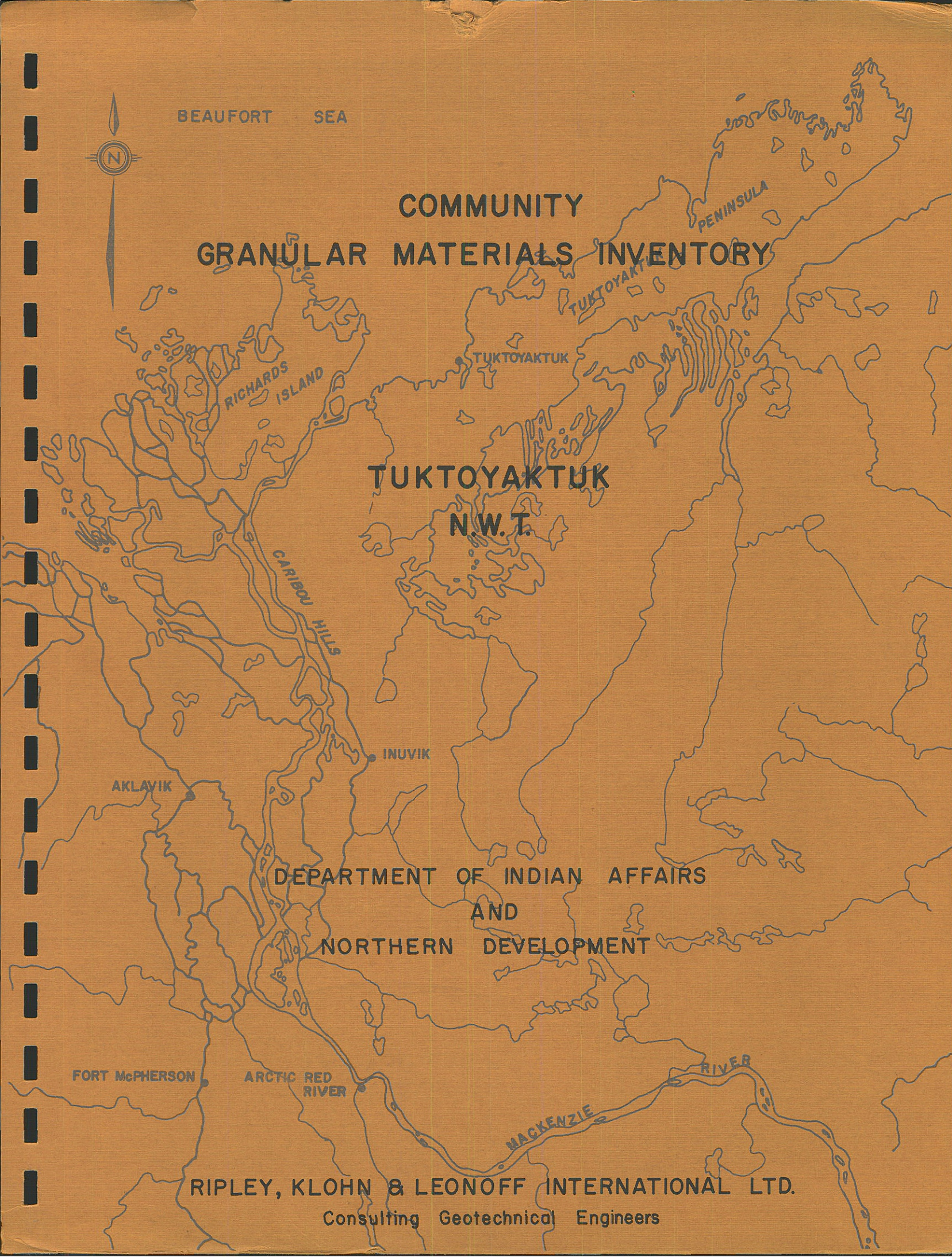

COMMUNITY GRANULAR MATERIALS INVENTORY

TUKTOYAKTUK N.W.T.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

RIPLEY, KLOHN & LEONOFF INTERNATIONAL LTD.
Consulting Geotechnical Engineers

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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 adjacent to the Community of Tuktoyaktuk, N.W.T. 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 each source. The approximate quantities of granular materials required for the Tuktoyaktuk Community were as follows:

Fine grained aggregate (sand)	60,000 cu. yds.
Coarse grained aggregate (gravel) . . .	90,000 cu. yds.
Material suitable for building pads, roads, airstrips etc	1,500,000 cu. yds.

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 investigative 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.

The field reconnaissance to ground-check potential sources was done by means of surface sampling and hand-dug test pits. Obser-

vations relative to existing access roads, drainage conditions, biotic environmental concerns and source development considerations were made. The reconnaissance program indicated that 14 sources for the Community are within a 10 mile radius of the Community and 2 sources are about 17 miles southeast of the Community.

1.3 Data Presented

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

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

Section entitled "Maps and Tables" provides topographic maps showing the location of the Community and the location of the sources for the Community. A summary table giving the pertinent information relative to each source is also provided in this section, together with an explanation of the symbols and terms used in the 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. TUKTOYAKTUK COMMUNITY

2.1 Surficial Geology

Tuktoyaktuk 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 south, and for this reason the extremity of a spit can be excavated continuously without any effect on the remainder of the spit. Excavating the midpoint 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.

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

Tuktoyaktuk is located in the barren lands where vegetative growth is very sparse. The Tuktoyaktuk Peninsula is used as summer range for the reindeer herd and the barren ground caribou. A large portion of the Community source study area forms a part of the white fox trapping area and is part of an important waterfowl breeding area. Tuktoyaktuk Harbour is considered to be an important domestic fishing area on a year-round basis. Kugmallit Bay west of the Community is very important for the Beluga whale, which occupies the Bay during pupping season. The local inhabitants hunt the whale in the Bay and use the beaches to process their kill. There are no critical wildlife zones within the Community area, however, as pointed out by the Canadian Wildlife and Fisheries Services, plans to exploit the spits and beaches must take into consideration their present use by the waterfowl and by the local inhabitants for beaching the Beluga whale.

2.3 Sources and Materials

In the course of this study 16 sources, numbers T-100 to T-115 inclusive, were investigated. Eleven are spits or beaches exposed to the open sea, two are beach deposits in Tuktoyaktuk Harbour, and three are glacial deposits on-shore.

Of the 16 sources studied, 6 were rejected as being unworthy of further consideration. Source T-104A is a beach adjacent to the proposed townsite extension, and is exposed to the open sea.

Development could expose this section of the coast to severe erosion. The other sources rejected (T-102A, 103A, 108A, 110A and 111A) are all spits exposed to the open sea, and each protects a section of coast and a body of water from wave action. Development of each source could have a serious effect on the area behind, and is not considered advisable at this time.

Of the 10 sources remaining, Sources T-100 and T-101 are spits containing sand for fill. Sources T-106 and T-107 are located in Tuktoyaktuk Harbour and contain gravel and sand suitable only for fill. Source T-115 is a glacial outwash deposit near the Community that can be developed quite readily for fill.

Sources T-105, T-109, T-113, and T-114 all contain material that can be used for any purpose, generally with some processing and blending for specification products.

The best material available to the Community comes from T-109, a long spit at close hand. The petrographic analysis of gravel from this source indicates quartz and quartzite (57%), chert (19%), and sandstone (12%) are the main constituents, with schist, ironstone, shale, granite, and limestone making up the remaining 13%. The deleterious content is 7% of the total. The chert is not likely to be reactive, but pending further qualitative tests it is recommended that concrete made with this aggregate should use cement containing no more than 0.6% alkali.

Chlorides and sulphates were found to be negligible in the beach and spit deposits.

2.4 Management

The Tuktoyaktuk Community is in a very difficult position with respect to the supply of granular materials. All sources are within areas used for nesting by waterfowl and sea birds. In addition, the spits and beaches are used by local inhabitants for beaching the Beluga whale and for other activities related to fishing.

Exploitation of beach deposits could accelerate shoreline retreat which would be environmentally unacceptable. The indiscriminate exploitation of spits, particularly breaching of a spit at an intermediate point, could have adverse effects on the shoreline behind as well as disturbance of waterfowl and marine life.

The island Source T-106 is currently used for general fill, and should continue to be exploited. As it approaches depletion, Source T-107 must be investigated for development. Both, however, have limited resources (about 70,000 cu. yds. combined above water level), and large-scale development will require other sources. Two alternatives are available. One is to investigate, both technically and environmentally, the feasibility of excavating these sources below water level. The other is to develop either Source T-113 or T-114, about 17 miles away by winter road, or possibly the sand deposits on Source T-100 or T-101, on the coast and available by either barge or truck at different seasons. The choice will depend on the economics of hauling and on the nature and size of the project.

Source T-109 is now being used to supply general fill. Because of the quality of this material, and the general scarcity of good aggregate in the area, it is recommended that this source be reserved for specification material. The volume available without jeopardizing the coast and waters behind is about 75,000 cubic yards above water line, and probably this volume can be extended by excavating to a lower level. Concrete specifications will require blending with a sand, available in Sources T-100, T-101, or T-112.

Large-scale demands for concrete can be met by development of Sources T-113 or T-114.

In the discussion of the 10 sources under consideration, Sources T-105 and T-115 have not been mentioned. Both are small, and in addition T-105 lies on the boundary of the proposed townsite extension.

Because granular materials are premium resources of the Community and because beaches and spits are vulnerable to careless excavation, it is recommended that a local resident be appointed responsible for pit supervision in the area. He would administer policy with respect to this important field of development.

2.5 Development

2.5.1 General

At the time of the investigation two Sources (T-106 and T-109) were in use. An ocean spit to the south of T-109, designated by X on the Airphoto for Source T-109, had been excavated and was down to about 2 feet above sea ice level. Observation of this spit with respect to erosion could provide useful information for further exploitation of spit sources.

The easterly portion of Source T-113 has been excavated to provide granular fill for oil exploration.

When the Mackenzie Highway is ultimately constructed the Tuktoyaktuk Community could consider obtaining materials from sources to the south in the Parsons Lake area. With this possible alternative the Community could look forward to a year-round supply of materials.

2.5.2 Access

Sources T-113 and T-114 are accessible by truck on prepared winter roads across the tundra, ponds, and ocean ice. This form of transport is, however, limited to about 4 months of the year, from January through April, and means that provision must be made for stockpiling materials in the Community. To build an all-season road from the Community to Source T-113 would require more than 30% of the total estimated granular material requirements for the Community, and does not appear to be feasible, hence only winter hauling should be considered.

Source T-106 is readily accessible by barge in the summer season and by truck across ocean ice in the winter.

The same is true of the other sea-coast sources, although most of them are more remote from the Community.

Source T-115 is readily available by winter road, lying only 3½ miles from the centre of the Community.

2.5.3 Material Use and Handling

For the supply of general fill, it is considered that Source T-106, and possibly T-107, will be adequate for the short-term needs of the Community. As the demand for this material increases, it will be necessary to extend the reserves of these sources by excavating below water level or to develop a new source (T-100, T-101, T-113, or T-114). All these sources can provide good general fill or base-course material.

For the supply of aggregate for concrete and asphalt construction, T-109 offers the best material and is well located. Here the reserves must be considered limited, however, and large new projects will require the development of another source, probably T-113 or T-114. In all cases the pit-run material must be screened and crushed to make most efficient use of the gravel, and must be blended with a suitable sand to improve the grading, probably from T-100, T-101, or T-112.

The development of the sea-coast deposits will follow the current pattern of work. Where stripping is required, a dozer must be used. A front-end loader can fill trucks or can feed a conveyor that discharges onto a barge. Final clean-up will require a dozer.

The on-shore deposits will require a dozer with ripper attachment, a front-end loader, and trucks. Depending on the product being produced, Sources T-113 or T-114 may require the installation of a crushing and screening plant, otherwise this equipment would be located at a central distributing point.

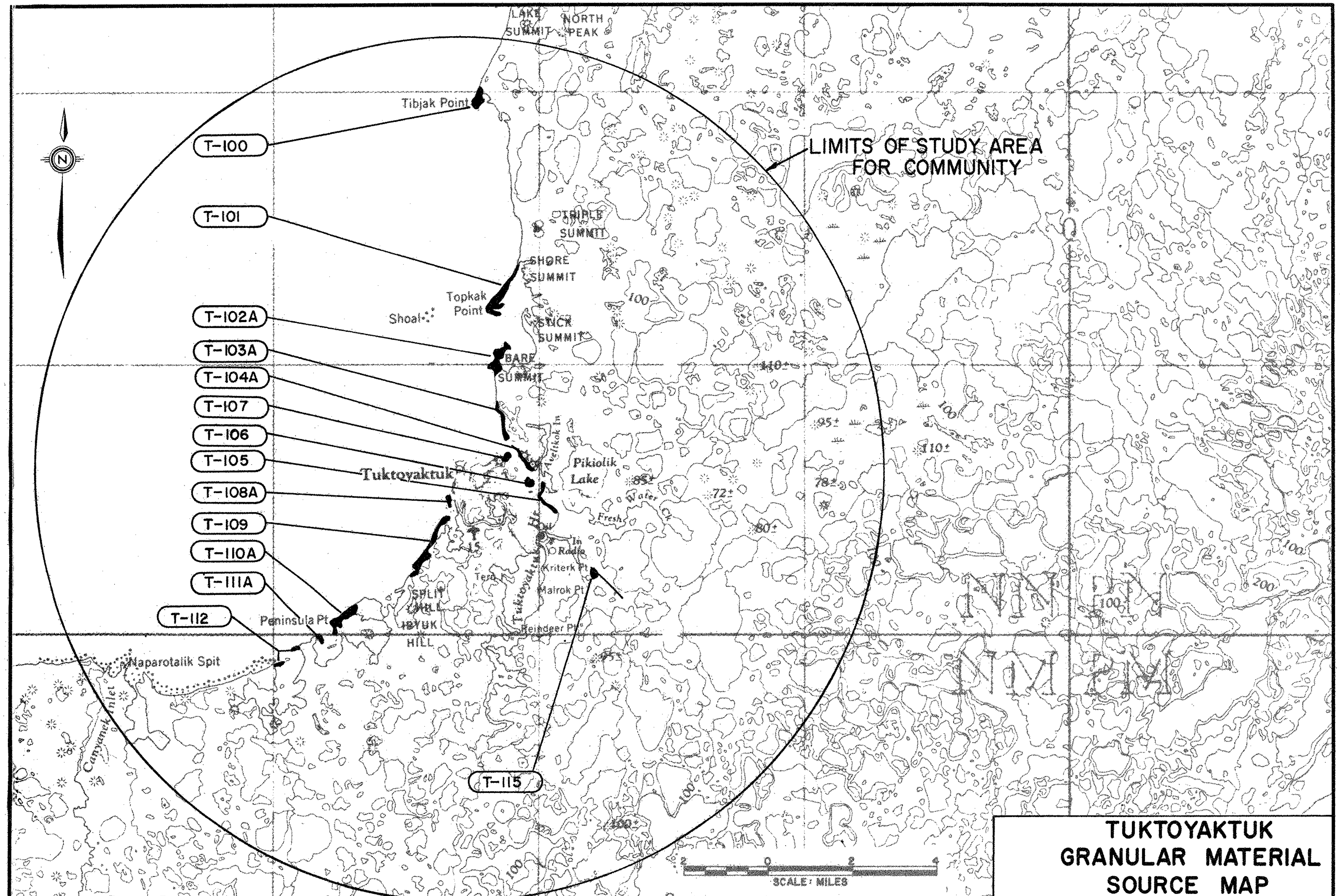
2.5.4 Stripping and Restoration

The sea-coast deposits are generally free of vegetation, and

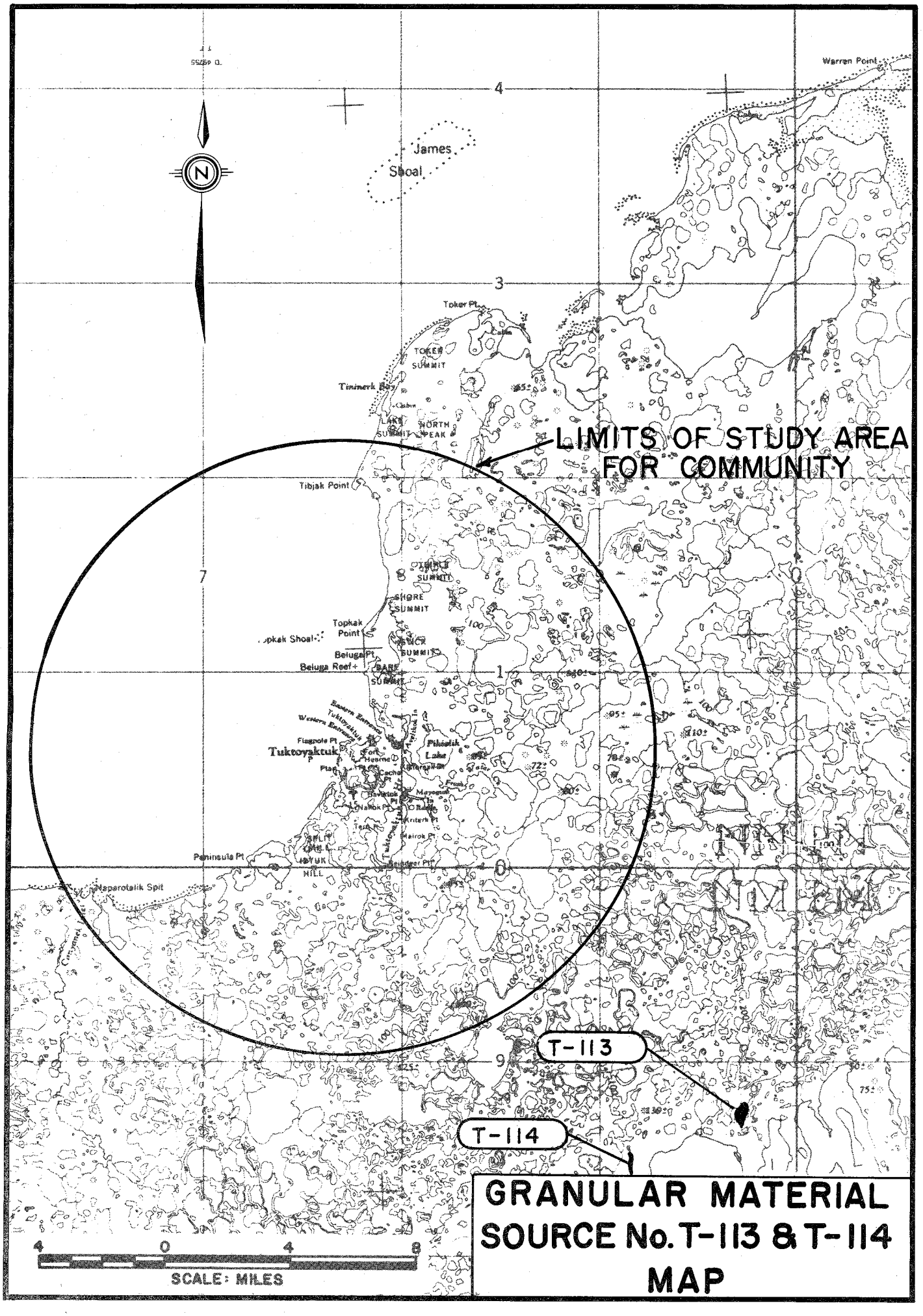
stripping is not required. Where it is necessary, the stripped material must be disposed of permanently above possible wave action. In this situation restorative measures appear to be limited to clean-up and grading, but environmental studies associated with different sources may recommend further work.

The on-shore sources are typical glacial deposits covered by a heavy ground cover of moss and a more or less dense growth of shrubs. All this material must be stripped to expose the granular material, and must be stockpiled nearby for replacement after the granular material has been removed. All banks must be graded to a stable slope before restoration. The area should be seeded for speedy revegetation, using a selection of plants and methods of preparation recommended by a scientist experienced in Arctic horticulture.

Both in development of all sites and in transportation of materials the value of local fisheries and wildlife to the native population must be a guiding consideration. Activities that could lead to siltation of protected marine waters or lakes must be avoided. In the same way the unnecessary disturbance of nesting waterfowl or seabirds must be avoided. The ecological balance may be precarious, and must be preserved.



TUKTOYAKTUK GRANULAR MATERIAL SOURCE MAP



GRANULAR MATERIAL SOURCE No. T-113 & T-114 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						
T-100	9	SAND - little gravel (S W)	80,000	Beach erosion Seabird nesting Marine life	Low priority for development due to quality and the necessity for studies to determine effects of the spit removal on beach erosion and wildlife	Excellent	Nil	N/A	N/A	Nil	3	Push into piles, load into trucks or on barges	General fill	Dozer, Loader, Truck or Barge	Undeveloped
						SEE SECTION T-100 FOR SOURCE DETAILS									
T-101	3½ to 5	SAND - little gravel (S W)	100,000	Beach erosion Seabird nesting Beluga Whale	Low priority for development due to quality and the necessity for studies to determine effects of the spit removal on beach erosion and wildlife	Excellent	Nil	N/A	N/A	Nil	3	Push into piles, load into trucks or on barges	General fill	Dozer, Loader, Truck or Barge	Undeveloped
						SEE SECTION T-101 FOR SOURCE DETAILS									
T-102A	3	SAND - little gravel (S W)	90,000	Beach erosion Seabird nesting Beluga Whale	Not recommended for development due to beach erosion and other environmental concerns	Excellent	Nil	N/A	N/A	Nil	2		General fill		Undeveloped
						SEE SECTION T-102A FOR SOURCE DETAILS									
T-103A	2	SAND - some gravel (S W)	100,000	Beach erosion Seabird nesting Beluga Whale	Not recommended for development due to beach erosion and other environmental concerns	Excellent	Nil	N/A	N/A	Nil	3		General fill		Undeveloped
						SEE SECTION T-103A 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						
T-104A	1½	SAND - some gravel (S W)	25,000	Beach erosion Seabird nesting	Not recommended for development due to beach erosion problems and small quantity and low quality of material	Excellent	Nil	N/A	N/A	Nil	3	SEE SECTION T-104A FOR SOURCE DETAILS	General fill		Undeveloped
T-105	2	GRAVEL - some sand trace silt (G W)	30,000	Seabird nesting and waterfowl Domestic fishing area offshore	Low priority for development pending results of oceanographic and environmental studies	Excellent	Nil	N/A	N/A	Nil	2½	Push into piles, load into trucks or barges SEE SECTION T-105 FOR SOURCE DETAILS	Concrete, Base course, Asphalt General fill	Dozer, Loader, Screen, (maybe crusher) Dozer, Loader, Barge	Undeveloped
T-106	1½	GRAVEL - some sand trace silt (G W)	50,000	Waterfowl Domestic fishing offshore	Suitable for continued development	Good	Moss and silt	1	Stockpile for later grading	Low to medium	6	Rip, push into piles, thaw, load onto barge SEE SECTION T-106 FOR SOURCE DETAILS	General fill	Dozer, Loader, Barge or Truck	Developed and in use by Community
T-107	1	GRAVEL - and sand (G W)	20,000	Waterfowl area Domestic fishing area. Area used by local inhabitants	Low priority for development due to required studies and local use of beach	Excellent	Nil	N/A	N/A	Nil	3	Push into piles, load into truck or barge SEE SECTION T-107 FOR SOURCE DETAILS	Base course, and General fill	Dozer, Loader, Barge or Truck, maybe Crusher	Undeveloped

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						
T-108A	½	SAND - and gravel (S W)	25,000	Beach erosion Waterfowl area Area used by local inhabitants	Not recommended for development due to erosion problem and local useage	Excellent	Nil	N/A	N/A	Nil	4	SEE SECTION T-108A FOR SOURCE DETAILS	Concrete, Base course, Asphalt General fill		Slightly developed
T-109	1 to 3	GRAVEL - and sand (G W)	75,000	Waterfowl nesting Beluga Whale	Suitable for limited development by removal of the landward side of spit. Environmental studies required for large scale development	Excellent	Nil	N/A	N/A	Nil	5 to 7	Push into piles, load into truck or barge. Screen and Crush SEE SECTION T-109 FOR SOURCE DETAILS	Concrete, Base course, Asphalt aggregates	Dozer, Loader, Screen, Truck or Barge maybe Crusher	Partially developed and in use by Community
T-110A	4	SAND - (S P)	45,000	Beach erosion Waterfowl area Beluga Whale	Not recommended for development due to poor quality and environmental concerns	Excellent	Nil	N/A	N/A	Nil	3	SEE SECTION T-110A FOR SOURCE DETAILS	Concrete blending sand only		Undeveloped
T-111A	5	GRAVEL - and sand (G W)	20,000	Beach erosion Waterfowl area Beluga Whale	Source not recommended for development due to low quantity and environmental concerns	Excellent	Nil	N/A	N/A	Nil	4	SEE SECTION T-111A FOR SOURCE DETAILS	Base course, Aggregate and General fill		Undeveloped

SOURCE No.	DISTANCE FROM COMMUNITY MILES	MATERIAL TYPE (UNIFIED GROUP SYMBOL)	VOLUME ESTIMATES CUBIC YARDS	ENVIRONMENTAL CONCERNS	CONCLUSIONS
T-112	6	GRAVEL - and sand (G W)	25,000	Waterfowl area Beluga Whale	Suitable for partial development but would require studies to determine the limits of area
T-113	17	GRAVEL - and sand (G P)	1,500,000	Waterfowl nesting	Source is suitable for development, but access difficult
T-114	16	GRAVEL - some sand	300,000	Waterfowl nesting	Source is suitable for development but access is difficult
T-115	3½	GRAVEL - and sand (G W) SAND - and gravel (S W)	100,000	Waterfowl nesting	Source is suitable for development

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						
Excellent	Nil	N/A	N/A	Nil	3	Push into piles, load in barge	Concrete, Base course, Asphalt aggregates General fill	Dozer, Loader, Barge, maybe Crusher and Screens	Undeveloped
						SEE SECTION T-112 FOR SOURCE DETAILS			
Good	Moss and silt	1 to 2	Stockpile for later grading	Low to medium	20	Rip, doze into piles, load into trucks	Concrete, Base course, and Asphalt aggregates General fill	Dozer, Loader, Trucks, Screens and maybe Crusher	Very slight development by oil exploration
						SEE SECTION T-113 FOR SOURCE DETAILS			
Good	Moss and silt	1 to 2	Stockpile for later grading	Low to Medium	20	Rip, doze into piles, load into trucks	Concrete, Base course, and Asphalt aggregates General fill	Dozer, Loader, Trucks, Screens and maybe Crusher	Undeveloped
						SEE SECTION T-114 FOR SOURCE DETAILS			
Fair to good	Peat and silt	1 to 4	Stockpile for later regrading	Low to Medium	25	Rip, doze into piles, thaw and drain, load into trucks	General fill	Dozer-Ripper, Loader, Trucks	Undeveloped
						SEE SECTION T-115 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.

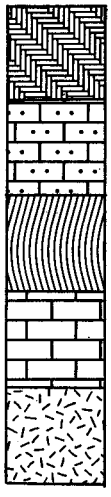
Interbedded .... composed of alternate layers of different soil or rock types.

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



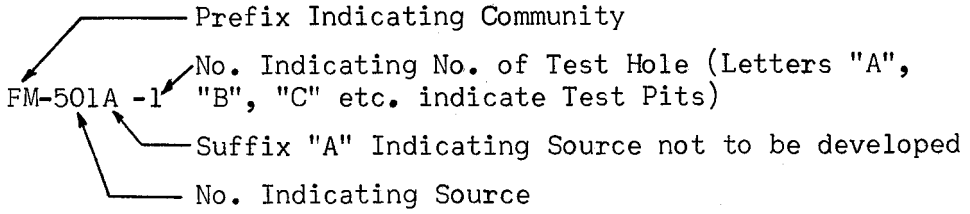
Bedrock

Sandstone

Shale

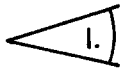
Limestone

Talus



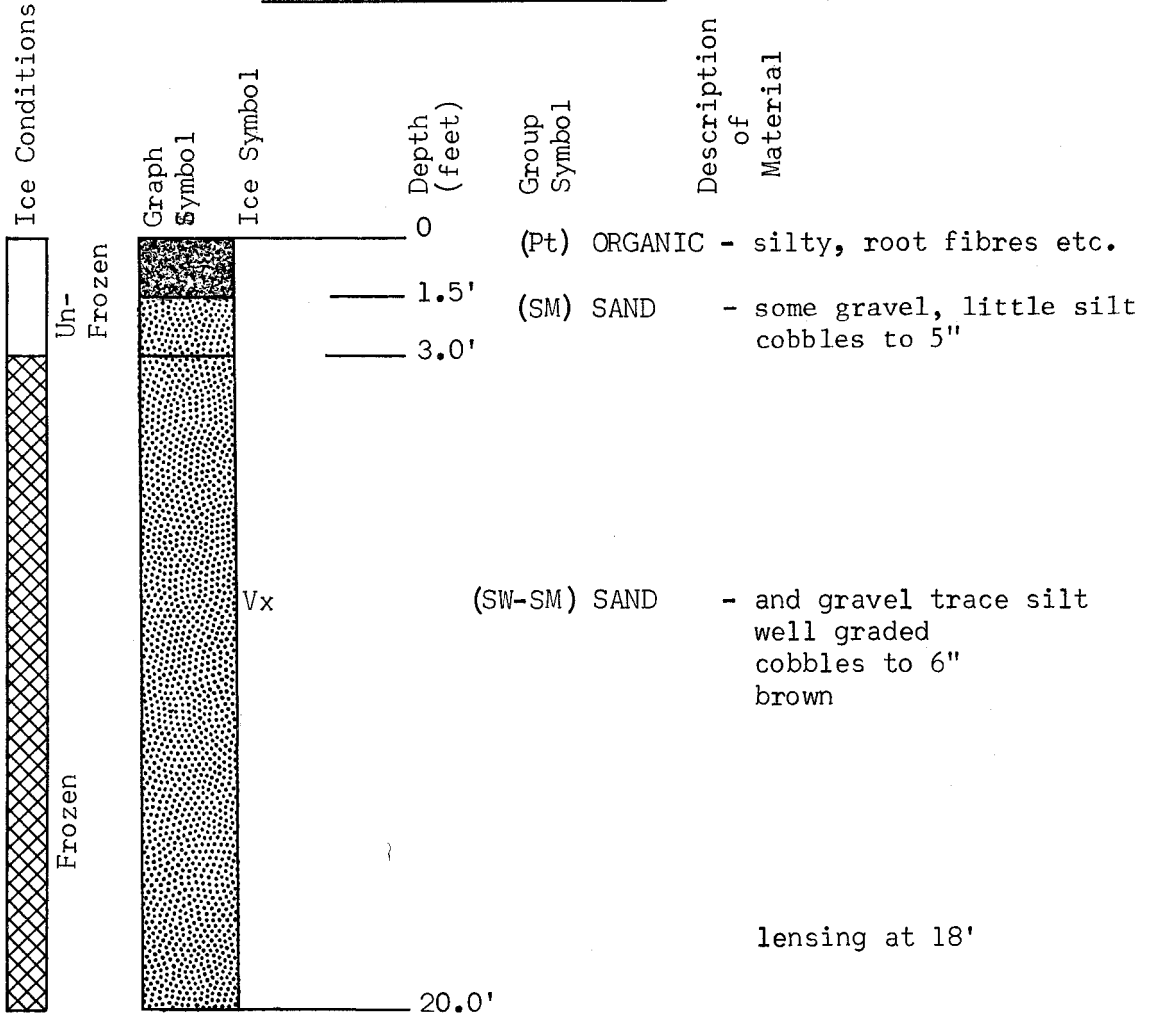
Indicates Test Hole Location

Indicates Test Pit Location



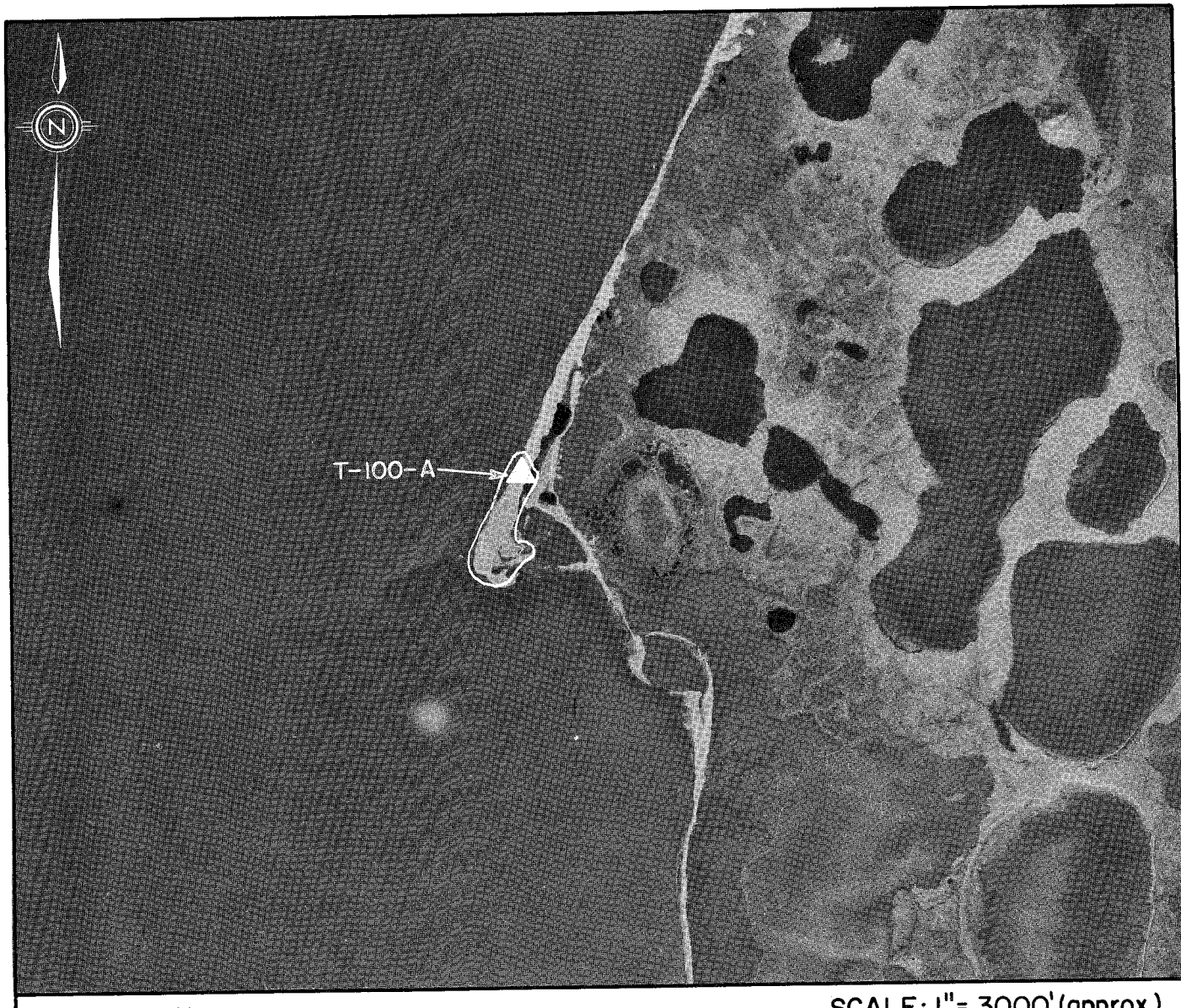
Indicates Direction of Ground Photograph and Field of View

EXAMPLE OF SOIL LOG



TUKTOYAKTUK
SOURCE No. T-100

LANDFORM AND LOCATION:	Ocean Spit (Tibjak Point) 9 miles north of Tuktoyaktuk
MATERIAL:	SAND - little gravel
VOLUME:	80,000 cu. yds., approximately
CONCLUSION:	Source is low priority for development as the material is primarily sand. Also, an oceanographic study would be required to determine whether the spit could be removed without causing erosion of the shoreline or interfering with wildlife and marine life



AIRPHOTO No. A12902 - 128

SCALE: 1" = 3000' (approx.)

