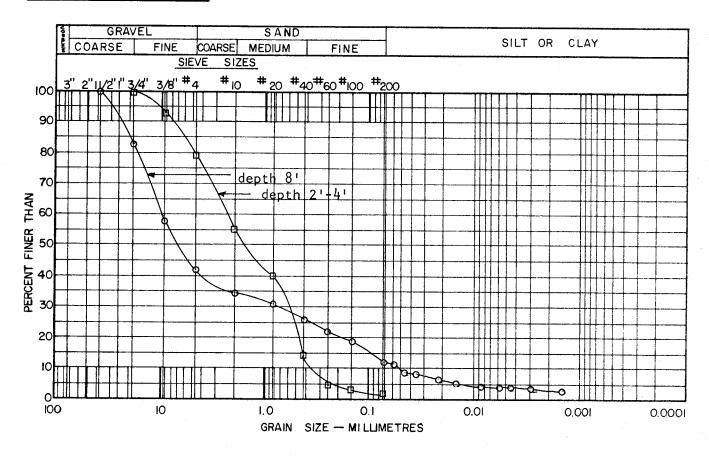


30.01

30 i

# LABORATORY TEST DATA TEST HOLE-SOURCE No. 227-3

#### GRAIN SIZE DISTRIBUTION



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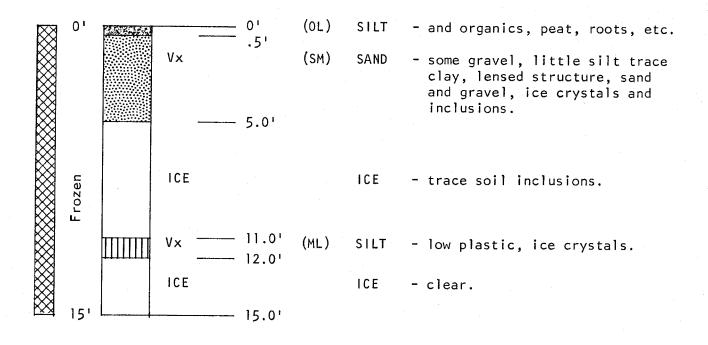
		00.0.		
Sample	1	depth	2'	9.6%
Sample	2	depth	41	3.6%
Sample	3	depth	61	18.7%
Sample	4	depth	8 ı	9.6%
Sample	5	depth	10'	20.1%

