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HYDROLOGIC RECONNAISSANCE OF THE STONY RIVER BASIN, ALASKA, 1983-84

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TABLE OF CONTENTS

LIST OF GRAPHICS

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Alaska DGGS personnel reconnoitered the Stony River basin in southwestern Alaska in August 1983 and March 1984 to collect hydrologic data to describe the flow characteristics and quality of the surface water in the basin under both summer (high-flow) and winter (low-flow) conditions.

The 180-mi-long Stony River drains approximately 3,300 mi^2 of southwestern Alaska. The river drops 3,750 ft from its glacial headwaters in the Alaska Range to its confluence with the Kuskokwim River. Poorly-drained soils with a peaty surface layer over a shallow permafrost table predominate within the basin (Selkregg, 1976). Spruce-hardwood forest is the dominant vegetation, with alpine tundra at the higher elevations. Bedrock is exposed in the upper basin.

The Stony River basin straddles parts of the Holitna Lowland, Nushagak-Big River Hills and Southern Alaska Range as described by Wahrhaftig (1965). The Stony River is one of several large, braided glacial streams which rise from glaciers in the Alaska Range and flow across the moraine-mantled lowlands. Pleistocene alluvial deposits border the lower river, and Permian limestone and volcanic rock occur in the Lime Hills, conspicuous isolated steep-sided ridges which rise to an altitude of 1000-2000 ft. Mountains in the basin consist of Tertiary and Cretaceous granitic rocks, Cretaceous and Jurassic sedimentary and volcanic rocks, and pre-Cretaceous sedimentary, volcanic and igneous rocks (Beikman, 1974). Numerous morainal and thaw lakes occur throughout the lowland.

The Stony River basin lies within the continental climatic zone of Alaska, characterised by cold winters and hot summers. The weather station at Sparrevohn, on the southwest margin of the basin, records a mean summer temperature of 40" to 61°F, mean winter temperature of 0° to 20°F, and extremes of -47°F and 82°F over a IO-year period. Average annual precipitation at the station is 21 in. including 81 in. of snow (Selkregg, 1976). Regional variations should be expected within the basin.

DGGS personnel floated the Necons River from Two Lakes to its confluence with

the Stony River, then the Stony River to its mouth in August 1983 and obtained discharge, water-quality and stream-channel measurements at 11 sites. In March 1984 the sites were revisited by helicopter.

Information in this report can be used to assess runoff and baseflow conditions of the river system and to estimate the year-round regimen of this southwestern Alaska river basin.

EXPLANATION OF GRAPHICS

Figure 1 is an index of U.S. Geological Survey (USGS) 1:250,000- and 1:63,360-scale topographic maps of the Stony River basin.

Figure 2 shows the generalized physiography of the basin superimposed over a diagrammatic representation of t-he riverine system.

Figure 3 is a profile of the Stony Kiver and selected tributaries compiled from USGS 1:63,360-scale topographic maps. Comparative gradients along river segments and the position of tributaries and data-collection sites are shown.

Figure 4 contains a channel cross section of each data-collection site. Cross sections were developed from survey measurements taken during the August 1983 reconnaissance. Bankfull channel stage was determined from the flood-plain surface and the Lower Limits of permanent vegetation (Childers and Kernodle, 1983); maximum-evident-flood (MEF) stage was extrapolated from high-water marks found on the riverbanks.

Table I is a summary of the channel geometry and discharge measurements taken during the two reconnaissance trips and the calculated unit runoff based on these measurements. Unit runoff, obtained by dividing stream discharge by drainage area, can be used to compare seasonal water yields in a basin or subbasin (Childers and Kernodle, 1983).

