

SNOW SURVEYS IN THE BLACK RIVER DRAINAGE AREA

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ABSTRACT

"Snow Plugging is a time honored method of obtaining snow pack data as input into the hydrological background of information necessary for proper water management. In the interests of reducing the time, costs, and personnel required to survey a multitude of sites, the Hudson River-Black River Regulating District has analyzed a method of obtaining snow data from six key sites in the Black River Drainage Area, as compared to that obtained from the normal twenty plus snow survey sites over a five year period.

DISCUSSION

The purpose of this experiment, conducted by the Hudson River-Black River Regulating District, was to reduce the time, effort, and cost of obtaining accurate snow pack data from the upper regions of the Black River Drainage Area. For water management purposes, the objective was to reduce the number of survey sites, investigate new equipment and/or new procedures to obtain results equal to or improved over multi site snow surveys.

The Black River Drainage Basin is located in the northerly part of New York State with an area of 1916 square miles, situated in the westerly part of the Adirondack Mountains and the easterly part of the Tug Hill Plateau. (Figure 1 & 2)

Upper regions range from 1000 feet (305 m) to 2000 feet (610 m) elevation above sea level, average 50 inches (127 cm) of annual precipitation, 150 inches (281 cm) to 300 inches (762 cm) of total seasonal snowfall. Winds are predominately from the west and north placing this region in the path of the "Lake Effect" snow patterns, especially from Lake Ontario.

This organization is a public corporation, a state agency, but receiving no revenue from the State of New York. Income is derived from the beneficiaries of regulated waters within the respective drainage areas. Beneficiaries include paper companies, municipalities and utilities. Budgets are frugal with debts limited to construction bonds for additional storage reservoirs.

This District continually reviews all information available to better manage the water storage and release requirements of its regulating reservoirs; three of which are in the Black River Area and one in the Hudson River Area. Its combined storage capacity is 44.65 billion cubic feet (1,265,228 hm³) of water.

For years, snow surveys have been taken four to five times a season at an average of about 20 sites by District personnel and cooperators. It requires at minimum, a two day period and usually the better part of four, depending upon weather conditions. Approximately six people were involved travelling at least 400 miles (644 km) total.