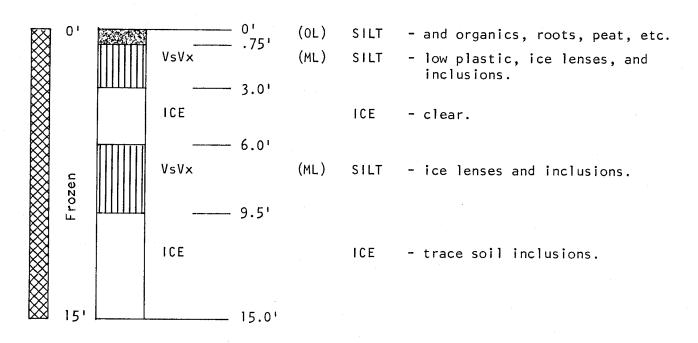
Sample 6 depth 15' 25.1%

#### ORGANIC CONTENT

HARDNESS TEST

227-4

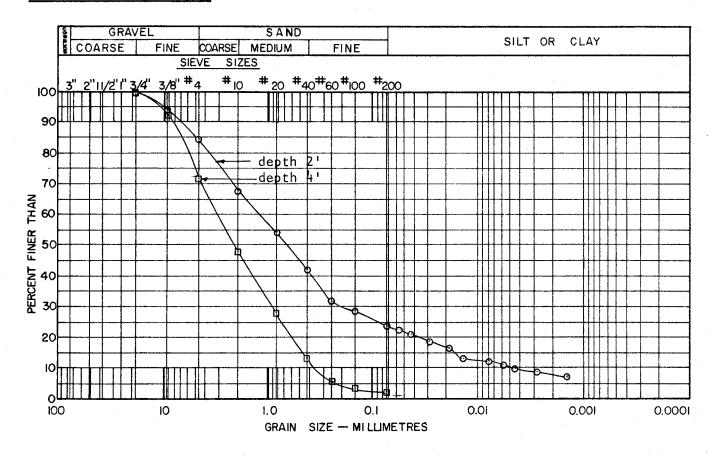




#### LABORATORY TEST DATA

#### TEST HOLE-SOURCE No. 227-4

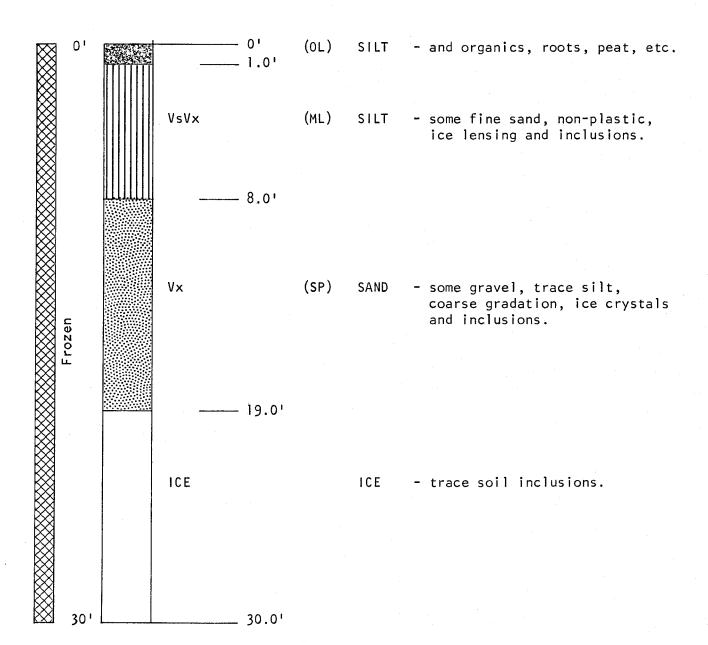
#### GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT Sample 1 depth 2' 9.6% Sample 2 depth 4' 14.3%

ORGANIC CONTENT

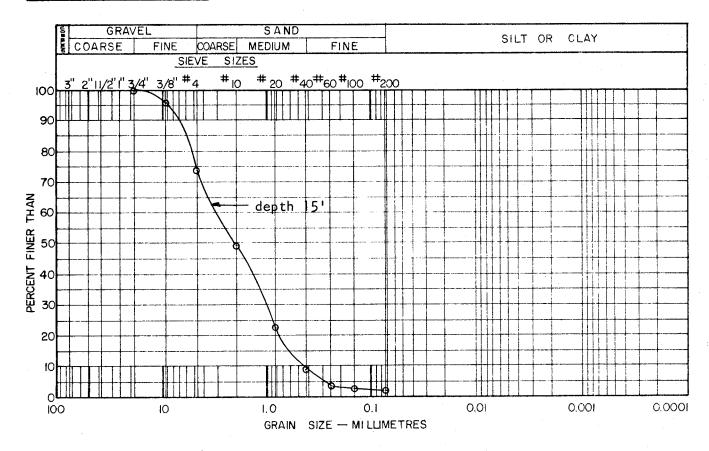
HARDNESS TEST



### LABORATORY TEST DATA

#### TEST HOLE-SOURCE No. 227-6

#### GRAIN SIZE DISTRIBUTION

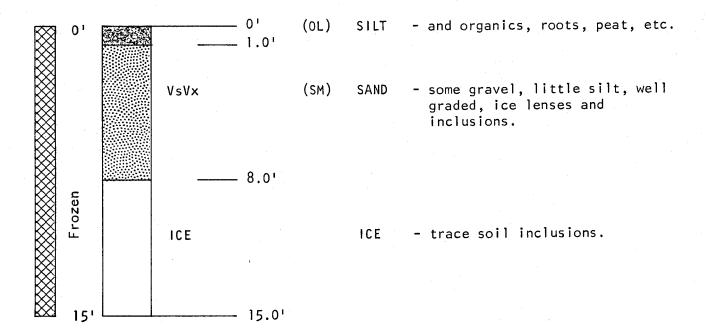


#### MOISTURE CONTENT

Sample 1 depth 2' 34.4% Sample 2 depth 4' 37.1% Sample 3 depth 15' 12.3%

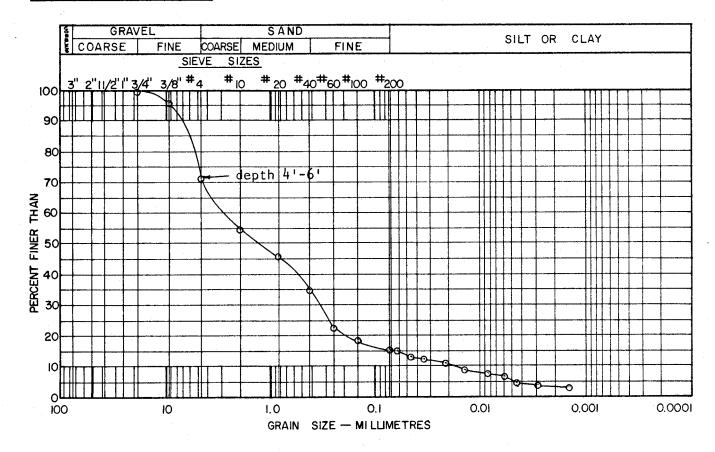
ORGANIC CONTENT

HARDNESS TEST



## LABORATORY TEST DATA TEST HOLE-SOURCE No. 227-7

#### GRAIN SIZE DISTRIBUTION



#### MOISTURE CONTENT

Sample 1 depth 4'-6' 10.0%

ORGANIC CONTENT

HARDNESS TEST