Table 2 contains calculations based on the observed data. From the channe 1 cross sections, the approximate discharge *for* bankfull **and** MEF conditions are calculated with the simplified slope-area method (Riggs, 1979). The bankfull discharge indicates the maximum amount of flow that may be expected without flooding, and the MEF discharge indicates the maximum instantaneous peak discharge at the site in recent years (Childers and Kernodlt, **1983).** Drainage-basin characteristics are used to calculate predicted 2-yr and 50-yr floods using Lamke's (1979) method. (A 2-yr flood has a 50 percent chance of being exceeded in a particular year, whereas a 50-yr flood has a 2 percent chance of being exceeded; these values are based on multiple regression analysis of streamflow records, which are very scanty in Alaska.) The Froude number is a mathematical relationship between mean velocity, mean depth, and the gravitational constant and is used to compare states of flow at the sites. (In a rectangular channel, flow **is tranquil** if the Froude number is less than **1.0** and is rapid if greater than 1.O [Dalrymple and Benson, 1968]). Observed summer stage was used as a basis in calculating discharge **using** the simplified slope-area method and may be compared to the actual discharge **values** in Table 1. Site-specific conditions, such as local variations in slope due to a nonideal channel reach, cause discrepancies between calculated and measured discharge values.

Table 3 is a summary of water-quality data gathered at all sites during **the 1983** and 1984 reconnaissance trips.

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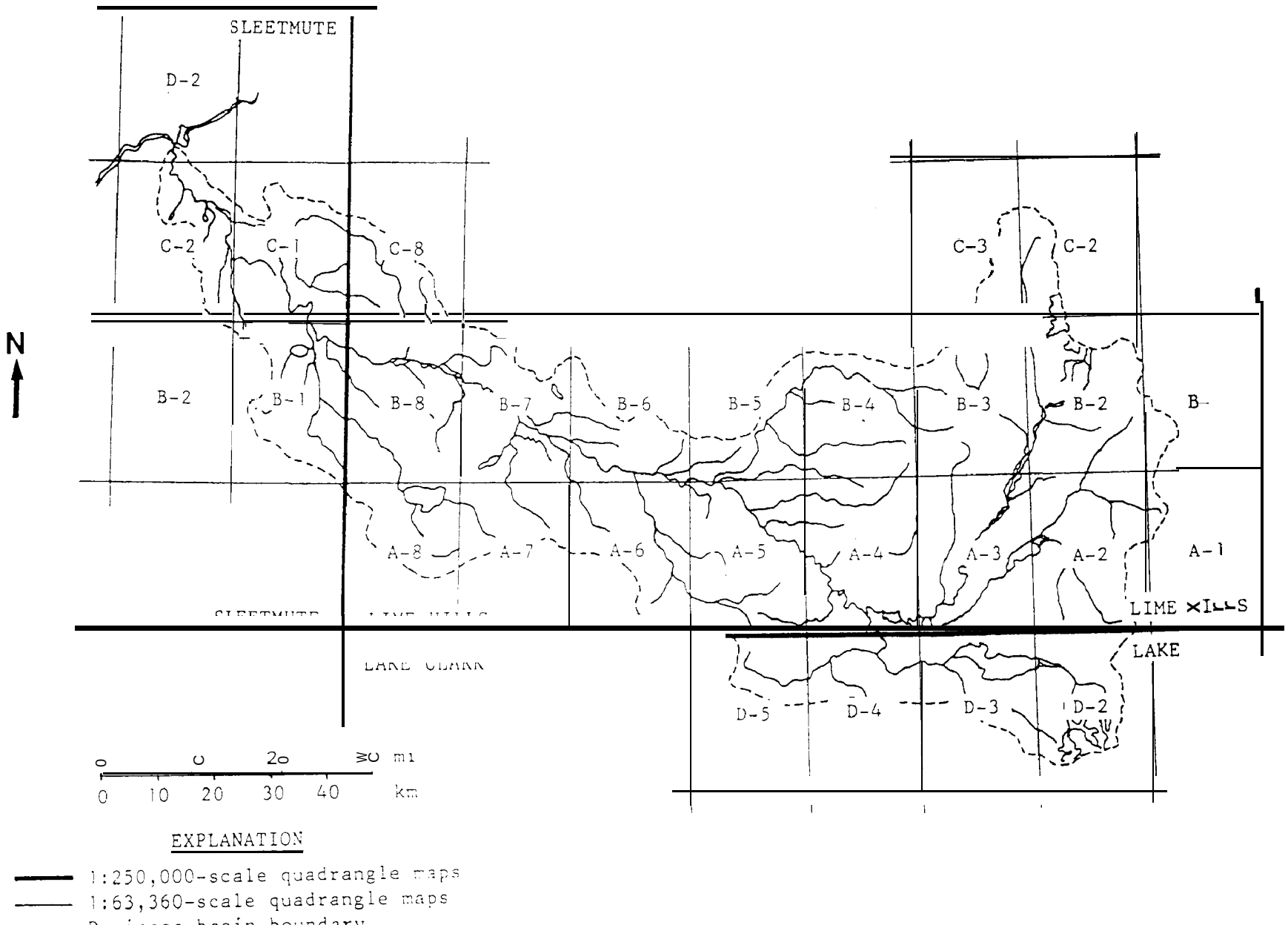

