GRANULAR RESOURCE INVENTORY

SOUTHERN MACKENZIE VALLEY

TROUT LAKE, 95 A

GEOLOGICAL SURVEY OF CANADA

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DEPARTMENT OF ENERGY, MINES AND RESOURCES

GRANULAR RESOURCE INVENTORY - SOUTHERN MACKENZIE VALLEY TROUT LAKE (95A) (1:125,000)

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100

Table of Contents

SUMMARY

Coarse natural granular material and competent, crushable bedrock are limited in the Trout Lake map-area. Unconsolidated deposits of glaciofluvial origin contain most of the available sand and gravel. Secondary sources of good natural granular material include glaciolacustrine, alluvial and morainal deposits. No competent bedrock is available for crushing.

Glaciofluvial outwash plain, hummocky, ridge, and esker deposits are relatively small in surface area, but are well drained, have little organic cover, and have a fairly high percentage of coarse material.

Glaciolacustrine, alluvial, and morainal deposits contain a higher percentage of fine material, and are often poorly drained. They also have higher ground ice content and more organic cover. At the surface, large, well drained moraine ridges () consist of silty till. Drilling might show gravel and sand at depth within the ridges.

Bedrock is at the surface only on the southwestern side of Trout Lake. The shale and sandstone of this formation are too soft and too poorly exposed to provide competent, crushable bedrock.

Sources for granular material are rarest in the northern half of the map-sheet and coarse material would have to be transported some distance if needed for construction projects in this portion of the map-area.

INTRODUCTION

Granular material for construction purposes can be obtained from unconsolidated deposits or competent bedrock. This report will discuss the distribution and physical characteristics of these sources of granular material and will also present an estimate of the quantity of material available in unconsolidated deposits.

Unconsolidated deposits resulting from various geologic processes, i.e. glacier activity, river deposition, wind action, and mass wasting, are a source of natural granular material of gravel (> 2 mm), sand (1/16-2 mm), silt (1/16-1/256 mm), and clay (< 1/256 mm) sizes.

Good natural granular material for construction uses is generally larger than silt size (1/16 mm)[1]. In the southern Mackenzie Valley good granular material comes primarily from deposits of glaciofluvial and glaciolacustrine origin, and secondarily from morainal, eolian, alluvial, and colluvial deposits.

Bedrock that can be crushed by mechanical means can also supply granular material. Competent bedrock suitable for crushing includes limestone, dolomite, sandstone, and certain igneous and metamorphic rock types. Other less resistant rock types, i.e. shale, can be used for fill material but will not be included here as a bedrock source of granular material. In the southern Mackenzie

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[1] Silt and clay size material < 1/16 mm can be used for fill. This material is unlimited in the unconsolidated deposits of this map-sheet and will not be included in the numerical estimate of the quantity of granular material available.

Valley limestone and dolomite are the best sources of rippable bedrock.

Published and unpublished Geological Survey of Canada maps and reports, personal communication with officers of the Geological Survey, and field investigation have provided the basic data for this report. Supplementary information on distribution, thicknesses, and textures of unconsolidated deposits was obtained from unpublished oil and pipeline company shot hole and drilling records (see sources of information, Appendix A).

A Geological Survey surficial geology map at a scale of 1:125,000 (Rutter, N.W., Minning G.V., and Netterville, J.A., 1972) provided data on location and areal extent of unconsolidated deposits containing good granular material. This map is indexed as GSC Open File 93 and may be viewed at the Geological Survey of Canada offices in Ottawa, Calgary and Vancouver. Copies may be obtained at a nominal cost from Riley's DataShare International, 631 - 8 Avenue South West, Calgary, Alberta.

Quantities of natural granular material in unconsolidated deposits have been computed using data on areal extent and thicknesses obtained from the surficial geology map, drilling results, and field observations. Variables such as ground ice and height of water table were considered when deriving final volumes of material available in each deposit[2]. The tabular summary at the end of this report contains detailed volumetric data.

Information on bedrock that can supply granular material comes mainly

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[2] The area of each deposit was measured on the surficial geology map with a planimeter. The average thickness of the deposit was multiplied by the area to get the total volume of the deposit. Variables, i.e. water table, type of deposit, were assessed to obtain the final percentage of the total volume that is listed in the table as material available for exploitation.

from Geological Survey of Canada Paper 58-11. Map 28-1958 which accompanies this paper, has been used as a base for indicating competent bedrock that is available at or near the surface.

