UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

# ACTIVITIES OF THE ALASKA DISTRICT,

# WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, 1987

Compiled by Elisabeth F. Snyder

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OPEN-FILE REPORT 87-38

Activities conducted in cooperation with:

Alaska Department of Natural Resources
Alaska Department of Fish and Game
Alaska Department of Transportation and Public Facilities
Alaska Power Authority
U.S.D.A. Forest Service
U.S. Department of the Army, Corps of Engineers
Municipality of Anchorage
Fairbanks North Star Borough
City and Borough of Juneau
Kenai Peninsula Borough
Matanuska-Susitna Borough
City and Borough of Sitka

Anchorage, Alaska
1987

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

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U.S. Geological Survey
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## MESSAGE FROM THE DISTRICT CHIEF

The U.S. Geological Survey began describing the water resources of Alaska more than 80 years ago. This early work was related to the gold rush and concurrent need for streamflow data. Following World War II, surface-water data collection activities expanded and ground-water studies were undertaken in the Anchorage, Fairbanks, and Juneau areas.

Construction of the Trans-Alaska Pipeline during the 1970's gave impetus to increased water-resources studies and data-collection activities. The Federal-State cooperative water-resources program was expanded during the early part of the decade. However, during the last few years (early 1980's) both Federal and State funds for water-resources studies and data collection have declined.

The water resources of Alaska remain relatively undescribed compared to those in the rest of the United States. Thousands of the State's streams have never been measured and, except for the few large population centers, information regarding ground-water resources is sparse. Only a relative handful of Alaska's thousands of lakes and glaciers have been adequately studied.

The need for accurate and timely water-resources information is as critical as ever, and as the development of Alaska's natural resources proceeds the information needs will continue to expand.

Although these are difficult times for Federal, State, and local governments, the Alaska District of the Survey's Water Resources Division will continue its efforts to provide information needed to wisely conserve, protect, and manage the State's water resources.

Philip A. Emery
District Chief
U.S. Geological Survey
Water Resources Division
Anchorage, Alaska
January 1987

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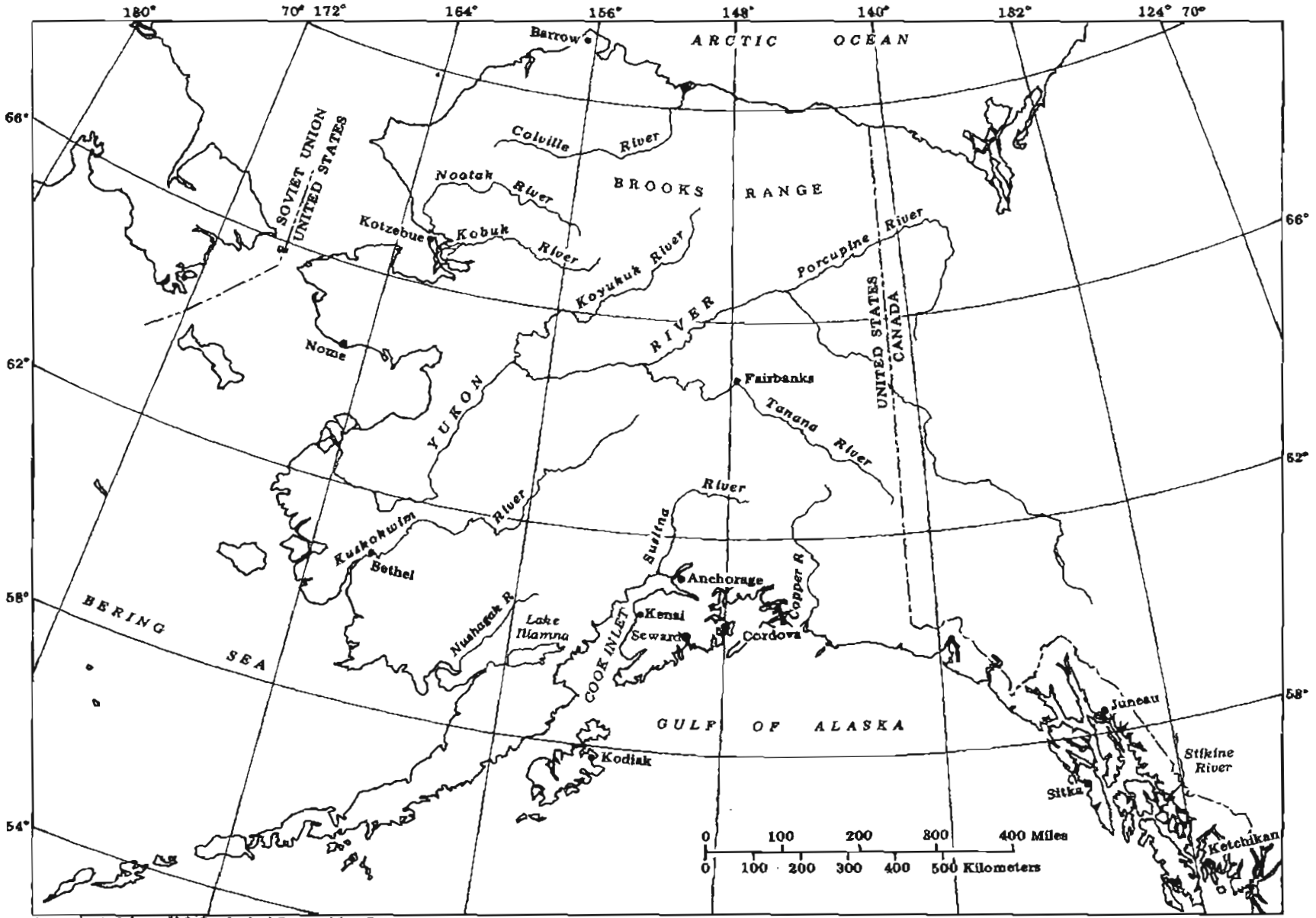


