East Channel Areas -- Field Summary of Soils and Permafrost Data with a Preliminary Site Appraisal

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EAST CHANNEL AREAS -- FIELD SUMMARY OF SOILS AND PERMAFROST DATA WITH A PRELIMINARY SITE APPRAISAL

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EAST CHANNEL AREAS -- FIELD SUMMARY OF SOILS AND PERMAFROST DATA WITH A PRELIMINARY SITE APPRAISAL

by J. A. Pihlainen

This note attempts to summarize pertinent field information on the East Channel area collected by our personnel (J.A. Pihlainen, R.J.E. Brown, and G.H. Johnston) on the Aklavik Survey Party. The aim of this note is to report the most significant field findings at this time with the understanding that a more complete report will be made when all of the soil testing data are complete and all field notes have been reviewed.

The East Channel sites are centred at approximately the same latitude as the present town of Aklavik and are 35 air miles east. Townsite location requirements outlined by the Subcommittee on Aklavik, Advisory Committee on Northern Development, and air photo investigations previous to ground reconnaissance revealed four probable townsite areas. These were reported as East 1, 2, 3 and 4 at a meeting of the Subcommittee on March 2, 1954.

Before field investigations were initiated, reports of shoals on the East Channel between East 2 and 3 from varied local sources suggested the early elimination of the two sites E1 and E2. This observation came from several reliable sources (F. Norris, F. Jacobsen, M. Firth) and hence the first investigations of the East Channel were confined to sites E3 and E4. Exploratory soundings of the East Channel (to be reported by K.C. Berry, Department of Public Works) did reveal the presence of shoals objectionable to river transportation and the sites E1 and E2 were only visited briefly. Accordingly exploratory investigations were confined to sites E3 and E4.

POTENTIAL SITE EAST 4

East site 4 is approximately 36.0 air miles (57.6 channel miles) northeast of the present town of Aklavik. The area investigated is approximately 4 miles along the East Channel and extends inland for about a mile (Fig. 1).

Topography

Topographically the northern portion of the site is generally flat with terrace-like undulations and rising to the gulley at the east. The southern portion is a series of rounded hills and knolls with a general rise to the northeast (Fig. 1). Topographically, the northern portion is well suited for an airstrip on the southern portion of the townsite.

A striking surface feature of almost the entire area is the hummocky ground. Many are up to 5 feet in diameter with separating trenches 2 to 3 feet deep. Some of the hummocks have frost cracks several inches wide while others are bare of vegetation and exposed brown clayey silt with some fine sand. Generally, however, the hummocks have a vegetation cover.

Vegetation

Vegetation on the northern portion of East 4 is predominantly scattered birch up to 30 feet high. The long slope with terrace-like undulation rising to the gully at the east is covered predominantly with birch. There are scattered spruce up to 30 feet high which become more sparse up the slope. Most of the ground is covered with dense willow, alder and ground birch. Many dead and burned trees, mostly spruce, were observed. Ground cover consists of hummocks and grassy tufts. The vegetation on the hummocks consists of berry plants, juniper, wintergreen, sphagnum moss, and occasionally Labrador Tea. Some have small clumps of grass several inches high and are most pronounced on the sloping areas.

The vegetation in the southern portion of scattered knolls and swales is birch up to 20 feet high with scattered spruce and is found on the better drained areas. The undergrowth is dense ground birch and the ground surface is hummocky.

Soils Data

The location of exploratory boreholes was dictated largely by the availability of wash water and accessibility. Fortunately representative areas in the north and south portions of the area were close to the East Channel and back packing sampling and drilling equipment over the hummocky terrain and through the dense undergrowth was kept to a minimum.

Exploratory Borehole AB-24 on the northern portion of the East 4 area (Fig. 1) was advanced to a depth of 32 feet. Soil testing data are not presently available and the following soil descriptions are from the boring log.

Much difficulty was experienced in obtaining sufficient samples from the first 10 feet. Three attempts were made with relatively disappointing results. Two possible explanations for this core loss are:

1. small stones destroyed the core or;
2. a stratum of unfrozen ground exists in the first 10 feet of depth.