GENERAL GEOLOGY AND PHYSIOGRAPHY

The Trout Lake map-area falls mainly in the Alberta Plateau, and partially in the Great Slave Plain (northern edge) and Ft. Nelson Lowland (southern edge) (see location map, Figure 1).

Bedrock geology was mapped by the Geological Survey on Operation Mackenzie in 1957 (Douglas, 1959). A reconnaissance surficial geology investigation was undertaken by B. G. Craig as part of this operation (Douglas, 1959; Craig, 1965). A detailed surficial geology map based on airphoto interpretation and field investigations was compiled by the Geological Survey in 1971 (Rutter, Minning, and Netterville, 1972).

Bedrock formations[3] are basically Cretaceous shales with minor sandstones.

These formations which underlie most of the area and outcrop on the southwestern edge of Trout Lake are poor sources of granular material.

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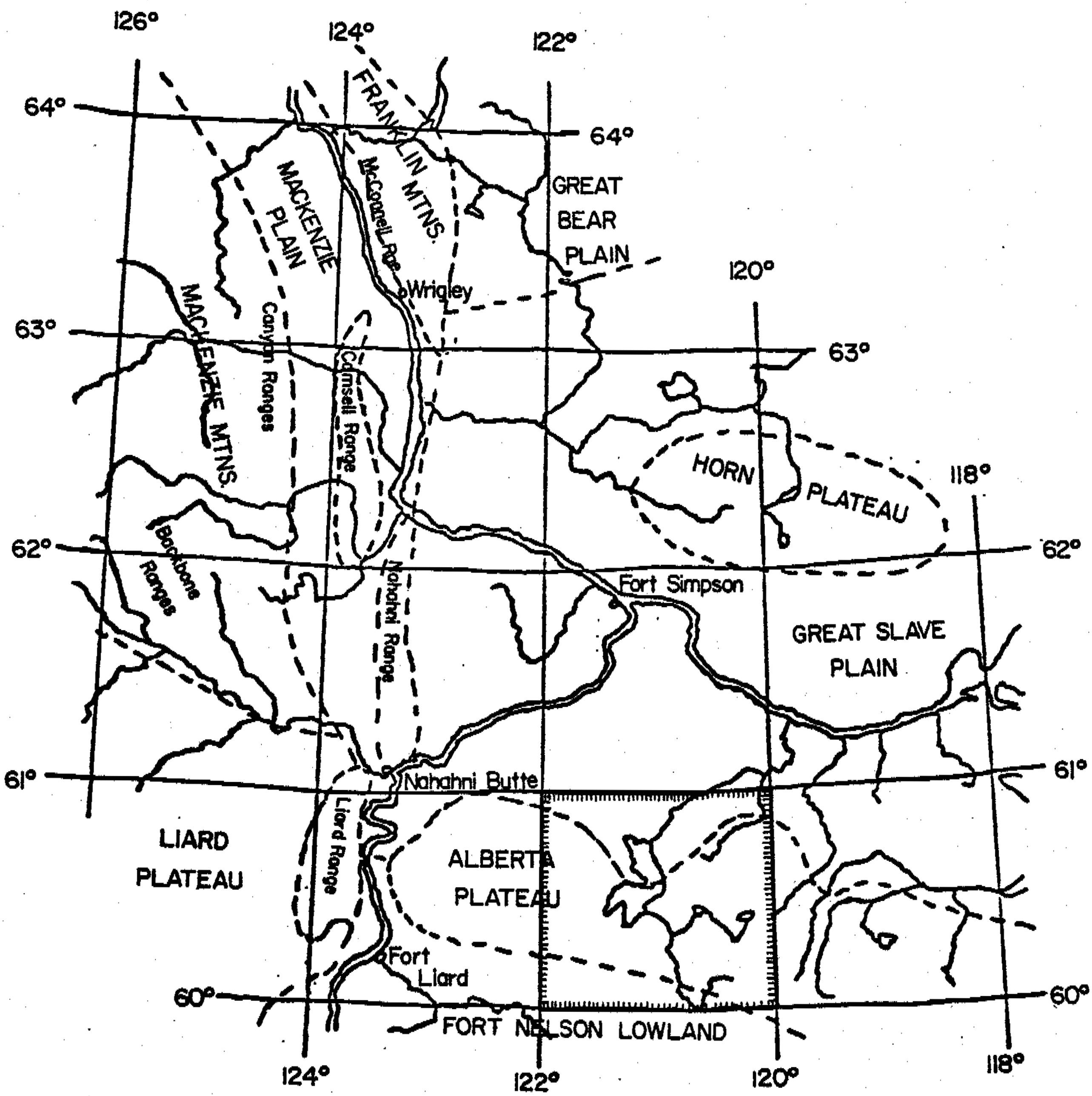
[3] A formation is a bed (of rocks) or assemblage of beds with well-marked upper and lower boundaries that can be traced and mapped over a considerable tract of country (Holmes, 1965).



