A SNOW COURSE NETWORK FOR ALASKA AND THE RAMPART PROJECT

By

T. G. Freeman[1/]

INTRODUCTION

Alaska is entirely covered by snow from early winter until late spring every year. Unlike the watersheds of other western states and southern British Columbia, the entire watershed from sea level to the high mountains produces runoff from melting snow. Water is a very abundant and largely undeveloped natural resource, certain to play a great part in any major development in Alaska.

Since water for agriculture is generally sufficient in most areas to meet future needs, snow surveys for streamflow forecasts are usually associated economically with problems of hydro-power, flood control, or fish and game management. The initiation of Alaskan snow surveys was related to water control plans on the Eklutna River.

A great deal more needs to be known about the snow and the runoff from Alaskan Snowpacks. Pioneering work has been started by several interested cooperating government agencies. The Soil Conservation Service, established in cooperation with the Department of Lands and Forests in northern British Columbia, near the Alaskan Border at the very headwaters of the Yukon River. (Fig. 1) This snow course, called "Log Cabin", is located just beyond White Pass, not far from Skagway, Alaska, on the route used by the gold rush stampeders to the Klondike in 1898.

In 1960, five courses were installed by the author in the interior of Alaska, on the north slope of the Alaska range and in the Tanana Valley. During the winter of 1962, the Corps of Engineers and the Soil Conservation Service cooperated in establishing several snow courses in the Chena River watershed. The purpose of these courses is to aid the Corps in flood forecasting. The Chena River flows through the military installation of Ft. Wainwright and the city of Fairbanks. The Corps of Engineers is currently studying a proposed flood control project for this area.

During the past year, the Alaska State Office of SCS cooperated with the Alaska Department of Fish and Game and the Corps of Engineers in establishing 19 more snow courses and aerial markers in the Susitna and Copper river drainage areas. The Alaska Department of Fish and Game will take the measurements at these stations and expects to use the information in its research studies concerning moose management and winter survival. Other agencies will use the data for hydrologic purposes. On this project the lowest elevation snow course on record was established--at 120 ft. above m.s.l.

The Bureau of Reclamation and the Corps of Engineers have several hydro projects in the planning stage in the panhandle region of Alaska. Two lakes near Juneau--Long Lake and Crater Lake--are scheduled for development for this purpose, with construction to start in about two years. Some preliminary work has been done in locating sites for snow courses and aerial markers on these lakes, and it is expected that these will be established this summer.

USES OF DATA

Very little work has been done in using Alaskan snow water measurements in stream flow forecasting. This is primarily because of the short period during which records have been collected. There is, however, every reason to believe that seasonal snow water is the principal contributor to summer streamflow in all watersheds not influenced by major glaciers. It is recognized that large amounts of glacial melt can overshadow the streamflow from melting seasonal snow on some drainage areas. Until definite streamflow forecasting procedures are established, skeleton snow course networks

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1/ The author is Soil Conservationist, Staff, Snow Survey and Water Supply Forecast Unit, Soil Conservation Service, Portland, Oregon.

covering large areas will probably be more economically useful than intensive coverage of smaller watersheds.

INSTALLATION AND MEASUREMENT PROBLEMS

The installation and operation of a snow course network in a region as large and as inaccessible as Alaska presents a number of problems. Distances are always great, and most of the locations have to be reached by airplane or helicopter. The helicopter is the best means of access to the remote areas in rugged terrain and is used for the Chena and the Eklutna courses. These watersheds are relatively close to Fairbanks and Anchorage, which makes it feasible to use short range aircraft. The courses in the Susitna and Copper river watersheds are reached by ski-equipped airplane in the winter and float plane during the summer.

Because of the vastness of the area and the limitation of time, aerial snow markers are being used extensively in Alaska. The snow depths are read by an observer in the airplane flying by the location, and related to a ground measurement taken at a course with similar exposure and elevation, to obtain an estimated density. Permafrost at most snow course locations makes the installation of aerial markers difficult. Holes 2½ to 3 feet deep need to be slowly chipped out of the frozen earth before the marker pole can be placed and secured at the site.

Animals have also presented some problem in this work in Alaska. The aerial markers offer an inviting place for moose or caribou or bears to rub themselves. If the poles are secured with guy wires, they are likely to become tangled in the horns of bull moose or caribou. The lower metal cross pieces on the aerial markers on the Chena have all been bent double by the bears in that area.

There has never been any actual difficulty with animals during installation of the Alaska snow courses, but the work party always carries a rifle--just in case. When you see an area that has been torn up by a grizzly bear searing for grubs, which looks like a bulldozer has been through it, you don't mind the extra weight of a rifle on your pack.

