

**WATER RESOURCE INVENTORY
AND ASSESSMENT
ARCTIC NATIONAL WILDLIFE REFUGE
1987-1992 Final Report**



Water Resource Branch
Fish and Wildlife Service
U.S. Department of the Interior
Anchorage, Alaska

WATER RESOURCE INVENTORY AND ASSESSMENT,
COASTAL PLAIN, ARCTIC NATIONAL WILDLIFE REFUGE
1987-1992 Final Report

Steven M. Lyons
John M. Trawicki

June 1994

Water Resource Branch
Fish and Wildlife Service
U.S. Department of the Interior
Anchorage, Alaska

Acknowledgements:

A special thank you to Jon Kostohrys of the Bureau of Land Management for his review of this manuscript, Bob Burrows of the U.S. Geological Survey for his technical review of the field techniques and of this manuscript, and to Ken Thompson of the U.S. Geological Survey for his review of the analysis techniques.

The correct citation for this report is:

Lyons, Steven M., and John M. Trawicki. 1994. Water resource inventory and assessment, Coastal Plain, Arctic National Wildlife Refuge, 1987-1992 final report, WRB 94-3. U.S. Department of the Interior, Fish and Wildlife Service, Anchorage, Alaska.

TABLE OF CONTENTS

INTRODUCTION	1
PHYSICAL AND BIOLOGICAL ENVIRONMENT	2
Wetlands	2
Permafrost	4
Surficial Deposits	4
Climate	4
Vegetation Types	5
Wildlife Resources	5
Fishery Resources	6
HYDROLOGY	6
Streams	7
Springs	9
Lakes	9
Groundwater	9
Watershed Description	10
METHODS	12
Project Scoping	12
Stream Discharge	12
Winter Water in Streams	14
Lake Volume	14
Lake Surface Water Elevation	15
RESULTS	15
Project Scoping	15
Stream Discharge	17
Lake Volume	20
Lake Surface Water Elevation	20
DISCUSSION and RECOMMENDATIONS	22
REFERENCES	28
Appendix A	

WATER RESOURCE INVENTORY AND ASSESSMENT
COASTAL PLAIN, ARCTIC NATIONAL WILDLIFE REFUGE

Final Report (1987-1992)

INTRODUCTION

The potential for oil and gas exploration and development along the coastal plain of the Arctic National Wildlife Refuge (Arctic NWR) has raised the issue and concern that competing uses of the limited water resources may have adverse impacts on the habitats and populations of fish and wildlife. The purpose of this study was to collect baseline hydrologic data required to quantify water resources and to aid resource managers in making sound management decisions along the coastal plain of the Arctic NWR.

Public Land Order 2214, December 6, 1960, established the Arctic National Wildlife Range by withdrawing the public lands "... for the purpose of preserving unique wildlife, wilderness, and recreational values..." to be managed by the U.S. Fish and Wildlife Service. Public Land Order 2214 was the first Federal action withdrawing lands and establishing a Federal Reserve Water Rights priority date for the Arctic National Wildlife Range. On December 2, 1980, the Alaska National Interest Lands Conservation Act (ANILCA) added 9.16 million acres to the Range and changed the name to the Arctic National Wildlife Refuge. ANILCA placed the majority of the Arctic NWR in wilderness designation. Section 1002(c) of ANILCA excluded the coastal plain of the Arctic NWR (sometimes referred to as the 1002 area) from wilderness designation for the purpose of study of the fish, wildlife and potential energy resources. ANILCA also broadened the purpose for which the Arctic NWR was established (Section 303(2)(B)) and specified that the Arctic NWR should be managed:

- (i) to conserve fish and wildlife populations and habitats in their natural diversity including but not limited to, the porcupine caribou herd... polar bears, grizzly bears, muskox, Dall sheep, wolves, wolverines, snow geese, peregrine falcons, and other migratory birds and Arctic char and grayling;
- (ii) to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;
- (iii) to provide, in a manner consistent with the purpose set forth in subparagraph (i) and (ii), the opportunity for continued subsistence uses by local residents; and
- (iv) to ensure to the maximum extent practicable and in a manner consistent with the purpose set forth in paragraph (i), water quality and necessary water quantity within the refuge.

Clearly the intent of Congress was to reserve the necessary waters to protect the fisheries, wildlife and their habitats in their natural diversity.

This report is a summary of the hydrologic inventory and assessment conducted by the Water Resources Branch, U.S. Fish and Wildlife Service (1987-1992) on the coastal plain of the Arctic NWR. The U.S. Fish and Wildlife Service (1989), Lyons (1990), Lyons and Trawicki (1991, 1992, and 1993) collected and reported discharge and water temperature data for several rivers and streams in the coastal plain of the Arctic NWR for the open water seasons of 1988, 1989, 1990, 1991, and 1992 respectively. An inventory of winter water availability within river systems was conducted by Elliott (1989), and Elliott and Lyons (1990). Trawicki et al. (1991) collected depth profile measurements to determine lake volumes for 119 lakes across the coastal plain of the Arctic NWR. Under contract to U.S. Fish and Wildlife Service Global Positioning Service, Inc. (1993) surveyed the elevations of the water surface and the outer perimeter of the wet meadow zone for 150 lakes. This report summarizes the methods and results of these five projects.

PHYSICAL AND BIOLOGICAL ENVIRONMENT

The coastal plain of the Arctic NWR is located more than 250 miles north of the Arctic Circle in the remote northeast corner of Alaska adjacent to the Beaufort Sea. The coastal plain of the Arctic NWR extends south from the Beaufort Sea approximately 40 miles to the foothills of the Brooks Range. The coastal plain of the Arctic NWR extends from its western boundary, the Canning River, east approximately 100 miles to the Aichilik River. There are 10 large rivers and 14 named smaller rivers or streams in the coastal plain of the Arctic NWR. Rivers and streams flow north from the Brooks Range to the Beaufort Sea.

The Inupiat Eskimo village of Kaktovik is located on Barter Island just north of the coastal plain. Prudhoe Bay is located approximately 115 miles to the west of Kaktovik. There are no roads within the refuge. Access to the coastal plain of the Arctic NWR is by charter aircraft from either Prudhoe Bay, Barter Island or Fairbanks.

Wetlands

Approximately 99 percent of the coastal plain, Arctic NWR is classified as wetland. Wetlands in the Arctic are broken down into five (5) classification systems: marine, estuarine, riverine, lacustrine, and palustrine. The systems are subdivided into a number of subsystems. The vast majority of the coastal plain of the Arctic NWR fall into the palustrine system, which is commonly referred to as wet tundra or tussock tundra (National Wetlands Inventory, unpublished). Arctic wetland areas generally have dense vegetative cover and permafrost occurring at a shallow depth due to the insulating effect of the vegetation. Soils in the wetland areas remain saturated throughout most of the growing season. The small area of non-wetland habitat along the coastal plain of the Arctic NWR is generally restricted to upland areas with sparse vegetation where depth to permafrost is great enough for soils to be well drained (Clough et al. 1987, and U.S. Fish and Wildlife 1988).

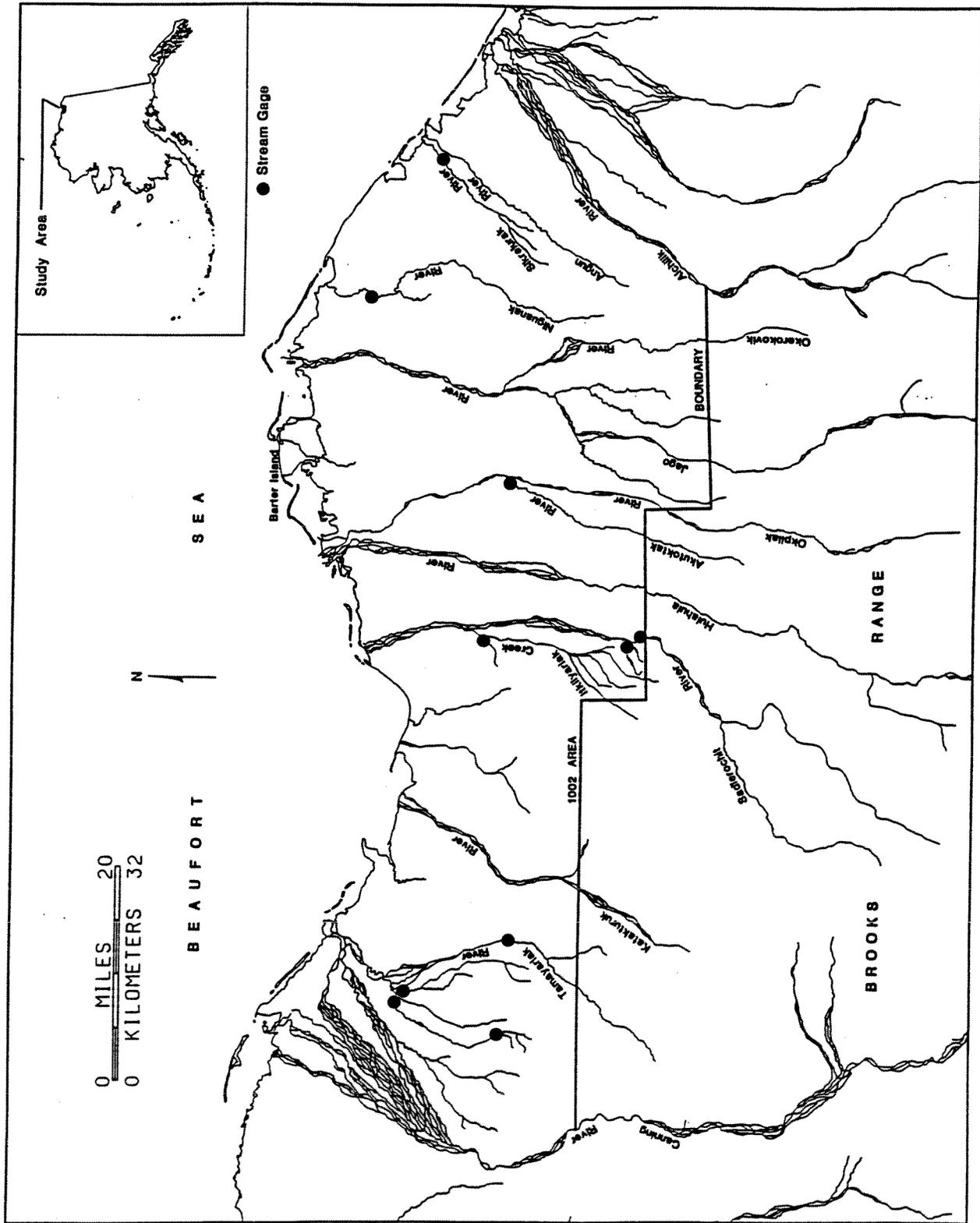


Figure 1.-The 1002 area of the Arctic National Wildlife Refuge with stream discharge gaging station locations.

Permafrost

Permafrost is a controlling physical force with respect to the water resources along the North Slope. Permafrost is defined as perennially frozen ground and may consist of soil, rock, minerals, organic matter, bedrock, and ice. With the exception of a small area associated with Sadlerochit Springs, the entire coastal plain of the Arctic NWR is thought to be underlain with permafrost with an active layer that is one to five feet thick. Permafrost depths across the Arctic slope range from a few feet to greater than 2,200 feet in the vicinity of Prudhoe Bay (Clough et al. 1987). Permafrost restricts infiltration of surface water, limits soil water storage and increases runoff from precipitation events. Permafrost also eliminates the availability of ground water within the frozen zone. The formation of ice wedges in the permafrost play an important role in the succession of thaw lakes (Sloan 1987).

Surficial Deposits

Surficial deposits in the Arctic NWR include Quarternary and Recent deposits of glacial, alluvial, eolian and colluvial sediments. Although at least six glacial advances occurred in the refuge, glaciers apparently never advanced more than a few miles beyond the present mountain front. Still, alluvium along the coastal plain of the Arctic NWR is reworked glacial deposits that have been eroded and transported by stream action (Clough et al. 1987, and Hartman 1973).

Climate

Climate of the coastal plain is considered to be Arctic marine (Clough et al. 1987), characterized by short, cool summers, with continuous daylight. Winters are long, dark, and extremely cold. The average temperature for the warmest month on Barter Island is 43°F. Daily summer temperatures vary from below freezing to the record high of 78°F. Winter temperatures are also extremely variable. The average January temperatures for Barter Island varied from +4.5°F in 1981 to -21.8°F in 1983. The record minimum temperature for Barter Island is -59°F set in February, 1950 (Clough et al. 1987). Temperatures along the coast are moderated by the effects of the open water of the Beaufort Sea. Summer winds, precipitation, and fog are generally greater in the immediate coastal areas while inland summer temperatures are warmer with a greater diurnal variation.

Precipitation along the coastal plain usually occurs as light rain or drizzle during the summer and as light snow in the winter. Snow may occur during any month of the year. Average precipitation for Barter Island is 6.3 inches (Clough et al. 1987). Snow accounts for more than half of the average annual precipitation. Most snow fall occurs from September-November and in January. Snow cover is persistent throughout the winter, though strong winds redistribute the snow creating large snow drifts and exposed ridges.

There are no precipitation gages located within the coastal plain of the Arctic NWR. The closest precipitation gage is located on Barter Island, and is operated by the U.S. Soil Conservation Service (SCS). The SCS also maintains six other precipitation gages in the Arctic region: Atigun Camp, Atigun Pass, Barrow, Prudhoe Bay, Sagwon, and Toolik River. The National Oceanic and Atmospheric Administration (NOAA) maintained a weather station on Barter Island from 1956 to 1989. NOAA presently maintains seven (7) weather stations in the Arctic region. The data collected from these weather stations are not representative of precipitation events that occur in the drainage basins of the Arctic NWR coastal plain area, but do provide general climatic conditions for the Arctic slope.

Vegetation Types

Walker et al. (1982) mapped five (5) distinct vegetation cover types on the coastal plain, Arctic NWR: foothills (45%), river flood plains (25%), hilly coastal plains (22%), flat thaw-lake plains (3%), and mountains (0.05%). Foothill vegetation cover type comprises about 45% of the Arctic NWR coastal plain, and extends from the Canning River to the Sadlerochit River, and rises from Camden Bay to the foothills of the Sadlerochit Mountains. Vegetation is dominated by sedges and tussock forming sedges. Dwarf willow and birch is common, but sparsely distributed. The river flood plain vegetation type consists of the barren deltas and river flood plains of the larger rivers, terraces and alluvial areas associated with old river channels, and the deltaic formations at the base of the foothills. Land cover of the river flood plain vegetation includes water, barren and sparsely vegetated flood plains, wet germinoid, moist/wet tundra complex, dry prostrate dwarf scrub and moist graminoid tussock tundra. The hilly coastal plain cover type accounts for 22% of the coastal plain of the Arctic NWR, mainly east of the Sadlerochit River. This region with slightly elevated ridges and depressions is dominated by moist/wet tussock tundra and moist prostrate dwarf scrub. Flat thaw-lake plains compromise 3% of the coastal plain of the Arctic NWR located generally between the Canning and Tamayariak River Deltas. The mountain terrain area is complex and is interspersed with nonvegetated and talused slopes mostly above 1,970 feet. The vegetation types mapped by Walker et al. (1982) are different from those used in the National Wetland Inventory.

Wildlife Resources

Approximately 30 species of mammals use the coastal plain, Arctic NWR and its coastal waters, eight of which are marine mammals (Tweeten 1985, and Clough et al. 1987). The entire coastal plain of the Arctic NWR is within the calving grounds of the Porcupine caribou herd numbering 180,000 animals in 1986. Sixty-four muskox were reintroduced in to the coastal plain of the Arctic NWR in 1969 and 1970. In 1985 the population was estimated at more than 476 animals. Moose, Dall sheep, wolves, Arctic foxes, brown bears, and a variety of ground squirrels and rodents are found throughout the coastal plain of the Arctic NWR. Polar bears, seals, and whales are found in or near the refuge coastal waters. The endangered bowhead whale is found off the coast of

the coastal plain and is taken for subsistence by the residents of Kaktovik (Clough et al. 1987).

One hundred thirty-five species of birds have been recorded on the coastal plain, Arctic NWR (Clough et al. 1987). The majority are migratory, and are present for only a brief period between May and September. Six species are considered to be year round residence: rock and willow ptarmigan, snowy owl, common raven, gyrfalcon, and the American dipper. Swans, geese and ducks use the coastal plain area for breeding and/or staging. As many as 100 swan nests have been observed during annual surveys. Four species of geese use the coastal plain annually. Seven species of seabirds are known to breed there. Tundra habitats within the river delta areas and riparian habitats are important nesting and staging areas for shorebirds. Several species of raptures including the endangered American peregrine falcon and the threatened Arctic peregrine falcon are found in the Arctic NWR. Riparian willow stands support the highest nesting density and diversity of passerine species along the coastal plain of the Arctic NWR (Clough et al. 1987).

Fishery Resources

West and Fruge (1989) reviewed the fishery surveys conducted on the lakes and streams of the coastal plain of the Arctic NWR. Twenty-five fish species have been reported in the coastal and inland waters (Table 1). Seven species were reported in stream of the coastal plain of the Arctic NWR. Six freshwater/marine and one marine species have been collected from lakes (West and Fruge 1989). Winter habitat limits the abundance and distribution of Arctic fishes. Springs, deep lakes and isolated deep pools in the rivers provide limited overwintering habitat. The Canning River, Tamayariak River, Sadlerochit Spring Creek, Sadlerochit River, and the Hulahula River are considered important over wintering areas within the coastal plain of the Arctic NWR. There are a limited number of lakes with depth great enough to provide wintering fish habitat. Arctic char, Arctic grayling, and ninespine sticklebacks are the most common occurring fish in the freshwater systems. The lagoons, bays and estuaries of the coastal plain are an important habitat for the fishery resources. Input from the stream to coastal areas create a water temperature and salinity gradient in the lagoons, bays and estuaries. The large flush of water that occurs during breakup creates these gradients (T.J. Underwood, U.S. Fish and Wildlife Service, personal communication). The functional intricacies of the coastal habitat is not completely understood.

HYDROLOGY

The Arctic climate and permafrost are the controlling physical forces of the hydrologic cycle across the coastal plain. The extreme cold temperatures and short days during the winter cause the streams and lakes to freeze to substrate. There is a six month period during which most stream flow ceases. The only non-frozen water during the winter months is located in small isolated pools beneath ice hummocks, lakes with depth greater than seven feet, and flowing surface waters associated with springs. Breakup on the North Slope occurs in a brief period in late-May or early-June. Snowmelt begins

Table 1.—List of fish species reported from coastal plain of the Arctic National Wildlife Refuge (West and Fruge 1989).

<u>Anadromous</u>	<u>Freshwater</u>	<u>Marine</u>
Arctic char	Arctic grayling	Arctic cod
Arctic cisco	Burbot	Arctic sculpin
Broad whitefish	Lake trout	Arctic flounder
Chum salmon	Round whitefish	Bering wolfish
Least cisco		Capelin
Ninespine stickleback		Fourhorn sculpin
Pink salmon		Kelp snailfish
Rainbow smelt		Pacific hearing
		Pacific sand lance
		Pallid ellpout
		Saffron cod
		Stout eelblenny
		Slender eelblenny

earliest in the mountains and foothills and progresses towards the coastal plain. The rapidly melting water from the foothills runs over the frozen ground as sheetflow. Infiltration is prohibited because of the presence of permafrost. Water in the stream channels rises rapidly, flowing over ice covered stream channels. As much as 50 percent of the annual flow of North Slope rivers may take place during breakup (Clough et al. 1987, and Sloan 1987).

Streams

Hydrologic data for the coastal plain are limited. Childers et al. (1977) reported a reconnaissance level investigation of rivers, springs, aufeis fields, and lakes of the Arctic coastal plain including the coastal plain area of the Arctic NWR. Childers et al. (1977) reported data on channel characteristics, watershed characteristics, and estimated flood characteristics of the Canning River, Marsh Creek, Sadlerochit River, Hulahula River, Jago River, and Okerokovik River. Daum et al. (1984), Glesne and Deschermeier (1984), and Smith and Glesne (1982) reported selected physical and chemical characteristics of streams and springs across the coastal plain of the Arctic NWR. Elliott and Lyons (1990) reported on the availability of winter water within stream systems within the coastal plain of the Arctic NWR.

The U.S. Geological Survey (USGS) currently operates five (5) stream gaging stations along the Arctic slope of Alaska and has limited historical data on several other streams (Table 2). The closest USGS stream gaging station to the coastal plain of the Arctic NWR is located on the Sagavanirktok River (USGS gage #15908000) near pump station 3. The Sagavanirktok River is located 80 miles west of the Canning River, the western boundary of the coastal plain of the Arctic NWR. The Sagavanirktok River is larger than any river in the coastal plain area of the Arctic NWR.

Table 2.—Index to USGS gaging stations located along the Arctic Slope, Alaska (Still and Cosby 1989).

Station Identification	Name	Location		Drainage Area mi. ²	Years of Record
		Latitude	Longitude		
15798700	Nunavak Creek near Barrow	71°15'35"	156°46'57"	a2.79	b1971-92
15799000	Esatkuat Creek near Barrow	71°16'30"	156°43'44"	1.46	1972-73
15799300	Esatkuat Lagoon	71°17'40"	156°46'06"	3.52	1972-73
15803000	Meade River at Atkasuk	70°29'20"	157°24'40"	a1800	1977
15830000	Miguakiak River near Teshekpuk Lake near Lonely	70°40'13"	154°19'20"	a1460	1977
15880000	Colville River near Nuiquisit	70°09'56"	150°55'00"	20670	1977
15896000	Kuparuk River near Deadhorse	70°16'54"	148°57'35"	3130	b1971-92
15896700	Putuligayuk River near Deadhorse	70°16'30"	148°37'41"	a176	1970-79 1981-86
15904900	Atigun River tributary near Pump Station 4	68°22'25"	149°18'48"	32.6	1976-86
15906000	Sagavanirktok River tributary near Pump Station 3	68°41'13"	149°05'42"	28.4	b1987-92
15908000	Sagavanirktok River near Pump Station 3	69°00'54"	148°49'02"	a1860	b1982-92
15910000	Sagavanirktok River near Sagwon	69°05'24"	148°45'34"	229	1970-78
15975000	Chamberlin Creek near Peters Lake	69°17'30"	144°57'50"	1.46	1958
15976000	Neruckpukkoonga Creek near Peters Lake	69°18'30"	145°01'30"	123	1958
15904800	Atigun River near Pump Station 4	68°12'54"	149°24'13"	48.7	b1992

a Approximate Area

b Record may extend beyond 1992

Springs

Childers et al. (1977) conducted a reconnaissance investigation of the springs on the eastern North Slope, Alaska. The study included 18 springs, 6 of which are located within the coastal plain, Arctic NWR: Sadlerochit Spring, Red Hill Spring, Katakaturuk River tributary spring, Hulahula River spring at fish hole #1, Okerokovik River spring, and Aichilik River spring. Sadlerochit Spring is the largest within the coastal plain of the Arctic NWR. During the winter months pressurized water discharged from a spring pushes up through the ice to the surface, spreads out and freezes forming aufeis or icings. Aufeis formations may become extensive. Aufeis formations melt slower than snow and often persists throughout the summer. Open water associated with springs become important wintering habitat once surface runoff has ceased due to freezing.

Lakes

Lakes located on the coastal plain of the Arctic NWR tend to be shallow thaw lakes with surface areas ranging from 1,500 acres to less than 10 acres. Distribution of lakes is uneven. The majority of the lakes are located at the mouth of the Canning River or in the vicinity of the Jago River. Thaw lakes form in relatively flat terrain and in general are isolated from river drainage systems by permafrost. Recharge is limited to snowmelt and direct precipitation within the lakes' small recharge area. The topographic relief on the western portion (between the Canning river and the Sadlerochit River) of the Arctic NWR prohibits the formation of thaw lakes.

Ice thickness is snow cover or water depth dependent, but in general ice thickness is 2 feet by mid-November and by mid-January the ice thickness is 4 feet. The maximum ice thickness on lakes along the coastal plain is 6 to 7 feet (Bilello and Bates 1969, 1971, 1972, and 1975). Shallow lakes that freeze to the bottom in the winter melt from the surface down. Ice on the deeper lakes that do not freeze to substrate may be present well into July.

Childers et al. (1977) sampled six lakes for water quality, ice thickness, and water depth. A study of the quantity and distribution of water within lakes of the coastal plain of the Arctic NWR was conducted and reported by Elliott (1990), and Trawicki et al. (1991).

Groundwater

Little information is known about the groundwater in the coastal plain, Arctic NWR. Groundwater that may exist below permafrost (subpermafrost) is thought to be saline or brackish (Williams 1970). Several test wells have been drilled in the vicinity of Prudhoe Bay and the Kuparuk River with little success of finding water. Water that has been found in the oil and gas fields of the North Slope is a sodium-chloride type, high in dissolved solids with salinity ranging from brackish to brine (Sloan 1987). Groundwater located above permafrost (suprapermafrost) occurs beneath rivers and lakes. Suprapermafrost plays a major role in the formation of surface features such as

wetlands, patterned ground, pingos, and shallow lakes (Nelson and Munter 1990). Suprapermafrost water may be available on a seasonal basis but is susceptible to contamination (Nelson and Munter 1990). No information is currently available concerning suprapermafrost water in the coastal plain, Arctic NWR.

