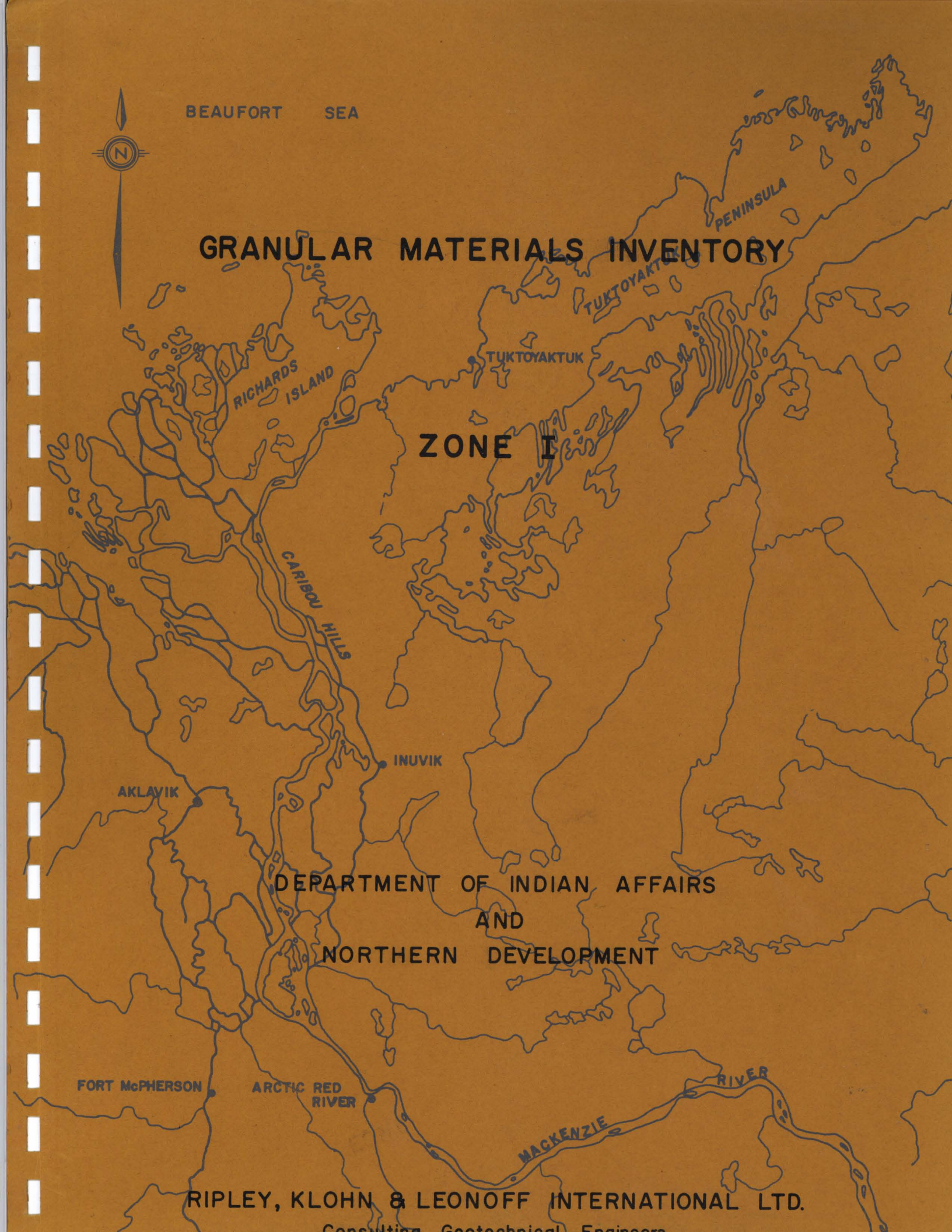


GRANULAR MATERIALS INVENTORY

ZONE I

DEPARTMENT OF INDIAN AFFAIRS
AND
NORTHERN DEVELOPMENT

RIPLEY, KLOHN & LEONOFF INTERNATIONAL LTD.
Consulting Geotechnical Engineers

TABLE OF CONTENTS

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 I, as shown on the Zone Location Plan. In general, the report discusses sources that lie outside the 10-mile radius of the Community of Tuktoyaktuk. 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 co-operation 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

considerations. The reconnaissance program identified 6 sources in Zone I, in addition to those identified within 10 miles of the Community of Tuktoyaktuk, plus two other sources outside the 10-mile radius that are reserved for the use of the Community.

1.3 Data Presented

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

Section Entitled "Zone I" - 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 I

2.1 Surficial Geology

Zone I is located to the east of the Mackenzie Delta on a Pleistocene coastal plain formed from ancient layered sand deposits. These deposits were laid down in the pre-glacial Mackenzie River Delta and were subsequently overlain by glaciofluvial sands and gravels deposited during two major periods of glaciation. As the last glacier receded, post-glacial lacustrine deposits consisting of silt, sands, and gravels were deposited overlying much of the glaciofluvial materials.

Along the coast, sand and gravel beaches and spits have been formed by erosion and sorting of the basic coastal formations. A beach is an area backed up by land, opposed to a spit that is generally surrounded by water on three sides.

Spits are generally extended by the action of the long-shore current, in this area trending to the southwest, and for this reason the extremity of a spit can be excavated continuously without any effect on the remainder of the spit. Excavating the mid-point of a spit may cause breaching, which in turn may interrupt the littoral drift, with serious consequences for the stability of the coast.

Beaches may be in process of accretion or erosion by the long-shore current, and the distinction must be clear before excavation is attempted.

From the point of view of quality and quantity, the spits should be more suitable than the beaches because the spits represent areas of accumulated littoral drift material whereas the beaches are probably either thin layers of material in transit from erosion sources or possibly erosion sources in themselves.

Bedrock does not outcrop within the area and the total overburden

thickness is believed to exceed 200 feet. Immediately north of Eskimo Lakes, glaciofluvial coarse sands and gravels were deposited as outwash plains near the edge of the melting ice. Further north, finer materials were deposited so that where they are exposed in the Tuktoyaktuk area the soils are predominantly silts and sands, although some coarse gravel may occur as lenses within the sands.

In general, the recoverable granular material in Zone I is either in coastal deposits, such as spits and beaches, or in isolated glacial features such as kame fields and eskers.

The topography of the area is characterized by hummocky terrain and many small lakes which were formed from subsidence and erosion when frozen sediments and ground ice melted.

2.2 Environment

Zone I is well within the barren ground, and the birch and willow growing here are dwarfed to a height of about 3 feet. Some protected valleys east of the Mackenzie Delta contain spruce. The usual ground cover is moss and lichen, with some grass on the higher areas.

This is the summer range of the Mackenzie Reindeer Herd and of the barren-ground caribou. Although important to both, the area is not considered to be a critical part of the Mackenzie Reindeer Grazing Reserve.

The only critical areas are isolated and rather small summer habitat of various species of waterfowl.

Beluga whales frequent Kugmallit Bay for pupping each year, and sealing is reportedly very good along the outer shores of the Tuktoyaktuk Peninsula.

Fishing plays a large part in the life of the native population, expecially in Liverpool Bay, Eskimo Lakes, and along the outer coast.

The International Biological Programme propose to reserve a

substantial area around Toker Point as a natural area for scientific study. The area is notable for a concentration of pingos and also for a variety of Arctic vegetation.

2.3 Sources and Materials

In Zone I a total of 6 sources were identifed and investigated by surficial examination and usually by test-pitting. This number is additional to those identified and reported for the Community of Tuktoyaktuk, two of which are about 17 miles southeast of the Community.

Of the 6 sources investigated, 2 are ocean spits and the remainder are fluvial or glacial features located on the north and west sides of Eskimo Lakes.

Source 150 contains sand with some gravel, an excellent general fill that may be used for concrete and asphalt construction as well. A simple screening operation will be required for aggregate production.

Source 151 is a large area with a most impressive bank of gravel and sand exposed on the shore of Eskimo Lakes. More detailed investigation is required to confirm the potential of this source.

Source 152 is an extensive series of ocean spits near Cape Dalhousie, at the northern extremity of the Tuktoyaktuk Peninsula. The source is rated very low priority, suitable only for minor local projects that require a small volume of low-grade granular fill.

Sources 153 and 154 are contained in a band of glacial features that lies parallel to the northwest shore of Eskimo Lakes. Both are kame fields and display gravel and sand on the steep surfaces of many of the kames. They require further investigation to establish the recoverable volume and the location of the best material. The surface samples indicate good material.

Source 155 is a fluvial deposit on the benches above a stream

in ice-rich ground. The source contains material of variable quality and limited volume, and is rated very low priority for development.

Source 150 contains gap-graded sand and gravel grading to 1½ inches maximum particle size. The material is clean, and can be used for medium grades of concrete. The deposit is believed to be substantially free of ice to a depth of about 3 feet.

Source 151 was sampled near the top of the deposit, and there contains 80% coarse gravel and 20% well-graded sand. The lower levels of the deposit are reported to contain more sand and finer gravel. The petrographic analysis of this material indicates a sound gravel containing 94% quartzite, quartz, and granite, 4% soft sandstone, and 1% each of ironstone and chert. Undoubtedly, ice will be a factor in developing this source.

2.4 Management

Only Source 150 is in a particularly sensitive environmental setting. Aside from the need to ensure the stability of the coast, this source is located within the proposed Toker Point Reserve of the International Biological Programme. Both aspects should be studied before this source is developed.

The main point in developing Source 152 is that the spits must not be breached. Everything connected with the source is negative except that it is the only deposit of granular material in a large area.

Sources 151, 153, and 154 are located on or near Eskimo Lakes, and any operation must be guided by the need to prevent siltation of these lakes and of the streams flowing to them. Otherwise the area is not critical to wildlife or to fish.

Source 155 is another remote source, the only deposit of granular material in a large area. The environmental problems

are formidable because of a high level of ground ice and high silt content, and restoration of an excavated area will require special attention.

2.5 Development

2.5.1 General

For future development on the outer coast, the best source is the spits at Tininerk Bay, Source 150. The environmental aspects of this deposit should be studied fairly soon so that it can be confirmed as a potential source of granular material.

On the inner coast, along Liverpool Bay and Eskimo Lakes, Sources 151, 153, and 154 are all likely deposits. All should be drilled and investigated more fully and a schedule established for the priority of development for different materials. Probably all will require development at least one year before use because of the need for thawing and draining.

After the preliminary investigations are complete, further development will depend on the location, size, and nature of future projects.

2.5.2 Access

With the exception of Source 155, all sources are on or near the sea and can be reached by barge in summer as well as by truck in winter. Source 150 can serve a considerable length of the outer coast, and Sources 151, 153, and 154 can serve the inland waters.

Trucking near Sources 153 and 154 must be planned carefully because of the high level of ground ice and the fragile ground cover, otherwise the low-lying areas will degrade wherever a truck passes.

2.5.3 Material Uses and Handling

Sources 152 and 155 are suitable only for supplying general fill. The material from Source 152 is uniformly low quality

because of fine grading and silt, and that from Source 155 is variable.

The other sources can probably be developed for any purpose, from general fill to concrete aggregate, although this preliminary finding must be confirmed by further study, and particularly by drilling.

Sources 151, 153, and 154 must be ripped, thawed, and drained before shipping. These steps are not necessary at Source 150.

The equipment required to develop these sources is the usual assembly of dozer with ripper attachment, front-end loader, and trucks. The production of aggregate for concrete or asphalt will require at least a screen for removing oversize gravel, and eventually a crushing and screening plant with conveyors for stockpiling and loading.