Figure 1. Index of U.S. Geological Survey topographic maps by quadrangle for the Stony River basin, Alaska.

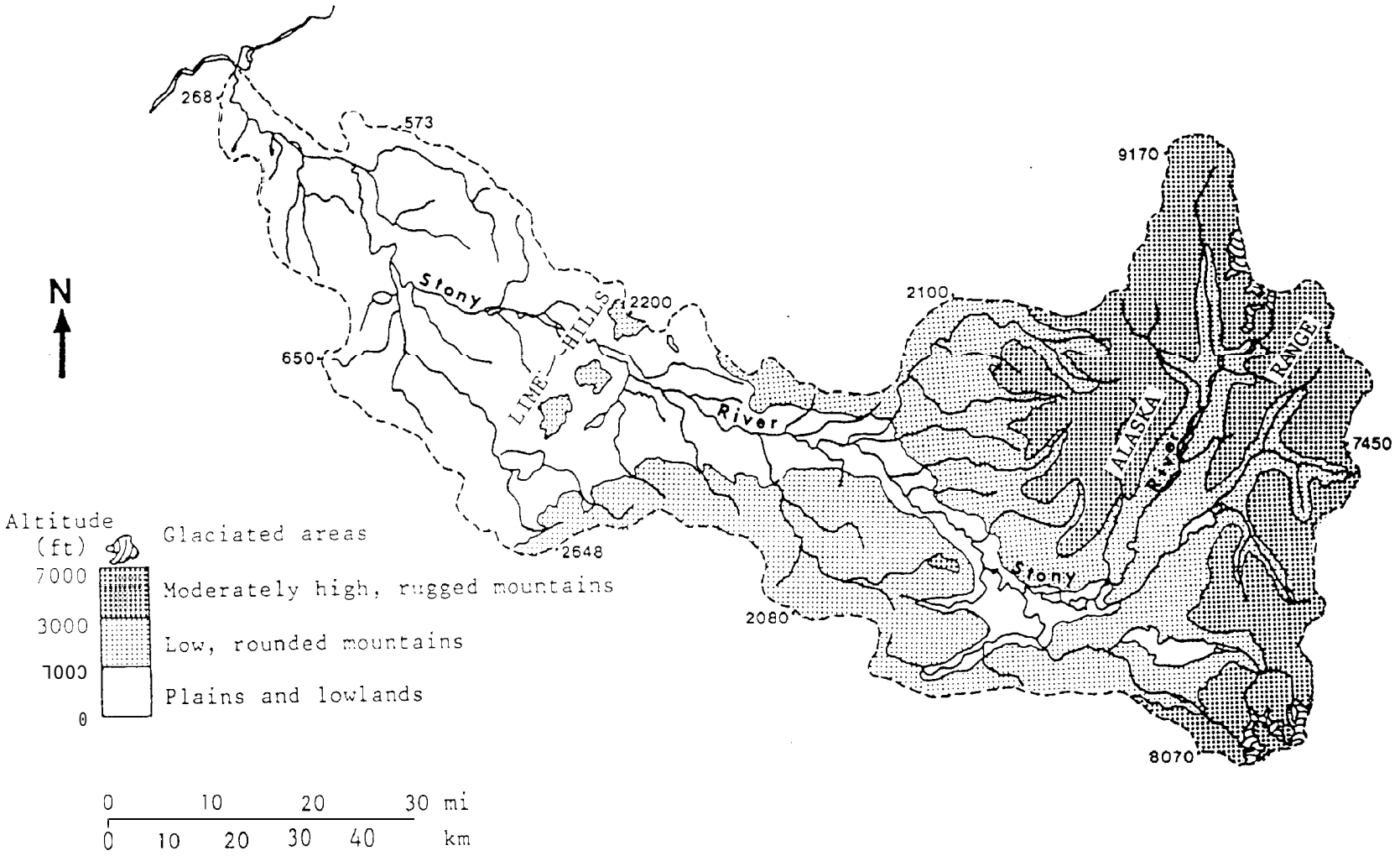

Figure 2. Generalized physiography, Stony River basin, Alaska.

