

Overview of Surface-Water Resources at the U.S. Coast Guard Support Center Kodiak, Alaska, 1987-89

By Gary L. Solin

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BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
GORDON P. EATON, Director

For additional information write to:

District Chief
U.S. Geological Survey
4230 University Drive, Suite 201
Anchorage, AK 99508-4664

Copies of this report may be purchased from:

U.S. Geological Survey
Branch of Information Services
Box 25286
Denver, CO 80225-0286

CONTENTS

Abstract	1
Introduction	1
Climate and physiography	5
Data collection	5
Surface-water discharge	6
July 1987	15
August 1987	15
May 1988	15
July 1988	15
February 1989	15
Estimates of peak, average, and low flows	16
Summary	17
References cited	18

FIGURES

1-3. Maps showing locations of:	
1. Kodiak Island, Alaska, and study area	2
2. Surface-water sites, U.S. Coast Guard Support Center Kodiak	3
3. Surface-water sites, Nyman Peninsula	4

PLATES

[Plates in pocket]

1. Drainage areas and surface-water flow directions, U. S. Coast Guard Support Center Kodiak
2. Drainage areas and surface-water flow directions, Nyman Peninsula and Kodiak Airport area

TABLES

1. Mean-monthly and mean-annual temperature, precipitation, and snowfall values, 1973-87, Kodiak Airport, Alaska	5
2. Surface-water data-collection sites and miscellaneous streamflow measurements, U.S. Coast Guard Support Center Kodiak	7
3. Water-surface elevations of selected streams and lakes	11
4. Water discharges at selected sites in the Buskin River drainage below Buskin Lake, February 23-24, 1989	16
5. Estimates of peak, average, and low flows for Buskin River	17

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
square mile (mi ²)	2.590	square kilometer
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second

In this report, temperature is reported in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by the following equation:

$$^{\circ}\text{F} = 1.8 (^{\circ}\text{C}) + 32$$

VERTICAL DATUM

Mean sea level: In this report, “mean sea level” refers to a tidal datum midway between the arithmetic means of the high-water heights and low-water heights for the Kodiak, Kodiak Island tidal station. This is also called mean tide level. Mean sea level is 4.3 feet above mean lower low water.

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Abstract

Hydrologic data at a U.S. Coast Guard Support Center on Kodiak Island, Alaska, were collected from 1987 through 1989 to determine hydrologic conditions and if contamination of soils, ground water, or surface water has occurred. This report summarizes the surface-water-discharge data collected during the study and estimates peak, average, and low-flow values for Buskin River near its mouth. Water-discharge measurements were made at least once at 48 sites on streams in or near the Center. Discharges were measured in the Buskin River near its mouth five times during 1987-89 and ranged from 27 to 367 cubic feet per second. Tributaries of Buskin River below Buskin Lake that had discharges greater than 1 cubic foot per second include Bear Creek, Alder Creek, Magazine Creek, Devils Creek and an outlet from Lake Louise. Streams having flows generally greater than 0.1 cubic foot per second but less than 1 cubic foot per second include an unnamed tributary to Buskin River, an unnamed tributary to Lake Catherine and a drainage channel at Kodiak airport. Most other streams flowing into Buskin River, and all streams on Nyman Peninsula, usually had little or no flow except during periods of rainfall or snowmelt. During a low-flow period in February 1989, discharge measurements in Buskin River and its tributaries indicate that three reaches of Buskin River below Buskin Lake lost water to the ground-water system, whereas two reaches gained water; the net gain in streamflow attributed to ground-water inflow at a location near the mouth was estimated to be 2.2 cubic feet per second. The 100-year peak flow for Buskin River near its mouth was estimated to be 4,460 cubic feet per second. Average discharge was estimated to be 125 cubic feet per second and the 7-day 10-year low flow was estimated to be 5.8 cubic feet per second.

INTRODUCTION

Kodiak Island is about 250 mi southwest of Anchorage in the Gulf of Alaska in south-central Alaska (fig. 1). The U.S. Coast Guard (USCG) Support Center Kodiak (fig. 2 and 3) (referred to as "Center" in this report) is on the east coast of Kodiak Island and was established during World War II as a U.S. Navy base. It covers about 55 mi² and served as a submarine base, air station, and port during and after the war. In 1972, the Navy transferred the station to the USCG. The Center is about 5 mi southwest of the city of Kodiak.

The USGS, at the request of USCG, began a study of geologic and hydrologic conditions in February 1987 to help determine the extent of contamination of soils, ground water, and surface water at the Center. This report summarizes water-discharge data collected by the USGS in streams and drainage channels on or near the Center during 1987-89. Other published reports of this investigation include those by Allely (1989), Brown (1989), Carr (1996), Combellick (1989), and Solie and Reifenstuhel (1989). USGS reports addressing ground-water resources and water quality are in progress.