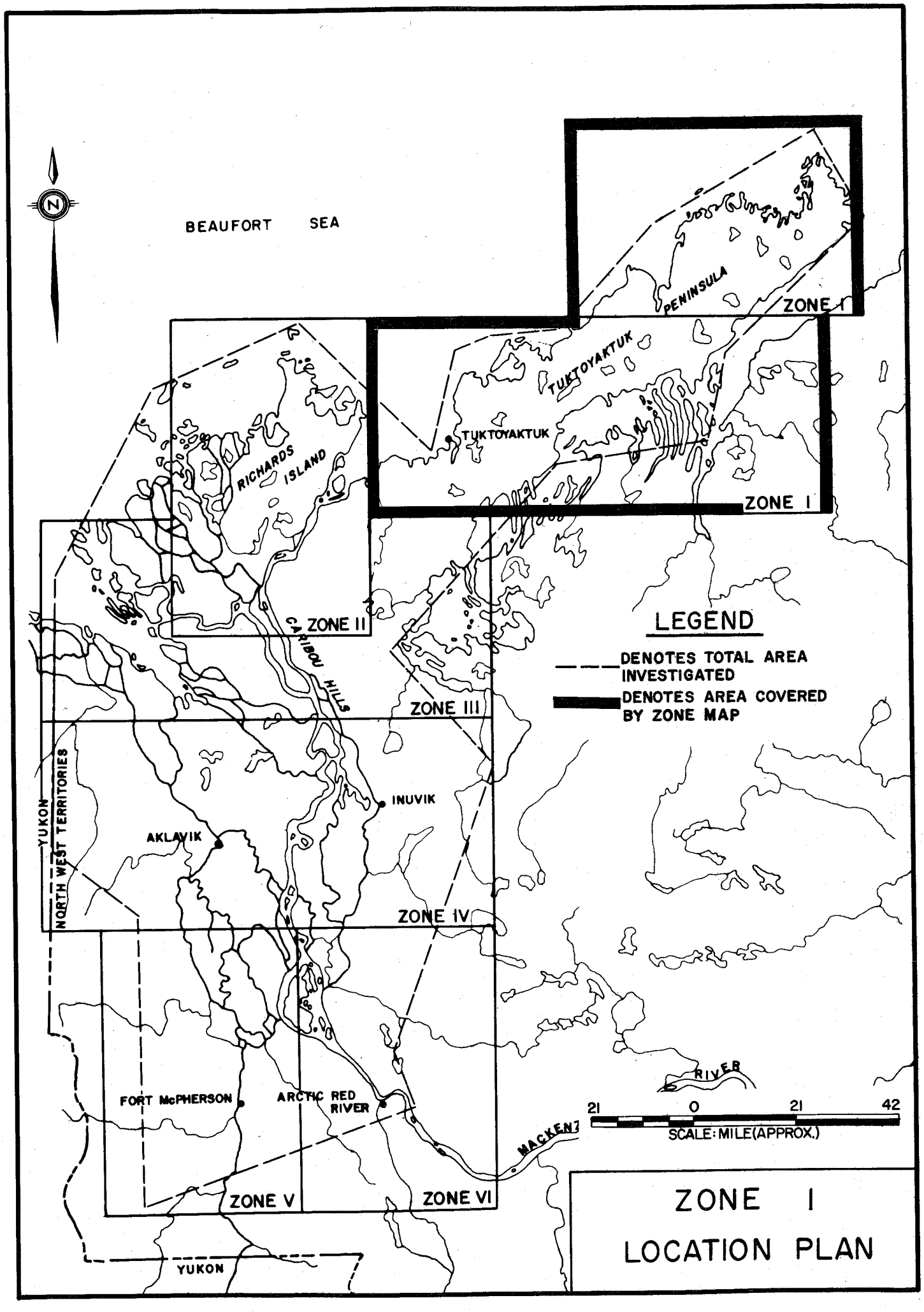
2.5.4 Stripping and Restoration

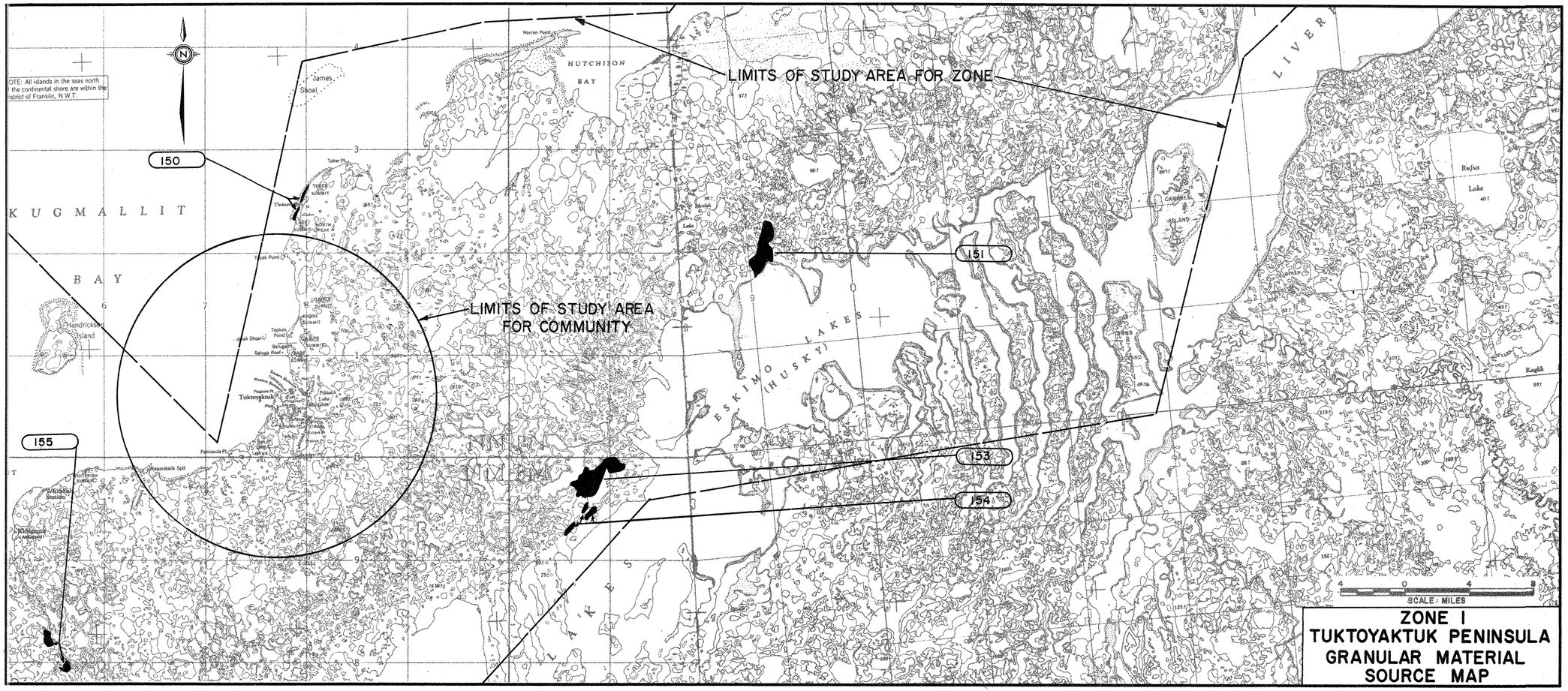
The sources on the open sea must be studied by an oceanographer before development can begin, in order to ensure the stability of the coast nearby. Probably these studies will recommend restorative measures to be applied after an area is depleted.

The other sources are covered to some extent with silt and organic cover. Generally, this material must be stockpiled for replacement, but not if the topsoil is likely to wash into valuable fishing lakes or into streams leading to such lakes.

In general, the description of vegetative cover to be employed in restoring disturbed areas is beyond the scope of this report, but can be provided by a botanist familiar with the Arctic region.

More detailed comments concerning the stripping and restoration of the 6 sources investigated in Zone I are provided in the discussion of each source.


BEAUFORT SEA
PENINSULA
ZONE I
TUKTOYAKTUK
TUKTOYAKTUK
RICHARDS ISLAND
ZONE I
ZONE II
CARIBOU HILLS
ZONE III
LEGEND
DENOTES TOTAL AREA INVESTIGATED
DENOTES AREA COVERED BY ZONE MAP
YUKON
NORTH WEST TERRITORIES
INUVIK
AKLAVIK
ZONE IV
RIVER
FORT McPHERSON
ARCTIC RED RIVER
MACKENZ
21 0 21 42
SCALE: MILE(APPROX.)
ZONE V
ZONE VI
YUKON
ZONE I
LOCATION PLAN



NOTE: All islands in the seas north of the continental shore are within the district of Franklin, N.W.T.

UJ VJ
UH VH

152

LIMITS OF STUDY
AREA FOR ZONE

Cape Dalhousie

Nunaruk Point

Phillips Island

RUSSELL
INLET

Kittigazuit Lake

BEAUFORT SEA
(ARCTIC OCEAN)

Atkinson Pt.

McKinley
Bay

TUKTOYAKTUK PENINSULA

KENDAY

NOTE: Islands off the shores of the District of MacKenzie are within the District of Franklin.

4 0 4 8
SCALE: MILES

ZONE I
TUKTOYAKTUK PENINSULA
GRANULAR MATERIAL
SOURCE MAP

SOURCE No.	DISTANCE FROM COMMUNITY MILES	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	SOURCE DEVELOPMENT DATA									
						DRAINAGE	STRIPPING			GRD. ICE	REC. DEPTH (FT.)	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT OF SOURCE
							MATERIAL	DEPTH (FT)	DISPOSAL						
150	On Tininerk Bay 12 by air north of Tuktoyaktuk	SAND - some gravel (SP)	200,000	Erosion of coastline. Located within proposed Toker Point Reserve of International Biological Programme	Suitable for partial development. Oceanographic study required to determine effects of partial spit removal on coast erosion and wildlife	Excellent	N/A	Nil	N/A	Nil	3	Push into piles, load into trucks or barges	General fill possibly for aggregate	Dozer, Loader, Trucks or Barges, Screen for aggregate production	Undeveloped
						SEE SECTION 150 FOR SOURCE DETAILS									
151	On Eskimo Lakes 30 by air east of Tuktoyaktuk	GRAVEL - some sand (GW)	500,000 at least	Operation must avoid siltation Eskimo Lakes.	Suitable for development but drilling program required to gain further data	Good	Topsoil	0 to 1	Stockpile away from Lakes	Medium	5 to 10	Rip, stockpile thaw, drain, load to trucks or barge	General fill Aggregate for concrete and asphalt production	Dozer with Ripper, Loader, Trucks or Barge Screen and possibly Crusher for aggregate production	Undeveloped
						SEE SECTION 151 FOR SOURCE DETAILS									
152	Cape Dalhousie 100 by air north east of Tuktoyaktuk	SAND - fine trace silt (SP)	25,000 per mile of coast	Erosion and stability of coastline	Low priority for development. Possible for small local projects pending oceanographic study	Good	N/A	Nil	N/A	Medium	3	Push into piles, load to trucks or barges	Poor quality General fill	Dozer, Loader, Trucks or Barge	Undeveloped
						SEE SECTION 152 FOR SOURCE DETAILS									
153	20 by air east of Tuktoyaktuk	GRAVEL - some sand, trace silt (GW)	1,000,000	Operation must avoid siltation Eskimo Lakes	Suitable for development following drilling program	Good	Topsoil and silt	0 to 1	Stockpile for replacement	Medium	10	Rip, Stockpile, thaw, drain, load to trucks	General fill, possibly for aggregate production	Dozer with Ripper, Loader, Trucks	Partially developed for oil exploration
						SEE SECTION 153 FOR SOURCE DETAILS									

SOURCE No.	DISTANCE FROM COMMUNITY MILES	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS	SOURCE DEVELOPMENT DATA									
						DRAINAGE	STRIPPING			GRD. ICE	REC. DEPTH (FT.)	TYPE OF EXCAVATION	MATERIAL USEAGE	EQUIPMENT REQUIRED	STATE OF DEVELOPMENT OF SOURCE
							MATERIAL	DEPTH (FT)	DISPOSAL						
154	20 by air S.E. of Tuktoyaktuk	GRAVEL - some sand trace silt (GW) SAND - trace silt (SP)	200,000 at least	Operation must avoid siltation Eskimo Lakes	Suitable for development following drilling program	Good	Topsoil and silt	0 to 1	Stockpile for regrading	Medium	10	Rip, stockpile thaw, drain, load to trucks	General fill possibly for aggregate production	Dozer with Ripper, Loader, Trucks	Partially developed for oil exploration
						SEE SECTION 154 FOR SOURCE DETAILS									
155	21 by air S.W. of Tuktoyaktuk	SAND - some gravel little silt (SM-SP)	1,000,000	Operation must avoid siltation in adjacent stream	Very low priority for development because of variable material high ice content and problems in preventing siltation of adjacent stream	Fair	Peat and silt	1 to 2	Stockpile away from streams for later regrading	Medium to high	3 to 5	Rip, stockpile thaw, drain, load to trucks	Variable quality General fill	Dozer with Ripper, Loader, Trucks	Undeveloped
						SEE SECTION 155 FOR SOURCE DETAILS									