Base adapted from U.S.Geological Survey Map C

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# ACTIVITIES OF THE ALASKA DISTRICT, WATER RESOURCES DIVISION, U.S. GEOLOGICAL SURVEY, 1987

Compiled by Elisabeth F. Snyder

## INTRODUCTION

The overall mission of the U. S. Geological Survey's Water Resources Division is to provide the hydrologic information and understanding needed for the best use and management of the Nation's water resources. For almost 90 years, the U.S. Geological Survey has studied the occurrence, quantity, quality, distribution, and movement of the surface and underground water that composes the Nation's water resources. As the principal Federal water-data agency, the Geological Survey collects and disseminates about 70 percent of the water data currently being used by numerous State, local, private, and other Federal agencies to develop and manage our water resources. This nationwide program, which is carried out through the Water Resources Division's 43 District offices and 4 Regional offices, includes the collection, analysis, and dissemination of hydrologic data and water-use information, areal resource appraisals and other interpretive studies, and research projects. Much of this work is a cooperative effort in which planning and financial support are shared by state and local governments and other Federal agencies.

## ACTIVITIES

The Water Resources Division's activities in Alaska are divided into three broad categories. One category is hydrologic data collection to provide information about hydrologic characteristics essential to planning and carrying out hydrologic appraisals and/or hydrologic research. In 1987 this type of work constitutes the major part of the Division's efforts in Alaska. A second category is hydrologic appraisals. This includes: analyses of conditions in hydrologic basins; studies of areas likely to be or being affected by mineral, energy, fisheries, coastal-zone, or urban development; studies of water resources in urban areas; and investigations of potential hydrologic hazards. The third category is basic and applied research in hydrologic topics unique to cold climates. Subjects being studied include surface and ground water, water quality, instrumentation, glaciers, snow and ice, ice dynamics, and limnology.

## ALASKA'S WATER RESOURCES

Glaciers cover nearly 30,000 square miles in Alaska, about 5 percent of the total area of the State. However, snow forms a veneer on most of Alaska for one-half to three-quarters of the year, and the freezing and thawing of water affect virtually all of the State to some extent.

## Surface Water

Surface waters of Alaska include many large rivers. The Yukon River ranks fifth in size in the United States, and six Alaskan rivers (Yukon, Copper, Stikine, Susitna, Kuskokwim, and Tanana) are among the 30 largest U.S. rivers. Glacial sources for most Alaskan rivers cause important hydrologic consequences in addition to the heavy loads of glacier-derived silt carried by the glacial streams. Even a small glacier-covered area in a drainage basin can have a significant effect on the amount and timing of runoff.