Time did not permit a test pit at this location but this will be dug later during the summer.

At Borehole AB-24, the organic cover is underlain by approximately 2 feet of light brown silt with some clay and irregular ice segregation up to 3/4-inch thick (estimated water content of 150 per cent by weight). From approximately 2 to 10 feet, the soil appears to be a grey clayey silt with many small stones and pockets of organic material. Ice segregation is irregular and up to 1/8-inch thick, (estimated water content of 100 per cent by weight). A stoney stratum was observed between 7 feet 6 inches and 8 feet 6 inches. From approximately 10 to 30 feet the soil

is a low to medium plastic grey clay with unsorted, angular and subrounded stones up to 2 inches in diameter. Ice segregation is in the form of lenses up to 1/4 inch thick and spaced from 3 to 6 inches apart. Below this depth the material is a compacted light grey silt clay (which approaches a soft shale, although was friable) with no discernible ice segregation.

Exploratory Borehole AB-25 on the southern portion of East 4 area (Fig. 1) was advanced to a depth of 37 feet 2 inches. No soil testing data are presently available and the following soil testing data are based on the field boring log.

At the location of Borehole AB-25 the soil under the organic cover to a depth of approximately 7 feet is a greyish-brown silt clay with random pebbles up to 3/8 inch and irregular ice segregation up to 1/2 inch thick (estimated water content 150 per cent by weight). From 7 to 30 feet the soil is a grey silt clay of low plasticity, assorted angular and subrounded pebbles up to one inch in diameter, and with irregular ice segregation. From 30 to 37 feet, the soil is a grey clay of low to medium plasticity, some small pebbles, and with ice in lenses up to 1/4 inch thick spaced approximately every 3 inches.

A third exploratory hole was planned between AB-24 and AB-25 on the edge of Lake No. 3 (Fig. 1). A natural bank exposure eliminated the need for this borehole and instead, a test pit, AX-7, was excavated. The exposure was in an area of soil slumping which seemed to occur frequently along the eastern fringe of the lakes. From the test pit, the soil in this vicinity appears to be a series of sand, silt and coarse sand strata for the first 3 or 4 feet. This is underlain by a well-graded silty gravel with boulders up to 18 inches in diameter. The top of the excavation was 32 feet above the lake water-level and extended down to 17 feet 5 inches above the lake. Thus the observed silty gravel appeared to be at least 12 feet thick. The soil was thawed and moist. No ground seepages were observed in the excavation.

POTENTIAL SITE EAST 3

East Site 3 is approximately 34.5 air miles (70.7 channel miles) east from the present town of Aklavik. The area investigated was approximately 4 miles long and varied in width from $\frac{1}{2}$ mile at the north to 2 miles wide at the south (Fig. 2).

Topography

Topographically the area may be subdivided into three regions:

1. A northern region of terrace-like steps which rise and finally merge with the upland. The terrace-like steps are low, rounded and separated by smooth swale-like depressions. There is little surface drainage although during the spring, water trickles down the slopes in many places.

2. The middle portion of the area is predominantly low and intermediate in elevation to the deltaic deposits and the "terraces" to the north. Large areas of undrained depressions are randomly interrupted by low rounded hills.

3. To the south are parallel, northwest-southwest directional, rounded hills with large lakes between them.

Vegetation

Vegetation in the area is so varied that only generalities can be reported at this time. Relatively steep slopes, such as the terraces of the north, the main gulley, and the parallel ridges, are predominantly birch. The terrace flats and lower slopes generally have sparse spruce growth with some birch and thickets. The middle low area is predominantly stunted spruce or thickets which merge into open sphagnum and reindeer moss areas. Local depressions in all regions appear to merge into these open areas.