PHYSIOGRAPHIC REGIONS – TROUT LAKE, 95A

miles 50 Scale

Figure I

after Bostock 1969

Morainal deposits mantle the bedrock with shot hole records showing them to be at least 50 feet thick in most places[4]. Where this ground moraine covers the nearly flat lying Cretaceous shales (the only area with much local relief is southwest of Trout Lake) there is often poor drainage and thick organic deposits. In addition to the ground moraine cover, glacier activity has produced minor glaciofluvial channel, esker, and glaciolacustrine beach deposits which rise above the moraine plain. Rivers and creeks have reworked unconsolidated material into alluvial plain and terrace deposits. All of these unconsolidated deposits contain some coarse natural granular material.

GEOLOGIC DESCRIPTION OF EXPLOITABLE MAP UNITS

Unconsolidated deposits and bedrock that can supply granular material appear on Figures 2 and 3 respectively.

Figure 2 is adapted from a Geological Survey of Canada surficial geology map. Unconsolidated deposits with good natural granular material are labelled with the appropriate map-unit name and assigned a pattern designation (see Figure 2, 2b). Pattern designations are based on geologic origin and texture of material in the deposit. Where map-unit names are used without pattern designations, the deposit either consists almost entirely of material less than 1/16 mm or has organic material and high water table present throughout 50% of its surface area.

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[4]There might be > 50 feet of till over bedrock, but shot holes end at 50 feet even if bedrock is not encountered.

Figure 3 is a Geological Survey of Canada bedrock geology map. Bedrock at or near the surface is indicated by an x. Bedrock formations preceded by an asterisk (*) in the legend (see legend, Fig. 3) could be crushed to obtain granular material.

Unconsolidated Deposits

Glacial Deposits

Glaciofluvial deposits contain high quality granular material of gravel and sand size. Glasiolacustrine beach deposits consist mainly of coarse sand. Morainal deposits are generally fine material, but ridges may contain some sand and gravel.

Glaciofluvial Deposits
(Gp, Gpc, Gh, Gr, Ghr, Gt, eskers)

Small glaciofluvial deposits scattered throughout the area consist of sand and gravel. They have been indicated by a dot and circle pattern or an esker symbol on the natural granular materials map (see Figure 2).

The capital G in the unit mapped indicates the glaciofluvial origin of the deposit and the lower case prefix denotes the principal types of material, e.g. silt (si), sand (s), and gravel and sand (g). It should be noted that if two prefixes are used, the first refers to the most abundant constituent (see legend for surficial geology maps, Figure 2b).

Topographic expression of the unit is indicated by the suffix attached, e.g. terrace (t), ridge (r), hummocky (h), plain (p). Symbols like esker (≚)

also show surface form. Glaciofluvial units vary from flat and gently sloping (Gt, Gp) to hummocky and ridged (Gh, Gr, Ghr, eskers). Thicknesses of glaciofluvial deposits vary from 10 feet for small eskers to 50 feet for larger eskers and hummocky or plain deposits. Widths of esker ridges vary from 10 to 150 feet.

Glaciolacustrine Deposits
(Lpbx, $\frac{\text{Lpv}}{\text{tm}}$)

Only a few glaciolacustrine deposits are found adjacent to Trout Lake. The capital L in each map-unit indicates its glaciolacustrine origin and the lower case prefixes and suffixes give textural and morphologic information respectively.

Glaciolacustrine plain veneer deposits ($\frac{\text{Lpv}}{\text{tm}}$) are generally flat or gently sloping and beach ridges (Lpbx) are from 5 to 10 feet high.

The glaciolacustrine beaches along Trout Lake consist of coarse sand and are about 10 feet thick.