T-100 ENVIRONMENT

Physical

The source is an ocean spit named Tibjak Point approximately 3,000 feet long, 250 feet wide and rising about 4 feet above water level.

Drainage of the source is excellent, with no ground ice encountered to a depth of 3½ feet during the reconnaissance in September.

Removal or substantial lowering of this spit may expose the shoreline behind to wave action and possible erosion.

The source is 9 miles by air north of Tuktoyaktuk. The source has not been developed.

Biotic

The spit is free of vegetative cover. It is considered to be an important seabird nesting area and is used for beaching the Beluga whales that are often caught in the vicinity. The Fisheries Branch of Environment Canada have indicated that exploitation of this spit would be harmful to the marine life of the area.

T-100 MATERIALS AND QUANTITIES

The material contained in this source is clean sand with about 15% coarser than #4 mesh.

The volume that could be removed behind the south end of the spit is estimated to be 80,000 cubic yards.

T-100 DEVELOPMENT

General

The source is not recommended for large-scale development because of objections raised by the Canadian Wildlife Service and the Fisheries Branch. Probably both seabirds and fish could be affected by development.

Removal of the spit, or a substantial lowering, could lead to erosion of the shoreline behind the spit.

A small amount of material could probably be removed behind the south end of the spit without serious effects, either physical or biological, but any action in this direction must be preceded by an oceanographic and environmental study.

If development of the spit were to proceed, excavation must start at the south end and progress to the north.

Access

Transportation from this source could be accomplished by barge in summer or by truck in winter, following the coast-line. In either case the haul is about 9 miles.

Material Use and Handling

The material in this source could be used as general fill.

The equipment required for development during summer would be a dozer, front-end loader, conveyor, and barges. During the winter a dozer with ripper attachment would be required to excavate the sand, then a front-end loader would load the trucks.

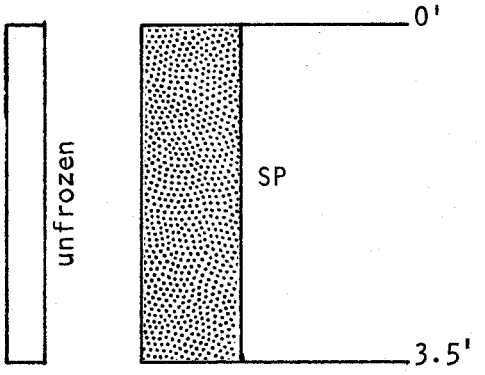
Stripping and Restoration

The surface of the spit is bare, and stripping is not necessary. Restoration work would be minimal, although the environmental study might recommend certain measures that are not obvious at this time. At least, the surface must be graded smooth following excavation.

TEST PIT LOGS

SOURCE No. T-100

T-100-A

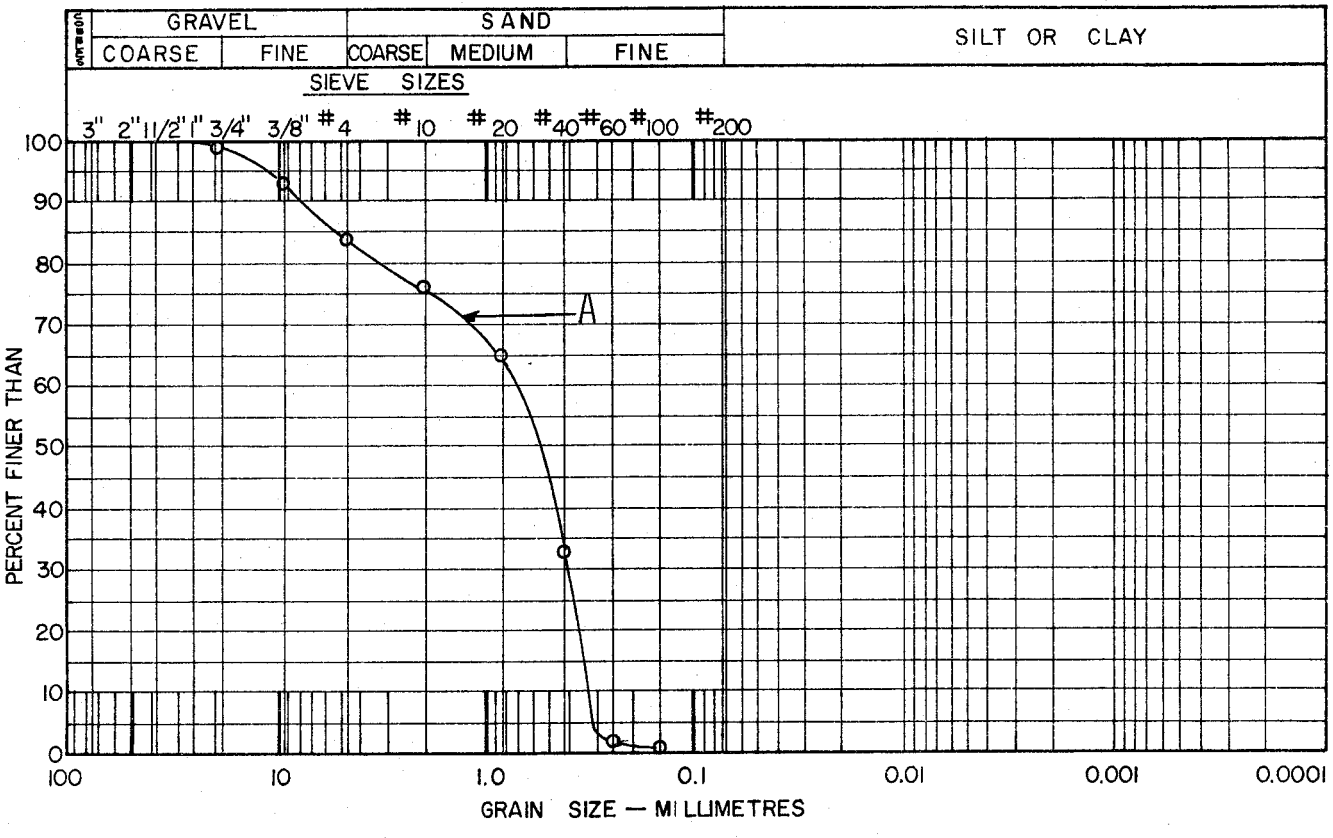


SAND - little gravel, med. to coarse
poorly graded, brown

water at 3.5'

LABORATORY
TEST DATA
TEST PIT-SOURCE No. T-100

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A (0' - 3.5') M/C = 2.9%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

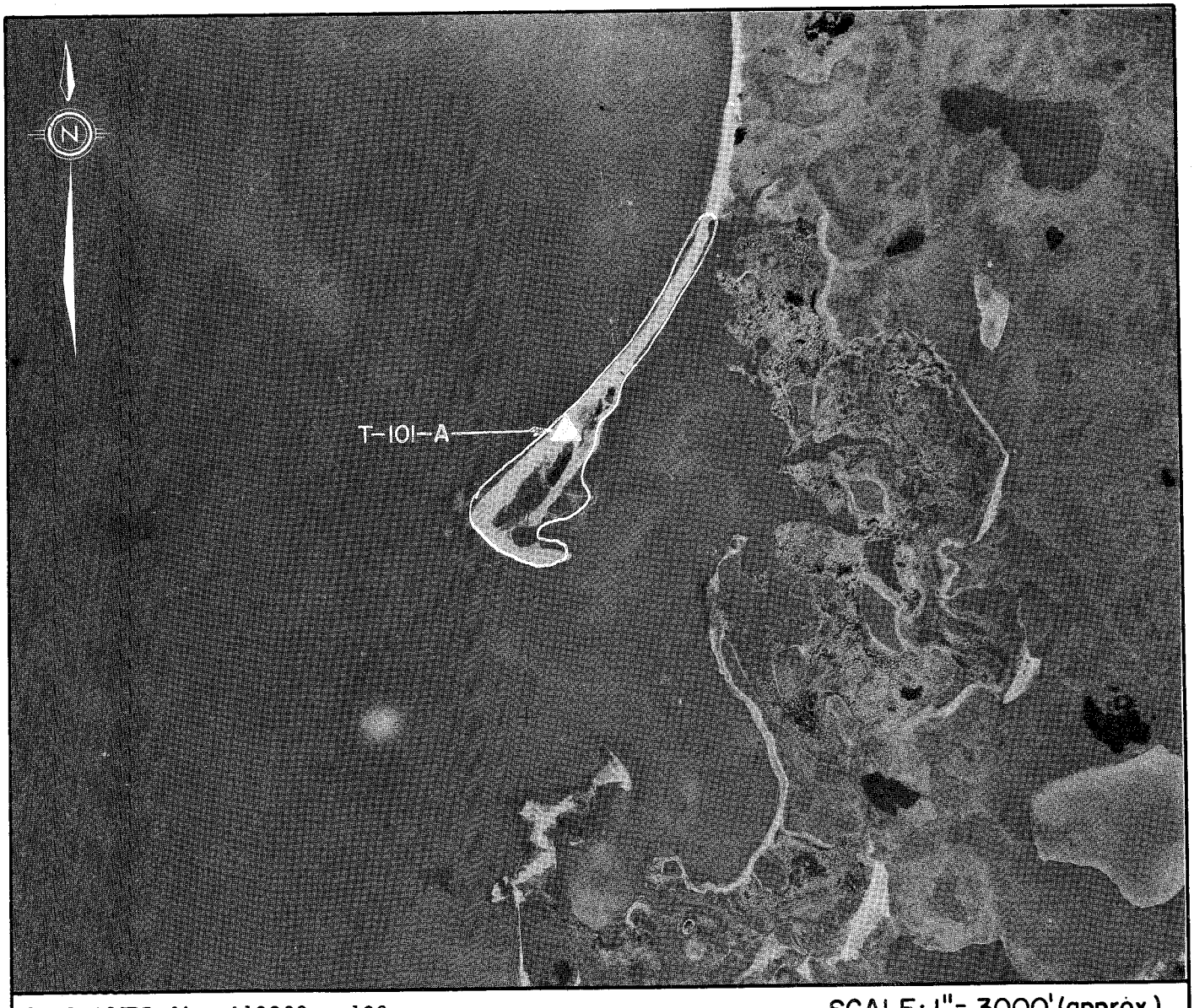
TUKTOYAKTUK
SOURCE No. T-101

LANDFORM AND LOCATION: Ocean Spit (Topkak Point) 3½ to 5 miles north of Tuktoyaktuk

MATERIAL: SAND - little gravel

VOLUME: 100,000 cu. yds., approximately

CONCLUSION: Source is low priority for development as the material is primarily sand. Also, an oceanographic study would be required to determine whether the spit could be removed without causing erosion of the shoreline or interfering with wildlife and marine life



AIRPHOTO No. A12902 - 130 SCALE: 1" = 3000' (approx.)

T-101 ENVIRONMENT

Physical

The Source is an ocean spit known as Topkak Point, about 2 miles long, variable in width, and rising about 5 feet above ocean level.

Drainage is good, with no ground ice observed in September to a depth of $4\frac{1}{2}$ feet.

The spit forms a barrier to protect the shoreline behind from wave action and possible erosion.

The Source is $3\frac{1}{2}$ to 5 miles north of Tuktoyaktuk, and has not been developed.

Biotic

The spit is free of vegetative cover. It is considered to be an important seabird nesting area and is used for beaching the Beluga whales that are often caught in the vicinity. The Fisheries Branch of Environment Canada have indicated that exploitation of this spit would be harmful to the marine life of the area.

T-101 MATERIALS AND QUANTITIES

The material contained in this Source is a clean sand with about 15% coarser than #4 mesh.

The recoverable volume over the total area of the spit is about 350,000 cubic yards. The volume that could be removed behind the south end of the spit is estimated to be 100,000 cubic yards.

T-101 DEVELOPMENT

General

The Source is not recommended for large-scale development because of objections raised by the Canadian Wildlife Service and the Fisheries Branch, indicating that both seabirds and fish could be affected by development.

Removal of the spit, or even a substantial lowering, could lead to erosion of the shoreline behind the spit.

A limited amount of material could probably be removed behind the south end of the spit without serious effects, either physical or biological, but any action in this direction must be preceded by an oceanographic and environmental study.

If development of the spit were to proceed, excavation must start at the south end and progress to the north.

Access

Transportation from this source could be accomplished by barge in summer or by truck in winter, following the coast-line. In either case the haul is about 4 miles.

Material Use and Handling

The material in this source could be used as general fill.

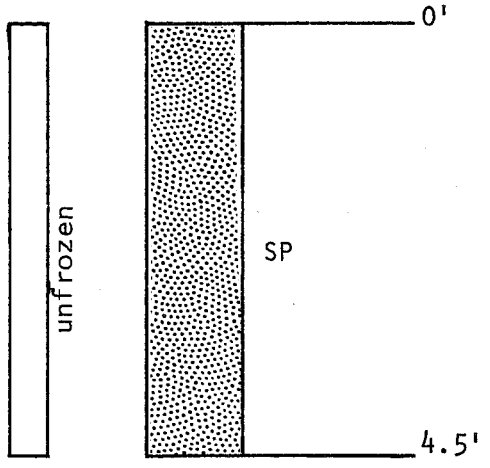
The equipment required for development during summer would be a dozer, front-end loader, conveyor, and barges. During the winter a dozer with ripper attachment would be required to excavate the sand, then a front-end loader would load the trucks.

Stripping and Restoration

The surface of the spit is bare, and stripping is not necessary. Restoration work would be minimal, although the environmental study might recommend certain measures that are not obvious at this time. At least, the surface must be graded smooth following excavation.

TEST PIT LOGS
SOURCE No. T-101

T-101-A

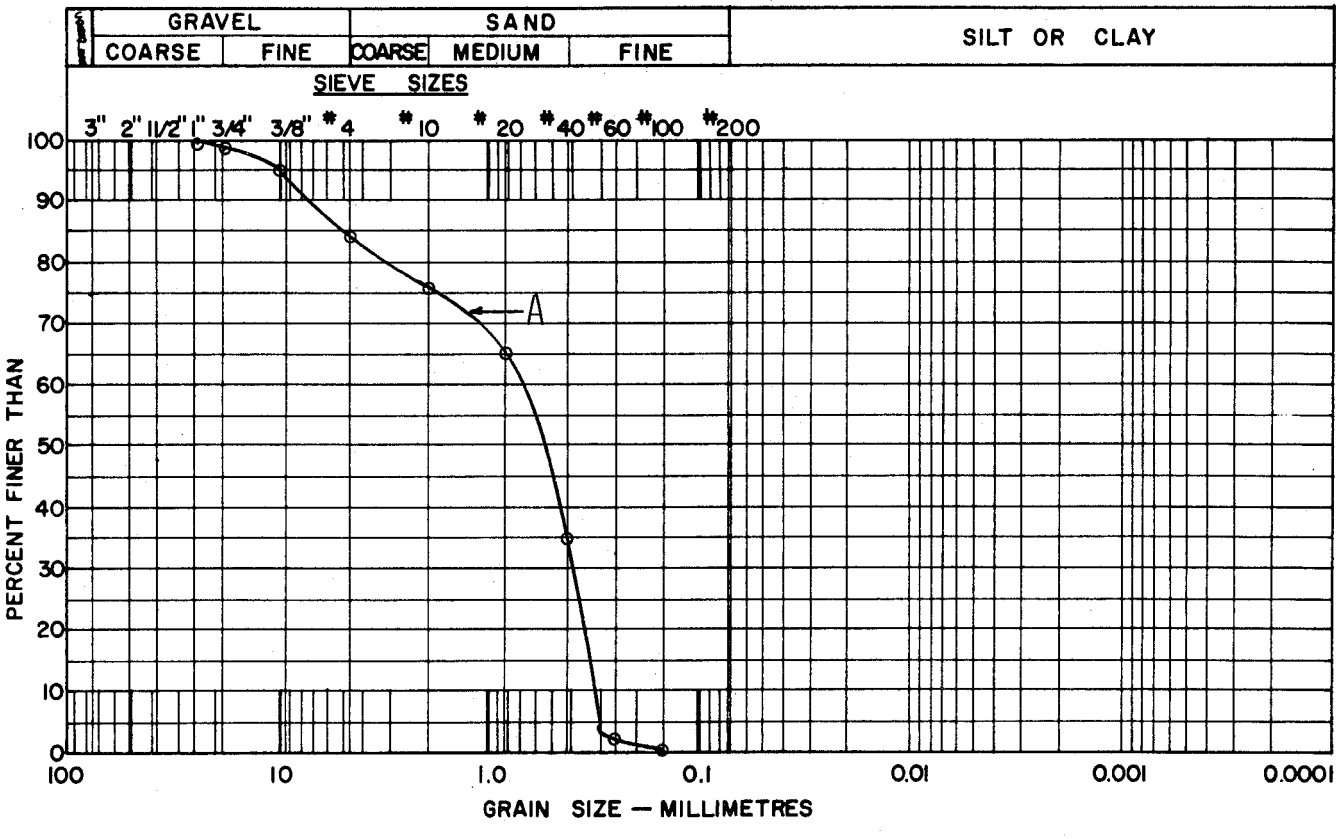


SAND - little gravel, med. to coarse, poorly graded, brown

water at 4.5'

LABORATORY
TEST DATA
SOURCE No. T-101

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 4.5') M/C = 2.9%

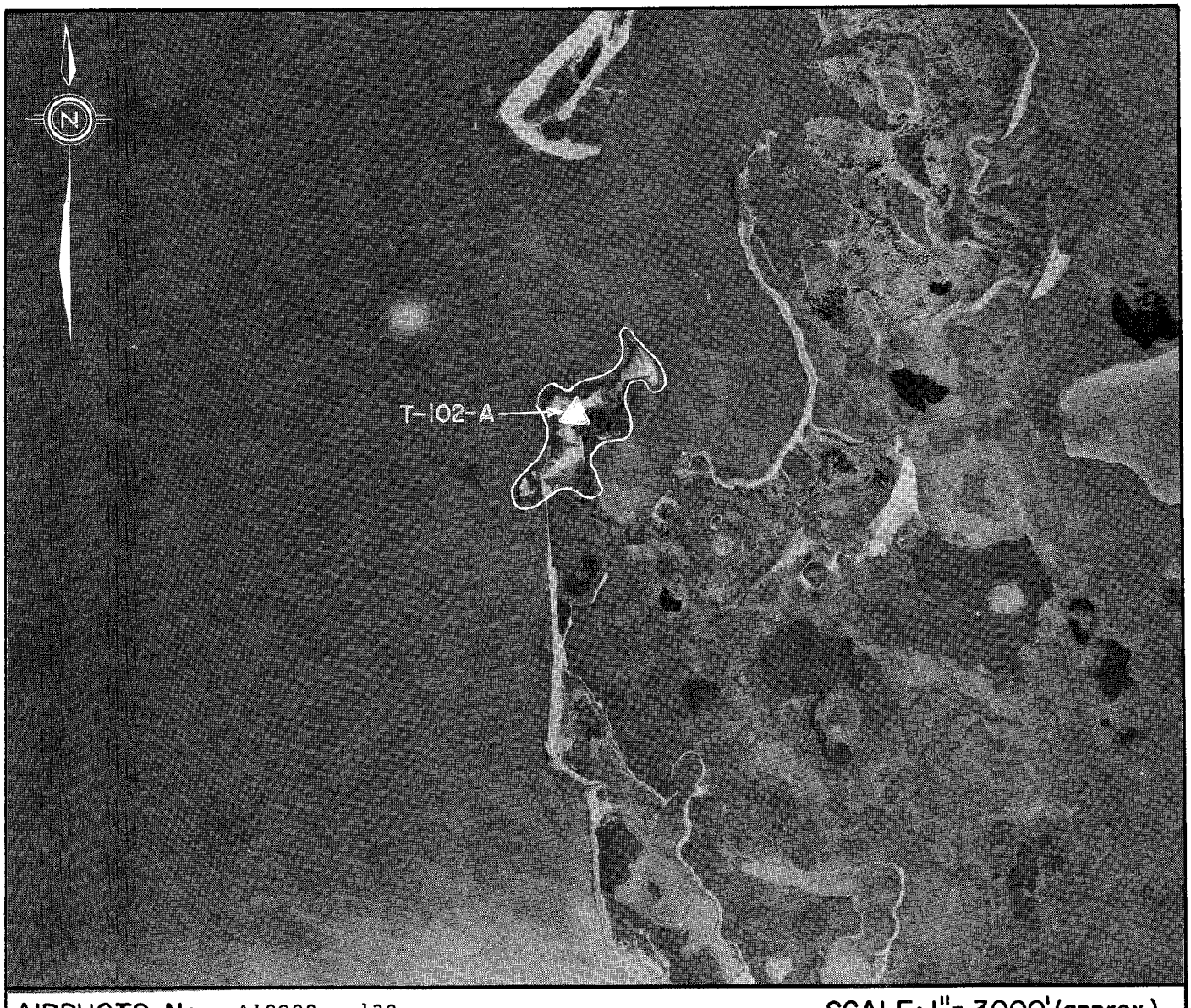
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No.T-102A

LANDFORM AND LOCATION:	Beach (Beluga Point) 3 miles north of Tuktoyaktuk.
MATERIAL:	SAND - little gravel
VOLUME:	90,000 cu. yds.
CONCLUSION:	Source is not suitable for development because of erosional and environmental concerns.



AIRPHOTO No. A12902 - 130 SCALE: 1"= 3000' (approx.)

T-102A ENVIRONMENT

Physical

The source is a section of beach at Beluga Point, about 3,000 feet long, from 200 to 800 feet wide, and about 4 feet above ocean level.

Drainage is excellent, and no ground ice was encountered to a depth of 3½ feet when the source was investigated in September.

Removal or substantial lowering of this beach could expose the shoreline behind to the full effects of ocean waves, with resultant erosion.

The source is 3 miles north of Tuktoyaktuk, and has not been developed.

Biotic

Vegetation is sparse and patchy. Where present, it consists of tufted grass and small shrubs.

The beach is a nesting ground for seabirds, and is considered important for waterfowl and the beaching of Beluga whales that are caught nearby. Marine life is considered prolific in the sheltered water behind the beach, and would be seriously disturbed by its removal.

T-102A MATERIALS AND QUANTITIES

The material contained in this source is a clean uniform sand with about 10% coarser than #4 mesh.

The volume of beach material above water level and above an underlying silt layer is estimated at 90,000 cubic yards.

T-102A DEVELOPMENT

General

This source is not recommended for development. The cost of development, in terms of physical and environmental losses, is too great, as long as alternative sources are available.

Access

Transportation to this source can be accomplished by barge in summer and by truck in winter, following the coast-line. The distance to

Tuktoyaktuk is about 3½ miles.

Material Use and Handling

If development were feasible the material would be suitable for general fill.

However, the development and handling would require particular care because of the soft layer of organic black silt beneath, which could not support equipment.

Winter operation of the source would require a dozer with ripper attachment, a front-end loader, and trucks. Summer operation would require a dozer, front-end loader, a conveyor, and barges.

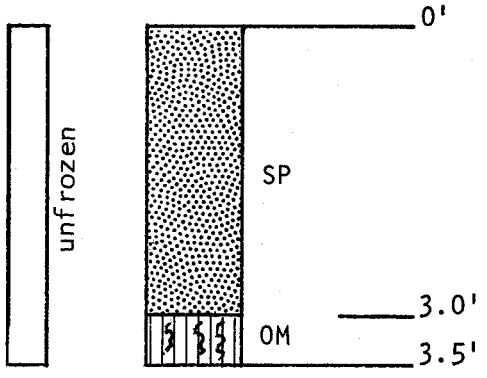
Stripping and Restoration

Removal of the sand beach would not only expose the land behind to erosion, but also the underlying silt. Extensive restoration would be required to stabilize the area.

TEST PIT LOGS

SOURCE No. T-102A

T-102A-A



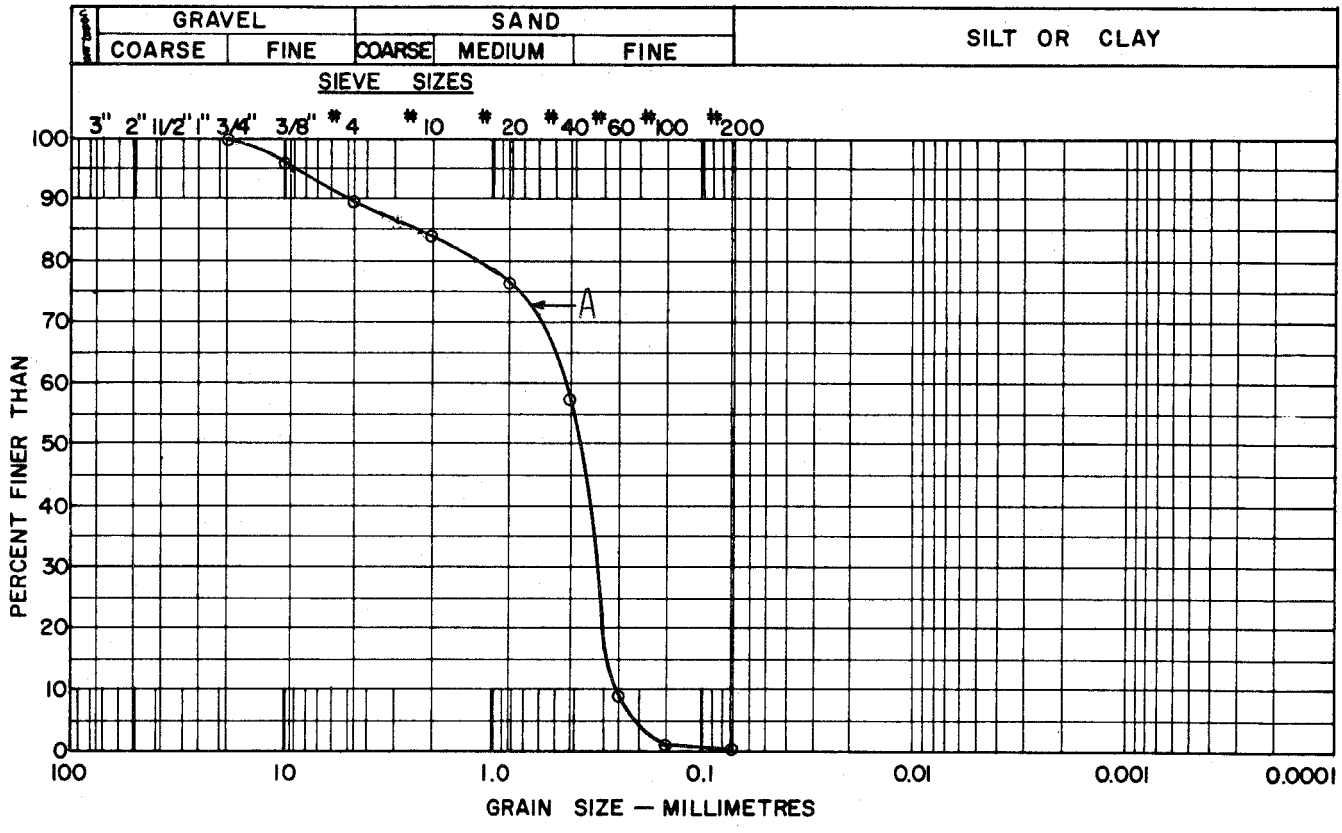
SAND - little gravel, fine to coarse, poorly graded, brown

water at 3'

SILT - organic black

LABORATORY
TEST DATA
SOURCE No. T-102A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 3') M/C = 6.0%

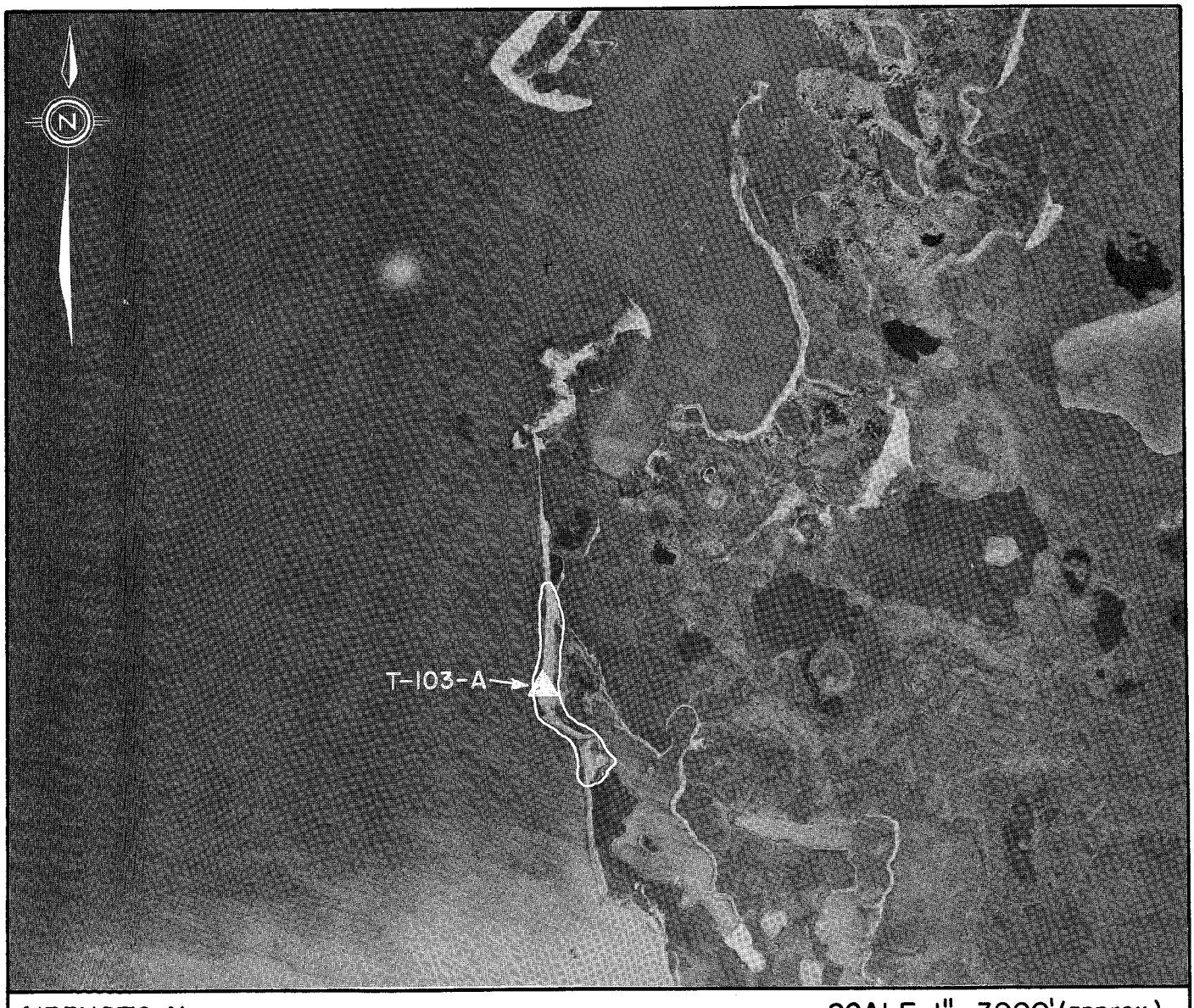
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-103A

LANDFORM AND LOCATION:	Ocean beach strip 2 miles north of Tuktoyaktuk
MATERIAL:	SAND - little gravel
VOLUME:	100,000 cu. yds.
CONCLUSION:	Source is not suitable for development due to erosion and other environmental concerns.



AIRPHOTO No. A12902 - 130 SCALE: 1"= 3000' (approx.)

T-103A ENVIRONMENT

Physical

The source is a section of beach facing the open sea, about 1 mile long, 200 feet wide and rising about 3 feet above ocean level.

Drainage is good, with no ground ice observed to a depth of 3 feet in September.

The source is about 2 miles from Tuktoyaktuk, and has not been developed.

Biotic

The beach is generally bare, with increasing amounts of grass and shrubs at the inner edge.

The beach is considered to be an important seabird nesting area and is used for beaching the Beluga whales that are caught in the vicinity.

T-103A MATERIALS AND QUANTITIES

The material is a clean uniform sand with about 10% coarser than #4 mesh.

The volume of beach material above water level is estimated to be 100,000 cubic yards.

T-103A DEVELOPMENT

General

Development of this source is not recommended because it would expose the nearby shoreline to strong wave action and resultant erosion. In addition, the Canadian Wildlife Service have objected to any disturbance of this nesting area.

Access

Transportation to this source could be accomplished by barge in summer and by truck in winter.

Material Use and Handling

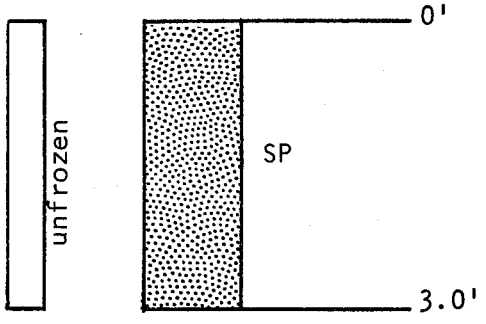
If development were feasible the material could be suitable for general fill. As at nearby sources, development would require a dozer, front-end loader, conveyor, barge, or trucks.

Stripping and Restoration

No stripping of this source would be necessary for development. However, removal of the sand from the beach area could expose the beach area behind to erosion. Extensive restoration may then be required to stabilize the area again.