Watershed Description

Akutoktak River: Also referred to as the Akootoaktuk River on some USGS maps, headwaters in the foothills of the Romanzof Mountains and is the largest west side tributary to the Okpilak River. The U.S. Fish and Wildlife Service gaging station was located 0.6 miles upstream from the confluence with the Okpilak River. The gaged drainage area was 97 mi² of which 66 mi² is located within the Arctic NWR Wilderness Area. The Akutoktak River is a clear water, low gradient, braided, stream with intermittent summer flow in the upper portion. The Akutoktak River freezes to substrate in the fall and there is no winter flow. Stream width at the gaging station was approximately 65 feet. Substrate and islands are composed of gravel and cobble. Arctic char, Arctic grayling and ninespine stickleback are present in the Akutoktak River (Wiswar 1991).

Itkilyariak Creek, West Fork: The West Fork Itkilyariak Creek is a tributary to Itkilyariak Creek, which in turn is the largest west side tributary to the Sadlerochit River. The Sadlerochit Mountains are the headwaters of the Itkilyariak Creek drainage. The U.S. Fish and Wildlife Service gaging station is located on the west fork tributary 0.6 miles upstream from the confluence of the Itkilyariak Creek. The drainage area above the gaging station is 27 mi² of which one third of the area is located in the Arctic NWR Wilderness Area. Substrate and islands are unstable gravel and cobble. The channel is braided and summer flow is intermittent at times. Flow ceases during the winter months. Adult and juvenile Arctic grayling have been observed in the West Fork. Arctic char and ninespine stickleback are present in the Itkilyariak River drainage.

Niguanak River: The Niguanak River is a small tundra drainage east of the Jago River that empties into the Oruktalik Lagoon. The flow in the Niguanak River is derived from melting snow and stormflow events. The channel is low gradient, substrate is sand and gravel, summer flow is often intermittent and there is no flow during the winter months. Drainage area above the U.S. Fish and Wildlife Service gage is 136 mi². The topographic relief in this area is generally flat. Ninespine sticklebacks are the only fish to have been observed in the Niguanak River drainage.

Sadlerochit River: The headwaters of the Sadlerochit River are located high in the Brooks Range and are fairly extensive. Peters and Schrader Lakes, two adjoining glacial lakes, are significant contributors to the Sadlerochit River system. The drainage area above the U.S. Fish and Wildlife Service gaging station is 520 mi². The gaging station was located where the river comes out of the mountains. The gradient is moderate to high at and above the gaging station, but quickly turns low as the river reaches the coastal plain. Substrate is cobble and boulder in the mountains and turns to sand, gravel, and cobble along the coastal plain. Aufeis formations are present on the

Sadlerochit River along the coastal plain. Water is generally clear, but may become turbid during breakup and storm events. Flow is present during the summer months in the Sadlerochit River, but the river does freeze to substrate during the winter months. Arctic char, Arctic grayling, and ninespine stickleback are present in the Sadlerochit River (West and Fruge 1989).

Sadlerochit Spring Creek: There are two primary spring sources to Sadlerochit Spring Creek. Both sources emerge from the base of the eastern end of the Sadlerochit Mountains and converge to form a single channel. Drainage area above the U.S. Fish and Wildlife Service stream gaging station is 0.5 m². (Note: On USGS topographic maps Sadlerochit Spring Creek is shown to be a primary tributary to the Sadlerochit River.) In actuality Sadlerochit Spring flows north parallel to the Sadlerochit River and is a tributary to the Itkilyariak Creek which in turn is a tributary to the Sadlerochit River. Sadlerochit Spring Creek becomes braided about three miles below its origin. The braided channel marks the upper extent of the aufeis formation that develops over the winter. In July of 1987, the aufeis was over two miles long and a mile wide, with ice thicknesses greater than 5 ft. Downstream of the aufeis field the creek channel remains braided for the three miles to its confluence with the Itkilyariak Creek. A resident population of Arctic char and grayling are present in the creek.

Sikrelurak River: The Sikrelurak River is a small tundra drainage east of the Jago River. The flow in the Sikrelurak River is derived from melting snow and stormflow events. The channel is low gradient. Substrate is sand and gravel. Summer flow is often intermittent and there is no flow during the winter. Drainage area above the U.S. Fish and Wildlife Service gage is 75 mi². Ninespine stickleback and one Arctic char have been observed in this drainage.

Tamayariak River: Because of the complexity of the drainage system and the multiple resource values in this area four U.S. Fish and Wildlife Service stream gaging stations were installed in the Tamayariak River drainage: Tamayariak River, Middle Fork Tamayariak River, Lower West Fork Tamayariak River and the Upper West Fork Tamayariak River. The Tamayariak River is a tributary to the Canning River with its origin in the Sadlerochit Mountains. Total drainage area is approximately 350 mi². The foothills extend out towards the coast in this area giving the Tamayariak River drainage some topographic relief. The area is described as hilly. The drainage crosses the Marsh Creek Fault where the channel often becomes dry. Flow resumes 2 to 3 miles down stream in the vicinity of the springs and aufeis formation. The channel drying up is also evident on the West Fork of the Tamayariak River. Just at or below the Upper West Fork gaging station surface flow ceased on an annual basis. Several miles downstream a series of springs rejuvenate the stream flow and surface flows were recorded at the Lower West Fork gaging station. The Tamayariak River and its tributaries become more braided as the river size increases moving downstream. There is an aufeis formation on the mainstem four miles upstream from the confluence with the West Fork. From the icing to the confluence with the West Fork the mainstem is extensively braided. From the confluence with the West Fork moving downstream the river becomes less braided, eventually forming a single channel before joining the Canning River near tidewater. Arctic grayling have been observed extensively

throughout the drainage. Arctic char and ninespine stickleback are also present in the Tamayariak River drainage. Muskox were observed on a regular basis in the Tamayariak River drainage.

METHODS

Project Scoping

A multilevel scoping process was conducted to define the issues and concerns of oil and gas exploration on the water resources in the coastal plain, Arctic NWR. Initially a watershed priority matrix was developed to assist land managers in identifying drainage basins and lakes in need of immediate attention. The matrix included eight probable development impacts and 32 resource values. Resource values, impact severity, and likelihood of occurrence were rated from 1 to 10. Values for each stream were summed and compared (Tweeten 1985). In 1986 a second priority matrix was developed to re-evaluate and determine the need for resource inventories on streams in the coastal plain, Arctic NWR. The second matrix included 25 resource value categories, 15 development pressures and 7 management conflict categories (Lyons and Elliot 1987, unpublished plan of study). As part of the matrix evaluation a scoping meeting was conducted with the Arctic NWR staff and the Fairbanks Fishery Resources Office and Wildlife Enhancement Field Station personnel. Areas of biological importance and threatened critical habitats were identified.

Stream Discharge

Water depth and temperature measurements were taken at stream gaging stations. A pressure transducer and temperature thermistor were attached to an anchor and placed on the stream bottom. A cable connected the transducer and the thermistor to a computerized field recorder located along the stream bank. The field recorder and battery were placed in the weather shelter and the cable was buried to minimize damage from wildlife and floating debris. A reference elevation bench mark was established at each site.

Pressure transducers were calibrated prior to field use. The computerized field recorder measured water depth and temperature readings at 5 minute intervals. Water depths were measured to the nearest 0.01 feet, and water temperature to the nearest 0.1°C. At the end of each 24 hour period the field recorder summarized the 5 minute readings into a report that contained: average daily depth, maximum depth and time of maximum depth, minimum depth and time of minimum depth, average water temperature, maximum water temperature and time of maximum temperature, and minimum temperature and time of minimum temperature. The summarized data was stored on a data storage pack. The summarized data were later downloaded onto a computer.

Stream gaging stations were installed annually in early June, following breakup and removed from operation at freeze-up, during late September. Calibration data were collected using standard stream discharge measurement procedures (Buchanan and Somers 1969, and Lyons 1988) and included stream

discharge in cubic feet per second (cfs), water depth, and water surface elevation with respect to the reference bench mark. Calibration data were collected throughout all months of stream gage operation. Calibration data were collected during high and low flow periods to increase the range of the calibration.

A rating curve for each gaging station was developed through regression analysis of water depth (the independent variable) and stream discharge (the dependant variable). The resultant regression equation was then used to convert the recorded water depth to stream discharge. Since stream gages were not permanent, a new relationship between water depth and stream discharge was required for each year of operation.

Average daily discharges were estimated for gaging stations that experienced technical problems during the stream gaging period. Technical problems included equipment malfunction, damage to gaging equipment from wildlife or flooding. For a single missing data point not associated with a storm event, the missing data point was estimated by averaging the average daily discharge from the day prior to and the day following the missing data point. For small data gaps (2-5 days), not associated with a hydrologic event, data points were estimated by analyzing the trend of the average daily discharge of one or more similar drainage for the period of missing data. Data points were then estimated to fit the trend of the similar drainage. For larger data gaps, a linear relationship was established between the stream with missing data and a stream with similar watershed characteristics and discharge rates. The relationship was established from the average daily discharge for all days that the two streams had records in common. The linear relationship was used to estimate the missing average daily discharge of one stream from the known average daily discharge of the other stream. Where no relationship could be established between two rivers the data gap was left as missing data. Estimates of missing peak discharge events were calculated using the indirect slope-area method as outlined in the Geological Survey Water-Supply Paper 2175 (Rantz 1982). Because breakup is a regional climatic event driven by increasing air temperatures, estimates of discharge during breakup were made using a linear regression analysis between rivers of the Arctic NWR and the Kugaruk River. The stream gaging station on the Kugaruk River is located on the coastal plain 10 miles upstream from Gwyder Bay and 13 miles northwest of Deadhorse. The Kugaruk River gaging station has more than 20 years of record.

Flood flow frequency estimates were determined using the log-Pearson Type III distribution (Hydrology Subcommittee 1982). Flood flow frequencies were plotted using the Hydrologic Engineering Center's HECWRC Flood Flow Frequency Analysis Computer Program 723-X6-L7550 (US Army Corps of Engineers 1982). The annual maximum recorded or estimated discharge from a rainfall event was used for each station for each year of record. Annual maximum discharge from snowmelt during breakup was not included in this analysis and will be addressed separately. Using the equation:

$$\text{Log } Q = \bar{X} + KS$$

where: Q = discharge
 \bar{X} = mean logarithm
K = a function of the skew and exceedence probability
S = standard deviation of logarithms

Discharge events were fitted to the log-Pearson Type III distribution at the 2, 5, 10 and 25 year exceedence probabilities using a generalized skew coefficient of logarithms of 0.70 (Hydrologic Subcommittee 1982).

The annual seven (7) day low flow is the lowest average of the mean daily discharge for seven consecutive days. The annual seven (7) day low flow was calculated for each stream for each year of record. All annual seven (7) day low flow calculations are based on the open water season (June through September). The average seven (7) day low flow for the period of record was also calculated for each stream by averaging the annual seven (7) day low flow for all years of record.

Winter Water in Streams

Data gaps identified by Elliott (1989) provided the basis for the investigation to determine the volume of water in pools located beneath ice hummocks (pressure ridges) and the distribution of the ice hummocks within the major river drainage along the coastal plain of the Arctic NWR (Elliott and Lyons 1990).

River drainages were flown by helicopter in April of 1989, when river ice thickness was at its maximum. Ice hummock locations were plotted on 1:63,360 scale topographic maps. The height and length of each hummock was estimated. Periodic ground truthing of ice hummock length and height was conducted.

A sample of nine ice hummocks was measured to determine length, height and water depth. A series of holes were drilled along the long axis of each hummock to determine the water margins located beneath the ice. Three additional transacts were drilled perpendicular to the original. Water depth was measured in each hole. Contour maps were created for each pool measured. Pool size and volume were then calculated from the contour maps (Elliot and Lyons 1990).

A linear relationship was then established between the size coefficient (product of length and maximum height of the hummock) and the volume of water beneath the ice hummock. Water volumes were then estimated for ice hummocks plotted on the topographic maps. Total water volume for each drainage was then calculated by summing the pool volume estimates of each hummock in the drainage.

Lake Volume

The quantity and distribution of water within lakes in the coastal plain area of the Arctic NWR were evaluated to identify water availability throughout the year (Trawicki et al. 1991). Lakes were identified for evaluation from U.S. Geological Survey topographic (1:63,360) maps. Identification of lakes was based on surface area.

Water depth, to the nearest 0.1 feet, was measured along a minimum of 6 transacts per lake. Depth measurements were taken with a recording fathometer

mounted on the back of an inflatable boat. The fathometers were calibrated at each lake before transects were run. Lakes with maximum depths less than 2.5 feet were not measured using the fathometer. Surface area and estimates of maximum depth were used to approximate the volume of these shallow lakes.

Enlargement of U.S. Geological Survey maps provided lake shoreline maps. Water depth transect data were plotted on the shoreline maps. Contour lines for 1 foot intervals were then drawn on each shoreline map. The area of each 1 foot contour was measured using a planimeter. Lake volume was then calculated for the entire lake. Water volumes during the winter months were calculated by subtracting 1 foot strata volumes from the ice-free volume to estimate the volume of water beneath successive 1 foot intervals of ice. Ice thickness dates were based on Bilello and Bates (1969, 1971, 1972 and 1975) 8 years of ice thickness data for Barter Island.

Lake Surface Water Elevations

The second part of the study of lakes on the coastal plain of the Arctic NWR was to survey the elevation of the lake water level and the outer perimeter of the wet meadow zone (the annual high water level). The water surface elevation was that of the day the survey was conducted. In August 1993, Global Positioning Services, Inc. was contracted to accomplish the survey. The survey was conducted using state of the art global positioning system (GPS) technology.

A single local datum was established and tied to 27 monuments and three oil wells. The oil wells were located outside the Refuge boundaries. Fast static GPS receivers with digital data link were used. At each lake or complex of lakes a primary hub was set. A real time kinematics observation was taken. The receiver was then repositioned and a redundancy observation was recorded. Subsequent observations were taken at the waters' edge (present water surface elevation) and at the upper edge of the wet meadow zone (the annual high water level). The ellipsoidal elevations were determined during post-processing. Ellipsoidal height, latitude, and longitude of all monuments were confirmed during post processing as a check on the accuracy of the process (Global Positioning Services 1993). Video footage and/or photographs were taken of each lake identifying the perimeter of the wet meadow zone. A detailed description of the methods and results, and maps containing the surveyed lakes are printed in Global Positioning Services, Inc. (1993).

RESULTS

Project Scoping

The priority matrices identified six streams as high priority. These streams included the Hulahula River, Canning River, Okpilak River, Sadlerochit River, Jago River (Okerokovik Spring) and the Kogopak River. During the scoping meetings with the Arctic NWR staff it was determined that the Tamayariak River and Sadlerochit Spring Creek should also be included as high priority streams. The Tamayariak River has an abundance of fish and wildlife

resource values that were overlooked during the initial evaluation and Sadlerochit Springs is an area unique with fish, wildlife, and cultural values.

In July and September of 1987 a reconnaissance trip was conducted across the coastal plain of the Arctic NWR to determine feasibility and location of potential stream gaging stations. Results of the reconnaissance trip during the early summer of 1987 concluded that stream gages could not be operated on a year round basis and that stream gaging station locations were limited due to extreme braided channels and intermittent flow. It was recommended that stream gaging stations be installed on Tamayariak River, Sadlerochit River, Sadlerochit Spring Creek, Itkilyariak Creek and the Akutoktak River (Figure 1). Since the Tamayariak River is a hydrological diverse system with abundant fish and wildlife resources, four stream gaging stations were installed on this watershed. The Water Resources Branch initiated a stream gaging network consisting of eight (8) gaging stations in the coastal plain area of the Arctic NWR in 1988. In 1989 two additional stream gaging stations were installed on two tundra streams on the eastern portion of the refuge. The new gaging stations were located on the Niguanak River and Sikrelurak River. Table 3, contains the legal description of the location of each stream gaging station.

Table 3.-Stream gaging station locations (Umiat Meridian).

Watershed	Gage Location
Akutoktak River	Center sec.36, T6N, R33E
West Fork, Itkilyariak Creek	NE $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.33, T6N, R31E
Niguanak River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.36, T8N, R36E
Sadlerochit River	NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec.31, T4N, R32E
Sadlerochit Spring Creek	NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.36, T4N, R31E
Sikrelurak River	SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec.36, T7N, R38E
Tamayariak River	SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec.35, T6N, R26E
Lower West Fork, Tamayariak River	NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.12, T7N, R25E
Middle Fork, Tamayariak River	Center sec.12, T7N, R25E
Upper West Fork, Tamayariak River	W $\frac{1}{2}$ W $\frac{1}{2}$ sec.33, T6N, R25E

The Canning and Hulahula Rivers rated high in the priority matrix and were not gaged due to equipment and logistical constraints. Both of these rivers have significant fishery resources. The Hulahula and Canning Rivers are also highly used recreational rivers. As technology advances, the equipment and logistical constraints will be overcome. The Okpilak and Jago-Okerokovik Springs were not gaged due to lack of suitable gaging station locations.

The Kogopak River is a tundra stream located on the eastern end of the coastal plain of the Arctic NWR. The Kogopak River was not gaged, but gages were installed on the Niguanak and Sikrelurak Rivers, two tundra streams with similar drainage characteristics.

Stream Discharge

These data represent the hydrologic conditions for the 1988-1992 summer stream gaging seasons. Stream gaging stations were installed between July 18 and July 20, 1988, on the Akutoktak River, Itkilyariak Creek, Sadlerochit River, Sadlerochit Spring Creek, Tamayariak River, Middle Fork Tamayariak River, Lower West Fork Tamayariak River, and the Upper West Fork Tamayariak River. All stream gaging stations were in service until Sept. 27 or 28, 1988. In 1989 stream gaging stations were reinstalled at the 1988 stream gaging sites with the exception of the gage located on the Itkilyariak Creek. The Itkilyariak Creek stream gage was moved to the West Fork Itkilyariak Creek. The two additional gaging stations located on the Niguanak and Sikrelurak Rivers were also installed. Gaging stations were installed between June 14 and June 29, 1989, and remained in operation until September 24, 1989. Similarly, all 10 gaging stations were reinstalled during the open water months in 1990, 1991, and 1992. Stream gages were installed each spring just after breakup when river bottoms were free of anchor ice. Gages were in operation until mid to late September each year.

Rating curves were developed for each stream gage for each year of operation. Polynomial relationships between stage and discharge were developed for all stations except Sadlerochit Springs, where a linear relationship was used. The correlation coefficient for all relationships ranged from 0.95 to 0.99. The average daily discharge for each station for each year of record is reported in Appendix A. Summary statistics are reported in Table 4.

During the five (5) years of data collection bears, ground squirrels, floods, equipment malfunction, and human error resulted in several data gaps. Data gaps were estimated when possible. All estimated data reported in Appendix A and are denoted with an "e". Estimates of small data gaps are considered to be fair. Estimates of larger data gaps are poor. When no reasonable method or estimate could be made the data gap was left as missing data. On July 21, 1991, a large flood event washed out the gaging stations on the Sadlerochit and Tamayariak Rivers. A field camp located along the bank of the Sadlerochit River had to be moved because of overbank flooding. Another geology field camp was completely washed away. Estimates of peak flows from this event were estimated using the slope-area method (Darymple et al. 1967). Estimates of discharge during breakup were made using a linear relationship between the USGS data from the Kuparuk River and the rivers located on the coastal plain of the Arctic NWR. Estimates of the breakup flows are considered to be poor, but are the best professional estimates available.

Flood frequency estimates are based on high discharge from precipitation events. Flooding that occurred during breakup was excluded from the analysis.

Table 4.-Summary statistics for the open water season of gaged streams within the coastal plain area, Arctic National Wildlife Refuge, Alaska.

Watershed	Drainage Area (mi ²)	Average Annual Discharge (cfs)	Average Total Runoff (in)	Peak Flow (cfsm)	Date of Peak Flow	Average 7-Day Low Flow (cfs)	Years of Record
Akutoktak River	97.1	102	4.42	18.7	08/27/92	4.0	1988-92
Itkilyariak Cr., West Fork	26.9	70	8.67	52.8	08/20/89	1.8	1989-92
Niguanak River	136.2	233	8.85	68.0	08/21/89	14.5	1989-91
Sadlerochit River	520.1	1144	8.07	40.4	07/21/91	190.3	1988-92
Sadlerochit Spring Cr.	0.5	37	1012.90	216.0	08/20/89	28.0	1988-90 1992
Sikrelurak River	74.7	93	5.43	23.9	06/04/91	2.2	1989-92
Tamayariak River	136.1	305	9.90	38.2	07/21/91	45.6	1988-92
Tamayariak River, Lower West Fork	98.1	179	8.3	25.0	09/06/90	14.9	1988-91
Tamayariak River, Middle Fork	61.3	123	9.1	30.5	06/04/91	5.6	1988-92
Tamayariak River, Upper West Fork	49.2	128	11.3	30.0	08/20/89	2.9	1988-92

Results of the flood flow frequency analysis are given in Table 5. Flood flow estimates were calculated for the 2, 5, 10, and 25 year flood frequency events. From the table it can be inferred that the two year storm on the Akutoktak River is equal to 485 cfs or there is a 50% chance that a flow of 485 cfs will be exceeded in any given year. Flood flow estimates calculated for the Akutoktak River, Sadlerochit River, Tamayariak River, and Middle Fork Tamayariak River are based on five (5) years of data. Estimates for West Fork Itkilyariak Creek and Upper West Fork Tamayariak River are each based on four years of record. No flood flow estimates were calculated on the Niguanak River, Sikrelurak River, Lower West Fork Tamayariak River and Sadlerochit Spring Creek. The Hydrologic Subcommittee (1982) requires a minimum of 10 years of data for statistically reliable flood flow frequency analysis. The flood flow frequency estimates in Table 5 are based on less than 10 years of data and should be used with caution. The relatively high standard deviation is an indication of the low confidence of the flood flow estimates.

The annual seven (7) day low flow was calculated for each stream for each year of record and is reported in the summary statistics at the bottom of each Table in Appendix A. All low flow calculations are based on the open water season (June through September). The average seven (7) day low flow for the period of record for each stream is reported in Table 4. The annual seven (7) day low flow was less than 1 cfs on the Akutoktak River, West Fork Itkilyariak Creek, Niguanak River, Sikrelurak River, and the Middle and Upper West Fork Tamayariak River. During the winter months all streams freeze to substrate and flow goes to zero (Elliott and Lyons 1990). The exceptions to this are short segments of streams associated with springs. Sadlerochit Spring Creek is open year round from its source for approximately 3 miles to where the channel becomes braided and the aufeis forms in the winter.

Table 5.—Estimates of the 2, 5, 10 and 25 year flood events. Q_t is discharge in cubic feet per second. (Note: These estimates are based on less than 10 years of data and should be used with caution).

Watershed	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Years	Mean Logarithm	Standard Deviation
Akutoktak River	485	1470	2850	6180	5	2.7470	0.5310
Sadlerochit River	5960	12700	20000	34000	5	3.8173	0.3633
Itkilyariak Creek, WF	553	1250	2030	3590	4	2.7881	0.3901
Tamayariak River	2420	4360	6200	9350	5	3.4167	0.2819
Tamayariak River, MF	695	1250	1780	2680	5	2.8747	0.2815
Tamayariak River, UWF	925	1600	2220	3250	4	2.9963	0.2622

Winter Water in Streams

Six hundred and four (604) ice hummocks were identified along approximately 237 miles of river in seven major drainage of the coastal plain area of the Arctic NWR in 1989. Nine ice hummocks were sampled for length, width, height and water depth. Table 6 contains the size parameters and water volumes of the nine measured ice hummocks. A positive linear correlation between size coefficient (C) and pool volume (V) of

$$V = 38.16C - 8679.66$$
$$(r^2 = 0.77)$$

was used to estimate the pool volume for each ice hummock inventoried. The size coefficient is the product of length and height. Water was found beneath seven of the nine ice hummocks sampled. Two of the ice hummocks were frozen to substrate. A total of 8,839,200 gallons (27.1 acre-ft) of water was estimated to occur beneath the 604 ice hummocks. Table 7 contains a summary of the water by drainage located beneath ice hummocks of the coastal plain, Arctic NWR (Elliott and Lyons 1990).

Lake Volume

Over a three year period 119 lakes were surveyed to estimate water availability throughout the year. Surface areas of lakes surveyed ranged from 0 to 1,533 acres. Maximum depths for individual lakes ranged from 0 to 24.8 ft. with an average maximum depth of 6.7 feet. Fifty-nine of the surveyed lakes had maximum depths that exceeded 7.0 feet. Four of the 119 lakes identified on the U.S. Geological Survey topographic maps were dry or contained less than one ft. of water. Individual lake volumes during ice free conditions ranged from 0 to 9,285 acre-ft. Total volume for the 119 lakes was 55,379 acre-ft. When ice thickness reaches 4 ft. (early January) 34 lakes will have frozen to substrate and the remaining total volume of water will be 17,755 acre-ft from 85 lakes. By mid-April when ice is at its maximum thickness 60 lakes will have frozen solid. Total remaining volume would be approximately 3,365 acre-ft. from 59 lakes. Location, surface area, maximum depth, and volume with increasing ice thicknesses for individual lakes is reported in Trawicki et al. (1991).

Unlike the majority of the North Slope where low topographic relief permits the formation of numerous thaw lakes, the rolling hill topography east of the Canning River prohibits the formation of thaw lakes. The majority of the lakes along the coastal plain of the Arctic NWR are located at the mouth of the Canning River and in the vicinity of the Jago River. There is large region between the Tamayariak and Okpilak Rivers, an area roughly 40 miles wide, that is nearly void of lakes.

Lake Surface Water Elevations

State-of-the-art GPS equipment and techniques were used to survey the water surface elevation and outer perimeter of the wet meadow zone for 150 lakes on

Table 6.—Size parameters and calculated water volumes of the nine ice hummocks selected for study (Elliott and Lyons 1990).