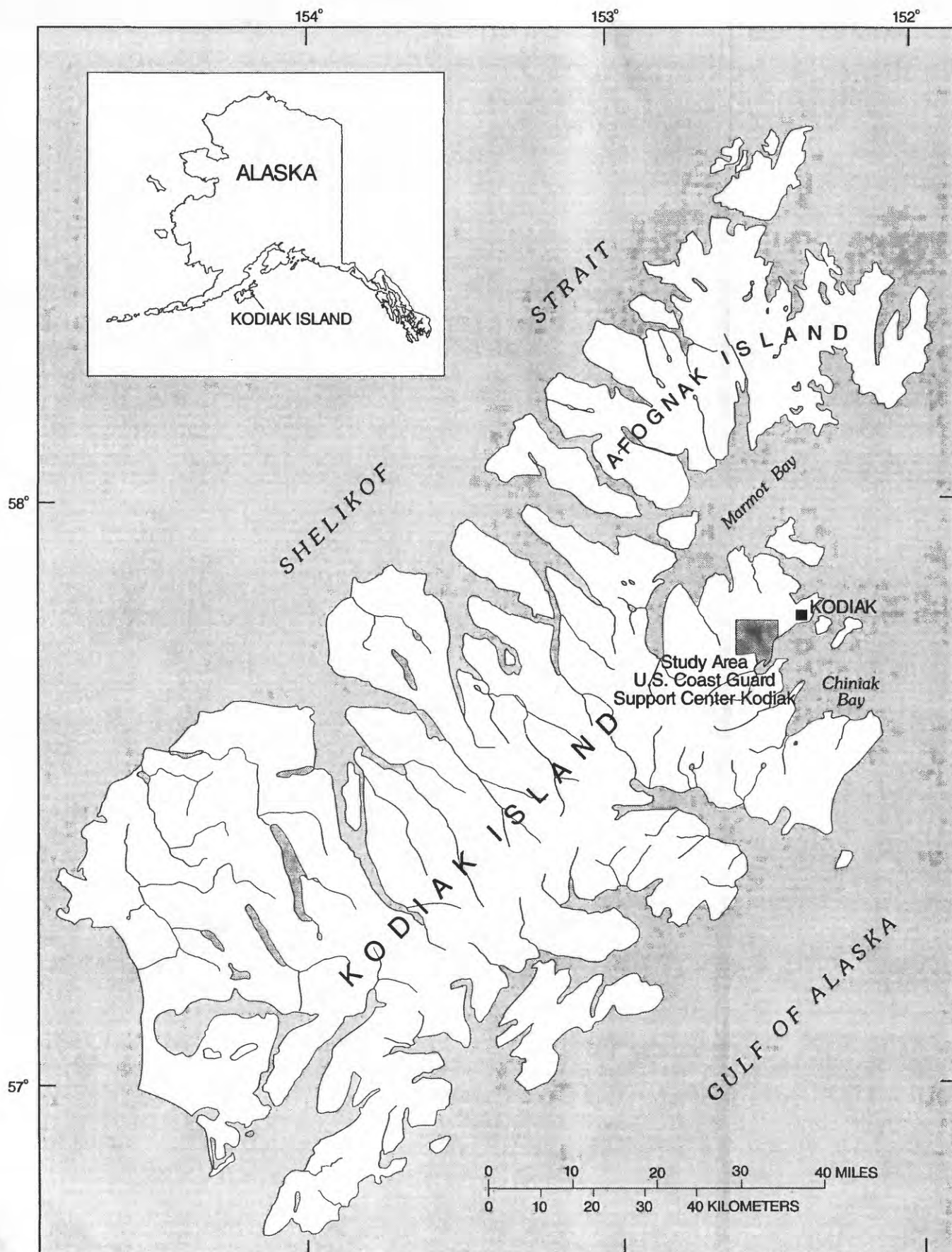
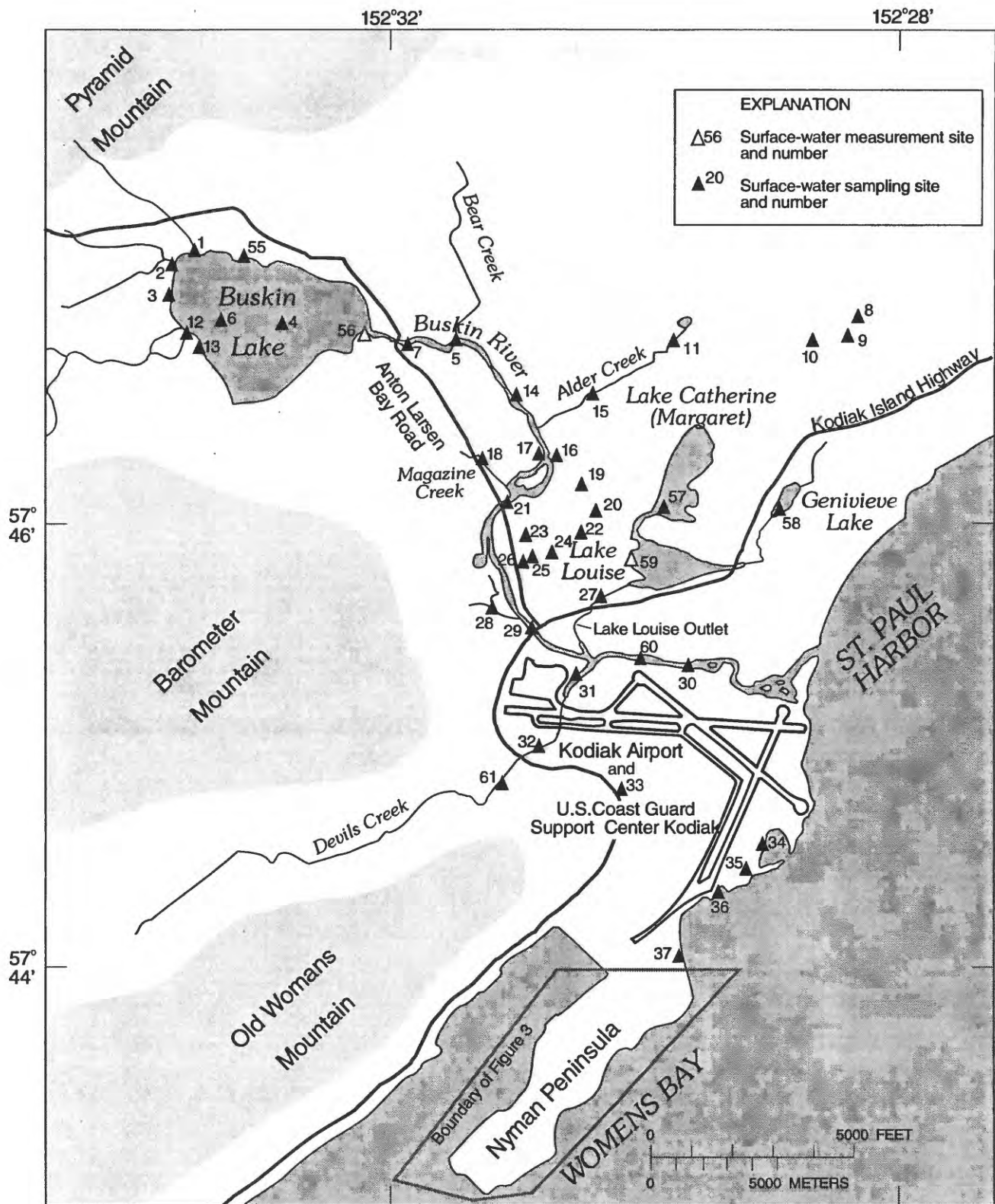