EXPLANATION OF SYMBOLS AND TERMS USED IN THIS REPORT

GENERAL CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			Group SYMBOL	Graph SYMBOL	TYPICAL DESCRIPTION
COARSE-GRAINED SOILS (more than half by weight larger than 200 sieve)	BOULDERS		N/A		LARGER THAN 8 INCHES DIAMETER
	COBBLES		N/A		3 TO 8 INCHES DIAMETER
	GRAVELS more than half coarse grains larger than No. 4 sieve & 100% smaller than 3 inches diameter	CLEAN GRAVELS (little or no fines)	G W		WELL GRADED GRAVELS, LITTLE OR NO FINES
			G P		POORLY GRADED GRAVELS, AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		DIRTY GRAVELS (with some fines)	G M		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			G C		CLAYEY GRAVELS, GRAVEL-SAND CLAY MIXTURES
	SANDS more than half fine grains smaller than No. 4 sieve.	CLEAN SANDS (little or no fines)	S W		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			S P		POORLY GRADED SANDS, LITTLE OR NO FINES
		DIRTY SANDS (with some fines)	S M		SILTY SANDS, SAND-SILT MIXTURES
			S C		CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS (more than half by weight passes 200 sieve)	SILTS below "A" line negligible organic content	W_L 50%	M L		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY
		W_L 50%	M H		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS
	CLAYS above "A" line on plasticity chart negligible organic content	W_L 30%	C L		INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS
		30% W_L 50%	C I		INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS
		W_L 50%	C H		INORGANIC CLAYS OR HIGH PLASTICITY, FAT CLAYS
	ORGANIC SILTS & CLAYS below "A" line on chart	W_L 50%	O L		ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		W_L 50%	O H		ORGANIC CLAYS OF HIGH PLASTICITY
HIGHLY ORGANIC SOILS			P t		PEAT AND OTHER HIGHLY ORGANIC SOILS

SUPPLEMENTARY TERMS IDENTIFYING THE COMPOSITION OF GRANULAR SOILS

Component	Identification	Terms Identifying Proportions	Defining Range Percentage by Weight
Principal Component.....	GRAVEL	...	50 or more
	SAND	...	
	SILT	...	
Minor Component.....	Gravel	and	35 to 50
	Sand	some	20 to 35
	Silt	little	10 to 20
		trace	1 to 10

CLASSIFICATION SYSTEM FOR ICE

Non Visible Ice	Nf	Poorly bonded
	Nbn	Well bonded
	Nbe	Excess Ice
Visible Ice Less than 1 inch thick	Vx	Individual ice crystals or inclusions
	Vc	Ice coatings or particles
	Vr	Random or irregularly oriented ice formation
	Vs	Stratified or distinctly oriented ice formations
Visible Ice Greater Than 1 inch thick	ICE+	Ice with soil inclusions
	ICE	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.

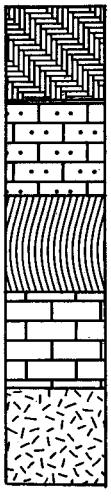
Interbedded .... composed of alternate layers of different soil or rock types.

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.

SUPPLEMENTARY SYMBOLS AND NOTATIONS



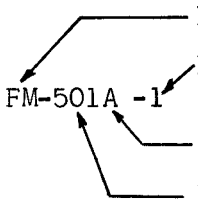
Bedrock

Sandstone

Shale

Limestone

Talus

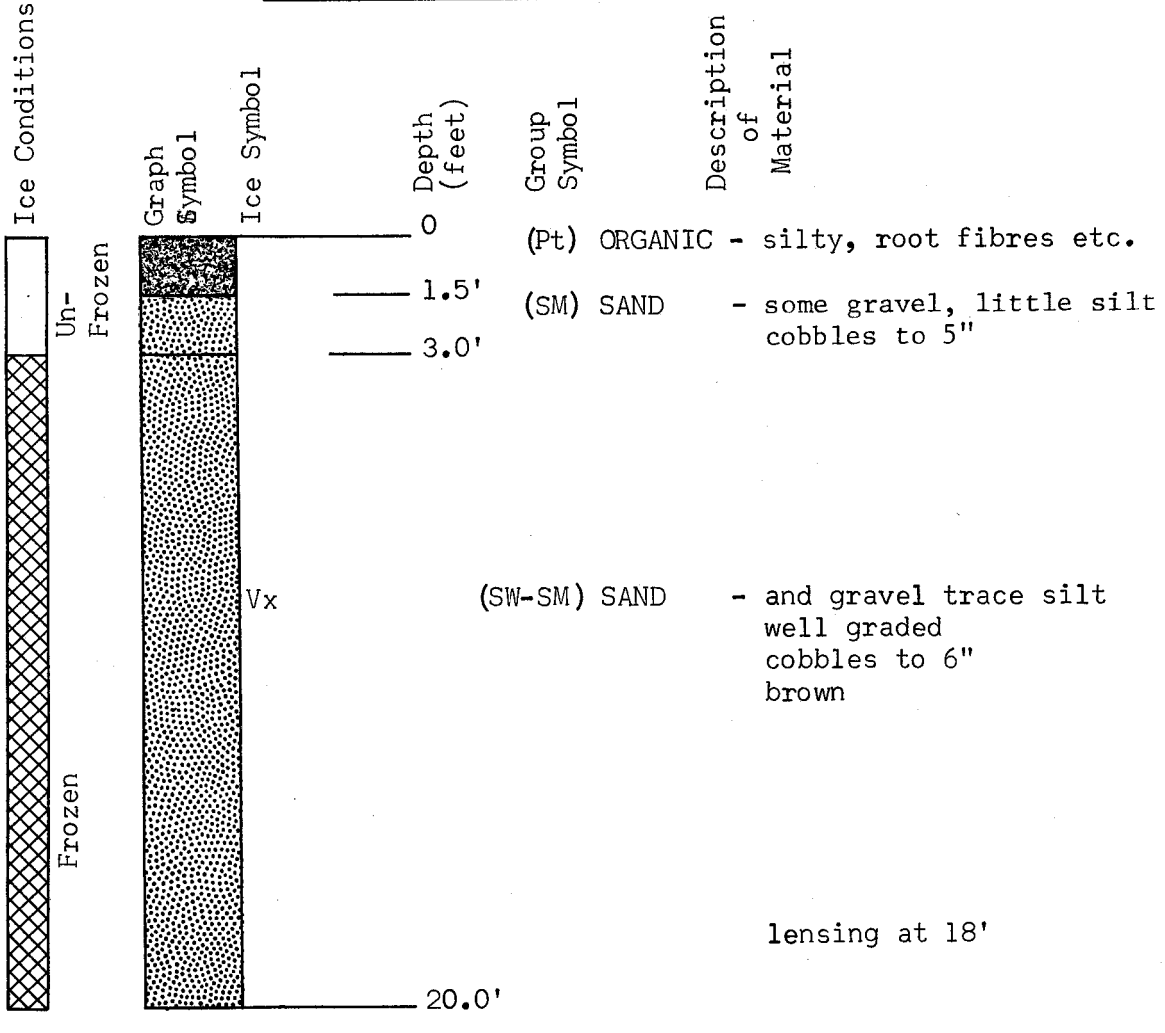


Indicates Test Hole Location

Indicates Test Pit Location

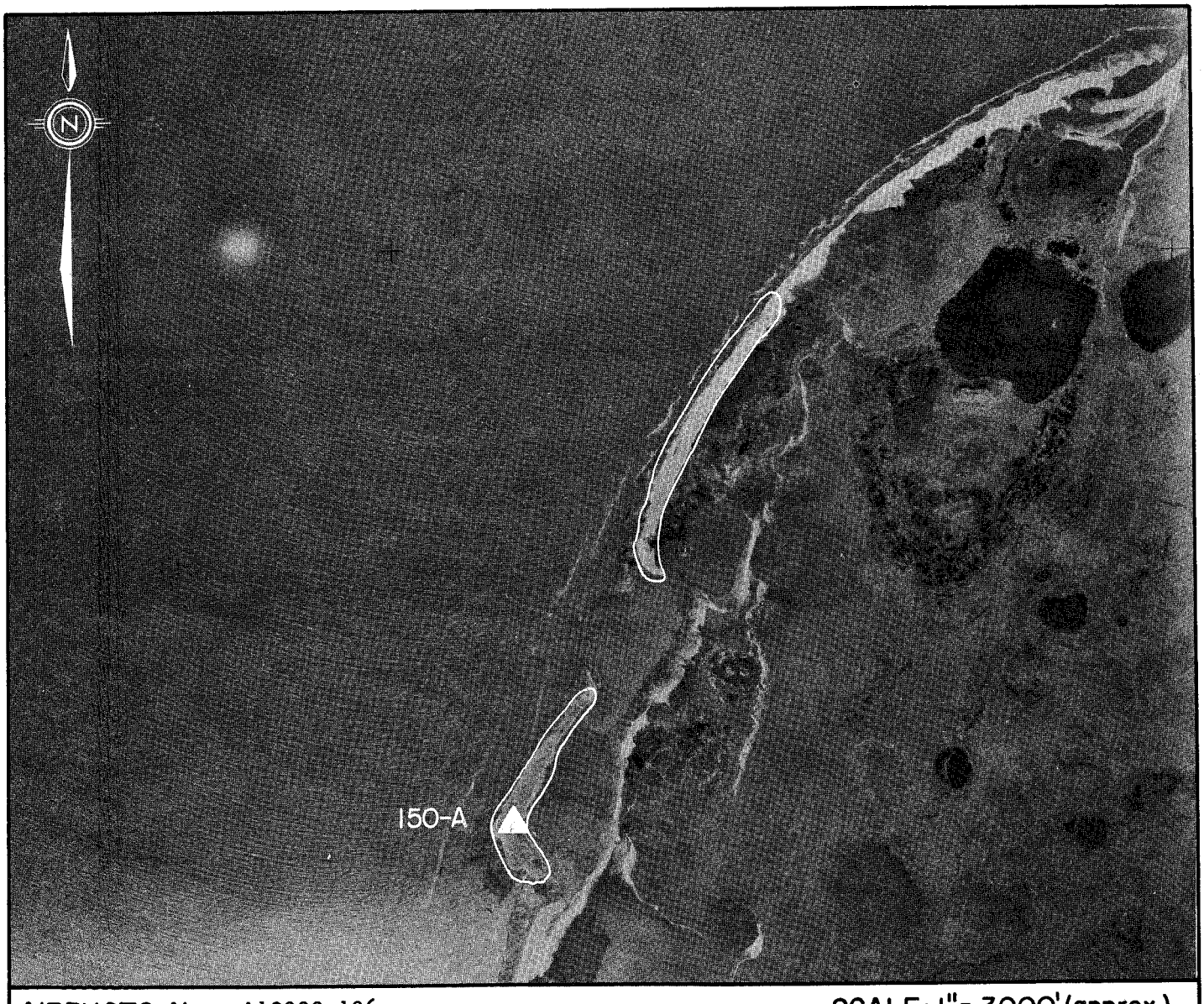
Indicates Direction of Ground Photograph and Field of View

EXAMPLE OF SOIL LOG



ZONE 1
SOURCE No. 150

LANDFORM AND LOCATION:	Ocean spits 12 miles north of Tuktoyaktuk
MATERIAL:	SAND - some gravel
VOLUME:	200,000 cubic yards
CONCLUSION:	Suitable for partial development for general fill or aggregates. Oceanographic study required to determine effects of partial development on coast erosion and wildlife.



AIRPHOTO No. A12902-126 SCALE: 1"= 3000'(approx.)

150 ENVIRONMENT

Physical

This source is two spits that form Tininerk Bay, 12 miles north by air of Tuktoyaktuk. The spits are 9,000 feet in total length, about 500 feet wide, and standing about 5 feet above sea level.

Biotic

The spits are bare of vegetation.

The source lies within an important waterfowl breeding area. Ground fish can be caught in great numbers in shallow waters.

Seals, and especially the ringed seal, are hunted intensively from September to freeze-up, and to a lesser extent through the winter months.

The source lies at the western boundary of an area notable for the occurrence of pingos, and the International Biological Programme have expressed their interest in the area as a reserve. No pingos are to be found within the source area.