Drainage	Hummock Number	Maximum Height (ft)	Length (ft)	Size Coefficient	Water Volume (gal)
Tamayariak River	1	6.5	90	585	22,180
Katakturuk River	2	8.0	86	688	18,770
Sadlerochit River	3	10.6	75	795	35,690
Sadlerochit River	4	9.0	165	1,485	26,390
Sadlerochit River	5	7.8	230	1,794	72,440
Sadlerochit River	6	3.0	50	150	140
Jago River	7	5.1	60	306	170
Okerokovik River	8	3.4	95	323	0
Okerokovik River	9	4.8	110	528	0

Table 7.—Data summary of ice hummock inventory by drainage system (Elliott and Lyons 1990).

Drainage	Miles of River Surveyed	Ice Hummocks Observed (N)	Estimated Volume (gal)
Canning River	35	138	1,861,000
Tamayariak River	34	45	483,100
Katakturuk River	23	60	829,200
Sadlerochit River	20	121	3,237,300
Hulahula River	25	165	2,100,600
Okpilak River	31	10	25,600
Jago River	69	65	447,400
TOTAL	237	604	8,939,200

the coastal plain of the Arctic NWR. The results of the lake surface water elevation survey conducted by Global Positioning Services (1993) were better than anticipated. The horizontal control exceeded the minimum requirement of 1:100,000. The least accurate horizontal control was better than

1:219,000, with the average horizontal control for the project of 1:800,000. This high degree of accuracy exceeded the specifications and standards of the Federal Geodetic Control Committee as outlined in the Geometric Geodetic Accuracy Standards and Specifications for Using GPS Relative Positioning Techniques. (Global Positioning Services 1993). Ellipsoidal height differences were less than five (5) centimeters with the majority having 2 centimeter accuracy. One hundred and twelve of the 150 lakes were lakes sampled by Trawicki et al. (1991) for lake water depth and volume. Lake numbers in the survey report (Global Positioning Services, Inc. 1993) coincide with those of Trawicki et al. (1991).

DISCUSSION and RECOMMENDATIONS

The North Slope of Alaska is a vast remote region with an abundance of natural resources. Due to the extreme climatic conditions and limited access the extent of the natural resources is largely unknown. As resource demands increase and technology advances, the natural resources along the North Slope will become economically and technologically accessible.

There has been little interest by State, Federal or private sector in the water resources along the coastal plain primarily because of a lack of competitive uses. The potential for oil and gas exploration along the coastal plain of the Arctic NWR resulted in a water resource inventory and assessment. The intent of the inventory and assessment is to provide resource managers with the hydrologic information required to make informed water allocation decisions concerning industrial development, mitigation measures, and fish and wildlife habitat protection.

The water resource studies conducted along the coastal plain of the Arctic NWR (1987-1992) provide a hydrologic database that will aid in resource management decisions. The studies provide a general understanding of the hydrologic regime and the physical processes that occur along this portion of the coastal plain. In general, breakup is the most significant hydrologic event of the year for streams that originate in the coastal plain. In most years more than 50 percent of the average annual discharge occurs during the breakup period. Streamflow quickly diminishes once snowmelt is complete. Summer discharge is low on most streams and in the absence of storm events discharge will go to zero on many streams. The presence of permafrost reduces infiltration resulting in quick stream response to storm events. Storm peaks are high and rapid, and recede quickly. Figure 2, is a generalized hydrograph for streams along the coastal plain. (Note that the hydrograph is from mid-May through mid-October.) Most years there was an increase in discharge just prior to freeze-up. The increase in discharge was due to snowfall followed by warmer temperatures and/or rain. By late September flow has diminished and ice has begun to form. With the exception of isolated pools and springs, rivers freeze to substrate. Lakes located along the coastal plain tend to be small shallow thaw lakes congregated near the mouth of the Canning River or west of the Okpilak River. Lakes less than 7 feet in depth generally freeze to substrate.

Regional Hydrograph

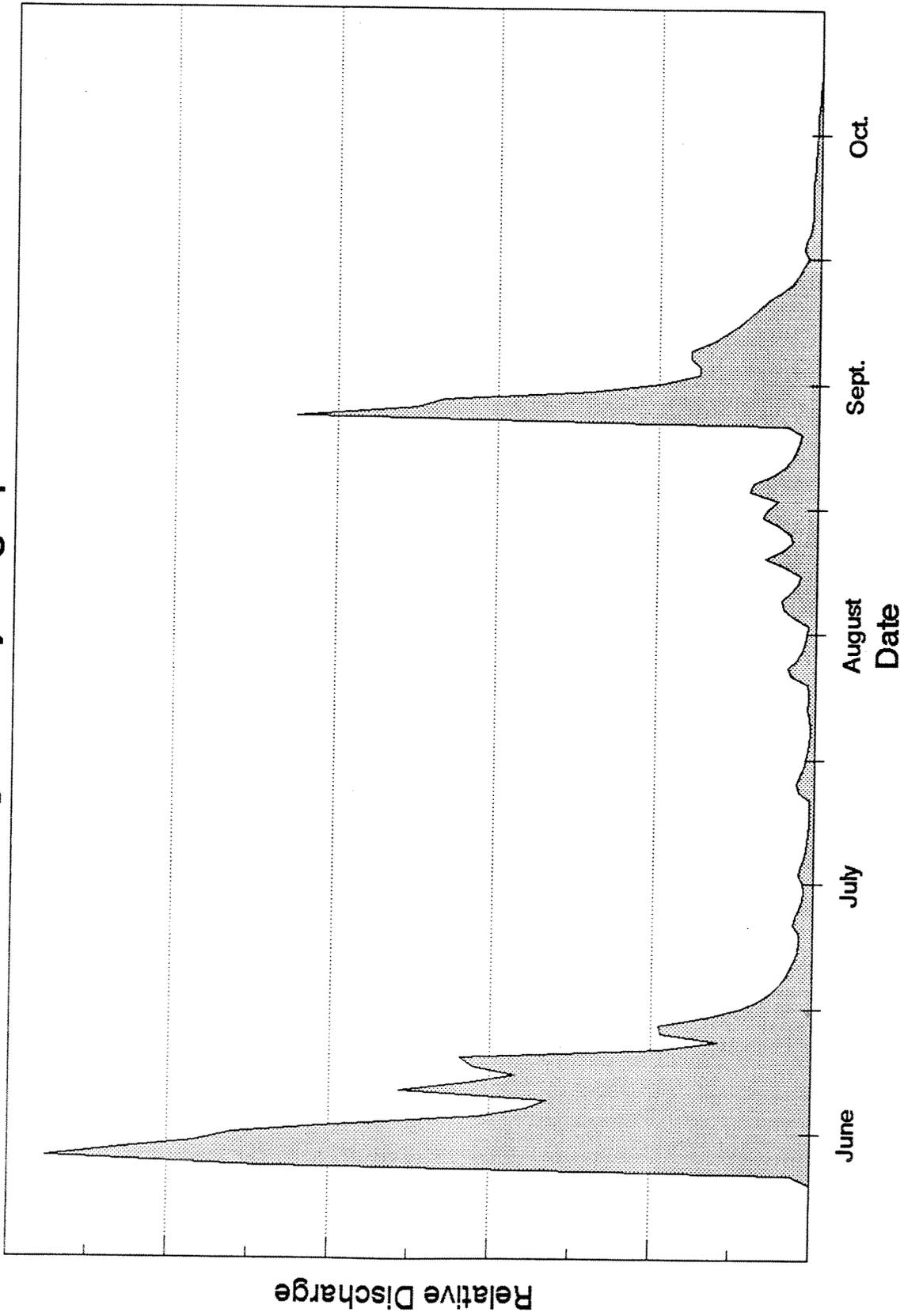


Figure 2.-Regional hydrograph for the streams of the coastal plain area, Arctic National Wildlife Refuge, Alaska.

The average daily discharges reported in Appendix A are considered to be good. With the short period of record (5 years) statistical analysis is limited, but the five years of stream discharge data collected along the coastal plain of the Arctic NWR are representative of the longterm average annual discharge. Comparing the 1988 through 1992 average annual discharge of the Kuparuk and Sagavanirktok Rivers with the longterm average annual discharge of these rivers, indicate that the five (5) years of discharge data for the coastal plain area of the Arctic NWR are representative of the expected long term average annual discharge of the coastal plain. The 5 years (1988 to 1992) were 2 percent below and 6.5 percent above the long term average annual discharge of the Kuparuk and Sagavanirktok Rivers respectively. During the five (5) years there was considerable variation in discharge. In 1989, the Kuparuk and Sagavanirktok Rivers were considerably higher than their long term average, 60 percent and 18 percent respectively. The converse occurred in 1990. The Kuparuk River was 35 percent below the average long term annual discharge while the Sagavanirktok River was 15 percent below. These trends are evident on the streams of the coastal plain of the Arctic NWR. The annual hydrograph of the Tamayariak River (Figure 3) is representative of the variation among the five (5) years of data.

Breakup data for the gaged streams located on the coastal plain of the Arctic NWR have been estimated. These estimates are considered to be poor, but are the best available. During breakup the normal relationship between water surface elevation (depth) and discharge does not always hold true. Initially, water from the melting snow flows over thick layers of river ice. The water flowing over ice creates a temporary and extremely high water surface elevation. Once the ice has eroded from the channel the relationship between water depth and discharge can be established. Stream gaging stations were not installed until river channels were ice free.

Estimates for missing data, other than for breakup, were made using existing data from gaging stations located within the coastal plain, Arctic NWR. These estimates are also considered to be poor. USGS stream gaging stations are located too far from the streams of the coastal plain area of the Arctic NWR to be used to estimate local rainfall events.

The distribution and timing of water is critical for the management of resources located along the coastal plain of the Arctic NWR. The water resource data in this report provide information required to make management decisions, but are by no means conclusive. In the planning stages of resource development along the coastal plain additional water resource data will be required. It is recommended that stream gaging stations be installed on the Canning River, Hulahula River, Okpilak River and the Jago River prior to development. These rivers were identified as high priority streams but were not gaged due to logistical and technical restraints. The Hulahula, and Canning Rivers have significant resource and recreational values. There are several spring areas associated with each river. These spring areas provide overwintering habitat for Arctic char populations. The Hulahula River is also used for subsistence purposes by the residence of Kaktovik.

The Kogopak River was also identified as high priority during the scoping process, but data for this stream can be synthesized and a gage is not

Tamayariak River

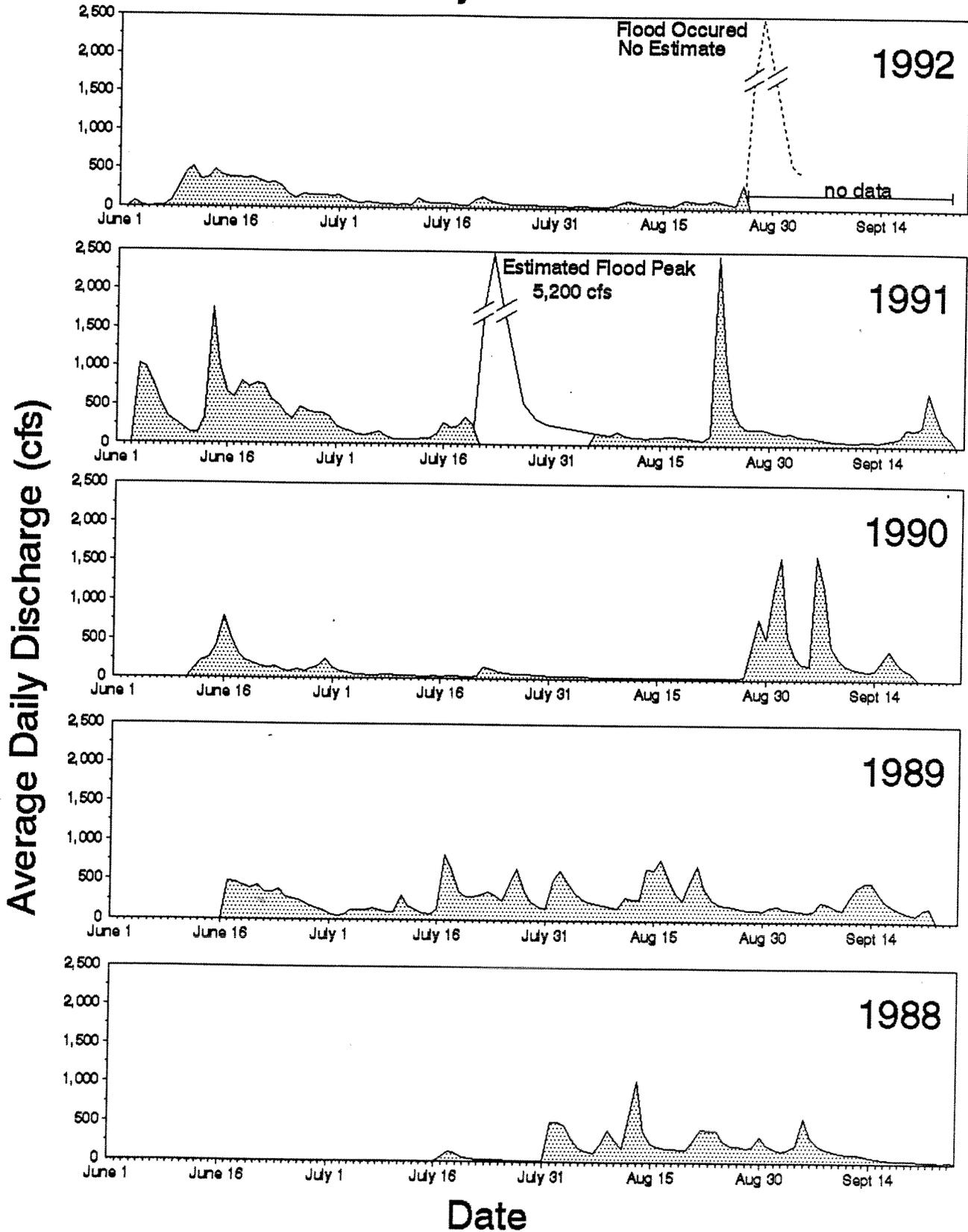


Figure 3.-Comparison of discharge records for the Tamayariak River for the 5 years of record, 1988-1992.

required. Gages could also be reinstalled on the Tamayariak River, Sadlerochit River, Akutoktak River, and the Sikrelurak River to augment the existing database. It is also recommended that summer and winter precipitation data be collected in the headwaters and along the coastal plain. The new and additional data would increase the existing database and allow for a more rigorous statistical analysis.

Since many biologic processes are dependent on the hydrologic cycle it is recommended that the U.S. Fish and Wildlife Service secure instream water rights on the streams, springs, wetlands, and lakes along the coastal plain of the Arctic NWR. Water resources are limited 10 months of the year. The little water that is available during the winter and the low flow summer periods provide the only available aquatic habitat. The relatively high flows associated with breakup provide the water necessary for fish passage in and out of the streams, and provide the volume of water required to establish the salinity and temperature gradients in the estuaries and lagoons.

Regular and periodic flooding are an integral part of the hydrologic cycle and are required to maintain the longterm functional integrity of most ecosystem. Ninety-nine percent of the coastal plain of the Arctic NWR is classified as wetland (Clough et al. 1987) with the majority falling into the palustrine system (moist tundra) (National Wetland Inventory, unpublished). Based on this classification almost the entire watershed for all drainages in the coastal plain area, Arctic NWR are a moist tundra system. The river systems themselves are a dominating factor influencing the physical characteristics of the riverine and estuarine wetland systems. Temporary and/or occasional flooding is required to maintain the functional integrity of these wetland systems. Instream water rights need to incorporate flood flows on a periodic basis for the purpose of maintaining the stream and connected habitats. Securing instream water rights at the present time would be prudent of the Service and alleviate future conflict with respect to water allocation.

The topographic relief on the western portion of the study area is distinctly different from the Prudhoe Bay region and the eastern portion of the 1002 area. The topographic relief prohibits the formation of thaw lakes. Except for region with topographic relief, thaw lakes generally provide a more abundant source of winter water than naturally occurring water pools in springs and rivers. Should oil and gas development occur along the coastal plain of the Arctic NWR the topographic relief will present engineering problems different from those of Prudhoe Bay. Roads and/or pipelines that run east and west will cross several drainages and will run perpendicular to the slope of the landscape. It is recommended that bridges be required at all stream crossings to handle storm and breakup flows, and ice flowing in the stream channel. Roads running perpendicular to the slope of the landscape will create a barrier to sheetflow during breakup and storm events. To maintain the integrity of the wetlands, road culverts (18" or larger) should be located at a minimum of every 1,000 ft. and at all natural depression or drainage.

The physical and biological process in the Arctic ecosystem are dynamic. For every change in the physical environment there is a biological response.

Managing to maintain the functional integrity of the Arctic ecosystem and providing for its socioeconomic use is and will continue to be a challenge. The intent of this report was to provide resource managers with information required to make resource management decisions along the coastal plain of the Arctic NWR.

REFERENCES

- Bilello, M.A., and R.E. Bates. 1969. Ice thickness observations, North American Arctic and Subarctic, 1964-65, 1965-66. U.S. Army Corp of Engineers, Cold Regions Research and Engineering Laboratory Special Report 43, Part IV, Hanover, New Hampshire.
- Bilello, M.A., and R.E. Bates. 1971. Ice thickness observations, North American Arctic and Subarctic, 1966-67, 1967-68. U.S. Army Corp of Engineers, Cold Regions Research and Engineering Laboratory Special Report 43, Part IV, Hanover, New Hampshire.
- Bilello, M.A., and R.E. Bates. 1972. Ice thickness observations, North American Arctic and Subarctic, 1968-69, 1969-70. U.S. Army Corp of Engineers, Cold Regions Research and Engineering Laboratory Special Report 43, Part IV, Hanover, New Hampshire.
- Bilello, M.A., and R.E. Bates. 1975. Ice thickness observations, North American Arctic and Subarctic, 1970-71, 1971-72. U.S. Army Corp of Engineers, Cold Regions Research and Engineering Laboratory Special Report 43, Part IV, Hanover, New Hampshire.
- Buchanan, T.J., and W.P. Somers. 1969. Discharge measurements at gaging stations. U.S. Geological Survey Techniques Water-Resource Investigation of the United States Geological Survey, Book 8, Chapter A, Washington D.C.
- Childers, J.M., C.E. Sloan, J.P. Meckel, and J.W. Nemine. 1977. Hydrologic reconnaissance of the eastern north slope, Alaska. U.S. Geological Survey Open-File Report 77-492, Anchorage, Alaska.
- Clough, N.K., P.C. Patton, and A.C. Christiansen, editors, 1987. Arctic National Wildlife Refuge, coastal plain resource assessment--Report and recommendation to the Congress of the United States and final legislative environmental impact statement. U.S. Fish and Wildlife Service, U.S. Geological Survey, and Bureau of Land Management, v. 1, Washington D.C.
- Dalrymple, Tate, and M.A. Benson. 1967. Measurement of peak discharge by slope-area method: Department of the Interior, Techniques of Water Resources Inventory, U.S. Geological Survey, Book 3, Chapter A2.
- Daum, D., P. Rost, and M. Smith. 1984. Fisheries studies on the north slope of the Arctic National Wildlife Refuge, 1983. Pages 464-522 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment: 1983 update report, baseline study of the fish, wildlife, and their habitats. U.S. Wildlife Service, Anchorage, Alaska.

- Elliott, G.V. 1989. Winter water availability on the 1002 Area of the Arctic National Wildlife Refuge. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 3. Anchorage, Alaska.
- Elliott, G.V. 1990. Quantification and distribution of winter water within lakes of the 1002 area, Arctic National Wildlife Refuge, 1989. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 7, Anchorage, Alaska.
- Elliott, G.V. and S.M. Lyons. 1990. Quantification and distribution of winter water within river systems of the 1002 area, Arctic National Wildlife Refuge. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 6, Anchorage, Alaska.
- Estes, C.C. 1993. Annual summary of Alaska Department of Fish and Game instream flow reservation applications. Alaska Department of Fish and Game, Division of Sport Fish, Fishery Data Series No. 93-43, Anchorage, Alaska.
- Glesne, R.S., and S.J. Deschermeier. 1984. Abundance, distribution and diversity of aquatic microinvertebrates on the north slope of the Arctic National Wildlife Refuge, 1982 and 1983. Pages 523-569 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment: 1983 update report, baseline study of the fish, wildlife, and their habitats. U.S. Wildlife Service, Anchorage, Alaska.
- Global Position Services, Inc. 1993. Selected lake elevations survey within the 1002 Area of the Arctic National Wildlife Refuge. Anchorage, Alaska.
- Hartman, D.C. 1973. Geology and mineral evaluation of the Arctic National Wildlife Range, northeast Alaska (revised). Alaska Division of Geological and Geophysical Surveys Open-file Report 22.
- Hydrologic Subcommittee. 1982. Guidelines for determining flood flow frequency, Bulletin #17B. U.S. Department of the Interior, Geological Survey, Office of Water Data Coordination. Reston, Virginia.
- Lyons, S.M., G.V. Elliott. 1987. FY-1987 status report federal reserve water rights, Arctic National wildlife Refuge. Alaska Investigations, Branch of Water Resources Operations, U.S. Fish and Wildlife Service, Anchorage, Alaska.
- Lyons, S.M. 1988. Stream discharge measurement handbook. U.S. Fish and Wildlife Service, Region 7, Anchorage, Alaska.
- Lyons, S.M. 1990. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1989 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 8, Anchorage, Alaska.

- Lyons, S.M., J.M. Trawicki. 1991. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1990 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report, Anchorage, Alaska.
- Lyons, S.M., J.M. Trawicki. 1992. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1991 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report Number 92-2, Anchorage, Alaska.
- Lyons, S.M., J.M. Trawicki. 1993. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1992 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Water Resource Progress Report Number 93-1, Anchorage, Alaska.
- National Wetlands Inventory. National wetlands inventory notes to the user for north slope 1:63,360. U.S. Fish and Wildlife Service, Anchorage Alaska.
- Nelson, G.L., J.A. Munter, 1990. Ground water: in Cold regions hydrology and hydraulics. Edited by W.L. Ryan and R.D Crissman. Technical Council on Cold Regions Engineering of the American Society of Civil Engineers, New York, New York.
- Rantz, S.E., and others. 1982. Measurement and computation of streamflow: Volume 1. Measurement of stage and discharge. Geological Survey Water-Supply Paper 2175. United States Government Printing Office, Washington, D.C.
- Slaughter, C.W. 1990. Aufeis formation and prevention: in Cold regions hydrology and hydraulics. Edited by W.L. Ryan and R.D Crissman. Technical Council on Cold Regions Engineering of the American Society of Civil Engineers, New York, New York.
- Sloan, C.E. 1987. Alaskan North Slope Geology: Volume 1. U.S. Geological Survey, Anchorage, Alaska.
- Smith, M.W., and R.S. Glesne. 1982. Aquatic Studies on the north slope of the Arctic National Wildlife Refuge, 1981 and 1982. Pages 291-364 in G.W. Garner and P.E. Reynolds, editors. Arctic National Wildlife Refuge coastal plain resource assessment: 1982 update report, baseline study of the fish, wildlife, and their habitats. U.S. Wildlife Service, Anchorage, Alaska.
- Still, P.J., and J.M. Cosby. 1989. Alaska index: streamflow, lake levels, and water quality records to September 30, 1988. U.S. Geological Survey, Open File-Report 89-269, Anchorage, Alaska.
- Trawicki, J.M., S.M. Lyons, and G.V. Elliott. 1991. Distribution and quantification of water within lakes of the 1002 area, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 10, Anchorage, Alaska.

- Tweeten, R.G. 1985. Inventory of water resources pertinent to quantification of federal reserved water rights on selected areas within the Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Habitat Resources Program, Division of Technical Services, Anchorage, Alaska.
- U.S. Army Corps of Engineers. 1982. Flood flow frequency analysis, generalized computer program 723-X6-L7550. Hydrologic engineering Center, Water Resource Center, Davis, California.
- U.S. Fish and Wildlife Service. 1988. Arctic National Wildlife Refuge final comprehensive conservation plan, environmental impact statement, wilderness review and wild river plans. U.S. Fish and Wildlife Service, Region 7, Anchorage, Alaska.
- U.S. Fish and Wildlife Service. 1989. Water resource inventory and assessment, Arctic National Wildlife Refuge, 1988 stream discharge gaging data. U.S. Fish and Wildlife Service, Alaska Fisheries Progress Report, Anchorage, Alaska.
- Walker, D.A., Acevedo, W., Everett, K. R., Gaydos, L., Brown, J., and Webber, P. J., 1982. Landsat-assisted environmental mapping in the Arctic National Wildlife Refuge, Alaska: US Army Corp of Engineers Cold Research and Engineering Laboratory, CRREL Report 82-37, Hanover, New Hampshire.
- West, R.L., and D.J. Fruge, 1989. A review of coastal plain fish surveys and the results of 1986 fish surveys of selected coastal lakes and streams, Arctic National Wildlife Refuge, Alaska. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 4, Anchorage, Alaska.
- Williams, J.R. 1970. Ground water in the permafrost regions of Alaska. U.S. Geological Survey Professional Paper 696. Anchorage, Alaska.
- Wiswar, D.W., 1991. Summer distribution of fishes in the Okpilak and Akutoktak Rivers, Arctic National Wildlife Refuge, Alaska, 1989. U.S. Fish and Wildlife Service, Alaska Fisheries Technical Report Number 11, Anchorage, Alaska.