Alaskan lakes are so numerous they are essentially uncounted. Lake Iliamna, Alaska's largest, has a surface area of 1,000 square miles. Springs occur throughout the State -- as innumerable small seeps and as warm or mineral waters that support recreational centers. On the North Slope, flow from large springs produces widespread icings in winter.

## Ground Water

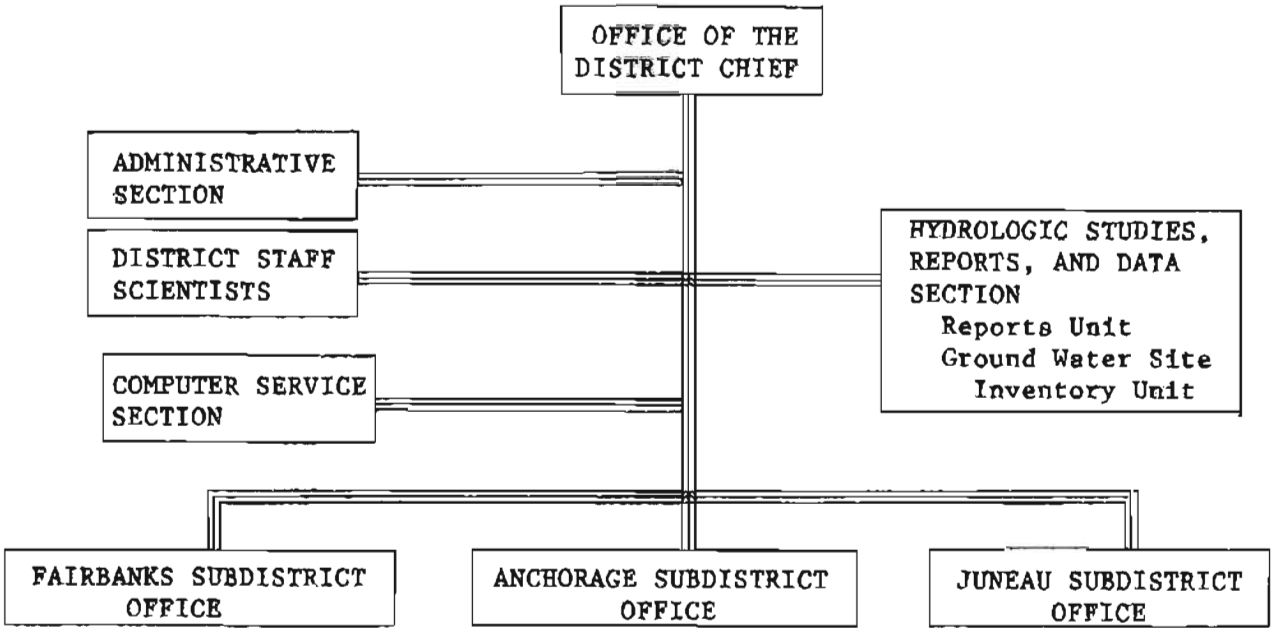
Ground water is an untested resource in most of Alaska, and in many areas potential development of the resource far exceeds current use. Ground-water conditions are diverse: major aquifers are present in the alluvium of large river valleys (Yukon, Tanana, Kuskokwim, Susitna), in glacial outwash deposits under coastal basins (Cook Inlet) and valleys (Seward and Juneau), and in carbonate bedrock of the Brooks Range. In many areas, however, the fine-grained material of glacial and glacial-lake deposits and poorly permeable consolidated rocks offer a much less promising ground-water potential. In addition, the recharge, discharge, movement, and thus the availability of ground water over much of the interior, western, and northern parts of the State and on the flanks of the Alaska Range are restricted by permafrost -- permanently frozen ground.

## Water Quality

The quality of Alaskan waters is generally acceptable for most uses. However, available data do indicate naturally occurring problems such as suspended sediment in glacier-fed streams, and salt-water intrusion and undesirable concentrations of iron or arsenic in ground water at various locations. Local pollution from septic tank leakage has occurred in several locations, and an increasing number of cases of ground-water contamination by gasoline or other petroleum products have been reported in the past few years.

