AIRPHOTO SEARCH FOR SUITABLE GRANULAR MATERIALS VICINITY OF CREE LAKE, SASKATCHEWAN, AND OF PROVIDENCE, NWT

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Prepared for:

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September 24, 1962.

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INTRODUCTION

Purpose of the study reported here concerns the location and description of prospective granular deposits located within a 10-mile-square area centered on the following two locations:

	Latitude	Longitude
Cree Lake, Sask.	57°40'N	106°25'N
Providence, NWT	61°19'N	117°36'N

Because the chances of finding suitable granular materials within a 10-mile-square area is quite remote and because small-scale aerial photographs were available, we ordered photos covering a larger area than requested to be on the safe side.

In the Cree Lake area, photos were flown at slightly different levels along parallel flight lines, making assembly of a mosaic unusually costly. Each flight line at a particular scale would have to be photographed individually at Riley's in Calgary. The four flight lines covering the search area would have to be brought to a common scale. A mosaic of the four flight lines reproduced to a common scale would then have to be assembled and rephotographed. I phoned Mr. Sebastyan who suggested that if I felt the extra cost could not be justified, that we should forego the mosaicing aspect. I did not feel the mosaicing would provide extra data and the cost would be greatly increased. Consequently, we abandonned the idea of having mosaics reproduced at Calgary. We have shown our information in colored crayon on uncontrolled mosaics of the Cree Lake and Providence areas. These "mosaics" consist of stapled contact prints.

Data on prospective sources of granular material were traced from the "mosaics" to a plan for use as a permanent record. A hand-colored print has been made up showing each area (Cree Lake and Providence).

The non-mosaiced contact aerial photographs have been placed in a manilla envelope and stapled at the ends of appropriate flight lines. Accordingly, the annotated aerial pictures may be studied stereoscopically by your engineers in Ottawa and I feel this idea has considerable merit.

The bedrock and surficial geology of each area determines the type of data that may be shown and how it is shown. The surficial geology determines the degree of reliability of mapped data and the manner of field checking that should be followed to make optimum use of time available and to keep costs to a minimum.

I will treat each site area separately, beginning with the Cree Lake site.

A: CREE LAKE SITE

BEDROCK GEOLOGY

The site is located at latitude 57°40'N, longitude 106°25'N, just north of Cree Lake, Saskatchewan. The bedrock consists of the Athabasca formation, which is a medium-to-coarse-grained sandstone (approximately 1 to 4 mm in grain-size range), believed to be Precambrian in age. However, there has been much controversy concerning the age of this essentially flat-lying unfossilized sandstone formation.

Composition of the bedrock has had a profound effect on the grain-size distribution and physical properties of the unconsolidated materials derived from it. Deposits tend to be quite uniform medium-to-coarse sands with angular sandstone fragments. The sands likely lack cohesion and their density in place will depend mainly on their mode of deposition.

SURFICIAL GEOLOGY

The ice-deposited till deposits in the site area are almost certain to be high in sand sizes and contain very little to no cohesion. Generally, sands will be compact where they have accumulated subglacially, as in the case of the cigar-shaped (drumlinized) and distinctly fluted areas (see laydown mosaic of flight lines).

Where the sand has accumulated on the surface of or within a stagnant glacier as it has in certain areas (see aerial photograph A13387-48 and bottom of A13384-125 for examples), the granular deposits will be less dense. These sands are glaciofluvial (meltwater deposited) in origin rather than ice-deposited.

In the area studied there appear to be four types of surficial materials -- all granular -- as well as bedrock outcrops (see Fig 1). Very little to no "fines" are anticipated, such as may be required for stabilizing the foundations of unpaved highways.

The four surficial materials expected to occur are as follows:

1) Sandy till with angular sandstone fragments in drumlinized and fluted areas.

2) Sandy ice-contact deposits such as kames, eskers, esker-kame complexes and esker-deltas. I expect the sandy variety of ice-contact deposits to occur on islands in Cree Lake and in the area lying generally west of Cree River. Here the source area for the sediments is the Athabasca formation (see trend of drumlins).

3) Gravelly to cobbly ice-contact deposits in eskers and crevasse fillings east of Cree River and north of about latitude 57°30'. These appear so coarse that a major crushing operation is indicated. Here the source area is partly Athabasca sandstone but also gneissic Shield rocks to the northeast.

4) Wave-reworked clean beach sands around the north shore of Cree Lake and at several wave-worked bays on islands in Cree Lake.

INDIVIDUAL DEPOSITS IN CREE LAKE AREA
(See laydown mosaic and Fig 1 traced therefrom.)