Figure 1. Location of Kodiak Island, Alaska, and study area.



Base from U.S. Geological Survey, Kodiak, Alaska, 1:250,000, 1952

Figure 2. Location of surface-water sites, U.S. Coast Guard Support Center Kodiak, Alaska.

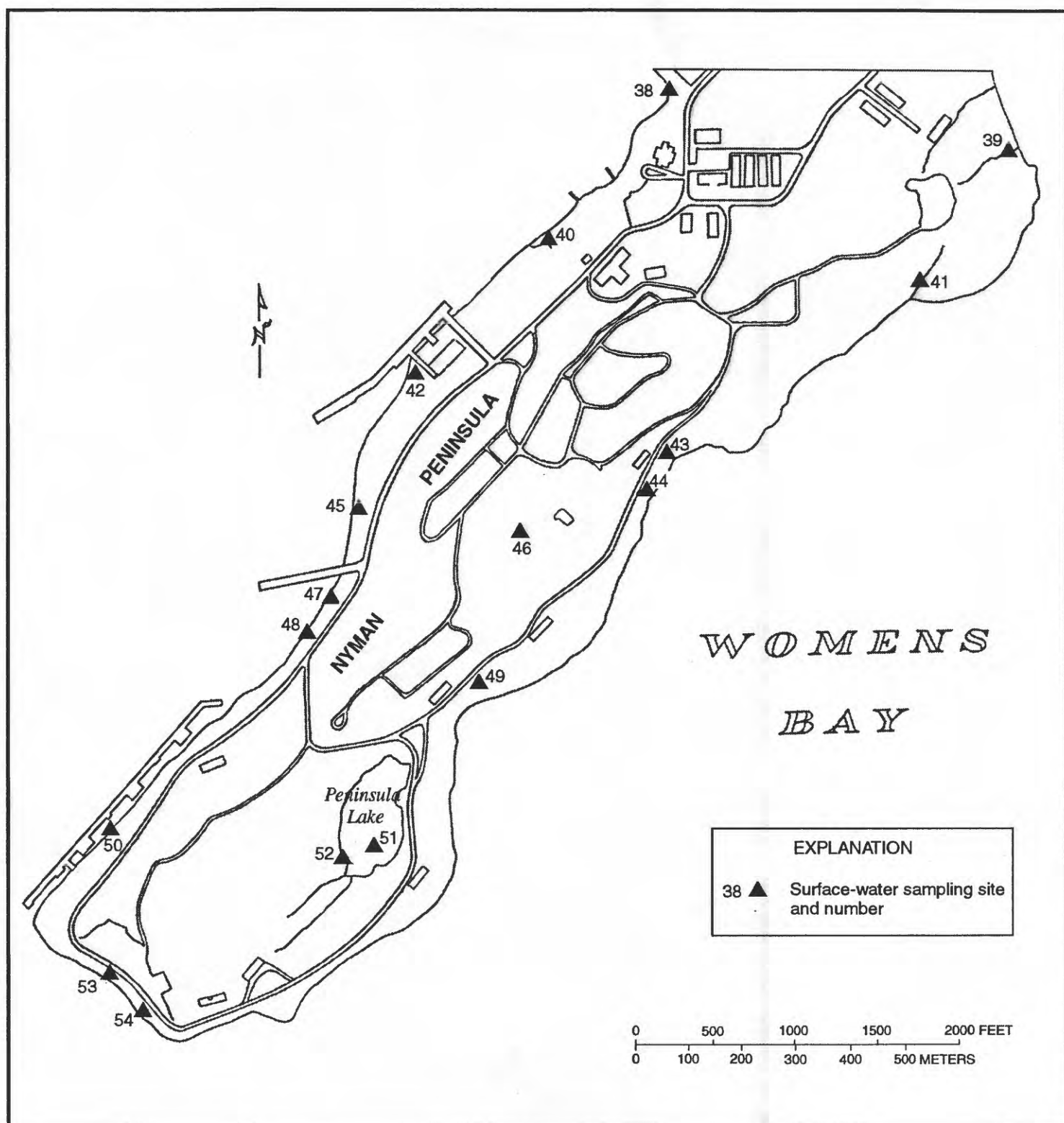


Figure 3. Location of surface-water sites, Nyman Peninsula. (See figure 2 for location.)