## ORGANIZATION

U. S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
ALASKA DISTRICT




Inquiries regarding projects described in this report may be directed to the District Office or Subdistrict Office in which the work originated.

| | | |
|---|---|---|
| District Office | (907)271-4138 | District Chief<br>4230 University Drive<br>Suite 201<br>Anchorage, AK 99508-4664 |
| Anchorage Subdistrict Office | (907)271-4153 | Subdistrict Chief<br>1209 Orca Street<br>Anchorage, AK 99501 |
| Fairbanks Subdistrict Office | (907)479-5645 | Subdistrict Chief<br>800 Yukon Drive<br>Fairbanks, AK 99775 |
| Juneau Subdistrict Office | (907)586-7216 | Subdistrict Chief<br>P.O. Box 1568<br>Juneau, AK 99802 |

## SURFACE WATER STATIONS


Period of project:

Continuous since July 1948

Chief:

Robert D. Lamke
District Office

Funding:

USGS; Alaska Departments of Natural Resources, Fish and Game, Transportation and Public Facilities; U.S. Army Corps of Engineers; U.S.D.A. Forest Service; Alaska Power Authority; Municipality of Anchorage; City and Borough of Sitka; Kenai Peninsula Borough; City and Borough of Juneau

Purpose:

To provide a surface-water data base through collection, analysis, and publication of records for gaging stations and selected sites along streams and lakes throughout Alaska. The gaging network is operated in cooperation with other Federal, State, and local agencies. The surface-water data base provides information for research purposes of surveillance, planning, design, hazards warning, accounting systems, operation, and management in various water-related fields.

Status:

The ongoing data-collection effort and processing continue. In 1987, the USGS is operating 77 gaging stations and 61 crest-stage gages in Alaska.

Reports:

Data published in U.S. Geological Survey annual report "Water Resources Data for Alaska."

Planned Reports:

Lamke, R. D., and Bigelow, B. B., Flood of October 10-13, 1986, in southcentral Alaska: U.S. Geological Survey Open-File Report.

Jones, S. H., and Zenone, Chester, Flood of October 11, 1986 at Seward, Alaska: U.S. Geological Survey Hydrologic Investigations Atlas.

## GROUND WATER STATIONS


Period of project:

Continuous since June 1947

Chief:

Gordon L. Nelson
District Office

Funding:

USGS, Kenai Peninsula Borough, Alaska Department of Natural Resources, Fairbanks North Star Borough, Municipality of Anchorage

Purpose:

Ground water is an important source of water supply for many Alaskan communities. Thus, it is essential to observe the effects on ground-water quantity and quality exerted by such factors as climatic variations and withdrawal patterns. Water-level data are collected to provide a base against which short- and long-term fluctuations can be compared for proper planning and management.

Status:

Of the 137 wells currently being monitored, 32 are equipped with recorders that continuously record water levels. Water levels in other wells are measured from 2 to 12 times per year.

Reports:

Data published in U.S. Geological Survey annual report "Water Resources Data for Alaska."

Planned Reports:

Still, P. J., and Brunett, J. O., Ground-water levels in Alaska, water year 1984: U.S. Geological Survey Open-File Report.

Glass, R. L., Water resources data for Dillingham, Alaska: U.S. Geological Survey Water-Resources Investigations Report.

## QUALITY OF WATER STATIONS


Period of project:

Continuous since June 1949

Chief:

Robert J. Madison
District Office

Funding:

USGS, Kenai Peninsula Borough, City and Borough of Juneau, Alaska Power Authority, U.S.D.A Forest Service

Purpose:

To collect, analyze, and publish water-quality data for selected sites in Alaska. In addition to serving needs of cooperating agencies, the records contribute to a national water-quality data base requisite to nationwide and regional planning and action programs.

Status:

Operation of 5 NASQAN (National Stream-Quality Accounting Network) stations, 14 temperature stations, and 12 water-quality stations. In addition, one hydrologic benchmark station provides data for a basin in which the hydrologic regimen will likely be governed solely by natural conditions.

Reports:

Data published in U. S. Geological Survey annual report "Water Resources Data for Alaska."