Appendix A

Surface Water Discharge Records

ARCTIC NATIONAL WILDLIFE REFUGE

A-1

Akutoktak River

LOCATION.--Lat 69°49.97' N., long 143°46.83' W., in center sec. 36, T.6N., R.33E., Umiat Meridian, 0.6 miles upstream from the confluence with the Okpilak River, 20.8 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--97.1 mi², of which 66 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR THE PERIOD OF RECORD.--Maximum Discharge, 119 cfs Aug. 23, 1988 @ 0830 hrs; Minimum Discharge, 4.7 cfs Sept. 25, 1988 @ 0645 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	80 e	20 e	5.6	36							
2	0.0 e	90 e	20 e	5.5	29							
3	0.0 e	90 e	20 e	6.1	34							
4	0.0 e	90 e	20 e	8.0	60							
5	0.0 e	90 e	10 e	7.4	89							
6	0.0 e	90 e	10 e	6.8	74							
7	0.0 e	230 e	10 e	6.5	58							
8	0.0 e	810 e	10 e	8.5	43							
9	0.0 e	1000 e	10 e	31	32							
10	0.0 e	920 e	10 e	65	24							
11	0.0 e	870 e	10 e	43	19							
12	0.0 e	750 e	10 e	29	16							
13	0.0 e	630 e	10 e	28	14							
14	0.0 e	530 e	10 e	22	14							
15	0.0 e	420 e	10 e	16	12							
16	0.0 e	360 e	10 e	13	11							
17	0.0 e	290 e	10 e	18	10							
18	0.0 e	230 e	10 e	18	9.2							
19	0.0 e	30 e	170 e	10 e	17	8.7						
20	0.0 e	70 e	130 e	8.0	18	8.7						
21	0.0 e	120 e	100 e	8.0	23	9.2						
22	0.0 e	150 e	80 e	7.6	63	8.7						
23	0.0 e	150 e	70 e	7.8	111	8.0						
24	0.0 e	120 e	60 e	8.5	104	7.6						
25	0.0 e	100 e	50 e	8.3	76	6.5						
26	0.0 e	90 e	50 e	7.6	55	5.9						
27	0.0 e	80 e	40 e	7.0	46	---						
28	0.0 e	80 e	30 e	6.6	43	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	80 e	30 e	6.3	39	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	80 e	20 e	5.9	46	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	80 e	---	6.1	47	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1230	8400	318	1023	648
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95	280	10	33	25
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150	1000	20	111	89
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30	20	5.9	5.5	5.9
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.97	2.88	0.11	0.34	0.26
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.47	3.22	0.12	0.39	0.25
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2440	16661	630	2029	1286

TOTAL 11619
 MEAN (MAY 19 TO SEP 26) 89
 SEVEN-DAY LOW FLOW 6.03
 INSTANTANEOUS PEAK FLOW 119 e (Aug. 23, 1988)

TOTAL RUNOFF (AC-FT) 23046
 AVERAGE RUNOFF (CFSM) 0.91
 TOTAL RUNOFF (INCHES) 4.45

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-2

Akutoktak River

LOCATION.--Lat 69°49.97' N., long 143°46.83' W., in center sec. 36, T.6N., R.33E., Umiat Meridian, 0.6 miles upstream from the confluence with the Okpilak River, 20.8 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--97.1 mi², of which 66 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Data gap (July 26 to Aug. 12) caused by equipment malfunction. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,703 cfs Aug. 20, 1989 @ 2350 hrs; Minimum Discharge, 2.2 cfs July 6-7, 1989.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	430 e	7.7	---	---							
2	0.0 e	510 e	5.9	---	---							
3	0.0 e	600 e	3.5	---	---							
4	0.0 e	680 e	3.8	---	---							
5	0.0 e	770 e	2.8	---	---							
6	0.0 e	850 e	2.4	---	---							
7	0.0 e	940 e	2.8	---	---							
8	0.0 e	1020 e	4.1	---	---							
9	0.0 e	600 e	5.5	---	---							
10	0.0 e	500 e	6.9	---	---							
11	0.0 e	360 e	23	---	---							
12	0.0 e	250 e	44	---	---							
13	0.0 e	220 e	27	66	---							
14	0.0 e	190 e	16	608	---							
15	0.0 e	187	10	549	---							
16	0.0 e	143	10	392	---							
17	0.0 e	105	290	349	---							
18	0.0 e	74	344	223	---							
19	0.0 e	52	146	138	---							
20	0.0 e	48	114	251	---							
21	0.0 e	42	235	---	---							
22	0.0 e	37	469	---	---							
23	0.0 e	45	295	---	---							
24	0.0 e	48	719	---	---							
25	0.0 e	46	444	---	---							
26	0.0 e	42	---	---	---							
27	0.0 e	29	---	---	---							
28	0.0 e	20	---	---	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	14	---	---	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	10	---	---	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	---	---	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8862	3231	2576	---
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	295	129	---	---
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1020	719	608	---
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10	2.4	66	---
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.04	1.33	---	---
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.39	1.24	---	---
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17578	6409	5109	---

TOTAL	14669	TOTAL RUNOFF (AC-FT)	29096
MEAN (JUN 6 TO AUG 20)	233	AVERAGE RUNOFF (CFSM)	2.40
SEVEN-DAY LOW FLOW	3.57	TOTAL RUNOFF (INCHES)	5.62
INSTANTANEOUS PEAK FLOW	1703 (Aug. 20, 1989)		

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-3

Akutoktak River

LOCATION.--Lat 69°49.97' N., long 143°46.83' W., in center sec. 36, T.6N., R.33E., Umiat Meridian, 0.6 miles upstream from the confluence with the Okpilak River, 20.8 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--97.1 mi², of which 66 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,703 cfs Aug. 20, 1989 @ 2350 hrs; Minimum Discharge, 0.7 cfs Aug. 18, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	20 e	5.8	3.0	19							
2	0.0 e	10 e	5.1	2.4	27							
3	0.0 e	10 e	4.2	1.8	20							
4	0.0 e	10 e	3.0	1.7	15							
5	0.0 e	8.0 e	2.4	1.6	12							
6	0.0 e	7.0 e	1.7	1.4	23							
7	0.0 e	6.0 e	1.4	1.7	60							
8	0.0 e	5.0 e	1.4	1.6	52							
9	0.0 e	5.0 e	1.6	1.3	36							
10	0.0 e	4.0 e	1.8	1.2	24							
11	0.0 e	---	5.0 e	2.4	1.1	19						
12	0.0 e	---	6.0 e	2.4	1.0	16						
13	0.0 e	---	8.9	2.2	1.0	13						
14	0.0 e	---	11	1.7	0.93	11						
15	0.0 e	---	10	1.4	0.86	15						
16	0.0 e	---	9.4	1.1	0.80	21						
17	0.0 e	---	14	1.6	0.80	17						
18	0.0 e	---	14	1.6	0.80	17						
19	0.0 e	1360 e	48	1.7	1.2	11						
20	0.0 e	560 e	44	1.6	5.1	8.1						
								370 e	134	1.6	4.5	---
21	0.0 e	280 e	118	1.4	4.8	---						
22	0.0 e	210 e	99	3.2	4.8	---						
23	0.0 e	160 e	64	2.8	4.8	---						
24	0.0 e	130 e	46	1.6	3.9	---						
25	0.0 e	90 e	35	1.3	3.0	---						
26	0.0 e	60 e	22	1.1	2.4	---						
27	0.0 e	40 e	15	1.0	2.0	---						
28	0.0 e	40 e	11	4.5	2.4	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	30 e	8.5	8.1	9.4	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	20 e	6.9	5.4	10	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	20 e	---	3.9	11	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3370	802	80	94	420
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	241	27	3	3	22
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1360	134	8	11	60
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20	6.9	1.0	0.80	8.1
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.48	0.28	0.03	0.03	0.23
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.29	0.31	0.03	0.04	0.16
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6684	1591	159	187	833

TOTAL 4767
 MEAN (MAY 18 TO SEP 19) 38
 SEVEN-DAY LOW FLOW 0.93
 INSTANTANEOUS PEAK FLOW 215 (June 20, 1990)

TOTAL RUNOFF (AC-FT) 9454
 AVERAGE RUNOFF (CFSM) 0.39
 TOTAL RUNOFF (INCHES) 1.83

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

Akutoktak River

LOCATION.--Lat 69°49.97' N., long 143°46.83' W., in center sec. 36, T.6N., R.33E., Umiat Meridian, 0.6 miles upstream from the confluence with the Okpilak River, 20.8 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--97.1 mi², of which 66.0 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,703 cfs Aug. 20, 1989 @ 2350 hrs; Minimum Discharge, 0.7 cfs Aug. 18, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	600 e	62	63	10							
2	0.0 e	1230 e	50	45	8.2							
3	0.0 e	630 e	32	34	7.3							
4	0.0 e	566	22	28	6.9							
5	0.0 e	395	14	29	7.3							
6	0.0 e	194	10	26	5.4							
7	0.0 e	124	8.7	20	4.7							
8	0.0 e	73	7.1	19	5.0							
9	0.0 e	50	4.9	19	5.0							
10	0.0 e	40	4.5	23	4.7							
11	0.0 e	31	3.8	18	4.4							
12	0.0 e	58	3.8	15	4.7							
13	0.0 e	308	3.8	12	5.4							
14	0.0 e	597	3.8	55	4.4							
15	0.0 e	451	3.1	96	5.0							
16	0.0 e	296	4.5	100	4.2							
17	0.0 e	284	3.8	80	76							
18	0.0 e	3.0 e	348	3.8	60	532						
19	0.0 e	6.0 e	10 e	256	53	318						
20	0.0 e	10 e	60 e	227	44	37						
21	0.0 e	80 e	169	37	29	213						
22	0.0 e	110 e	124	60	25	298						
23	0.0 e	130 e	76	314	30	226						
24	0.0 e	140 e	64	236	44	141						
25	0.0 e	150 e	43	122	43	---						
26	0.0 e	160 e	53	71	34	---						
27	0.0 e	170 e	163	47	26	---						
28	0.0 e	200 e	100	36	21	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	260 e	61	33	17	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	320 e	46	29	14	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	420 e	---	63	11	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2219	7657	1389	1118	2094
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	148	255	45	36	87
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	420	1230	314	100	532
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	31	3.1	11	4.2
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.52	2.63	0.46	0.37	0.90
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.85	2.93	0.53	0.43	0.80
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4401	15188	2755	2218	4154

TOTAL	14478	TOTAL RUNOFF (AC-FT)	28717
MEAN (MAY 17 TO SEP 24)	111	AVERAGE RUNOFF (CFSM)	1.14
SEVEN-DAY LOW FLOW	3.77	TOTAL RUNOFF (INCHES)	5.55
INSTANTANEOUS PEAK FLOW	768 (June 14, 1991)		

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-5

Akutoktak River

LOCATION.--Lat 69°49.97' N., long 143°46.83' W., in center sec. 36, T.6N., R.33E., Umiat Meridian, 0.6 miles upstream from the confluence with the Okpilak River, 20.8 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--97.1 mi², of which 66.0 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,818 cfs Aug. 27, 1992 @ 1200 hrs; Minimum Discharge, 0.7 cfs Aug. 18, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	630 e	9.9	8.8	122							
2	0.0 e	590 e	11	7.5	122							
3	0.0 e	470 e	15	22	132							
4	0.0 e	340 e	13	34	132							
5	0.0 e	290 e	9.9	36	109							
6	0.0 e	270 e	8.1	26	95							
7	0.0 e	420 e	6.5	19	83							
8	0.0 e	350 e	5.5	16	73							
9	0.0 e	302	4.8	33	64							
10	0.0 e	345	4.5	53	53							
11	0.0 e	359	4.3	36	40							
12	0.0 e	154	5.2	25	29							
13	0.0 e	95	16	27	22							
14	0.0 e	154	19	40	17							
15	0.0 e	157	15	57	12							
16	0.0 e	105	11	51	16							
17	0.0 e	73	8.8	41	15							
18	0.0 e	54	6.8	70	11							
19	0.0 e	42	5.7	67	8.5							
20	0.0 e	32	5.2	47	7.1							
21	0.0 e	26	5.0	35	6.3							
22	0.0 e	22	6.0	28	---							
23	0.0 e	18	7.5	22	---							
24	0.0 e	15	6.8	19	---							
25	0.0 e	14	7.1	17	---							
26	0.0 e	14	7.8	31	---							
27	0.0 e	20	25	943	---							
28	0.0 e	19	29	652	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	560 e	14	19	383	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	780 e	11	14	233	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	710 e	---	11	162	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2070	5403	322	3240	1167
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	518	180	10	105	56
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	780	630	29	943	132
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	11	4.3	7.5	6.3
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.33	1.85	0.11	1.08	0.57
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.79	2.07	0.12	1.24	0.45
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4106	10716	639	6425	2316

TOTAL 12202
 MEAN (MAY 28 TO SEP 21) 104
 SEVEN-DAY LOW FLOW 5.57
 INSTANTANEOUS PEAK FLOW 1818 (Aug. 27, 1992)

TOTAL RUNOFF (AC-FT) 24202
 AVERAGE RUNOFF (CFSM) 1.07
 TOTAL RUNOFF (INCHES) 4.67

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-6

Itkilyariak Creek, West Fork

LOCATION.--Lat 69°50.31' N., long 144°24.71' W., NE¼NW¼ sec. 33, T.6N., R.31E., Umat Meridian, 0.6 miles upstream from the confluence with the Itkilyariak Creek, 20.75 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--26.9 mi², of which 8.7 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--June to Sept. 1989.

REMARKS.--This is a 3rd Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Stream normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,419 cfs Aug. 20, 1989; Minimum Discharge, 0 cfs July 2-6, 1989.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	90 e	4.0	29	80							
2	0.0 e	70 e	2.1	35	46							
3	0.0 e	60 e	0.0	139	45							
4	0.0 e	50 e	0.0	251	40							
5	0.0 e	50 e	0.0	92	32							
6	0.0 e	50 e	2.1	54	36							
7	0.0 e	50 e	6.6	42	56							
8	0.0 e	50 e	7.4	35	40							
9	0.0 e	50 e	4.5	29	29							
10	0.0 e	60 e	4.5	25	25							
11	0.0 e	60 e	59	26	26							
12	0.0 e	60 e	20	26	31							
13	0.0 e	60 e	14	37	45							
14	0.0 e	60 e	11	409	48							
15	0.0 e	61	8.0	176	40							
16	0.0 e	78	18	184	27							
17	0.0 e	52	218	122	20							
18	0.0 e	34	98	63	15							
19	0.0 e	34	41	40	15							
20	0.0 e	27	31	300	11							
21	0.0 e	24	35	554	12							
22	0.0 e	18	41	139	9.2							
23	0.0 e	15	33	59	---							
24	0.0 e	21	29	37	---							
25	0.0 e	27	61	34	---							
26	0.0 e	13	251	31	---							
27	0.0 e	10	320	30	---							
28	0.0 e	40 e	7.7	92	27							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	90 e	6.6	44	27
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	120 e	4.9	28	26
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	---	23	67	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	380	1253	1506	3145	728
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12	42	49	101	33
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120	90	320	554	80
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	25.0	9.2
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.46	1.55	1.81	3.77	1.23
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.53	1.73	2.08	4.35	1.01
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	754	2486	2988	6238	1444

TOTAL 7012
 MEAN (MAY 27 TO SEP 22) 59
 SEVEN-DAY LOW FLOW 1.88
 INSTANTANEOUS PEAK FLOW 1419 (Aug. 20, 1989)

TOTAL RUNOFF (AC-FT) 13909
 AVERAGE RUNOFF (CFSM) 2.19
 TOTAL RUNOFF (INCHES) 9.69

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-7

Itkilyariak Creek, West Fork

LOCATION.--Lat 69°50.31' N., long 144°24.71' W., NE¼NW¼ sec. 33, T.6N., R.31E., Umat Meridian, 0.6 miles upstream from the confluence with the Itkilyariak Creek, 20.75 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--26.9 mi², of which 8.7 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

REMARKS.--This is a 3rd Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Stream normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,419 cfs Aug. 20, 1989; Minimum Discharge, 0 cfs July 2-6, 1989, and July 13-16, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
1	0.0 e	40 e	4.5	5.4	73								
2	0.0 e	40 e	3.4	3.7	40								
3	0.0 e	30 e	3.0	3.0	28								
4	0.0 e	30 e	2.7	4.9	21								
5	0.0 e	30 e	2.1	6.8	20								
6	0.0 e	20 e	1.4	4.9	110								
7	0.0 e	20 e	1.4	3.7	165								
8	0.0 e	10 e	1.9	3.4	97								
9	0.0 e	10 e	2.1	3.0	59								
10	0.0 e	10 e	1.6	2.7	40								
11	0.0 e	20 e	1.0	2.4	31								
12	0.0 e	43	0.5	2.1	26								
13	0.0 e	1.0 e	81	0.1	1.9	21							
14	0.0 e	3.0 e	47	0.0	1.6	21							
15	0.0 e	8.0 e	28	0.1	1.6	50							
16	0.0 e	90 e	32	1.0	4.1	64							
17	0.0 e	26	1.2	4.5	33								
18	0.0 e	1260 e	30	1.4	3.7	19							
19	0.0 e	890 e	66	1.4	3.7	14							
20	0.0 e	710 e	89	0.6	3.7	---							
21	0.0 e	410 e	44	0.8	4.1	---							
22	0.0 e	280 e	53	21	3.7	---							
23	0.0 e	230 e	30	25	3.0	---							
24	0.0 e	200 e	20	16	2.1	---							
25	0.0 e	170 e	12	9.5	1.6	---							
26	0.0 e	130 e	7.8	49	1.2	---							
27	0.0 e	110 e	80 e	6.8	42	1.4	---						
28	0.0 e	80 e	70 e	5.8	16	20.6	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	70 e	60 e	4.9	11	14.8	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	60 e	50 e	5.4	8.9	12.7	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	50 e	---	6.8	18.8	---	
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4802	890	237	155	934	
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155	30	7.6	5.0	49	
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1260	89	49	21	165	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	0.0	1.2	14.1	
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.76	1.10	0.30	0.21	1.83	
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.64	1.23	0.33	0.21	1.29	
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9525	1766	469	308	1853	

TOTAL	7019	TOTAL RUNOFF (AC-FT)	13921
MEAN (MAY 13 TO SEP 19)	54	AVERAGE RUNOFF (CFSM)	2.01
SEVEN-DAY LOW FLOW	0.53	TOTAL RUNOFF (INCHES)	9.70
INSTANTANEOUS PEAK FLOW	160 (June 19, 1990)		

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-8

Itkilyariak Creek, West Fork

LOCATION.--Lat 69°50.31' N., long 144°24.71' W., NE¼NW¼ sec. 33, T.6N., R.31E., Umiat Meridian, 0.6 miles upstream from the confluence with the Itkilyariak Creek, 20.75 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--26.9 mi², of which 8.7 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 3rd Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data due to equipment damage during flood event. Stream normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,419 cfs Aug. 20, 1989; Minimum Discharge, 0 cfs July 2-6, 1989, and July 13-16, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
1	0.0 e	770 e	30	---	19								
2	0.0 e	1120 e	19	---	17								
3	0.0 e	830 e	14	---	10								
4	0.0 e	440 e	11	11	8.4								
5	0.0 e	250 e	8.1	11	7.9								
6	0.0 e	140 e	8.1	13	6.5								
7	0.0 e	155	8.1	14	4.8								
8	0.0 e	111	8.1	11	4.4								
9	0.0 e	90	6.5	16	4.1								
10	0.0 e	70	6.5	17	3.1								
11	0.0 e	61	6.5	11	3.7								
12	0.0 e	70	6.5	7.9	2.2								
13	0.0 e	178	8.1	6.1	2.8								
14	0.0 e	241	6.5	5.2	2.5								
15	0.0 e	170 e	6.0	5.6	3.4								
16	0.0 e	120 e	11	7.4	2.5								
17	0.0 e	100 e	8.1	7.9	137								
18	0.0 e	178	8.1	7.9	177								
19	0.0 e	1.0 e	144	14	6.1	105							
20	0.0 e	5.0 e	40 e	144	8.1	4.8	64						
21	0.0 e	50 e	122	37	4.1	102							
22	0.0 e	80 e	100	---	14	100							
23	0.0 e	90 e	70	---	173	56							
24	0.0 e	110 e	52	---	115	29							
25	0.0 e	120 e	37	---	64	---							
26	0.0 e	130 e	80	---	40	---							
27	0.0 e	150 e	70	---	29	---							
28	0.0 e	180 e	52	---	29	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	250 e	44	---	31	---	
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	340 e	37	---	26	---	
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	480 e	---	---	22	---	
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2026	6046	239	710	872	
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	145	202	11	25	36	
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	480	1120	37	173	177	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37	6.0	4.1	2.2	
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.38	7.49	0.42	0.94	1.34	
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.80	8.36	0.33	0.98	1.21	
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4019	11992	475	1408	1730	

TOTAL	9894	TOTAL RUNOFF (AC-FT)	19624
MEAN (MAY 18 TO SEP 24)	85	AVERAGE RUNOFF (CFSM)	3.14
SEVEN-DAY LOW FLOW	2.89	TOTAL RUNOFF (INCHES)	13.68
INSTANTANEOUS PEAK FLOW	276 (June 14, 1991)		

NOTE: e = Estimated

ARCTIC NATIONAL WILDLIFE REFUGE

A-9

Itkilyariak Creek, West Fork

LOCATION.--Lat 69°50.31' N., long 144°24.71' W., NE¼NW¼ sec. 33, T.6N., R.31E., Umiat Meridian, 0.6 miles upstream from the confluence with the Itkilyariak Creek, 20.75 miles south-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--26.9 mi², of which 8.7 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 3rd Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data due to bear damage (7/8/92 to 8/6/92), and equipment malfunction (8/10/92 to 8/13/92). Stream normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,419 cfs Aug. 20, 1989; Minimum Discharge, 0 cfs July 2-6, 1989, and July 13-16, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	710 e	16	---	54							
2	0.0 e	250 e	24	---	55							
3	0.0 e	60 e	18	---	47							
4	0.0 e	33	16	---	41							
5	0.0 e	27	15	---	37							
6	0.0 e	24	16	---	35							
7	0.0 e	18	17	3.7	33							
8	0.0 e	74	---	4.9	30							
9	0.0 e	142	---	14	27							
10	0.0 e	247	---	---	19							
11	0.0 e	204	---	---	20							
12	0.0 e	101	---	---	16							
13	0.0 e	59	---	---	16							
14	0.0 e	49	---	12	14							
15	0.0 e	37	---	17	10							
16	0.0 e	29	---	12	9.1							
17	0.0 e	24	---	19	9.5							
18	0.0 e	20	---	78	13							
19	0.0 e	18	---	45	11							
20	0.0 e	16	---	33	11							
21	0.0 e	13	---	27	9.1							
22	0.0 e	12	---	20	---							
23	0.0 e	12	---	16	---							
24	0.0 e	9.8	---	14	---							
25	0.0 e	---	7.7	---	13	---						
26	0.0 e	---	24	---	32	---						
27	0.0 e	---	49	---	679	---						
28	0.0 e	---	25	---	270	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	710 e	18	---	185	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	1110 e	15	---	118	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	970 e	---	---	71	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2790	2325	121	1682	513
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	930	78	---	80	24
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1110	710	24	679	55
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	15	3.7	9.1
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.6	2.88	---	2.98	0.91
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.86	3.21	---	2.32	0.71
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5534	4612	240	3335	1018

TOTAL	7431	TOTAL RUNOFF (AC-FT)	14740
MEAN (MAY 29 TO SEP 21)	91	AVERAGE RUNOFF (CFSM)	3.37
SEVEN-DAY LOW FLOW	---	TOTAL RUNOFF (INCHES)	10.27
INSTANTANEOUS PEAK FLOW	1255 (Aug. 27, 1992)		

NOTE: e = Estimated

ARCTIC NATIONAL WILDLIFE REFUGE

Niguanak River

LOCATION.--Lat 70°0.58' N., Long 143°1.9 W., NW/NE sec. 36, T.8N., R.36E., Umiat Meridian, 6 miles upstream from the mouth, 16.5 mi south-east of Kaktovik, Alaska.

DRAINAGE AREA.--136.2 mi².

PERIOD OF RECORD.--June to Sept. 1989.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 2,071 cfs Aug. 21, 1989 @ 0310 hrs; Minimum Discharge, 3.3 cfs July 3, 1989 @ 1805 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	520 e	44	61	266							
2	0.0 e	630 e	38	60	266							
3	0.0 e	730 e	18	67	573							
4	0.0 e	740 e	44	107	581							
5	0.0 e	940 e	89	94	346							
6	0.0 e	1050 e	60	75	367							
7	0.0 e	1150 e	140	64	297							
8	0.0 e	1260 e	50	59	160							
9	0.0 e	1360 e	30	55	105							
10	0.0 e	1230 e	34	50	115							
11	0.0 e	1050 e	71	52	362							
12	0.0 e	750 e	42	57	413							
13	0.0 e	580 e	27	60	395							
14	0.0 e	597	30	203	657							
15	0.0 e	491	43	311	557							
16	0.0 e	550	109	266	341							
17	0.0 e	279	82	234	227							
18	0.0 e	227	30	193	163							
19	0.0 e	158	51	147	166							
20	0.0 e	123	56	320	119							
21	0.0 e	187	79	1,148	117							
22	0.0 e	150	67	413	111							
23	0.0 e	109	57	288	---							
24	0.0 e	147	69	227	---							
25	0.0 e	---	137	53	231	---						
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	109	145	166	---
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94	311	160	---
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	63	199	187	---
29	0.0	0.0	0.0	0.0	---	0.0	0.0	---	53	109	180	---
30	0.0	0.0	0.0	0.0	---	0.0	0.0	---	84	94	203	---
31	0.0	---	0.0	0.0	---	0.0	---	---	---	81	246	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	15548	2352	5984	6704
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	518	76	193	305
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1360	311	1148	657
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	53	18	50	105
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3.81	0.56	1.42	2.24
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	4.25	0.64	1.63	1.83
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	30839	4665	11869	13297

TOTAL 30588
 MEAN (JUN 9 TO SEP 22) 259
 SEVEN-DAY LOW FLOW 39.50
 INSTANTANEOUS PEAK FLOW 2071 (AUG. 21, 1989)

TOTAL RUNOFF (AC-FT) 60670
 AVERAGE RUNOFF (CFSM) 1.90
 TOTAL RUNOFF (INCHES) 8.35

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-11

Niguanak River

LOCATION.--Lat 70°0.58' N., Long 143°1.9 W., NW¼NW¼NE¼ sec. 36, T.8N., R.36E., Umiat Meridian, 6 miles upstream from the mouth, 16.5 mi south-east of Kaktovik, Alaska.