CLIMATE AND PHYSIOGRAPHY

Kodiak Island has a maritime climate characterized by small temperature variations. The island receives large amounts of precipitation and frequently experiences high velocity winds. Weather data from a station at the island's main airport adjacent the Center are available monthly from the National Oceanic and Atmospheric Administration and are summarized periodically by the University of Alaska (Leslie, 1989). From 1973-87, the mean annual temperature was 41.3 °F (table 1). Precipitation occurs mostly as rain. Mean annual precipitation (as inches of moisture, includes both rain and snow) is about 74 in. Mean annual snowfall is about 66 in. (Leslie, 1989).

Table 1. Mean-monthly and mean-annual temperature, precipitation, and snowfall values, 1973-87, Kodiak Airport, Alaska.

[Modified from Leslie (1989); °F, degree Fahrenheit]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature (°F)													
Mean maximum ¹	36.9	35.8	39.8	43.3	49.1	55.3	60.3	61.8	56.4	47.5	40.3	37.3	47.0
Mean minimum ²	27.6	25.1	29.0	31.9	38.1	43.8	48.7	48.6	43.8	34.9	29.5	26.8	35.7
Mean	32.3	30.5	34.4	37.6	43.6	49.6	54.5	55.2	50.2	41.2	35.0	32.1	41.3
Precipitation (inches of moisture)													Total
Mean	9.52	5.67	5.16	4.47	6.65	5.72	3.80	4.03	7.18	7.85	6.89	7.39	74.3
Snowfall (inches)													
Mean	12.7	14.8	10.8	8.1	0.4	0.0	0.0	0.0	0.0	2.0	6.9	9.9	65.6

¹Record maximum, 81 °F, July 1987.

²Record minimum, -8 °F, January 1975 and February 1982.

Steep, rugged, glaciated terrain characterizes most of Kodiak Island, including areas near and within the Center. Surface elevations near the Center range from sea level to 2,482 ft above sea level at Barometer Mountain (fig. 2). Bedrock is exposed throughout much of the Center and is predominantly metamorphic marine sedimentary rocks of Cretaceous age (Solie and Reifentstahl, 1989). Where not exposed, bedrock is covered by thin layers of glacial till, silt, volcanic ash, and (or) vegetated soil mat (Combellick, 1989).

Natural water drainage on Nyman Peninsula and the airport has been extensively altered by the construction of ditches, culverts, and storm-sewer lines. Many streams are short, have small drainage areas, and discharge directly into the ocean. The largest stream in the study area is Buskin River, which has a drainage area of about 26 mi². Buskin Lake is the primary source of water for the Center.

DATA COLLECTION

Discharge measurements were made at the time of water-quality sampling to document flow conditions. During stable conditions, discharge values and concentrations of chemical constituents can be used to calculate the quantity or "load" of chemical constituents or pollutant that has been added to or removed from a stream. Water-discharge measurements were also made to help quantify the quantity and timing of runoff in a drainage basin and help determine if water is flowing from a stream into the underlying aquifer (a "losing" stream) or if water flows from an aquifer into a stream (a "gaining" stream).

Water-discharge measurements were made at least once at 48 sites between 1987-89, including several sites along the Buskin River and its major tributaries (fig. 2). Many other sites were streams, drainage channels, or seeps near areas of potential contamination, such as landfills or areas where fuels or other chemicals were stored or spilled. Water-quality samples were collected at many of these sites prior to measurement of discharge during May 1988 through March 1989. All water-discharge measurements were made by using current meters or flumes, or by volumetric means using techniques described by Rantz and others (1982). These measurements are estimated to be within 5 percent of the true discharges, unless otherwise noted. Discharges of less than 0.01 ft³/s were commonly determined by volumetric measurements or by estimations of flow volume and time. Where possible, the drainage area for each site was determined from topographic maps, aerial photographs, and field reconnaissance. Estimates of peak, average, and low flows were made to help determine in which general parts of the flow regime the water-quality samples were collected.

Topographic contours, drainage areas, directions of surface-water flow, and data-collection sites are shown on plates 1 and 2.

SURFACE-WATER DISCHARGE

To help quantify runoff characteristics or to document flow conditions at the time of water-quality sampling, discharge was measured at three sites on the Buskin River (below Buskin Lake, map site 7; 1.3 mi below lake, map site 17; and near its mouth, map site 30). Discharge was also measured on two of its tributaries (Lake Louise Outlet, map site 27; and Devils Creek, map site 32) during July and August 1987, May and July 1988, and February 1989. (See figures 2 and 3 for map sites.) Water-discharge measurements were also made at least once at 43 other sites. Values of discharges measured are listed in table 2. The table also includes discharges measured by USGS before and after the study period. Water-surface elevations (stages) of selected streams and lakes are listed in table 3.

Discharge measurements were made in Buskin River near its mouth (map site 30) five times during 1987-89 and ranged from 27 to 367 ft³/s. The tributaries of Buskin River below Buskin Lake commonly having discharges greater than 1 ft³/s were Bear Creek (map site 5), Alder Creek (map sites 11 and 15), Magazine Creek (map site 18), Devils Creek (map sites 31 and 32), and Lake Louise Outlet (map site 27). Streams having flows generally greater than 0.1 ft³/s but less than 1 ft³/s include an unnamed tributary to Buskin River (map site 28), an unnamed tributary to Lake Catherine (map sites 9 and 10), and a drainage channel at Kodiak Airport (map site 35). Most other streams below Buskin Lake, as well as all streams on Nyman Peninsula, had little or no flow except during periods of rainfall or snowmelt. During late October 1991—after the study period of this investigation—heavy precipitation caused flooding of the Buskin River. The maximum flood discharge at Bridge 6 (map site 21) was estimated to have reached 3,510 ft³/s (B.B. Bigelow, USGS, written commun., 1995).