## SEDIMENT STATIONS


Period of project:

Continuous since July 1949

Chief:

Harold R. Seitz
Juneau Subdistrict Office

Funding:

USGS, Alaska Power Authority,
U.S.D.A. Forest Service

Purpose:

To provide a data base needed to assess sediment transport characteristics of drainage areas required for water resources planning and management.

Status:

Collection of miscellaneous sediment data at 5 NASQAN (National Stream Quality Accounting Network) sites; 1 benchmark station; 1 site for the U.S.D.A. Forest Service; 2 sites each for the Alaska Departments of Transportation and Public Facilities, and Natural Resources; 1 site for the City and Borough of Juneau; and 1 site for the collection of basic records.

Reports:

Data published in U. S. Geological Survey annual report "Water Resources Data for Alaska."

## ALASKA WATER USE DATA PROGRAM


Period of project:

Continuous since April 1978

Chief:

Leslie D. Patrick
District Office

Funding:

USGS, Alaska Department of Natural Resources

Purpose:

To establish an effective and coordinated program for collecting, storing, accessing, and disseminating water-use data. Information will help resolve critical water problems such as water-quality residuals, environmental impact, energy development, and resources allocation.

Status:

Acquired, estimated, and summarized the information needed for the Alaska section of "Estimated Use of Water in the United States in 1985," which is published every 5 years. The cooperator continues to add to and update the public-supply water-use information, which is stored in their online data system, known as AWUDS (Alaska Water-Use Data System). Enhancements have baen made to facilitate the interactive entry of information into that system.

## GEOHYDROLOGY OF THE ANCHORAGE AREA

Period of project:

Continuous since July 1966

Chief:

Timothy P. Brabets
Anchorage Subdistrict Office

Funding:

USGS, Municipality of Anchorage

Purpose:

To determine the quantity and quality of the area's water resources; to address current and anticipated water-related problems.

Status:

Reports on the hydrology of two wetland areas in Anchorage were published. Two test wells have been drilled in Girdwood. A report on the confined and unconfined aquifers of the Anchorage Bowl is in review. A study of ground-water declines in the Hillside area was begun.

Recent Reports:

Glass, Roy L., 1986, Hydrologic conditions in the Klatt Bog area, Anchorage, Alaska: U. S. Geological Survey Water-Resources Investigations Report 85-4330, 19 p.

_____1986, Hydrologic conditions in Connors Bog area, Anchorage, Alaska: U. S. Geological Survey Water-Resources Investigations Report 86-4044, 23 p.

Planned reports:

U.S. Geological Survey, Water-Resources Division, Alaska District: Pumpage data from public-supply wells at Anchorage, Alaska, 1957-1985; U.S. Geological Survey Open-File Report 86-542, 47 p.

Patrick, L. D., Brabets, T. P., and Glass, R. L., Analysis of the ground-water system at Anchorage, Alaska; U.S. Geological Survey Water-Resources Investigations Report.

## UNSATURATED FLOW NEAR LEACH FIELDS IN A SUBARCTIC ENVIRONMENT

Period of project:

April 1984 to April 1987

Chief:

Gordon L. Nelson
District Office

Funding:

USGS, Fairbanks North Star Borough

Purpose:

To determine net water use of Fairbanks households pumping water from wells in an upland area where water levels have been declining continuously. (Net water use is the volume of water pumped minus the amount that percolates to the water table from leach fields.) To define unsaturated flow processes in order to analyze evaporative losses from leach fields.

Status:

Three 12-foot diameter suction lysimeters have been operated for 2 years, and less than 1 inch of precipitation per year has been documented. A digital model of a typical hillside aquifer has been constructed but not calibrated. Meteorological and soil-moisture data have been collected and are being used to estimate evapotranspiration and movement of water in the upper 10 feet of soil.

Planned Reports:

Nelson, G. L., Net water use by households using wells and septic systems near Fairbanks, Alaska: U.S. Geological Survey Professional Paper.

_____Unsaturated flow from domestic seepage fields in a subarctic environment: Journal areticle.

## MAGNITUDE AND FREQUENCY OF FLOODS IN ALASKA


Period of project:

August 1984 to September 1987

Chief:

Stanley R. Jones
District Office

Funding:

USGS, Alaska Department of Transportation
and Public Facilities

Purpose:

To provide information on flood characteristics of streams. This information is critical to the design of drainage and flood protection structures, in order to minimize potential damages and costs resulting from floods.