TEST PIT LOGS
SOURCE No. T-103A

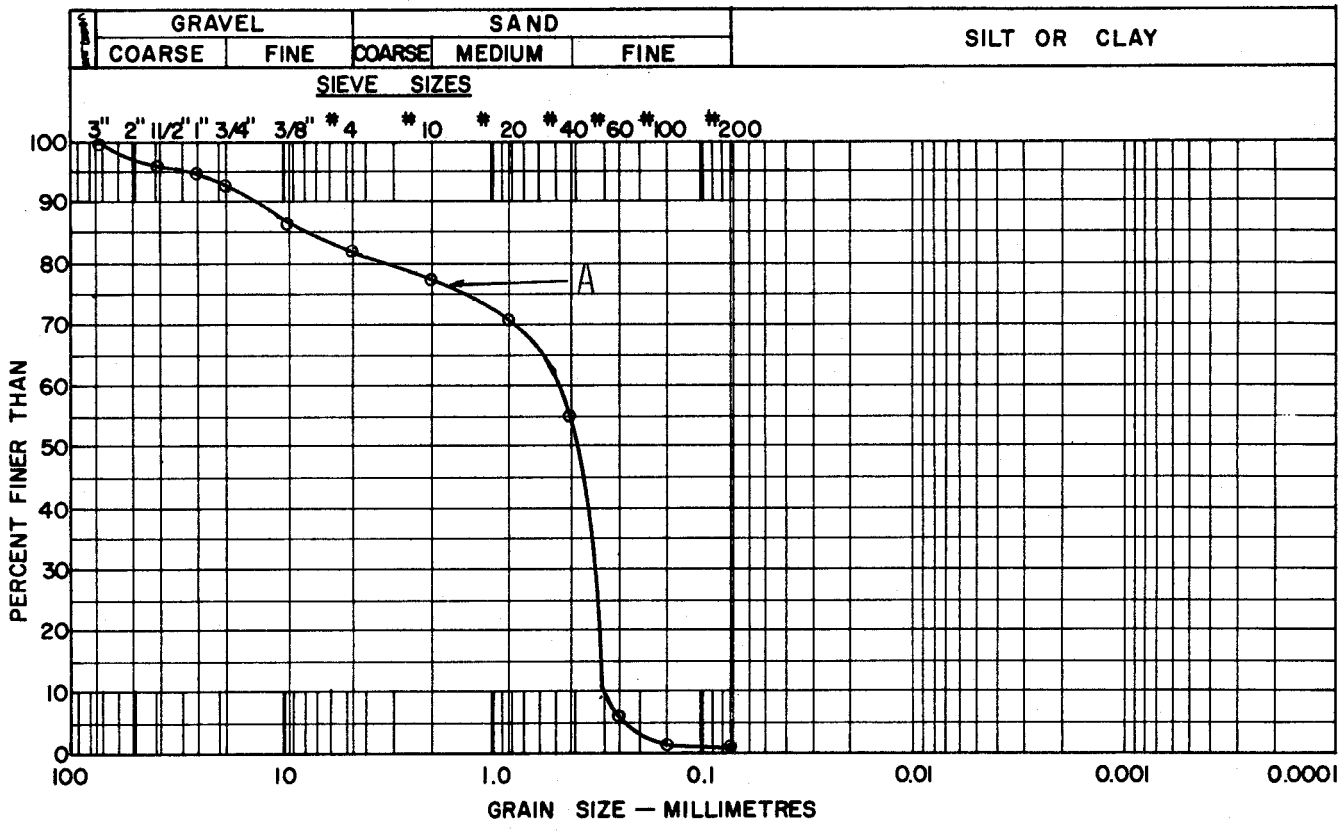
T-103A-A



SAND - little gravel, uniform med. sand, poorly graded, clean, brown

LABORATORY
TEST DATA
SOURCE No. T-103 A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 3') M/C = 6.7%

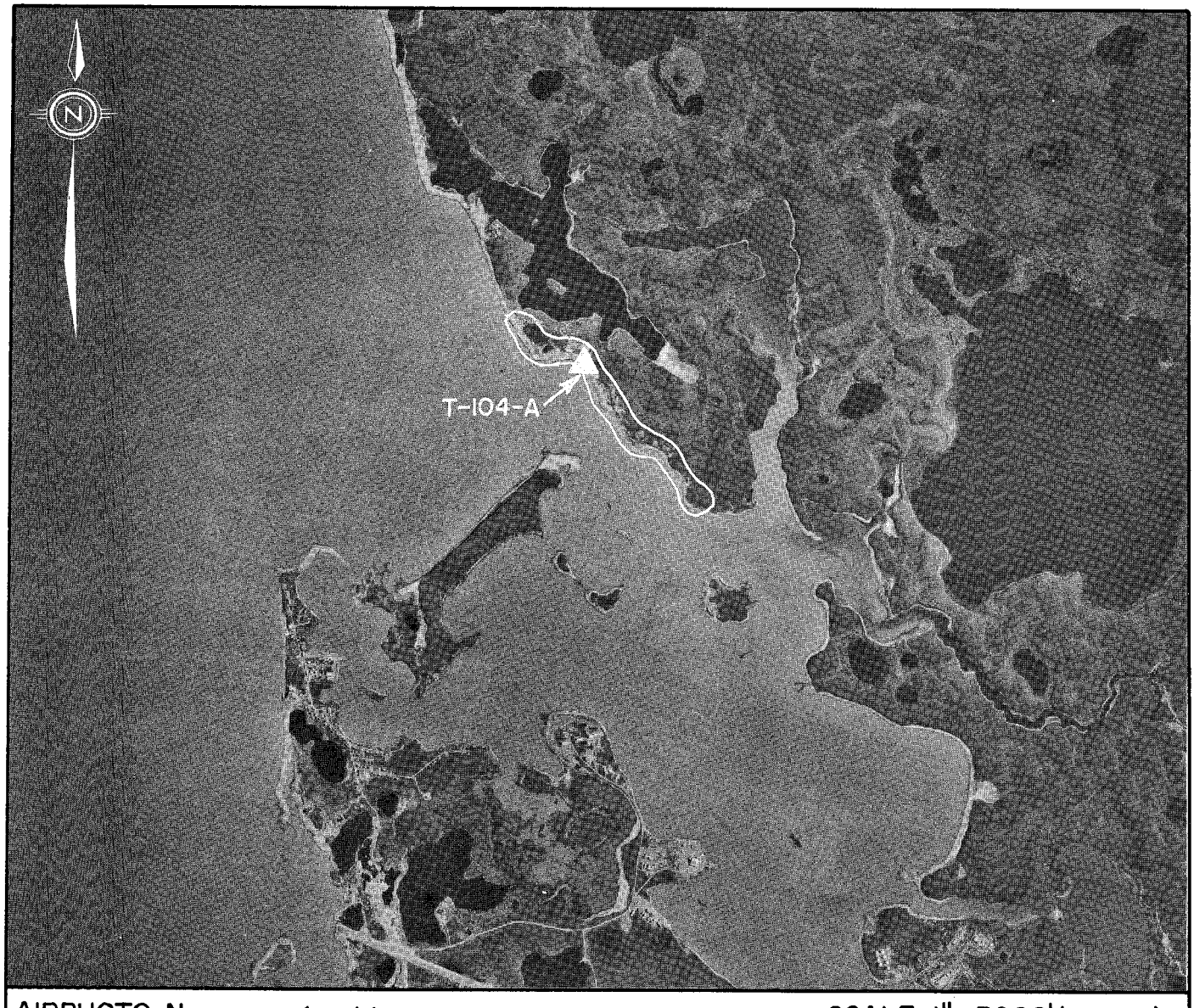
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-104A

LANDFORM AND LOCATION:	Ocean beach strip 1½ miles east of Tuktoyaktuk
MATERIAL:	SAND - some gravel
VOLUME:	25,000 cu. yds.
CONCLUSION:	Source is not suitable for development as shoreline retreat could be accelerated and the quality of the material and quantity available does not justify the damage that could be created.



AIRPHOTO No. A22936 - 46 SCALE: 1"= 3000' (approx.)

T-104A ENVIRONMENT

Physical

The source is a section of beach slightly more than 1 mile long and over 30 feet wide. The northern end lies between the open sea and an on-shore lagoon.

Biotic

The vegetation is sparse, consisting of grass, small shrubs, and moss, and is concentrated on the inshore edge of the beach.

The beach lies in a seabird nesting area and is considered important to waterfowl.

T-104A MATERIALS AND QUANTITIES

The material is a clean, poorly graded sand with about 25% coarser than #4 mesh. The volume above water level is estimated to be only 25,000 cubic yards.

T-104A DEVELOPMENT

General

The source is not recommended for development because of the possible erosion of the coastline that could result, especially adjacent to the lagoon. The shore-line in this area is particularly important because the area is being considered for future expansion of the Community.

The objections raised by the Canadian Wildlife Service are another reason for leaving this area undisturbed.

Access

Transportation to this source could be accomplished by barge in summer and by truck in winter, travelling across the harbour.

Material Use and Handling

If development were feasible the material would only be suitable for general fill. Development of this source would require the use of a

dozer, front-end loader, conveyor, barges or trucks.

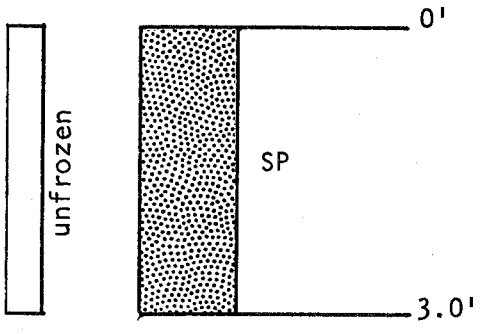
Stripping and Restoration

Stripping of the source would be minimal but restoration of the area could be difficult if removal of the beach accelerated bank erosion behind. Therefore development of the source is not recommended.

TEST PIT LOGS

SOURCE No. T-104A

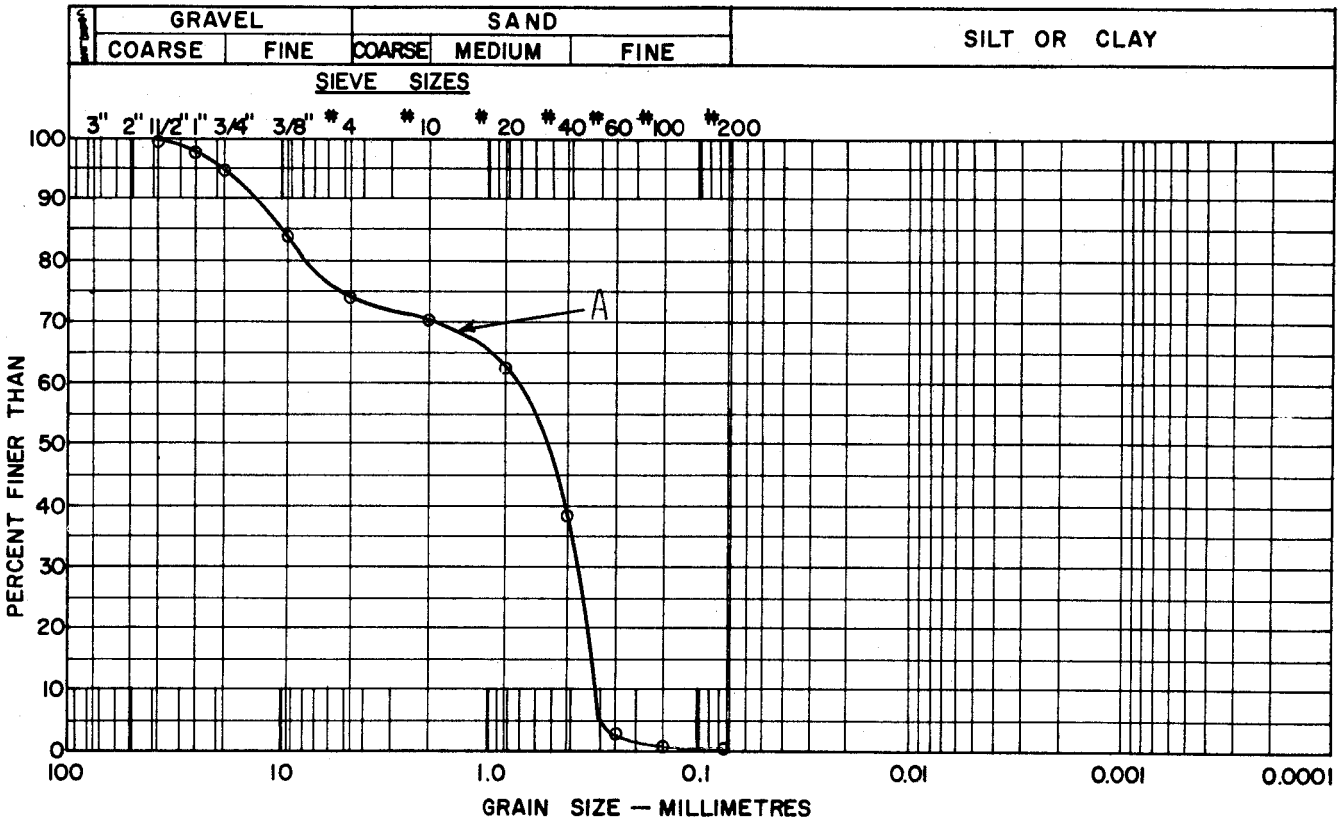
T-104A-A



SAND - some gravel, max. 2", rounded to subangular, poorly graded

LABORATORY
TEST DATA
SOURCE No. T-104A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 3') M/C = 6.8%

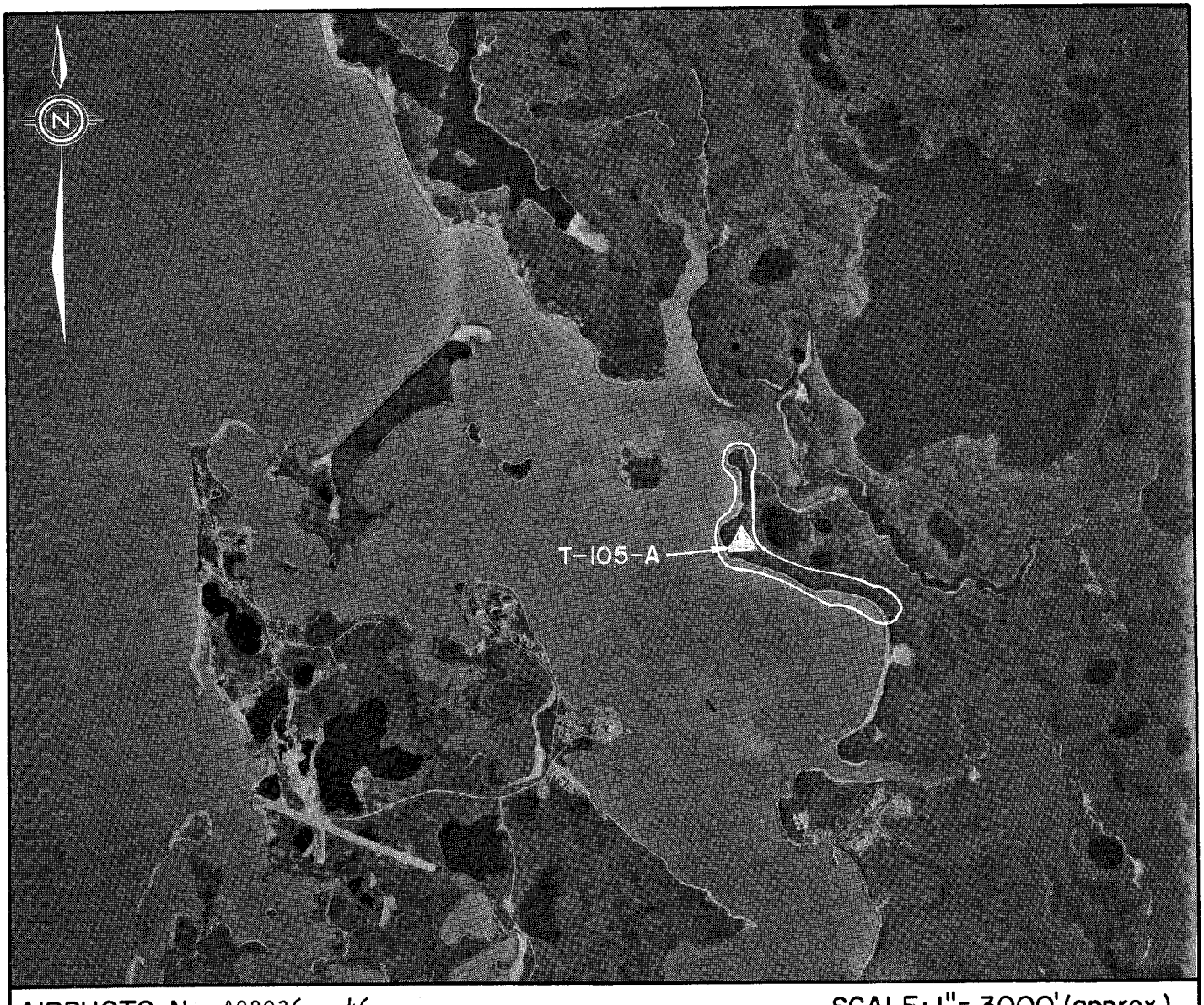
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-105

LANDFORM AND LOCATION:	Ocean Beach strip located 2 miles southeast of Tuktoyaktuk.
MATERIALS:	GRAVEL - some sand
VOLUME:	30,000 cu. yds.
CONCLUSION:	Source is suitable for development for coarse and fine grained aggregates if approved by oceanographic environmental studies.



AIRPHOTO No. A22936 - 46 SCALE: 1"= 3000' (approx.)

T-105 ENVIRONMENT

Physical

The Source is a narrow strip of beach 1½ miles long, located on the east side of Tuktoyaktuk Harbour. The water bordering on this section of beach is relatively calm.

The Source was well-drained to a depth of 2½ feet when investigated in September.

The land east of this beach has been reserved for a possible new townsite.

The Source lies 2 miles across the Harbour from Tuktoyaktuk, and has not been developed.

Biotic

The usual tundra ground-cover of peat, moss, and grass border the beach on-shore.

The Source lies within the area designated as being a seabird nesting area and important to waterfowl.

Tuktoyaktuk Harbour is an important fishery, with domestic fishing conducted throughout the year.

T-105 MATERIALS AND QUANTITIES

The material is gravel containing about 25% sand. The grading of the gravel is not particularly good, with the maximum size about 4 inches.

The volume above water level is estimated at about 30,000 cubic yards.

T-105 DEVELOPMENT

General

This Source is rated low priority, with off-setting considerations that warrant further study. The material quality is good and the Source is located in protected waters so that erosion should not be as serious as for the exposed Sources. On the other hand, it is

on the boundary of a proposed townsite.

Before the Source is developed it should be subjected to an oceanographic, environmental, and planning study to evaluate the possibility of erosion, the environmental effects, and the effect on the proposed townsite, that would follow the development.

Access

Transportation to this Source could be accomplished by barge in summer or by truck in winter, hauling 2 miles straight across the Harbour.

Material Use and Handling

The balance of material in this deposit is not suitable for concrete aggregate, but the deficiency can be corrected by crushing the oversize material and blending with fine aggregate from another Source such as T-100 or T-101.

This Source should be reserved for development as a source of concrete or asphalt aggregate.

Development of the Source will require the usual assembly of dozer, front-end loader, conveyor, and barge or trucks. Because of restricted space on the beach, a crushing and screening plant would be located at a central distributing point.

Stripping and Restoration

If development proceeds, stripping of the beach will be unnecessary, but it may be necessary to strip some of the adjacent tundra to provide a suitable slope to the water. This matter would be covered in the shore-line study that has been recommended. If the adjacent tundra were stripped, the ground cover would be spread on a suitable area on-shore and above possible wave action.

Other recommendations for restoration would develop from the shore-line study.

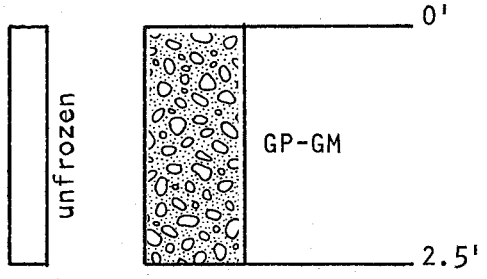
An important consideration is the need for preserving water quality

in the Harbour. Fortunately the Source contains very little silt (about 8%), but siltation or other types of disturbance must be minimized. The crushing and screening plant, for example, should not discharge wash-water to the Harbour, but should operate a closed circuit with clarification ponds or tanks.

TEST PIT LOGS

SOURCE No. T-105

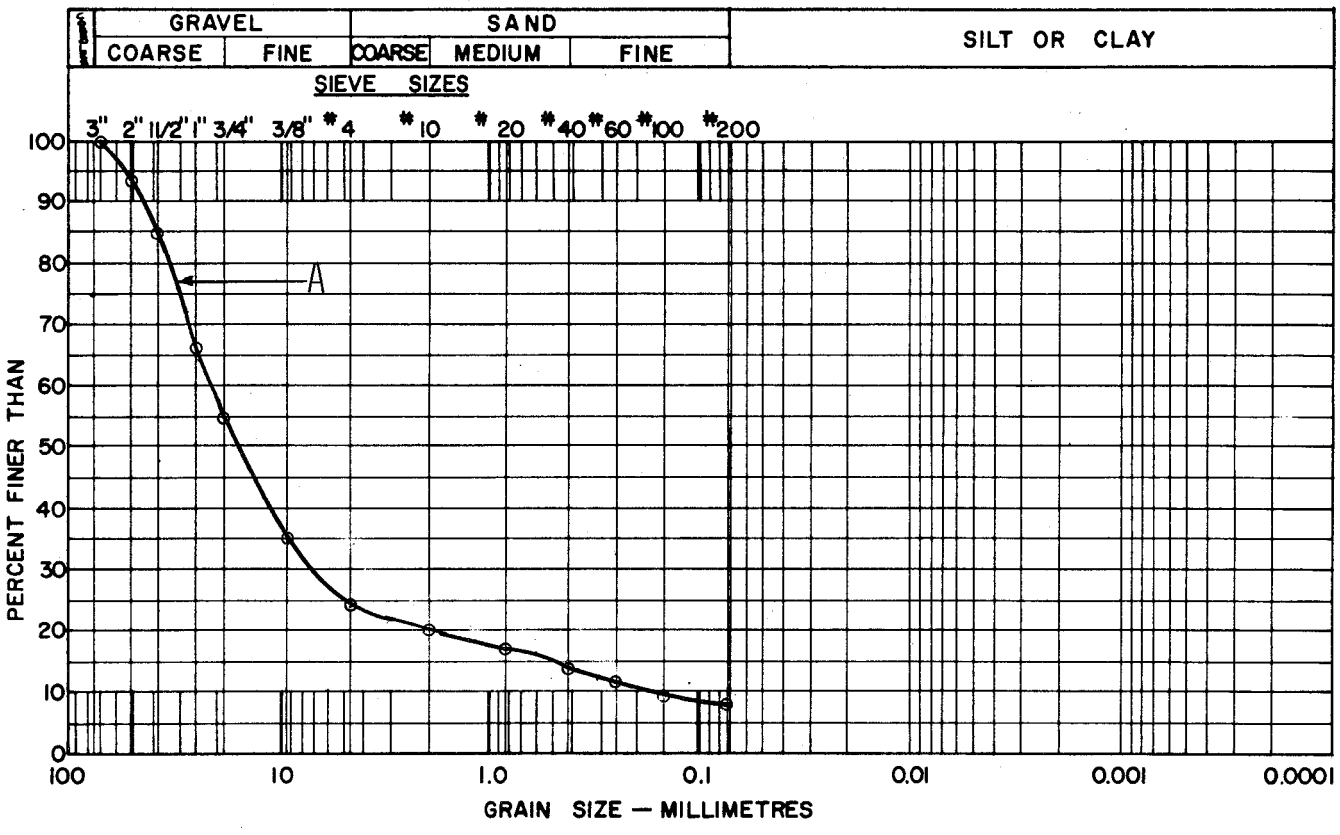
T-105-A



GRAVEL - some sand, trace silt, poorly graded, max. 4", angular to subrounded

LABORATORY
TEST DATA
SOURCE No. T-105

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 2.5') M/C = 4.5%

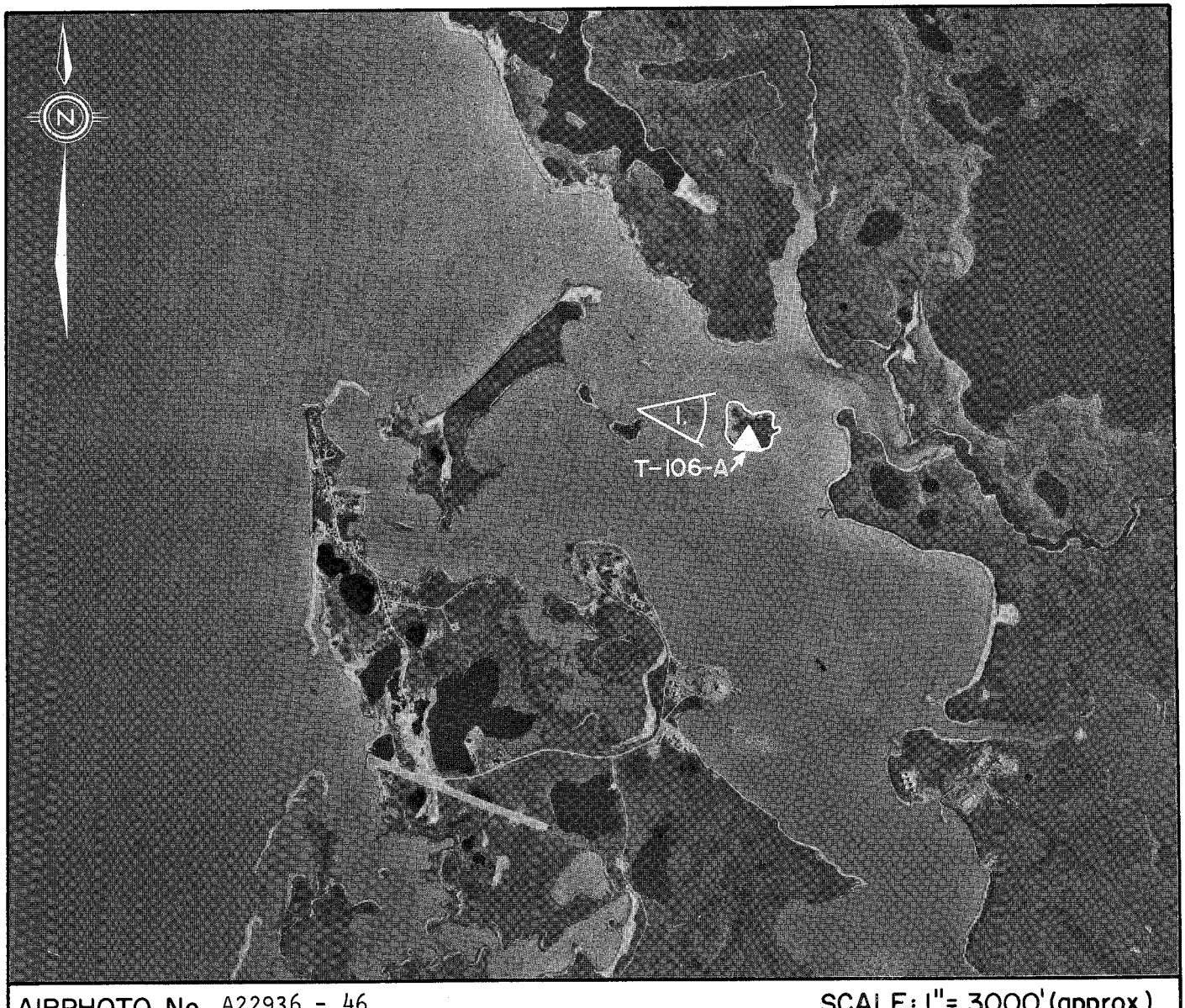
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-106

LANDFORM AND LOCATION:	Small island located 1½ miles east of Tuktoyaktuk
MATERIAL:	GRAVEL - and sand, trace of silt
VOLUME:	50,000 cu. yds.
CONCLUSION:	Source may continue to be developed to provide general fill and coarse aggregate



AIRPHOTO No. A22936 - 46 SCALE: 1"= 3000' (approx.)

T-106 ENVIRONMENT

Physical

The Source is a small island in Tuktoyaktuk Harbour, less than two miles east of the Community. The area is about 15 acres.

T-106 - Photo No. 1 looking east at island

Drainage of the area that was investigated is good, and the occurrence of ground ice was found to be low to medium.

The Source is currently developed for the supply of granular material to the Community.

Biotic

A substantial part of the island is covered by moss. The surrounding area is important to waterfowl, and the Harbour is an important domestic fishery.

T-106 MATERIALS AND QUANTITIES

The material is a well-graded gravel and sand, containing 56% gravel,

37% sand, and 7% silt.

A petrographic analysis of a sample of material indicated that the majority was quartzite (59%) and soft sandstone (22%) with chert, limestone, ironstone, quartz, granite and siltstone making up the remaining 19%.

Assuming a recoverable depth of 6 feet of material, the source is estimated to contain at least 50,000 cubic yards.

T-106 DEVELOPMENT

General

This source is recommended for full development for the supply of general fill and base course materials.

Access

This source is well located with respect to the Community, both present and proposed. Transportation will continue to be provided by barge in summer and by truck in winter.

Material Use and Handling

This source can provide material for general fill and base course. The material from this source is not suitable for quality concrete construction because of the large proportion of soft sandstone and flat particle shape of the material.

The development of this source will require a dozer with ripper attachment, a front-end loader, a conveyor, and a barge or trucks, depending on the season.

Stripping and Restoration

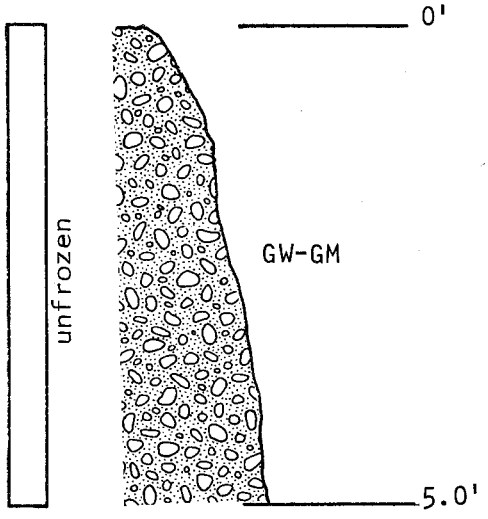
Most of the area to be developed for aggregate is bare of vegetation, so no stripping is required.

Restoration must be planned in consultation with the Canadian Wildlife Service, so that the source is made suitable for the future use by wildlife, waterfowl, or other native life.

TEST PIT LOGS

SOURCE No. T-106

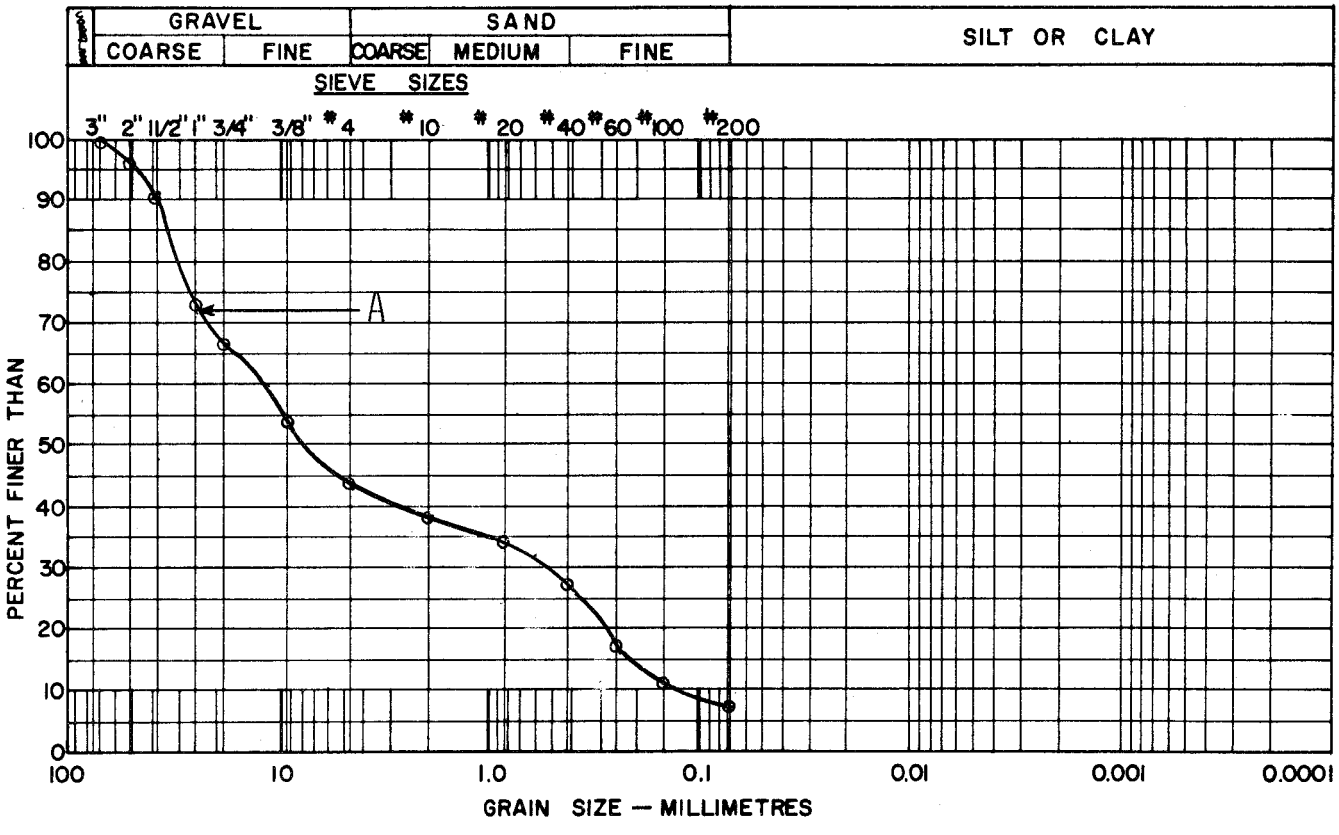
T-106-A



GRAVEL - and sand, trace silt, well graded, max. 8", rounded to subrounded

LABORATORY
TEST DATA
SOURCE No. I-106

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(stockpile) M/C = 3.8%

ORGANIC CONTENT

HARDNESS TEST

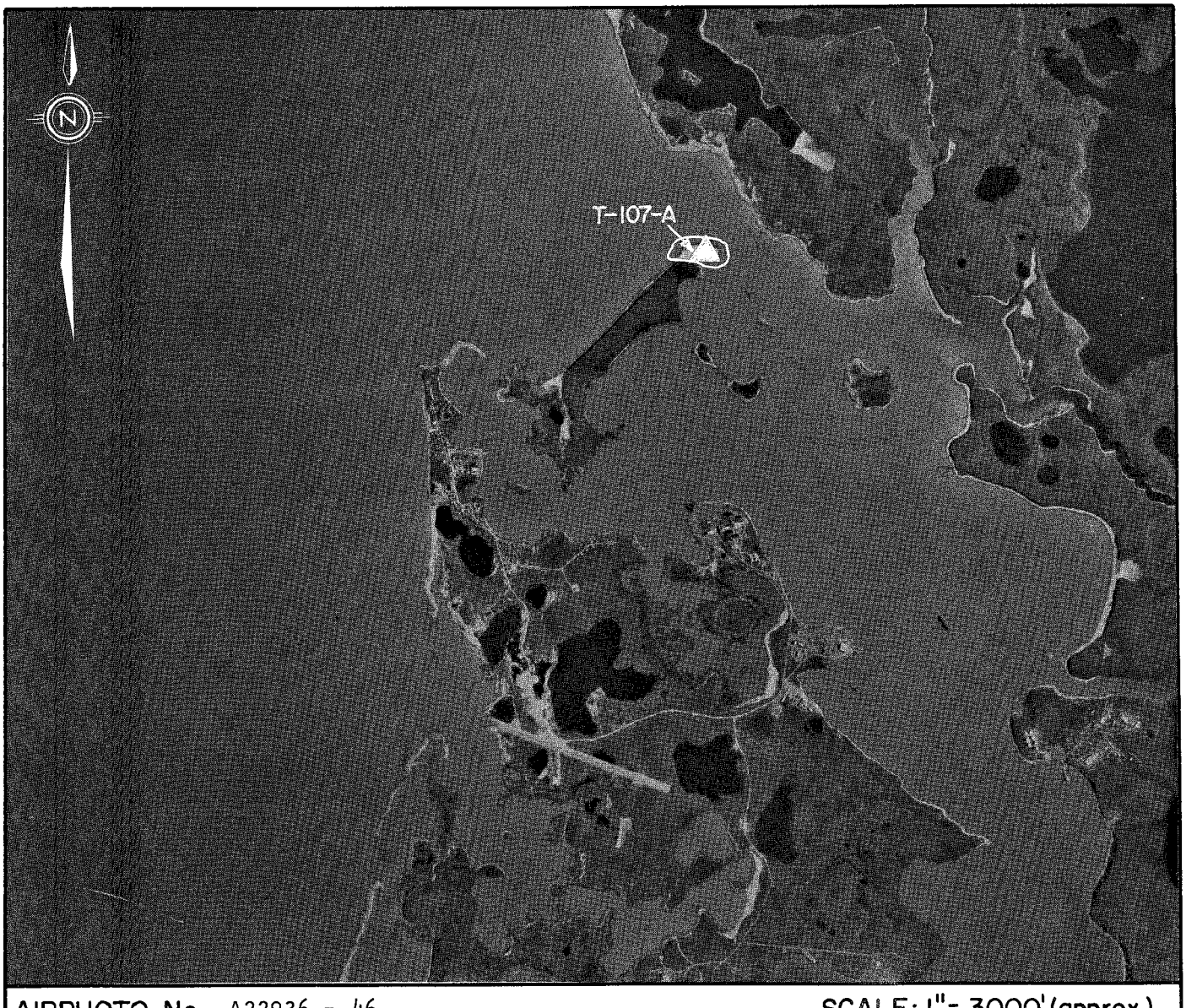
PETROGRAPHIC ANALYSIS

Sample 106-A

Quartzite	- 59%	Granite	-1%
Sandstone-soft	- 22%	Siltstone	-neg.
Chert	- 8%	Total	100%
Limestone	- 4%		
Ironstone	- 4%		
Quartz	- 2%		

TUKTOYAKTUK
SOURCE No. T-107

LANDFORM AND LOCATION:	Ocean spit on island located 1 mile northeast of Tuktoyaktuk.
MATERIAL:	GRAVEL - and sand
VOLUME:	20,000 cu. yds.
CONCLUSION:	Source is low priority for development to provide general fill and base course, pending the results of coast-line and environmental studies.