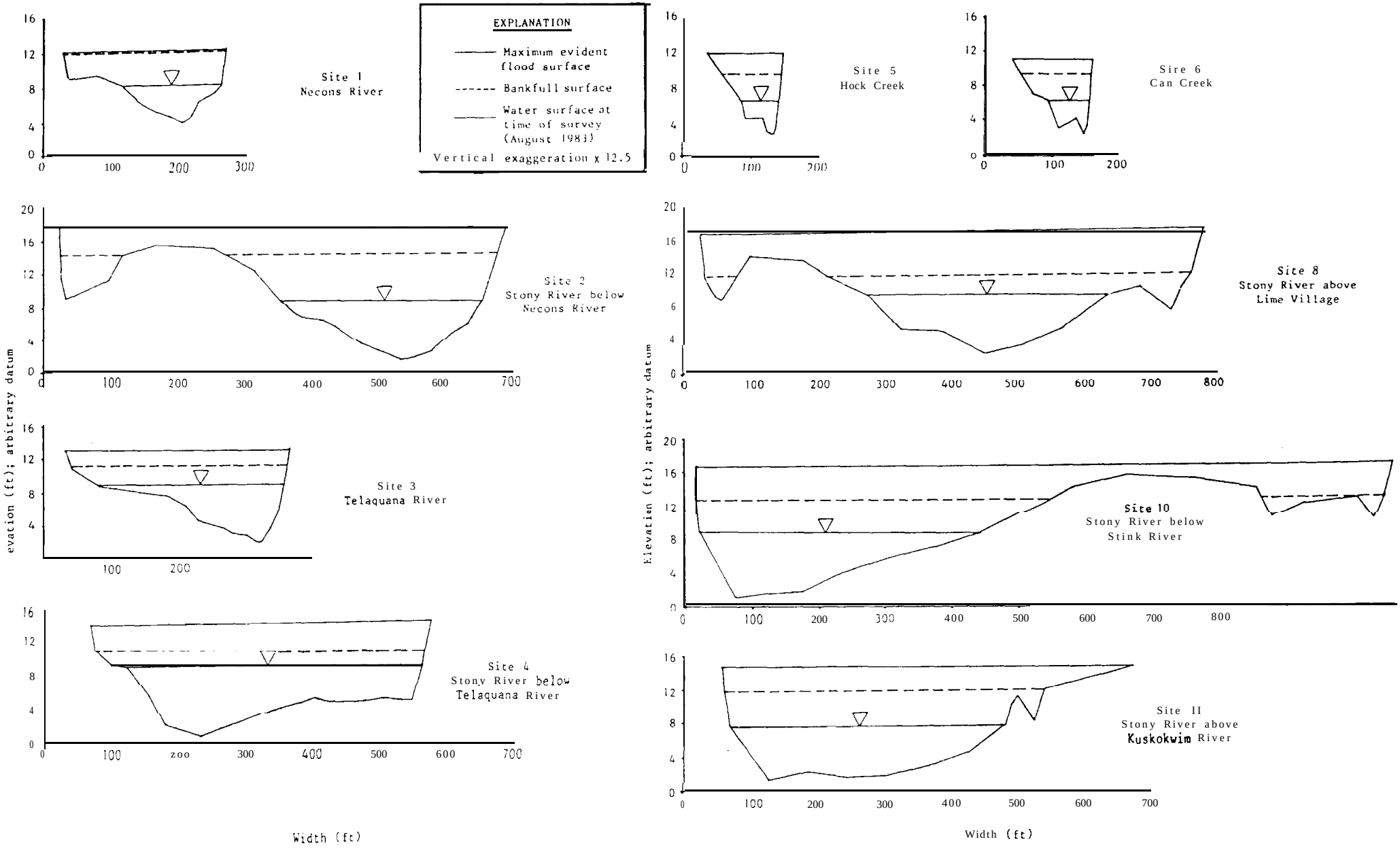

Figure 4. Channel cross-sections, Stony River basin, Alaska, August 1983.