Morainal Deposits
(Mm, Mr, Mp, Mpre, )

Morainal deposits are shown by a capital M with appropriate textural and morphologic modifiers. The deposits which have been assigned a broken line pattern on the granular materials map contain some coarse material, but the percentage is low (1% - 2%). Also some morainal deposits (Mm, Mr, Mpm, Mmr) without pattern designation consist of well-drained, fine-grained till which could be used for fill and might contain coarser material below the surface[5].

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[5]Some gravel and sand appear in shot hole records for Mm, Mr, Mp areas south and southeast of Trout Lake. These areas of coarser material are not represented by surface features like individual moraine ridges or eskers.

Large moraine ridges (•—•) have the best potential for providing coarse material. These ridges range from 10 to 50 feet in height and from 50 to 700 feet in width. They are always well drained with little organic cover. Drilling might show them to have gravel at depth even though fine grained till appears at the surface. Estimates of available coarse material are based on 5% of the total volume of each ridge.

<u>Alluvial Deposits</u>
(Ap)

Alluvial deposits are composed of sediments deposited by rivers and streams. Only those with significant coarse material have been assigned a pattern designation on the accompanying natural granular materials map (see Figure 2). All alluvial deposits are mapped as A with textural and morphologic modifiers.

Alluvial deposits form plains with little relief along present river and stream channels. Coarse material in the deposits is generally well washed and well sorted. Finer grained sands and silts often have thick organic cover. Thicknesses of alluvial plain deposits have been calculated at 9 feet.

<u>Bedrock</u>

Cretaceous shale formations with some sandstone members underlie the thick glacial drift throughout the Trout Lake area. Only one of these formations is exposed on the southern edge of Trout Lake but is too soft to be considered as a good bedrock source for construction materials.

GEOGRAPHIC DISTRIBUTION OF EXPLOITABLE MATERIALS

All natural granular deposits have been assigned an identification number, e.g. A-1, for use in assembling data. Roman numerals I to V and geographic names designate groups of natural granular deposits discussed in this report. The lowest Roman numeral applies to the best area of natural granular deposits (Fig. 2).

Further details on volumetric estimates of natural granular material and types of bedrock available in each Roman numeral area are found in the tabular summary of this report.

I. Muskeg River Glaciofluvial Deposits

Several small glaciofluvial gravel and sand hummocky, ridge, and plain deposits are located in this area. They are generally well drained and have little organic cover. Except for one veneer deposit (approximately 9 feet thick) thicknesses of 50 feet have been used in volume calculations. Outwash deposits with till in addition to glaciofluvial material, i.e., tMp + sgGr, contain approximately 20% coarse granular material.

Good quality sand and gravel is also present in eskers of glaciofluvial origin. Four of the eskers are small with volumes based on heights of 10 feet and widths of 20 feet, and one is larger with a height of 50 and a width of 100 feet. Available material in each esker is estimated at 80% of the total volume.

Granular material might also be obtained from one moraine ridge, but the percentage of estimated coarse material in this ridge is low (5%). No competent bedrock is available as a source for granular material.

II. Island River Ridge Area

Granular material could be obtained from eskers, glaciofluvial plain and hummocky deposits, and moraine ridges. Esker ridges are composed of sand and gravel and vary in height from 10 to 30 feet and in width from 10 to 50 feet. Approximately 80% of the material in these ridges is coarse granular material. Glaciofluvial plain, hummocky, and ridge deposits are estimated to be 50 feet thick and to contain 40% to 70% coarse material.

Moraine ridges[6] are composed of sandy till and have a low percentage of coarse material. The ridges are well drained, so the fine material might be usable as fill. Moraine ridges are approximately 10 feet high and 100 feet wide and might contain gravel at depth. No competent bedrock is exposed.

III. Trout Lake Moraine Area

There are large areas of till (usually tMr, TMm) which are well drained and contain some gravel[7]. Only one of these areas is considered to contain enough coarse material to be indicated by pattern designation on the granular materials map.

Coarse sand is available in glaciolacustrine beach deposits along Trout Lake. However, deposits along the eastern shoreline are adjacent to the

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[6] Some of these moraine ridges have the same surface expression on air photographs as adjacent eskers. Ground checking was necessary to determine moraine ridges from esker ridges.

[7] Shot holes indicate sand and gravel is present in some of these moraine areas even though it did not appear at the surface.

permanent settlement of the Trout Lake Indians and should probably be left undisturbed. Several small eskers and two minor alluvial plain deposits could also supply sand and gravel.

One Cretaceous shale and sandstone unit is reported to outcrop on the southwestern end of Trout Lake. The poorly exposed formation is too soft to be considered as a source for granular material.

