

Granular Resources Inventory  
- Mackenzie Valley -  
Fort Macpherson - 106 M



D002985



GRANULAR RESOURCE INVENTORY - MACKENZIE

FORT MCPHERSON NTS 106M

SCALE (1:125,000)

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Northern Affairs

## SUMMARY

Unconsolidated granular material in the Fort McPherson area occurs as small, widely scattered deposits. Glaciofluvial and fluvial deposits are found west of the Peel River; eskers and morainal ridges make up the deposits east of it. Shale bedrock in the vicinity of the settlement of Fort McPherson is near the surface, rippable and presently being used for construction of the Dempster Highway. Access to the coherent bedrock of the Richardson Mountains is difficult.

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## INTRODUCTION

This report attempts to assess the quantity of granular material available for construction from both unconsolidated and bedrock sources. Glaciofluvial and fluvial materials are considered first rate sources of sand and gravel. Lacustrine deposits are of variable quality whereas eolian material is of limited use because of its fine texture. Generally, moraines have been considered only where they are known to be hummocky and to contain some coarse granular material. Terminal moraines, for the purpose of this report, are considered to be sources of granular material whereas ground moraines are not.

Bedrock has been considered only if it is coherent and resistant to weathering, i.e., limestones, dolomites, sandstones and most rocks of Precambrian age. Other rock types, such as shales could be used as fill for road and other construction uses.

The information in this report and on the accompanying map has been compiled largely from published and unpublished manuscripts and by personal communication with officers of the Geological Survey of Canada. Supplementary data, mainly on depths, thicknesses and, in some cases, on texture of deposits have been obtained from confidential reports of other government departments and industry. (See Sources of Information). Field checking was carried out during the summer of 1972.

The basic document used in this compilation and from which all areal data were obtained is a surficial geology map at a scale of 1:125,000 (Hughes, 1972). It is indexed as GSC Open File Number 97 and may be viewed at Geological Survey of Canada offices in Ottawa, Calgary and Vancouver; ozalid copies may be obtained at nominal cost. All major unconsolidated granular deposits of granular material are represented at this scale.