Most Alaska snow courses have been established below 3000 feet in elevation. This is done to take advantage of trees for protection of the course against excessive wind drifting. The timberline at these latitudes is from 2000 to 3000 feet and, in many of the mountain regions, winter winds are severe. A few courses have been put in above timberline in what appeared to be relatively protected areas.

Days are very short during early and mid-winter. This makes long flying trips hazardous during this time of year. Most snow courses on a flying circuit have been installed with only five sampling points each in order to save time at the site when measurements are made. Winter temperatures may also be very low at any time from October through mid-April. Temperatures of 50 or 60 below zero are common throughout interior Alaska, and this can upset measurement schedules. Very cold weather makes flying and working in the open hazardous, and it is usually desirable to wait for better weather. The weather presents a double problem; good clear flying weather is generally accompanied by extreme cold, and the warmer, more enjoyable weather is accompanied by cloudy, bad flying conditions.

As the network expands to the more remote regions in Alaska, it is most likely that local people will be utilized as snow surveyors, as in British Columbia. In many of these remote localities, short wave radios are available which can be used to transmit the data to Anchorage or to Fairbanks. In other locations, scheduled bush flights can carry out the information.

A remote snow sentinel with reliable telemetry, which can accurately sense the water equivalent of a snowpack and transmit the data to a base station, will have a definite place in the Alaskan snow course network. The great distances, rugged terrain, and difficult weather conditions will make this device a very valuable piece of equipment in Alaska.

Obtaining good measurements in the very low density, extremely cold snow of this arctic region has also been a major problem. Retaining good sample cores of light snow and depth hoar at a site underlaid by frozen soil has presented some difficulty to the Alaskan snow surveyor.

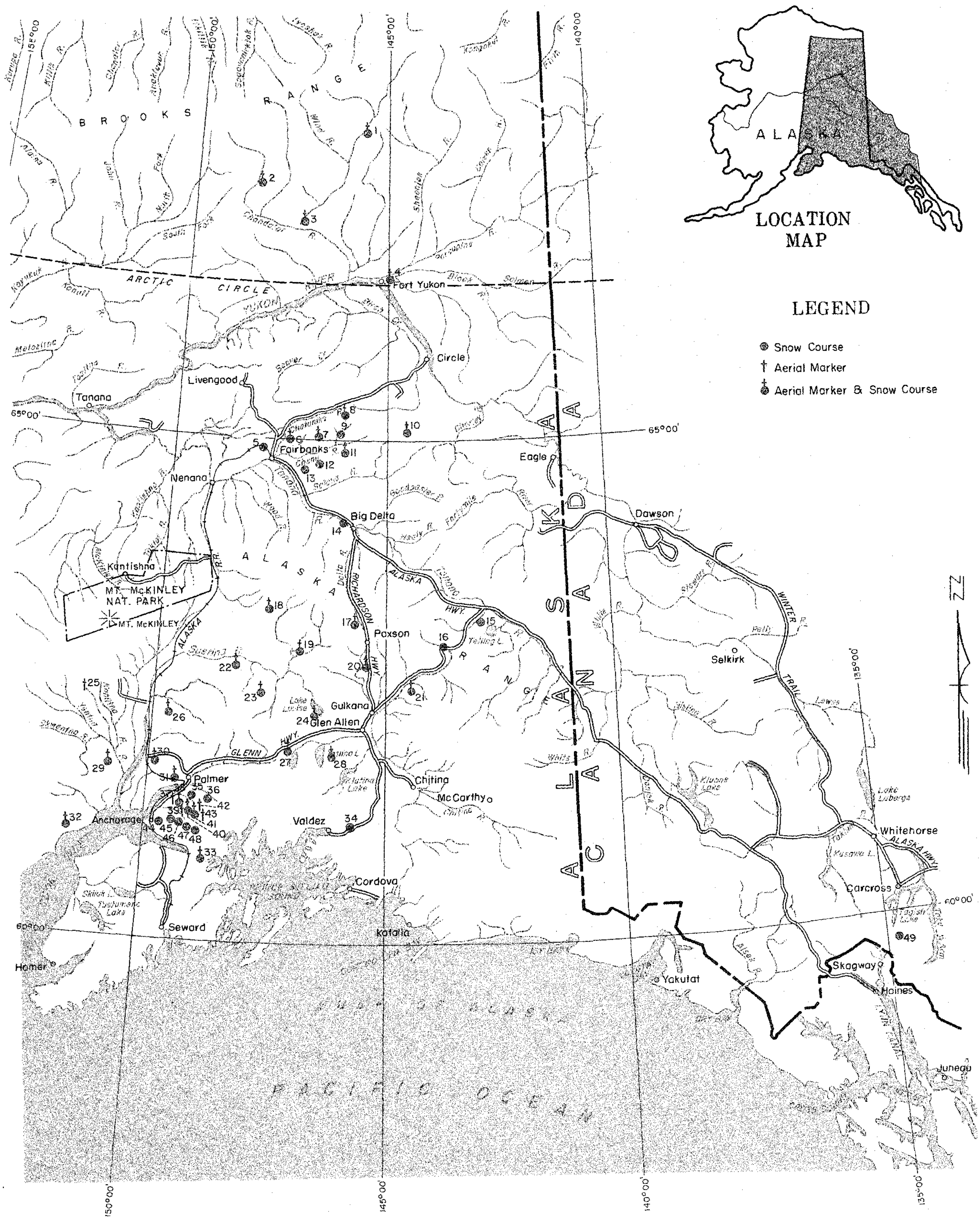
Work is now underway to find a solution to these problems in a cooperative effort by the Army's Cold Regions Research and Engineering Laboratory (CRREL) and the Soil Conservation Service. Tests of all types of practical field sampling equipment to determine the best methods of making the snow measurements are now in progress. Each sample with each measuring device is compared to a very precise determination of a large volume snow measurement at the same site.