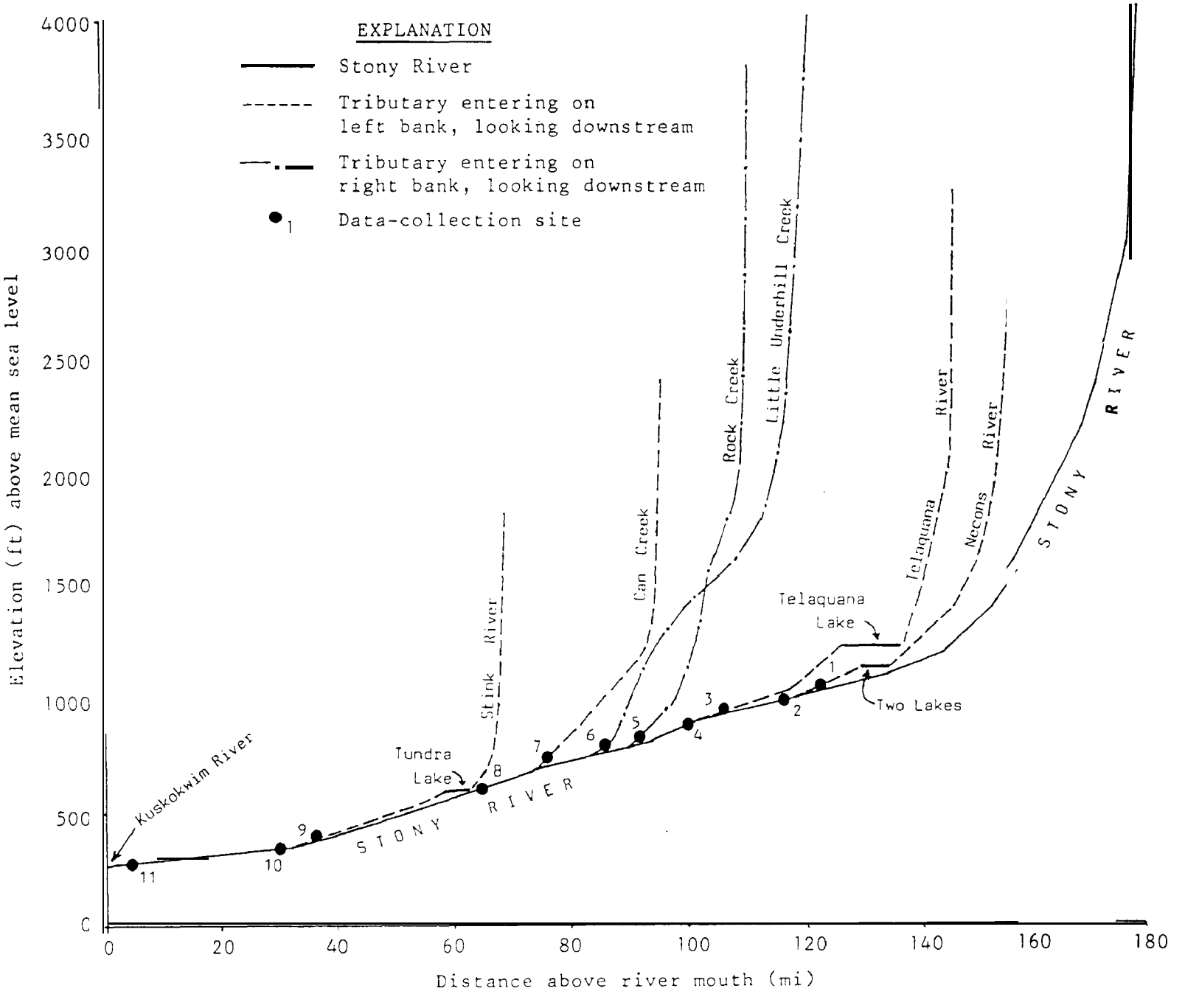

Figure 3. Profile of Stony River and selected tributaries, Alaska.

Table 1. Summary of observed discharge and cross-sectional data, Stony River basin, Alaska, 1983-84.

Data collection site	Slope (ft/ft)	Cross-sectional area-ft² [a] winter	summer	Water-surface width (ft) winter	summer	Mean depth (ft) winter	summer	Maximum depth (ft) winter	summer	Mean velocity (fps) winter	summer	Maximum velocity (fps) winter	summer	Discharge (cfs) winter	summer	Unit runoff (cfs/mi²) winter	summer
1. Necons River	0.0018	138	412	160	150	0.9	2.8	2.0	5.2	1.6	2.5	2.5	4.0	201	1,290	0.56	3.58
2. Stony River belov Necons River	0.0008	559	1,020	152	287	3.7	3.8	6.1	7.7	1.0	2.8	1.6	4.6	514	3,140	0.73	4.49
3. Telaquana River	0.0001	266	827	217	282	1.2	3.3	2.8	6.8	0.9	1.3	1.2	2.2	212	1,420	0.48	3.19
4. Stony River belov Telaquana River	0.0004	425	2,130	445	460	1.0	4.4	3.7	7.0	1.2	2.1	2.3	3.2	479	5,050	0.40	4.21