AIRPHOTO No. A22936 - 46 SCALE: 1"= 3000' (approx.)

T-107 ENVIRONMENT

Physical

The Source is a spit on the northeastern end of the island at the entrance to Tuktoyaktuk Harbour, about 600 feet long, 300 feet wide, and rising about 3 feet above water level.

The source is well-drained, and contained no ground ice to a depth of 3 feet in September.

This Source is about 1 mile northeast of Tuktoyaktuk, and has not been developed.

Biotic

The spit is bare of vegetation. It lies in an area considered valuable to waterfowl and other birds, and the Harbour supports an important domestic fishery. The spit is often used to beach Beluga whales caught near by.

T-107 MATERIALS AND QUANTITIES

The material contained in this Source is a poorly graded gravel and sand. The gravel component is 57% of the total, and contains 20% grading from 1½ to 3 inches in size. The fraction passing the #4 mesh is poorly graded and deficient in the #4 to #20 fractions, as well as in the fraction passing #60 mesh.

Because of the adjacent location and apparent similarity, the material in this source is assumed to have a petrographic analysis similar to that from Source T-106.

The volume of material above the water level is estimated to be 20,000 cubic yards.

T-107 DEVELOPMENT

General

This Source is low priority for development after Source T-106 is depleted. Before an operation is planned at this Source, however, the effect of this development on the nearby coast-line and on the

biological environment should be studied. It is considered at this time that a substantial volume of material can be removed without adverse effects on either the physical or biological environment.

Access

This source is well located with respect to the Community, both present and proposed. Transportation from the source would be by barge in summer and by truck in winter, with a distance of about 1½ miles across the Harbour.

Material Use and Handling

The material from this source can be used for general fill or base course.

The material is not suitable for concrete construction because of the expected large proportion of soft sandstone particles.

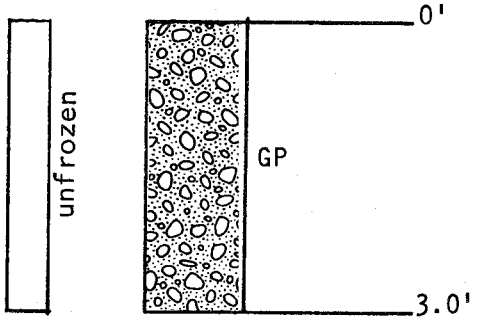
The development of this source will require the usual assembly of dozer, front-end loader, conveyor, and barge or trucks, depending on the season.

Stripping and Restoration

Stripping will not be required. The measures required for restoration will probably be provided in the coast-line and environmental studies, although they may consist of no more than grading to a smooth contour.

TEST PIT LOGS
SOURCE No. T-107

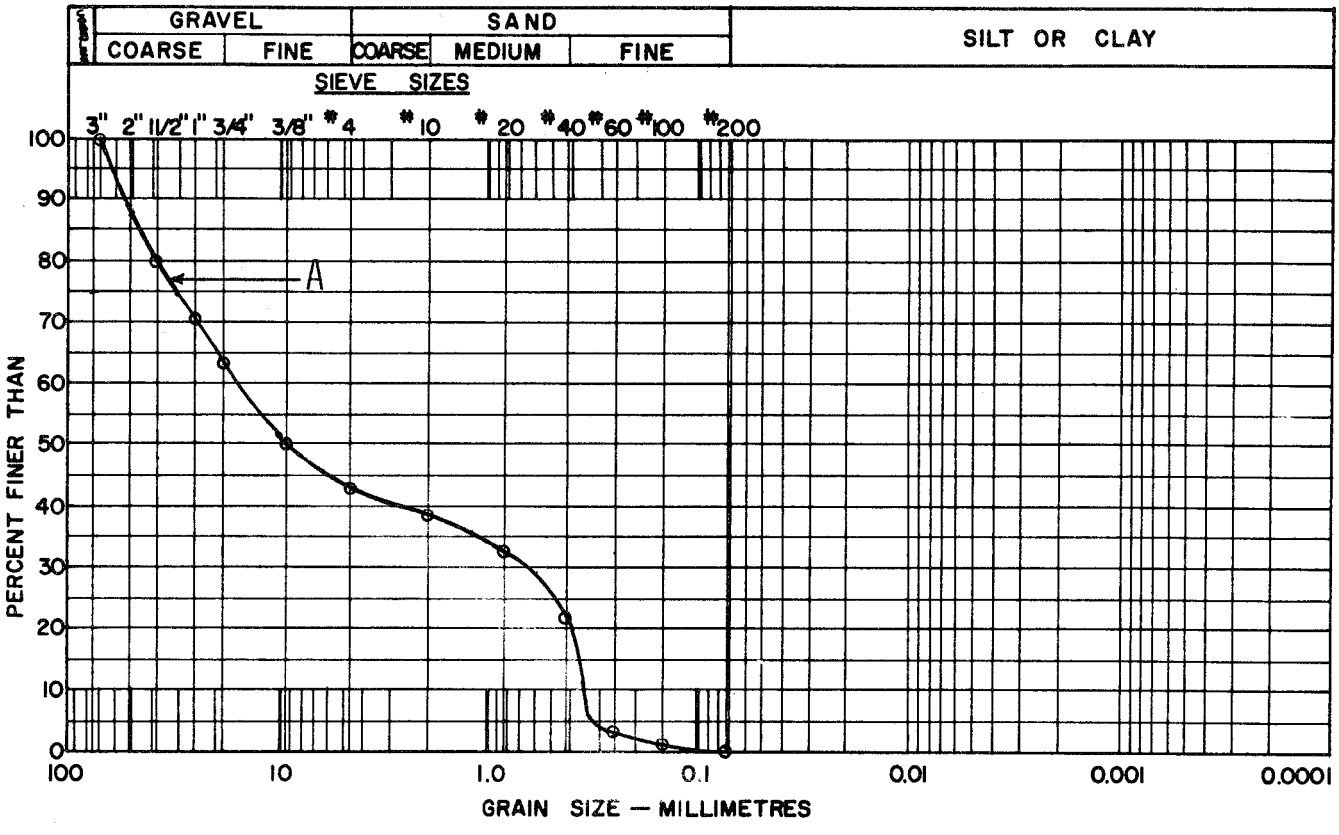
T-107-A



GRAVEL - and sand, poorly graded,
max. 2½", flat gravel, brown

LABORATORY
TEST DATA
SOURCE No. I-107

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 3') M/C = 2.0%

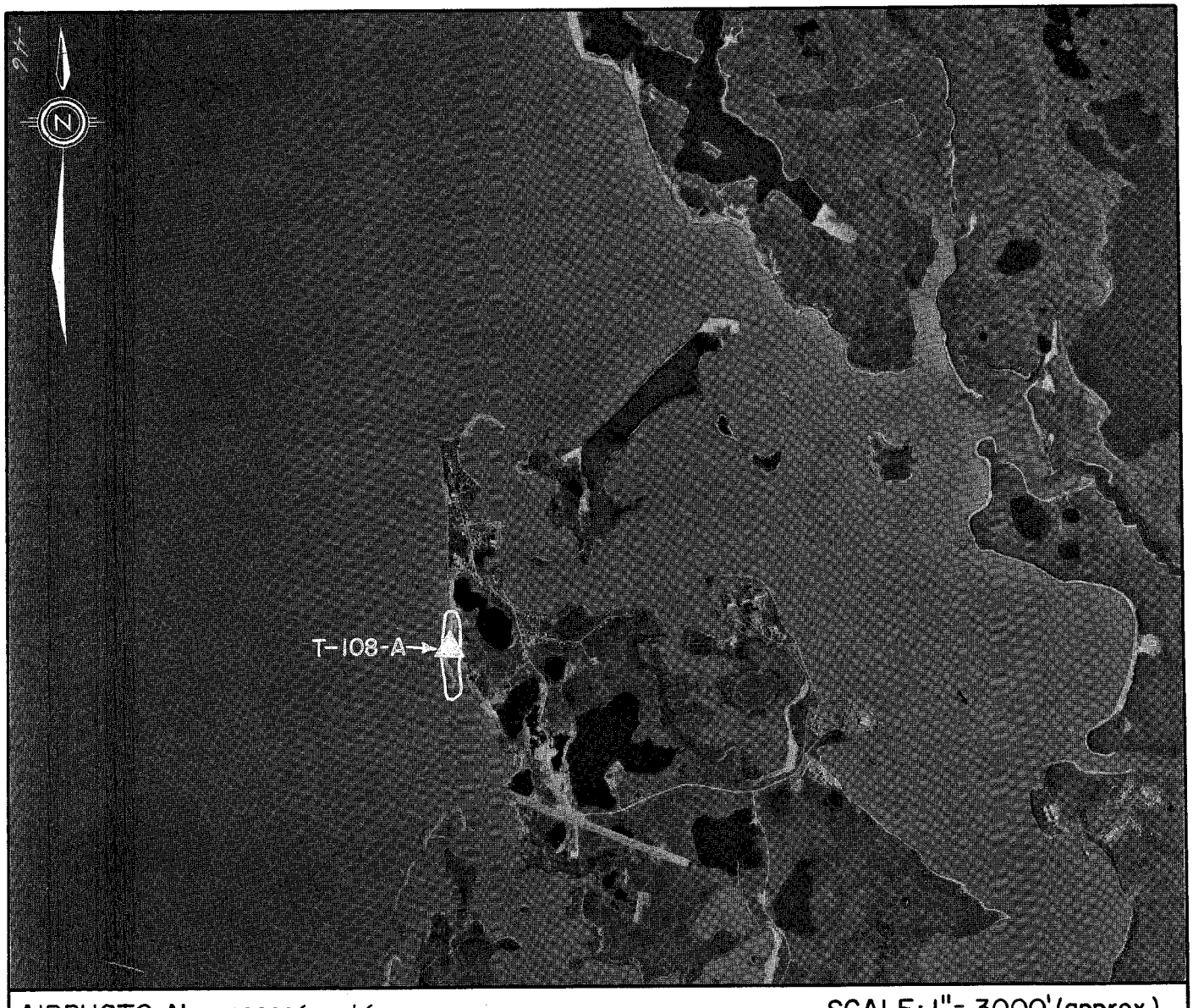
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-108A

LANDFORM AND LOCATION:	Ocean spit 1 mile south of Tuktoyaktuk
MATERIAL:	SAND - and gravel
VOLUME:	25,000 cu. yds.
CONCLUSION:	Source is not suitable for development because of erosional and environmental concerns. This spit protects the shoreline of the Community from destructive wave action.



AIRPHOTO No. A22936 - 46 SCALE: 1"= 3000' (approx.)

T-108A ENVIRONMENT

Physical

The source is a spit running south from the Community for a distance of about 2,000 feet. It is 100 feet wide, and rises about 4 feet above water level.

The spit protects part of the shoreline of the Community from the action of waves from the open sea.

Drainage of this source is excellent, and no ground ice was discovered during excavation to a depth of 4 feet during September.

The source is adjacent to the Community, and has not been developed.

Biotic

The spit is bare of vegetation. It lies within a seabird nesting area and is important to waterfowl. Kugnallit Bay, adjacent to the spit, is an important pupping and concentration area for the Beluga whale. The animals are found here in large numbers from pupping time in late June through mid-August. Local residents use this spit for beaching the whales caught nearby.

Marine life is said to be prolific in the sheltered water behind and near the spit.

T-108A MATERIALS AND QUANTITIES

The material in this source is clean, well-graded sand and gravel with a maximum size of 1½ inches and a 50-50 split on the #4 mesh.

The estimated volume of material above water level is 25,000 cubic yards.

T-108A DEVELOPMENT

General

This source is not recommended for development because of environmental considerations. Removal or substantial lowering of the spit could endanger the stability of the coast-line behind, with the

possible loss of Community property.

The immediate area is obviously very important to the Beluga whale population, and bird life and marine life would all be affected adversely.

Access

This source is accessible by truck from the Community at almost any time of the year.

Material Use and Handling

If this source could be developed, the material could be used for any purpose, from general fill to concrete aggregate. It appears that good concrete could be manufactured from the sample taken from the spit, with no processing of any kind.

The development of this source would require a dozer, front-end loader, and trucks.

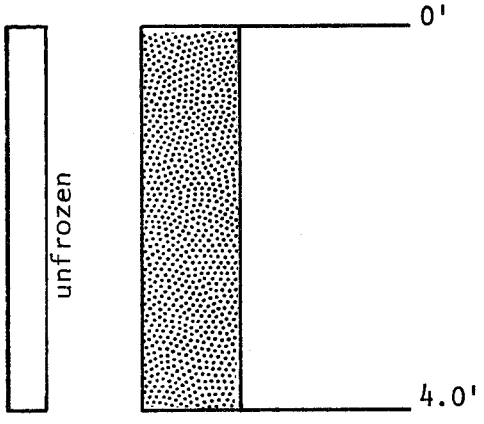
Stripping and Restoration

Stripping would be unnecessary, and restoration would consist of grading to a smooth contour. However removal of the granular material could lead to serious problems of stabilizing the banks behind from the effects of erosion.

TEST PIT LOGS

SOURCE No. I-108A

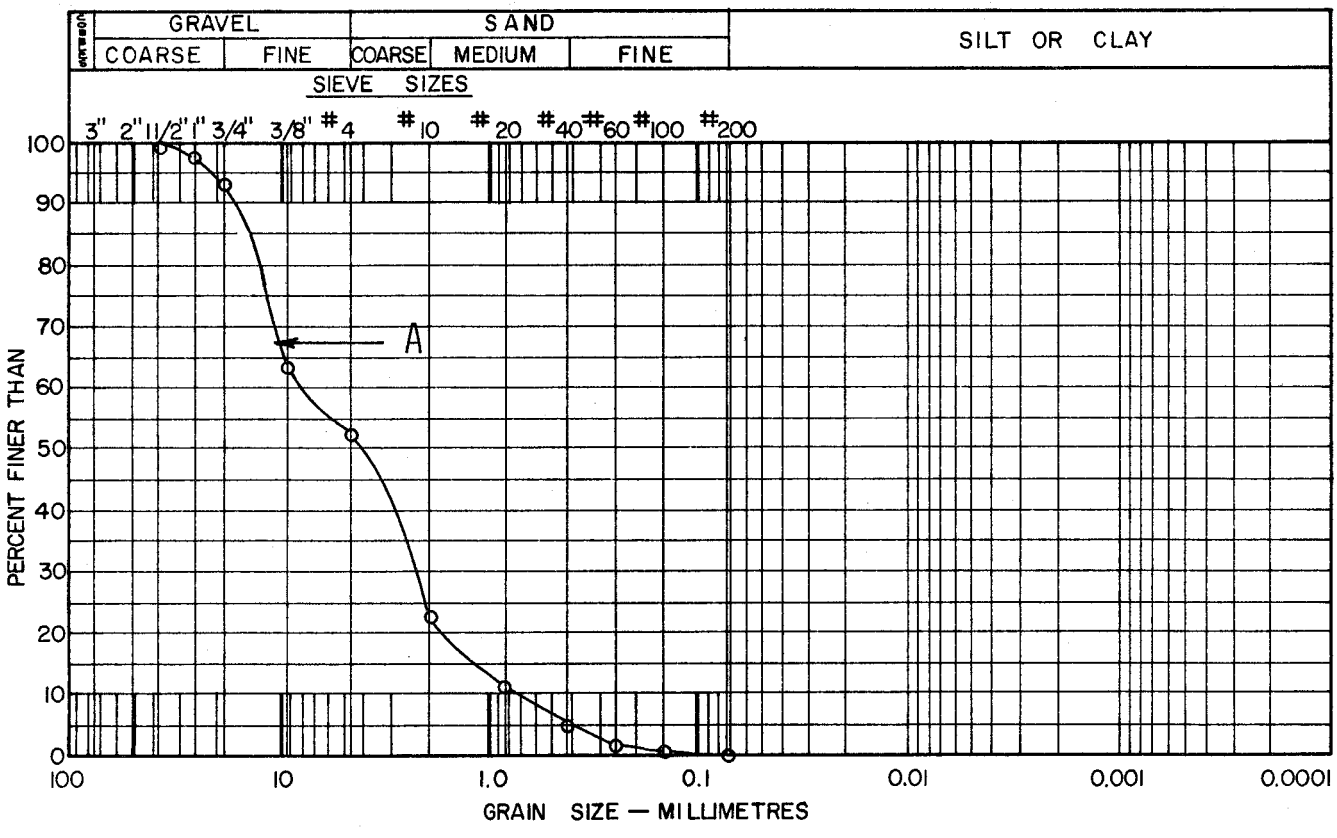
T-108-A



(SW) SAND - and gravel, well graded, max. 1", rounded to subangular.

LABORATORY
TEST DATA
TEST PIT-SOURCE No. T-108A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 3') M/C = 2.1%

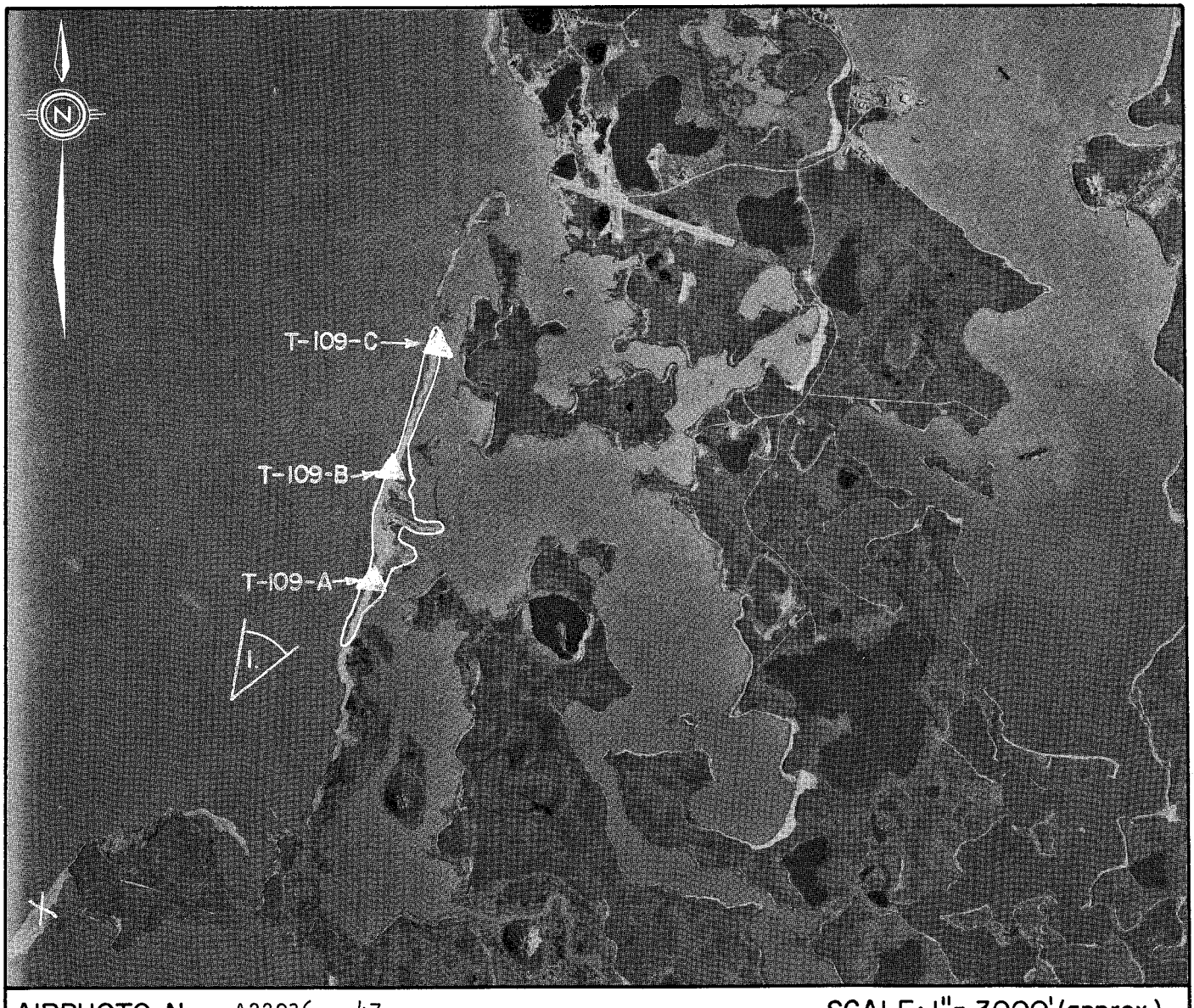
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-109

LANDFORM AND LOCATION:	Ocean spit 1 to 3 miles southwest of Tuktoyaktuk.
MATERIAL:	GRAVEL - and sand
VOLUME:	75,000 cu. yds.
CONCLUSION:	Source can be developed in part, but must not be breached. Oceanographic and environmental study required.



AIRPHOTO No. A22936 - 47 SCALE: 1"= 3000' (approx.)

T-109 ENVIRONMENT

Physical

The Source is a long narrow spit exposed to the open sea, about 1 to 3 miles southwest of Tuktoyaktuk. The spit is about 6,000 feet long, from 150 to 250 feet wide, and in places stands 7 feet above sea level.

T-109 Photo No. 1 looking north along spit

The spit protects the coastline behind from destructive wave action.

This Source is well drained, and when investigated in September no ground ice was detected within 4 feet of the surface.

The Source is now being used for supplying granular material to the Community.

Biotic

Vegetation on the spit is very sparse, consisting of scattered patches of grass and small shrubs.

The source lies within an important waterfowl breeding area. Kugmallit Bay nearby is an important pupping and concentration area for Beluga whales, and large numbers can be seen from pupping season in late June through mid-August. The marine life in the sheltered water behind the spit is said to be prolific.

T-109 MATERIALS AND QUANTITIES

The materials from this source are clean sand and gravel with a maximum size of 2 inches. The fine aggregate (passing the #4 mesh) varies from 40% to 60% of the total, and is deficient in the fraction passing the #60 mesh.

The petrographic analysis of gravel indicates the main components to be quartz and quartzite (56%), chert (19%) and sandstone (12%), with schist, ironstone, shale, granite, and limestone making up the remaining 13%. The deleterious components are schist (1%), ironstone (1%), and clay shale (5%), for a total of 7%.

The chert is potentially reactive, and until further qualitative tests are conducted, concrete made with this aggregate should use cement containing 0.6% alkali as a maximum.

This source contains some thin layers of organic soil distributed throughout, evidently old surfaces of the spit.

The volume of material above sea level on this source is about 165,000 cubic yards. If, however, the source is developed in such a way that it will continue to serve as a barrier to the sea, a volume of 75,000 cubic yards could be removed.

T-109 DEVELOPMENT

General

The materials from this source should be reserved for specified uses, such as concrete and asphalt construction. The current development

of this Source is near Test Pit B, and could lead to the breaching of the spit.

It is recommended that future development be limited to the landward side of the spit, and that the main protective body be left intact.

Before large-scale development is undertaken, however, an oceanographic study should be authorized to confirm that this can be done without endangering the shore-line behind the spit and the productive sheltered water.

Access

Transportation from this Source can be accomplished by barge in summer and by truck in winter. An all-weather access road could be built, placing one or more causeways across the shallow inland water, but this construction should provide for the marine life in these waters. Vehicular traffic on the spit should be limited to the area under development because of the use of this spit by birds during the summer months.

Material Use and Handling

The material from this Source can be used for any purpose, from general fill to concrete aggregate. Because of the general shortage of high-quality aggregate, however, the material should be reserved for its best use, and general fill should be obtained elsewhere, for example from Sources T-106 and T-107.

Selected material from this Source can be used for ordinary concrete without further processing, although the quality will be erratic and the cement requirement quite high. A good aggregate can be produced by screening and crushing the oversize rock, and blending with fine sand from another Source such as T-100 or T-101.

The use of this material for asphalt construction will require a screening and crushing plant, in order to avoid wasting oversize and to produce the desirable proportion of angular particles.

Development of this source will require a dozer, front-end loader, conveyor, and either a barge or trucks, depending on the season. Probably a screening and crushing plant will be located at a central distribution point.

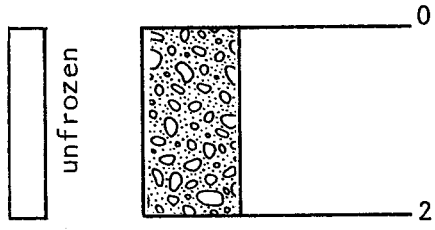
Stripping and Restoration

The stripping of this source is expected to be minimal. Any material removed from the surface should be hauled on-shore for distribution above sea-level.

Restoration will probably be limited to grading the depleted area to a smooth contour.

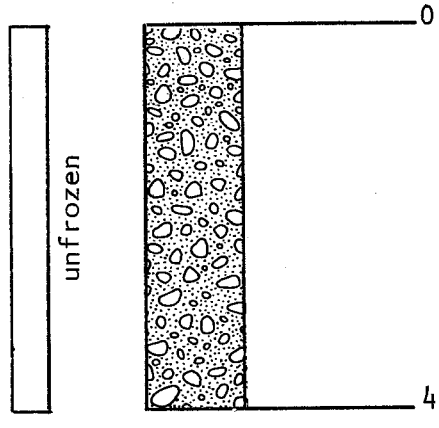
TEST PIT LOGS
SOURCE No. T-109

T-109-A



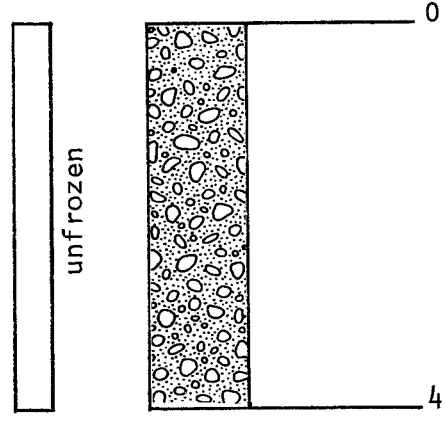
(GW) GRAVEL - some sand, well graded, rounded to subangular, Max. 2"

T-109-B



(GW) GRAVEL - and sand, well graded, max. 1½", rounded to sub-rounded, clean

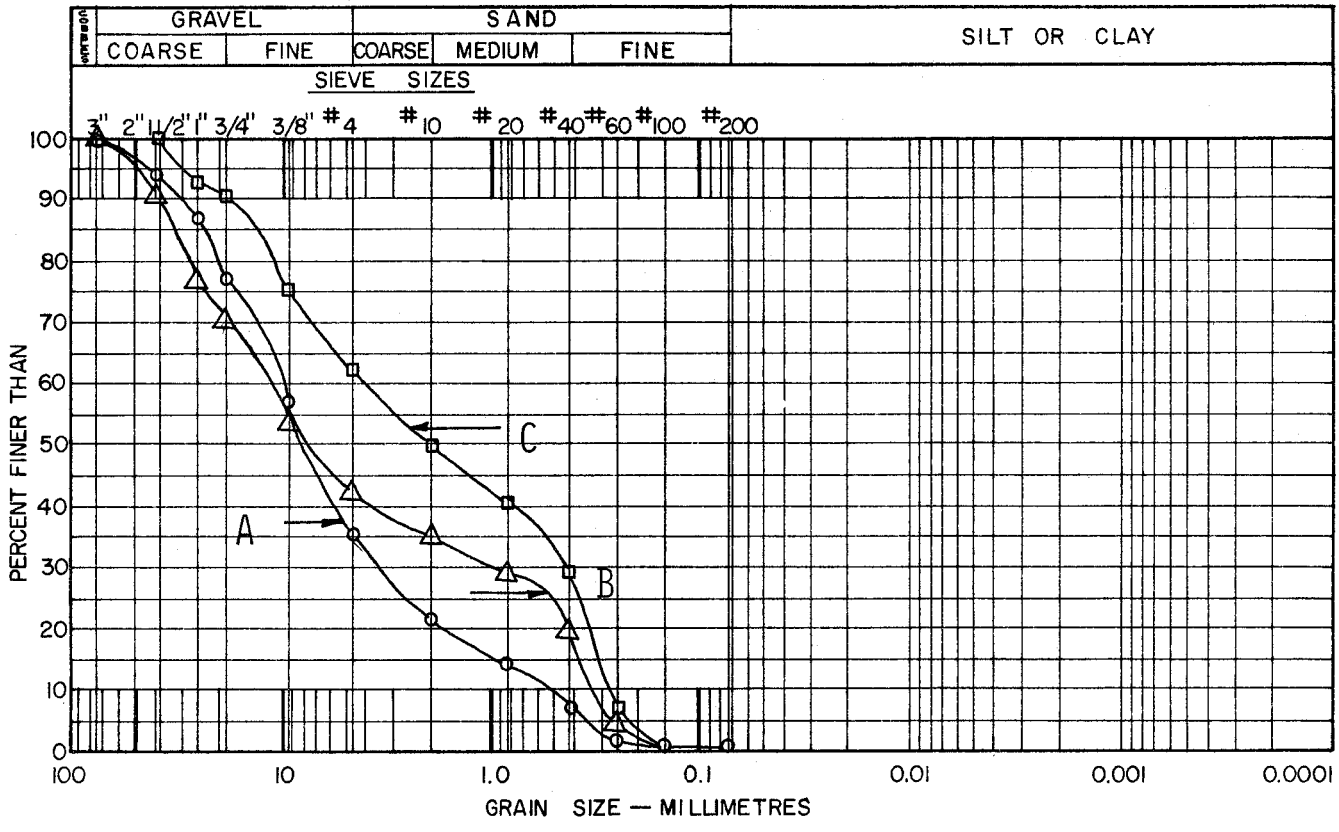
T-109-C



(GW) GRAVEL - and sand, well graded, Max. 1½", rounded to subrounded

LABORATORY
TEST DATA
TEST PIT-SOURCE No. T-109

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 1½') M/C = 2.6%
B-(0' - 4') M/C = 3.2%
C-(0' - 4') M/C = 1.6%

ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

A-(0' - 1½')

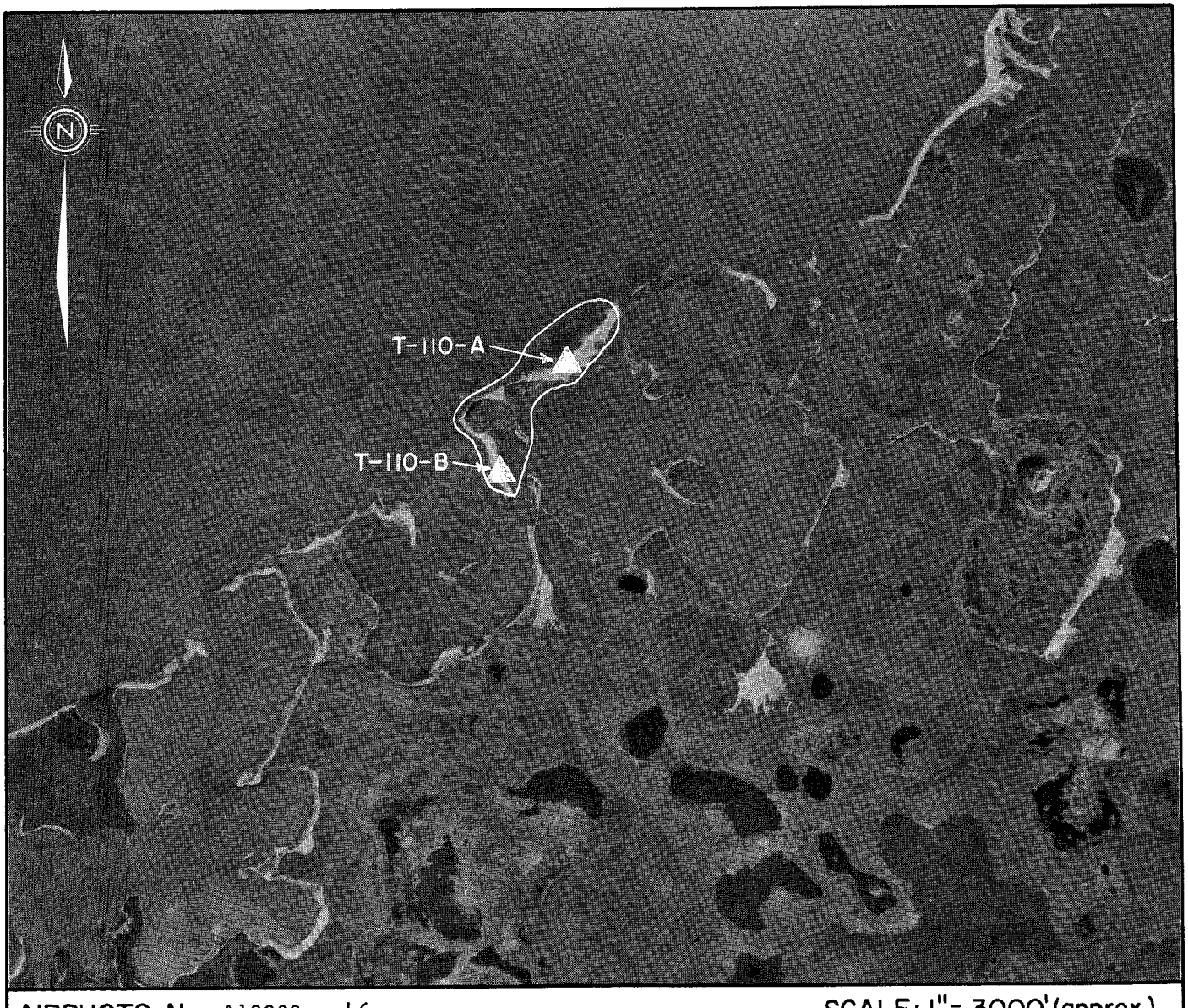
Quartz & Quartzite	- 56%
Chert	- 19%
Sandstone	- 12%
Schist, Ironstone, Shale	- 7%
Granite	- 3%
Limestone	- 3%
	100%

Deleterious Content

Schist	-1.0%
Ironstone	-1.0%
Clay Shale	-5.0%
Total	7.0%

TUKTOYAKTUK
SOURCE No. T-110A

LANDFORM AND LOCATION:	Ocean beach (Penninsula Point) 4 miles southwest of Tuktoyaktuk
MATERIAL:	SAND
VOLUME:	45,000 cu. yds.
CONCLUSION:	Source is not recommended for development because of environmental concerns. In addition the fine material obtained from this source would only be suitable as a concrete blending sand.