RAMPART DAM

The Rampart Dam on the Yukon River appears to be at least a definite possibility for construction at some time in the future. The project would be very large with a resultant reservoir approximately the size of Lake Erie in area, with one billion, three hundred million acre-feet of storage. The Yukon River is the third longest river in North America, behind the Mississippi and the McKenzie. It is about 1880 miles in length, with the Rampart damsite at river mile 752. The watershed above the damsite is approximately 200,000 square miles and includes the drainage of several of the major rivers of the north. These rivers include the Chandalar and Porcupine in Alaska, and the Stewart, Pelly, Teslin, Lewes and White rivers in Canada as well as several minor streams.

Four snow courses were established late last fall on the Chandalar River in Alaska by SCS in cooperation with CRREL located at Hanover, New Hampshire, in collaboration with Dr. Robert Gerdel. These courses were located near Arctic Village,Chandalar Lake, Venetie, and Ft. Yukon. It is planned that more snow courses will be established on the Yukon watershed in Alaska next year to provide hydrologic information and to provide a site for detailed snow studies in the sub-Arctic region.

A complete snow course network for the Rampart project will require the full cooperation of the Canadian Government. At least two-thirds of the water that flows by Rampart comes out of Canada, making necessary the snow information from this portion of the Yukon River watershed. A considerable number of snow courses would need to be installed and measured in cooperation with the Canadian Dominion Government and would provide mutually useful information.



SNOW COURSES for ALASKA

50 0 50 100 150
SCALE IN MILES

INDEX OF ALASKA SNOW COURSES

Map No.	Course Name	Course No.	Elev.
1	Arctic Village	45TT1A	2300
2	Chandalar Lake	48SS1A	2040
3	Venetie	46SS1A	610
4	Fort Yukon	45RR1A	500
5	Yak Pasture	47PP1	540
6	Cleary Summit	47QQ1A	2230
7	Little Chena	46QQ2A	2200
8	Mt. Ryan	46QQ1A	2950
9	Chena Hot Springs	46QQ3	1180
10	Big Windy	44QQ2A	3850
11	Munson Ridge	46PP1A	3100
12	Little Salcha	46PP3	1500
13	French Creek	46PP2	2010
14	Big Delta	45PP1	975
15	Tok Junction	43001	1650
16	Mentasta Pass	43NN1	2430
17	Fielding Lake	45001A	3000
18	Monahan Flat	47001A	2710
19	Clearwater Lake	46NN1A	3100
20	Haggard Creek	45NN1A	2540
21	Chistochina	44NN1A	2170
22	Fog Lakes	48NN1A	2270
23	Oshetna Lake	47NN1A	2950
24	Lake Louise	46NN2A	2400
25	Chelatna Lake	51NN1a	1650
26	Bald Mtn. Lake	49NN1A	2150
27	Sheep Mountain	45MM1	2700
28	St. Anne's Lake	46MM1A	1985
29	Alexander Lake	50MM1A	200
30	Willow Airstrip	50MM2A	
31	Wasilla Airstrip	49MM6A	
32	McArthur	51MM1A	120
33	Twenty Mile	48LL1A	
34	Worthington Glacier	45MM1	2400
35	Moraine	48MM1A	2100
36	Ptarmigan	48MM2	3000
37	Glacier	48MM3a	
38	Grizzly	48MM4A	5000
39	Sheep	48MM5a	2500
40	Bowl	48MM6a	4500
41	Goat	48MM7A	3200
42	Marmot	48MM8A	2000
43	Little Glacier	48MM9a	4000
44	Arctic Valley #1	49MM1	500
45	Arctic Valley #2	49MM2	1000
46	Arctic Valley #3	49MM3	2030
47	Arctic Valley #4	49MM4	2330
48	Arctic Ski Bowl	49MM5	3000
49	Log Cabin (British Columbia)	35KK1	2880