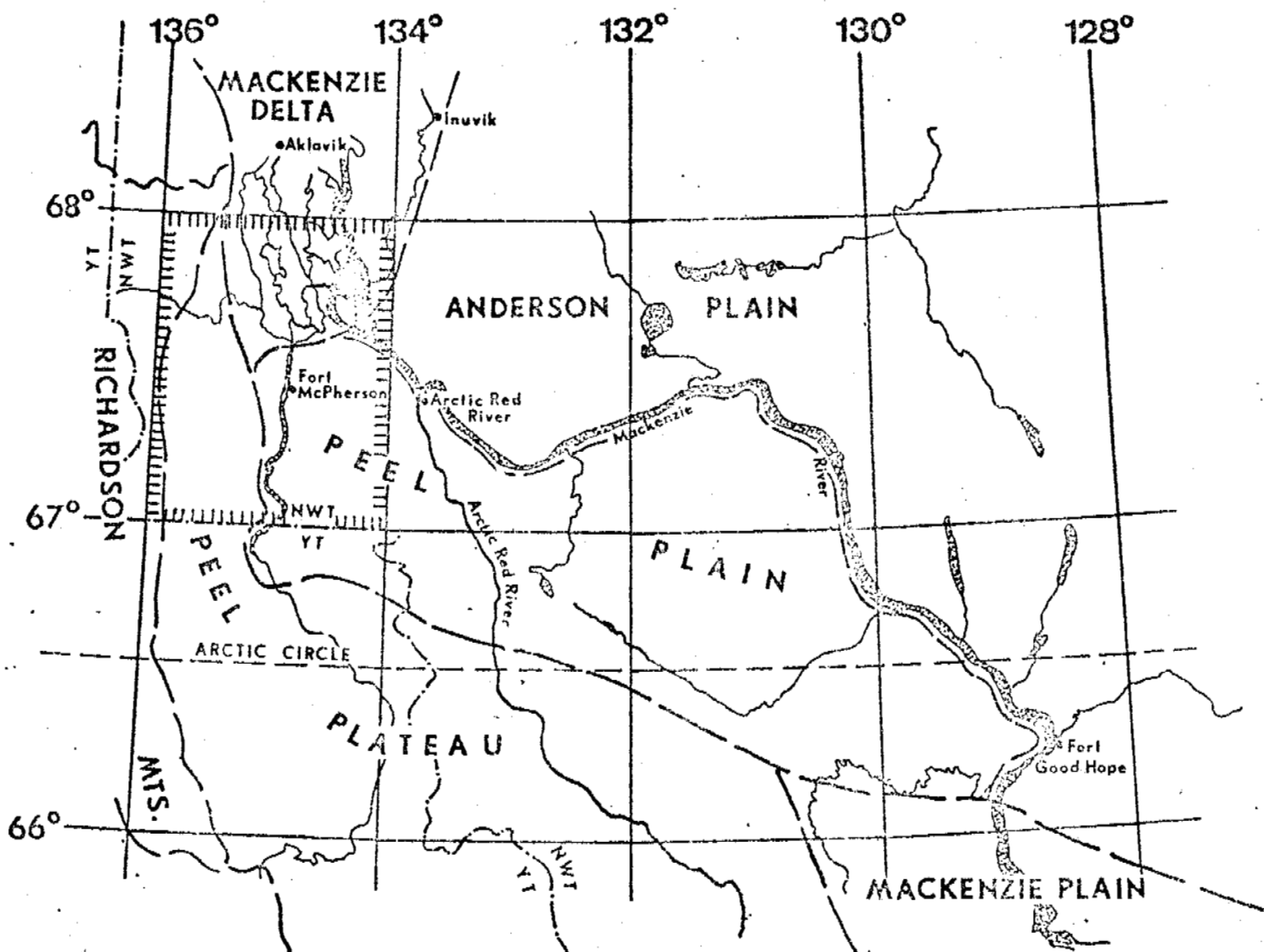
The map for granular material has been derived from the basic surficial geology map in conjunction with field observations on thickness, texture, ice content, drainage, and the variability of the map units.

Additional information was gathered from seismic shot hole records and samples, and from other drill hole logs.

Areal extent of deposits was estimated by planimeter. Average thickness for each deposit was estimated from the data mentioned above and adjusted according to several variables such as drainage, height above water table, and amount of ground ice.. From this, a volume of granular material was estimated. All esimated volumes of material appear in a tabular summary at the end of the paper.

In addition to the estimates of unconsolidated granular material, a derivative bedrock geology map has been prepared as an overlay sheet. This is intended to indicate where bedrock, suitable for crushing or fill, could be extracted if unconsolidated material is not available.

For purposes of description, areas of granular material are outlined on the surficial geology map and are numbered to correspond to a tabular summary of materials. Areas which appear to have little material with respect to anticipated demand or areas which require more detailed work are discussed in the report.



## FORT McPHERSON

PHYSIOGRAPHIC REGIONS

0 M.I. 80

after BOSTOCK 1967

## GENERAL GEOLOGY AND PHYSIOGRAPHY

Four physiographic regions are represented in the Fort McPherson map area: Peel Plain in the southeast, Mackenzie Delta in the northeast; Peel Plateau in the west; and Richardson Mountains in the extreme western portion of the map area (Bostock, 1967). Unconsolidated granular material is scattered sparsely in all physiographic regions except on the Mackenzie Delta which consists exclusively of silts and clays (Hughes, 1972).

Bedrock, except in the Richardson Mountains, is covered by surficial deposits which vary in thickness up to 50'. The Richardson Mountains rise up to 4000' in elevation with surficial deposits being found only in the valleys. Shales, sandstones and conglomerates underlie most of the Peel Plain and Plateau (Douglas, R.J.W. and MacLean, B., 1963). A ground moraine covered this bedrock during the advance of the continental glacier. During its retreat granular material was deposited in the form of morainal ridges, terraces and eskers in association with the development of glaciofluvial channels. Other granular deposits in this map area are fluvial deposits formed on the west side of the Peel River since glaciation.