This area is the habitat of the white fox, but these animals are not trapped as intensively as in years past. The source also lies within the Mackenzie Reindeer Grazing Reserve.

150 MATERIALS AND QUANTITIES

The material exposed in one test pit 2 feet deep is a gap-graded sand and gravel containing 25% gravel, grading from 1½ inches, and 75% sand. The material is deficient in the sizes from 3/8 inch to #20 mesh and many of the particles are flat.

The source was not drilled, but its close similarity to others near Tuktoyaktuk leads to the opinion that the deposit is free of ice at least to sea level. The volume of recoverable material is about 200,000 cubic yards, based on a recoverable depth of 3 feet and an excavated width of 300 feet.

150 DEVELOPMENT

General

This source is suitable for partial development. An important consideration in its development is the necessity of keeping the excavation to the landward side of the spit, and leaving a substantial width, about 200 feet, of the spit undisturbed. Nothing must be done that could lead to the breaching of the spit, or else the stability of this section of coast may be jeopardized. The plan of development should be approved by an oceanographer before work begins.

Access

This source is accessible during the summer, hauling by barge, or during winter, hauling by truck over the sea ice or over tundra. The distance to Tuktoyaktuk by either barge or truck is about 13 miles.

Material Use and Handling

The material from this source can be used for general fill or road construction with no processing. With some screening and with care it can also be used in low-to-medium grade concrete. The salt content in these spit deposits is not high enough to be a problem in concrete.

The equipment required for the development of this source is the usual assembly of dozer, front-end loader, and trucks or barge, depending on the season. The production of aggregate will require a screen.

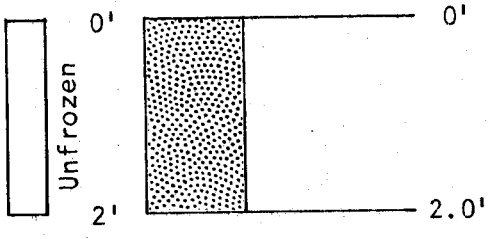
Stripping and Restoration

This source, being bare of vegetation, requires no stripping. All depleted areas and the banks against undisturbed areas should be graded smooth when an area is vacated.

TEST PIT LOGS

SOURCE No. 150

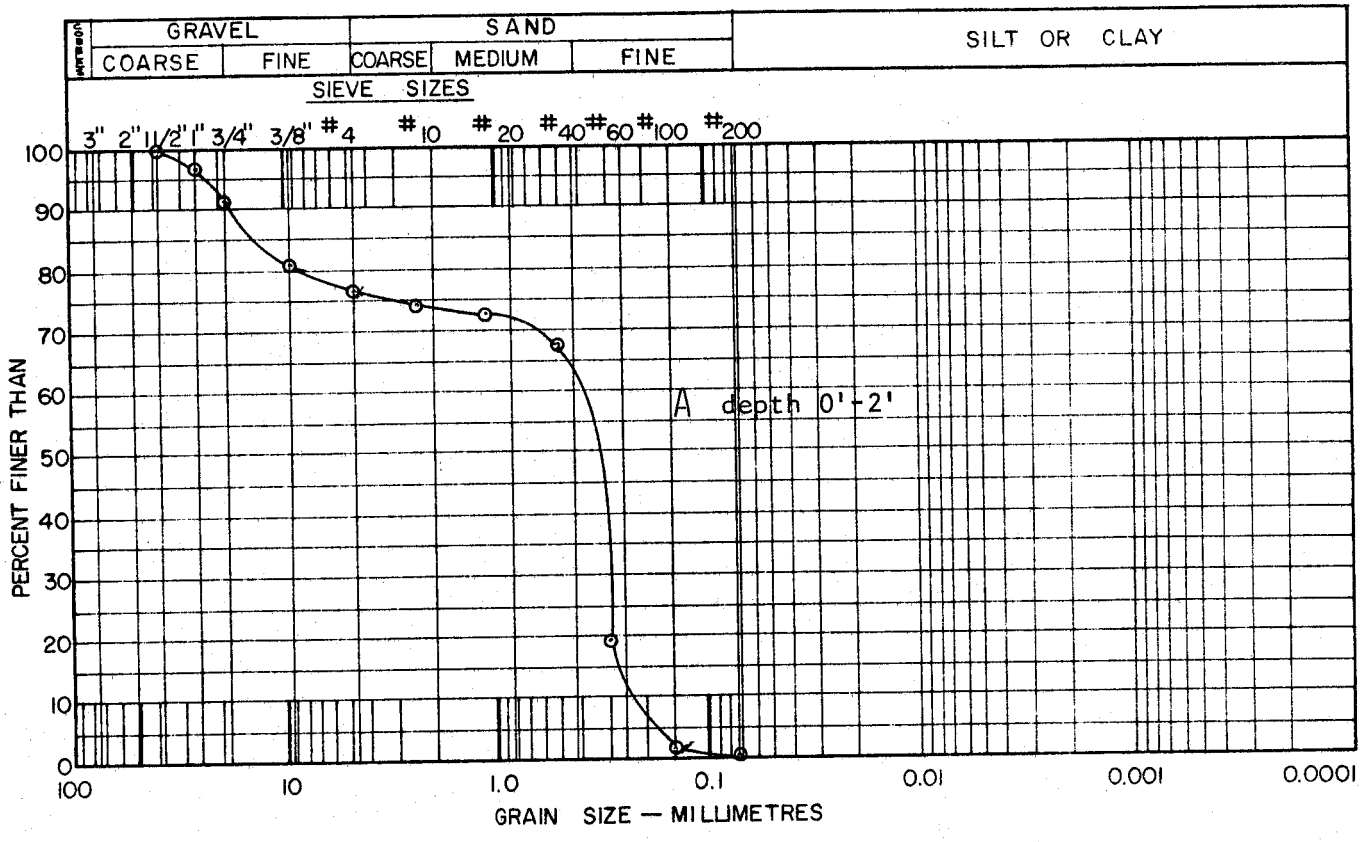
150-A



(SP) SAND - some gravel, 1½" maximum, clean, gap-graded

LABORATORY
TEST DATA
TEST PIT-SOURCE No. 150-A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Pit A depth 0'-2' 13.5%

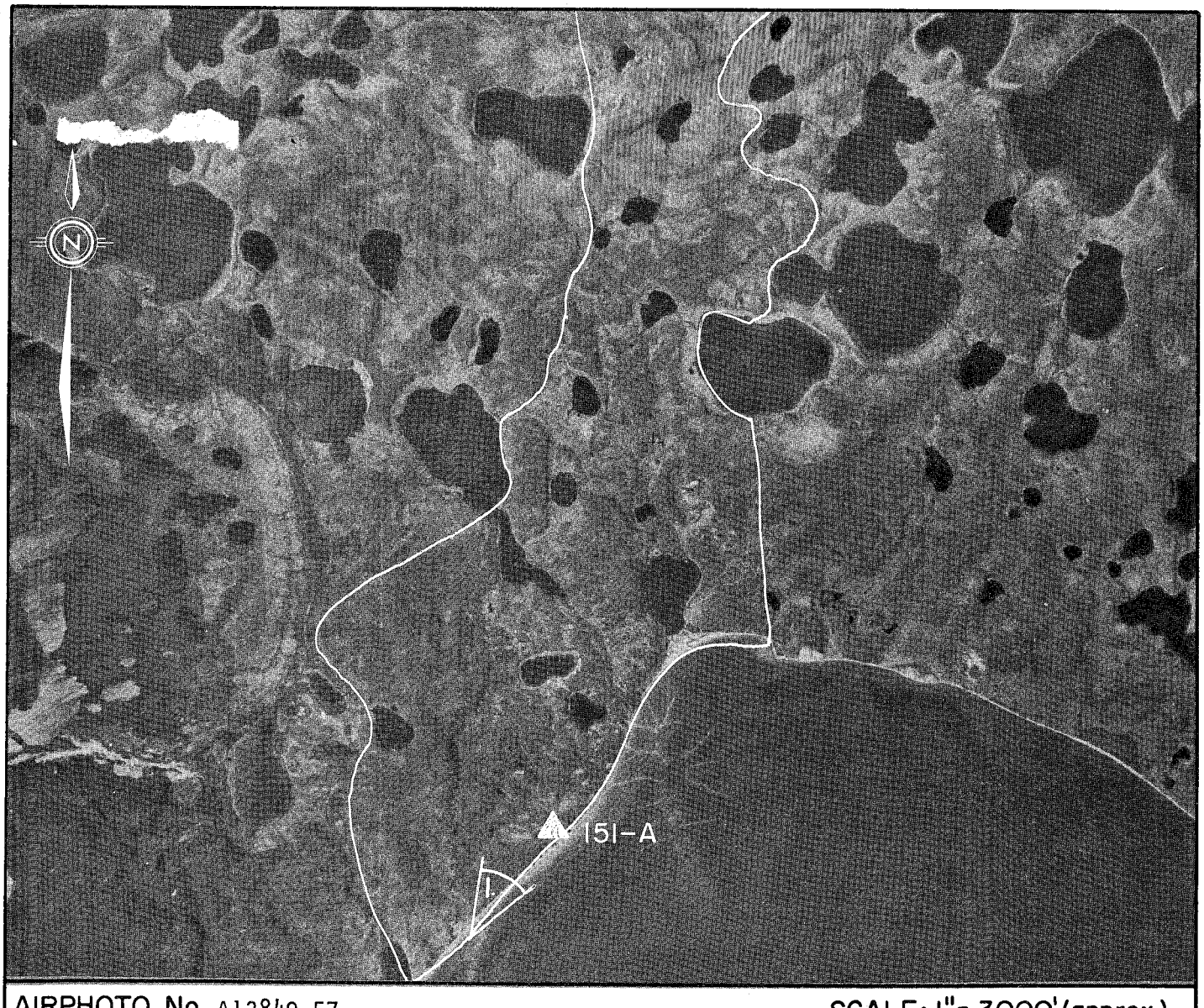
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

ZONE I
SOURCE No. 151

LANDFORM AND LOCATION:	Outwash area about 2½ miles long and 3,000 feet wide on north end of Eskimo Lakes.
MATERIAL:	GRAVEL - some sand
VOLUME:	500,000 cubic yards at least
CONCLUSION:	Source is suitable for development but requires a drilling program to gain further data on quantity and possible variations in quality.



AIRPHOTO No. A12849-57 SCALE: 1" = 3000' (approx.)

151 ENVIRONMENT

Physical

This source is a fluvial deposit, possibly an outwash, located on the north shore of Eskimo Lakes 30 miles east of Tuktoyaktuk. The source area is large, about 2½ miles long by 3,000 feet average width. The surface is rolling, with many lakes and streams. The main feature of the source is a ridge parallel to the lakeshore that slopes steeply to the lake and gently to the interior.

Photo No. 1 - Source 151 - showing exposure of ridge at beach level

The southwestern half of this ridge, about 50 feet high, displays coarse gravel and sand, the northeastern half is sand and silt. The narrow beach at lake level is coarse gravel, and the same material forms a spit that isolates a lagoon at the southwestern corner of the source.

Biotic

Vegetative cover over this area is primarily moss and lichen, with some dwarf shrubs. The large ridge beside the lake is mostly bare on the lake side.

This area is important to many forms of wildlife. The Tuktoyaktuk Peninsula is the summer range of the Reindeer Herd and barren land caribou, and lies within the Mackenzie Reindeer Grazing Reserve. Fishing is important to the native population, with several species of anadromous fish caught at different seasons and, lake trout, grayling and whitefish being fished throughout the year for domestic use and for sport.

Scamps and Scoters use this area extensively for moulting and staging during the summer months.

151 MATERIALS AND QUANTITIES

Coarse, clean gravel is exposed on the southwestern half of the steep slope facing the lake. The maximum size is 6 inches, and the grain size analysis of a sample taken near the top of the ridge indicates 80% gravel and 20% sand. The lower portion of the deposit contained finer gravel and more sand.

A petrographic analysis of the material indicates that the gravel is primarily quartzite (89%) with soft sandstone (4%), quartz, granite, ironstone and chert making up the remainder.

Permafrost is only 12 inches deep at the top of the ridge.

This source was examined only superficially, and was not drilled. The volume of recoverable material depends on several factors that can be determined only in the field, such as the orientation of the gravel-sand interface and the depth of rippable gravel in the deposit. Probably the volume of gravel will exceed 500,000 cubic yards, and it may be many times this amount.