Status:

Data entry is 90 percent complete. Statistical analysis is 60 percent complete. Draft of report text has been written. Project period was extended to allow incorporation of additional peak-flow data (including those for selected Canadian streams) and for significant flooding in southcentral Alaska in October 1986.

Planned Report:

Jones, S. R., Magnitude and frequency of floods in Alaska: U.S. Geological Survey Open-File Report.

## KNIK-MATANUSKA RIVER ESTUARY

Period of project:

June 1984 to September 1987

Chief:

Stephen W. Lipscomb
Anchorage Subdistrict Office

Funding:

USGS, Alaska Department of Transportation
and Public Facilities

Purpose:

To determine flood flows for the Knik and Matanuska Rivers. To provide pertinent data needed to define the hydrodynamics of the tidally influenced lower reaches of the Knik and Matanuska Rivers.

Status:

The calibration and verification of the branch-network flow model were completed during the summer of 1986. A data report and final report have been written and are currently in review.

Planned Reports:

Lipscomb, Stephen W., Knik-Matanuska River and estuary--hydrologic data: U.S. Geological Survey Open-File Report.

_____Hydrodynamics of the Knik-Matanuska River estuary, Alaska: U.S. Geological Survey Professional Paper.

## EUTROPHICATION OF SOUTH-CENTRAL ALASKAN LAKES

Period of project:

October 1984 to September 1989

Chief:

Paul F. Woods

For information, contact:
Chester Zenone
Alaska District Office

Funding:

USGS, Alaska Department of Natural Resources

Purpose:

To identify those limnological characteristics that make south-central Alaska lakes susceptible to cultural eutrophication. To design a limnological sampling program to study the process of eutrophication in Alaska lakes.

Status:

Two reports were published and presented at two American Water Resources Association-Alaska Symposia in fiscal year 1986. For the second year, limnological data were collected at Horseshoe Lake. Compilation of an index to limnological data for southcentral Alaskan lakes is nearing completion.

Reports:

Woods, P. F., 1985, Potential for circumventing internal nutrient-recycling in Lucile Lake at Wasilla, Alaska, in "Resolving Alaska's water resources conflicts," Proceedings, Alaska Section, American Water Resources Association: Institute of Water Resources, University of Alaska, Fairbanks, Report IWR-108, p. 39-49.

Woods, P. F., and Rowe, T. G., 1986, Primary production, chlorophyll, and nutrients in Horseshoe Lake, Point MacKenzie, Alaska, in Cold Regions Hydrology Symposium, Fairbanks, 1986, Proceedings: American Water Resources Association, p. 213-220.

Planned Report:

Woods, P. F., and Mauer, Mary, Limnological data--southcentral Alaska lakes: U.S. Geological Survey Open-File Report.

## SUSPENDED-SEDIMENT TRANSPORT, SEDIMENTATION, AND RUNOFF AT EKLUTNA LAKE

Period of project:

October 1984 to September 1988

Chief:

Timothy P. Brabets
Anchorage Subdistrict Office

Funding:

USGS, Municipality of Anchorage

Purpose:

To determine how melting of snow and glacier ice affects runoff in the Eklutna Lake basin. To determine how sediment moves into, within, and out of Eklutna Lake.

Status:

Streamflow, suspended sediment, bedload, and air temperature data were collected on the major inflow streams to Eklutna Lake. Snow density, snow depth, and ice ablation were measured on Eklutna Glacier. Profiles of water and light transmissivity were measured at points throughout Eklutna Lake.

Planned Report:

Brabets, T. P., Suspended-sediment transport, sedimentation, and runoff at Eklutna Lake, Alaska: U.S. Geological Survey Water-Supply Paper.