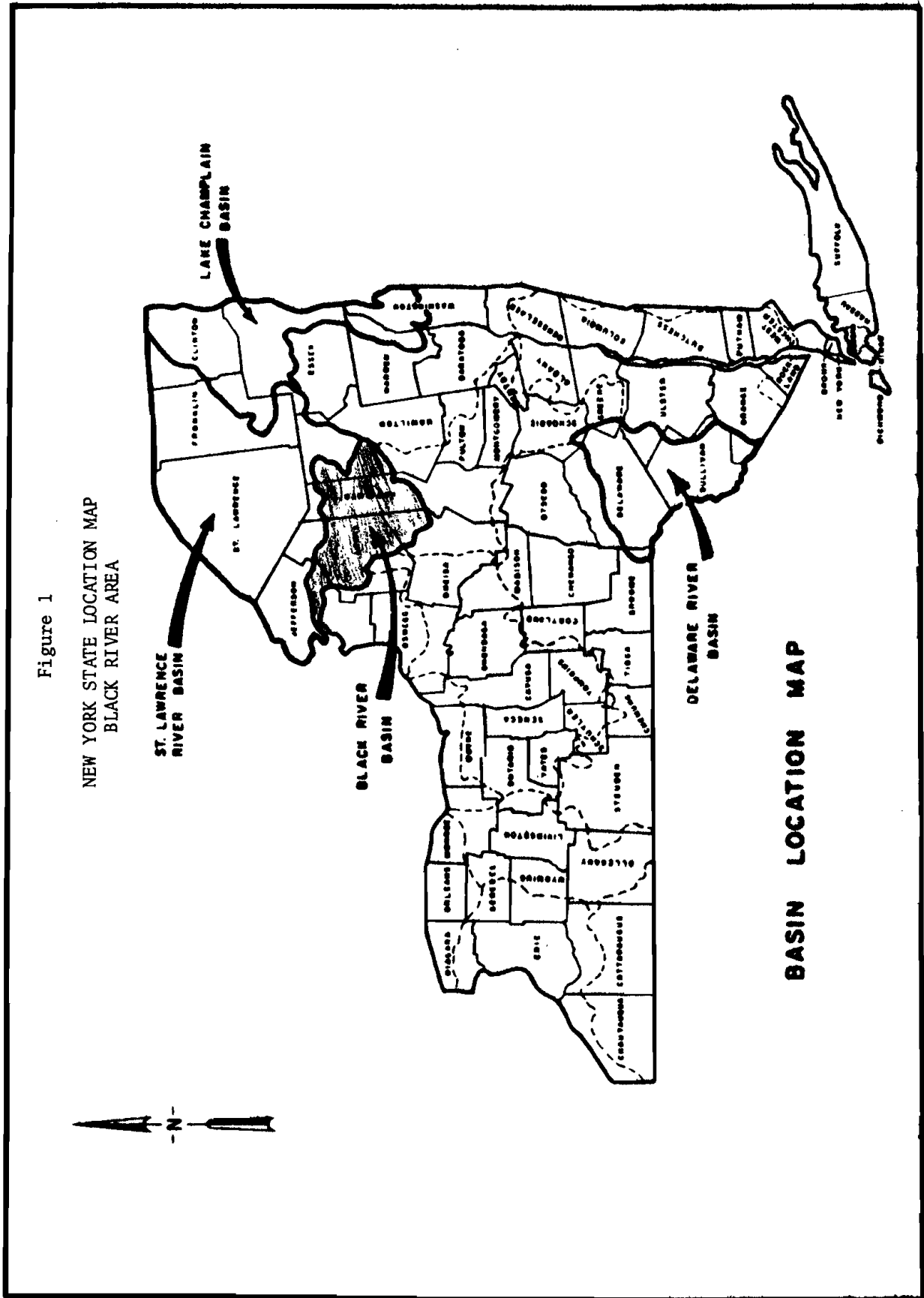


Figure 1
 NEW YORK STATE LOCATION MAP
 BLACK RIVER AREA

BASIN LOCATION MAP

Figure 2A