IV. Miscellaneous Deposits

Small, scattered alluvial, glaciofluvial and morainal deposits occur throughout this large area. Esker ridges are generally small, 10 feet high and 20 to 25 feet wide, but contain 80% usable material. Glaciofluvial hummocky and plain deposits are 25 to 50 feet thick. Alluvial deposits along the Trout River are fairly thick, ranging from 25 to 80 feet. Percentages of available material in these deposits vary from 10% to 50%. Two large moraine ridges also may contain some coarse material (5%) in addition to till. No competent bedrock is available in this area.

V. Meltwater Channel Area

Two glaciofluvial plain deposits 50 feet thick and one thin alluvial plain deposit (8 feet) are present here. No competent bedrock is exposed.

TABULAR SUMMARY

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	I. Muskeg River Glaciofluvial Deposits				
A- 6	glaciofluvial gravel and sand in plain	50	9.84	518.50	207.40
A- 7	and hummocky deposits, well drained	50	1.60	84.25	58.97
A- 8		50	1.08	56.87	39.81
A-25	glaciofluvial sands and minor gravel	9	1.47	13.74	3.44
A-27	with high percentage of till, some	50	3.30	174.25	34.85
A-28	organic cover	50	0.46	24.48	3.67
A-29		50	1.40	73.78	11.06
A-34	esker ridges of sand and gravel	10		.184	.147
A-35		10		.110	.088
A-36		10		.018	.014
A-33		10		.129	.103
A-39		50		3.260	2.600
A-32	moraine ridge, mostly till	10		.484	.024
	Bedrock - None				
				I. TOTAL	362.17

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	II. Island River Ridge Area				
A-43	moraine ridges composed of till,	10		0.448	0.022
A-44	well drained	10		1.250	0.062
A-47		10		0.448	0.022
A-48		10		0.987	0.049
A-45	esker ridges of sand and gravel	30		0.264	0.211
A-46		10		0.055	0.044
A-46A		10		0.055	0.044
A-48A		10		0.036	0.029
A-49		10		0.092	0.074
A- 9	glaciofluvial gravel in ridge,	50	3.26	127.12	50.62
A-10	plain, and hummocky deposits	50	0.50	26.69	10.68
A-11		50	0.19	10.20	4.08
A-12		50	0.27	14.28	10.00

Bedrock - None

II. TOTAL 76.93

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	III. Trout Lake Moraine Area				
A-19	alluvial gravel, sand, silt	9	1.20	11.22	1.12
A-20		9	0.97	9.03	0.90
A- 1	sandy, lacustrine beaches	5	0.93	5.78	2.31
A- 2		10	0.53	4.71	3.30
A- 3		10	0.58	5.43	3.80
A-37	eskers of sand and gravel	10		0.048	0.038
A-40		20		0.160	0.128
A-23	till and glaciofluvial gravel	50	0.50	26.69	8.00
A-52	gravelly till plain	20	17.40	377.28	3.77
	Bedrock - None				
				III. TOTAL	23.36

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	IV. Miscellaneous Deposits				
A-13	glaciofluvial gravel and sand in	50	0.58	30.77	21.54
A-21	plain and hummocky deposits	50	0.42	22.61	9.04
A-22		25	0.58	14.37	5.74
A-24		50	0.54	28.73	11.49
A-38	eskers of gravel and sand	10		0.061	0.049
A-41		10		0.085	0.068
A-42		10		0.136	0.109
A-50		10		0.110	0.088
A-51		10		0.036	0.029
A-14	alluvial gravel, sand, silt	25	2.02	50.16	25.08
A-15		40	0.77	31.33	6.27
A-16		40	0.31	12.48	2.50
A-17		80	0.50	4.71	0.47
A-30	moraine ridges, mostly till	30		92.25	4.59
A-31		10		0.538	0.027
	Bedrock - None				
				IV. TOTAL	87.09

	Description & Material	Thickness (ft.)	Area (sq. mi.)	Volumes Total	(Million yds.^{3}) Available
	V. Meltwater Channel Area				
A- 4	glaciofluvial silt and gravel	50	1.12	59.50	23.80
A- 5		50	1.28	67.66	27.06
A-18	alluvial gravel and silt	8	4.62	43.05	4.31
	Bedrock - None				
				V. TOTAL	55.17

Total granular resources for 95A 603.72 million yds.^{3}

Appendix A

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