## GROUND-WATER CONTAMINATION IN GLACIAL MATERIALS: METHODS OF INVESTIGATION

Period of project:

October 1985 to September 1987

Chief:

Jilann O. Brunett
District Office

Funding:

USGS, Municipality of Anchorage

Purpose:

To identify and determine the extent of ground-water contamination plumes at a landfill in glacial deposits. To determine an efficient method for drilling and completing shallow monitoring sites in fine-grained and (or) poorly sorted materials. To develop methods for sampling both volatile and nonvolatile contaminants in ground water in areas where traditional sampling methods fail because of poor permeability of materials.

Status:

An electromagnetic survey was run and maps were drawn. Fifteen wells were drilled. Two water-quality runs were made and 34 samples were collected. Seventy-eight water-level measurements were collected. Two streamflow measurements were made.

Planned Reports:

Brunett, J. O., Well logs and water levels, Merrill Field Landfill: U.S. Geological Survey Open-File Report.

_____, Ground-water contamination in glacial materials: Methods of investigations: Journal article.

## EFFECTS OF FLOODS ON GROUND-WATER LEVELS IN THE CHENA-TANANA RIVER FLOOD PLAIN

Period of project:

October 1985 to September 1989

Chief:

Gordon L. Nelson
District Office

Funding:

USGS, Fairbanks North Star Borough

Purpose:

To determine the water-table configuration at various stages and flow durations of the Chena and Tanana Rivers. To determine areas at risk from high water tables and areas that are inundated by poor drainage of ground water.

Status:

Seventy-two new observation wells have been drilled. Datums have been established at nearly 100 new and old observation wells. Crest-stage gages have been installed in all wells. Water levels were measured in the fall of 1986, and preliminary maps are in progress.

Planned Report:

Glass, R. L., and Nelson, G. L., Ground-water conditions and fluctuations, Chena flood plain: U.S. Geological Survey Water-Resources Investigations Report.

## HYDROLOGIC EFFECTS OF SURFACE MINING AT HEALY

Period of project:

October 1985 to September 1990

Chief:

Robert J. Madison
District Office

Funding:

USGS, Alaska Department of Natural Resources

Purpose:

To determine flow and water-quality characteristics of unmined areas of the Lignite Creek basin. To determine the specific sources and relative concentration and yields of sediment and water-quality constituents being contributed by mined and unmined areas. To evaluate potential effects of increased mining activities on the stream systems and relate these effects to the geologic and hydrologic characteristics of the basin. To evaluate the usefulness of relations developed in this study for predicting potential effects of mining in other areas in Alaska.

Status:

Program temporarily reduced to operation of one gaging station on Lignite Creek. Sediment, water quality, and streamflow data collected at this site during fiscal year 1986 will be published in the annual report "Water Resources Data for Alaska."

## GROUND-WATER CONDITIONS AT LANDFILLS IN THE MATANUSKA-SUSITNA BOROUGH

Period of project:

February 1986 to September 1987

Chief:

Chester Zenone
District Office

Funding:

USGS, Matanuska-Susitna Borough

Purpose:

To determine those geohydrologic conditions--principally depth to and direction of ground-water flow as well as current water quality--that will allow the Matanuska-Susitna Borough to design, establish, and operate a ground-water monitoring system at five landfill sites.

Status:

Exploration and quality-of-water (QW) sampling wells were drilled at the five landfill sites, and two rounds of QW samples have been collected. Samples were analyzed for a variety of constituents, including purgeable organics, trace metals, and phenols.

Planned Report:

Zenone, Chester, Ground-water conditions at landfills in the Matanuska Susitna Borough: U.S. Geological Survey Water-Resources Investigations Report.

## SEDIMENT DISCHARGE IN CAMPBELL CREEK, ANCHORAGE

Period of project:

October 1986 to September 1988

Chief:

Stephen W. Lipscomb
Anchorage Subdistrict Office

Funding:

USGS, Alaska Department of Transportation and
Public Facilities

Purpose:

To better understand the sediment discharge characteristics of a small urban stream prior to, during, and following construction activities within and adjacent to the stream by 1) collecting streamflow and sediment data upstream and downstream of the bridge construction site and 2) using the data to define the timing and estimate the sediment discharge in the creek immediately upstream from Campbell Lake.

Status:

Sediment data collected during the summer of 1986 were analyzed. The basic-data report is in review. The project was expanded to include an additional site upstream.