AIRPHOTO No. A12902 - 46 SCALE: 1"= 3000' (approx.)

T-110A ENVIRONMENT

Physical

The source is a section of beach at Peninsula Point, about 4 miles southwest of Tuktoyaktuk. The beach is about 4,000 feet long, variable in width, and stands about 3 feet above sea-level.

Drainage is excellent, and no ground ice was observed within the top 2½ feet during the investigation in September. The source has not been developed.

Biotic

Vegetation is sparse to negligible. The beach lies at the northern end of an important fishing area that is exploited from mid-June to early fall. During the same period many of the Beluga whale population gather in Kugmallit Bay for pupping.

The beach is located in an important waterfowl area, and marine organisms flourish in the lagoon protected by the beach.

T-110A MATERIALS AND QUANTITIES

The material in this source is a clean, fine sand with very narrow grading (70% passing #40 mesh and retained on #100 mesh).

Assuming a recoverable depth of 3 feet, the source could provide about 45,000 cubic yards of sand.

T-110A DEVELOPMENT

General

The source is not recommended for development because of environmental consideration and because the material is too fine for general fill.

Some material could probably be removed from the sheltered or southerly section of the beach, in order to provide a blending sand for concrete construction. Excavation would have to be limited, to avoid removing the barrier between open sea and lagoon.

Any development of this source should be preceded by an oceanographic and environmental study.

Access

The easiest access to this source is by barge in summer, although activity at this time may conflict with other uses of the area.

Material Use and Handling

This material is suitable only for blending to offset deficiencies in concrete aggregate.

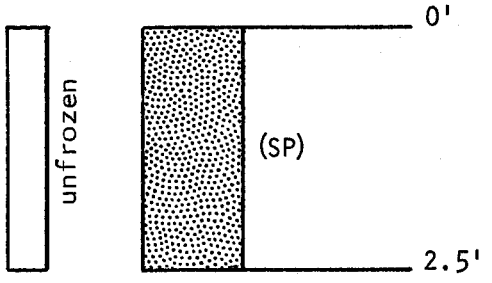
Development of the source would require a front-end loader and barge.

Stripping and Restoration

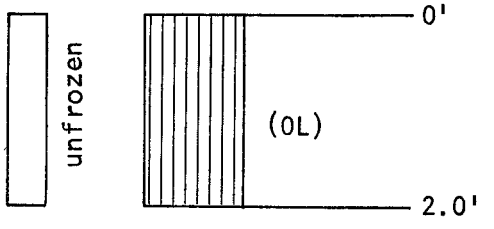
Stripping of the source would be negligible so that restoration would likely consist of levelling a depleted area. However, a breaching of the source area could result in large scale restoration requirements to repair the erosional damage.

TEST PIT LOGS
SOURCE No. T-110A

T-110A-A



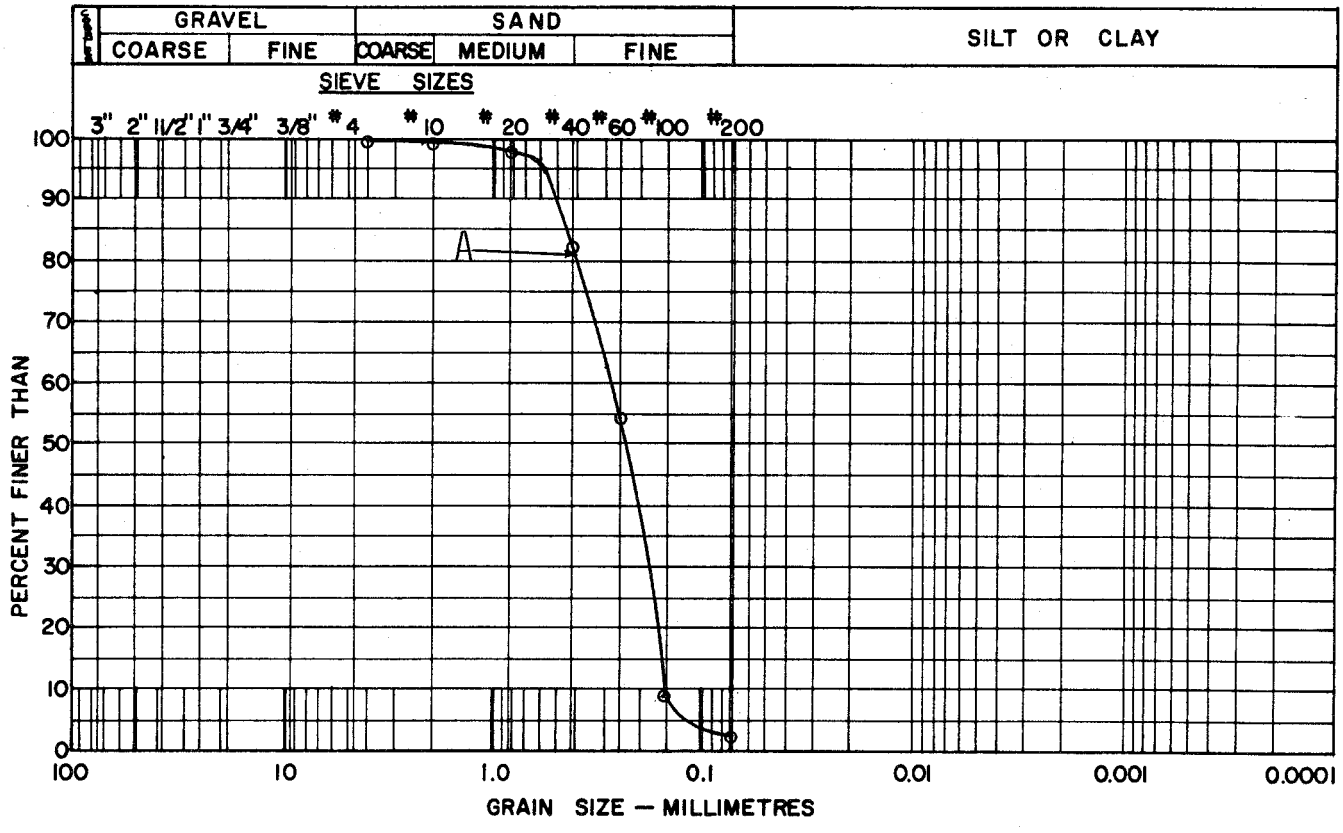
SAND - fine, uniform, clean,brown



SILT - organic, some sand, some gravel

LABORATORY
TEST DATA
SOURCE No. T-110 A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 2.5') M/C = 5.2%

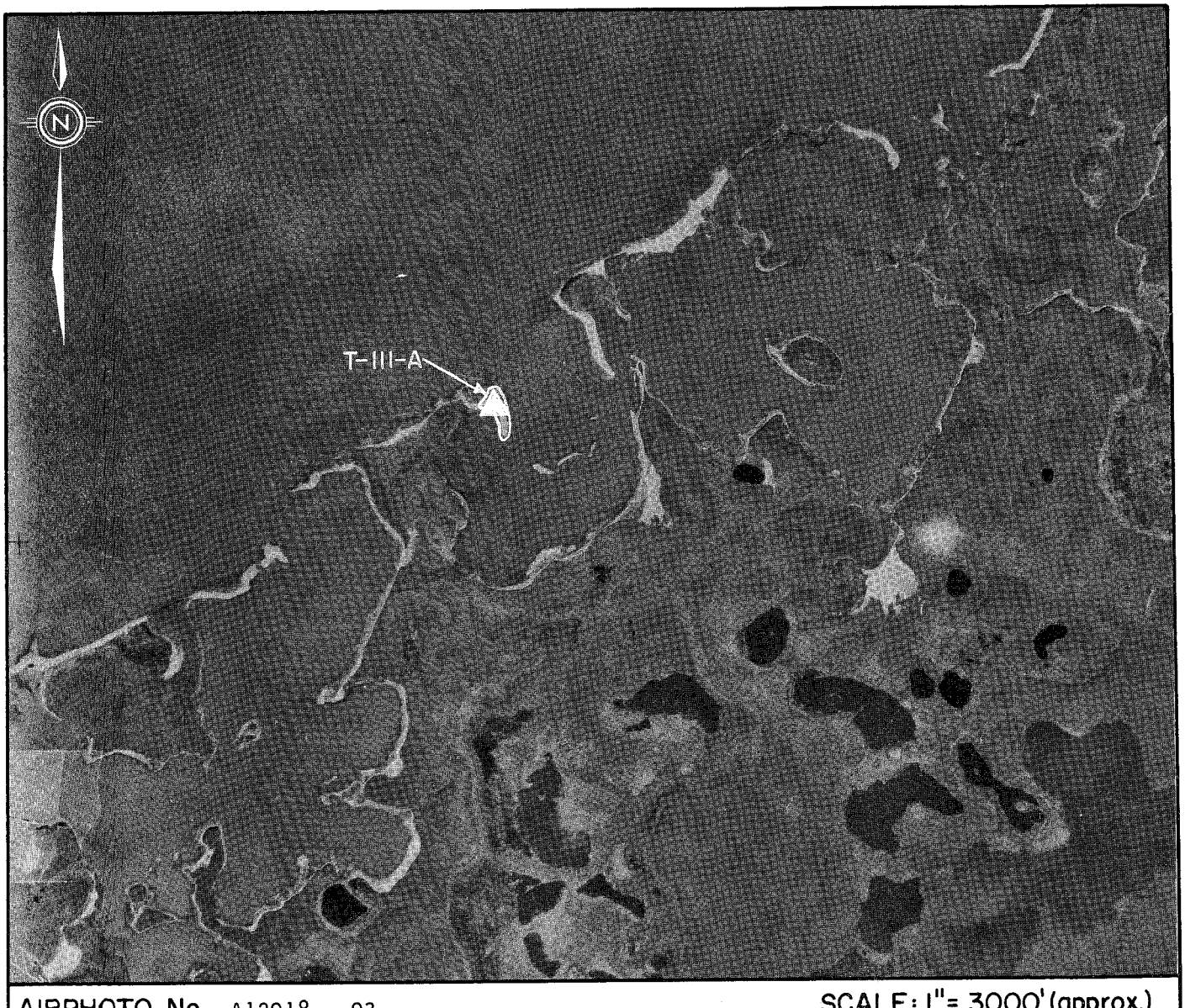
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-IIIA

LANDFORM AND LOCATION:	Ocean spit 5 miles southwest of Tuktoyaktuk
MATERIAL:	GRAVEL - and sand
VOLUME:	20,000 cu. yds.
CONCLUSION:	Source is not recommended for development because of low quantity and beach erosion, and other environmental concerns.



AIRPHOTO No. A12918 - 93 SCALE: 1" = 3000' (approx.)

T-111A ENVIRONMENT

Physical

The source is a spit exposed to the open sea, about 1,500 feet long and 100 feet wide, rising about 5 feet above sea-level. The spit lies 5 miles southwest of Tuktoyaktuk, and has not been developed.

Drainage is excellent, with no ground ice discovered to a depth of 4 feet during the investigation in September.

Biotic

Vegetation is sparse to negligible. The spit lies at the northern end of an important fishing area which is exploited from mid-June to early fall. During the same period large numbers of Beluga whale gather in this area for pupping.

The spit is located within an important waterfowl area, and marine life in the adjacent sheltered waters is considered to be prolific.

T-111A MATERIALS AND QUANTITIES

The material in this source consists of a layer of gravel and sand about 1½ feet thick overlying a deposit of clean sand. The mixture of these materials to a depth of 4 feet is a poorly-graded aggregate with a maximum size of 1½ inches. The fine aggregate is deficient in the fine fraction passing the #60 mesh.

Assuming a depth of 4 feet above water level, the source could produce about 20,000 cubic yards of material.

T-111A DEVELOPMENT

General

This source is not recommended for development because of environmental considerations, the small volume available, and the inferior quality. Removal or substantial lowering of this spit would expose the shoreline behind to severe wave action.

Access

The most feasible access would be by barge in summer, but activity at this time would conflict with other uses of the area.

Material Use and Handling

If the source were feasible to develop the material is considered to be suitable for general fill or base course.

Development would require a front-end loader and barge.

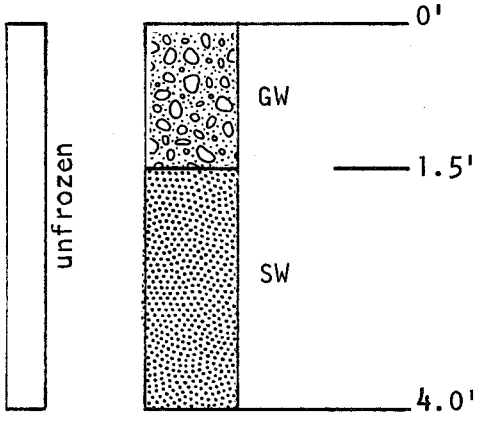
Stripping and Restoration

Stripping of the area would be negligible,necessitating only levelling of the depleted area. However, removal of the spit could cause erosion to the land behind requiring extensive restoration of the general area.

TEST PIT LOGS

SOURCE No. T-111A

T-111A-A

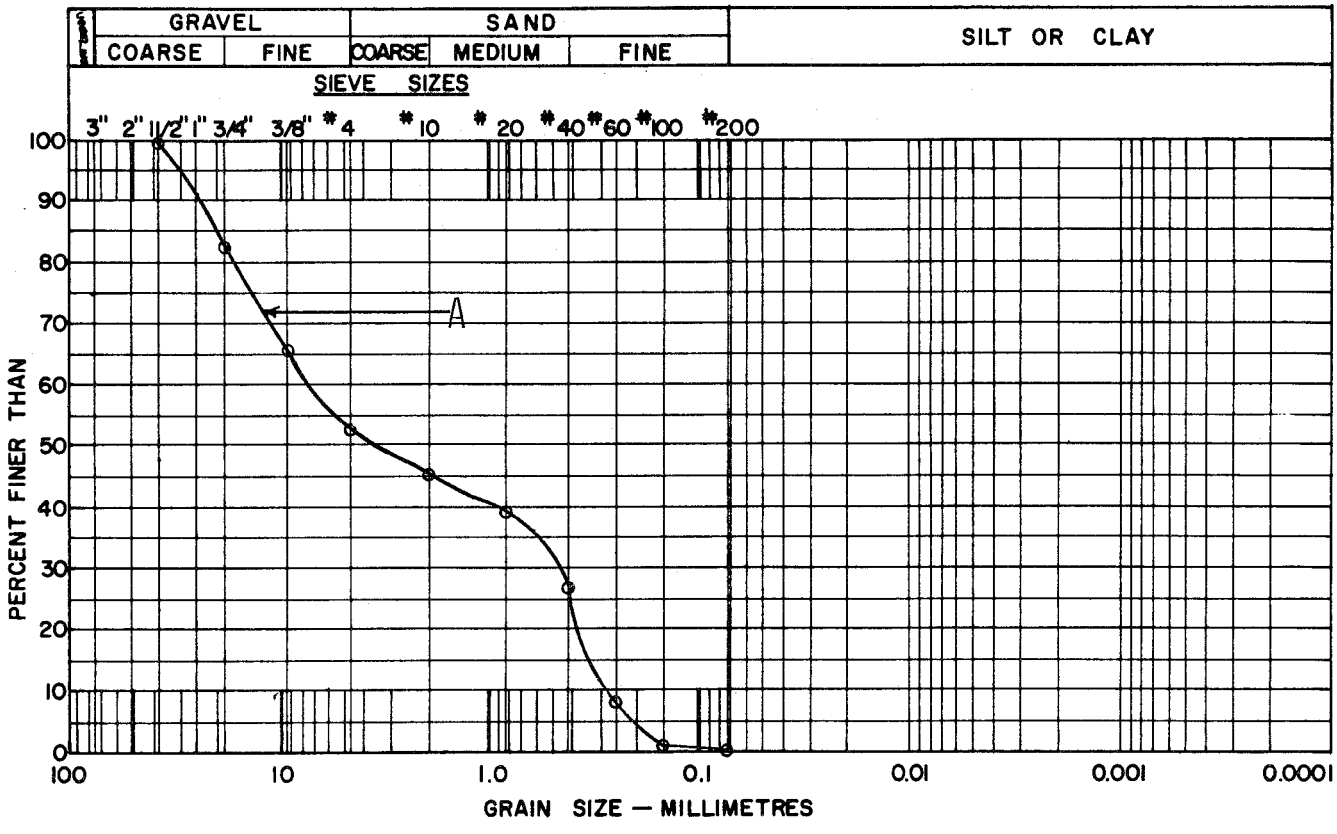


GRAVEL - and sand, well graded, max. 4", clean

SAND - and gravel, well graded max. 1½", clean

LABORATORY
TEST DATA
SOURCE No. I-111 A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

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

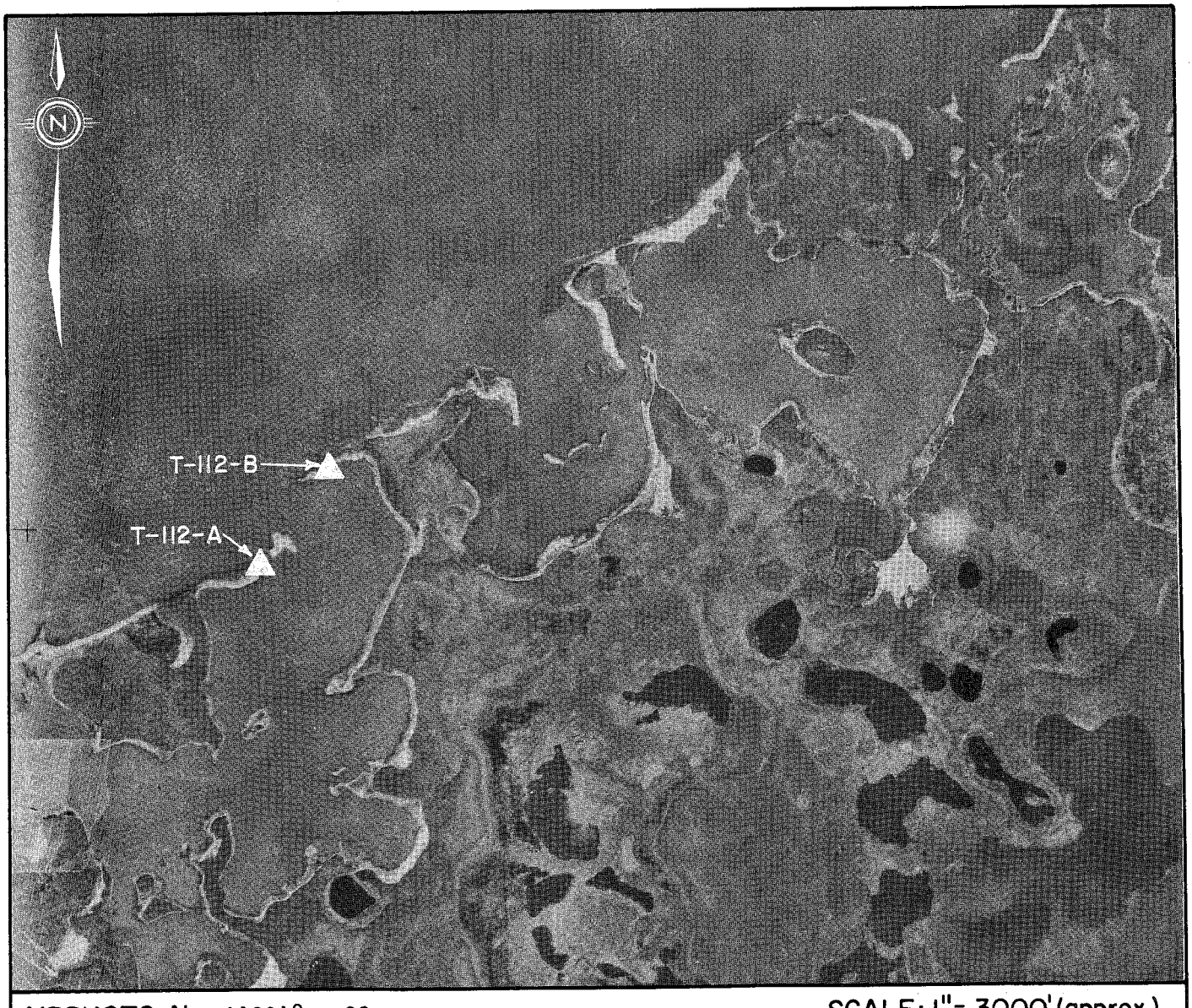
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No.T-112

LANDFORM AND LOCATION:	Ocean spit 6 miles southwest of Tuktoyaktuk
MATERIAL:	GRAVEL - and sand
VOLUME :	25,000 cu. yds, approximately
CONCLUSION:	Source is low priority for partial development because other sources are closer to the Community and environmental studies would be required for development



AIRPHOTO No. A12918 - 93

SCALE: 1" = 3000' (approx.)

T-112 ENVIRONMENT

Physical

The source is two opposing spits reaching across the mouth of a bay, about 6 miles southwest of Tuktoyaktuk. The total length of spit is about 3,000 feet, the width is 100 feet, and the height above sea-level is 4 feet.

Drainage is excellent, and no ground ice was discovered to a depth of 4 feet during the investigation in September.

Biotic

Vegetation is sparse to negligible. The spits lie at the north end of an important fishing area that is exploited from mid-June to early fall. During the same period large numbers of Beluga whale gather in this area for pupping.

The spit is located within an important waterfowl area, and marine life in the adjacent sheltered waters is considered to be prolific.

T-112 MATERIALS AND QUANTITIES

The material is fairly well graded aggregate, with about 55% passing the #4 mesh, and the maximum particle size is 2 inches. The sand fraction is deficient in the fine material passing #60 mesh.

Assuming a recoverable depth of 4 feet, the total volume of material available is 45,000 cubic yards. If the source is only partially developed, with the objective of preserving the protective barrier across the mouth of the bay, the available material is about 25,000 cubic yards.

T-112 DEVELOPMENT

General

The source is rated low priority, for partial development after the sources nearer to the Community are depleted, and after an oceanographic and environmental study is completed.

It is recommended that the study should be based on the removal of about 50% of the available material, excavating from the extremities of the spits and on the landward side. The actual volume of material that may be removed would be one of the findings of the study.

Access

Transportation to this source can be accomplished by barge in summer.

Material Use and Handling

The material is suitable for general fill or base course, and can be processed for use in concrete and asphalt construction. The oversize material would have to be screened and crushed, and the deficiency in the fine fraction corrected by blending with sand from another source.

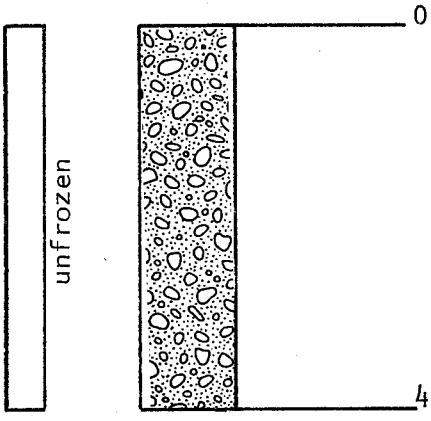
Development of the source would require a dozer, front-end loader, conveyor, and barge. Further treatment, such as crushing and screening, would probably be provided at a central distribution point.

Stripping and Restoration

Stripping of the area would be negligible. Restoration would only entail grading a suitable back slope at the point where the excavation ends. The oceanographic study would reveal any other action found necessary.

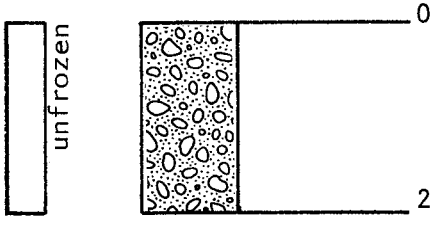
TEST PIT LOGS
SOURCE No. T-112

T-112-A



(GW) GRAVEL - and sand, stratified, well graded, max. 2", clean

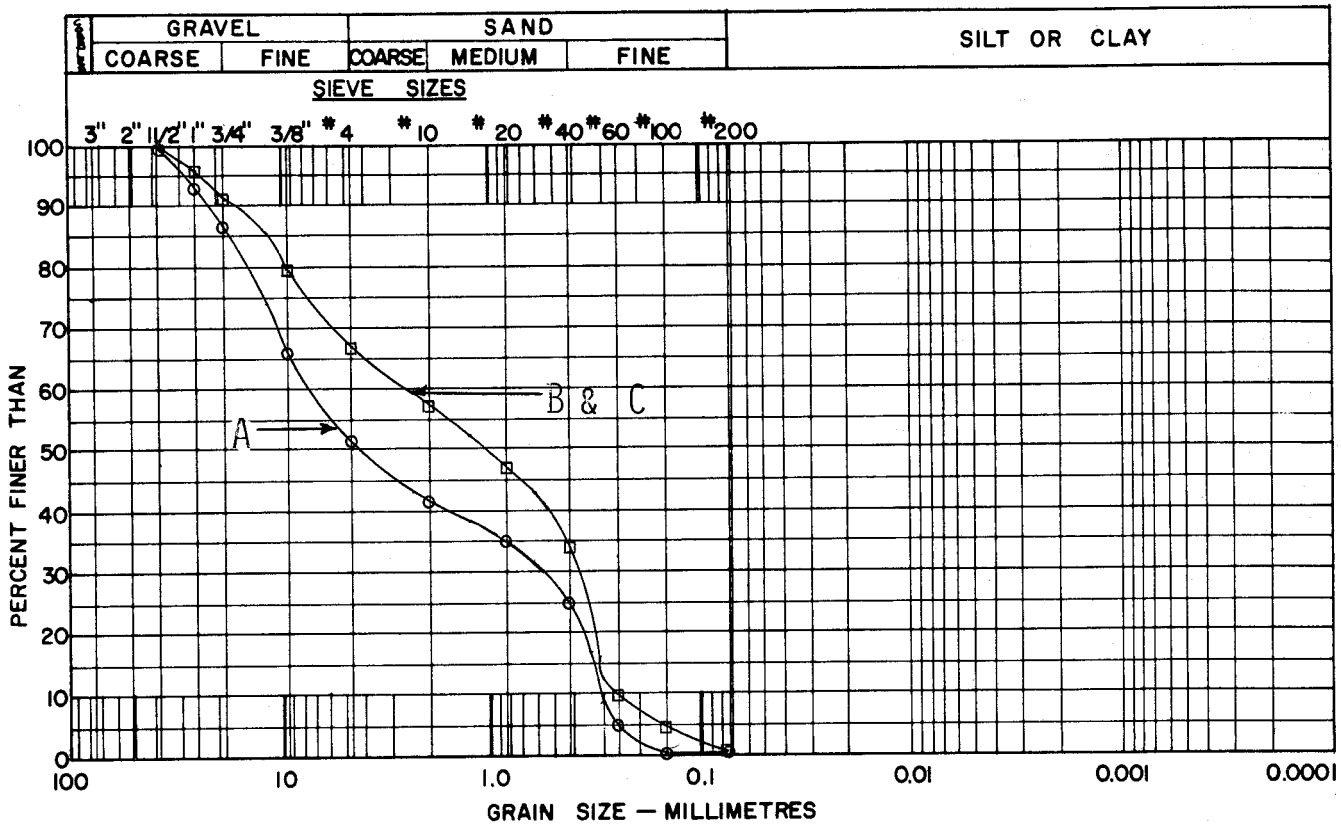
T-112-B



(GW) GRAVEL - and sand, stratified, well graded, max. 2", clean

LABORATORY
TEST DATA
SOURCE No. T-112

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

A-(0' - 1') M/C = 2.8%
B & C-(0' - 4') M/C = 2.7%

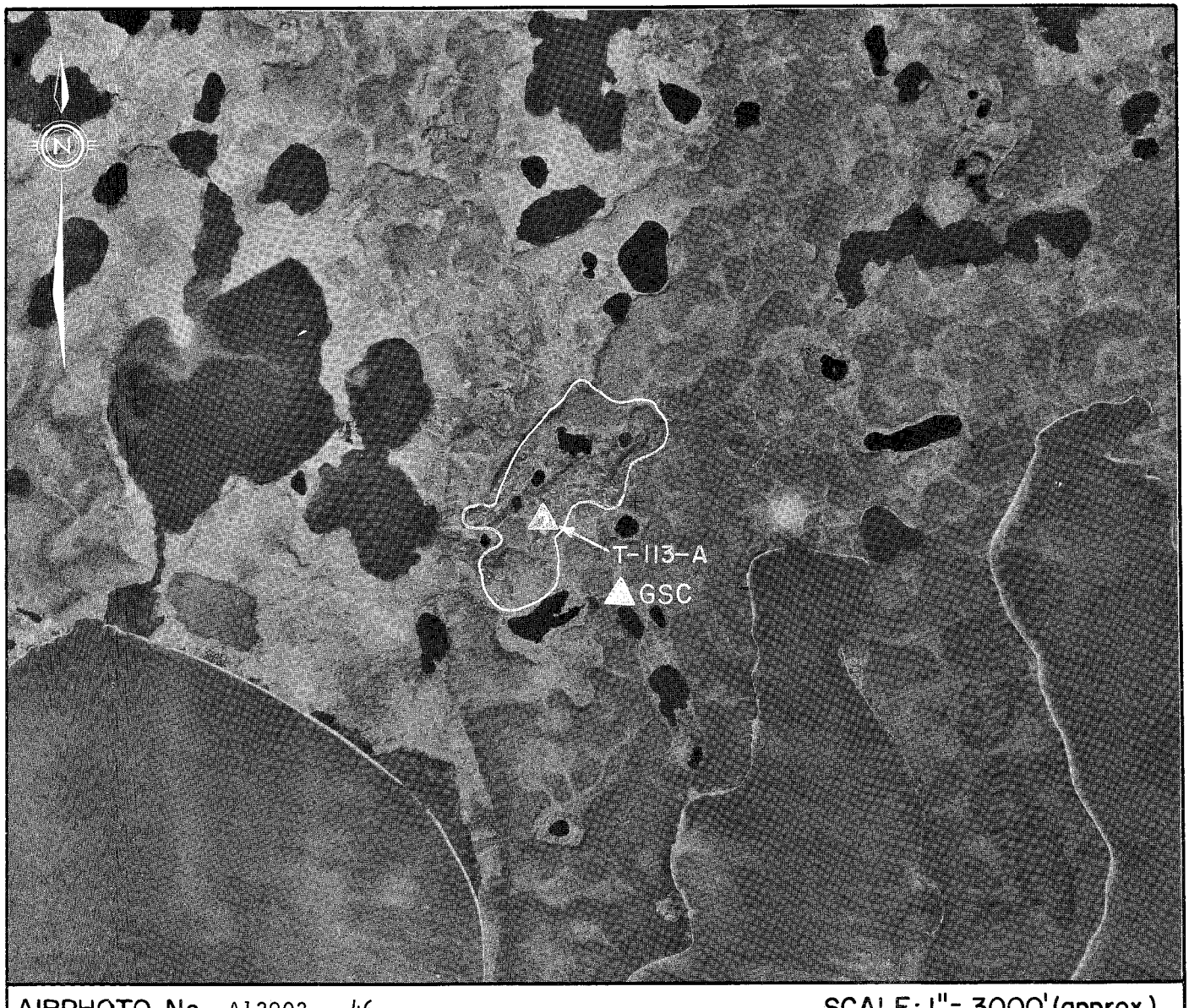
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TUKTOYAKTUK
SOURCE No. T-113

LANDFORM AND LOCATION:	A source of kames located 17 miles southeast of Tuktoyaktuk
MATERIAL:	GRAVEL - and sand
VOLUME:	1,500,000 cu. yds.
CONCLUSION:	Source suitable for development to provide all classes of granular materials for the Community. Access is difficult and is limited to winter hauling unless an expensive all season road is constructed.



AIRPHOTO No. A12902 - 46 SCALE: 1" = 3000' (approx.)

T-113 ENVIRONMENT

Physical

The source is a kame field located on the northwest shore of Eskimo Lakes, about 17 miles southeast of Tuktoyaktuk. The field is about 4,500 feet long and about 1,500 feet wide, and contains kame terraces and kames up to 75 feet high and 250 feet in diameter.

Drainage of the kames is good. Ground ice was not encountered in the one Test Pit, 4 feet deep, but can be expected in the finer strata of these features. Thermokarst ponds are common features of the area.

This source has been developed to a very minor degree, in connection with oil exploration.

Biotic

The kames are covered by moss, with a medium to high density of low shrubs.

The source is not located in a critical wildlife area. The area surrounding Eskimo Lakes is, however, used extensively by scaups and scoters as a moulting and staging area from mid-June to October. The source is only 2 miles from the area designated as the summer range of the Reindeer Herd, and possibly of the barren-ground caribou, occupied from mid-June to mid-September.

T-113 MATERIALS AND QUANTITIES

Granular material is exposed on the tops of the kames and kame terraces. The materials vary from well-graded sand to poorly-graded coarse gravel containing about 30% sand.

The one sample from the source was subjected to petrographic analysis. It contained primarily quartz and quartzite (75%), chert (15%), and granite (5%), with hard limestone, soft sandstone, and conglomerate making up the remaining 5%. The only unsound materials are the sandstone (3½%) and conglomerate, a total of less than 4%.

The depth of recoverable material must be determined by further investigation, but the source is thought to contain at least 1,500,000 cubic yards.

T-113 DEVELOPMENT

General

This source is recommended for development, to provide general fill, base course, and aggregates for concrete and asphalt construction.

The source is both large and complex. It is recommended that, before a large-scale development can be planned, the source should be investigated by drilling. Only in this way can the limits of suitable material be established, and the excavation can proceed with some expectation of continuity.

Access

The only practical access from Tuktoyaktuk to this source is by winter road, a distance of at least 17 miles.

An all-weather access road is considered to be too expensive for consideration.

Material Use and Handling

The materials in this source can be used for any purpose, from general fill to concrete aggregate.

The maximum size of aggregate is about 3 inches, too large for anything but general fill. The oversize material could be screened and crushed, yielding a material suitable for concrete or asphalt construction.

The sand tested in one sample is deficient in the finer fraction, and would require blending for use in concrete.