### Unconsolidated Deposits

#### Glaciofluvial Deposits, sand and gravel, G

Sand and gravel occur in this map area as terrace and channel deposits, and eskers. The major terrace and channel deposits are found in glacial outwash channels. The majority of these deposits are found west of the Peel River and east of the Richardson Mountains. Minor deposits are found on the Peel Plain. Eskers are predominant on the Peel Plain but exhibit no preferred direction.

All three glaciofluvial deposits are composed of sand and gravel. They vary in thickness between 10 and 40 feet and contain approximately 80% available granular construction material.

#### Fluvial Deposits, F

Fluvial deposits produced only by fast flowing water are likely to contain granular material suitable for construction purposes. In the Fort McPherson map area such conditions are met in the Richardson Mountains and the Peel Plateau. These rivers have formed deep valleys and canyons and have carried coarse grained material from the mountains onto the Plateau where they have been deposited. The coarse material eroded from the river valleys has been deposited at the mouth of the Peel River, and its respective tributaries.

These deposits tend to be thin (10'-20'), but approximately 80% is estimated to be available as granular material.

#### Morainal Deposits, M

End moraines and morainal ridges, contain gravel material mixed with a fine matrix - a till. The resulting topography is hummocky or rolling. High ice content and the large amount of fines, limit the use of this material for construction purposes. Only 1% is considered available and useful as granular material.

#### Bedrock Geology

The bedrock geology of the Fort McPherson map area can be divided into two groups: the flat-lying bedrock underlying the Peel Plain and Plateau; the uplifted bedrock of the Richardson Mountains.

Devonian and Cretaceous shale, minor sandstone and conglomerate underlie the Peel Plain and Plateau. The shale is fine grained, fissile, has a low moisture content and is rippable which makes it a good source of construction material. The depth to bedrock varies but is usually

no greater than 20'. Shale is presently being used as construction material on the Dempster Highway between Arctic Red River and Fort McPherson.

In general the rocks of the Richardson Mountains are more coherent than rocks underlying the lowlands to the east. In age, the rocks range from Cambrian to Cretaceous with the majority of the rock being of Permian, Jurassic and Cretaceous ages. Rock types vary greatly but include quartzite, limestone, sandstone, conglomerate and shale. Many of the units have not been mapped in detail and hence are undivided on the bedrock overlay sheet. Most of the coherent rock when crushed would make excellent aggregate, but access is difficult.

## MATERIALS

The majority of the unconsolidated granular materials are situated to the west of the Peel River on the Peel Plateau and in the foothills of the Richardson Mountains. These consist of glaciofluvial terrace and channel deposits (up to 50' thick) and fluvial plain deposits (less than 20' thick).

East of the Peel River on the Peel Plain principal deposits are eskers, 10'-20' in height, composed of sand and gravel, and morainal ridges composed of glacial till.

The unconsolidated granular deposits suitable as construction materials in this map area are small and widely separated thus the use of crushed and ripped bedrock for construction material may be required. The shales between Arctic Red River and Fort McPherson are being ripped and used in the construction of the Dempster Highway. This practice as well as crushing bedrock may be continued in the construction of the Dempster Highway west of Fort McPherson.

The settlement of Fort McPherson has two sources of construction material; fluvial sand and gravel from the Peel River and shale bedrock. Both sources have their limitations and further work should be carried out to find other sources of granular construction material.