BLACK RIVER DRAINAGE AREA MAP
W/Multiple Snow Survey Sites

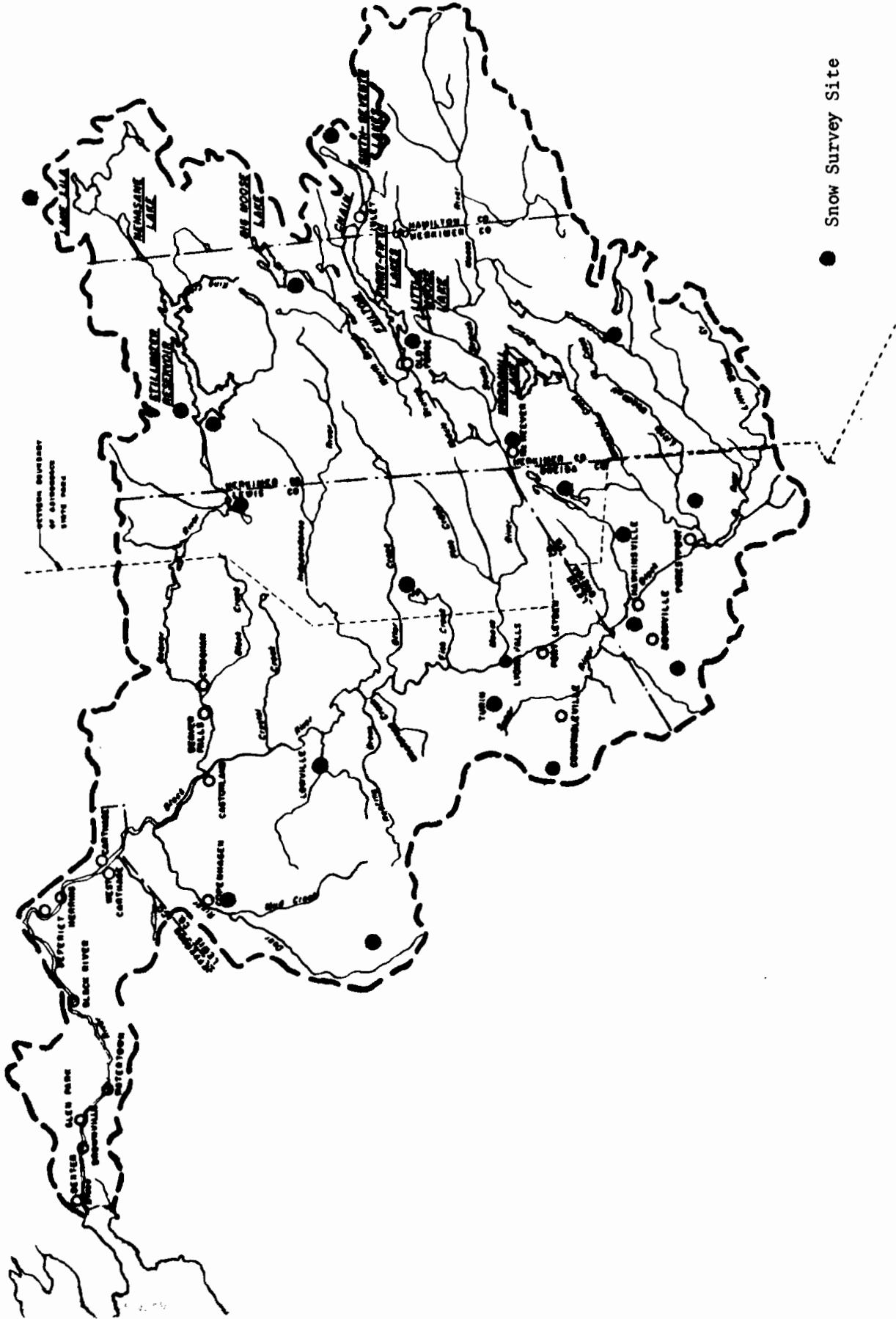
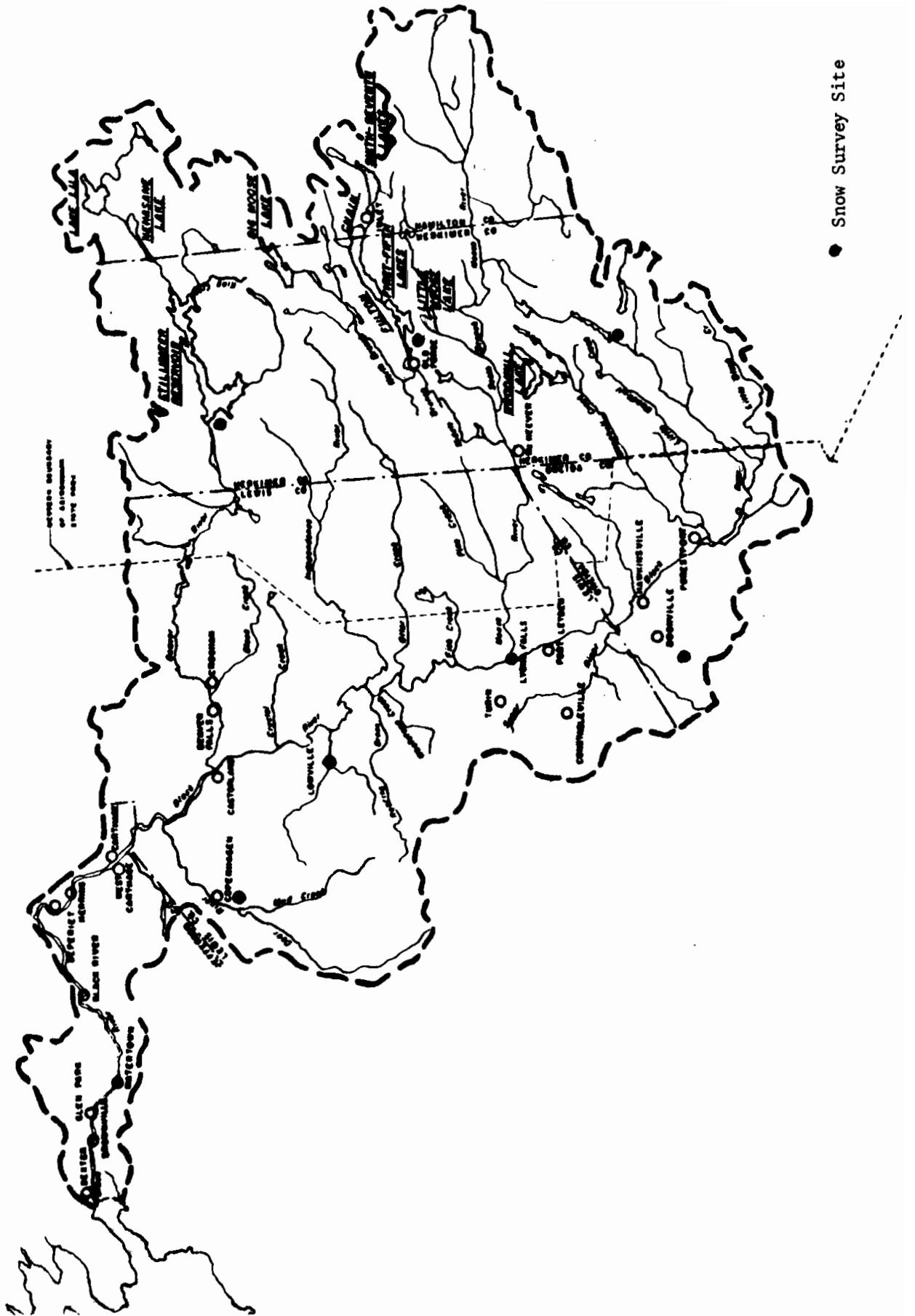