Photo Designation	Remarks
A13384-123	Large cobbly to bouldery crevasse filling that trends diagonally NE-SW across this photo. Several million tons of crushable cobbles and boulders are expected here.
A13386-3	Several winding, discontinuous eskers believed to yield gravel sizes for concrete construction. Drumlins between eskers are a compact sand/sandstone boulder till having very little to no cohesion.
A14508-68	Expect coarse gravels and cobbles in esker-crevasse-filling-kame complex in northwest corner of A14508-68. Beach sands appear white; are probably dominantly quartz; are derived from sandy rather than gravelly glaciofluvial materials.

Photo Designation	Remarks
A14670-154, 156	The site is shown on this photo. Extensive areas of ablation sands, small winding sandy eskers, and a sandy esker-delta are noted. These overlie an ice-laid sandy till containing angular sandstone rock fragments. I expect the whitish areas to be local sandstone outcrops.

There is local evidence of sand-dune formation which indicates (because it is quite localized) that the sand is probably too dense and a little too coarse to develop into large dunes.

The grain-size gradation of the sands found in this area will vary depending on mode of deposition (ice versus meltwater) but a common grain-size range is probably around 1 to 4 mm.

ACCESSIBILITY AT CREE LAKE SITE

At the Cree Lake site I do not expect to find wet ground, muskeg, permafrost, nor fine-grained soil materials such as one may expect at Fort Providence. The area at Cree Lake has been repeatedly burnt-over. Topography is rolling and pronounced ridges are common. One would likely experience trouble if wheeled vehicles were to be used for cross-country travel. The problem is one of becoming "mired" in cohesionless sands, should the thin surface horizon be disrupted. Cross-country travel in winter should be relatively simple. And it may be possible to haul granular material over frozen lake ice.

B: FORT PROVIDENCE AREA

The geology of the Fort Providence is markedly different from that at Cree Lake. In short, construction problems are vastly different.

Whereas at Cree Lake one is dealing with well-drained medium to coarse sands on rolling topography, at Fort Providence the whole search area is characterized by low-lying, poorly drained fine-grained alluvial sediments containing discontinuous permafrost in subsoils and widespread muskeg and swamps at ground surface.

BEDROCK GEOLOGY

Geologic reports indicate that the underlying rocks are greenish-grey shale, limestone, and sandstones. While in geologic reports shale is suggested to be the most likely rock, on the basis of airphoto evidence I would suspect underlying carbonate rocks. I believe leaching and differential consolidation, caused by ground water moving downward into joints in underlying carbonate rocks, has produced the linear elements in the surface drainage pattern and also the maze of criss-crossing lineaments in the wet flats adjoining the river -- especially south and east of Providence airstrip.

SURFICIAL DEPOSITS

If my predictions are correct, surficial materials in the area are likely to be highly frost-susceptible calcareous silty (rock flour) materials that contain sporadic ground ice. Granular materials are expected to be scarce in upland positions. And the most likely place to find (and easiest to field check) granular deposits will be around channel-islands and in wavecut alcoves along the shoreline of Mackenzie River.

Because of expected limited range of surficial deposits, flat featureless terrain, and abundance of muskeg, swamp and wet ground, I have been forced to classify all prospective granular deposits as doubtful. I have selected a number of spots to field check, places that can be prospected quite easily (i.e., from a motorboat on the Mackenzie River), even though I think the chances of discovering suitable granular material are very poor.

River water will have melted "fossil" ice lenses and so make granular channel deposits more amenable to working, if indeed such exist.

I recently made a route-location study for DPW which covered the area north of Kakisa Lake (see Falaise Lake, Army Survey Establishment, Provisional Map Sheet 85F). Based on this airphoto study I know there are granular beach deposits situated along the "winter tractor road" shown on this map. Thus if suitable granular materials cannot be found in the search area (see attached map) it may be necessary to haul deposits ~~for~~ from the new highway (shown as "under construction" on Map 85F.)

FIELD CHECKING

I think the quickest and most efficient method of field checking the doubtful prospects is by motor boat. One should be able to visit all prospects along shorelines within 2 days, perhaps less. In checking cutbanks for exposures of suitable granular material, the field investigator should be alert to the masking effects of overburden that has sloughed down the bankside. The overburden has a tendency to obliterate from view the underlying sediments. In these cases it is necessary to dig below the shallow sloughed layer.

The chances of finding suitable sand and gravel supplies at places noted are poor and it may be necessary to go farther afield than the requested search area. The flats along the north shore of Mills Lake is one such possibility; the multiple beach ridges along the winter tractor-road some 17 miles due south of Fort Providence represents a second possibility.

END OF REPORT