DRAINAGE AREA.--136.2 mi².

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Bear disturbed instrument July 13, 1990. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 2,071 cfs Aug. 21, 1989 @ 0310 hrs; Minimum Discharge, 0 cfs Aug. 2, 7, 10-27, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	0.0	50 e	21	1 e	16 e						
2	0.0 e	0.0	40 e	17	0 e	29 e						
3	0.0 e	0.0	40 e	14	1 e	39 e						
4	0.0 e	0.0	30 e	13	1 e	37 e						
5	0.0 e	0.0	20 e	8 e	1 e	37 e						
6	0.0 e	0.0	20 e	5 e	1 e	84 e						
7	0.0 e	0.0	20 e	5 e	0 e	200 e						
8	0.0 e	0.0	20 e	3 e	1 e	155 e						
9	0.0 e	0.0	20 e	5 e	1 e	115 e						
10	0.0 e	0.0	71	4 e	0 e	87 e						
11	0.0 e	60 e	87	4 e	0 e	66 e						
12	0.0 e	70 e	78	3 e	0 e	50 e						
13	0.0 e	100 e	135	2 e	0 e	37 e						
14	0.0 e	160 e	138	2 e	0 e	29 e						
15	0.0 e	220 e	138	1 e	0 e	25 e						
16	0.0 e	570 e	107	1 e	0 e	22 e						
17	0.0 e	2540 e	92	2 e	0 e	19 e						
18	0.0 e	2110 e	94	2 e	0 e	16 e						
19	0.0 e	1310 e	89	1 e	0 e	13 e						
20	0.0 e	1090 e	92	1 e	0 e	---						
21	0.0 e	820 e	92	1 e	0 e	---						
22	0.0 e	630 e	94	5 e	0 e	---						
23	0.0 e	490 e	94	6 e	0 e	---						
24	0.0 e	380 e	64	2 e	0 e	---						
25	0.0 e	290 e	52	1 e	0 e	---						
26	0.0 e	200 e	48	1 e	0 e	---						
27	0.0 e	140 e	34	1 e	0 e	---						
28	0.0 e	120 e	34	1 e	1 e	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	90 e	32	1 e	1 e	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	80 e	26	1 e	1 e	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	60 e	---	1 e	3 e	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11530	1949	136	16	1076
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	549	65	---	---	---
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2540	138	21	1	200
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26	0.7	0.0	---
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.03	0.48	---	---	---
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.15	0.53	---	---	---
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22869	3867	269	31	2134

TOTAL 14707
MEAN (MAY 11 TO SEP 19) 111
SEVEN-DAY LOW FLOW 0.00
INSTANTANEOUS PEAK FLOW ---

TOTAL RUNOFF (AC-FT) 29170
AVERAGE RUNOFF (CFSM) 0.82
TOTAL RUNOFF (INCHES) 4.02

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-12

Niguanak River

LOCATION.--Lat 70°0.58' N., Long 143°1.9 W., NW¼NW¼NE¼ sec. 36, T.8N., R.36E., Umiat Meridian, 6 miles upstream from the mouth, 16.5 mi south-east of Kaktovik, Alaska.

DRAINAGE AREA.--136.2 mi².

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Bear disturbed instrument July 13, 1990. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 2,071 cfs Aug. 21, 1989 @ 0310 hrs; Minimum Discharge, 0 cfs Aug. 2, 7, 10-27, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	1710 e	200	52	9.3							
2	0.0 e	2000 e	175	45	8.5							
3	0.0 e	1800 e	148	36	7.8							
4	0.0 e	1150 e	117	26	6.4							
5	0.0 e	780 e	82	23	3.4							
6	0.0 e	520 e	100	37	3.8							
7	0.0 e	370 e	117	29	5.2							
8	0.0 e	280 e	77	28	3.8							
9	0.0 e	220 e	67	26	5.2							
10	0.0 e	240 e	54	21	3.8							
11	0.0 e	390 e	43	17	3.4							
12	0.0 e	620 e	41	15	4.7							
13	0.0 e	1114	48	16	4.7							
14	0.0 e	1281	59	18	3.8							
15	0.0 e	1114	87	20	3.8							
16	0.0 e	888	106	21	4.7							
17	0.0 e	80 e	781	109	21	16						
18	0.0 e	110 e	946	87	16	117						
19	0.0 e	180 e	867	79	11	196						
20	0.0 e	410 e	765	95	10	283						
21	0.0 e	470 e	654	120	9.3	339						
22	0.0 e	550 e	525	193	15	480 e						
23	0.0 e	590 e	352	515	23	350 e						
24	0.0 e	630 e	308	366	28	250 e						
25	0.0 e	650 e	215	219	28	---						
26	0.0 e	660 e	246	132	23	---						
27	0.0 e	700 e	326	103	17	---						
28	0.0 e	760 e	361	77	14	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	870 e	339	65	13	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	950 e	308	63	11	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	1230 e	---	56	9.3	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8840	21471	3802	678	2114
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	589	716	123	22	88
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1230	2000	515	52	480
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	215	41	9.3	3.4
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.33	5.25	0.90	0.16	0.65
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.41	5.86	1.04	0.19	0.58
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17534	42586	7540	1346	4193

TOTAL 36904
 MEAN (MAY 17 TO SEP 24) 282
 SEVEN-DAY LOW FLOW 4.11
 INSTANTANEOUS PEAK FLOW 1319 (June 14, 1991)

TOTAL RUNOFF (AC-FT) 73199
 AVERAGE RUNOFF (CFSM) 2.07
 TOTAL RUNOFF (INCHES) 10.08

NOTE: e = Estimate

ARCTIC NATIONAL WILDLIFE REFUGE

Niguanak River

LOCATION.--Lat 70°0.58' N., Long 143°1.9 W., NW¼NW¼NE¼ sec. 36, T.8N., R.36E., Umiat Meridian, 6 miles upstream from the mouth, 16.5 mi south-east of Kaktovik, Alaska.

DRAINAGE AREA.--136.2 mi².

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data beginning July 7, 1992 due to equipment malfunction. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 2,071 cfs Aug. 21, 1989 @ 0310 hrs; Minimum Discharge, 0 cfs Aug. 2, 7, 10-27, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	890 e	203	---	---							
2	0.0 e	500 e	140	---	---							
3	0.0 e	340 e	100	---	---							
4	0.0 e	150 e	92	---	---							
5	0.0 e	171	116	---	---							
6	0.0 e	123	105	---	---							
7	0.0 e	110	103	---	---							
8	0.0 e	230	---	---	---							
9	0.0 e	689	---	---	---							
10	0.0 e	717	---	---	---							
11	0.0 e	1109	---	---	---							
12	0.0 e	710	---	---	---							
13	0.0 e	446	---	---	---							
14	0.0 e	337	---	---	---							
15	0.0 e	273	---	---	---							
16	0.0 e	227	---	---	---							
17	0.0 e	241	---	---	---							
18	0.0 e	265	---	---	---							
19	0.0 e	273	---	---	---							
20	0.0 e	253	---	---	---							
21	0.0 e	216	---	---	---							
22	0.0 e	220	---	---	---							
23	0.0 e	174	---	---	---							
24	0.0 e	110	---	---	---							
25	0.0 e	---	90	---	---	---						
26	0.0 e	---	90	---	---	---						
27	0.0 e	---	96	---	---	---						
28	0.0 e	---	190 e	159	---	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	1310 e	227	---	---	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	1570 e	189	---	---	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	1480 e	---	---	---	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3070	9623	859	---	---
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	321	---	---	---
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1570	1109	203	---	---
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90	92	---	---
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	2.36	---	---	---
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	2.63	---	---	---
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6089	19087	1703	---	---

TOTAL
MEAN
SEVEN-DAY LOW FLOW
INSTANTANEOUS PEAK FLOW

TOTAL RUNOFF (AC-FT)
AVERAGE RUNOFF (CFSM)
TOTAL RUNOFF (INCHES)

NOTE: e = Estimate

ARCTIC NATIONAL WILDLIFE REFUGE

Sadlerochit River

LOCATION.--Lat 69°38' N., long 144° 22.83' W., in NW¼SW¼ sec. 31, T.4N., R.32E., Umiat Meridian, 0.5 miles below the Wilderness boundary, 37.5 miles southwest of Kaktovik, Alaska.

DRAINAGE AREA.--520.1 mi², of which 517.5 mi² is located within the Arctic National Wildlife Refuge Wilderness Area. Glaciers account for 2.3 percent of the drainage area or about 11.8 mi² depending on existing climatic conditions.

PERIOD OF RECORD.--July to Sept. 1988.

REMARKS.--This is a 6th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data (July 28 to Aug. 15) was caused by a loose electrical connector. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 2,194 cfs Aug. 22, 1988 @ 1900 hrs; Minimum Discharge, 70.2 cfs Sept. 27, 1988 @ 1145 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	0.0 e	---	---	---	660						
2	---	0.0 e	---	---	---	601						
3	---	0.0 e	---	---	---	571						
4	---	0.0 e	---	---	---	547						
5	---	0.0 e	---	---	---	577						
6	---	0.0 e	---	---	---	520						
7	---	0.0 e	---	---	---	464						
8	---	0.0 e	---	---	---	398						
9	---	0.0 e	---	---	---	331						
10	---	0.0 e	---	---	---	285						
11	0.0 e	---	---	---	254							
12	0.0 e	---	---	---	229							
13	0.0 e	---	---	---	208							
14	0.0 e	---	---	---	185							
15	0.0 e	---	---	---	170							
16	0.0 e	---	---	---	978							
17	0.0 e	---	---	978	159							
18	0.0 e	---	---	928	139							
19	0.0 e	---	---	873	132							
20	0.0 e	---	---	828	122							
21	0.0 e	---	---	---	811	116						
22	0.0 e	---	---	846	1495	110						
23	0.0 e	---	---	702	1937	101						
24	0.0 e	---	---	607	1840	95						
25	0.0 e	---	---	520	1450	92						
26	0.0 e	---	---	454	1130	92						
27	0.0 e	---	---	385	928	84						
28	0.0 e	---	---	342	828	76						
29	0.0 e	---	---	---	747	---						
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	---	695	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	---	811	---
											771	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	3856	17052	7316
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	---	---	271
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	---	---	660
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	846	1937	76
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	342	695	0.50
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	---	---	0.10
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	---	---	14512

TOTAL 28224
 MEAN (JUL 21 TO SEP 27) ---
 SEVEN-DAY LOW FLOW 92.91
 INSTANTANEOUS PEAK FLOW 2194 (Aug. 22, 1988)

TOTAL RUNOFF (AC-FT) ---
 AVERAGE RUNOFF (CFSM) ---
 TOTAL RUNOFF (INCHES) ---

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

Sadlerochit River

LOCATION.--Lat 69°38' N., long 144° 22.83' W., in NW¼SW¼ sec. 31, T.4N., R.32E., Umiat Meridian, 0.5 miles below the Wilderness boundary, 37.5 miles southwest of Kaktovik, Alaska.

DRAINAGE AREA.--520.1 mi², of which 517.5 mi² is located within the Arctic National Wildlife Refuge Wilderness Area. Glaciers account for 2.3 percent of the drainage area or about 11.8 mi² depending on existing climatic conditions.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989.

REMARKS.--This is a 6th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 5,733 cfs Aug. 4, 1989 @ 1545 hrs; Minimum Discharge, 70.2 cfs Sept. 27, 1988 @ 1145 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	0.0 e	---	1275	894	904						
2	---	0.0 e	---	1013	1742	982						
3	---	0.0 e	---	775	1881	829						
4	---	0.0 e	---	649	4385	740						
5	---	0.0 e	---	749	3411	673						
6	---	0.0 e	---	866	2286	602						
7	---	0.0 e	---	923	1853	572						
8	---	0.0 e	---	1173	1608	784						
9	---	0.0 e	---	1275	1455	649						
10	---	0.0 e	---	1129	1298	536						
11	0.0 e	---	1217	1151	501							
12	0.0 e	---	2147	1054	820							
13	0.0 e	---	1530	1003	962							
14	0.0 e	---	1275	1151	1118							
15	0.0 e	---	1162	3053	943							
16	0.0 e	---	1107	2563	723							
17	0.0 e	---	2350	2193	565							
18	0.0 e	---	4124	1825	448							
19	0.0 e	1240	2698	1430	359							
20	0.0 e	923	1797	1173	255							
21	0.0 e	1151	1811	1997	234							
22	0.0 e	1582	2664	2366	176							
23	0.0 e	2056	2579	1492	158							
24	0.0 e	2012	2027	1096	---							
25	0.0 e	3315	2178	885	---							
26	0.0 e	2613	2132	913	---							
27	0.0 e	1783	2962	820	---							
28	0.0 e	1595	2546	749	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	1530	1595	657	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	1369	1162	625	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	943	572	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	21169	51833	49581	14533
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	1672	1599	632
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3315	4124	4385	1118
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	923	649	572	158
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	3.20	3.10	1.20
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	---	3.70	3.60	1.00
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	41988	102809	98342	28826

TOTAL 137116
 MEAN (JUN 19 TO SEP 23) 1414
 SEVEN-DAY LOW FLOW 313.63
 INSTANTANEOUS PEAK FLOW 5733 (Aug. 4, 1989)

TOTAL RUNOFF (AC-FT) 271966
 AVERAGE RUNOFF (CFSM) 2.72
 TOTAL RUNOFF (INCHES) 9.80

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-16

Sadlerochit River

LOCATION.--Lat 69°38' N., long 144° 22.83' W., in NW¼SW¼ sec. 31, T.4N., R.32E., Umiat Meridian, 0.5 miles below the Wilderness boundary, 37.5 miles southwest of Kaktovik, Alaska.

DRAINAGE AREA.--520.1 mi², of which 517.5 mi² is located within the Arctic National Wildlife Refuge Wilderness Area. Glaciers account for 2.3 percent of the drainage area or about 11.8 mi² depending on existing climatic conditions.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 6th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 5,733 cfs Aug. 4, 1989 @ 1545 hrs; Minimum Discharge, 70.2 cfs Sept. 27, 1988 @ 1145 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	0.0 e	---	1416	597	692						
2	---	0.0 e	---	1255	584	476						
3	---	0.0 e	---	1119	537	346						
4	---	0.0 e	---	1055	506	---						
5	---	0.0 e	---	983	470	---						
6	---	0.0 e	---	---	954	426	---					
7	---	0.0 e	---	---	944	394	---					
8	---	0.0 e	---	---	887	374	---					
9	---	0.0 e	---	---	798	355	---					
10	---	0.0 e	---	---	756	341	---					
11	0.0 e	---	177	708	337	---						
12	0.0 e	---	200	700	337	---						
13	0.0 e	---	459	781	337	---						
14	0.0 e	---	557	993	360	---						
15	0.0 e	---	1065	1267	399	---						
16	0.0 e	---	2578	1044	436	---						
17	0.0 e	---	1889	896	447	---						
18	0.0 e	---	2678	815	442	---						
19	0.0 e	---	2052	764	447	---						
20	0.0 e	---	2520	732	442	---						
21	0.0 e	---	1328	748	410	---						
22	0.0 e	---	1550	1429	374	---						
23	0.0 e	---	1086	1429	337	---						
24	0.0 e	---	869	1174	307	---						
25	0.0 e	---	740	983	282	---						
26	0.0 e	---	773	1044	271	---						
27	0.0 e	---	896	896	351	---						
28	0.0 e	---	1550	708	662	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	1634	633	655	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	2069	670	500	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	647	662	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	26668	29232	13381	1514
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1333	943	432	---
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	2678	1429	662	692
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	177	633	271	346
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	2.60	1.80	0.83	---
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1.90	2.10	1.00	---
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	52803	57879	26493	3004

TOTAL 70795
 MEAN (JUN 11 TO SEPT 3) 833
 SEVEN-DAY LOW FLOW 333.05
 INSTANTANEOUS PEAK FLOW 4857 (June 18, 1990)

TOTAL RUNOFF (AC-FT) 140419
 AVERAGE RUNOFF (CFSM) 1.60
 TOTAL RUNOFF (INCHES) 5.06

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

Sadlerochit River

LOCATION.--Lat 69°38' N., long 144° 22.83' W., in NW¼SW¼ sec. 31, T.4N., R.32E., Umiat Meridian, 0.5 miles below the Wilderness boundary, 37.5 miles southwest of Kaktovik, Alaska.

DRAINAGE AREA.--520.1 mi², of which 517.5 mi² is located within the Arctic National Wildlife Refuge Wilderness Area. Glaciers account for 2.3 percent of the drainage area or about 11.8 mi² depending on existing climatic conditions.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 6th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data (July 21 to Aug. 4) due to equipment problem due to flood event. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 21,000 cfs July 21, 1991; Minimum Discharge, 39 cfs Sept. 15, 1991 @ 1413 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	0.0 e	---	2324	---	442						
2	---	0.0 e	---	1775	---	460						
3	---	0.0 e	---	1432	---	424						
4	---	0.0 e	1304	1195	---	376						
5	---	0.0 e	1583	987	819	334						
6	---	0.0 e	1291	909	1092	294						
7	---	0.0 e	844	1050	1020	227						
8	---	0.0 e	543	844	872	235						
9	---	0.0 e	430	648	812	188						
10	---	0.0 e	371	554	614	148						
11	0.0 e	374	475	523	156							
12	0.0 e	389	421	479	120							
13	0.0 e	365	401	620	124							
14	0.0 e	792	399	919	78							
15	0.0 e	1028	433	763	83							
16	0.0 e	918	543	784	148							
17	0.0 e	---	768	698	368							
18	0.0 e	---	1932	835	620							
19	0.0 e	---	2584	1641	528							
20	0.0 e	---	2921	1060	465							
21	0.0 e	---	3305	9200	380							
22	0.0 e	---	3621	---	608							
23	0.0 e	---	3067	---	1732							
24	0.0 e	---	2880	---	887							
25	0.0 e	---	2097	---	655							
26	0.0 e	---	3715	---	538							
27	0.0 e	---	3239	---	470							
28	0.0 e	---	2527	---	442							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	---	2642	---	442
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	---	2880	---	451
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	---	---	---	451
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	48412	27665	18684	7657
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1793	1317	692	319
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3715	9190	1732	685
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	365	399	380	78
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3.45	2.53	1.33	0.61
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3.46	1.98	1.34	0.55
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	96024	54873	37059	15187

TOTAL 102417
 MEAN (JUN 4 TO SEP 24) 1035
 SEVEN-DAY LOW FLOW 122.67
 INSTANTANEOUS PEAK FLOW 21000 (July 21, 1991)

TOTAL RUNOFF (AC-FT) 203142
 AVERAGE RUNOFF (CFSM) 1.99
 TOTAL RUNOFF (INCHES) 7.32

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-18

Sadlerochit River

LOCATION.--Lat 69°38' N., long 144° 22.83' W., in NW¼SW¼ sec. 31, T.4N., R.32E., Umiat Meridian, 0.5 miles below the Wilderness boundary, 37.5 miles southwest of Kaktovik, Alaska.

DRAINAGE AREA.--520.1 mi², of which 517.5 mi² is located within the Arctic National Wildlife Refuge Wilderness Area. Glaciers account for 2.3 percent of the drainage area or about 11.8 mi² depending on existing climatic conditions.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 6th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data due to equipment failure (July 31 to Aug. 5). River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 21,000 cfs JULY 21, 1991; Minimum Discharge, 39 cfs Sept. 15, 1991 @ 1413 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	---	0.0 e	1520	1941	1300 e	1303						
2	---	0.0 e	1736	1564	1160 e	1407						
3	---	0.0 e	1189	1199	1035 e	1233						
4	---	0.0 e	407	1049	940 e	999						
5	---	0.0 e	359	995	822	807						
6	---	0.0 e	227	926	722	678						
7	---	0.0 e	123	851	692	567						
8	---	0.0 e	219	795	775	479						
9	---	0.0 e	1329	771	1109	399						
10	---	0.0 e	1520	787	964	275						
11	0.0 e	2614	986	830	258							
12	0.0 e	2415	2185	767	206							
13	0.0 e	2055	1575	767	180							
14	0.0 e	1759	1040	767	139							
15	0.0 e	1531	803	807	122							
16	0.0 e	1654	667	692	109							
17	0.0 e	2093	625	642	99							
18	0.0 e	2198	632	685	80							
19	0.0 e	2029	681	567	78							
20	0.0 e	1867	2485	491	67							
21	0.0 e	1979	2251	503	69							
22	0.0 e	2106	1423	567	---							
23	0.0 e	1954	1412	503	---							
24	0.0 e	1759	1381	415	---							
25	0.0 e	1487	1991	362	---							
26	0.0 e	2185	5197	1428	---							
27	0.0 e	2004	5656	4216	---							
28	0.0 e	1444	4317	2380	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	1520	2471	2023	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	1620	1643	1683	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	1085	---	1465 e	1449	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	46901	51762	32067	9552
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1563	1670	1034	455
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	2614	5656	4216	1407
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	123	625	362	67
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3.01	3.21	1.99	0.87
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3.35	3.70	2.29	0.68
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	93027	102667	63603	18946

TOTAL
MEAN (JUN 1 TO SEP 21) 141366
SEVEN-DAY LOW FLOW 88.97
INSTANTANEOUS PEAK FLOW 9506 (July 26, 1992)

TOTAL RUNOFF (AC-FT) 280395
AVERAGE RUNOFF (CFSM) 2.38
TOTAL RUNOFF (INCHES) 10.11

NOTE: e = ESTIMATE

ARCTIC NATIONAL WILDLIFE REFUGE

A-19

Sadlerochit Spring Creek

LOCATION.--Lat 69°39.88' N., long 144°24.87' W., NE¼NW¼ sec. 36, T.4N., R.31E., Umat Meridian, 3000 ft. downstream of Sadlerochit Spring, 37.5 mi. southwest of Kaktovik, Alaska.

DRAINAGE AREA.--0.5 mi².

PERIOD OF RECORD.--July to Dec. 1988.

REMARKS.--This is a 2nd Order drainage with 2 springs contributing most of the flow.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 55 cfs Aug. 16 & 19, 1988 @ 1115 hrs; Minimum Discharge, 28 cfs Aug. 15, 1988 @ 1815 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40 e	39 e	37 e	35 e	32 e	30 e	29 e	29 e	33 e	40 e	37	44
2	40 e	39 e	37 e	35 e	32 e	30 e	29 e	29 e	33 e	40 e	38	44
3	40 e	39 e	37 e	35 e	32 e	30 e	29 e	29 e	33 e	40 e	38	44
4	40 e	39 e	37 e	35 e	32 e	30 e	29 e	29 e	33 e	40 e	38	44
5	40 e	39 e	37 e	35 e	32 e	30 e	29 e	29 e	33 e	40 e	38	43
6	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	34 e	40 e	38	45
7	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	35 e	40 e	38	46
8	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	35 e	40 e	38	45
9	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	35 e	40 e	40	44
10	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	35 e	40 e	40	44
11	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	36 e	40 e	43	44
12	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	36 e	40 e	41	43
13	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	37 e	40 e	40	44
14	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	37 e	40 e	41	44
15	40 e	38 e	36 e	34 e	32 e	30 e	29 e	29 e	38 e	39 e	38	44
16	39 e	37 e	35 e	33 e	31 e	30 e	28 e	29 e	39 e	39 e	41	44
17	39 e	37 e	35 e	33 e	31 e	30 e	28 e	29 e	39 e	39 e	41	44
18	39 e	37 e	35 e	33 e	31 e	30 e	28 e	29 e	39 e	39 e	41	44
19	39 e	37 e	35 e	33 e	31 e	30 e	28 e	29 e	40 e	39 e	42	44
20	39 e	37 e	35 e	33 e	31 e	30 e	28 e	29 e	40 e	39 e	43	43
21	39 e	37 e	35 e	33 e	31 e	29 e	28 e	30 e	40 e	38 e	41	43
22	39 e	37 e	35 e	33 e	31 e	29 e	28 e	30 e	40 e	38	42	44
23	39 e	37 e	35 e	33 e	31 e	29 e	28 e	30 e	40 e	38	44	43
24	39 e	37 e	35 e	33 e	31 e	29 e	28 e	30 e	40 e	38	44	43
25	39 e	37 e	35 e	33 e	31 e	29 e	28 e	30 e	40 e	38	44	42
26	39 e	37 e	35 e	33 e	31 e	29 e	28 e	31 e	40 e	38	43	43
27	39 e	37 e	35 e	33 e	31 e	29 e	28 e	32 e	40 e	38	43	42
28	39 e	37 e	35 e	33 e	31 e	29 e	28 e	32 e	40 e	37	43	42
29	39 e	37 e	35 e	33 e	31 e	29 e	28 e	32 e	40 e	37	43	42
30	39 e	37 e	35 e	33 e	---	29 e	28 e	32 e	40 e	36	43	42
31	39 e	---	35 e	33 e	---	29 e	---	32 e	---	37	44	---
TOTAL	1224	1130	1105	1043	914	919	855	921	1125	1210	1264	1295
MEAN	39	38	36	34	32	30	29	30	38	39	41	43
MAX	40	39	37	35	32	30	29	32	40	40	44	46
MIN	39	37	35	33	31	29	28	29	33	37	37	42
AC-FT	2428	2241	2192	2069	1813	1823	1696	1827	2231	2401	2507	2568

ANNUAL TOTAL	13005	ANNUAL RUNOFF (AC-FT)	25795
ANNUAL MEAN	36	ANNUAL RUNOFF (CFSM)	---
ANNUAL SEVEN-DAY LOW FLOW	28	ANNUAL RUNOFF (INCHES)	967
INSTANTANEOUS PEAK FLOW	55 (Aug. 16 & 19, 1988)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-20

Sadlerochit Spring Creek

LOCATION.--Lat 69°39.88' N., Long 144°24.87' W., NE¼NW¼ sec. 36, T.4N., R.31E., Umat Meridian, 3000 ft. downstream of Sadlerochit Spring, 37.5 mi. southwest of Kaktovik, Alaska.

DRAINAGE AREA.--0.5 mi².

PERIOD OF RECORD.--July to Dec. 1988; June to Sept. 1989.

REMARKS.--This is a 2nd Order drainage with 2 springs contributing most of the flow.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 108 cfs Aug. 20, 1989 @ 1345 hrs; Minimum Discharge, 28 cfs Aug. 15, 1988 @ 1815 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	42	40	38	35 e	32 e	30 e	29 e	29 e	32 e	42	50	81
2	42	40	38	35 e	32 e	30 e	29 e	29 e	33 e	42	46	81
3	41	38	38	35 e	32 e	30 e	29 e	29 e	33 e	42	54	81
4	41	38	37	35 e	32 e	30 e	29 e	29 e	33 e	42	48	79
5	41	38	38	35 e	32 e	30 e	29 e	29 e	34 e	40	46	79
6	42	38	38	34 e	32 e	30 e	29 e	29 e	34 e	42	46	79
7	41	38	37	34 e	32 e	30 e	29 e	29 e	34 e	42	46	79
8	41	38	36	34 e	32 e	30 e	29 e	29 e	35 e	40	48	79
9	41	38	36	34 e	32 e	30 e	29 e	29 e	35 e	38	48	79
10	41	38	38	34 e	32 e	30 e	29 e	29 e	35 e	44	48	79
11	40	38	37	34 e	32 e	30 e	29 e	29 e	36 e	50	50	81
12	41	38	37	34 e	32 e	30 e	29 e	29 e	36 e	40	52	81
13	41	38	38	34 e	32 e	30 e	29 e	29 e	36 e	40	56	85
14	41	38	36	34 e	32 e	30 e	29 e	29 e	37 e	40	60	83
15	41	38	35	34 e	32 e	30 e	29 e	29 e	37 e	42	56	81
16	41	40	36	33 e	31 e	30 e	28 e	29 e	37 e	48	60	81
17	41	40	35	33 e	31 e	30 e	28 e	29 e	38 e	52	58	79
18	42	38	35	33 e	31 e	30 e	28 e	29 e	38	42	58	79
19	41	38	35	33 e	31 e	30 e	28 e	29 e	40	44	58	79
20	40	38	35	33 e	31 e	30 e	28 e	29 e	38	46	81	79
21	41	38	36	33 e	31 e	29 e	28 e	30 e	38	42	67	79
22	41	40	36	33 e	31 e	29 e	28 e	30 e	38	42	62	77
23	41	38	35	33 e	31 e	29 e	28 e	30 e	40	50	62	76 e
24	41	38	35	33 e	31 e	29 e	28 e	30 e	42	48	62	75 e
25	40	38	35	33 e	31 e	29 e	28 e	30 e	42	44	64	75 e
26	38	38	35 e	33 e	31 e	29 e	28 e	31 e	42	48	64	74 e
27	40	38	35 e	33 e	31 e	29 e	28 e	32 e	42	38	67	73 e
28	40	38	35 e	33 e	31 e	29 e	28 e	32 e	42	40	67	73 e
29	41	38	35 e	33 e	---	29 e	28 e	32 e	42	46	71	72 e
30	40	38	35 e	33 e	---	29 e	28 e	32 e	42	46	73	71 e
31	40	---	35 e	33 e	---	29 e	---	32 e	---	46	81	---
TOTAL	1252	1159	1130	1043	883	919	855	921	1121	1348	1809	2349
MEAN	40	39	36	34	32	30	29	30	37	43	58	78
MAX	42	40	38	35	32	30	29	32	42	52	81	85
MIN	38	38	35	33	31	29	28	29	32	38	46	71
AC-FT	2484	2300	2241	2069	1751	1823	1696	1827	2223	2674	3588	4659

ANNUAL TOTAL	14789	ANNUAL RUNOFF (AC-FT)	29334
ANNUAL MEAN	41	ANNUAL RUNOFF (CFSM)	---
ANNUAL SEVEN-DAY LOW FLOW	28	ANNUAL RUNOFF (INCHES)	1100
INSTANTANEOUS PEAK FLOW	108 (Aug. 20, 1989)		

NOTED: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-21

Sadlerochit Spring Creek

LOCATION.--Lat 69°39.88' N., long 144°24.87' W., NE¼NW¼ sec. 36, T.4N., R.31E., Umat Meridian, 3000 ft. downstream of Sadlerochit Spring, 37.5 mi. southwest of Kaktovik, Alaska.

DRAINAGE AREA.--0.5 mi².

PERIOD OF RECORD.--July to Dec. 1988; June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 2nd Order drainage with 2 springs contributing most of the flow.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 108 cfs Aug. 20, 1989 @ 1345 hrs; Minimum Discharge, 28 cfs Aug. 15, 1988 @ 1815 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	71 e	52 e	37 e	35 e	32 e	30 e	29 e	29 e	36 e	40	36	36
2	70 e	51 e	37 e	35 e	32 e	30 e	29 e	29 e	36 e	39	36	36
3	70 e	51 e	37 e	35 e	32 e	30 e	29 e	29 e	36 e	39	36	36
4	69 e	50 e	37 e	35 e	32 e	30 e	29 e	29 e	36 e	39	36	36
5	68 e	49 e	37 e	35 e	32 e	30 e	29 e	29 e	37 e	39	36	36
6	68 e	49 e	36 e	34 e	32 e	30 e	29 e	29 e	37 e	39	36	37
7	67 e	48 e	36 e	34 e	32 e	30 e	29 e	29 e	38 e	39	36	37
8	67 e	47 e	36 e	34 e	32 e	30 e	29 e	29 e	38 e	39	36	37
9	66 e	47 e	36 e	34 e	32 e	30 e	29 e	29 e	38 e	39	36	37
10	65 e	46 e	36 e	34 e	32 e	30 e	29 e	29 e	38 e	38	36	37
11	65 e	46 e	36 e	34 e	32 e	30 e	29 e	29 e	39 e	38	36	37
12	64 e	45 e	36 e	34 e	32 e	30 e	29 e	29 e	39	36	36	38
13	63 e	44 e	36 e	34 e	32 e	30 e	29 e	29 e	40	36	36	39
14	63 e	44 e	36 e	34 e	32 e	30 e	29 e	30 e	40	36	36	39
15	62 e	43 e	36 e	34 e	32 e	30 e	29 e	30 e	40	36	36	38
16	62 e	43 e	35 e	33 e	31 e	30 e	28 e	31 e	40	36	36	36
17	61 e	42 e	35 e	33 e	31 e	30 e	28 e	31 e	40	36	36	37
18	60 e	41 e	35 e	33 e	31 e	30 e	28 e	31 e	40	36	36	37
19	60 e	41 e	35 e	33 e	31 e	30 e	28 e	31 e	40	36	36	37
20	59 e	40 e	35 e	33 e	31 e	30 e	28 e	32 e	40	36	36	38 e
21	59 e	39 e	35 e	33 e	31 e	29 e	28 e	32 e	40	36	36	38 e
22	58 e	39 e	35 e	33 e	31 e	29 e	28 e	32 e	40	36	36	38 e
23	57 e	38 e	35 e	33 e	31 e	29 e	28 e	33 e	40	37	36	38 e
24	57 e	37 e	35 e	33 e	31 e	29 e	28 e	33 e	40	37	35	38 e
25	56 e	37 e	35 e	33 e	31 e	29 e	28 e	33 e	40	37	35	38 e
26	55 e	37 e	35 e	33 e	31 e	29 e	28 e	34 e	40	36	36	38 e
27	55 e	37 e	35 e	33 e	31 e	29 e	28 e	34 e	40	36	36	38 e
28	54 e	37 e	35 e	33 e	31 e	29 e	28 e	34 e	40	36	36	38 e
29	54 e	37 e	35 e	33 e	---	29 e	28 e	35 e	40	36	36	38 e
30	53 e	37 e	35 e	33 e	---	29 e	28 e	35 e	40	36	35	37 e
31	52 e	---	35 e	33 e	---	29 e	---	35 e	---	36	36	---
TOTAL	1910	1294	1105	1043	883	919	855	964	1172	1152	1110	1117
MEAN	62	43	36	34	32	30	29	31	39	37	36	37
MAX	71	52	37	35	32	30	29	34	40	40	36	40
MIN	54	37	35	33	31	29	28	29	36	36	35	36
AC-FT	3789	2566	2192	2069	1751	1823	1696	1912	2324	2285	2203	2216

ANNUAL TOTAL	13524	ANNUAL RUNOFF (AC-FT)	26825
ANNUAL MEAN	37	ANNUAL RUNOFF (CFSM)	---
ANNUAL SEVEN-DAY LOW FLOW	28	ANNUAL RUNOFF (INCHES)	1006
INSTANTANEOUS PEAK FLOW	41	(Aug. 18 & 19, 1990)	

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Sadlerochit Spring Creek

LOCATION.--Lat 69°39.88' N., long 144°24.87' W., NE¼NW¼ sec. 36, T.4N., R.31E., Umat Meridian, 3000 ft. downstream of Sadlerochit Spring, 37.5 mi. southwest of Kaktovik, Alaska.

DRAINAGE AREA.--0.5 mi².

PERIOD OF RECORD.--July to Dec. 1988; June to Sept. 1989; June to Sept. 1990; and June to Sept. 1992.

REMARKS.--This is a 2nd Order drainage with 2 springs contributing most of the flow.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 108 cfs Aug. 20, 1989 @ 1345 hrs; Minimum Discharge, 28 cfs Aug. 15, 1988 @ 1815 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	37 e	36 e	35 e	34 e	32 e	30 e	29 e	29 e	36 e	40	45	46
2	37 e	36 e	35 e	34 e	32 e	30 e	29 e	29 e	36 e	40	45	46
3	37 e	36 e	35 e	34 e	32 e	30 e	29 e	29 e	36 e	40	45	46
4	37 e	36 e	35 e	34 e	32 e	30 e	29 e	29 e	36 e	40	45	46
5	37 e	36 e	35 e	34 e	32 e	30 e	29 e	29 e	36 e	40	45	46
6	37 e	36 e	35 e	33 e	32 e	30 e	29 e	29 e	36 e	40	45	47
7	37 e	36 e	35 e	33 e	32 e	30 e	29 e	29 e	36 e	40	45	47
8	37 e	36 e	35 e	33 e	32 e	30 e	29 e	29 e	36 e	40	45	47
9	37 e	36 e	35 e	33 e	32 e	30 e	29 e	29 e	36 e	40	45	47
10	37 e	36 e	35 e	33 e	32 e	30 e	29 e	29 e	36 e	40	45	47
11	37 e	36 e	35 e	33 e	32 e	30 e	29 e	29 e	36 e	41	45	47
12	37 e	36 e	34 e	33 e	32 e	30 e	29 e	29 e	36 e	41	45	47
13	37 e	36 e	34 e	33 e	32 e	30 e	29 e	29 e	36 e	41	45	47
14	37 e	36 e	34 e	33 e	32 e	30 e	29 e	30 e	36 e	41	45	47
15	37 e	36 e	34 e	33 e	32 e	30 e	29 e	30 e	36 e	41	46	47
16	37 e	36 e	34 e	33 e	32 e	30 e	28 e	31 e	36 e	41	45	47
17	37 e	36 e	34 e	33 e	32 e	30 e	28 e	31 e	36 e	41	47	47
18	37 e	35 e	34 e	33 e	32 e	30 e	28 e	31 e	36 e	42	46	47
19	37 e	35 e	34 e	33 e	32 e	30 e	28 e	31 e	36 e	42	45	47
20	37 e	35 e	34 e	33 e	32 e	30 e	28 e	32 e	36 e	43	45	47
21	37 e	35 e	34 e	33 e	32 e	29 e	28 e	32 e	36 e	43	45	47
22	37 e	35 e	34 e	33 e	32 e	29 e	28 e	32 e	36 e	43	45	46 e
23	37 e	35 e	34 e	33 e	32 e	29 e	28 e	33 e	36 e	43	45	46 e
24	36 e	35 e	34 e	33 e	31 e	29 e	28 e	33 e	36 e	43	45	45 e
25	36 e	35 e	34 e	33 e	31 e	29 e	28 e	33 e	36 e	43	45	45 e
26	36 e	35 e	34 e	33 e	31 e	29 e	28 e	34 e	39	45	46	45 e
27	36 e	35 e	34 e	33 e	31 e	29 e	28 e	34 e	40	44	51	45 e
28	36 e	35 e	34 e	33 e	31 e	29 e	28 e	34 e	40	45	46	45 e
29	36 e	35 e	34 e	33 e	---	29 e	28 e	35 e	40	44	45	45 e
30	36 e	35 e	34 e	32 e	---	29 e	28 e	35 e	40	44	45	44 e
31	36 e	---	34 e	32 e	---	29 e	---	35 e	---	45	46	---
TOTAL	1141	1067	1064	1025	891	919	855	964	1133	1298	1408	1383
MEAN	37	36	34	33	31	30	29	31	38	42	45	46
MAX	37	36	35	34	32	30	29	34	40	45	51	47
MIN	36	35	34	33	31	29	28	29	36	40	45	44
AC-FT	2263	2116	2110	2032	1768	1823	1696	1912	2247	2574	2792	2742

ANNUAL TOTAL	13146	ANNUAL RUNOFF (AC-FT)	26075
ANNUAL MEAN	36	ANNUAL RUNOFF (CFSM)	---
ANNUAL SEVEN-DAY LOW FLOW	28	ANNUAL RUNOFF (INCHES)	978
INSTANTANEOUS PEAK FLOW	61 (Aug. 27, 1992)		

NOTED: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Sikrelurak River

LOCATION.--Lat 69°54.71' N., Long 142°30.87' W., SE¼SE¼ sec. 36, T.7N., R.38E., Umiat Meridian, at the confluence with the West Fork Sikrelurak River, 31 mi south-east of Katktovik, Alaska.

DRAINAGE AREA.--74.7 mi².

PERIOD OF RECORD.--June to Sept. 1989.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 282 cfs Aug. 20 and 21, 1989; Minimum Discharge, 0 cfs July 20, 1989.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	510 e	10	22	64							
2	0.0 e	610 e	8.6	20	66							
3	0.0 e	710 e	4.0 e	34	154							
4	0.0 e	820 e	26	62	176							
5	0.0 e	920 e	26	51	120							
6	0.0 e	1,020 e	26	41	87							
7	0.0 e	1,120 e	25	32	70							
8	0.0 e	1220 e	12	26	56							
9	0.0 e	710 e	10	21	49							
10	0.0 e	590 e	11	18	42							
11	0.0 e	420 e	16	15	89							
12	0.0 e	290 e	8.6	13	107							
13	0.0 e	220 e	6.3	14	112							
14	0.0 e	148	5.0	74	151							
15	0.0 e	125	5.6	92	157							
16	0.0 e	109	3.2	89	101							
17	0.0 e	89	6.3	83	66							
18	0.0 e	62	5.0	70	51							
19	0.0 e	44	3.8	56	36							
20	0.0 e	39	1.7	128	27							
21	0.0 e	42	5.6	235	18							
22	0.0 e	36	19	151	12							
23	0.0 e	33	20	99	---							
24	0.0 e	34	18	72	---							
25	0.0 e	27	16	74	---							
26	0.0 e	32	39	66	---							
27	0.0 e	26	72	58	---							
28	0.0 e	24	60	51	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	19	45	49	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	16	34	51	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	26	60	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	10065	575	1927	1811
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	336	19	62	82
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1220	72	235	176
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	16	1.7	13	12
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	4.49	0.25	0.83	1.10
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	5.03	0.29	0.96	0.90
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	19964	1140	3822	3592

TOTAL 14378
MEAN (JUN 8 TO SEP 22) 126
SEVEN-DAY LOW FLOW 4.38
INSTANTANEOUS PEAK FLOW 282 (Aug. 20, 1989)

TOTAL RUNOFF (AC-FT) 28518
AVERAGE RUNOFF (CFSM) 1.69
TOTAL RUNOFF (INCHES) 7.16

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Sikrelurak River

LOCATION.--Lat 69°54.71' N., Long 142°30.87' W., SE¼SE¼ sec. 36, T.7N., R.38E., Umiat Meridian, at the confluence with the West Fork Sikrelurak River, 31 mi south-east of Katktovik, Alaska.

DRAINAGE AREA.--74.7 mi².

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 282 cfs Aug. 20 and 21, 1989; Minimum Discharge, 0 cfs July 20, 1989, August 14-28, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	20 e	9.2	0.4	7.8							
2	0.0 e	10 e	8.5	0.2	14							
3	0.0 e	10 e	8.5	0.4	19							
4	0.0 e	10 e	5.3	0.5	18							
5	0.0 e	9 e	4.3	0.5	18							
6	0.0 e	8 e	3.8	0.4	41							
7	0.0 e	7 e	2.2	0.2	97							
8	0.0 e	6 e	2.9	0.4	75							
9	0.0 e	5 e	2.5	0.4	56							
10	0.0 e	5 e	2.2	0.2	42							
11	0.0 e	---	29	1.8	0.2	32						
12	0.0 e	---	38	1.5	0.2	24						
13	0.0 e	---	47	1.2	0.2	18						
14	0.0 e	---	46	1.0	0.1	14						
15	0.0 e	---	44	0.7	0.1	12						
16	0.0 e	---	35	0.5	0.1	11						
17	0.0 e	---	31	1.0	0.0	9.2						
18	0.0 e	---	34	1.0	0.0	7.8						
19	0.0 e	1630 e	31	0.5	0.1	6.5						
20	0.0 e	660 e	34	0.4	0.0	---						
21	0.0 e	440 e	34	0.4	0.0	---						
22	0.0 e	320 e	32	0.5	0.0	---						
23	0.0 e	240 e	31	2.5	0.0	---						
24	0.0 e	190 e	29	2.9	0.0	---						
25	0.0 e	140 e	21	1.2	0.0	---						
26	0.0 e	110 e	20	0.7	0.0	---						
27	0.0 e	70 e	17	0.7	0.0	---						
28	0.0 e	50 e	15	0.5	0.0	---						
29	0.0 e	40 e	17	0.4	0.5	---						
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	30 e	15	0.4	0.7	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	30 e	11	0.4	0.7	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20 e	---	0.4	1.5	---
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3970	665	70	8.4	523
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	284	22	2.2	0.3	28
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1630	47	9.2	1.5	97
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20	11	1.7	0.0	6.5
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.80	0.30	0.03	0.004	0.37
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.98	0.33	0.03	0.004	0.26
								7874	1319	138	17	1037

TOTAL 5236
MEAN (MAY 18 TO SEP 19) 42
SEVEN-DAY LOW FLOW 0.00
INSTANTANEOUS PEAK FLOW 117 (Sept. 7, 1990)

TOTAL RUNOFF (AC-FT) 10386
AVERAGE RUNOFF (CFSM) 0.56
TOTAL RUNOFF (INCHES) 2.61

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Sikrelurak River

LOCATION.--Lat 69°54.71' N., Long 142°30.87' W., SE¼SE¼ sec. 36, T.7N., R.38E., Umiat Meridian, at the confluence with the West Fork Sikrelurak River, 31 mi south-east of Katktovik, Alaska.

DRAINAGE AREA.--74.7 mi².

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,787 cfs June 4, 1991 @ 2015 hr.; Minimum Discharge, 0 cfs July 20, 1989, August 14-28, 1990, and Sept 6-8, 1991.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	710 e	38	28	5.1							
2	0.0 e	1480 e	36	25	4.1							
3	0.0 e	750 e	31	18	3.6							
4	0.0 e	586	25	14	3.1							
5	0.0 e	888	24	14	3.6							
6	0.0 e	534	26	16	3.1							
7	0.0 e	304	22	13	2.0							
8	0.0 e	190	18	12	2.5							
9	0.0 e	133	16	11	4.1							
10	0.0 e	88	14	8.9	3.6							
11	0.0 e	80	13	8.4	6.2							
12	0.0 e	138	13	7.8	4.1							
13	0.0 e	359	14	10	5.1							
14	0.0 e	578	16	8.9	6.2							
15	0.0 e	447	17	8.9	8.9							
16	0.0 e	0.0	343	18	10	7.8						
17	0.0 e	3.0 e	289	15	8.9	11						
18	0.0 e	6.0 e	308	14	6.2	40						
19	0.0 e	20 e	234	14	4.6	80						
20	0.0 e	70 e	186	14	4.6	133						
21	0.0 e	100 e	136	39	4.6	146						
22	0.0 e	130 e	92	47	8.9	158						
23	0.0 e	150 e	68	118	11	111						
24	0.0 e	160 e	55	98	14	79						
25	0.0 e	180 e	44	70	15	---						
26	0.0 e	180 e	51	55	14	---						
27	0.0 e	200 e	68	46	11	---						
28	0.0 e	240 e	61	40	10	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	310 e	58	36	7.8	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	380 e	44	33	6.7	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	500 e	---	31	5.7	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2629	9302	1012	344	832
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	175	310	33	11	35
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	500	1480	118	28	158
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	44	13	4.6	2.0
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.35	4.15	0.44	0.15	0.46
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.05	7.25	0.50	0.17	0.41
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5215	18450	2008	683	1649

TOTAL	14119	TOTAL RUNOFF (AC-FT)	28004
MEAN (MAY 17 TO SEP 24)	108	AVERAGE RUNOFF (CFSM)	1.44
SEVEN-DAY LOW FLOW	3.14	TOTAL RUNOFF (INCHES)	7.03
INSTANTANEOUS PEAK FLOW	1787 (June 4, 1991)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Sikrelurak River

LOCATION.--Lat 69°54.71' N., Long 142°30.87' W., SE¼SE¼ sec. 36, T.7N., R.38E., Umiat Meridian, at the confluence with the West Fork Sikrelurak River, 31 mi south-east of Katktovik, Alaska.

DRAINAGE AREA.--74.7 mi².

PERIOD OF RECORD.--June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data due to ground squirrel chewing cable (8/25/92 to 9/3/92). River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,787 cfs June 4, 1991 @ 2015 hr.; Minimum Discharge, 0 cfs July 20, 1989, August 14-28, 1990, and Septl 6-8, 1991.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	750 e	26	1.4	---							
2	0.0 e	690 e	14	1.8	---							
3	0.0 e	550 e	8.4	1.4	---							
4	0.0 e	400 e	13	1.4	35							
5	0.0 e	330 e	16	1.4	40							
6	0.0 e	320 e	16	1.3	45							
7	0.0 e	500 e	14	1.3	43							
8	0.0 e	560 e	15	1.3	42							
9	0.0 e	388	11	1.3	39							
10	0.0 e	489	8.4	1.4	26							
11	0.0 e	494	5.2	1.4	26							
12	0.0 e	302	4.8	1.3	22							
13	0.0 e	163	3.3	1.4	18							
14	0.0 e	146	2.4	1.4	6.2							
15	0.0 e	112	3.0	1.4	---							
16	0.0 e	91	3.3	1.3	---							
17	0.0 e	94	3.0	1.4	---							
18	0.0 e	83	3.3	2.0	---							
19	0.0 e	79	3.3	1.7 e	---							
20	0.0 e	63	3.0	1.4	---							
21	0.0 e	53	2.4	1.4	---							
22	0.0 e	50	2.2	1.3	---							
23	0.0 e	31	2.0	1.3	---							
24	0.0 e	19	2.0	1.3	---							
25	0.0 e	17	1.7	---	---							
26	0.0 e	15	1.5	---	---							
27	0.0 e	20	1.4	---	---							
28	0.0 e	20 e	26	1.4	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	660 e	27	1.4	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	930 e	26	1.3	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	0.0 e	840 e	---	1.3	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2450	6888	195	34	342
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	613	767	6	1.4	31
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	930	930	26	2.0	45
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15	1.3	1.3	6.2
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	10.27	2.61	0.46	4.58
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	3.43	0.10	0.02	0.17
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4860	13662	387	67	678

TOTAL 9909
 MEAN (MAY 28 TO SEP 14) 99
 SEVEN-DAY LOW FLOW 1.35
 INSTANTANEOUS PEAK FLOW 1057 (June 10, 1992)

TOTAL RUNOFF (AC-FT) 19654
 AVERAGE RUNOFF (CFSM) 1.33
 TOTAL RUNOFF (INCHES) 4.93

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Tamayariak River

LOCATION.--Lat 69°49.97' N., long 145°33.16' W., in SW¼NE¼ sec. 35, T.6N., R.26E., Umiat Meridian, 11.8 miles upstream from the confluence of the West Fork, Tamayariak River, 53 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--136.1 mi², which 56.8 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,996 cfs Aug. 12, 1988 @ 1445 hrs; Minimum Discharge, 11.8 cfs Sept. 26, 1988 @ 1300 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	480 e	140 e	508	181							
2	0.0 e	460 e	130 e	508	156							
3	0.0 e	460 e	120 e	459	184							
4	0.0 e	460 e	120 e	307	233							
5	0.0 e	460 e	110 e	177	569							
6	0.0 e	470 e	100 e	136	331							
7	0.0 e	470 e	100 e	120	227							
8	0.0 e	480 e	90 e	225	175							
9	0.0 e	480 e	90 e	410	148							
10	0.0 e	480 e	80 e	289	133							
11	0.0 e	490 e	80 e	175	121							
12	0.0 e	820 e	80 e	583	111							
13	0.0 e	1400 e	80 e	1039	100							
14	0.0 e	1270 e	80 e	395	77							
15	0.0 e	1120 e	70 e	236	63							
16	0.0 e	1030 e	70 e	201	59							
17	0.0 e	920 e	72	184	48							
18	0.0 e	820 e	124	173	45							
19	0.0 e	700 e	103	166	42							
20	0.0 e	600 e	59	162	39							
21	0.0 e	510 e	39	307	37							
22	0.0 e	450 e	30	431	30							
23	0.0 e	390 e	26	416	25							
24	0.0 e	340 e	25	416	23							
25	0.0 e	290 e	25	271	26							
26	0.0 e	30 e	270 e	23	219	23						
27	0.0 e	270 e	240 e	22	219	---						
28	0.0 e	570 e	200 e	20	186	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	640 e	180 e	18	201	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	570 e	160 e	18	336	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	510 e	---	23	233	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2590	16900	2166	9687	3206
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	432	563	70	312	123
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	640	1400	140	1039	569
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	160	18	120	23
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.17	4.14	0.51	2.30	0.91
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.71	4.62	0.59	2.65	0.88
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5137	33521	4295	19214	6359

TOTAL	34549	TOTAL RUNOFF (AC-FT)	68526
MEAN (May 26 to Sept 26)	279	AVERAGE RUNOFF (CFSM)	2.05
SEVEN-DAY LOW FLOW	21.07	TOTAL RUNOFF (INCHES)	9.44
INSTANTANEOUS PEAK FLOW	1996 (Aug. 12, 1988)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-28

Tamayariak River

LOCATION.--Lat 69°49.97' N., long 145°33.16' W., in SW¼NE¼ sec. 35, T.6N., R.26E., Umiat Meridian, 11.8 miles upstream from the confluence of the West Fork, Tamayariak River, 53 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--136.1 mi², which 56.8 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,996 cfs Aug. 12, 1988 @ 1445 hrs; Minimum Discharge, 11.8 cfs Sept. 26, 1988 @ 1300 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	80 e	73	497	192							
2	0.0 e	200 e	53	628	159							
3	0.0 e	500 e	56	481	148							
4	0.0 e	820 e	114	359	134							
5	0.0 e	1730 e	124	271	117							
6	0.0 e	2110 e	121	230	127							
7	0.0 e	2140 e	141	207	246							
8	0.0 e	1810 e	121	192	215							
9	0.0 e	1360 e	92	169	169							
10	0.0 e	1230 e	95	162	148							
11	0.0 e	1030 e	305	297	301							
12	0.0 e	850 e	173	275	426							
13	0.0 e	740 e	114	275	486							
14	0.0 e	670 e	89	645	486							
15	0.0 e	600 e	67	634	336							
16	0.0 e	520 e	127	778	242							
17	0.0 e	481	823	545	184							
18	0.0 e	471	640	354	148							
19	0.0 e	431	350	259	111							
20	0.0 e	392	288	481	85							
21	0.0 e	431	297	704	155							
22	0.0 e	341	318	411	177							
23	0.0 e	345	354	275	---							
24	0.0 e	378	301	211	---							
25	0.0 e	284	238	199	---							
26	0.0 e	254	461	180	---							
27	0.0 e	226	651	162	---							
28	0.0 e	184	368	145	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	148	234	141	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	114	169	138	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	145	177	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	20870	7502	10482	4792
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	696	242	338	218
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	2140	823	778	486
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	114	53	138	85
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	5.11	1.78	2.48	1.60
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	5.70	2.05	2.86	1.31
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	41395	14880	20791	9505

TOTAL
MEAN (JUN 1 TO SEP 22) 43646
SEVEN-DAY LOW FLOW 383
INSTANTANEOUS PEAK FLOW 93.54
997

(July 17, 1989)

TOTAL RUNOFF (AC-FT) 86571
AVERAGE RUNOFF (CFSM) 2.81
TOTAL RUNOFF (INCHES) 11.93

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-29

Tamayariak River

LOCATION.--Lat 69°49.97' N., long 145°33.16' W., in SW¼NE¼ sec. 35, T.6N., R.26E., Umiat Meridian, 11.8 miles upstream from the confluence of the West Fork, Tamayariak River, 53 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--136.1 mi², which 56.8 mi² is located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; and June to Sept. 1990.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,996 cfs Aug. 12, 1988 @ 1445 hrs; Minimum Discharge, 11.8 cfs Sept. 26, 1988 @ 1300 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	190 e	133	38	1567							
2	0.0 e	180 e	91	34	555							
3	0.0 e	160 e	69	34	300							
4	0.0 e	150 e	55	35	205							
5	0.0 e	130 e	48	33	187							
6	0.0 e	130 e	44	30	1588							
7	0.0 e	120 e	41	29	1167							
8	0.0 e	110 e	52	28	428							
9	0.0 e	100 e	48	27	271							
10	0.0 e	100 e	43	27	192							
11	0.0 e	60 e	90 e	38	26	146						
12	0.0 e	70 e	124	33	23	127						
13	0.0 e	100 e	228	30	21	115						
14	0.0 e	160 e	260	31	21	118						
15	0.0 e	220 e	412	33	21	260						
16	0.0 e	570 e	794	32	26	382						
17	0.0 e	2540 e	535	33	32	233						
18	0.0 e	2110 e	313	33	30	149						
19	0.0 e	1310 e	228	31	29	102						
20	0.0 e	1050 e	187	30	29	---						
21	0.0 e	900 e	153	33	30	---						
22	0.0 e	770 e	136	146	29	---						
23	0.0 e	670 e	153	118	28	---						
24	0.0 e	590 e	105	86	27	---						
25	0.0 e	500 e	93	71	24	---						
26	0.0 e	410 e	107	61	24	---						
27	0.0 e	330 e	88	67	44	---						
28	0.0 e	300 e	130	62	420	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	260 e	160	53	781	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	180 e	249	45	516	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	210 e	---	41	1,100	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13310	5915	1731	3596	8092
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	634	197	56	116	426
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2540	794	146	1100	1588
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60	88	30	21	102
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.66	1.45	0.41	0.85	3.13
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.64	1.62	0.47	0.98	2.21
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26400	11732	3433	7132	16051

TOTAL 32644
 MEAN (MAY 11 TO SEP 19) 247
 SEVEN-DAY LOW FLOW 23.57
 INSTANTANEOUS PEAK FLOW 4099 (Sept. 6, 1990)

TOTAL RUNOFF (AC-FT) 64748
 AVERAGE RUNOFF (CFSM) 1.82
 TOTAL RUNOFF (INCHES) 8.92

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-30

Tamayariak River

LOCATION.--Lat 69°49.97' N., long 145°33.16' W., in SW¼NE¼ sec. 35, T.6N., R.26E., Umiat Meridian, 11.8 miles upstream from the confluence of the West Fork, Tamayariak River, 53 miles west-southwest of Kaktovik, Alaska.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data (July 23 to Aug. 5) due to lost of gaging station from flood event. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 5,200 cfs July 21, 1991; Minimum Discharge, 8.3 cfs Sept. 14, 1991 @ 1730 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	1360 e	245	170 e	150							
2	0.0 e	2000 e	197	160 e	161							
3	0.0 e	1390 e	160	150 e	133							
4	0.0 e	1024	131	150 e	121							
5	0.0 e	978	116	150 e	111							
6	0.0 e	762	143	159	93							
7	0.0 e	522	160	137	75							
8	0.0 e	343	98	127	73							
9	0.0 e	279	71	178	66							
10	0.0 e	207	66	128	59							
11	0.0 e	143	66	110	50							
12	0.0 e	139	69	102	73							
13	0.0 e	343	80	94	62							
14	0.0 e	1759	86	101	50							
15	0.0 e	1012	139	100	84							
16	0.0 e	664	279	121	91							
17	0.0 e	80 e	591	218	112							
18	0.0 e	110 e	803	239	104							
19	0.0 e	180 e	732	356	91							
20	0.0 e	410 e	782	267	80							
21	0.0 e	470 e	752	820 e	72	698						
22	0.0 e	550 e	573	1350 e	142	440						
23	0.0 e	590 e	498	1400 e	2442	206						
24	0.0 e	630 e	391	560 e	1105	121						
25	0.0 e	650 e	329	330 e	463	---						
26	0.0 e	660 e	474	250 e	274	---						
27	0.0 e	700 e	427	230 e	216	---						
28	0.0 e	760 e	398	220 e	212	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	870 e	405	200 e	216	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	980 e	363	190 e	196	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	1120 e	---	190 e	166	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8760	20442	8925	7250	3720
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	584	681	288	279	155
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1120	2000	1400	2442	698
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	139	66	72	50
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.29	5.01	2.12	2.05	1.14
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.39	5.59	2.44	1.98	1.02
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17375	40546	17702	14380	7378

TOTAL 49876
 MEAN (MAY 17 TO SEP 24) 381
 SEVEN-DAY LOW FLOW 62.13
 INSTANTANEOUS PEAK FLOW 3244 (Aug. 22, 1991)

TOTAL RUNOFF (AC-FT) 98928
 AVERAGE RUNOFF (CFSM) 2.80
 TOTAL RUNOFF (INCHES) 13.63

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Tamayariak River

A-31

LOCATION.--Lat 69°49.97' N., long 145°33.16' W., in SW¼NE¼ sec. 35, T.6N., R.26E., Umiat Meridian, 11.8 miles upstream from the confluence of the West Fork, Tamayariak River, 53 miles west-southwest of Kaktovik, Alaska.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 5th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Flood of Aug. 27, 1992 caused significant channel scour. Stream discharge discontinued. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 5,200 cfs July 21, 1991; Minimum Discharge, 4.2 cfs June 5, 1992 @ 1040 hrs.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	0.0	890 e	154	31	---						
2	0.0 e	0.0	500 e	103	28	---						
3	0.0 e	0.0	336	69	29	---						
4	0.0 e	0.0	143	57	30	---						
5	0.0 e	0.0	109	70	28	---						
6	0.0 e	0.0	171	59	26	---						
7	0.0 e	0.0	119	48	25	---						
8	0.0 e	0.0	350	42	29	---						
9	0.0 e	0.0	624	40	78	---						
10	0.0 e	0.0	927	43	94	---						
11	0.0 e	0.0	1032	40	82	---						
12	0.0 e	0.0	802	123	64	---						
13	0.0 e	0.0	823	78	56	---						
14	0.0 e	0.0	483	66	49	---						
15	0.0 e	0.0	408	66	44	---						
16	0.0 e	0.0	375	54	37	---						
17	0.0 e	0.0	382	43	56	---						
18	0.0 e	0.0	371	37	105	---						
19	0.0 e	0.0	386	37	100	---						
20	0.0 e	0.0	339	115	83	---						
21	0.0 e	0.0	306	150	89	---						
22	0.0 e	0.0	316	96	111	---						
23	0.0 e	0.0	274	70	87	---						
24	0.0 e	0.0	176	57	64	---						
25	0.0 e	0.0	123	52	52	---						
26	0.0 e	0.0	166	47	303	---						
27	0.0 e	70 e	161	45	---	---						
28	0.0 e	190 e	154	43	---	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	1310 e	154	38	---	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	1570 e	143	34	---	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	1480 e	---	32	---	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4620	11543	2007	1777	---
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	924	385	65	68	---
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1570	1032	154	303	---
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	109	32	25	---
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.79	2.83	0.48	0.50	---
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.26	3.15	0.55	0.49	---
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9164	22895	3981	3525	---

TOTAL	19947	TOTAL RUNOFF (AC-FT)	39564
MEAN (MAY 27 TO AUG 26)	217	AVERAGE RUNOFF (CFSM)	1.59
SEVEN-DAY LOW FLOW	27.69	TOTAL RUNOFF (INCHES)	5.45
INSTANTANEOUS PEAK FLOW	2856 (Est. Aug. 27, 1992)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

TAMAYARIAK RIVER, LOWER WEST FORK

LOCATION.--Lat 69°58.83' N., long 145°47.67' W., NW¼NW¼ sec 12, T.7N., R.25E., Umiat Meridian, 1.5 miles upstream from the confluence with the Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--98.14 mi², of which 5.55 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate by the first week of October.

EXTREMES.--Maximum Discharge, 496 cfs Sept. 5, 1988 @ 1430 hrs; Minimum Discharge, 9.0 cfs August 6 & 7, 1988.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	250 e	40 e	11	98							
2	0.0 e	250 e	40 e	10	65							
3	0.0 e	250 e	40 e	11	68							
4	0.0 e	250 e	30 e	10	100							
5	0.0 e	250 e	30 e	10	364							
6	0.0 e	260 e	30 e	9.4	249							
7	0.0 e	260 e	20 e	10	141							
8	0.0 e	330 e	20 e	42	89							
9	0.0 e	390 e	20 e	79	57							
10	0.0 e	390 e	20 e	191	45							
11	0.0 e	550 e	20 e	122	38							
12	0.0 e	1380 e	20 e	156	33							
13	0.0 e	1220 e	20 e	392	31							
14	0.0 e	1050 e	20 e	194	31							
15	0.0 e	890 e	20 e	110	27							
16	0.0 e	770 e	20 e	81	26							
17	0.0 e	660 e	17	73	24							
18	0.0 e	550 e	16	59	23							
19	0.0 e	440 e	15	56	23							
20	0.0 e	350 e	15	60	23							
21	0.0 e	280 e	15	141	22							
22	0.0 e	230 e	15	306	21							
23	0.0 e	190 e	14	249	19							
24	0.0 e	160 e	15	249	26							
25	0.0 e	120 e	14	149	18							
26	0.0 e	110 e	110 e	13	106	30						
27	0.0 e	220 e	90 e	13	98	---						
28	0.0 e	240 e	70 e	12	85	---						
29	0.0 e	240 e	60 e	11	87	---						
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	240 e	50 e	11	225	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	---	240 e	---	11	147	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1290	12100	616	3525	1689
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	215	403	20	114	65
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	240	1380	40	392	364
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110	50	11	9.4	18
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.19	4.11	0.20	1.16	0.66
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.49	4.59	0.23	1.34	0.64
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2559	24000	1223	6993	3349

TOTAL
MEAN (MAY 26 TO SEP 26) 19220
SEVEN-DAY LOW FLOW 155
INSTANTANEOUS PEAK FLOW 10.17
496

(Sept. 5, 1988)

TOTAL RUNOFF (AC-FT) 38123
AVERAGE RUNOFF (CFSM) 1.58
TOTAL RUNOFF (INCHES) 7.28

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-33

TAMAYARIAK RIVER, LOWER WEST FORK

LOCATION.--Lat 69°58.83' N., long 145°47.67' W., NW/4NW/4 sec 12, T.7N., R.25E., Umiat Meridian, 1.5 miles upstream from the confluence with the Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--98.14 mi², of which 5.55 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES.--Maximum Discharge, 647 cfs Aug. 21, 1989 @ 0225 hrs; Minimum Discharge, 9.0 cfs August 6 & 7, 1988.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	10 e	40	198	105							
2	0.0 e	40 e	36	391	85							
3	0.0 e	170 e	36	308	82							
4	0.0 e	550 e	41	205	78							
5	0.0 e	1880 e	41	136	61							
6	0.0 e	1660 e	39	100 e	49							
7	0.0 e	1780 e	38	90 e	57							
8	0.0 e	1770 e	30	90 e	66							
9	0.0 e	1170 e	27	75	54							
10	0.0 e	1010 e	28	62	48							
11	0.0 e	780 e	32	90	121							
12	0.0 e	590 e	26	125	235							
13	0.0 e	480 e	23	134	217							
14	0.0 e	470 e	22	287	270							
15	0.0 e	450 e	20	238	205							
16	0.0 e	440 e	25	285	134							
17	0.0 e	419	43	235	87							
18	0.0 e	314	110	144	59							
19	0.0 e	287	134	96	43							
20	0.0 e	233	129	183	38							
21	0.0 e	248	108	477	---							
22	0.0 e	172	110	217	---							
23	0.0 e	159	98	123	---							
24	0.0 e	181	76	79	---							
25	0.0 e	119	59	61	---							
26	0.0 e	98	121	57	---							
27	0.0 e	84	345	52	---							
28	0.0 e	---	69	181	47	---						
29	0.0 e	---	55	101	44	---						
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	47	64	47	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	---	---	---	47	72	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	15735	2230	4748	2094
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	525	115	153	105
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1880	345	477	270
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	10	43	44	38
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	5.34	1.17	1.63	1.07
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	5.96	0.85	1.80	0.79
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	31210	4423	9400	4153

TOTAL 24807
 MEAN (JUN 1 TO SEP20) 221
 SEVEN-DAY LOW FLOW 25.14
 INSTANTANEOUS PEAK FLOW 647 (Aug 21, 1989)

TOTAL RUNOFF (AC-FT) 49204
 AVERAGE RUNOFF (CFSM) 2.26
 TOTAL RUNOFF (INCHES) 9.40

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

TAMAYARIAK RIVER, LOWER WEST FORK

LOCATION.--Lat 69°58.83' N., long 145°47.67' W., NW/4NW/4 sec 12, T.7N., R.25E., Umiat Meridian, 1.5 miles upstream from the confluence with the Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--98.14 mi², of which 5.55 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data (June 14 to July 9) due to animal chewing probe cable. River normally freezes to substrate the first week of October.

EXTREMES.--Maximum Discharge, 2,455 cfs Sept. 6, 1990 @ 2246 hrs; Minimum Discharge, 9.4 cfs August 6, 1988.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	70 e	20 e	6.1	219							
2	0.0 e	60 e	10 e	5.8	460							
3	0.0 e	50 e	10 e	5.5	284							
4	0.0 e	50 e	20 e	5.2	202							
5	0.0 e	40 e	10 e	5.2	154							
6	0.0 e	30 e	10 e	4.9	758							
7	0.0 e	30 e	10 e	4.6	1396							
8	0.0 e	30 e	10 e	4.6	827							
9	0.0 e	20 e	10 e	4.6	542							
10	0.0 e	20 e	18	4.3	358							
11	0.0 e	---	30	18	3.7	280						
12	0.0 e	---	40	16	3.7	233						
13	0.0 e	---	47	15	3.4	199						
14	0.0 e	---	60 e	14	3.4	199						
15	0.0 e	---	60 e	14	3.1	260						
16	0.0 e	---	50 e	12	3.1	522						
17	0.0 e	---	50 e	12	3.1	426						
18	0.0 e	---	80 e	11	3.1	289						
19	0.0 e	2210 e	110 e	11	2.8	212						
20	0.0 e	800 e	90 e	10	2.8	---						
21	0.0 e	640 e	30 e	11	2.5	---						
22	0.0 e	510 e	30 e	12	2.2	---						
23	0.0 e	420 e	30 e	10	2.5	---						
24	0.0 e	340 e	30 e	8.4	2.2	---						
25	0.0 e	270 e	30 e	8.7	2.5	---						
26	0.0 e	200 e	30 e	8.0	2.2	---						
27	0.0 e	150 e	20 e	7.7	2.8	---						
28	0.0 e	130 e	20 e	7.0	3.7	---						
29	0.0 e	110 e	20 e	7.0	4.6	---						
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	90 e	20 e	6.4	4.6	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	---	80 e	---	6.1	5.5	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7060	1276	352	118	7822
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	504	43	11	3.8	412
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2210	110	20	6.1	1396
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80	20	6.1	2.2	154
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.14	0.43	0.11	0.04	4.20
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.68	0.48	0.09	0.04	2.96
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14003	2532	479	233	15515

TOTAL 16628
MEAN (MAY 18 TO SEP 19) 133
SEVEN-DAY LOW FLOW 2.41
INSTANTANEOUS PEAK FLOW 2455

(Sept. 6, 1990)

TOTAL RUNOFF (AC-FT) 32981
AVERAGE RUNOFF (CFSM) 1.36
TOTAL RUNOFF (INCHES) 6.30

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-35

TAMAYARIAK RIVER, LOWER WEST FORK

LOCATION.--Lat 69°58.83' N., long 145°47.67' W., NW/4NW/4 sec 12, T.7N., R.25E., Umiat Meridian, 1.5 miles upstream from the confluence with the Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--98.14 mi², of which 5.55 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; and June to Sept. 1991.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES.--Maximum Discharge, 2,455 cfs Sept 6, 1990 @ 2246 hrs; Minimum Discharge, 9.0 cfs August 6 & 7, 1988.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	1160 e	92	42	40							
2	0.0 e	2050 e	66	40	36							
3	0.0 e	1210 e	51	38	34							
4	0.0 e	840 e	42	36	35							
5	0.0 e	630 e	39	33	39							
6	0.0 e	590 e	35	30	32							
7	0.0 e	537	38	29	28							
8	0.0 e	341	40	29	29							
9	0.0 e	265	34	28	26							
10	0.0 e	205	34	28	29							
11	0.0 e	142	30	29	33							
12	0.0 e	144	28	27	39							
13	0.0 e	288	27	24	25							
14	0.0 e	1187	24	23	28							
15	0.0 e	811	24	25	30							
16	0.0 e	441	25	23	26							
17	0.0 e	20 e	312	26	22	30						
18	0.0 e	30 e	485	26	22	51						
19	0.0 e	60 e	576	51	21	56						
20	0.0 e	200 e	537	94	20	50						
21	0.0 e	250 e	467	341	19	141						
22	0.0 e	310 e	341	929	24	145						
23	0.0 e	340 e	219	960 e	48	97						
24	0.0 e	380 e	183	400 e	241	66						
25	0.0 e	400 e	140	163	193	---						
26	0.0 e	410 e	142	92	120	---						
27	0.0 e	440 e	135	71	83	---						
28	0.0 e	500 e	135	66	70	---						
29	0.0 e	610 e	138	56	70	---						
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	720 e	151	49	63	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	---	890 e	---	46	48	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5560	14800	3997	1547	1144
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	371	493	129	50	48
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	890	2050	960	241	145
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20	135	24	19	25
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.78	5.03	1.31	0.51	0.49
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.11	5.61	1.51	0.59	0.43
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11028	29355	7928	3069	2268

TOTAL 27048
MEAN (MAY 17 TO SEP 24) 206
SEVEN-DAY LOW FLOW 21.50
INSTANTANEOUS PEAK FLOW 1750

(July 23, 1991)

TOTAL RUNOFF (AC-FT) 53649
AVERAGE RUNOFF (CFSM) 2.10
TOTAL RUNOFF (INCHES) 10.25

NOTE: e = Estimated

ARCTIC NATIONAL WILDLIFE REFUGE

A-36

Tamayariak River, Middle Fork

LOCATION.--Lat 69°58.55' N., long 145°46.73' W., in center sec 12, T.7N., R.25E., Umiat Meridian, 0.4 miles upstream from the confluence with the West Fork Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--61.3 mi², of which 0.79 mi² are located within the Arctic National Wildlife Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 618 cfs Sept. 5, 1988 @ 0530 hrs; Minimum Discharge, 1.2 cfs Aug 6 & 7, 1988.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	140 e	40 e	2.4	64							
2	0.0 e	120 e	30 e	2.4	55							
3	0.0 e	120 e	20 e	2.8	88							
4	0.0 e	110 e	20 e	2.0	127							
5	0.0 e	120 e	10 e	1.5	445							
6	0.0 e	120 e	10 e	1.4	164							
7	0.0 e	120 e	10 e	1.7	89							
8	0.0 e	120 e	10 e	159	58							
9	0.0 e	120 e	9.0 e	351	45							
10	0.0 e	120 e	8.0 e	135	39							
11	0.0 e	130 e	7.0 e	84	34							
12	0.0 e	320 e	7.0 e	127	31							
13	0.0 e	1060 e	6.0 e	196	29							
14	0.0 e	1300 e	6.0 e	118	31							
15	0.0 e	1200 e	5.0 e	77	24							
16	0.0 e	1130 e	5.0 e	77	21							
17	0.0 e	980 e	5.0 e	79	17							
18	0.0 e	830 e	7.9	72	12							
19	0.0 e	700 e	7.9	75	9.4							
20	0.0 e	570 e	6.7	75	17							
21	0.0 e	480 e	5.2	159	15							
22	0.0 e	400 e	4.3	218	7.9							
23	0.0 e	320 e	4.0	193	5.6							
24	0.0 e	240 e	4.0	179	7.3							
25	0.0 e	190 e	3.6	97	7.9							
26	0.0 e	50 e	140 e	3.1	72	5.6						
27	0.0 e	100 e	110 e	3.1	82	---						
28	0.0 e	170 e	90 e	2.6	66	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	210 e	70 e	2.4	82	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	210 e	50 e	2.2	199	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	170 e	---	2.8	100	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	910	11520	268	3089	1449
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	152	384	8.6	100	56
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	210	1300	40	351	445
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	50	2.2	1.4	5.6
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	6.26	0.14	1.63	0.91
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.55	6.99	0.16	1.87	0.88
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1805	22850	531	6126	2873

TOTAL 17235
 MEAN (MAY 26 TO SEP 26) 139
 SEVEN-DAY LOW FLOW 2.02
 INSTANTANEOUS PEAK FLOW 618 (Sept. 5, 1988)