151 DEVELOPMENT

General

A program of drilling is required to evaluate this source more accurately. The potential for a large volume of good material is very encouraging, and this in an area where coarse granular material is very scarce.

Access

This source is well located to serve the northern Eskimo Lakes and Liverpool Bay areas, trucking over the ice in winter or barging on the lakes during the short summer season. Access across the tundra is feasible during the winter, but not in summer.

Material Use and Handling

The material exposed on the surface of the gravel bank is excellent general fill and road material, and with processing could provide aggregates for concrete and asphalt production.

Probably the best approach to development will be to strip the top surface of the gravel bank about 50 feet wide, and excavate a bench from south to north. Undoubtedly the gravel must be ripped, stockpiled and thawed before it can be shipped, and the operation must start on a small scale because of the lack of stockpile areas. Later the benches and beach can be used for this purpose.

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

Stripping and Restoration

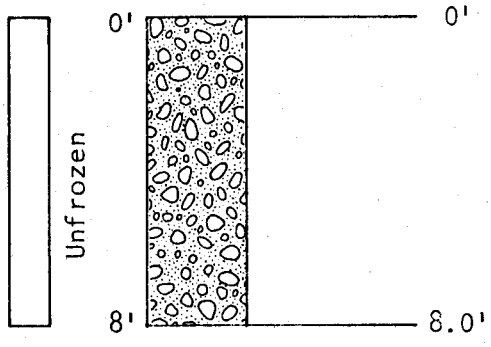
The stripping at the top of the gravel bank is primarily organic ground cover, but further from the lake it may include frozen silt as well. This material must be stockpiled away from drainage channels that lead to the lake. The frozen gravel contains very little silt, and drainage from stockpiles of this material will present no major problem. For the same reason exposures of ice-rich gravel can be left to recover a thermal balance, provided they are not graded to a slope greater than the angle of repose.

On this source the stripped organic material and topsoil should not be replaced, but should be distributed over a suitable area away from the drainage channels.

TEST PIT LOGS

SOURCE No. 151

151-A

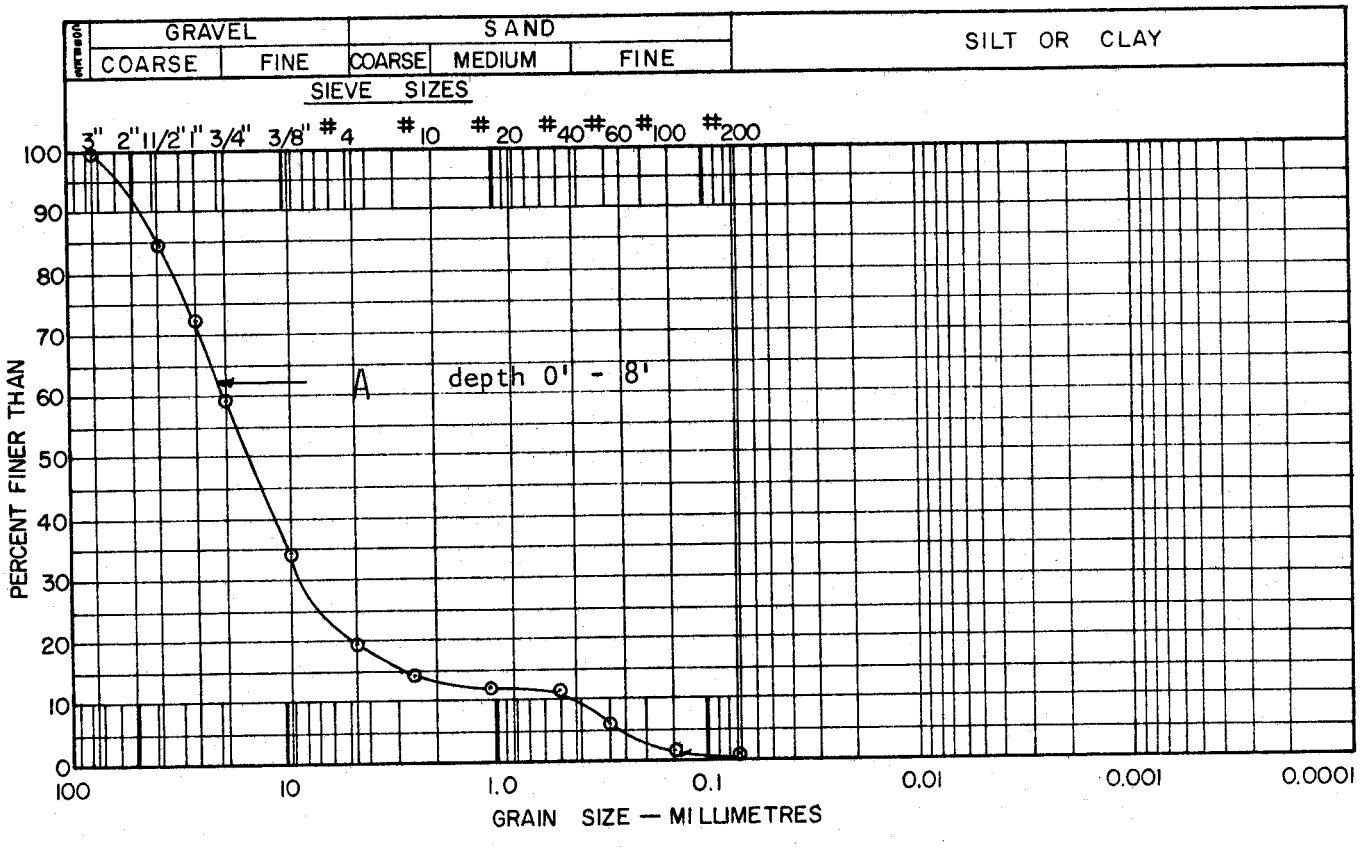


(GW) GRAVEL - some sand, maximum 6", well graded, rounded to sub-rounded

Bank face logged in the field

LABORATORY
TEST DATA
TEST PIT-SOURCE No. 151-A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Pit A depth 0' - 8' 0.7%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

Sample A depth 0 - 8'

Quartzite	- 89%
Sandstone-soft	- 4%
Quartz	- 3%
Granite	- 2%
Ironstone	- 1%
Chert	- 1%
Total	100%

ZONE I
SOURCE No. 152

LANDFORM AND LOCATION:	Group of ocean spits at Cape Dalhousie, at northeastern extremity of Tuktoyaktuk Peninsula.
MATERIAL:	SAND - trace silt, fine
QUANTITY:	Perhaps 5,000 cubic yards per mile of coastline.
CONCLUSION:	This source is low priority for development and only for small local projects. It is limited in volume and a very poor quality. Oceanographic study required to determine effects of development on coastline erosion.

AIRPHOTO No. A12702-411 SCALE: 1"= 3000'(approx.)

152 ENVIRONMENT

Physical

This source is a group of spits at the northeastern tip of Tuktoyaktuk Peninsula, at Cape Dalhousie. The deposits extend for many miles along the coast, none of them are large, and generally they rise up to 10 feet above sea level.

The source is located about 100 miles northeast of Tuktoyaktuk, and has not been developed.

Biotic

The spits in this area are bare of vegetation. The higher ground on-shore is thinly covered by moss, lichens, and grass, with some scattered dwarf shrubs.

The area is important to many forms of wildlife. The Tuktoyaktuk Peninsula is the summer range of the Reindeer Herd and of barren-ground caribou, and lies within the Mackenzie Reindeer Grazing Reserve. Many species of waterfowl frequent the area for moulting and staging, and some small areas of the Peninsula are critical for this reason.

Ground fish can be caught in great numbers in the shallow waters of this area.

152 MATERIALS AND QUANTITIES

The material in this source is a fine sand, with 88% between #40 mesh and #100 mesh sizes.

The depth of recoverable material is only a few feet, and the volume of material available on any spit can be only a few thousand cubic yards. From another point of view, perhaps 5,000 cubic yards could be excavated from each mile of coastline.

152 DEVELOPMENT

General

Large-scale development of this source is not recommended. The material is too fine to be good general fill.

Probably a small operation, based on excavating the very shallow surface deposit of unfrozen sand, could provide usable general fill to local projects.

An important consideration in its development is the necessity of keeping the excavation to the landward side of the spit, and leaving a substantial width, about 200 feet, of the spit undisturbed. Nothing must be done that could lead to the breaching of the spit, or else the stability of this section of coast may be jeopardized. The plan of development should be approved by an oceanographer before work begins.

Access

The area can be reached by truck in winter, hauling over the sea ice or over the tundra, or by barge in summer. The area is so remote that only local projects could be served.

Material Use and Handling

This material is a very poor grade of general fill.

The equipment required to develop the source would be a dozer, front-end loader, and trucks or a barge.

Stripping and Restoration

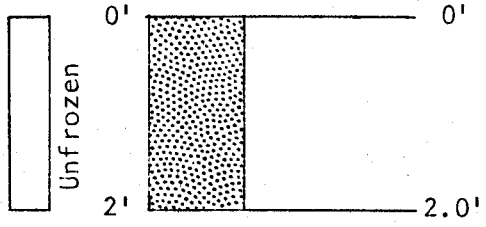
Stripping will probably be limited to the removal of organic debris from the sand.

All areas must be graded to a smooth contour before vacating.

TEST PIT LOGS

SOURCE No. 152

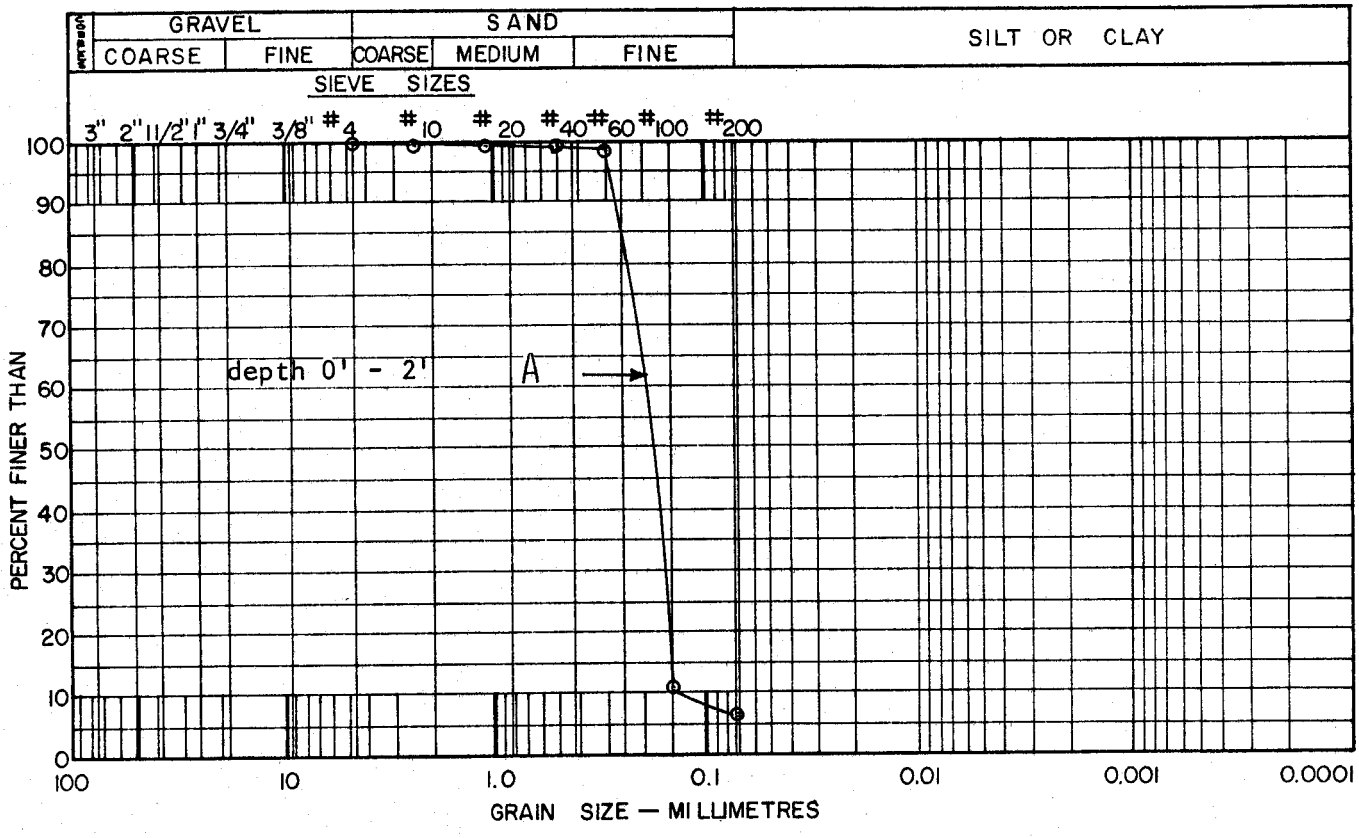
152-A



(SP) SAND - trace silt, very fine, poorly graded

LABORATORY
TEST DATA
TEST PIT-SOURCE No. 152-A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Pit A depth 0' - 2' 7.2%