Figure 2B

BLACK RIVER DRAINAGE AREA MAP
W/Six Snow Survey Sites



● Snow Survey Site

Snow surveys, at best, are only a factor in the considerations of potential water runoff. The analysis of snow surveys must be tempered with the intangibles of ground water absorption, temperature, wind and precipitation.

Considering only the Black River Drainage Area for this project, initial investigation ruled out snow pillows and remote telemetering. Satellite sensing and aerial reconnaissance of the snow pack are both in their infancy but are potentials for the future. Our next practical possibility was to locate key or index sites.

The time frame of this project included the six consecutive winter seasons of 1968 through 1973 which included a year (1971) of above normal, and a year (1968) of below normal precipitation.

Several factors were considered in the selection of these key or index stations, some of which were:

1. Location of the key stations for geographical coverage in the upper elevations;
2. Availability of the services of a snow surveyor living or working near this key station to reduce time and travel;
3. Attempting to obtain a cooperator who could take surveys as a part of his normal job activities;
4. Obtaining equipment for each snow surveyor, teaching him to care and use it properly for accurate results.

As a result, six index stations were finally selected. Each is a regular long term site in the vicinity of a regular weather recording station with the observer being the interested, dedicated surveyor. Data collected over this six year period indicate that the six station average is generally slightly less in both snow depth and water content than the multi station average. However, as indicated on the attached chart (Figure 3) the accuracy is well within acceptable tolerances. Probably from a practical point of view, it is more accurate than the multi station average in that all six site surveys can be taken at basically the same time. Multi station surveys taken over a 2 to 3 day period are subject to changing weather conditions affecting the total snow pack on the ground within this period.