Soils Data

Accessibility of many portions in the area curtailed exploratory drilling. An exposure at Twin Lake (see Fig. 2) suggested gravel occurrence in the northern portion of the area. Accordingly exploratory Borehole AB-26 was drilled on top of the steep slope north of Boot Lake. Gravelly material was encountered two feet below the ground surface. No samples are possible on gravel and the hole was abandoned at 14 feet 9 inches because of possible damage to the rig. Exploratory Borehole AB-27 was then drilled approximately ½ mile south of the gravel exposure and adjacent to the spring break-up observation campsite. Gravelly material was again encountered after two feet of silt material was penetrated. Again no sampling was possible and the hole was abandoned at 12 feet because of possible damage to the rig.

The gravel exposure at Twin Lake was stripped as Test Pit AX-8 and samples were obtained. In general (no soil testing data presently available) the soil appeared to be a stratified deposit of sandy gravel and sand with random strata of bluish grey silt. Stones ranged up to 8 inches in diameter and were subrounded to rounded.

FIELD APPRAISAL

It is difficult to confine comments solely to soils and permafrost considerations since many other factors are of equal, if not of more importance. This point is especially true for the east sites. Sites 1 and 2 were eliminated from investigations because of very probable navigational problems. Exploratory soil exploration in the remaining two sites E3 and E4 shows the soil to be glacial in origin and ranging from objectionable silt clay, with much ice segregation to the favoured well-graded gravel. Accessibility and a good water supply favour site E4 although natural favourable soil

conditions appear to be limited. On the other hand, site E3 approximately 15 miles farther upstream and with a more remote water supply appears to offer a larger area of favourable natural soil conditions. The exploratory investigations give hope to construction at both sites (with different techniques) which should be further investigated by:

1. Test pit excavations to map the gravelly deposits.
2. Comparison of construction costs at the two sites.

POTENTIAL SITE EAST 4

Location

The gently rising northern portion of the area can accommodate the areal and topographic requirements of an airstrip. The southern portion of low, rounded knobs approximately 3/4 mile east of the probable water supply lake would probably be the best location for the townsite. An access road of approximately 3/4 mile to wharf facilities would be required.

Drainage

Natural drainage in the northern portion (airstrip area) is to the Channel. Since airstrip construction in this portion of the area would impede natural drainage, an adequate system of perimeter drainage is essential because natural drainage is believed to be mostly surface run-off. In the townsite area, the general natural drainage is to Lake 3 which might, with time, become a public health hazard.

Roadsand Airstrip

The hummocky terrain and the silt-sized soils with high ice segregation in the top five feet of certain areas offer the largest problems to construction. Detailed soil investigations should precede any construction to keep roads over this material as short as possible. If short lengths of road must traverse this type of terrain then the hummock trenches should be filled with organic material and an additional layer of organic material should be provided before gravel fill is added. Every effort should be made to keep the permafrost table over the hummocks. Organic fill should not be from the sides but from some area removed from town activities. A similar type of construction is favoured for the airstrip.

Engineering Materials

A limited supply (extent unknown) of well-graded gravel occurs in the middle of the area. It should provide an excellent fill for roads and airstrip if it occurs in a sufficient quantity. Limestone outcrops approximately 20 channel miles upstream in Trout Lake could provide sufficient aggregate for concrete.

Buildings

Every effort should be made to confine the townsite area to the granular or gravelly deposits in the area. Should the location of some structures dictate that they be in an area of silt clay with ice segregation, then the use of pile foundations is favoured.

Opinion

Until more information on the distribution of the granular soils at East Site 4 are known, the merits of the area as a townsite can be no more than an opinion. If suitable fill for roads and an airstrip are proved, the area is recommended.

POTENTIAL EAST SITE 3

Location

The area generally north of Boot Lake appears to offer the most promising location for a townsite and possibly an airstrip. Should the area not be large enough for both of these facilities, then perhaps one of the ridges to the south might be utilized for the airstrip location.

Drainage

Most of the area proposed for the townsite drains into Boot or Twin Lakes. All of these lakes are shallow and could become a public health hazard if careful attention is not paid to surface drainage.

Roads and Airstrip

Gravel fill roads to minimize snow removal are recommended for the area. General access roads should follow ridges where gravelly material is more probable. If roads must be built over soils with considerable ice segregation, then some type of precaution for not thawing the sub-grade are thought to be in order. In principle this also applies to airstrip construction.