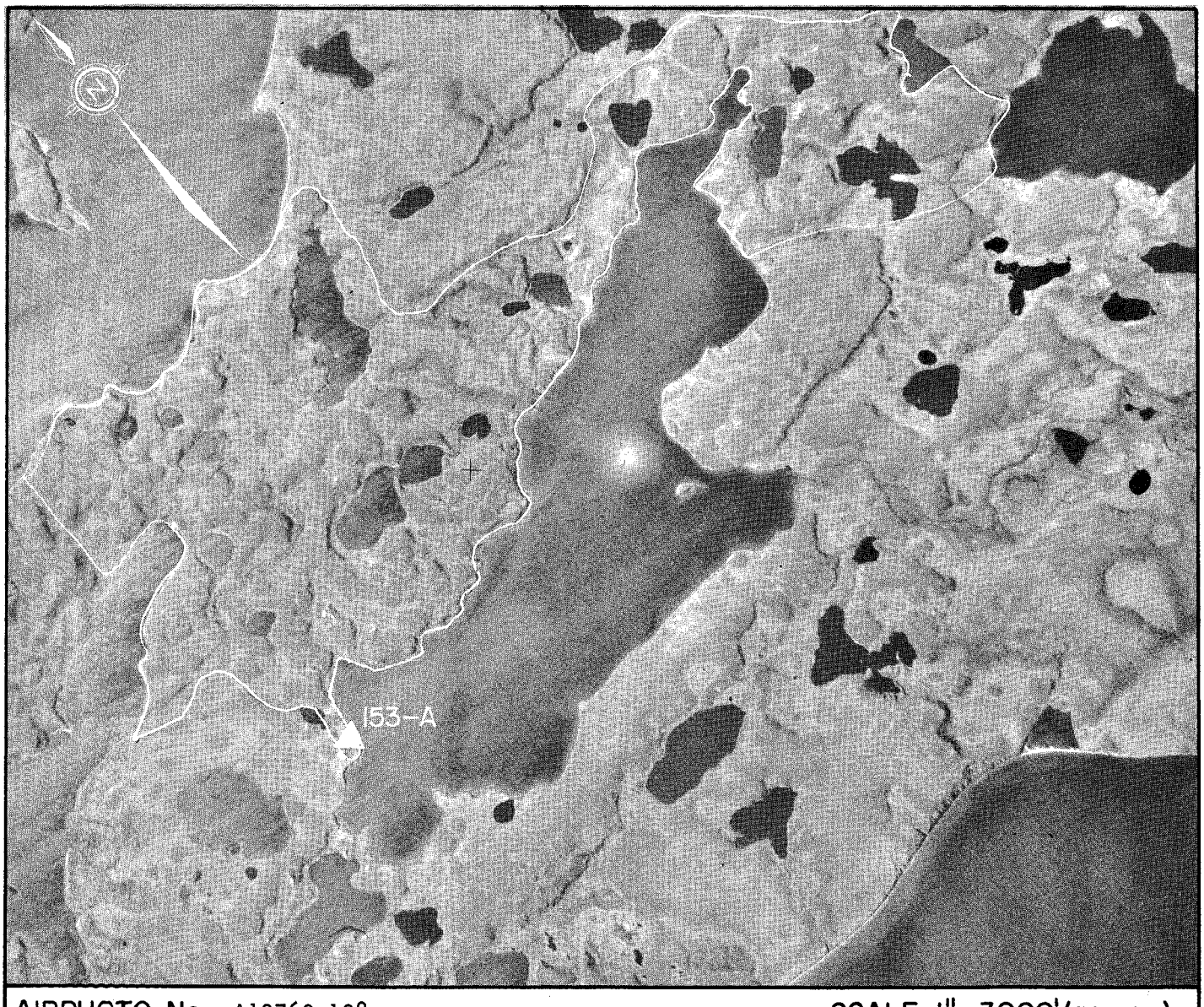
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

ZONE I
SOURCE No. 153

LANDFORM AND LOCATION:	Kame field about 3 miles long and 1½ miles wide located 2 miles northwest of Eskimo Lakes and 20 miles by air east of Tuktoyaktuk.
MATERIAL:	GRAVEL - some sand, trace silt
VOLUME:	1,000,000 cubic yards
CONCLUSION:	Suitable for development but a drilling program is required to delineate the areas of quality material.



AIRPHOTO No. A12760-128 SCALE: 1"= 3000' (approx.)

153 ENVIRONMENT

Physical

This source is a kame field located 2 miles northwest of Eskimo Lakes and 20 miles by air east of Tuktoyaktuk. The field is about 3 miles long and 1½ miles wide. The surface is hillocky, with kames about 50 to 75 feet high and from 150 to 250 feet across the base. The source contains a number of small lakes and is bounded on the north and south by large lakes.

Drainage is good on the kames, but the low ground between contains a polygonal ground pattern, indicative of poor drainage and high ice content.

Some kames have been developed in connection with oil exploration.

Biotic

Vegetative cover in this area is variable, with many of the kames bare on the upper slopes. In general, the ground cover is moss and lichens, with much of the area supporting dwarf birch and willow about 2 or 3 feet high.

The large lake north of the source is fished during winter in support of trapping.

The Tuktoyaktuk Peninsula is the summer range of the Reindeer Herd and of the barren-ground caribou, and is part of the Mackenzie Reindeer Grazing Reserve.

The Eskimo Lakes are important to many species of waterfowl during summer months, and probably they use the source area as well.

During the September reconnaissance, grizzly bears were observed in this area, although this is not noted as their regular habitat.

153 MATERIALS AND QUANTITIES

This source was examined superficially during the September, 1972, reconnaissance, but time did not permit drilling during the following winter. The surface exposures on the sides of the kames indicate

a substantial volume of good gravel and sand in the uppor portions, perhaps to a depth of from 10 to 30 feet. The limiting factor will undoubtedly be the ground ice that is prevalent in the area and the variability of the material.

The sample taken from an erosion face at the lakeshore at the southern corner of the source contains 75% gravel grading to 3 inches maximum size, 23% well-graded sand, and only 2% silt. The gravel is rounded to sub-rounded, and 50% of the particles are coated with carbonate.

A petrographic analysis of the material indicates that the majority of the gravel is quartzite (87%), with soft sandstone (8%), quartz, granite, chert and ironstone making up the remainder.

The volume of recoverable material in this source is extremely hard to estimate on the basis of existing information because it depends on the variation of material and the location of massive ground ice. Probably the amount is at least 1,000,000 cubic yards.

153 DEVELOPMENT

General

This source is suitable for development. It should be investigated by drilling before excavation in order to outline the best material and the largest deposits, thus avoiding the disruption caused by exploratory pits.

This source is one of several in a band stretching along the north side of Eskimo Lakes, and its development must fit into a regional plan.

Access

At present, the only access to this area is during winter, trucking over winter roads. All-weather access to this area is not feasible because of disturbance to the ground cover, as can be seen in the scars that mark old seismic lines.

A truck haul over a short winter road would connect the source to Eskimo Lakes, where barges could be loaded for summer haulage.

Material Use and Handling

The material from this source, as shown by the one test pit, would provide an excellent general fill or road material, but may not be suitable for concrete or asphalt construction if the coating on the gravel is prevalent through the source. This point must be confirmed by further investigation and sampling.

The interior of these kames is undoubtedly ice-rich, and an operation would have to depend on ripping, stockpiling, thawing, and draining.

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 surface soil to be removed is quite small, but this soil and the organic ground cover must be stockpiled for replacement after a kame has been depleted. Banks must be graded to a stable slope, and excavated areas graded to a smooth contour, before the topsoil is replaced.

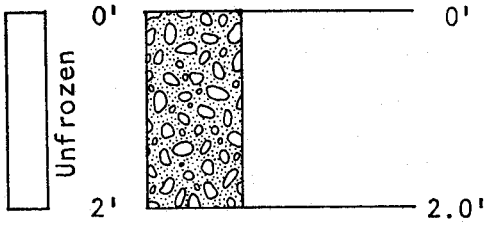
Massive ground ice must not be left exposed on slopes, but should be covered by several feet of granular material in order to prevent thaw and sloughing.

Particular care must be exercised to prevent the siltation of the large lakes and of the streams leading to them.

TEST PIT LOGS

SOURCE No. 153

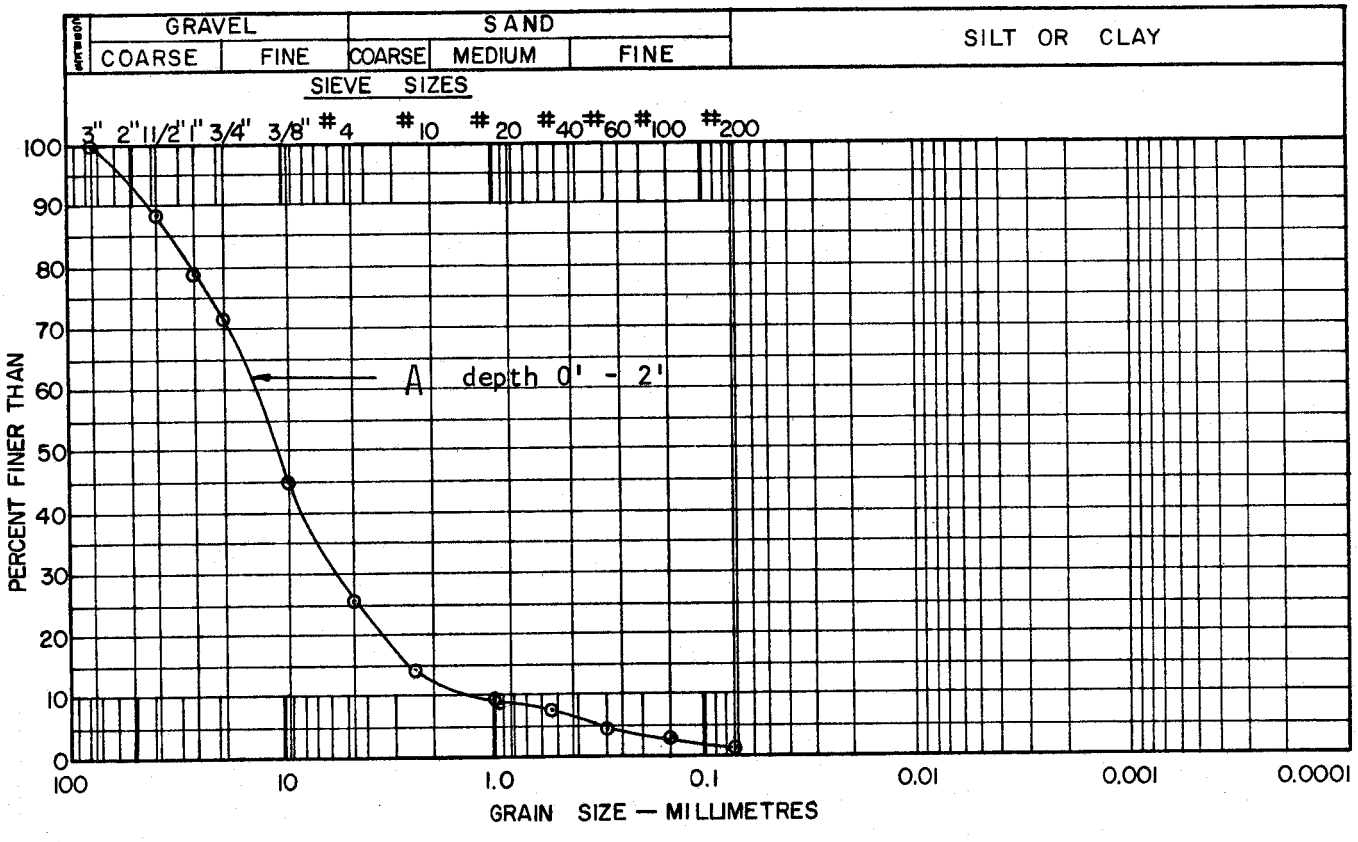
153-A



(GW) GRAVEL - some sand, trace silt, well graded, maximum 2" rounded to sub-rounded, alkali coated