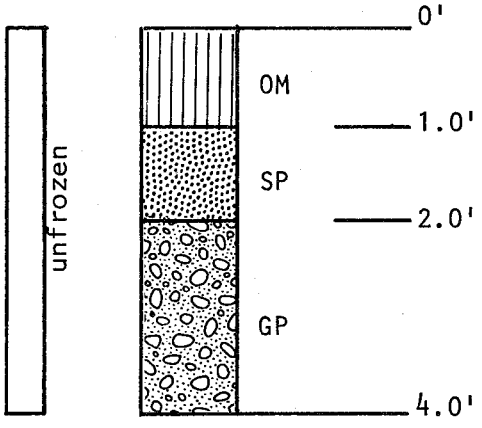
Development of this source will require a dozer with ripper attachment, front-end loader, and trucks. A screening plant will be required to remove unwanted aggregate sizes, and eventually a crushing plant should be added for the most efficient use of this source.

Stripping and Restoration

The vegetative cover and topsoil must be removed and stockpiled for replacement after an area has been depleted. All banks must be graded to a stable slope before restoration. Finally, the area should be seeded for speedy revegetation, using a selection of ground cover and methods of preparation recommended by a scientist experienced in Arctic horticulture.

TEST PIT LOGS
SOURCE No. T-113

T-113-A



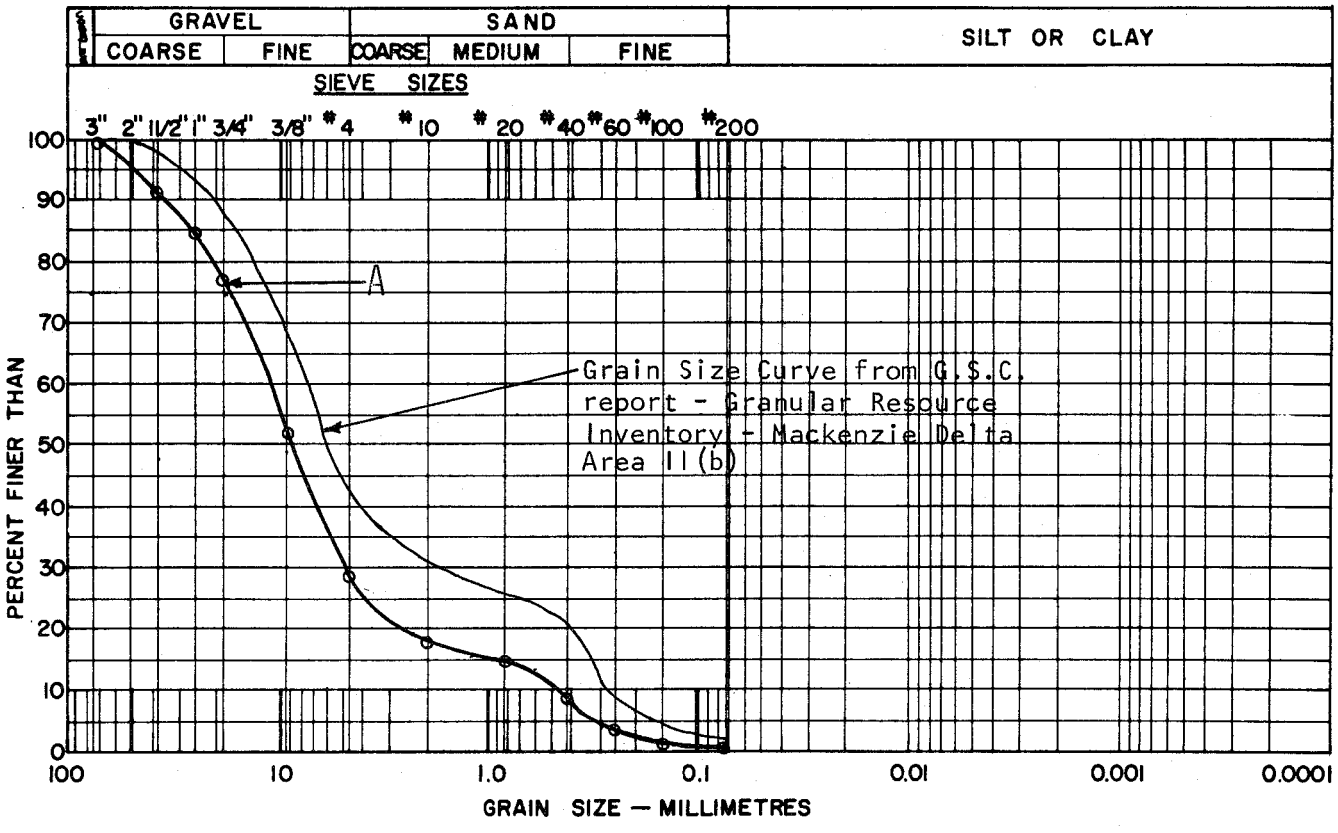
SILT - organic, roots, grass etc.

SAND - fine, uniform, clean

GRAVEL - some sand, max. 3" rounded to subrounded, poorly graded

LABORATORY
TEST DATA
SOURCE No. T-113

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

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

ORGANIC CONTENT

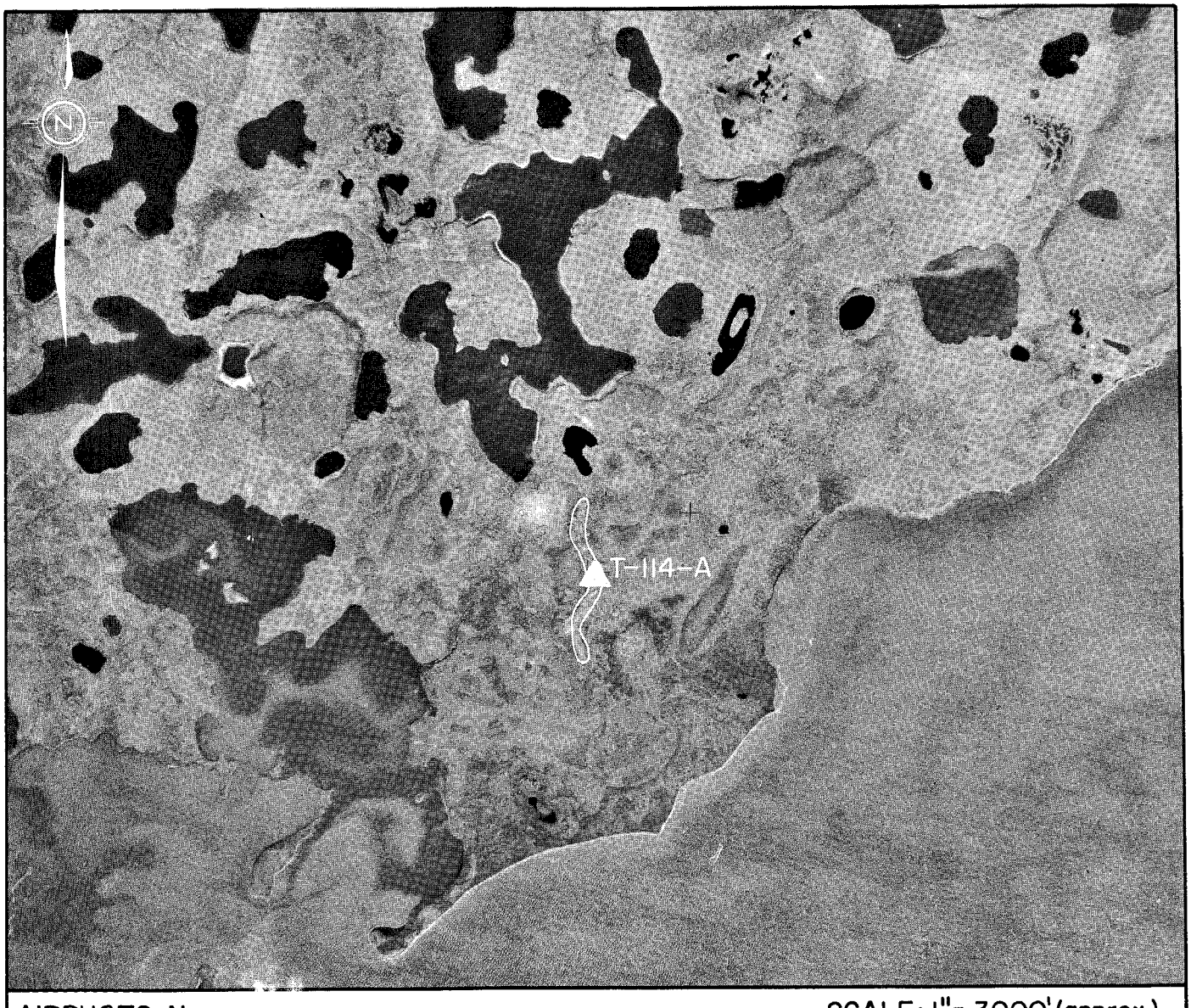
HARDNESS TEST

PETROGRAPHIC ANALYSIS

Quartzite	-74%
Chert	-15%
Granite	- 5%
Sandstone, soft	- 4%
Quartz	- 1%
Limestone, hard	- 1%
Conglomerate	-neg
Total	100%

TUKTOYAKTUK
SOURCE No. T-114

LANDFORM AND LOCATION:	Esker ridge about 16 miles southeast of Tuktoyaktuk
MATERIAL:	GRAVEL - some sand
VOLUME:	300,000 cu. yds. approximately
CONCLUSION:	Source is suitable for development for general fill and fine and coarse aggregate. Access by winter road



AIRPHOTO No. A12902 - 74 SCALE: 1"= 3000' (approx.)

T-114 ENVIRONMENT

Physical

The source is an esker about 2,000 feet long, 150 feet wide, and 25 feet high, located on the north shore of Eskimo Lakes about 16 miles southeast of Tuktoyaktuk.

The esker is well-drained, although the land around is patterned and ice-rich.

The source has not been developed.

Biotic

The esker is covered with moss and small shrubs.

The source is not located in a critical wildlife area. The area surrounding Eskimo Lakes is, however, used extensively by scaups and scoters as a moulting and staging area from mid-June to October. The source is only 2 miles from the area designated as the summer range of the Reindeer Herd, and possibly of the barren-ground caribou, occupied from mid-June to mid-September.

T-114 MATERIALS AND QUANTITIES

The material in this esker appears to be clean, well-graded gravel. The sand fraction is about 30% of the total, and is deficient in the material passing the #60 mesh.

The petrographic analysis of gravel indicates the main constituents to be quartz and quartzite (84%), chert (37%), and granite (5%), with sandstone and ironstone making up the remaining 2%. Only the sandstone and ironstone are unsound.

The material is sampled at only one point. Surficial examination indicates a reasonably uniform deposit that could contain up to 300,000 cubic yards.

T-114 DEVELOPMENT

General

This source is recommended for development, to supply general fill,

base course, and aggregates for concrete and asphalt construction.

The volume of available construction material must be determined by further investigation, and in particular by drilling.

Access

The only practical access to this source is by winter road from Tuktoyaktuk, a distance of at least 16 miles.

Material Use and Handling

The material from this source can be used as general fill, base course, and aggregate for concrete and asphalt construction.

For the most efficient use of the material for aggregate, a screening and crushing plant will be required, to screen and crush the oversize rock. Probably a fine sand will also be required for blending, to supply material that is deficient in this source.

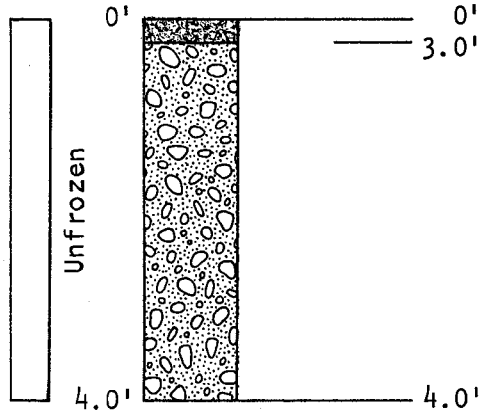
Development of the source will require a dozer with ripper attachment, a front-end loader, and trucks. Eventually a crushing and screening plant will be required to produce specification aggregate.

Stripping and Restoration

The vegetative cover and topsoil must be removed and stockpiled for replacement after an area has been depleted. All banks must be graded to a stable slope before restoration. Finally, the area should be seeded for speedy revegetation, using a selection of ground cover and methods of preparation recommended by a scientist experienced in Arctic horticulture.

TEST PIT LOGS
SOURCE No. T-114

T-114-A

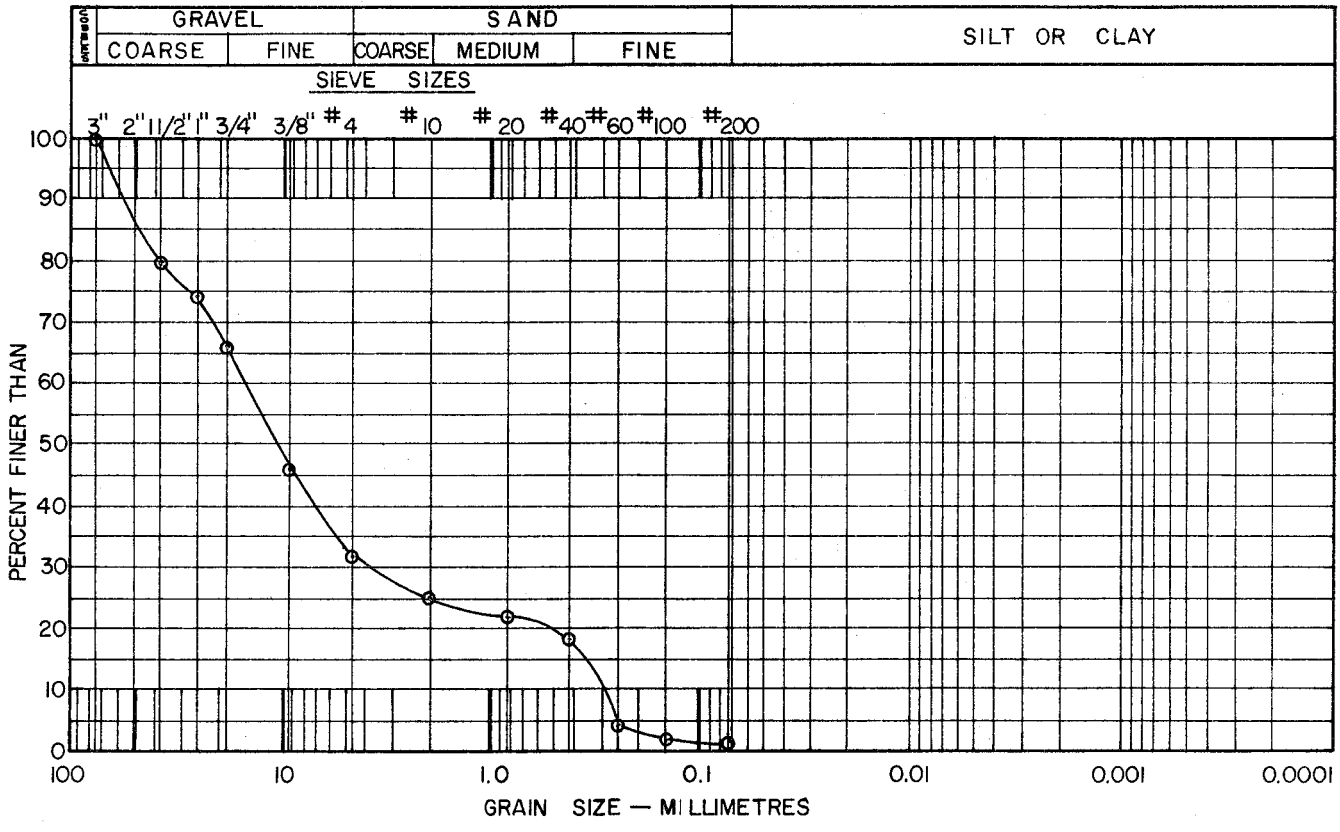


MOSS and shrubs

(GW) GRAVEL - some sand, max. 3", rounded to subrounded

LABORATORY
TEST DATA
TEST PIT-SOURCE No. T-114-A

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

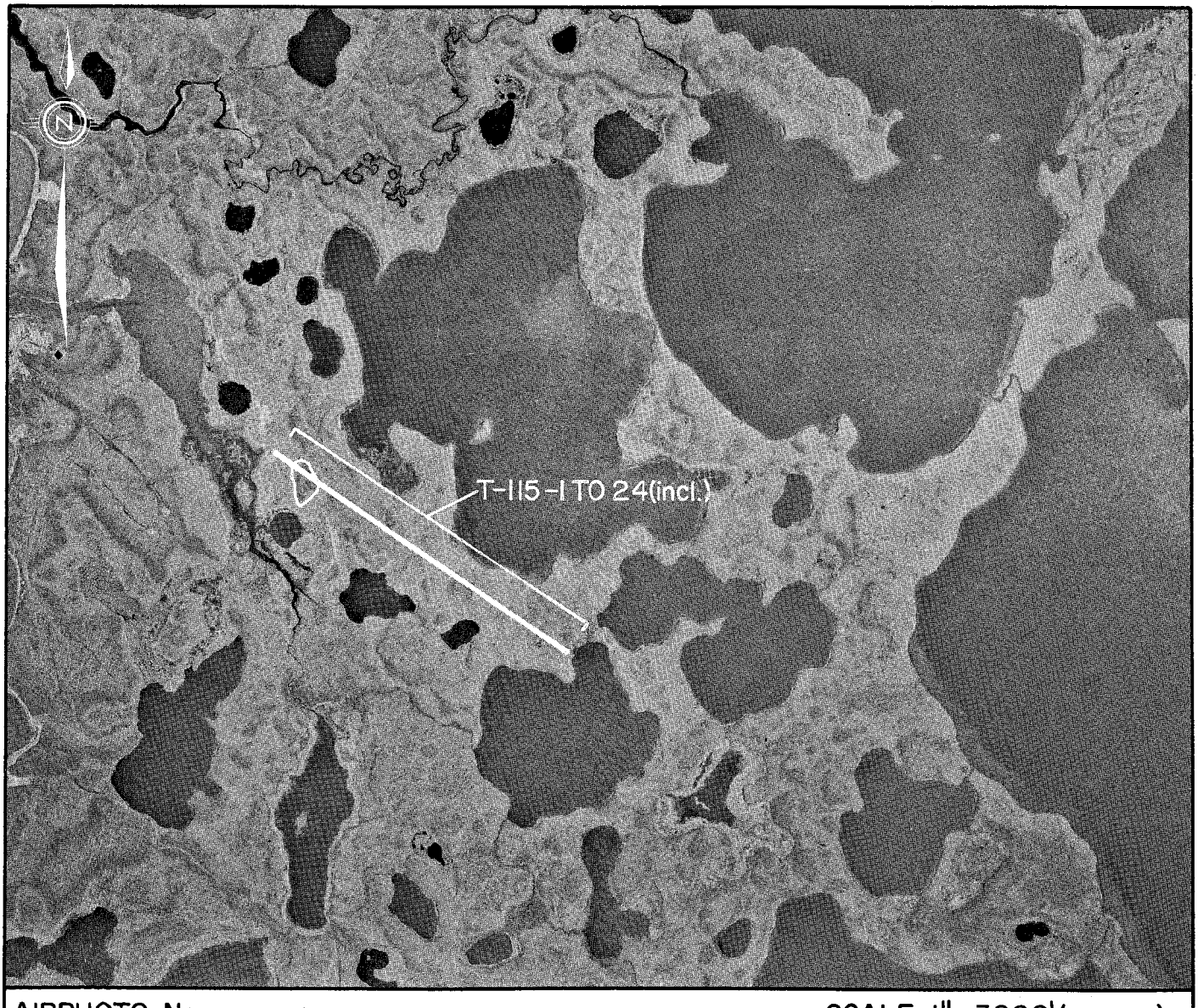
HARDNESS TEST

PETROGRAPHIC ANALYSIS

Quartzite	-83%	Quartz	- 1%
Chert	- 9%	Ironstone	-neg
Granite	- 5%		
Sandstone	- 2%	Total	100%

TUKTOYAKTUK
SOURCE No. T-115

LANDFORM AND LOCATION:	Glacial outwash deposit about 3½ miles southeast of Tuktoyaktuk and immediately adjacent to proposed Imperial Oil airstrip.
MATERIAL:	GRAVEL - and sand and SAND - and gravel
VOLUME:	100,000 cu. yds.
CONCLUSION:	Source is suitable for development for general fill.



AIRPHOTO No. A22936 - 162 SCALE: 1" = 3000' (approx.)

T-115 ENVIRONMENT

Physical

The source is a glaciofluvial outwash deposit, a gentle knoll about 600 feet by 300 feet and 25 feet high. The source is adjacent to the northwest end of the proposed Imperial Oil airstrip, 3½ miles southeast of Tuktoyaktuk.

Drainage of this source is good, although the surrounding area is poorly drained. Little or no segregated ice was encountered in any of the drill-holes.

This source has not been developed, although it has been evaluated in connection with the proposed airstrip construction.

Biotic

The vegetation is moss and low shrubs, with a total organic cover of from 1 to 4 feet, mostly peat.

The source lies within an important waterfowl breeding area, and is also within an important habitat of the white fox, trapped by the local residents.

The area is not part of a critical wildlife area.

T-115 MATERIALS AND QUANTITIES

The data for this source was obtained from the Imperial Oil Limited airstrip investigation for which 24 test holes were drilled. Only test hole Nos. 3 and 3A are in an area large enough to be exploited. Other holes indicated granular materials, however, the extent of material in other possible sources was limited and would not be feasible for development.

The material in this source is a sand and gravel, varying in composition from clean, well graded sandy gravel to silty sand. The percentage of coarse aggregate ranges from 10% to 30%, with a maximum particle size of 1 inch.

The source is estimated to contain 100,000 cubic yards of construction material.

T-115 DEVELOPMENT

General

The source is recommended for development for the supply of general fill. It could be excavated with very little preparation, and would not be delayed for environmental studies.

At this time we must assume that the source cannot be excavated below the proposed runway grade.

Access

The only feasible access at this time is by winter road, a distance of about 4 miles across the tundra and harbour to the Community.

The small volume of material does not warrant the construction of an all-weather access road.

Material Use and Handling

The material in this source is suitable for general fill and base course. Because of the low percentage of coarse aggregate the material cannot be used for concrete or asphalt construction.

The development will require a dozer with ripper attachment, front-end loader, and trucks.

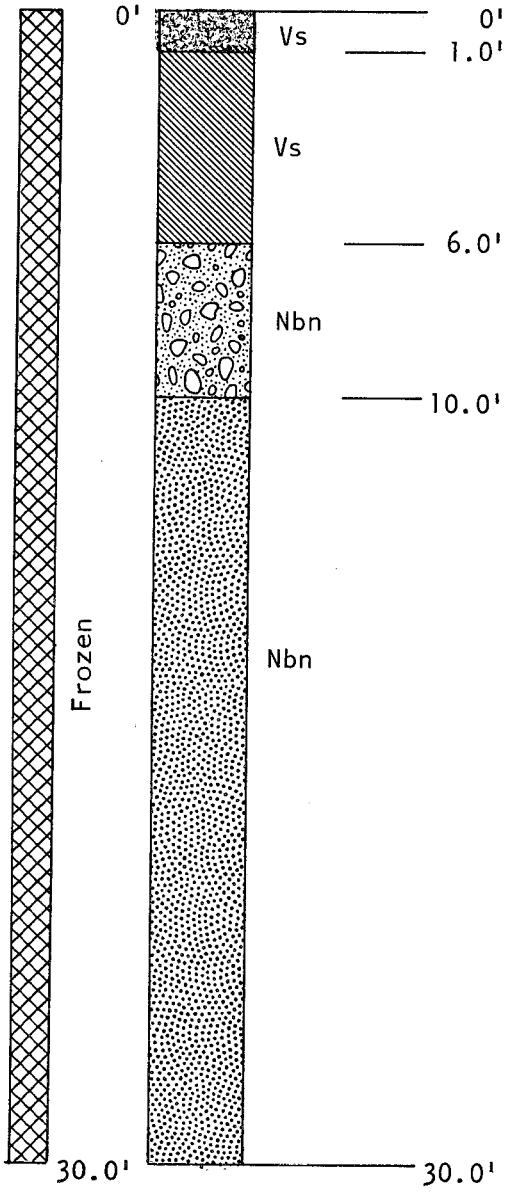
Stripping and Restoration

The vegetative cover and topsoil must be removed and stockpiled for replacement after an area has been depleted. All banks must be graded to a stable slope before restoration. Finally, the area should be seeded for speedy revegetation, using a selection of ground cover and methods of preparation recommended by a scientist experienced in Arctic horticulture.

TEST HOLE LOGS

SOURCE No. T-115

T-115-1

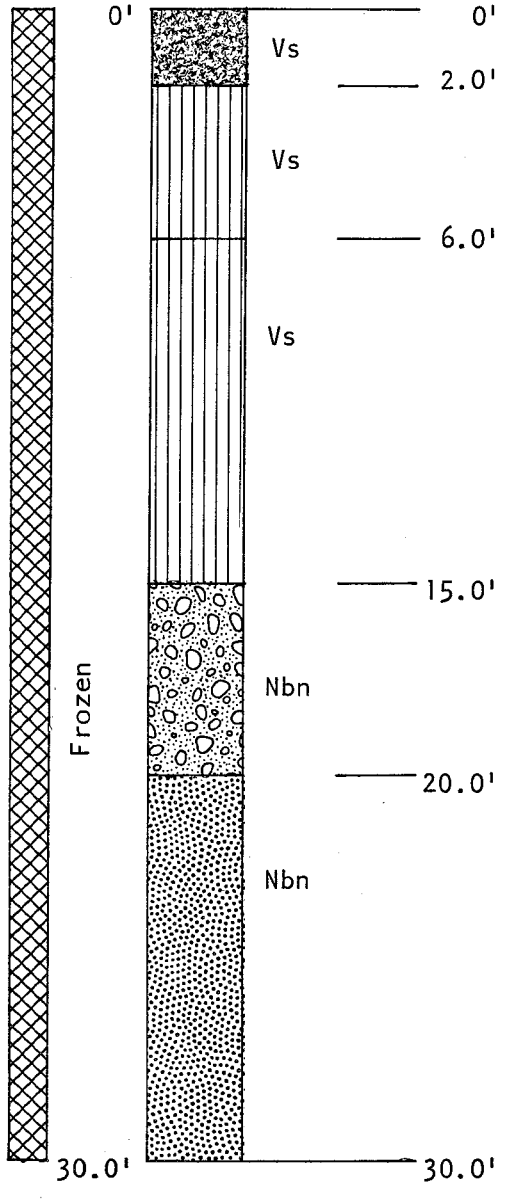


0'			
	Vs	(Pt)	PEAT - fibrous
1.0'			
	Vs	(CL)	CLAY - some silt, med plastic, brown
6.0'			
	Nbn	(GP)	GRAVEL - some sand
10.0'			
	Nbn	(SP)	SAND - trace silt
30.0'			

TEST HOLE LOGS

SOURCE No. T-115

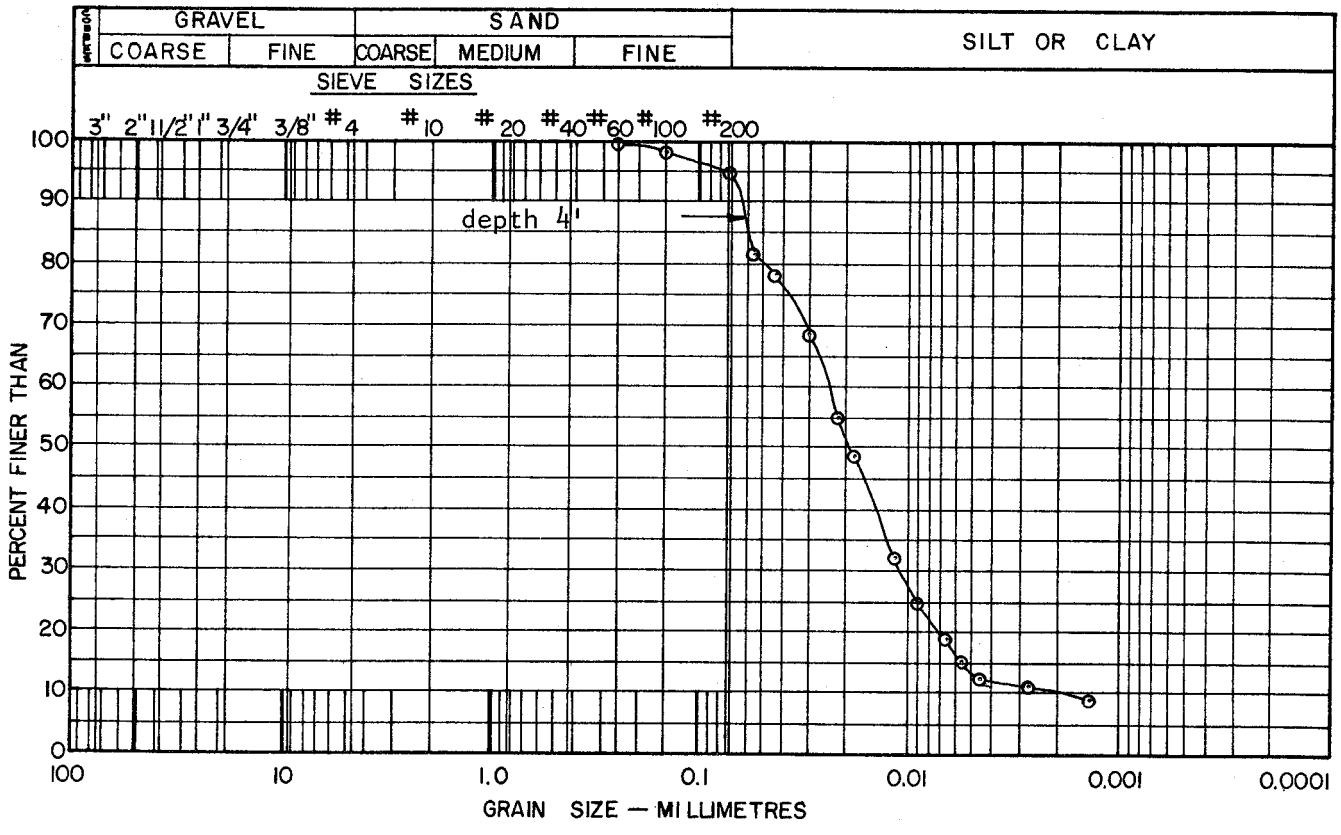
T-115-2



(Pt)	PEAT -	fibrous, oriented ice formations
(ML)	SILT -	some organic, trace clay and sand
(ML)	SILT -	some clay, some organic, low plastic
(GP)	GRAVEL -	some sand, no visible ice
(SP)	SAND -	trace silt, fine grained, no visible ice

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-2

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

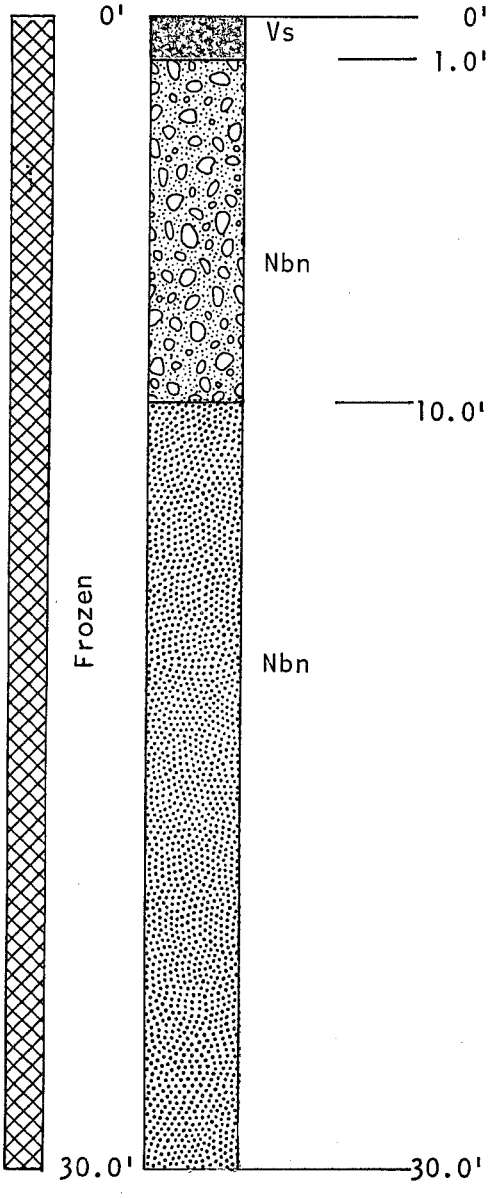
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-3



(Pt) PEAT - fibrous, stratified ice

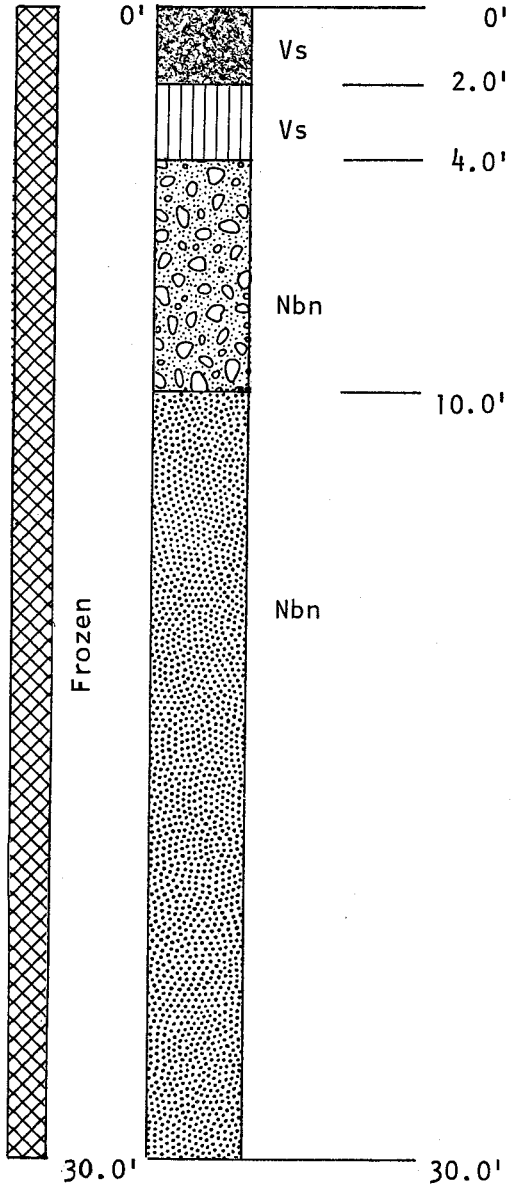
(GW) GRAVEL - and sand, trace silt, well-graded