TABULAR SUMMARY

| Description and Material                                                                           | Area<br>(sq. mi.) | Estimated<br>Average<br>Thickness<br>(ft.) | Estimated Volume of<br>Granular Material<br>(yds <sup>3</sup> x 10 <sup>6</sup> ) |           |
|----------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------|-----------------------------------------------------------------------------------|-----------|
|                                                                                                    |                   |                                            | total                                                                             | available |
| Area I FORT MCPHERSON-<br>EAST                                                                     |                   |                                            |                                                                                   |           |
| a) <u>tMh</u><br>till;<br>morainal hummocky.                                                       | 4.59              | 50                                         | 237.73                                                                            | 2.35      |
| b) <u>tMm</u><br>till; morainal<br>rolling.                                                        | .20               | 50                                         | 10.16                                                                             | .10       |
| c) <u>gGc</u><br>glaciofluvial channelled;<br>gravel.                                              | .39               | 12                                         | 4.88                                                                              | 3.90      |
| d) <u>G</u><br>glaciofluvial;<br>sand and gravel.                                                  | .16               | 12                                         | 1.96                                                                              | 1.56      |
| e) <u>s, si, Glp</u><br>glaciolacustrine<br>plain; sand and silt.<br>(appendix II,<br>station 108) |                   |                                            |                                                                                   |           |
| f) Eskers;<br>sand and gravel.                                                                     | 18.0 mi.          | 10                                         | .54                                                                               | .42       |
| Area II Fort McPherson -<br>southeast                                                              |                   |                                            |                                                                                   |           |
| a) <u>tMh</u><br>till; morainal hummocky.                                                          | .71               | 50                                         | 36.65                                                                             | .36       |
| b) <u>Gr, Gh, Gp</u><br>glaciofluvial ridged,<br>hummocky, plain; sand<br>and gravel.              | .36               | 12                                         | 4.36                                                                              | 3.46      |
| c) Eskers;<br>sand and gravel.<br>(appendix II,<br>station 109)                                    | 2.60 mi.          | 10                                         | .08                                                                               | .06       |
| d) Esker;<br>sand and gravel.                                                                      | 7.00 mi.          | 10                                         | .24                                                                               | .16       |

| Description and Material                                                                                                   | Area<br>(sq. mi.) | Estimated<br>Average<br>Thickness<br>(ft.) | Estimated Volume of<br>Granular Material<br>(yds <sup>3</sup> x 10 <sup>6</sup> ) |           |
|----------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------|-----------------------------------------------------------------------------------|-----------|
|                                                                                                                            |                   |                                            | total                                                                             | available |
| Area III LOWER HUSKY<br>CHANNEL - WEST<br>SHORE                                                                            |                   |                                            |                                                                                   |           |
| a) <u>gAp</u><br>alluvial plain;<br>gravel.                                                                                | 9.40              | 8                                          | 78.21                                                                             | 39.10     |
| b) <u>gGt</u><br>glaciofluvial terraced;<br>gravel.<br>(appendix II, station 110).                                         | 1.49              | 12                                         | 18.56                                                                             | 13.80     |
| c) <u>G</u><br>glaciofluvial;<br>sand and gravel.                                                                          | .28               | 12                                         | 3.44                                                                              | 2.74      |
| Area IV FORT MCPHERSON-<br>WEST SHORE                                                                                      |                   |                                            |                                                                                   |           |
| a) <u>gAp</u><br>alluvial plain;<br>gravel.                                                                                | 4.80              | 8                                          | 39.93                                                                             | 19.96     |
| b) <u>gAtv</u><br>alluvial terraced,<br>veneer; gravel.                                                                    | 2.51              | 8                                          | 21.73                                                                             | 10.82     |
| Area V FORT MCPHERSON<br>WEST                                                                                              |                   |                                            |                                                                                   |           |
| a) <u>gGt</u><br>glaciofluvial terraced;<br>gravel.<br>(appendix II, station 93)                                           | 1.33              | 12                                         | 27.58                                                                             | 20.01     |
| Area VI BARRIER RIDGE                                                                                                      |                   |                                            |                                                                                   |           |
| a) <u>gAp</u><br>glaciofluvial plain;<br>gravel.                                                                           | 16.93             | 12                                         | 140.83                                                                            | 70.39     |
| Area VII MOUNT GOODENOUGH                                                                                                  |                   |                                            |                                                                                   |           |
| a) <u>Gcm-tMn</u> , <u>Gcm</u><br>till; glaciofluvial channelled<br>rolling; sand and gravel.<br>(appendix II, station 94) | 2.93              | 36                                         | 109.80                                                                            | 87.84     |