LABORATORY
TEST DATA
TEST PIT-SOURCE No. 153-A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Pit A depth 0' - 2' 1.1%

ORGANIC CONTENT

HARDNESS TEST

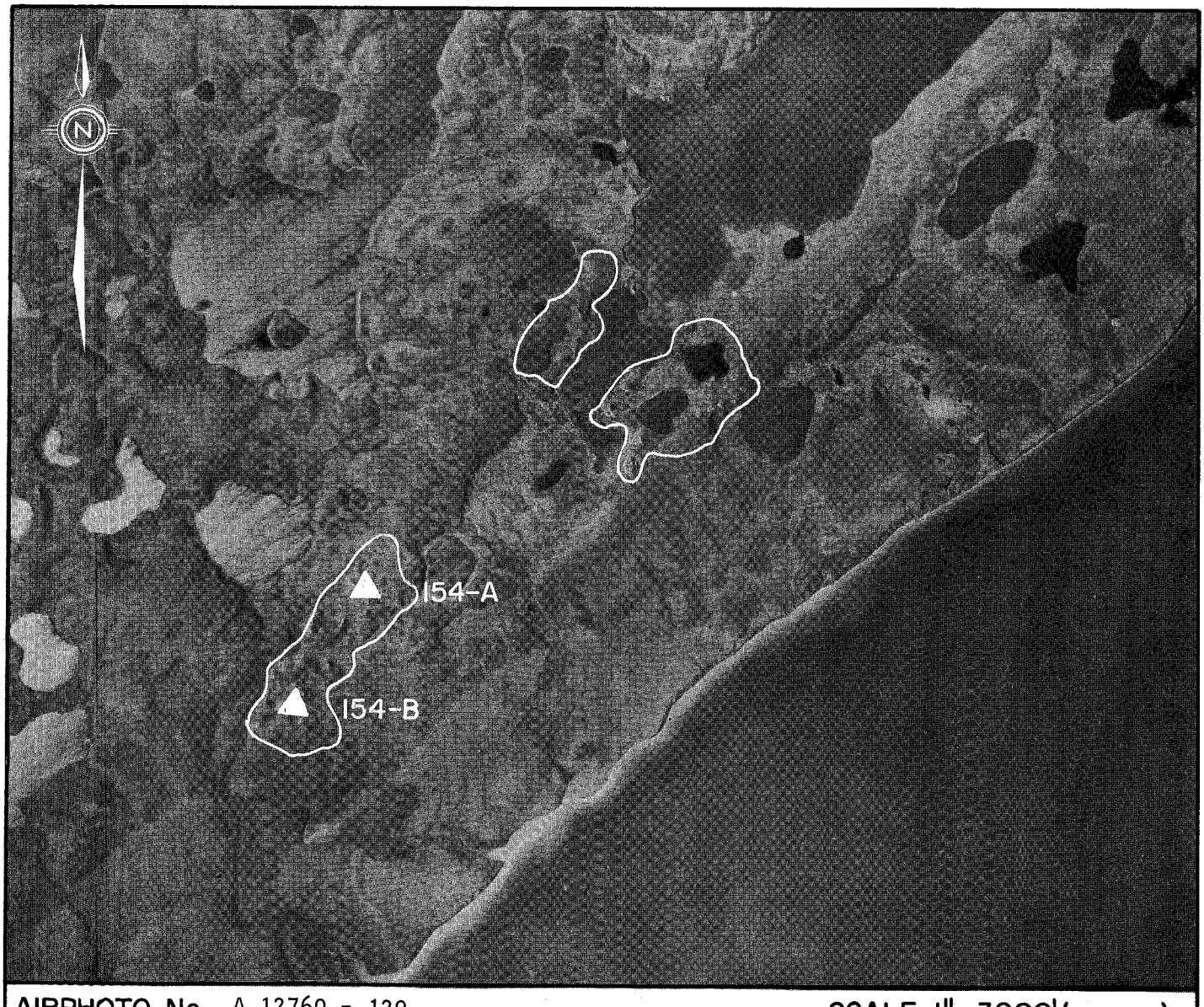
PETROGRAPHIC ANALYSIS

Pit A depth 0 - 2'

Quartzite	- 87%
Sandstone-soft	- 8%
Quartz	- 3%
Granite	- 2%
Chert	- Neg
Ironstone	- Neg
Total	100%

ZONE I
SOURCE No. 154

LANDFORM AND LOCATION:	Three kame fields about ½ square mile in area located 1 mile northwest of Eskimo Lakes and 20 miles southeast of Tuktoyaktuk.
MATERIAL:	GRAVEL - some sand SAND - trace silt
VOLUME:	200,000 cu. yds.
CONCLUSION:	Suitable for development but a drilling program is required to delineate the areas of quality material.



AIRPHOTO No. A 12760 - 129 SCALE: 1"= 3000' (approx.)

154 ENVIRONMENT

Physical

This source is three relatively small kame fields totalling about ½ square mile in area, located 1 mile northwest of Eskimo Lakes and 20 miles southeast of Tuktoyaktuk. Each area is hillocky with a maximum relief of about 30 feet, with gravel exposed on many of the steep kame slopes. Drainage is good on the kames, although the ground between is poorly drained and contains some ponds.

Some kames have been developed to a limited extent in connection with oil exploration.

Biotic

Vegetative cover in this area is variable, with many of the kames bare on the upper slopes. In general, the ground cover is moss and lichens, with much of the area supporting dwarf birch and willow about 2 or 3 feet high.

The Tuktoyaktuk Peninsula is the summer range of the Reindeer Herd and of the barren-ground caribou, and is part of the Mackenzie Reindeer Grazing Reserve.

The Eskimo Lakes are important to many species of waterfowl during summer months, and probably they use the source area as well.

During the September reconnaissance, grizzly bears were observed in this area, although this is not noted as their regular habitat.

154 MATERIALS AND QUANTITIES

This source was examined superficially during the September, 1972, reconnaissance, but time did not permit drilling during the following winter. The surface exposures on the sides of the kames indicate a substantial volume of good gravel and sand in the upper portions, perhaps to a depth of from 10 to 30 feet. The limiting factor will undoubtedly be the ground ice that is prevalent in the area and the variability of the material.

Two test pits were dug in the southwesterly kame field. One penetrated

clean fine sand from the surface to a depth of 4 feet. The sand is 94% between #20 mesh and #100 mesh. The other test pit contained clean gravel at a depth of 1 foot, graded to 1½ inch maximum size. The grading is 75% gravel, 23% well-graded sand, and 2% silt.

This source is similar to Source 153 in that the recoverable volume of material will be governed by the depth at which massive ice occurs and the variability of the source. The volume is tentatively estimated to be 200,000 cubic yards.

154 DEVELOPMENT

General

This source is suitable for development. It should be investigated by drilling before excavation in order to outline the best material and the largest deposits, thus avoiding the disruption caused by exploratory pits.

This source is one of several in a band stretching along the north side of Eskimo Lakes, and its development must fit into a regional plan.

Access

At present, the only access to this area is during winter, trucking over winter roads. All-weather access to this area is not feasible because of disturbance to the ground cover, as can be seen in the scars that mark old seismic lines.

A truck haul over a short winter road would connect the source to Eskimo Lakes, where barges could be loaded for summer haulage.

Material Use and Handling

The interior of these kames is undoubtedly ice-rich, and an operation would have to depend on ripping, stockpiling, thawing, and draining.

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 surface soil to be removed is quite small, but this soil

and the organic ground cover must be stockpiled for replacement after a kame has been depleted. Banks must be graded to a stable slope, and excavated areas graded to a smooth contour, before the topsoil is replaced.

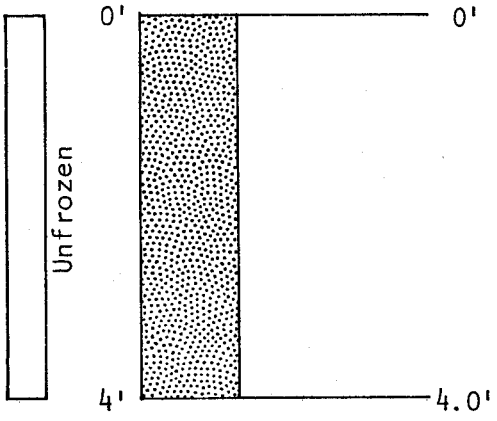
Massive ground ice must not be left exposed on slopes, but should be covered by several feet of granular material in order to prevent thaw and sloughing.

Particular care must be exercised to prevent the siltation of the large lakes and of the streams leading to them.

TEST PIT LOGS

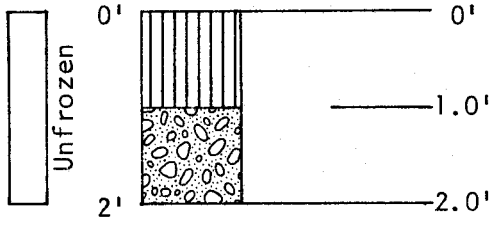
SOURCE No. 154

154-A



(SP) SAND - trace silt, fine to medium

154-B

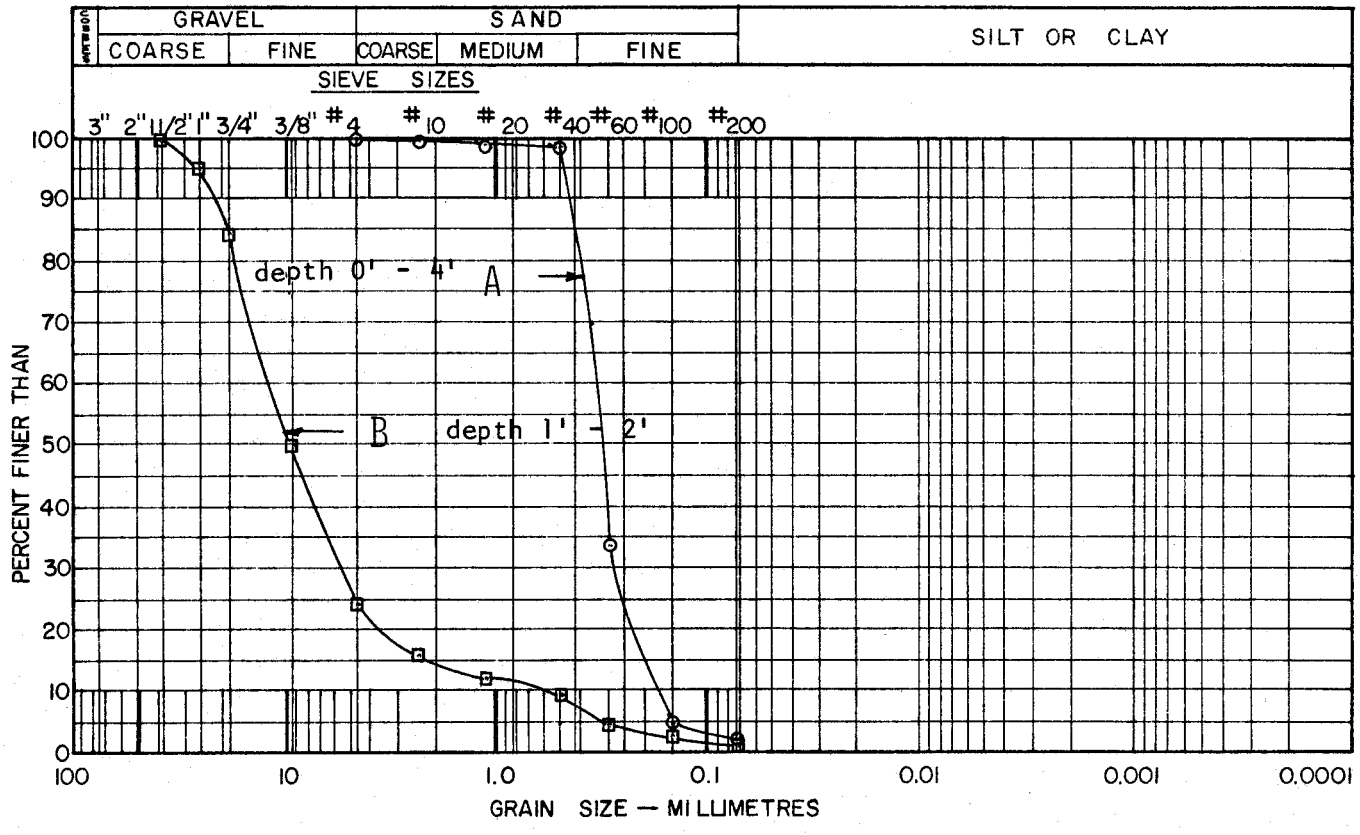


(OL) SILT - organic

(GW) GRAVEL - some sand, trace silt, maximum $1\frac{1}{2}$", rounded to sub-rounded, well graded