Buildings

Ice segregation in the gravel does not appear to be significant. Building foundations should pose no out of the ordinary problems although excavation may be costly.

Engineering Materials

The large gravel and sand exposure at Twin Lake offers much material for fill. The few sandy silt and silt-clay strata should not be mixed with gravel fill but can be wasted. Limestone outcrops at Trout Lake, 5 to 6 channel miles to the south of the area can provide sufficient aggregate for concrete.

Opinion

A serious disadvantage of the site is the lack of a good water supply. However, from the results of exploratory soil investigations the site is recommended.

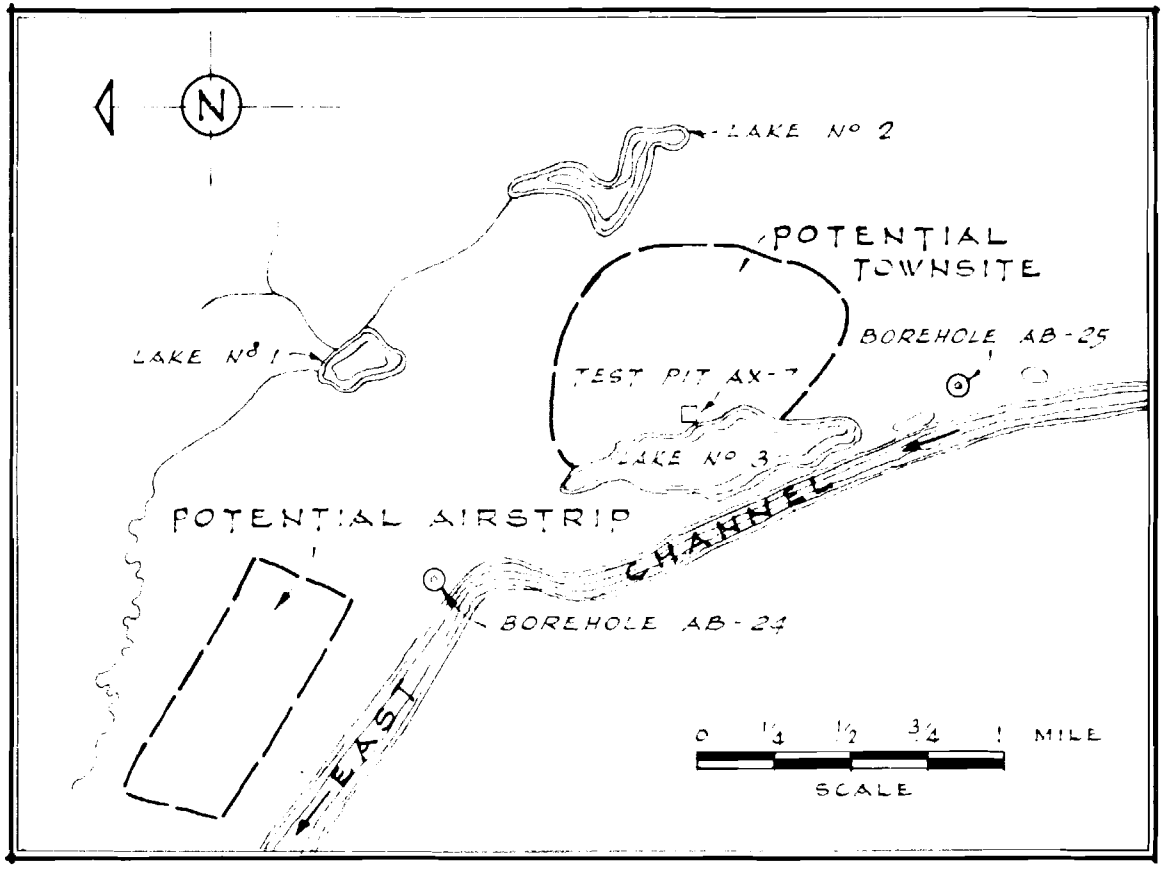

FIGURE 1

POTENTIAL EAST SITE No 4 SHOWING EXPLORATORY BOREHOLE LOCATIONS AND POTENTIAL SITES

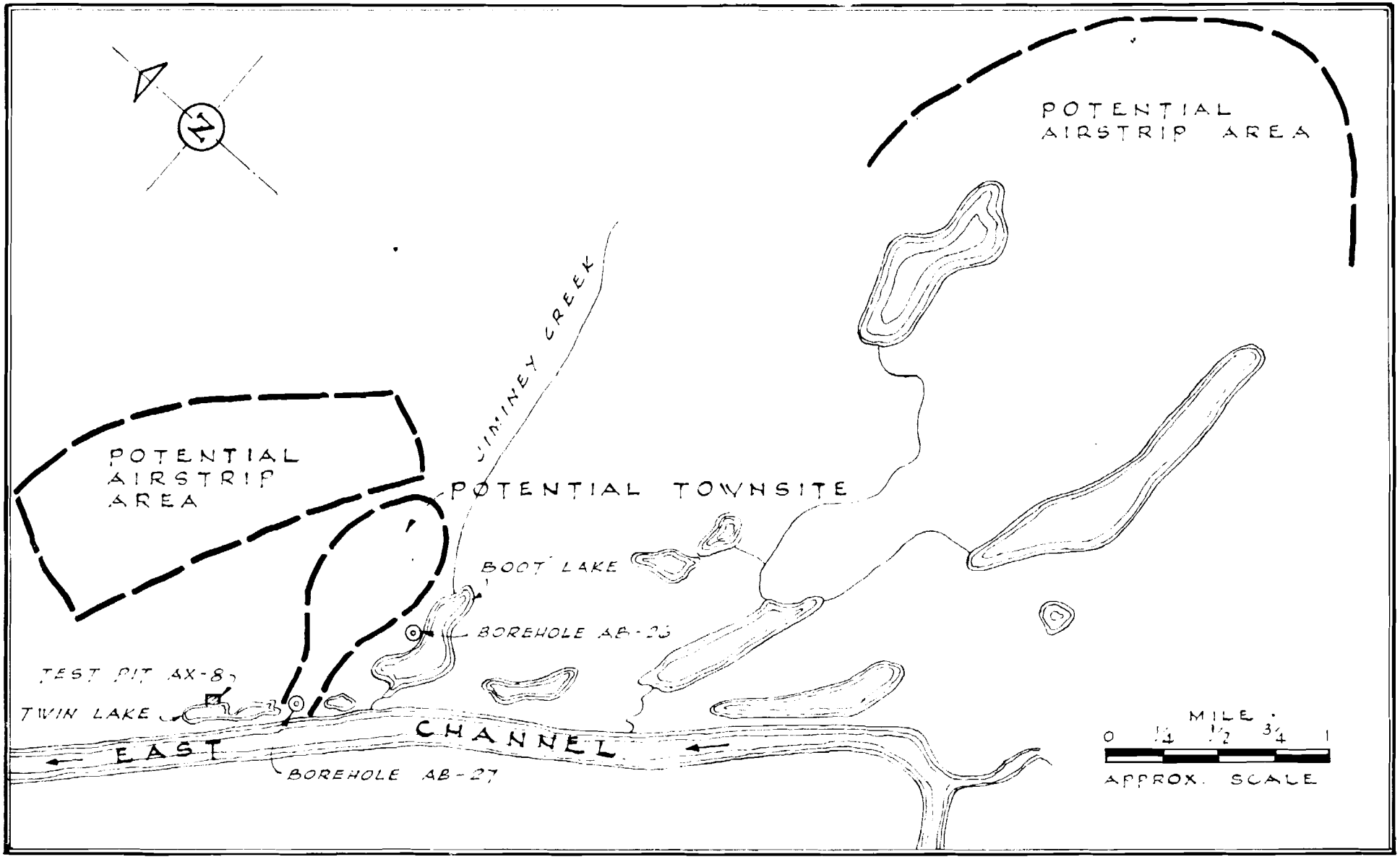

FIGURE 2

EAST SITE No 3 SHOWING BOREHOLE LOCATIONS AND POTENTIAL SITES