5. Rock Creek	0.0048	15	67	21	59	0.7	1.1	1.4	1.8	1.4	3.3	2.1	4.1	21	218	0.32	3.35
6. Little Underhill Creek	[b]																
7. Can Creek	0.0024	21	88	27	59	0.8	1.5	1.5	2.2	2.7	2.0	4.0	3.0	51	179	0.28	0.99
8. Stony River 4 mi above Lime Village	0.0014	654	1,590	355	368	1.8	3.7	3.5	7.0	2.3	5.2	4.0	5.6	1,360	8,260	0.64	3.90
9. Stink River		40	274	114	108	0.4	2.7	2.3	4.0	0.2	0.4	0.3	0.9	6	142	0.02	0.37
10. Stony River below Stink River	0.0008	510	1,740	350	420	1.5	3.9	4.0	7.5	1.7	3.9	2.5	4.8	805	6,860	0.28	2.37
11. Stony River above Kuskokwim River	0.0005	1,110	1,880	235	420	4.1	3.9	12.1	6.0	1.0	2.8	1.7	4.5	1,010	7,150	0.31	2.20

[a] 'Winter' refers to reconnaissance of March 1984; 'summer' to August 1983.
[b] No measurements made.

Table 2. Summary of calculated discharge and cross-sectional data, Stony River basin, Alaska, 1983-84.