Most certainly there is a considerable savings of personnel time and travel costs.

Since 1973, several checks of the six station average as compared to the multi station average have been made with similar results.

Another definite advantage of this 6 site snow survey is the convenience of an interim survey if conditions warrant. This year (1978) is a case in point. No regular surveys are normally taken in mid January. This year, with record snow pack conditions up to twice normal, an interim survey at these six sites yielded a check on the unusual growth of the snow pack. Consequently, the outflow of the District's reservoirs has been increased thus providing for additional spring storage capacity without undue change in downstream ice conditions.

Results of this six year program and subsequent checks thereafter, indicate that this six station snow survey accumulated data are comparable to a twenty station snow survey average in the Black River Drainage Area sufficient for the purposes of this District. It has resulted in a reduction of personnel, travel time and other normal expenses yielding at least as good, and most probably better, area snow pack depth and density averages.

FIGURE 3

BLACK RIVER AREA - SNOW STATION ANALYSIS SHEET

6 Index Stations Average Compared With Multi Stations Average

Year	No. Of Stations	First January		First February		First March		Mid March		First April	
		Snow Depth	Water Cont.	Snow Depth	Water Cont.	Snow Depth	Water Cont.	Snow Depth	Water Cont.	Snow Depth	Water Cont.
1968	A	19.2	3.25	12.9	3.24	27.1	7.14	20.1	6.78	Patches	
	B	18.3	2.98	15.3	3.89	26.5	6.78	20.7	6.90		
	Difference	(.9)	(.27)	+2.4	+6.65	(.6)	(.36)	+6	+12	-0-	
1969	A	27.0	5.53	22.2	5.66	25.3	7.83	27.2	7.99	25.6	7.63
	B	25.5	5.22	22.8	6.02	22.8	7.48	26.0	7.50	22.7	6.66
	Difference	(1.5)	(.31)	+6	+36	(2.5)	(.35)	(1.2)	(.49)	(2.9)	(.97)
1970	A	27.1	4.73	26.0	5.84	31.7	7.26	30.6	7.69	29.0	8.40
	B	26.4	4.44	25.6	5.68	30.3	7.25	29.8	7.24	25.8	6.71
	Difference	(.7)	(.29)	(.4)	(.16)	(1.4)	(.01)	(.8)	(.45)	(3.2)	(1.69)
1971	A	20.8	4.37	38.1	7.96	38.0	10.74	48.5	13.93	48.1	14.86
	B	20.3	4.03	38.0	8.04	38.9	10.66	51.0	14.62	45.7	14.48
	Difference	(.5)	(.34)	(.1)	+0.08	+9	(.08)	+2.5	+6.9	(3.4)	(.38)
1972	A	14.4	2.41	20.6	4.50	39.6	9.40	34.5	9.78	33.8	10.20
	B	14.4	2.55	20.8	4.28	40.9	10.29	35.4	9.92	32.4	9.63
	Difference	-0-	+16	+2	(.22)	+1.3	+8.9	+9	+14	(1.4)	(.57)
1973	A	16.6	4.29	20.7	5.28	24.4	7.00	13.2	4.85	1.9	.49
	B	13.2	3.71	19.6	4.88	23.4	6.27	8.4	3.87	1.5	.46
	Difference	(3.4)	(.58)	(1.1)	(.40)	(1.0)	(.73)	(4.8)	(.98)	(.4)	(.03)
6 Year Average											
Difference		(1.2)	(.27)	(.1)	+31	(.6)	(.11)	(.5)	(.16)	(2.3)	(.73)

Note: A = Multi Station (13-26) Average
 B = 6 Station Average

All above snow depth and water content expressed in inches only