Table 2. Surface-water data-collection sites and miscellaneous streamflow measurements, U.S. Coast Guard Support Center Kodiak

[E, estimated; --, no data; <, less than; mi², square mile; ft³/s, cubic foot per second]

Map site No.	USGS station number	Station name	Drainage area (mi ²)	Date (yr, mo, day)	Discharge (ft ³ /s)
1	574658152332600	Buskin Lake Tributary (North-northwest)	--	19870728	E0.60
2	574654152333600	Buskin Lake Tributary (Northwest)	--	19870728	7.6
3	574646152333700	Buskin Lake Tributary (West)	--	19870728	0.45
4	574640152324600	Buskin Lake (Station 1)	--	--	--
5	574640152312300	Bear Creek at mouth	3.35	19890224	2.4
6	574638152331000	Buskin Lake (Station 2)	--	--	--
7	574636152314200	Buskin River below lake	12.0	19590717	43
				19870728	48
				19870819	20
				19880510	191
				19880724	87
				19890224	16
8	574635152283400	Unnamed Creek at Building 477 above substation	--	19870731	E<0.01
			--	19880719	0.02
9	574633152283400	Unnamed Creek above Building 477 Road	--	19870730	E0.20
10	574633152283800	Unnamed Creek below Transformer Substation	--	19870730	E0.40
11	574635152300500	Alder Creek at BB Road	--	19890224	1.1
12	574638152333000	Buskin Lake Tributary (Southwest 1)	--	19870729	18
13	574637152332800	Buskin Lake Tributary (Southwest 2)	--	19870729	3.0
14	574628152310400	Buskin River 0.9 mile below Buskin Lake	--	19890224	18
15	574624152303200	Alder Creek at G Road	1.49	19880510	21
				19880724	4.4
				19880816	0
				19890224	0
16	574612152304500	Unnamed Tributary 1 to Buskin River	--	19870728	E0.04
				19870819	0
				19890224	0
17	574612152304300	Buskin River 1.3 mile below Buskin Lake	17.4	19870728	49
				19870819	18
				19880510	278
				19880724	105
				19890224	17
18	574610152311700	Magazine Creek at 0.9 mile Anton Larsen Road	0.76	19880724	2.5
				19890224	1.2

Table 2. Surface-water data-collection sites and miscellaneous streamflow measurements, U.S. Coast Guard Support Center Kodiak--Continued

[E, estimated; --, no data, <, less than; mi², square mile; ft³/s, cubic foot per second]

Map site No.	USGS station number	Station name	Drainage area (mi ²)	Date (yr, mo, day)	Discharge (ft ³ /s)
19	574603152303000	Coast Guard Landfill Drain North	--	19870730	E <0.01
				19890224	E <0.01
20	574558152302200	Coast Guard Landfill Drain East	--	19870730	E <0.01
				19890224	E <0.01
21	574559152310400	Buskin River at Bridge 6	18.2	19720225	10
				19730222	27
				19730323	20
				19890224	23
				19911031	3,510b
				19911114	223
22	574553152302700	Coast Guard Landfill Drain South	--	19880511	E <0.01
				19890310	E <0.01
				19890311	E <0.01
23	574553152305200	Landfill Pond North of Red Lake	--	--	--
24	574546152304200	Red Lake Inlet Ditch Southeast	--	19870730	0.05
				19890223	E <0.01
25	574547152305000	Red Lake	--	--	--
26	574548152305400	Red Lake Outlet West	--	19890223	E <0.01
27	574538152301000	Lake Louise Outlet	1.79	19870730	1.2
				19870819	0.49
				19880510	6.6
				19880724	3.8
				19890224	2.9
28	574536152310900	Unnamed Tributary 2 to Buskin River	0.45	19890224	0.22
29	574530152304600	Buskin River at Kodiak Island Highway	19.3	19710318	27
				19880512	506
				19880816	57
				19890224	21
30	574522152294000	Buskin River near mouth below Bridge 2	25.3	19870727	71
				19870819	27
				19880510	367
				19880724	131
				19890224	28

Table 2. Surface-water data-collection sites and miscellaneous streamflow measurements,
U.S. Coast Guard Support Center Kodiak--Continued

[E, estimated; --, no data, <, less than; mi², square mile; ft³/s, cubic foot per second]

Map site No.	USGS station number	Station name	Drainage area (mi ²)	Date (yr, mo, day)	Discharge (ft ³ /s)
31	574522152303800	Devils Creek below runway near mouth	4.04	19680326	7.9
				19680510	18
				19680619	18
				19680731	31
				19870727	8.2
				19870819	2.7
				19880510	58
				19880724	18
32	574505152304200	Devils Creek above runway below highway	4.01	19911031	840b
				19870727	9.0
				19880510	52
				19880724	18
33	574446152300000	Drury Gulch at Kodiak Island Highway	--	19890224	3.5
				19880510	0.05
				19880724	<0.01
				19890223	E 0.02
34	574446152285300	Kodiak Airport Drainage Site 3	--	19890310	E 0.01
				19890311	E 0.01
35	574436152290800	Kodiak Airport Drainage Site 1	--	19890224	E 0.03
36	574429152292000	Kodiak Airport Drainage Site A	--	19890223	E 0.40
				19880511	E <0.01
37	574409152293600	Nyman Peninsula Drainage Site 9	--	19890223	0.02
				19871020	E 0.04
38	574408152301000	Nyman Peninsula Drainage Site 1	--	19890223	E <0.01
39	574405152293300	Nyman Peninsula Drainage Site 8	--	19890223	0.01
				19871020	E 0.01
40	574358152302000	Nyman Peninsula Drainage Site 2	--	19890223	E <0.01
41	574355152294500	Nyman Peninsula Drainage Site 6a	--	19890223	(a)
				19880511	E 0.01
42	574351152304100	Nyman Peninsula Drainage Site 2a	--	19890223	0
43	574345152301200	Nyman Peninsula Drainage Site 6	--	19881009	E 0.01
				19870729	E 0.01
44	574344152301500	Nyman Peninsula Drainage Site 5a	--	19890223	<0.01
				19880511	<0.01