LABORATORY
TEST DATA
TEST PIT-SOURCE No. 154

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Pit A	depth 0' - 4'	3.0%
Pit B	depth 1' - 2'	1.5%

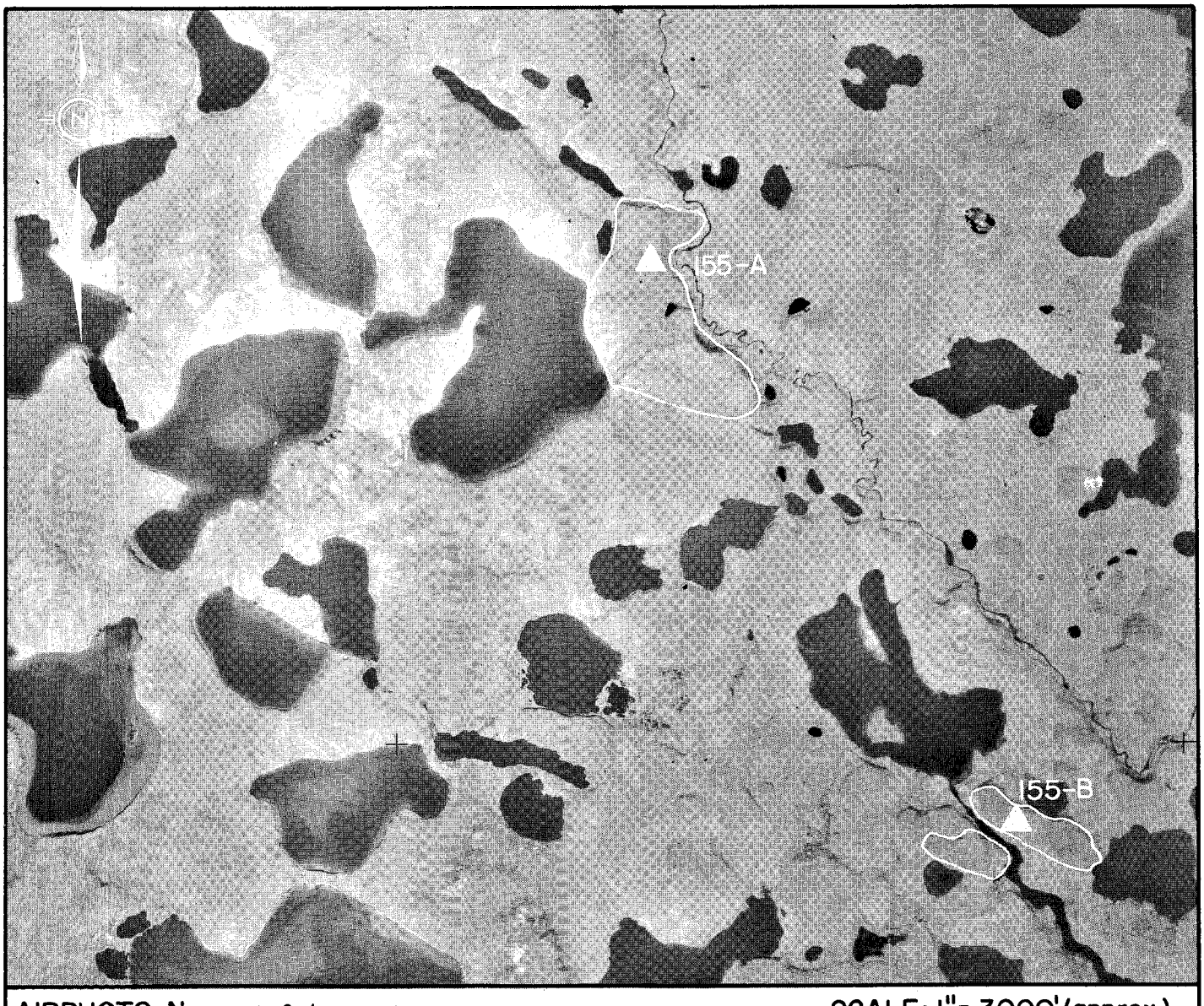
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

ZONE I
SOURCE No. 155

LANDFORM AND LOCATION:	Three benches adjacent to a stream located 21 miles by air southwest of Tuktoyaktuk.
MATERIAL:	SAND - some gravel, little silt.
VOLUME:	1,000,000 cu. yds.
CONCLUSION:	Low priority for development due to variable quality, medium to high ice content and problems in draining stockpiles so that silt is not carried to the stream.



AIRPHOTO No. A12854 - 311 SCALE: 1"= 3000' (approx.)

155 ENVIRONMENT

Physical

This source consists of 3 separate fluvial deposits on benches about 25 to 75 feet above a stream located 21 miles southwest of Tuktoyaktuk. The total area of the 3 deposits is about 1/4 of a square mile. The area is rolling, contains many lakes, and massive ground ice is prevalent in low-lying areas.

The slopes adjacent to the stream are fairly well drained, and this source has not been developed.

Biotic

Organic ground cover is a heavy layer of moss and lichen, with scattered groups of dwarf birch and willow about 2 feet high.

This source lies within the Mackenzie Reindeer Grazing Reserve, and also in an area hunted for moose during winter months. The area is not critical to any wildlife or fish.

155 MATERIAL AND QUANTITIES

Two test pits were dug in the upper levels of this source, one in the northern area and the other in the eastern area. Both struck permafrost at a depth of 2 feet, and both penetrated sand with some gravel and a variable silt content below 1 foot of organic soil. Ice-rich soil can be expected at a shallow depth in these deposits.

Assuming a recoverable depth of 3 to 5 feet of granular material over the area the volume of material in this source is about 1,000,000 cubic yards.

155 DEVELOPMENT

General

This source is rated low priority for development because of the variable silt content and the prevalence of ground ice. In addition the environmental problems of preventing siltation in the adjacent stream would be formidable. The stream flows directly to Kittigayuit Bay, only 6 miles

away, and siltation must not be allowed.

Access

This area is accessible only during the winter, trucking over a winter road. It is remote from any current development.

Material Use and Handling

Material excavated from this source would probably be ice-rich, and would have to be ripped, stockpiled, thawed, and drained. With the relatively high silt content, this operation could lead to siltation of the adjacent stream, unless great care is taken in locating the stockpiles of material. If the operation could be completed, the material would be a variable quality of general fill.

Stripping and Restoration

If this area were developed, the surface organic cover and topsoil would have to be stripped and stockpiled for replacement after the granular material has been removed.

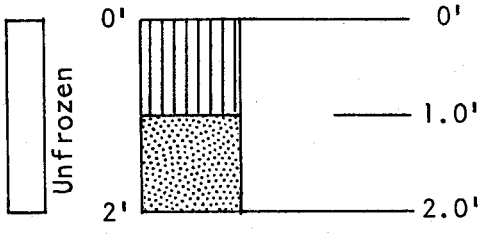
Ground ice must not be left exposed on slopes because of thermal erosion resulting in possible siltation of the streams.

From an environmental point of view, development of this source could be very difficult and very costly to restore.

TEST PIT LOGS

SOURCE No. 155

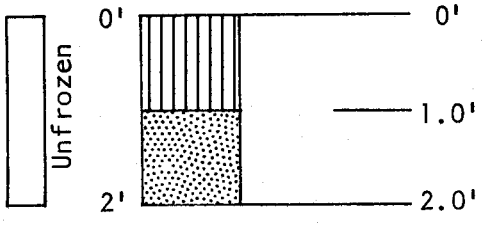
155-A



(OL) SILT - organic

(SM) SAND - some gravel, some silt, 3/4" maximum, rounded to sub-rounded

155-B

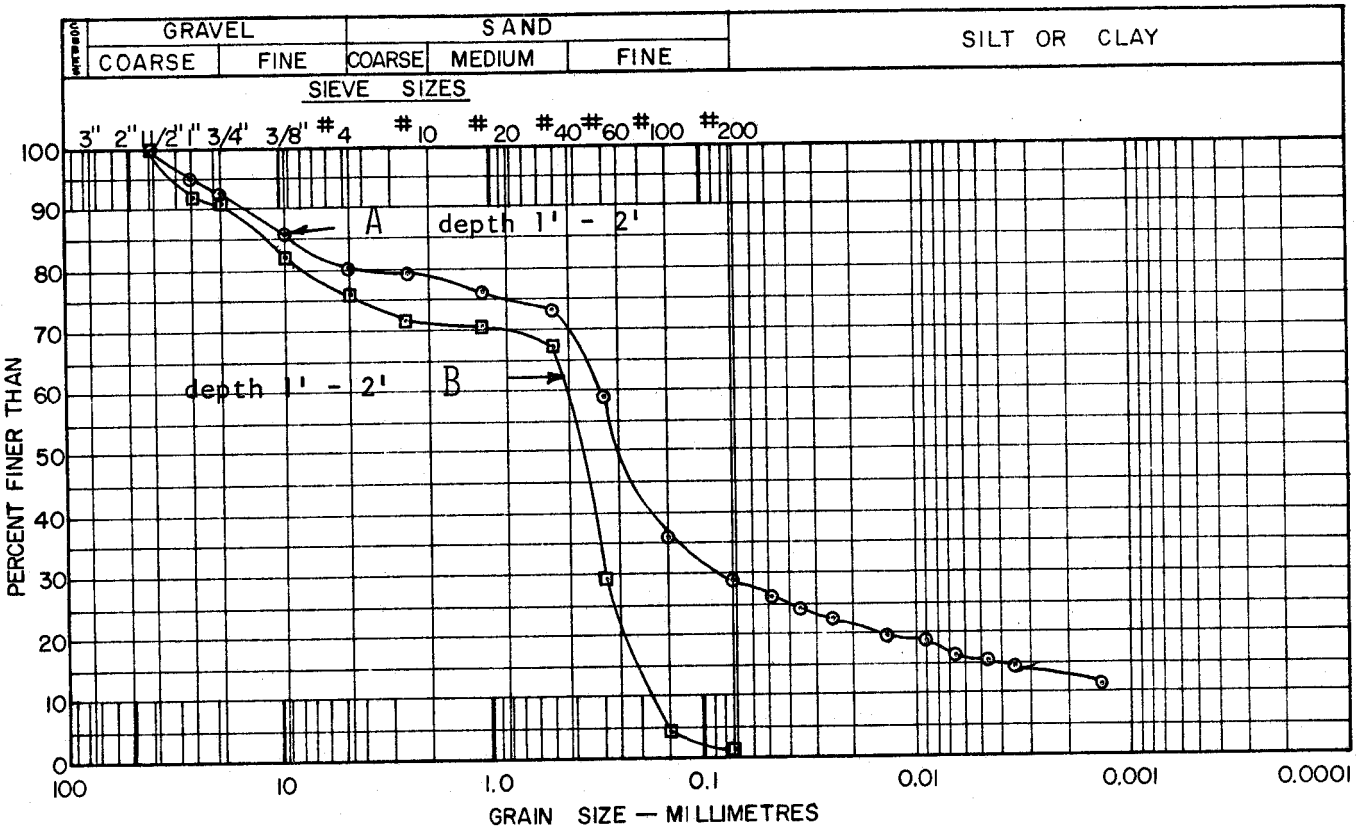


(OL) SILT - organic

(SM-SP) SAND - some gravel, trace silt, 1½" maximum, rounded

LABORATORY
TEST DATA
TEST PIT-SOURCE No. 155

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

Sample A depth 1' - 2' 10.8%
Sample B depth 1' - 2' 14.5%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS