SUMMARY OF HYDROLOGIC CONDITIONS

Surface Water

Alaska contains more than 40 percent of the Nation's surface-water resources. The highest runoff rates per unit area are in southeast Alaska and in other areas influenced by the maritime climate of the northern Pacific Ocean and the Gulf of Alaska. In the interior and northern parts of the State, runoff rates are markedly lower than in the maritime-influenced areas. Runoff generally increases with altitude throughout the State, and year-to-year runoff variability increases from south to north.

Seasonal runoff characteristics differ from southern to northern Alaska. Areas influenced by maritime climates usually have two periods with high runoff: a spring snowmelt period and a fall rainfall period. High water can occur throughout the year, but the highest instantaneous peak discharges are more prevalent in the fall months; low-water periods usually occur in late spring and mid-summer, prior to the rainy fall period. Farther north, most of the total runoff and floods occur in the period from May through September; low-flow periods usually occur during late winter, shortly before spring snowmelt.

Streamflow in Alaska was dominated more by temperatures during water year 2001 than by rainfall. No maximum peak-of-record streamflows were observed at any continuous or partial-record long-term (10 or more years) streamflow gaging station during water year 2001. However, higher than normal streamflows occurred from Wrangell to Deadhorse during the fall and winter of 2000-2001 when most of the state experienced significantly warmer temperatures. A cold spell in May and early June caused delayed snowmelt peaks, but warmer than average temperatures in mid June resulted in rapid melting and overall above average streamflow in June. Streamflow was generally above normal for the remainder of the water year throughout Alaska, though 13 continuous streamflow gaging stations recorded deficit flow (monthly mean streamflow equaled or exceeded more than 75 percent of the time) during July through September.

Record monthly mean streamflow that occurred during September 2000 (previous water year) continued during October at Yukon River at Eagle (station 15356000) and Tanana River at Nenana (station 15515500). Streamflow generally remained high through the fall. During January, average monthly temperatures were as much as 20 degrees Fahrenheit above normal, averaging 8.5 degrees above normal in Southeast, 12.6 degrees above normal in Cook Inlet, and 18.2 degrees above normal in the Yukon basin. More than 80 percent of the continuous streamflow gaging stations having 10 or more years of record recorded excessive monthly mean streamflows (streamflows equaled or exceeded less than 25 percent of the time). Yukon River at Eagle recorded the highest monthly mean streamflows of record (51 years) during October, December, and January. A few partial-record stations in Southcentral Alaska recorded annual peaks during winter. Fritz Creek near Homer (station 15239500) recorded an annual peak in January for the first time in 39 years of record.

Spring temperatures in Southeast Alaska were near or slightly below normal during April and May. Precipitation, generally snowfall at higher elevations, was below normal in April, above normal in May. Resulting streamflow was deficient at 10 of 19 stations in Southeast Alaska during April.

During May, cold temperatures throughout the state resulted in deficit streamflow at more than half the continuous streamflow gaging stations having 10 or more years of record. Rapid warming and clear, sunny days in June resulted in 20 of 55 sites recording excessive streamflow, although precipitation was generally below normal. Three stations, Spruce Creek near Seward (station 15238600), Sixmile Creek near Hope (station 15271000), and Tatalina River near Takotna (station 15303700) recorded the highest June monthly mean streamflow of record.

Because most of the higher than normal flows occurred during winter, annual flows were mostly near average. Only Indian River near Sitka (station 15087690) recorded record low mean annual streamflow (Indian River at Sitka, station 15087700 is affected by diversions). Indian River appeared to be out of phase with most other streams in Southeast Alaska, recording deficit flows during 5 months, even when other streams in the region were recording excessive flows. Ophir Creek near Yakutat (station 15129600) was the only streamflow gaging station to record maximum annual mean streamflow for the period of record.

Ground Water

Alaska's vast area and small population preclude a comprehensive evaluation of its ground-water resources. Throughout much of the State, aquifers are poorly defined. In many areas, wells have not been drilled and little is known about seasonal and long-term changes in ground-water storage. During water year 2001, the long-term monitoring of water levels in one well in Juneau, one well in Anchorage, and three wells in Fairbanks continued. Water levels were also measured intermittently in 32 wells in Juneau for studies of the interaction between ground water and water in anadromous fish streams.

Water levels in the long-term monitoring wells in Juneau, Anchorage, and Fairbanks were within the range of historical values. Water levels in wells in the Duck and Jordan Creek watersheds in Juneau were closely related to the infiltration of rain and snowmelt and the level of water in nearby streams. Some of these wells are in stream channels or on flood plains and are intermittently flooded; most water levels in these wells were within 10 feet of land surface.

Water Quality

General Overview

Information on the concentration and composition of constituents in Alaska’s surface water is markedly variable in coverage. Some subregions have had regular or periodic sampling for many years at many stream points and at a number of lakes. Information in other subregions consists of only a few miscellaneous samples. Although the chemical characteristics of water in the streams and lakes of Alaska seem variable, the ranges in concentration are not as great as those found in the conterminous United States. Most Alaskan streams above tidal reaches contain water of a calcium bicarbonate type, generally containing less than 200 mg/L dissolved solids. In these streams, the hardness generally increases with increased dissolved-solids content. The streams draining lowlands and intermontane basins usually contain harder water than the streams in the higher mountains. Some streams, especially those draining areas overlain by organic-rich deposits, can have excessive iron content.

In Alaska, the mineral content of water in lakes is more variable than that in rivers. The water in some mountain lakes is very low in dissolved-solids content and is little more concentrated than rainwater. Other lakes occupying lowlands near the sea, including many near the Arctic coastal plain, have become mineralized periodically by salts brought in from the sea either by overland flooding during storms or as ocean spray. The water in lakes in the lowlands remote from the sea is commonly very similar in chemical character to water in the larger rivers adjacent to them.

The character and distribution of suspended sediment are relatively complex in Alaska because glaciers contribute large amounts of very fine material (glacial flour) to many streams. In general, during the summer, suspended-sediment concentrations in nonglacial streams seldom exceed 100 mg/L, but can be greater than 2,000 mg/L for glacial streams. Nonglacial streams often transport the highest sediment loads during the spring breakup or during periods of high rainfall, whereas glacial streams transport the greatest sediment loads during periods of maximum glacial melting, usually in middle or late summer. The normal suspended-sediment concentration between January and April is usually less than 20 mg/L for most nonurban streams. Thus, less than 15 percent of the annual suspended-sediment load is carried during this period. The percentage of material finer than 0.062 millimeter (the silt-clay fraction as generally defined) transported by nonglacial streams is less than 50 percent in contrast to more than 50 percent for glacial streams.

Outside of the major urban areas, almost all ground water is obtained from unconsolidated aquifers. Most sampled water contains less than the State’s recommended limit of 500 mg/L dissolved solids. Calcium and magnesium, which along with bicarbonate contribute to the hardness of water, are the major dissolved ions. In most wells, hardness concentrations are about 60 to 80 percent of dissolved-solids concentrations. Water of sodium bicarbonate or sodium chloride type is present in numerous community wells drilled near the coast.

Iron is present in high concentrations in a large number of shallow wells in most areas of the State. Concentrations in excess of 1.0 mg/L are common. Iron concentrations of more than about 0.3 mg/L can cause staining of laundry and plumbing fixtures and impart an unpleasant taste to the water.

The bedrock aquifers in most of Alaska are undeveloped and very little is known about their water quality. In general, the concentration of dissolved solids in water from bedrock aquifers is higher than that found in the unconsolidated aquifers and the chemical quality of water in bedrock aquifers is more variable.

Most of the State’s ground-water resources have, for the present, been unaffected by humans. However, in the major urban areas and in some outlying villages, ground-water quality has been locally degraded, primarily from septic systems, landfills, and abandoned fuel storage tanks. Most ground-water contamination problems in Alaska are caused by petroleum products, primarily from leaky fuel tanks.

In 2001, the following sites were sampled for water quality as part of the National Water Quality Assessment Program (NAWQA): samples were collected at six stream-gaging stations in the Cook Inlet Basin nearly every month; and samples were collected at 4 sites on streams within the Municipality of Anchorage. As part of the Clean Water Action Plan, water-quality, and bed-material samples were collected at sites in Katmai, and Lake Clark National Parks and Preserves, and Sitka National Historical Park.

In 2001 sampling at 5 stations in the Yukon Basin started as part of the National Stream-Quality Assessment Program (NASQAN), the first year of a five year monitoring program. The Alaska District is also collecting samples for personnel from the National Research Program to help extend the normal NASQAN data.

Water-quality sampling is also done for projects throughout Alaska. The analyses for these samples are published in reports discussing these projects. For more information on reports published in 2001, contact the Chief, Water Resources Office (see p. ii) or the Alaska Water Resources Office webpage at http://ak.water.usgs.gov.

Remark Codes

The following remark codes may appear with the water-quality data in this section:

PRINTED OUTPUT	REMARK
E	Value is estimated.
>	Actual value is known to be greater than the value shown.
<	Actual value is known to be less than the value shown.
M	Presence of material verified, but not quantified.
N	Presumptive evidence of presence of material.
U	Material specifically analyzed for, but not detected.
A	Value is an average.
V	Analyte was detected in both the environmental sample and the associated blanks.
S	Most probable value.

Dissolved Trace-Element Concentrations

Traditionally, dissolved trace-element concentrations have been reported at the microgram per liter (µg/L) level. Recent evidence, mostly from large rivers, indicates that actual dissolved-phase concentrations for a number of trace elements are within the range of 10's and 100's of nanograms per liter (ng/L). Present data above the µg/L level should be viewed with caution. Such data may actually represent elevated environmental concentrations from natural or human causes. However, these data could reflect contamination introduced during sampling, processing, or analysis. To confidently produce dissolved trace-element data with insignificant contamination, the U.S. Geological Survey began using new trace-element protocols at some stations in water year 1994. Full implementation of the protocols took place during the 1995 water year.

Quality-control data

Data generated from quality-control (QC) samples are a requisite for evaluating the quality of the sampling and processing techniques as well as data from the actual samples themselves. Without QC data, environmental sample data cannot be adequately interpreted because the errors associated with the sample data are unknown. The various types of QC samples collected by this District are described in the following section. Procedures have been established for the storage of water-quality-control data within the USGS. These procedures allow for storage of all derived QC data and are identified so that they can be related to corresponding environmental samples.

BLANK SAMPLES – blank samples are collected and analyzed to ensure that environmental samples have not been contaminated by the overall data-collection process. The blank solution used to develop specific types of blank samples is a solution that is free of the analytes of interest. Any measured value signal in a blank samples for an analyte (a specific component measured in a chemical analysis) that was absent in the blank solution is believed to be due to contamination. There are many types of blank samples possible, each designed to segregate a different part of the overall data-collection process. The types of blank samples collected in this District are:

Source solution blank – a blank solution that is transferred to a sample bottle in an area of the office laboratory with an atmosphere that is relatively clean and protected with respect to target analytes.

Ambient blank – a blank solution that is put in the same type of bottle used for an environmental sample, kept with the set of sample bottles before sample collection, and opened at the site and exposed to the ambient conditions.

Field blank – a blank solution that is subjected to all aspects of sample collection, field processing preservation, transportation, and laboratory handling as an environmental sample.

Trip blank – a blank solution that is put in the same type of bottle used for an environmental sample and kept with the set of sample bottles before and after sample collection.

Equipment blank – a blank solution that is processed through all equipment used for collecting and processing an environmental sample (similar to a field blank but normally done in the more controlled conditions of the office.)

Sampler blank – a blank solution that is poured or pumped through the same field sampler used for collecting an environmental sample.

Pump blank – a blank solution that is processed through the same pump-and-tubing system used for an environmental sample.

Standpipe blank – a blank solution that is poured from the containment vessel (stand-pipe) before the pump is inserted to obtain the pump blank.

Filter blank – a blank solution that is filtered in the same manner and through the same filter apparatus used for an environmental sample.

Splitter blank - a blank solution that is mixed and separated using a field splitter in the same manner and through the same apparatus used for an environmental sample.

Preservation blank – a blank solution that is treated with the sampler preservatives used for an environmental sample.

Canister blank – a blank solution that is taken directly from a stainless steel canister just before the VOC sampler is submerged to obtain a field blank sample.

REFERENCE SAMPLES – Reference material is a solution or material prepared by a laboratory whose composition is certified for one or more properties so that it can be used to assess a measurement method. Samples of reference material are submitted for analysis to ensure that an analytical method is accurate for the known properties of the reference material. Generally, the selected reference material properties are similar to the environmental sample properties.

REPLICATE SAMPLES– Replicate samples are a set of environmental samples collected in a manner such that the samples are thought to be essentially identical in composition. Replicate is the general case for which a duplicate is the special case consisting of two samples. Replicate samples are collected and analyzed to establish the amount of variability in the data contributed by some part of the collection and analytical process. There are many types of replicate samples possible, each of which may yield slightly different results in a dynamic hydrologic setting, such as a flowing stream. The types of replicate samples collected in this district are:

Concurrent sample – a type of replicate sample in which the samples are collected simultaneously with two or more samplers or by using one sampler and alternating collection of samples into two or more compositing containers.

Sequential sample – a type of replicate sample in which the samples are collected one after the other, typically over a short time.

Split sample – a type of replicate sample in which a sample is split into subsamples contemporaneous in time and space.

SPIKE SAMPLES – Spike samples are samples to which known quantities of a solution with one or more well-established analyte concentrations have been added. These samples are analyzed to determine the extent of matrix interference or degradation on the analyte concentration during sample processing and analysis.

Concurrent sample – a type of spike sample that is collected at the same time with the same sampling and compositing devices then spiked with the same spike solution containing laboratory-certified concentrations of selected analytes.

Split sample – a type of spike sample in which a sample is split into subsamples contemporaneous in time and space then spiked with the same spike solution containing laboratory-certified concentrations of selected analytes.

Water Use

Water use in the broad sense deals with man's interaction with and influence on the hydrologic cycle. In a technical sense, water use refers to water that is actually used for a specific purpose, such as domestic use, commercial needs, or industrial processing. The water use for the state of Alaska was estimated for 1995. An estimate of water use for **2000 is underway**.

Industry is the largest user of fresh water in Alaska. In 1995, it accounted for about 38 percent of all offstream withdrawals. In 1995, water used instream for hydroelectric power generation was nine times more than that used offstream by man.

Another probable large instream use is for fish and wildlife resources. Approximately 15,000 water bodies have been identified by the Alaska Department of Fish and Game as producing anadromous fish. The Alaska Water Use Act was amended in 1980 to include instream flow as a use. The amendments provide the opportunity for private individuals, and local, State, and Federal governments to legally acquire instream flow water rights. Either one or a combination of the four following types of uses can be acquired: 1) protection of fish and wildlife habitat, migration, and propagation; 2) recreation and parks; 3) navigation and transportation; and 4) sanitation and water quality. Eleven instream flow rights applications have been granted.

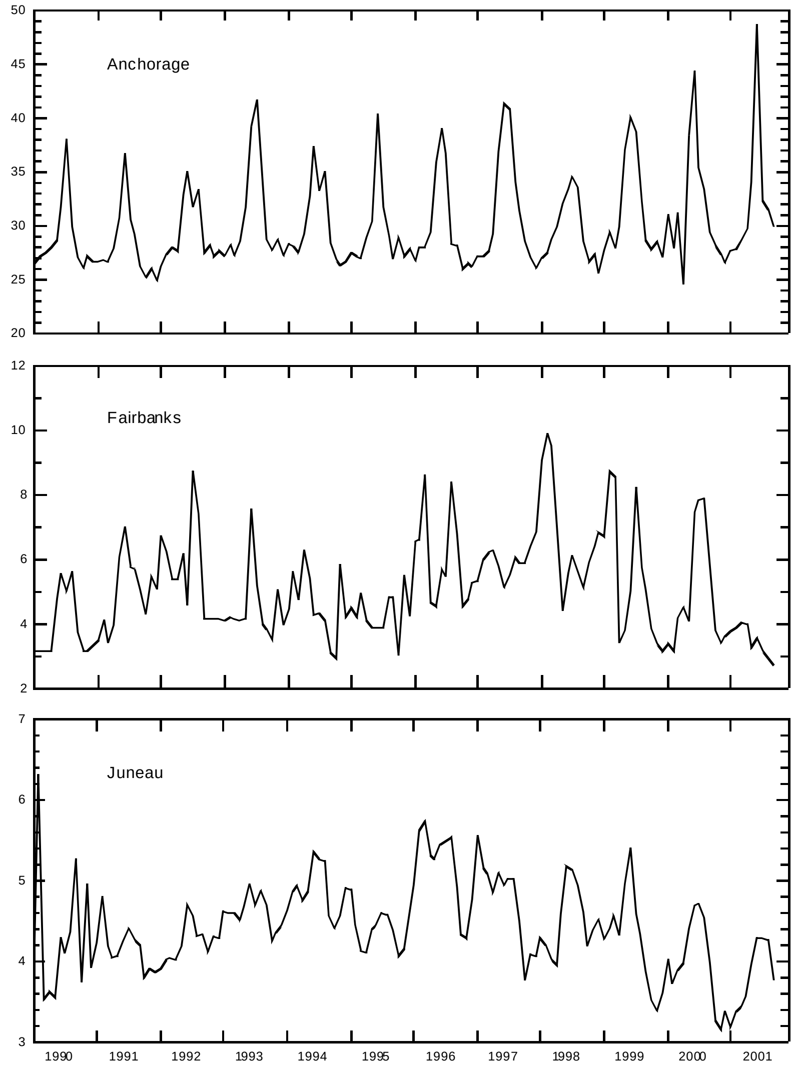
From 1990-2001, Alaska’s population increased 15 percent, which was one of the Nation’s larger percentage increases. In 2001, Alaska’s population increased by 1 percent. In 2001, about 60 percent of the State’s population lived in the Anchorage, Fairbanks, and Juneau areas.

Because of the population increase, public-supply use of water is also increasing. In 1995, public-supply use accounted for 33 percent of all offstream withdrawal and 63 percent of the State’s population received their water from a public-supply utility; the remainder supplied their own water. The main use of public-supply water was for domestic use of about 57 percent; the rest was primarily for commercial and industrial uses which has dropped since 1990 due to timber processing plants closing in southeast Alaska and changes in the fish processing industry.

In 1995, the water utilities in the Anchorage, Fairbanks, and Juneau areas used 60 percent of all water withdrawn in the State for public supply. The monthly mean rate of water withdrawn by the principal public-supply utilities servicing these three areas from January 1990 to September 2001 is shown in figure 1. (Data are from Municipality of Anchorage, Fort Richardson, City of Fairbanks, and City and Borough of Juneau.) The higher usage shown during the summer months in Anchorage and Fairbanks is probably due to tourism and other commercial activity, increased industrial activity, and seasonal climatic effects.

The State’s 1995 average use from public supply was 172 gallons per day per person, while the nation’s average is 184 gallons per day. One of the nation’s lowest per capita use of all public-supply customers of 10 gallons per day has been reported on the North Slope.

Surface water is the source for around 60 percent of the 2001 State’s public-water supply in these three cities, while ground water is the source for the remainder. Anchorage receives 81 percent of its water from surface-water sources. Surface water became the primary source when water from Eklutna Lake was brought into production in 1988. Juneau obtained 72 percent of public-supply water from ground-water sources in 2001. Juneau has reduced using its surface-water source because of cost to meet water-quality regulations. Fairbanks obtains 100 percent of public-supply water from ground-water sources. Of the water withdrawn in Fairbanks, about two-thirds is treated to be suitable for domestic use, and the other one-third is for thermoelectric power use.



Monthly mean water withdrawal rate for public supply in the Anchorage, Fairbanks, and Juneau area, 1990 to 2001.