| Description and Material                                                | Area<br>(sq. mi.) | Estimated<br>Average<br>Thickness<br>(ft.) | Estimated Volume of<br>Granular Material<br>(yds <sup>3</sup> x 10 <sup>6</sup> ) |           |
|-------------------------------------------------------------------------|-------------------|--------------------------------------------|-----------------------------------------------------------------------------------|-----------|
|                                                                         |                   |                                            | total                                                                             | available |
| b) <u>Gf</u><br>glaciofluvial fan;<br>sand and gravel.                  | .51               | 36                                         | 19.08                                                                             | 15.20     |
| c) <u>S</u><br><u>Gt</u><br>glaciofluvial terraced;<br>sand and gravel. | .43               | 36                                         | 16.08                                                                             | 12.86     |
| d) <u>gAp</u><br>alluvial plain;<br>gravel.                             | 1.10              | 12                                         | 5.50                                                                              | 4.54      |
| e) Esker;<br>sand and gravel.                                           | 2.0 mi.           | 10                                         | .06                                                                               | .04       |

SOURCES OF INFORMATION

Bostock, H.S.

1967: Physiographic Regions of Canada; Geol. Surv. Can. Map 1254A.

Douglas, R.J.W., MacLean, B.

1963: Yukon Territory and Northwest Territories, Geol. Surv. Can.  
Map 30-1963.

Hughes, O.L.

1969: Surficial Geology of Northern Yukon Territory and Northwestern  
District of Mackenzie, Northwest Territories, Geol. Surv.  
Can. Paper 69-36.

Hughes, O.L.

1972: Manuscript of Surficial Geology of Fort McPherson 106M,  
Geol. Surv. Can. Open File 97

Norris, D.K., Price, R.A., Mountjoy, E.W.

1963: Northern Yukon Territory and Northwestern District of  
Mackenzie, Geol. Surv. Can. Map 10-1963.

Norris, D.K.

1972: Manuscript Bedrock Geology Map Fort McPherson, Geol. Surv.  
Can. (unpublished).

Prest, V.K., Grant, D.R., Rampton, V.N.

1967: Glacial map of Canada; Geol. Surv. Can. Map 1253A.

APPENDIX I, Part I

Unconsolidated Granular Materials

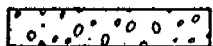
Each map sheet has a surficial geology legend (see appendix). This legend, differentiated by means of patterns, only indicates granular material classified by genetic characteristics. In some cases only part of a map unit has been patterned, indicating that only that portion is considered a suitable source for granular material.

Legend

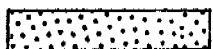
GLACIOFLUVIAL



coarse grained granular material: cobbles, pebbles, gravel; may be mixed with some coarse sand

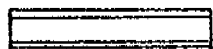


mixed or interbedded sand and gravel

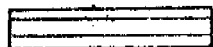


predominantly sand or sand with some fine material

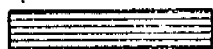
GLACIOLACUSTRINE



coarse grained granular material: cobbles, pebbles, gravel; may be mixed with some coarse sand.



mixed or interbedded sand and gravel



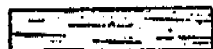
predominantly sand or sand with some fine material

FLUVIAL



only sand and gravel deposits are patterned

MORAINAL



predominantly till; unsorted matrix of silt, clay, and sand imbedded with pebbles, cobbles and boulders

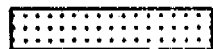
MARINE



coarse grained granular material: cobbles, pebbles, gravel; may be mixed with coarse sand



mixed or interbedded sand and gravel



predominantly sand or sand with some fine material

EOLIAN



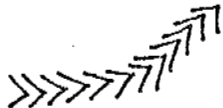
fine and medium sandy material

COLLUVIUM

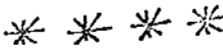


only the patterned area is coarse grained

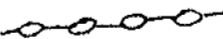
Symbols



eskers



gravel mounds



morainal ridge found within moraine

## APPENDIX I Part (ii)

## Bedrock Geology

(black line overlay)

The rock units which appear on the accompanying overlay are an engineering geological grouping according to gross lithology and age.

These units were derived from a more detailed geological map, whose units were subdivided largely on the basis of airphoto and stratigraphic interpretation. The units are identified by a two component code. The first component is upper case and designates age which is followed by a mnemonic designating gross lithology, e.g. Dls - Devonian limestone. When no lithology follows the age component, the unit is composed of many of the rock types listed below.

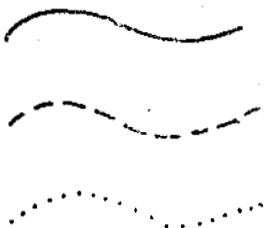
Legend

## Age

T - Tertiary  
K - Cretaceous  
JR - Jurassic  
TR - Triassic  
Pr - Permian  
C - Carboniferous  
D - Devonian  
S - Silurian  
O - Ordovician  
C - Cambrian  
P - Precambrian

## Lithology

car - carbonate  
limestone and/or dolomite  
ls - limestone  
dol - dolomite  
ss - sandstone  
sh - shale  
  
no mnemonic component  
indicates unit is composed  
of many of the above rock  
types

Symbols

Boundary of bedrock unit (approximate)

Boundary of bedrock unit inferred in  
areas of surficial cover

Limit of mapping

APPENDIX I, Part (iii)

GRANULAR RESOURCE UNITS

I GRANULAR RESOURCE AREAS (black)



granular resource area (see text for  
corresponding description)

## APPENDIX I, Part (iv)

## Surficial Geology and Landforms

| TEXTURE   | GENESIS            | MORPHOLOGY        | SLOPE (superscript)          |
|-----------|--------------------|-------------------|------------------------------|
| f fen     | O organic          | v veneer          | 1 moderate                   |
| p peat    | M morainic         | p plain           | ( $<5^{\circ}$ )             |
| c clay    | G glaciofluvial    | d drumlin         | 2 steep                      |
| si silt   | L lacustrine       | s fluted striated | ( $5^{\circ} - 15^{\circ}$ ) |
| s sand    | A alluvial         | t terrace         |                              |
| g gravel  | fluvial            | h hummocky        |                              |
| b boulder | C colluvial        | r ridged          | $>15^{\circ}$ normally       |
| t till    | E eolian           | e eroded          | in Cx unit                   |
|           | U upland, rolling  | f fan             |                              |
|           | bedrock controlled | m rolling         |                              |
|           | R rock outcrop     | c channelled      |                              |
|           |                    | k kettled         |                              |
|           |                    | thermokarst       |                              |
|           |                    | x complex         |                              |

## Complex Units:

e.g. in: Mp-fO, fO constitutes 25% to 49% of area  
: Mp/fO, fO = 5% - 24% of area

Using all four elements of the legend, a smooth ground moraine surface with moderate slope would be Mp<sup>1</sup>; hummocky and ridged glaciofluvial gravel would be gGhr. Note that there are inconsistencies in the use of Mp and Mv mainly because of the difficulty in estimating till thickness.

## APPENDIX II

## TEXTURAL DATA

The textural data presented in this appendix was gathered during the summer of 1972 when spot checking of surficial and bedrock sources of granular materials was carried out. Although these grain size curves were plotted from the test results of single samples, it is believed that the samples are representative of the deposits tested.

Reference to samples are by station and sample number. Cross reference with the "Tabular Summary" and UTM grid is included so that location of data on a 1:250,000 scale map can be established (see table below).

## SAMPLE LOCATIONS

## FORT MCPHERSON

| STA | SAMPLE  | TABULAR SUMMARY |         | GRID REFER. |
|-----|---------|-----------------|---------|-------------|
|     |         | AREA            | UNIT    | UTM         |
| 93  | LV81-72 | Va              | Ft      | MN816860    |
| 94  | LV82-72 | VIIa            | Gcm-tMm | ML816129    |
| 108 | LV95-72 | Ie              | s,siGlp | NK426658    |
| 109 | LV96-72 | IIc             | Esker   | NK322538    |
| 110 | LV97-72 | IIIb            | Gt      | MK729388    |