Table 2. Surface-water data-collection sites and miscellaneous streamflow measurements, U.S. Coast Guard Support Center Kodiak--Continued

[E, estimated; --, no data, <, less than; mi², square mile; ft³/s, cubic foot per second]

Map site No.	USGS station number	Station name	Drainage area (mi ²)	Date (yr, mo, day)	Discharge (ft ³ /s)
45	574342152304800	Nyman Peninsula Drainage Site 3	--	19870729	<0.01
				19890223	0.02
46	574341152302400	Nyman Peninsula Drainage Site 7 Tank	--	--	--
47	574337152305000	Nyman Peninsula Drainage Site 3a	--	19880511	<0.01
				19890223	0.01
48	574335152305200	Nyman Peninsula Drainage Site 3b	--	19880511	E 0.01
				19890223	0
49	574333152302800	Nyman Peninsula Drainage Site 5	--	19890223	E 0.01
50	574323152311500	Nyman Peninsula Drainage Site 3c	--	19880511	E <0.01
				19890223	0
51	574322152304600	Peninsula Lake	--	--	--
52	574325152305200	Peninsula Lake Inlet Nyman Peninsula	--	19871020	E 0.02
53	574314152311400	Nyman Peninsula Drainage Site 3d	-	19880511	E 0.10
				19890223	E 0.01
54	574313152311600	Nyman Peninsula Drainage Site 4	--	19870729	E <0.01
				19890223	0
55	574700152330000	Unnamed Creek north of Buskin Lake	--	--	--
56	574640152321100	Buskin Lake elevation site	--	--	--
57	574600152295200	Catherine (Margaret) Lake	--	--	--
58	574600152290000	Genevieve Lake	--	--	--
59	574551152300300	Lake Louise elevation site	--	--	--
60	15297440	Buskin River	25.2	19680731	210
				19690218	11.7
				19710318	27.1
61	15297439	Devils Creek	3.90	19700625	38.5
				19700804	11.2
				19701013	14.7
62	574500152300000	Kodiak climate station	--	--	--

Table 3. Water-surface elevations of selected streams and lakes, U.S. Coast Guard Support Center Kodiak

[a, stage elevation affected by backwater from ice]

Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)	Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)
Buskin River below lake (map site 7)			Buskin River at Kodiak Island Highway (map site 29)		
19880724	1605	65.95	19880510	1240	20.25
19880816	1715	64.64	19880512	1020	20.68
19880817	1059	64.69	19880512	1120	20.74
19880830	1420	65.65	19880614	1230	20.12
19880928	1758	65.15	19880630	0940	19.81
19881108	1719	64.88	19880630	2210	19.78
19881205	1140	a64.70	19880701	1045	19.74
19890109	1620	a64.63	19880715	1900	19.74
19890224	1040	64.35	19880716	0940	19.71
19890427	1913	65.10	19880717	2045	19.68
			19880718	0930	19.68
Buskin River at Bridge 6 (map site 21)			19880719	1125	19.68
19880724	1627	26.23	19880719	2325	20.08
19880816	1355	25.83	19880720	1015	20.22
19880816	1720	25.82	19880721	1000	20.03
19880817	1020	26.10	19880721	2240	19.92
19880824	1215	26.12	19880722	0945	19.88
19880830	1414	26.96	19880722	2020	19.80
19880928	1804	26.44	19880723	0845	19.80
19881108	1725	26.59	19880724	0745	19.76
19881205	1150	a25.78	19880724	1455	19.73
19890109	1640	a25.82	19880724	1800	19.71
19890224	1340	25.38	19880725	1545	19.68
19890427	1918	26.77	19880815	0905	19.44
			19880816	0910	19.42

Table 3. Water-surface elevations of selected streams and lakes, U.S. Coast Guard Support Center Kodiak--Continued

[a, stage elevation affected by backwater from ice]

Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)	Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)
Buskin River at Kodiak Island Highway (map site 29) (Continued)			Buskin River at Kodiak Island Highway (map site 29) (Continued)		
19880816	1730	19.43	19880921	1015	19.75
19880817	0645	19.45	19880922	0920	20.28
19880817	1015	19.57	19880923	1000	20.22
19880817	1555	19.88	19880924	1500	20.24
19880824	0820	19.68	19880926	1010	20.63
19880824	2145	19.64	19880927	1000	20.20
19880825	0710	20.33	19880928	0900	20.00
19880825	1435	20.58	19880928	1818	19.90
19880825	1720	20.66	19880929	0900	19.69
19880830	1400	20.29	19880930	0820	19.74
19880901	1000	19.93	19881001	0950	19.67
19880901	2125	19.88	19881002	0845	21.84
19880902	0745	19.97	19881002	1755	21.48
19880902	1510	19.97	19881003	0855	20.86
19880907	1000	19.66	19881004	0935	20.42
19880908	0944	19.64	19881005	0845	20.20
19880909	1020	19.54	19881006	0910	20.01
19880911	1125	20.14	19881007	0848	19.98
19880912	0835	20.02	19881008	0815	19.90
19880913	0933	19.90	19881009	1010	19.80
19880914	1000	19.79	19881010	1010	19.89
19880915	1130	19.72	19881011	1010	21.02
19880916	0922	19.66	19881012	1010	20.51
19880917	1220	19.69	19881013	1015	20.16
19880918	1000	19.76	19881014	0900	19.97
19880919	0850	20.54	19881015	0902	20.44
19880920	0930	19.85	19881016	0903	19.75

Table 3. Water-surface elevations of selected streams and lakes, U.S. Coast Guard Support Center Kodiak--Continued

[a, stage elevation affected by backwater from ice]

Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)	Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)
Buskin River at Kodiak Island Highway (map site 29) (Continued)			Buskin River at Kodiak Island Highway (map site 29) (Continued)		
19881017	0850	19.94	19890307	2045	a19.16
19881018	0853	19.73	19890310	1930	a19.12
19881019	1005	20.06	19890311	1745	a19.13
19881020	0958	19.80	19890418	1730	19.63
19881020	1000	19.94	19890427	1315	19.85
19881022	0115	20.33	19890427	1820	20.05
19881108	1015	19.62	19890428	0820	20.94
19881108	1739	19.98	19890428	1800	20.58
19881109	0830	21.59	19890429	0930	20.44
19881109	1750	21.94	19890429	1720	20.35
19881110	0915	21.79	19890510	1030	19.95
19881110	1330	21.55	19890511	0900	19.90
19890109	1000	a19.60	19890512	0820	19.87
19890109	1520	a19.47	19890513	0815	19.85
19890110	0950	19.38	19890515	0810	19.88
19890110	1835	a19.45	19890516	2100	19.79
19890111	0900	a19.51	19890517	0820	19.89
19890111	1620	19.48	19890518	0830	19.73
19890215	0850	a19.15	19890519	0845	19.73
19890222	0830	a19.23	19890520	0800	19.74
19890222	1540	a19.25	19890521	0800	19.73
19890223	0830	a19.72	19890616	0930	20.06
19890223	1850	a19.19	19890616	1900	20.13
19890224	0835	a19.18	19890620	1600	20.00
19890224	1545	a19.19	19890622	1000	20.50
19890224	1810	a19.19	19890816	0830	19.50
19890302	1030	a19.16	19890817	0630	19.48

Table 3. Water-surface elevations of selected streams and lakes, U.S. Coast Guard Support Center Kodiak--Continued

[a, stage elevation affected by backwater from ice]

Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)	Date (Year, month, day)	Time	Elevation of water surface (feet above mean sea level)
Buskin Lake elevation site (map site 56)			Buskin River (map site 60)		
19880630	1531	66.29	19880724	1420	10.30
19880724	1531	65.96	19880816	1735	10.11
19880725	1015	65.92	19880817	1120	10.36
19880816	1710	65.59	19880825	1715	11.47
19880817	1057	65.66	19880830	1500	10.61
19880830	1425	66.65	19880928	1820	10.38
19880928	1754	66.07	19881108	1745	10.77
19881108	1716	65.87	19890109	1245	a10.31
19890427	1910	66.13	19890111	1610	10.03
19890616	0845	66.23	19890224	1553	9.87
			19890427	1655	10.38
Lake Louise elevation site (map site 59)					
19880816	1330	21.78			
19880817	1110	21.88			
19880824	1015	21.99			
19880830	1435	21.98			
19880928	1809	22.26			
19881108	1732	22.13			
19890427	1844	22.18			
19890616	0925	22.18			

July 1987

Measurements of discharge were made at 21 sites during July 27-30, 1987. Total precipitation for the month of July 1987 was only 1.25 in.; thus, the observed flows may be lower than average summer flows. Discharge measurements were made in five tributaries to Buskin Lake (map sites 1, 2, 3, 12 and 13), Buskin River (map sites 7, 17 and 30), a tributary to Lake Catherine (map sites 8, 9 and 10), a tributary to Lake Louise (map site 20), tributaries to Buskin River below Buskin Lake (sites 16, 19, 24, 27, 31 and 32), and three drainage sites on Nyman Peninsula (map sites 43, 45 and 54). The total contribution of the five measured tributaries to Buskin Lake was about 30 ft³/s, whereas the lake's outflow was 48 ft³/s. Devils Creek (map site 32) and Lake Louise Outlet (map site 27) had the largest measured discharges for tributaries below the lake, 9 and 1.2 ft³/s, respectively. Near its mouth (map site 30), Buskin River had a discharge of 71 ft³/s. Discharges in three drainage ditches on Nyman Peninsula were 0.01 ft³/s or less.

August 1987

Discharges measured at six sites on August 19, 1987, were at or near their lowest levels at each site during the study. Precipitation for the months of July and August 1987 totaled only 1.90 in.; this value is considerably less than the monthly means for July and August, which total 7.83 in. (table 1). The discharge in the Buskin River below Buskin Lake (map site 7) was 20 ft³/s, but discharge at site 17, which is 1.3 mi below the lake, was only 18 ft³/s. This lower discharge indicates that within this reach, the Buskin River was losing water to the ground-water system.

May 1988

Discharges measured at 17 sites during May 10-12, 1988, were the highest flows measured at each site during the study. The discharge in the Buskin River near its mouth (map site 30) was 367 ft³/s on May 10. On May 12, Buskin River at Kodiak Island Highway (map site 29), 0.7 mi above map site 30, had a discharge of 506 ft³/s. A stream draining part of the airport (map site 36) and drainages on Nyman Peninsula (map sites 41, 44, 47, 48, 50 and 53) had discharges ranging from less than 0.01 to 0.1 ft³/s.

July 1988

Discharge measurements were made at 10 sites on July 24, 1988. Total precipitation for July 1988 was 4.11 in. and streamflows were at about average levels. Buskin River near its mouth (map site 30) had a discharge of 131 ft³/s.

February 1989

Water-discharge measurements were made at 36 sites during a stable winter low-flow period during February 23-24, 1989 (table 4), when the relative contribution of ground water to streamflow was expected to be high. Discharges measured in Buskin River and its tributaries (table 4) indicate that the Buskin River was "losing" about 1.1 ft³/s of streamflow to the ground-water system from below Buskin Lake (map site 7) to about 1.3 mi below the lake (map site 17). Alder Creek was also a "losing" stream in February 1989; discharge at site 11 on Alder Creek was 1.1 ft³/s, whereas downstream at site 15, no flow was observed. No flow was also observed entering the Buskin River from unnamed tributary 1 (map site 16) and unnamed tributary 2, even though flows were observed upstream in each tributary. Buskin River gained 4.6 ft³/s above Bridge 6 (map site 21) and 0.8 ft³/s above the mouth (map site 30) where bedrock occurs in the walls of the stream chan-

nels. However, a reach above the Kodiak Island Highway (map site 29) between map sites 21 and 30 lost 2.1 ft³/s to the ground-water system. Of the 28.3 ft³/s measured at the mouth, 15.9 ft³/s was from Buskin Lake, 10.2 ft³/s was from tributary streams, and 2.2 ft³/s was estimated to be from ground-water discharge.

Table 4. Water discharges at selected sites in the Buskin River drainage below Buskin Lake, February 23-24, 1989

[Discharge data in cubic feet per second; --, no data]

Map site No.	Station name	Drainage area (square miles)	Measured discharge		Gain from (+) or loss to (-) ground-water system
			Inflow	Main stem	
7	Buskin River below Lake	12.0	--	15.9	--
5	Bear Creek at Mouth	2.4	2.4	--	--
14	Buskin River 0.9 Mile Below Buskin Lake	--	--	17.5	-0.8
15	Alder Creek at G Road	1.49	0	--	--
16	Unnamed Tributary 1 to Buskin River	--	0	--	--
17	Buskin River 1.3 Mile below Buskin Lake	17.4	--	17.2	-0.3
18	Magazine Creek at 0.9 Mile Anton Larsen Road	0.76	1.2	--	--
21	Buskin River at Bridge 6	18.2	--	23.0	+4.6
28	Unnamed Tributary 2 to Buskin River	0.45	0.2	--	--
29	Buskin River at Kodiak Island Highway	19.3	--	21.1	-2.1
32	Devils Creek above Runway below Highway	4.01	3.5	--	--
27	Lake Louise Outlet	1.79	2.9	--	--
30	Buskin River near mouth below Bridge 2	25.3	--	28.3	+0.8

ESTIMATES OF PEAK, AVERAGE, AND LOW FLOWS

The primary causes of floods in the Kodiak region are spring snowmelt or summer and fall rainstorms (Jones and others, 1978); however, high streamflows derived from rainfall can occur in any month. Peak discharges at 2-, 10-, and 100-year recurrence intervals (table 5) were estimated for the Buskin River at Bridge 6 (map site 21) and near the mouth of the river using techniques described by Jones and Fahl (1994). For Buskin River near mouth, the peak discharge having a 100-year recurrence interval was estimated to be 4,460 ft³/s; that is, every year has a 1 percent chance that the Buskin River will have a discharge greater than 4,460 ft³/s. The standard error values listed are a measure of the accuracy associated with the calculated value; a large relative range indicates a small degree of accuracy between true and calculated values.

Table 5. Estimates of peak, average, and low flows for Buskin River
[Data in cubic feet per second]

Streamflow characteristic	Value	Range of standard error
Buskin River at Bridge 6 near Kodiak (map site 21) (Drainage area is 18.2 mi²)		
2-year peak discharge	1,200	900 to 1,610
10-year peak discharge	2,000	1,480 to 2,700
100-year peak discharge	3,050	2,170 to 4,270
Buskin River near mouth (Drainage area is 25.5 mi²)		
Average discharge	125	86 to 180
7-day 10-year low flow	5.8	No flow to 13.0
2-year peak discharge	1,740	1,300 to 2,330
10-year peak discharge	2,920	2,160 to 3,940
100-year peak discharge	4,460	3,170 to 6,240

Average discharge is the arithmetic mean of the individual daily mean discharges for a year. Using regional equations developed for south-central Alaska by Parks and Madison (1985), the average discharge for the Buskin River near its mouth was estimated to be 125 ft³/s.

The “7-day 10-year low flow” is an estimate of the minimum mean discharge for seven consecutive days having a recurrence interval of once in 10 years. A discharge of 5.8 ft³/s was calculated to be the 7-day 10-year low flow value for Buskin River near mouth using techniques described by Parks and Madison (1985). In other words, the probability that the mean daily discharge will be less than 5.8 ft³/s for seven consecutive days in any year is 10 percent.

SUMMARY

Water-discharge measurements were made at 48 sites in streams in or near the U.S. Coast Guard Support Center Kodiak on Kodiak Island, Alaska, during 1987-89. Measured flows in the Buskin River near its mouth ranged from 27 to 367 ft³/s, whereas the average flow was estimated to be 125 ft³/s. During a winter low-flow period, the length of the three reaches of the Buskin River below Buskin Lake losing water to ground water was longer than the two reaches gaining water. Ground water was estimated to contribute 2.2 ft³/s to the flow of the Buskin River at the most downstream site near the mouth. Most streams on Nyman Peninsula have small drainage areas and have little or no flow except during rainfall or snowmelt.

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