TOTAL RUNOFF (AC-FT) 34185
 AVERAGE RUNOFF (CFSM) 2.27
 TOTAL RUNOFF (INCHES) 10.46

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-37

Tamayariak River, Middle Fork

LOCATION.--Lat 69°58.55' N., long 145°46.73' W., in center sec 12, T.7N., R.25E., Umiat Meridian, 0.4 miles upstream from the confluence with the West Fork Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--61.3 mi², of which 0.79 mi² are located within the Arctic National Wildlife Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 618 cfs Sept. 5, 1988 @ 0530 hrs; Minimum Discharge, 1.2 cfs Aug 6 & 7, 1988.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	680 e	20	242	124							
2	0.0 e	810 e	19	255	85							
3	0.0 e	950 e	20	212	98							
4	0.0 e	1090 e	29	162	81							
5	0.0 e	1220 e	36	108	60							
6	0.0 e	1730 e	36	77	51							
7	0.0 e	1780 e	34	70	62							
8	0.0 e	1320 e	21	70	57							
9	0.0 e	800 e	18	60	49							
10	0.0 e	670 e	23	52	48							
11	0.0 e	490 e	27	160	143							
12	0.0 e	350 e	19	152	162							
13	0.0 e	270 e	18	116	171							
14	0.0 e	220 e	17	214	214							
15	0.0 e	180 e	14	179	198							
16	0.0 e	140 e	15	214	118							
17	0.0 e	110 e	124	175	70							
18	0.0 e	100 e	196	112	48							
19	0.0 e	80 e	118	81	33							
20	0.0 e	70 e	106	220	45							
21	0.0 e	70 e	98	282	---							
22	0.0 e	70 e	114	158	---							
23	0.0 e	80 e	104	90	---							
24	0.0 e	80 e	108	62	---							
25	0.0 e	60 e	76	52	---							
26	0.0 e	50 e	198	51	---							
27	0.0 e	40 e	255	48	---							
28	0.0 e	---	40 e	141	43	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	34	77	48	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	26	48	51	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	39	112	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	13610	2168	3928	1917
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	454	70	127	96
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	1780	255	282	214
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	26	14	43	33
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	7.40	1.14	2.07	1.56
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	8.26	1.32	2.38	1.16
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	26995	4300	7791	3802

TOTAL 21623
 MEAN (JUN 5 TO SWP 20) 193
 SEVEN-DAY LOW FLOW 18.87
 INSTANTANEOUS PEAK FLOW 303 (Aug. 21, 1989)

TOTAL RUNOFF (AC-FT) 42889
 AVERAGE RUNOFF (CFSM) 3.15
 TOTAL RUNOFF (INCHES) 13.12

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-38

Tamayariak River, Middle Fork

LOCATION.--Lat 69°58.55' N., Long 145°46.73' W., in center sec 12, T.7N., R.25E., Umiat Meridian, 0.4 miles upstream from the confluence with the West Fork Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--61.3 mi², of which 0.79 mi² are located within the Arctic National Wildlife Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 637 cfs Sept. 6, 1990 @ 1924 hrs; Minimum Discharge, 0.1 cfs Sept. 19, 1990 @ 2359.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	30 e	11	0.8	46							
2	0.0 e	30 e	10	0.7	49							
3	0.0 e	30 e	9.1	0.7	39							
4	0.0 e	30 e	7.3	0.7	26							
5	0.0 e	30 e	6.4	0.7	17							
6	0.0 e	30 e	5.8	0.6	195							
7	0.0 e	30 e	5.2	0.7	204							
8	0.0 e	30 e	7.0	0.7	69							
9	0.0 e	30 e	5.2	0.7	34							
10	0.0 e	30 e	4.5	0.7	12							
11	0.0 e	3.0 e	30 e	4.0	0.7	5.5						
12	0.0 e	4.0 e	26	3.4	0.7	3.6						
13	0.0 e	8.0 e	41	2.8	0.5	2.6						
14	0.0 e	20 e	40	2.5	0.5	2.0						
15	0.0 e	30 e	44	2.0	0.4	1.9						
16	0.0 e	170 e	43	1.9	0.5	2.2						
17	0.0 e	2410 e	54	2.0	0.5	1.4						
18	0.0 e	1730 e	50	1.8	0.5	0.7						
19	0.0 e	740 e	44	1.5	0.5	0.3						
20	0.0 e	500 e	38	1.4	0.5	---						
21	0.0 e	380 e	78	1.6	0.5	---						
22	0.0 e	290 e	151	2.5	0.5	---						
23	0.0 e	230 e	100	1.8	0.5	---						
24	0.0 e	180 e	23	1.3	0.5	---						
25	0.0 e	130 e	23	1.2	0.5	---						
26	0.0 e	90 e	22	1.2	0.5	---						
27	0.0 e	70 e	20	1.1	0.6	---						
28	0.0 e	50 e	16	1.0	0.9	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	40 e	15	0.9	1.3	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	40 e	12	0.9	1.5	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	30 e	---	0.8	4.7	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7145	1170	108	24	711
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	340	39	3.5	0.78	37
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2410	151	11	4.7	204
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	12	0.82	0.41	0.30
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.55	0.64	0.06	0.01	0.61
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.33	0.71	0.07	0.01	0.43
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14172	2320	215	48	1410

TOTAL	9158	TOTAL RUNOFF (AC-FT)	18165
MEAN (MAY 11 TO SEP 19)	69	AVERAGE RUNOFF (CFSM)	1.13
SEVEN-DAY LOW FLOW	0.46	TOTAL RUNOFF (INCHES)	5.56
INSTANTANEOUS PEAK FLOW	637 (Sept. 6, 1990)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

Tamayariak River, Middle Fork

LOCATION.--Lat 69°58.55' N., Long 145°46.73' W., in center sec 12, T.7N., R.25E., Umiat Meridian, 0.4 miles upstream from the confluence with the West Fork Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,867 cfs June 4, 1991 @ 0003 hrs; Minimum Discharge, 0.1 cfs Sept. 19, 1990 @ 2359.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	790 e	55	35	15							
2	0.0 e	1580 e	43	31	12							
3	0.0 e	1350 e	34	27	11							
4	0.0 e	1293 e	28	25	9.5							
5	0.0 e	845	23	23	7.9							
6	0.0 e	499	27	26	7.4							
7	0.0 e	219	29	19	6.9							
8	0.0 e	120	22	18	7.9							
9	0.0 e	86	20	15	6.5							
10	0.0 e	55	18	13	6.1							
11	0.0 e	38	16	10 e	6.4							
12	0.0 e	66	15	9.5 e	6.9							
13	0.0 e	808	16	9.5 e	6.4							
14	0.0 e	817	14	9.5	5.7							
15	0.0 e	426	21	9.9	5.5							
16	0.0 e	252	29	8.8	5.8							
17	0.0 e	5.0 e	226	33	8.5	11						
18	0.0 e	9.0 e	326	28	7.6	76						
19	0.0 e	20 e	230	26	7.4	121						
20	0.0 e	90 e	249	33	7.2	126						
21	0.0 e	120 e	192	181	6.9	108						
22	0.0 e	160 e	116	599	11	92						
23	0.0 e	180 e	74	800	111	61						
24	0.0 e	200 e	75	264	225	45						
25	0.0 e	210 e	66	121	134	---						
26	0.0 e	220 e	77	72	81	---						
27	0.0 e	240 e	78	57	53	---						
28	0.0 e	280 e	83	52	37	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	360 e	87	44	27	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	440 e	73	38	21	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	570 e	---	39	17	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3104	11198	2795	1048	766
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	207	373	90	34	32
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	570	1580	800	225	126
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	38	14	6.9	5.5
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.38	6.09	1.47	0.55	0.52
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.88	6.79	1.70	0.64	0.46
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6157	22212	5544	2078	1519

TOTAL	18910	TOTAL RUNOFF (AC-FT)	37507
MEAN (MAY 17 TO SEP 24)	144	AVERAGE RUNOFF (CFSM)	2.35
SEVEN-DAY LOW FLOW	6.11	TOTAL RUNOFF (INCHES)	11.47
INSTANTANEOUS PEAK FLOW	1867 (June 4, 1991)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-40

Tamayariak River, Middle Fork

LOCATION.--Lat 69°58.55' N., long 145°46.73' W., in center sec 12, T.7N., R.25E., Umiat Meridian, 0.4 miles upstream from the confluence with the West Fork Tamayariak River, 54 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--61.3 mi², of which 0.79 mi² are located within the Arctic National Wildlife Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,867 cfs June 4, 1991 @ 0003 hrs; Minimum Discharge, 0.1 cfs Sept. 19, 1990 @ 2359.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
1	0.0 e	470 e	17	1.2	70								
2	0.0 e	220 e	13	1.0	58								
3	0.0 e	103	9.5	0.8	50								
4	0.0 e	54	8.2	0.8	43								
5	0.0 e	42	8.8	0.6	38								
6	0.0 e	60	6.5	0.6	37								
7	0.0 e	52	5.6	0.6	37								
8	0.0 e	164	3.9	0.8	38								
9	0.0 e	193	3.2	0.8	36								
10	0.0 e	286	3.1	0.8	36								
11	0.0 e	269	3.2	0.8	38								
12	0.0 e	170	3.2	1.0	18								
13	0.0 e	94	2.7	0.8	17								
14	0.0 e	72	2.4	0.8	15								
15	0.0 e	63	2.1	0.8	4.3								
16	0.0 e	53	2.0	0.8	---								
17	0.0 e	45	1.9	1.8	---								
18	0.0 e	37	1.8	1.9	---								
19	0.0 e	40	1.7	1.6	---								
20	0.0 e	39	1.8	1.3	---								
21	0.0 e	29	1.6	1.2	---								
22	0.0 e	27	1.4	1.2	---								
23	0.0 e	27	1.3	1.0	---								
24	0.0 e	21	1.2	1.0	---								
25	0.0 e	16	1.2	1.0	---								
26	0.0 e	15	1.2	7.6	---								
27	0.0 e	14	1.2	1026	---								
28	0.0 e	20 e	14	1.0	467	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	740 e	13	1.0	244	---	
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	1020 e	12	0.8	142	---	
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	930 e	---	1.0	94	---	
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2710	2712	114	2004	538	
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	678	90	3.7	65	36	
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1020	470	17	1026	70	
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20	12	0.80	0.60	4.3	
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.05	32.98	1.87	32.70	8.78	
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.64	1.23	0.07	1.22	0.33	
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5375	4010	227	3975	1068	

TOTAL	8079	TOTAL RUNOFF (AC-FT)	16024
MEAN (MAY 28 TO SEP 15)	73	AVERAGE RUNOFF (CFSM)	1.19
SEVEN-DAY LOW FLOW	0.71	TOTAL RUNOFF (INCHES)	4.90
INSTANTANEOUS PEAK FLOW	1455 (Aug. 27, 1992)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-41

TAMAYARIAK RIVER, UPPER WEST FORK

LOCATION.--Lat 69°49.97' N., long 145°55.25' W., in the center W¼ sec 33, T.6N., R.25E., Umiat Meridian, 13.9 mi upstream from the confluence with the Tamayariak River, 61.1 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--49.2 mi², which 5.6 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 404 cfs Aug 13, 1988 @ 0315 hrs; Minimum Discharge, 0.8 cfs July 29-31, 1988.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1987 TO SEPTEMBER 1988
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	140 e	50 e	1.2	49							
2	0.0 e	130 e	40 e	1.1	40							
3	0.0 e	130 e	30 e	1.2	51							
4	0.0 e	130 e	20 e	1.1	72							
5	0.0 e	130 e	20 e	1.1	240							
6	0.0 e	140 e	20 e	1.2	129							
7	0.0 e	140 e	14 e	1.5	72							
8	0.0 e	140 e	12 e	88	47							
9	0.0 e	140 e	11 e	240	35							
10	0.0 e	140 e	10 e	106	29							
11	0.0 e	140 e	9.0 e	60	22							
12	0.0 e	360 e	8.0 e	168	15							
13	0.0 e	1220 e	7.0 e	271	11							
14	0.0 e	1490 e	7.0 e	110	8.2							
15	0.0 e	1380 e	6.0 e	60	7.3							
16	0.0 e	1300 e	5.0 e	54	6.9							
17	0.0 e	1120 e	4.0 e	48	6.2							
18	0.0 e	960 e	3.1	43	5.8							
19	0.0 e	800 e	2.3	41	5.2							
20	0.0 e	650 e	1.6	42	4.9							
21	0.0 e	550 e	1.2	143	4.9							
22	0.0 e	450 e	1.0	217	4.4							
23	0.0 e	360 e	0.92	189	3.7							
24	0.0 e	280 e	1.1	178	5.5							
25	0.0 e	210 e	1.0	94	8.2							
26	0.0 e	50 e	160 e	0.92	64	4.9						
27	0.0 e	120 e	130 e	0.92	65	---						
28	0.0 e	190 e	100 e	0.92	54	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	230 e	80 e	0.87	70	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	190 e	60 e	0.82	143	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	160 e	---	1.0	78	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	940	13160	291	2636	890
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	157	439	9.4	85	34
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	230	1490	50	271	240
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50	60	0.8	1.1	3.7
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.18	8.92	0.19	1.73	0.70
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.71	9.95	0.22	1.99	0.67
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1864	26102	577	5228	1764

TOTAL
MEAN (MAY 26 TO SEP 26) 17916
SEVEN-DAY LOW FLOW 144
INSTANTANEOUS PEAK FLOW 404

(Aug. 13, 1988)

TOTAL RUNOFF (AC-FT) 35536
AVERAGE RUNOFF (CFSM) 2.94
TOTAL RUNOFF (INCHES) 13.54

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-42

TAMAYARIAK RIVER, UPPER WEST FORK

LOCATION.--Lat 69°49.97' N., long 145°55.25' W., in the center W½ sec 33, T.6N., R.25E., Umat Meridian, 13.9 mi upstream from the confluence with the Tamayariak River, 61.1 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--49.2 mi², which 5.6 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data due to equipment electronic problems. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,478 cfs Aug 20, 1989 @ 1975 hrs; Minimum Discharge, 0 cfs July 9-10, and 13, 1989.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1988 TO SEPTEMBER 1989
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	60 e	17	130 e	48							
2	0.0 e	70 e	14	170 e	42							
3	0.0 e	80 e	15	130 e	44							
4	0.0 e	360 e	25	90 e	41							
5	0.0 e	1400 e	21	70 e	37							
6	0.0 e	1990 e	21	60 e	37							
7	0.0 e	2050 e	21	50 e	44							
8	0.0 e	1510 e	11	50 e	40							
9	0.0 e	910 e	3.4	40 e	37							
10	0.0 e	760 e	6.6	40 e	36							
11	0.0 e	550 e	20	80 e	149							
12	0.0 e	400 e	12	90 e	171							
13	0.0 e	300 e	3.4	123	242							
14	0.0 e	250 e	10 e	486	191							
15	0.0 e	210 e	10 e	248	74							
16	0.0 e	160 e	30 e	424	45							
17	0.0 e	130 e	220 e	180	37							
18	0.0 e	110 e	170 e	74	34							
19	0.0 e	327	90 e	49	30							
20	0.0 e	206	70 e	319	27							
21	0.0 e	185	80 e	530	---							
22	0.0 e	101	80 e	116	---							
23	0.0 e	101	90 e	55	---							
24	0.0 e	86	80 e	42	---							
25	0.0 e	51	60 e	41	---							
26	0.0 e	45	120 e	40	---							
27	0.0 e	38	170 e	39	---							
28	0.0 e	---	35	100 e	37	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	30	60 e	37	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	---	24	40 e	37	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	---	---	30 e	43	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	12529	1699	3920	1406
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	418	55	126	70
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	2050	220	530	242
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	24	3.4	37	27
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	8.49	1.11	2.57	1.43
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	9.47	1.28	2.96	1.06
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	---	24851	3371	7775	2789

TOTAL 19554
 MEAN (JUN 1 TO SEP 20) 175
 SEVEN-DAY LOW FLOW 10.89
 INSTANTANEOUS PEAK FLOW 1478 (Aug. 20, 1989)

TOTAL RUNOFF (AC-FT) 38785
 AVERAGE RUNOFF (CFSM) 3.55
 TOTAL RUNOFF (INCHES) 14.78

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

A-43

TAMAYARIAK RIVER, UPPER WEST FORK

LOCATION.--Lat 69°49.97' N., long 145°55.25' W., in the center W¼ sec 33, T.6N., R.25E., Umiat Meridian, 13.9 mi upstream from the confluence with the Tamayariak River, 61.1 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--49.2 mi², which 5.6 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,478 cfs Aug 20, 1989 @ 1975 hrs; Minimum Discharge, 0 cfs July 9-10, and 13, 1989, July 19-20 and Aug. 6-18, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	30 e	6.2	0.7	432							
2	0.0 e	20 e	5.2	0.5	190							
3	0.0 e	20 e	4.2	0.1	101							
4	0.0 e	20 e	3.7	0.3	60							
5	0.0 e	10 e	3.2	0.1	49							
6	0.0 e	10 e	2.8	0.0	629							
7	0.0 e	10 e	2.1	0.0	480							
8	0.0 e	10 e	2.2	0.0	168							
9	0.0 e	9.0 e	1.7	0.0	85							
10	0.0 e	8.0 e	1.8	0.0	57							
11	0.0 e	---	7.0 e	1.8	0.0	98						
12	0.0 e	---	25	1.5	0.0	35						
13	0.0 e	---	35	1.2	0.0	121						
14	0.0 e	---	30	1.2	0.0	74						
15	0.0 e	---	34	0.9	0.0	130						
16	0.0 e	---	130	0.3	0.0	217						
17	0.0 e	---	130	0.5	0.0	124						
18	0.0 e	1730 e	69	0.3	0.0	452						
19	0.0 e	740 e	40	0.0	2.0	509						
20	0.0 e	500 e	27	0.0	2.6	---						
21	0.0 e	380 e	18	0.9	2.6	---						
22	0.0 e	290 e	15	2.6	2.3	---						
23	0.0 e	230 e	11	2.3	2.1	---						
24	0.0 e	180 e	8.7	2.5	1.8	---						
25	0.0 e	130 e	8.7	2.2	1.7	---						
26	0.0 e	90 e	7.6	2.0	1.5	---						
27	0.0 e	70 e	6.2	1.4	2.6	---						
28	0.0 e	50 e	6.0	1.4	3.5	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	40 e	7.2	1.4	49	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	40 e	6.7	1.2	145	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	30 e	---	0.9	323	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4500	769	60	541	4010
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	321	26	1.9	17	211
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1730	130	6.2	323	629
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30	6.0	0.00	0.00	35
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.53	0.52	0.04	0.35	4.29
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.40	0.58	0.05	0.41	3.03
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8926	1525	118	1073	7954

TOTAL 9880
 MEAN (MAY 18 TO SEP 19) 79
 SEVEN-DAY LOW FLOW 0.00
 INSTANTANEOUS PEAK FLOW 1328 (Sept. 6, 1990)

TOTAL RUNOFF (AC-FT) 19597
 AVERAGE RUNOFF (CFSM) 1.61
 TOTAL RUNOFF (INCHES) 7.47

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

TAMAYARIAK RIVER, UPPER WEST FORK

LOCATION.--Lat 69°49.97' N., long 145°55.25' W., in the center W¼ sec 33, T.6N., R.25E., Umiat Meridian, 13.9 mi upstream from the confluence with the Tamayariak River, 61.1 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--49.2 mi², which 5.6 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,478 cfs Aug 20, 1989 @ 1975 hrs; Minimum Discharge, 0 cfs July 9-10, and 13, 1989, July 19-20 and Aug. 6-18, 1990.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1990 TO SEPTEMBER 1991
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	900 e	57	33	27							
2	0.0 e	1820 e	46	29	19							
3	0.0 e	950 e	38	24	14							
4	0.0 e	610 e	32	21	11							
5	0.0 e	410 e	30	20 e	9.4							
6	0.0 e	270 e	38	16	7.1							
7	0.0 e	200 e	36	14	4.6							
8	0.0 e	410 e	24	12	4.4							
9	0.0 e	110 e	17	15	4.1							
10	0.0 e	130 e	13	13	2.7							
11	0.0 e	210 e	9.1	9.9	3.6							
12	0.0 e	330 e	13	8.0	2.6							
13	0.0 e	390 e	17	6.7	2.3							
14	0.0 e	340 e	21	6.7	3.1							
15	0.0 e	320 e	34	8.9	2.3							
16	0.0 e	590 e	39	15	2.3							
17	0.0 e	5.0 e	420 e	35	16	3.3						
18	0.0 e	10 e	180 e	44	13	27						
19	0.0 e	20 e	210 e	63	10	130						
20	0.0 e	100 e	350	71	7.5	137						
21	0.0 e	140 e	302	373	6.3	134						
22	0.0 e	180 e	203	654	18	109						
23	0.0 e	200 e	151	681	202	68						
24	0.0 e	230 e	116	240	186	51						
25	0.0 e	240 e	96	117	111	---						
26	0.0 e	250 e	100	74	72	---						
27	0.0 e	280 e	98	63	57	---						
28	0.0 e	320 e	98	60	65	---						
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	410 e	102	49	68	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	500 e	82	42	52	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	650 e	---	41	38	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3535	10497	3071	1171	779
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	236	350	99	38	32
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	650	1820	681	202	137
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	82	9.1	6.3	2.3
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.79	7.11	2.01	0.77	0.66
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.67	7.93	2.32	0.89	0.59
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7012	20821	6091	2323	1545

TOTAL	19055	TOTAL RUNOFF (AC-FT)	37794
MEAN (MAY 17 TO SEP 24)	145	AVERAGE RUNOFF (CFSM)	2.96
SEVEN-DAY LOW FLOW	2.70	TOTAL RUNOFF (INCHES)	14.40
INSTANTANEOUS PEAK FLOW	1219 (July 22, 1991)		

NOTE: e = ESTIMATED

ARCTIC NATIONAL WILDLIFE REFUGE

TAMAYARIAK RIVER, UPPER WEST FORK

LOCATION.--Lat 69°49.97' N., long 145°55.25' W., in the center W½W½ sec 33, T.6N., R.25E., Umiat Meridian, 13.9 mi upstream from the confluence with the Tamayariak River, 61.1 miles west-southwest of Kaktovik, Alaska.

DRAINAGE AREA.--49.2 mi², which 5.6 mi² are located within the Arctic National Wildlife Refuge Wilderness Area.

PERIOD OF RECORD.--July to Sept. 1988; June to Sept. 1989; June to Sept. 1990; June to Sept. 1991; and June to Sept. 1992.

REMARKS.--This is a 4th Order drainage. Discharge records are initiated during break-up and discontinued at freeze-up of each year. Missing data due to bear damage (7/3/92 to 8/7/92), and a flood on Aug 6, 1992 which caused significant channel scour. Stream discharge gaging was discontinued. River normally freezes to substrate the first week of October.

EXTREMES FOR PERIOD OF RECORD.--Maximum Discharge, 1,478 cfs Aug 20, 1989 @ 1975 hrs; Minimum Discharge, 0 cfs July 9-10, and 13, 1989, July 19-20 and Aug. 6-18, 1990, and Aug 8-17, 1992.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1991 TO SEPTEMBER 1992
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.0 e	890 e	8.2	4.0 e	---							
2	0.0 e	500 e	4.9	3.0 e	---							
3	0.0 e	264	4.1	3.0 e	---							
4	0.0 e	101	8.0 e	2.0 e	---							
5	0.0 e	82	10 e	2.0 e	---							
6	0.0 e	148	10 e	1.0 e	---							
7	0.0 e	121	8.0 e	1.0 e	---							
8	0.0 e	293	7.0 e	0.0	---							
9	0.0 e	327	6.0 e	0.0	---							
10	0.0 e	425	7.0 e	0.0	---							
11	0.0 e	401	6.0 e	0.0	---							
12	0.0 e	286	30 e	0.0	---							
13	0.0 e	161	20 e	0.0	---							
14	0.0 e	123	10 e	0.0	---							
15	0.0 e	99	10 e	0.0	---							
16	0.0 e	83	10 e	0.0	---							
17	0.0 e	65	7.0 e	0.5	---							
18	0.0 e	50	5.0 e	0.3	---							
19	0.0 e	44	5.0 e	0.3	---							
20	0.0 e	35	30 e	0.3	---							
21	0.0 e	24	40 e	0.3	---							
22	0.0 e	22	20 e	0.3	---							
23	0.0 e	18	10 e	0.3	---							
24	0.0 e	12	10 e	0.4	---							
25	0.0 e	9.0	9.0 e	0.4	---							
26	0.0 e	9.9	8.0 e	---	---							
27	0.0 e	10	8.0 e	---	---							
28	0.0 e	30 e	9.0	7.0 e	---							
29	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	850 e	7.8	6.0 e	---	---
30	0.0 e	0.0 e	0.0 e	0.0 e	---	0.0 e	0.0 e	1170 e	6.6	5.0 e	---	---
31	0.0 e	---	0.0 e	0.0 e	---	0.0 e	0.0 e	1060 e	---	4.0 e	---	---
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3110	4625	333	19.1	---
MEAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	778	154	11	0.73	---
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1170	890	40	4.0	---
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30	6.6	4.0	0.00	---
CFSM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.80	3.13	0.22	0.01	---
IN.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.35	3.50	0.25	0.01	---
AC-FT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6169	9174	661	38	---

TOTAL	8088	TOTAL RUNOFF (AC-FT)	16042
MEAN (MAY 28 TO AUG 25)	89	AVERAGE RUNOFF (CFSM)	1.81
SEVEN-DAY LOW FLOW	0.00	TOTAL RUNOFF (INCHES)	6.11
INSTANTANEOUS PEAK FLOW	996 (June 10, 1992)		

NOTE: e = ESTIMATED