(SM) SAND - some silt, trace gravel

TEST HOLE LOGS

SOURCE No. T-115

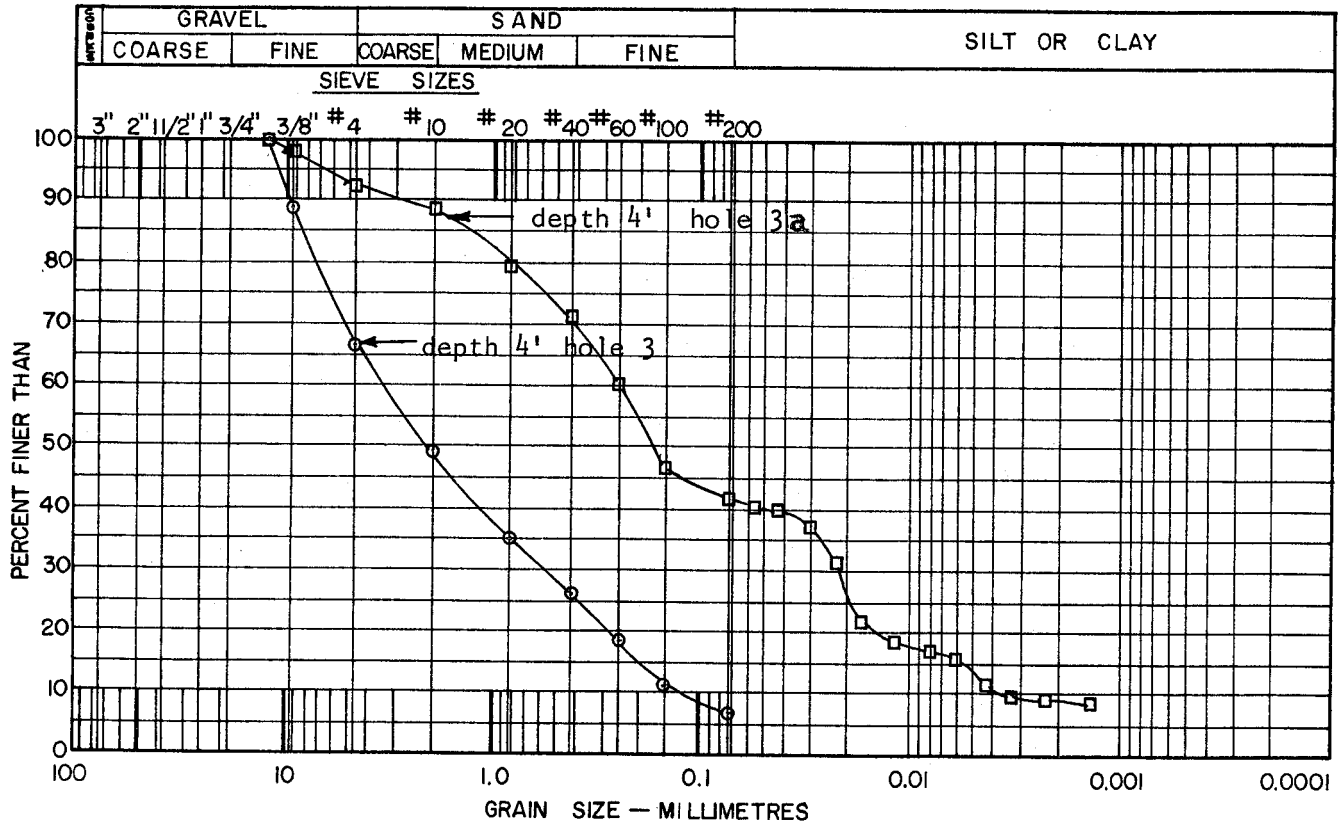
T-115-3a



(Pt)	PEAT - fibrous, stratified ice
(ML)	SILT - little sand
(GP)	GRAVEL - and sand, some silt, trace clay, angular
(SP)	SAND - trace silt

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-3

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

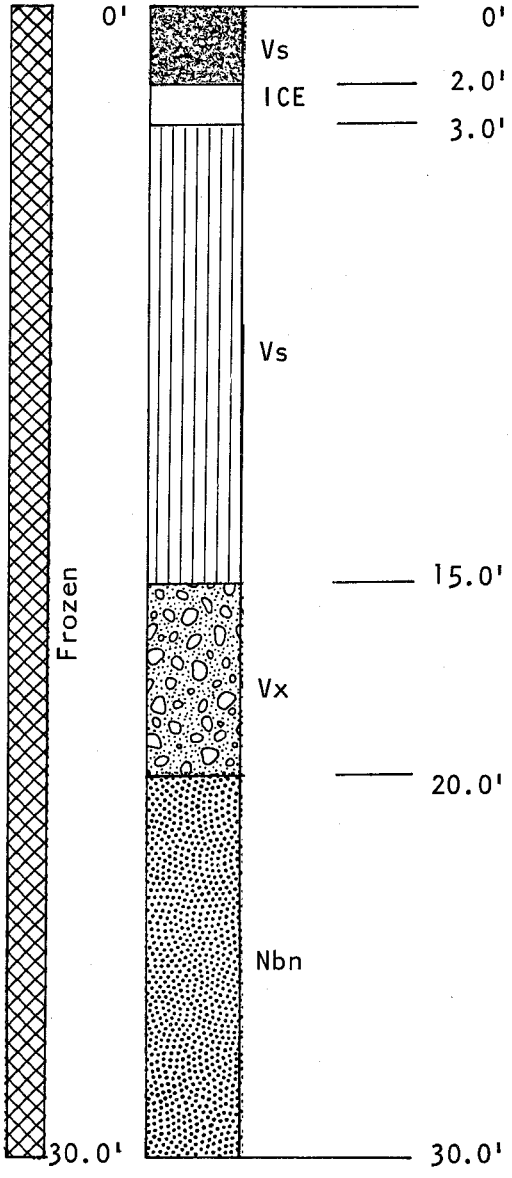
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-4

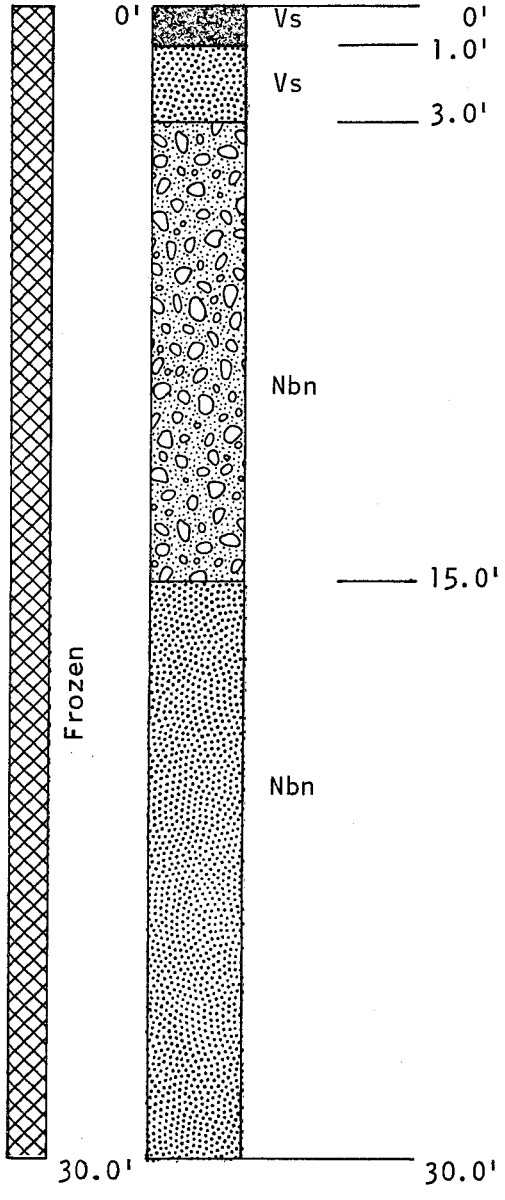


(Pt)	PEAT - fibrous, stratified ice	
	ICE	
(ML)	SILT - some clay, low plastic, stratified ice	
(GW)	GRAVEL - some sand, ice crystals and inclusions	
(SP)	SAND - some gravel, trace silt, fine grained, well bonded ice	

TEST HOLE LOGS

SOURCE No. T-115

T-115-5



(Pt) PEAT - fibrous, stratified ice

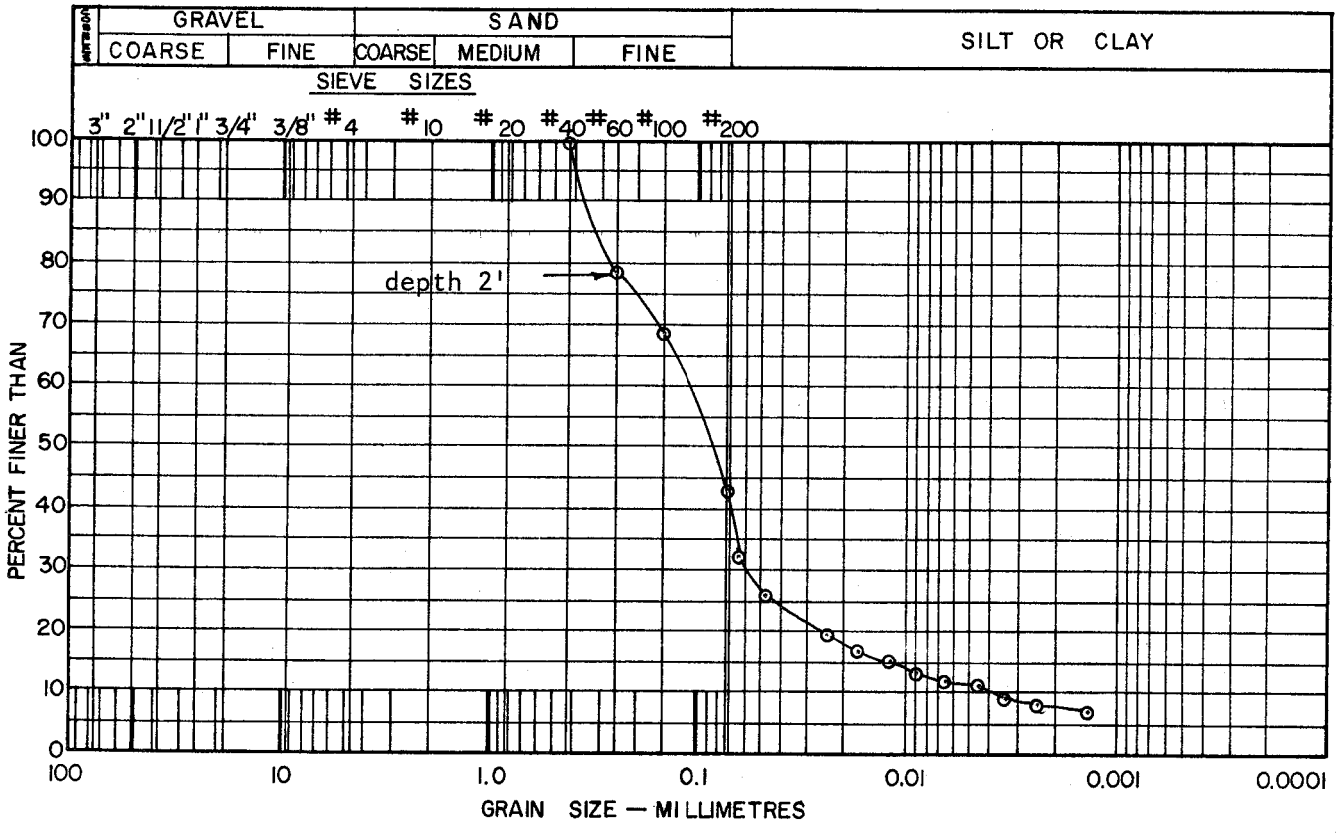
(SP) SAND - some silt, trace clay

(GP) GRAVEL - little sand, trace silt

(SM) SAND - some silt, fine grained

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-5

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

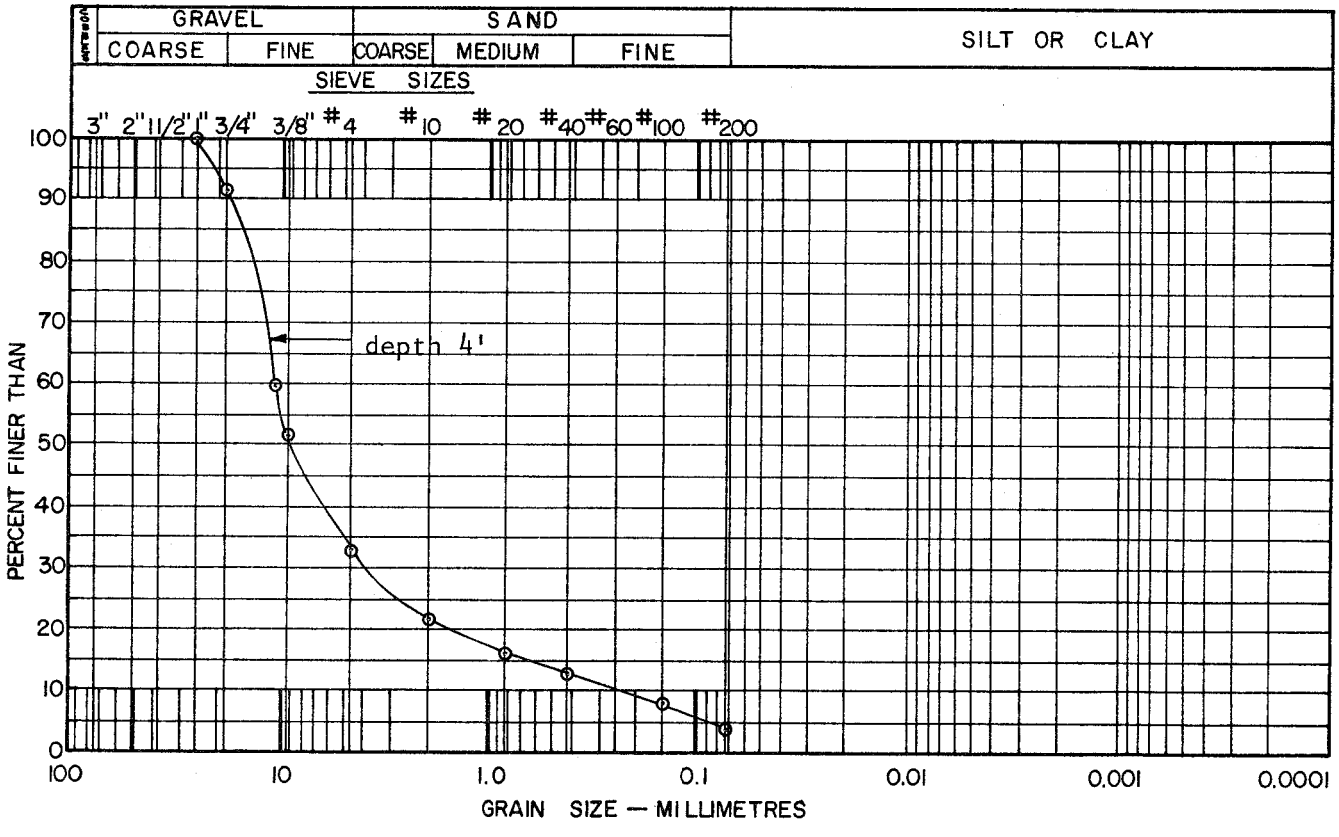
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-5

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

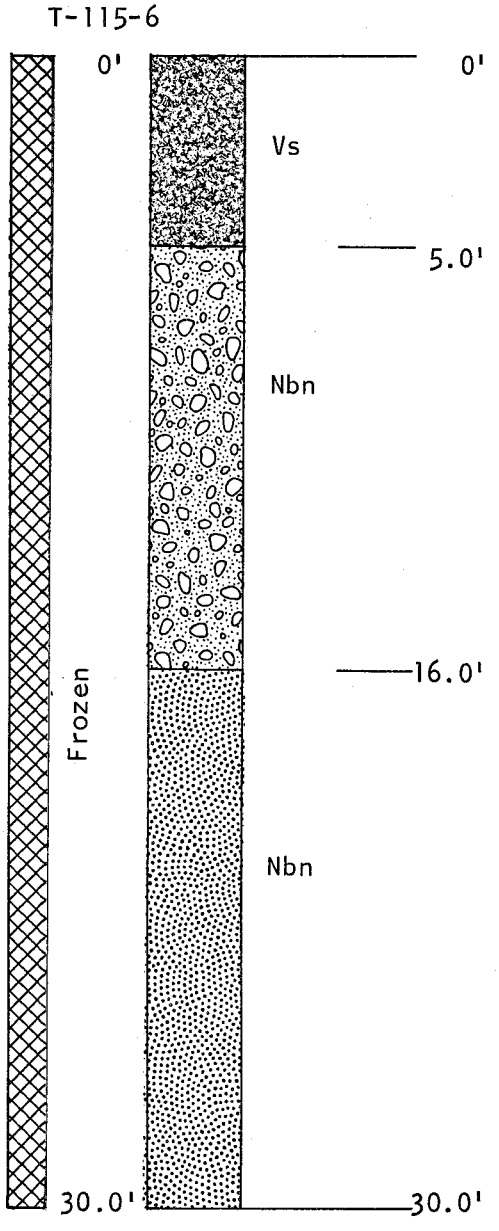
ORGANIC CONTENT

HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115



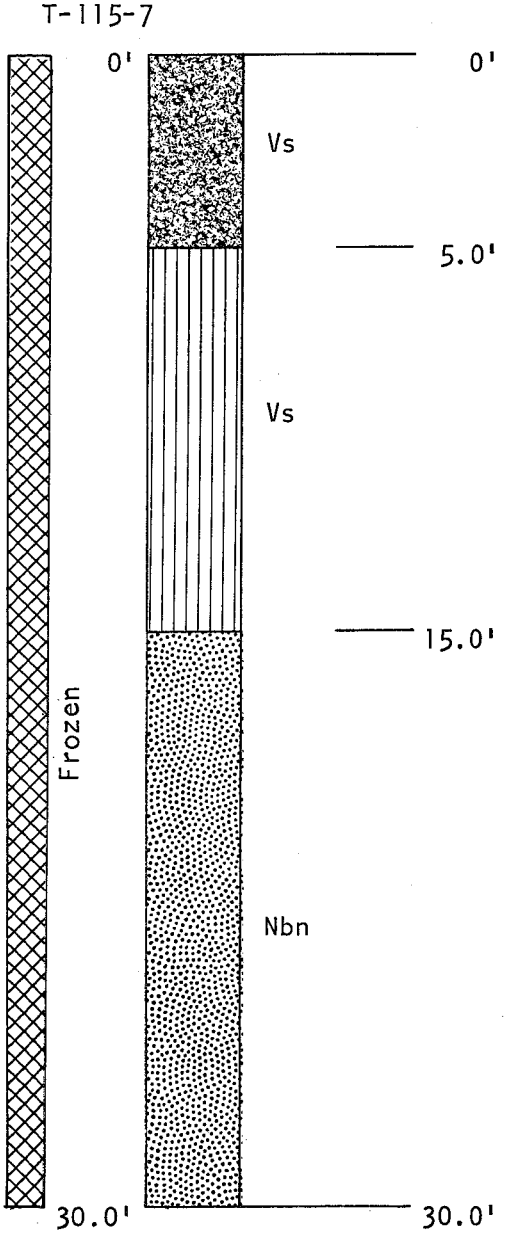
(Pt) PEAT - fibrous, stratified ice

(GW) GRAVEL - some sand, some silt, some clay, well bonded ice

(SP) SAND - trace silt, fine grained

TEST HOLE LOGS

SOURCE No. T-115



(Pt) PEAT - fibrous, stratified ice

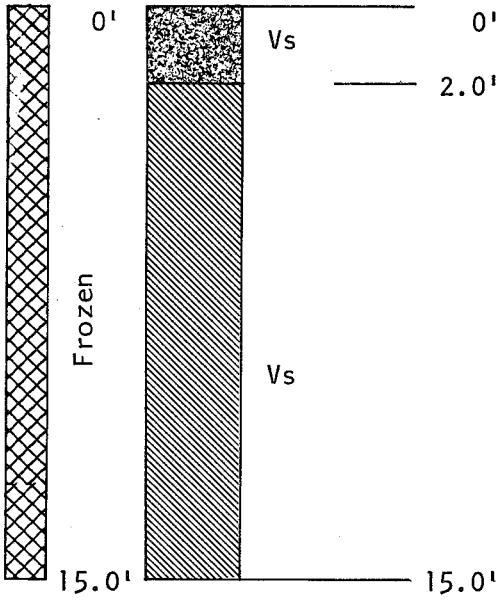
(ML) SILT - little sand, trace of clay, stratified ice

(SW) SAND - little silt, some gravel, well bonded ice

TEST HOLE LOGS

SOURCE No. T-115

T-115-10

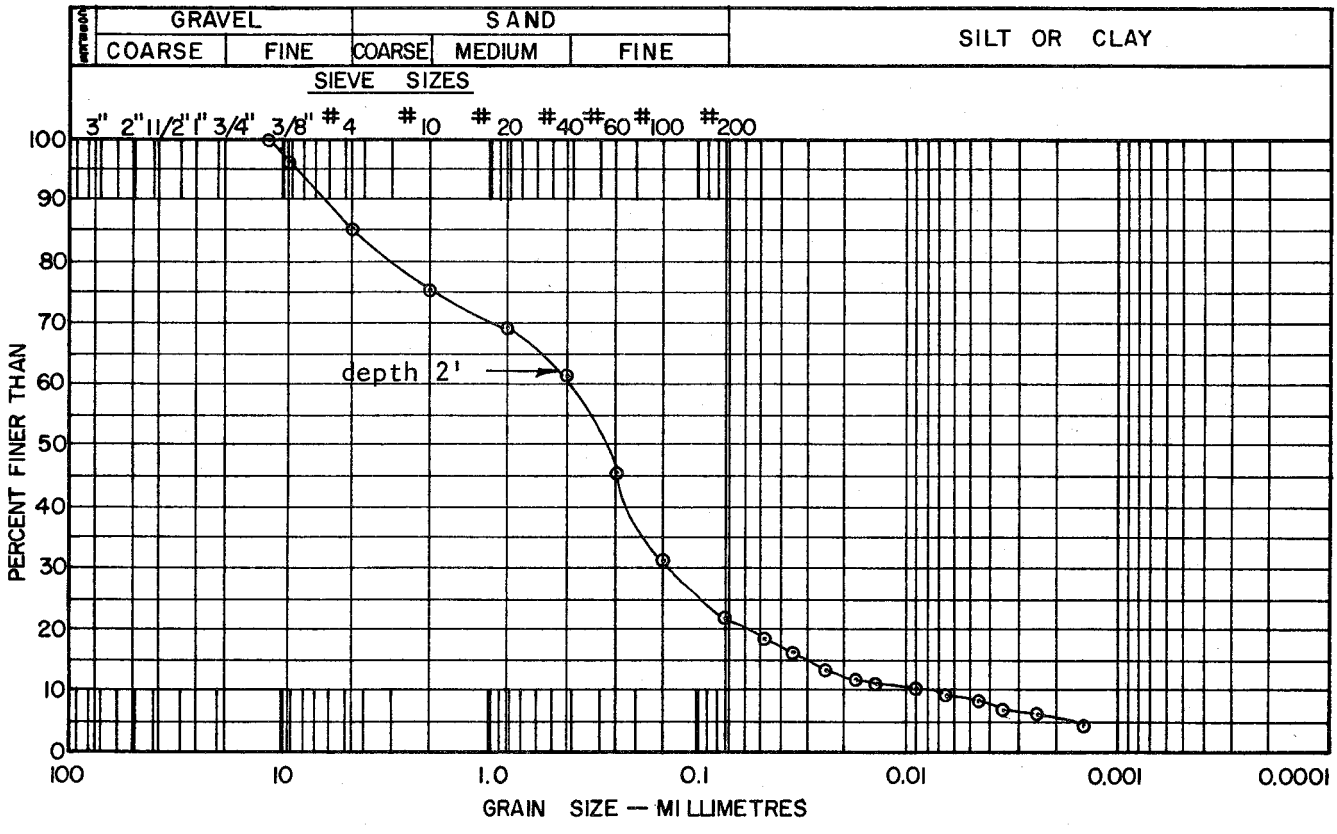


(Pt) PEAT - fibrous, stratified ice

(CH) CLAY - and silts, high plastic, stratified ice

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-8

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

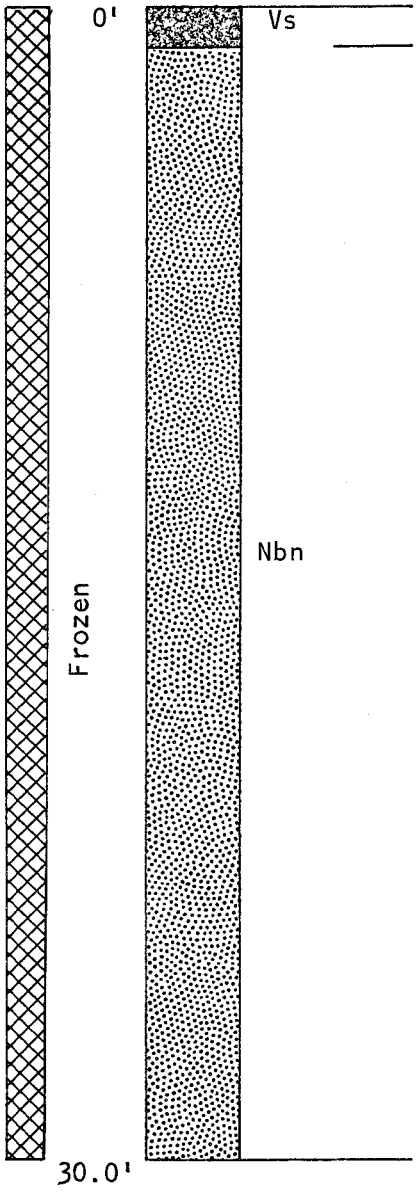
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-9



0' (Pt) PEAT - fibrous, stratified ice

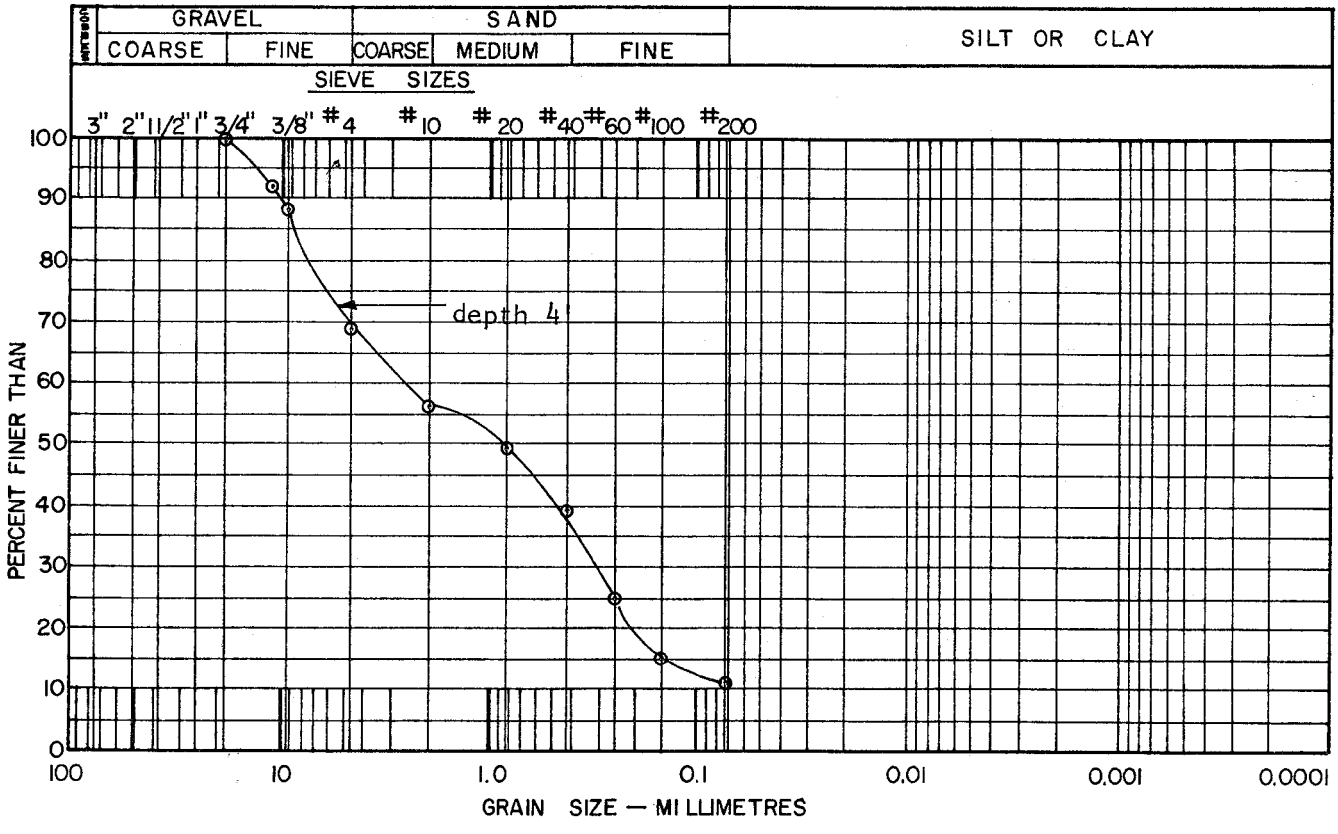
1.0'

(SW) SAND - and gravel, trace silt, well graded

30.0'

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-9

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

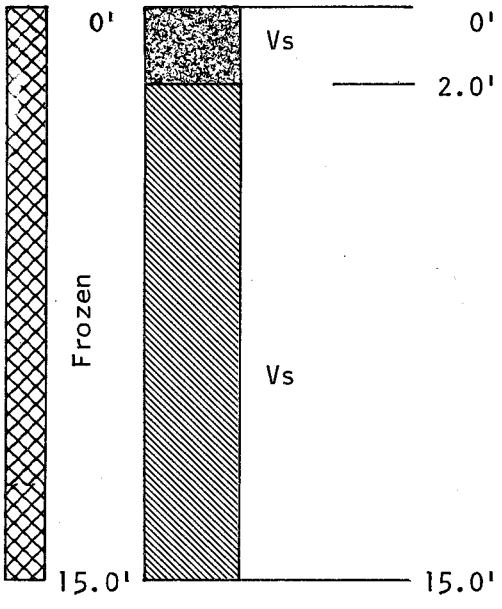
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-10

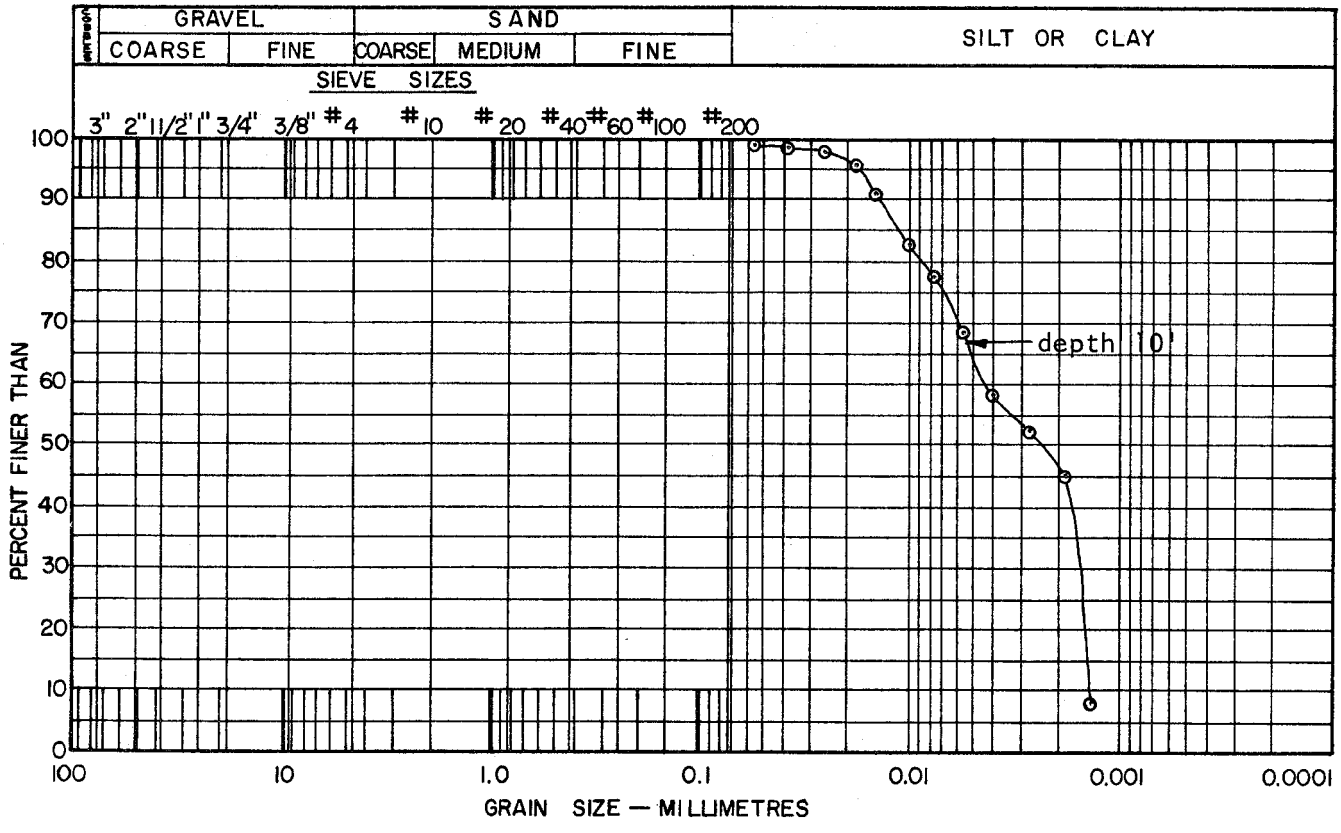


(Pt) PEAT - fibrous, stratified ice

(CH) CLAY - and silts, high plastic, stratified ice

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-10

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

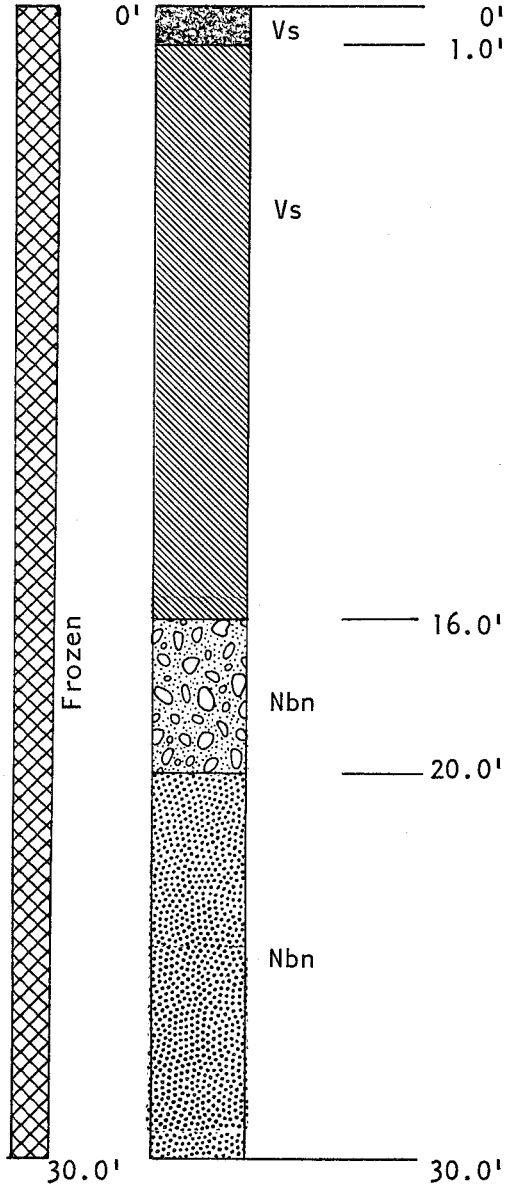
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-11