Data collection site	Calculated bankfull characteristics: Cross-sectional area (ft^2)	Water-surface width (ft)	Mean depth (ft)	Maximum depth (ft)	Mean velocity (fs)	Discharge (cfs)	Calculated MEF characteristics: Cross-sectional area (ft^2)	Discharge (cfs)	Unit runoff (cfs/mi)	Drainage basin characteristics: Area (mi^2)	Mean annual precipitation (in.)	Mean minimum temperature, January(°F)	% of basin forested	% of basin under lakes	Predicted flood Q_2 (cfs) 2-year flood	Q_{50} 50-year flood	Froude number (Aug. ,981 flow)	Calculated slope-area discharge at observed August 1983 stage (cfs)
1. Necona River	780	235	3.3	10.2	5.e	4,500	780	4,500	12.50	360	22	-8	30	3	2.450	6.360	0.26	1.930
2. Stony River below Necons River	2,600	510	5.1	12.8	b. 3	16,400	4,030	29,500	42.14	700	22	-3	LO	1	4,990	11,900	0.25	4,740
3. Telaquana River	1,440	335	4.3	9.8	2.1	2.960	1,870	4,180	9.39	445	22	-6	65	8	2.300	5,740	0.13	1,410
4. Stony River below Telaquana River	*2.960*	495	*6.0*	10.0	5.3	14,700	4,500	25,600	21.33	1,200	22	-8	JO	4	6.713	14.900	0.18	9.450
5. Rock Creek	155	95	*1.6*	3.5	4.7	130	250	1.370	21.08	65	22	-3	55	0	590	1.930	0.56	239
6. Little Underhill Creek	-[a]									285	22	-8	*60*	2	1,890	5,040		
7. Can Creek	160	105	*1.5*	7.2	3.8	605	310	1.460	8.11	180	22	-8	*20*	1	1,550	4,430	0.29	273
8. Stony River 4 mi above Lime Village	*2,890*	*635*	*4.6*	9.2	8.1	23.500	6,490	68.800	32.45	2.120	*22*	-8	55	3	11.800	24.200	0.48	10.600
9. Stink River										385	22	-8	50	7	2.130	5,430	0.04	
10. Stony River below Stink River	3.880	770	*5.0*	13.2	7.2	28,000	7.140	63,000	21.72	2.900	22	-8	60	4	14,900	29.400	0.35	*9.640*
11. Stony River above Kuskokwim River	3.890	450	*8.6*	9.2	6.0	23.200	5,580	17.500	11.54	3,250	22	-8	55	4	16.800	*32.700*	*0.25*	8,840

[a] No measurements made

Table 3. Field water quality at data collection sites, Stony River basin, Alaska, 1983-84.

Data	collection site	water temperature (°C) winter[a]	water temperature (°C) summer	Specific conductance (umhos/cm @ 25°C) winter	Specific conductance (umhos/cm @ 25°C) summer	Dissolved oxygen (mg/l) winter	Dissolved oxygen (mg/l) summer	pH winter	pH summer
1.	Necons River	-0.1	11.0	81	58	13.0	[b]	6.7	
2.	Stony River below Necons River	-0.2	10.0	84	49	12.3	12.2	6.0	
3.	Tclaquana River	-0.2	12.0	73	54	12.5		5.6	
4.	Stony River below Telaquana River	-0.2	12.0	80	56	11.8		6.0	–
5.	Rock Creek	-0.2	6.8	53	32	13.1		6.6	–
6.	Little Under-hill Creek		7.0	–	32	–	–	–	–
7.	Can Creek	-0.2	11.5	81	75	11.9		5.5	–
8.	Stony River 4 mi above Lime Village	-0.2	10.0	75	86	11.8		6.2	
9.	Stink River	-0.2	12.0	233	100	0.0		6.2	–
10.	Stony River below Stink River	-0.2	11.2	95	72	10.8	–	5.9	
11.	Stony River above Ruskokwim River	-0.1	12.0	41	58	10.0		5.6	–

[a] 'Winter' refers to reconnaissance of March 1984;'summer' to August 1983.
[b] No measurements made.