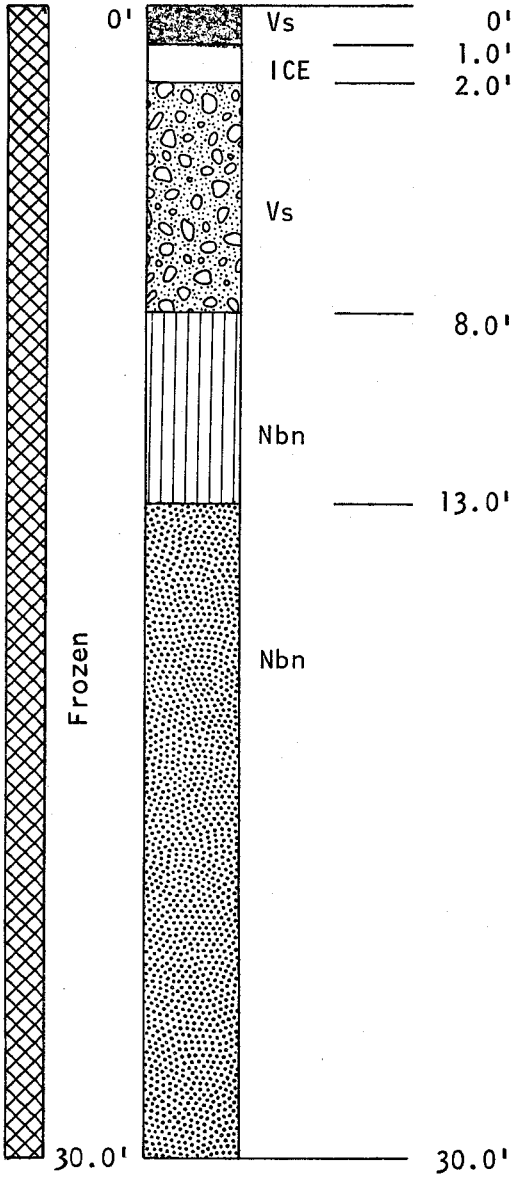


0'		(Pt)	PEAT - fibrous
1.0'			
	Vs	(Cl)	CLAY - little silt, trace organic, med plastic, ice, stratified
16.0'			
	Nbn	(GW)	GRAVEL - some sand, some silt
20.0'			
	Nbn	(SP)	SAND - trace silt, fine grained
30.0'			

TEST HOLE LOGS

SOURCE No. T-115

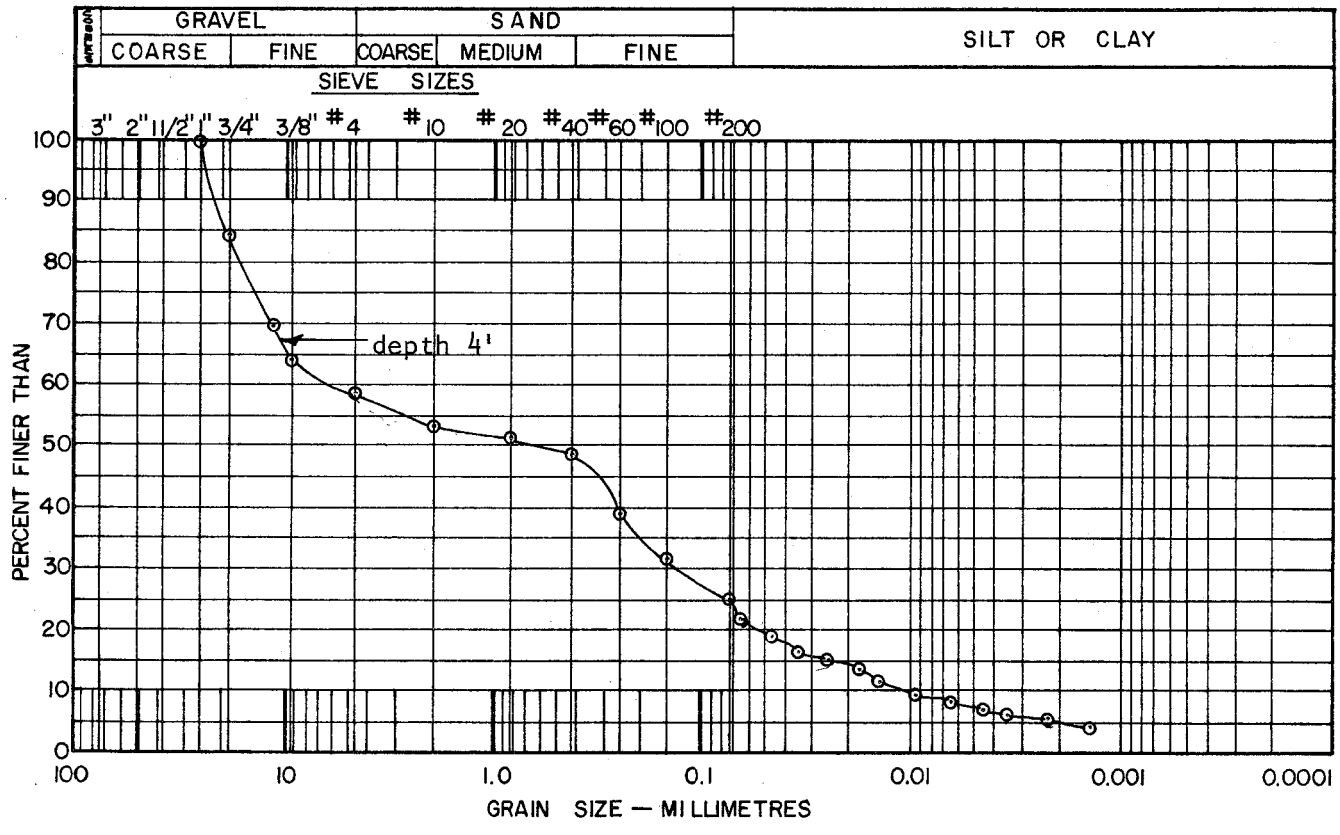
T-115-12



0'	(Pt)	PEAT - fibrous, stratified ice
1.0'		
2.0'		ICE
	(GW)	GRAVEL - some sand, little silt, trace clay, stratified ice
8.0'		
	(ML)	SILT - little clay, some sand
13.0'		
	(SP)	SAND - trace of silt, fine grained
30.0'		

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-12

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

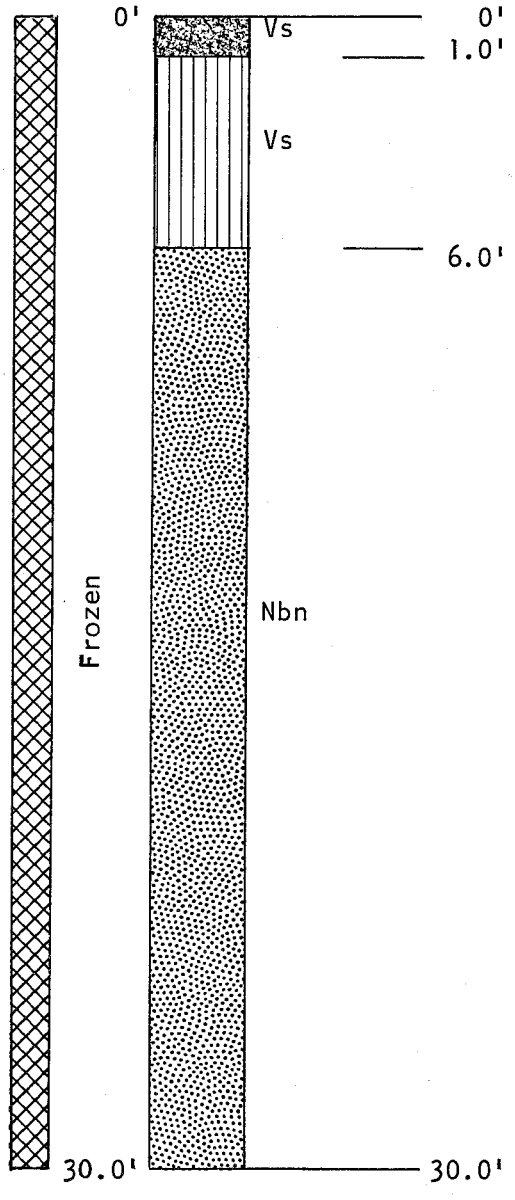
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-13

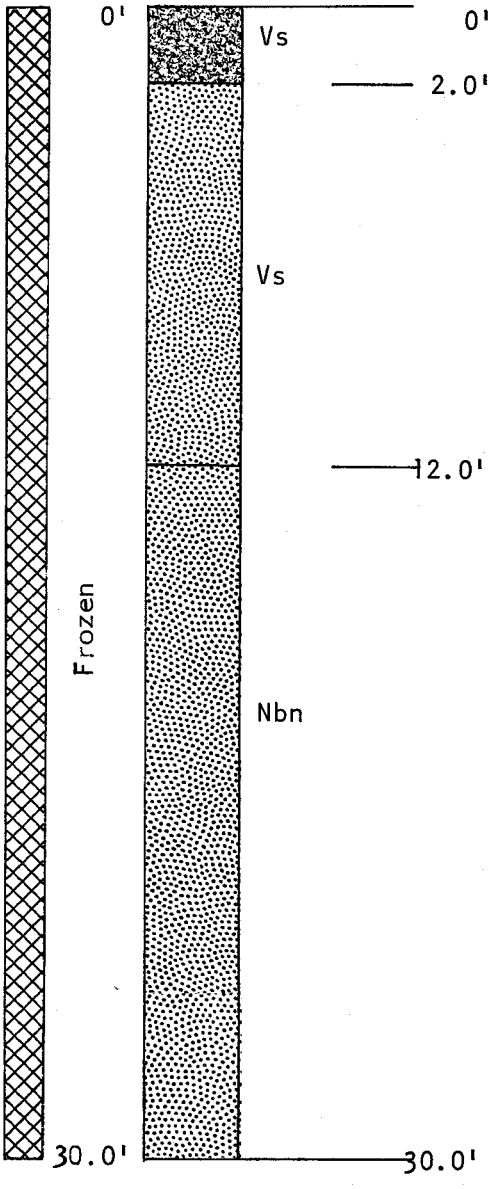


0'			
	Vs	0' – 1.0'	(Pt) PEAT - fibrous
	Vs	1.0' – 6.0'	(ML) SILT - some clay, some organics, trace gravel
	Nbn	6.0' – 30.0'	(SM) SAND - little silt, trace gravel
30.0'			

TEST HOLE LOGS

SOURCE No. T-115

T-115-14



0' (Pt) PEAT - fibrous, stratified ice

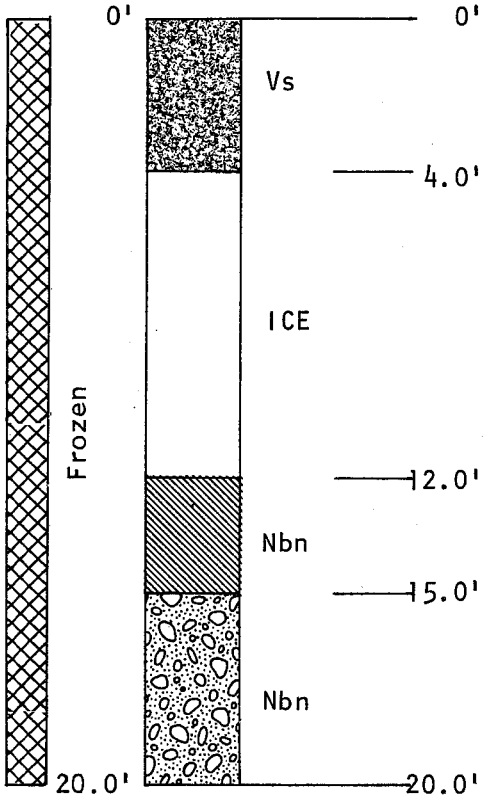
Vs (SP) SAND - trace gravel, stratified ice

Nbn (SW) SAND - some gravel, trace clay

TEST HOLE LOGS

SOURCE No. T-115

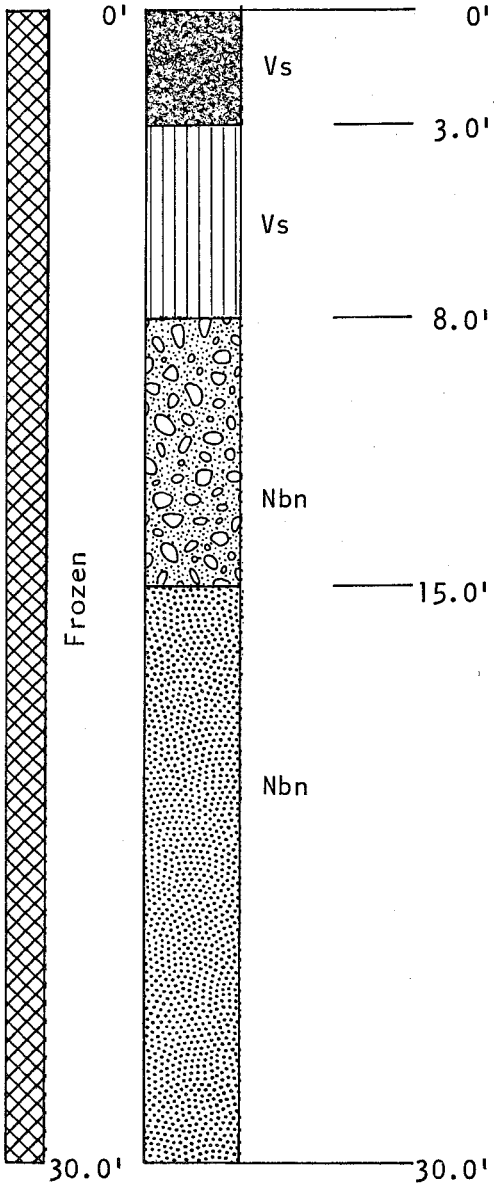
T-115-15



TEST HOLE LOGS

SOURCE No. T-115

T-115-16



(Pt) PEAT - fibrous

(ML) SILT - little sand, trace gravel, stratified ice

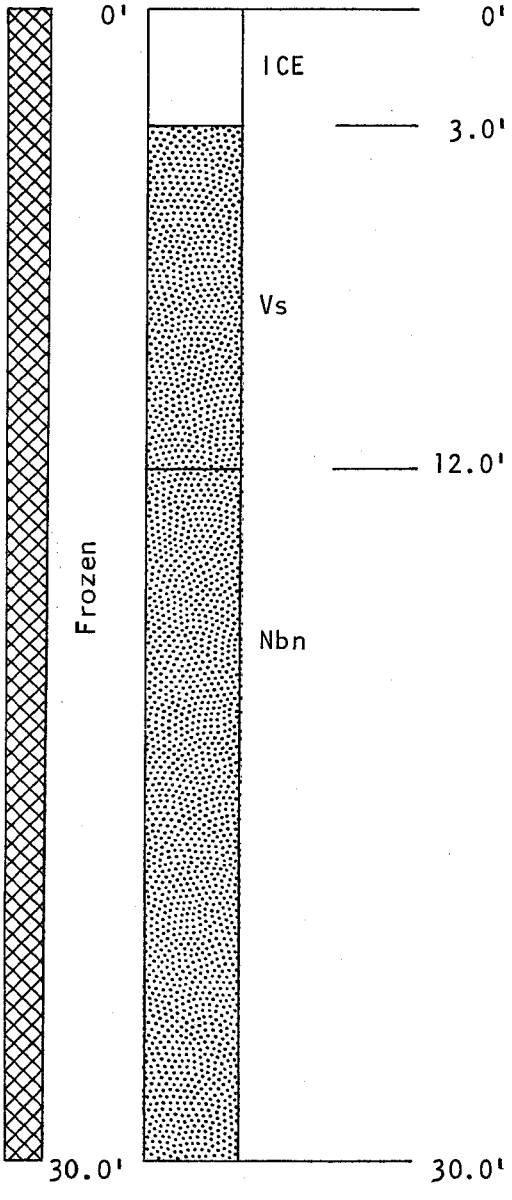
(GM) GRAVEL - little sand, some silt

(SP) SAND - trace of silt, fine grained

TEST HOLE LOGS

SOURCE No. T-115

T-115-17



ICE - and peat

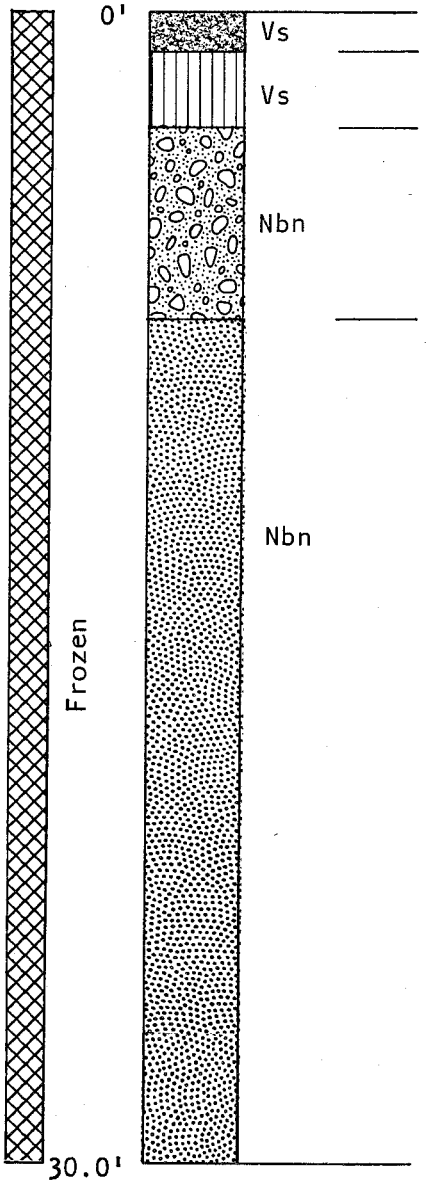
(SM) SAND - some silt, some clay, trace gravel, stratified ice

(SP) SAND - trace silt, fine grained

TEST HOLE LOGS

SOURCE No. T-115

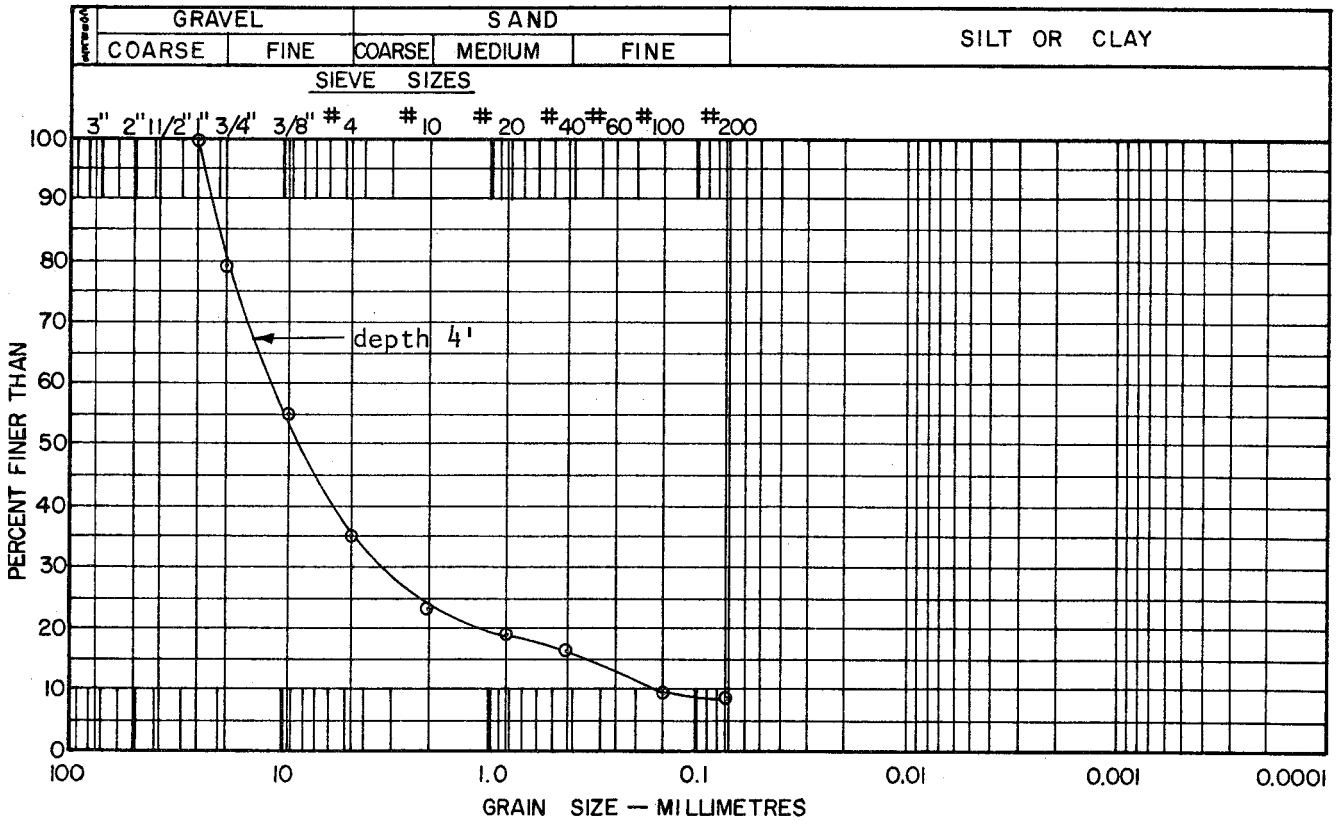
T-115-18



0'			
	Vs	(Pt)	PEAT - fibrous
1.0'			
	Vs	(OL)	SILT - trace organic, some clay
3.0'			
	Nbn	(GP)	GRAVEL - some sand, trace silt, poorly graded
8.0'			
	Nbn	(SP)	SAND - fine grained
30.0'			

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-18

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

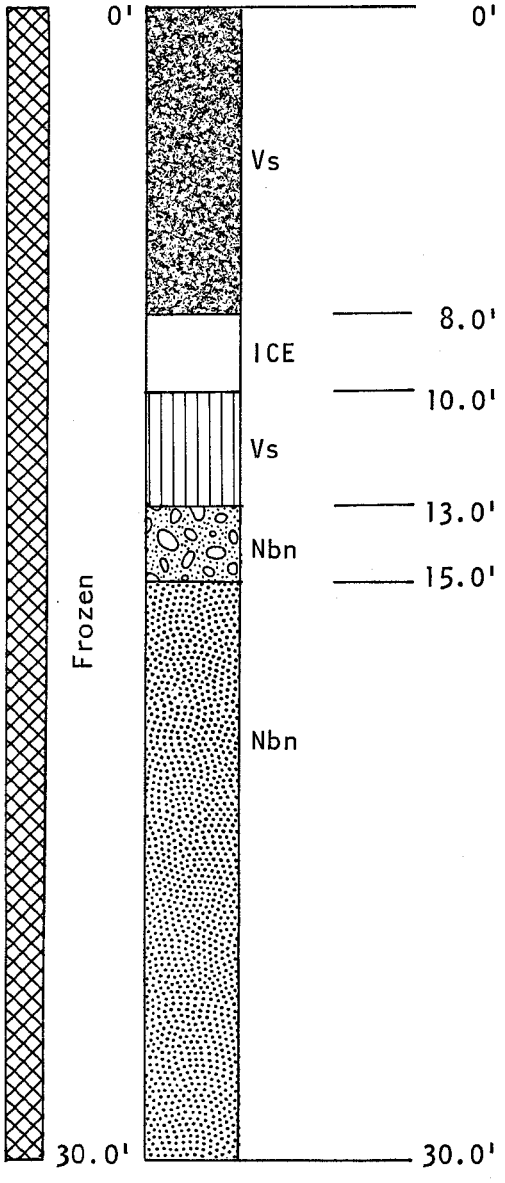
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-19



(Pt) PEAT - fibrous, stratified ice

ICE - with soil inclusions

(OL) SILT - organic, stratified ice

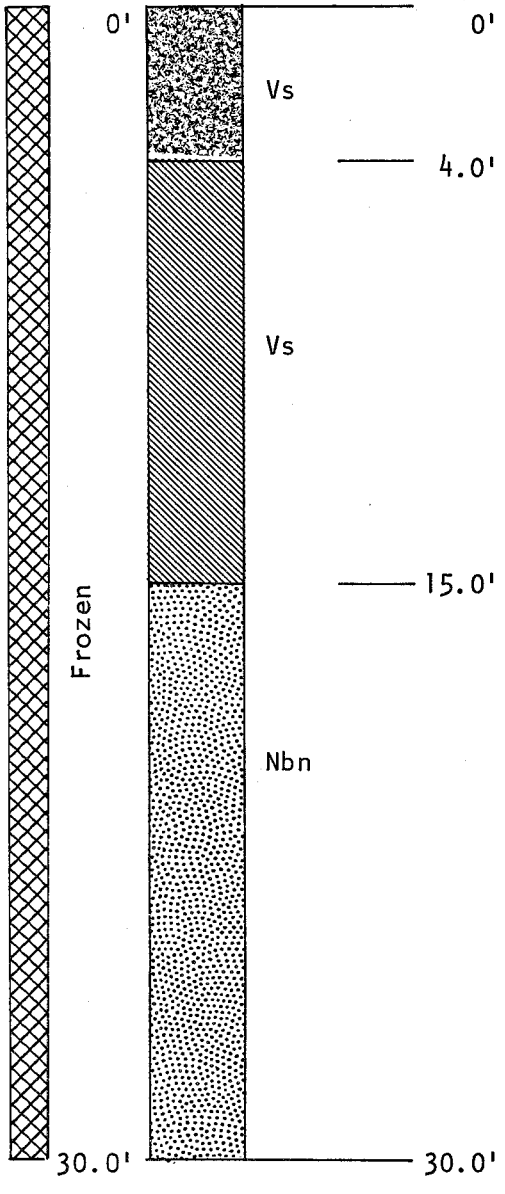
(GW) GRAVEL - some sand

(SP) SAND - trace silt, fine grained

TEST HOLE LOGS

SOURCE No. T-115

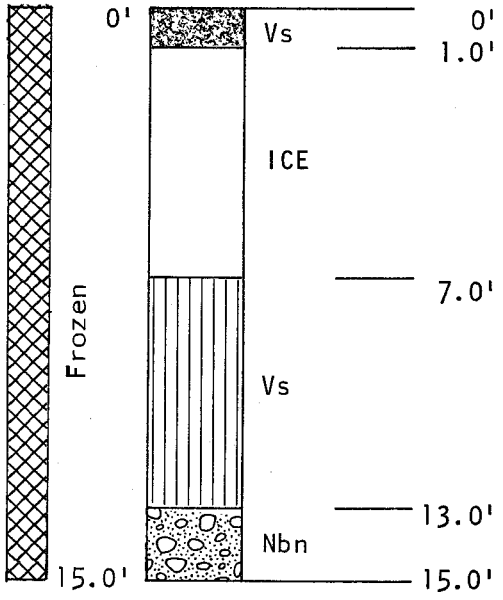
T-115-20



Vs	(Pt)	PEAT - fibrous, stratified ice
Vs	(CL)	CLAY - some silt, little sand, stratified ice
Nbn	(SP)	SAND - trace silt, fine grained

TEST HOLE LOGS
SOURCE No. T-115

T-115-21

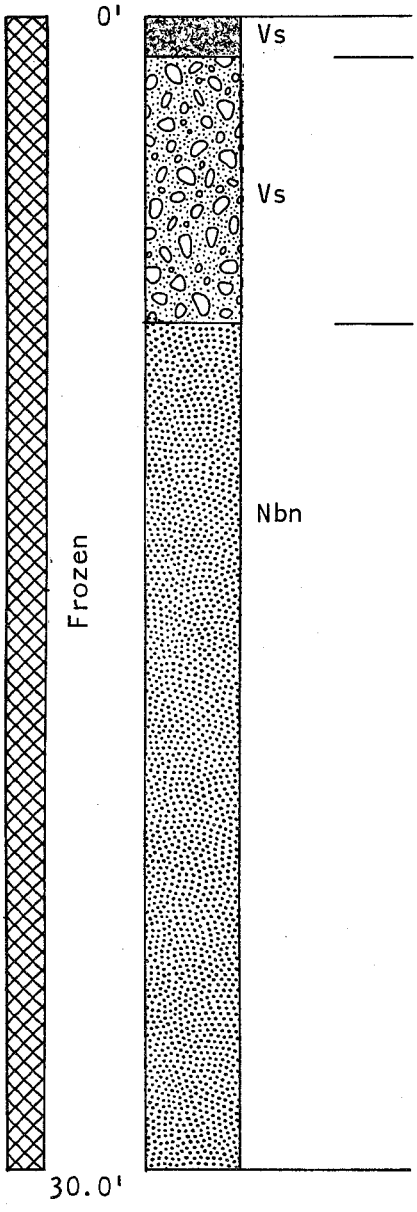


0' – 1.0'	(Pt)	PEAT - fibrous
		ICE -
7.0' – 13.0'	(OL)	SILT - some organic
13.0' – 15.0'	(GP)	GRAVEL - some sand, trace cobbles

TEST HOLE LOGS

SOURCE No. T-115

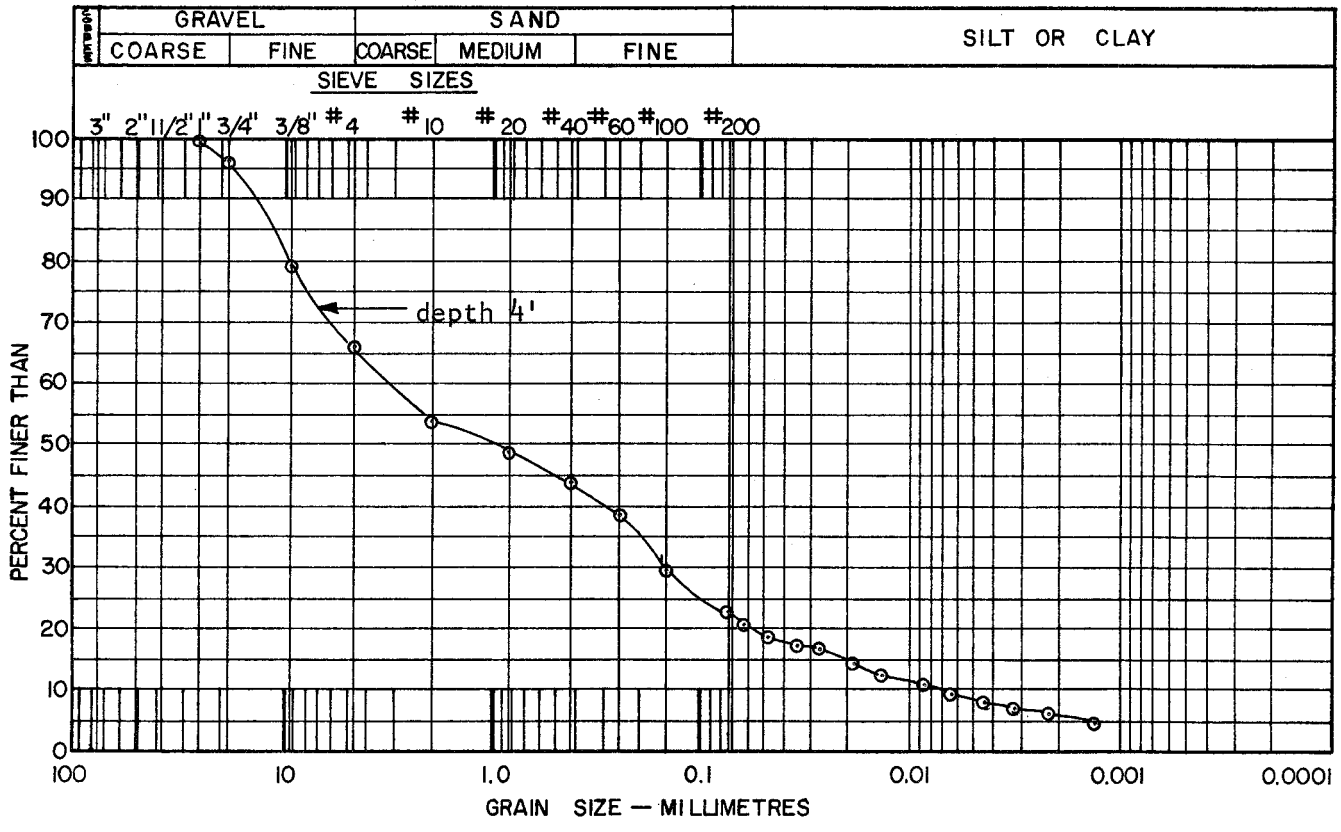
T-115-22



0'			
	Vs	(Pt)	PEAT - fibrous
1.0'			
	Vs	(GW)	GRAVEL - some sand, little silt, trace clay
8.0'			
	Nbn	(SM)	SAND - some silt
30.0'			

LABORATORY
TEST DATA
TEST HOLE-SOURCE No. T-115-22

GRAIN SIZE DISTRIBUTION



MOISTURE CONTENT

ORGANIC CONTENT

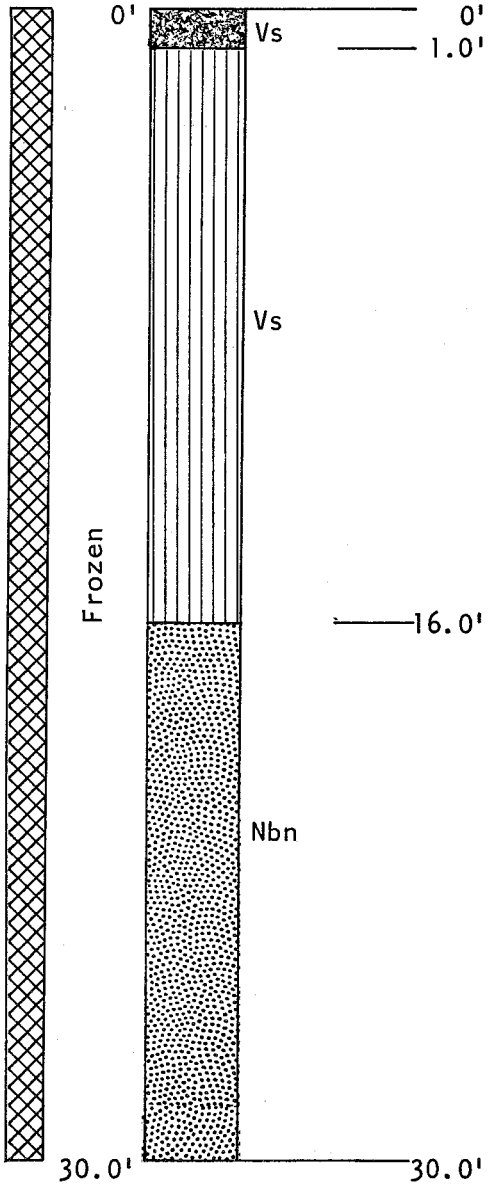
HARDNESS TEST

PETROGRAPHIC ANALYSIS

TEST HOLE LOGS

SOURCE No. T-115

T-115-23



(Pt) PEAT - fibrous, ice

(ML) SILT - little sand, trace clay, stratified ice

(SM) SAND - some silt, fine grained, well bonded ice