Planned Reports:

Lipscomb, S. W., Sediment discharge data for the lower reach of Campbell Creek, Anchorage, Alaska: May to October 1986: U.S. Geological Survey Open-File Report 87-101.

_____Sediment discharge in Campbell Creek: U.S. Geological Survey Water-Resources Investigations Report.

## ESTUARINE HYDRODYNAMICS OF TURNAGAIN ARM

Period of project:

October 1986 to September 1990

Chief:

Stanley H. Jones
District Office

Funding:

USGS, Alaska Department of Transportation and Public Facilities

Purpose:

To develop a basic understanding of the hydrodynamic processes in Turnagain Arm and to provide data on rapidly varying water velocities and water stage during a tidal cycle. To determine rates and volumes of scour and fill in the deep channels of the arm during a tidal cycle. To develop a numerical model of the arm that can be adapted to the wide range of conditions found in estuaries, thereby advancing the science of estuarine modeling. To improve methods and techniques for collecting hydraulic data under severe conditions posed by the high tidal range and high water velocities.

Status:

Two tidal gages were installed in February 1987. An attempt will be made to operate these gages through the winter months.

Planned reports:

Jones, S. H., and Lipscomb, S. W., Hydrologic and hydraulic data for Turnagain Arm: U.S. Geological Survey Open-File Report.
_____Some aspects of flow modeling, Turnagain Arm: Journal article.
_____Simulated hydrodynamics of Turnagain Arm: Preliminary report: U.S. Geological Survey Open-File Report.
_____Simulated hydrodynamics of Turnagain Arm: U.S. Geological Survey Water-Supply Paper.

BIBLIOGRAPHY

This bibliography includes reports published between 1984 through 1986 by Geological Survey authors, on the water resources of Alaska. For a comprehensive listing of reports from 1870-1976, please refer to:

Feulner, A. J., and Reed, K. M., 1977, Bibliography of reports by members of the U. S. Geological Survey on the water resources of Alaska, 1870-1976: U. S. Geological Survey Open-File Report 77-687, 112 p.

For reports published between 1977 through 1983, please refer to the bibliography in:

Snyder, E. F., compiler, 1984, Activities of the Alaska District, Water Resources Division, U. S. Geological Survey, 1984: U. S. Geological Survey Open-File Report 84-246, 33 p.

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Brabets, T. P., 1984, Instrumentation of the tide-affected Potter Marsh outlet near Anchorage, Alaska, in "Alaska's water--a critical resource," Proceedings, Alaska Section, American Water Resources Association: Institute of Water Resources, University of Alaska, Fairbanks, Report IWR-106, p. 15-23.

_____1987, Quantity and quality of urban runoff from the Chester Creek basin, Anchorage, Alaska: U.S. Geological Survey Water-Resources Investigations Report 86-4312, 58 p.

Brunett, J. O., 1986, Ground-water levels in Alaska, water year 1983: U.S. Geological Survey Open-File Report 86-56, 229 p.

Bugliosi, E. F., 1985, Hydrologic reconnaissance of the Chilkat River basin, southeast Alaska--with special reference to the bald eagle critical habitat at the Tsirku River alluvial fan: U.S. Geological Survey Open-File Report 84-618, 46 p.

_____1985, Hydrology of Tsirku River alluvial fan near Haines, Alaska, in "Resolving Alaska's water resources conflicts," Proceedings, Alaska Section, American Water Resources Association: Institute of Water Resources, University of Alaska, Fairbanks, Report IWR-108, p. 179-189.

Emery, P. A., Jones, S. H., and Glass, R. L., 1985, Water resources of the Copper River basin, Alaska: U.S. Geological Survey Hydrologic Investigations Atlas HA-686, 3 sheets.

Flynn, D. M., 1985, Hydrology and geochemical processes of a sub-arctic landfill, Fairbanks, Alaska--basic data: U.S. Geological Survey Open-File Report 85-195, 41 p.

Glass, R. L., 1986, Hydrologic conditions in the Klatt Bog area, Anchorage, Alaska: U. S. Geological Survey Water-Resources Investigations Report 85-4330, 19 p.

_____1986, Hydrologic conditions in Connors Bog area, Anchorage, Alaska: U. S. Geological Survey Water-Resources Investigations Report 86-4044, 23 p.

Hopkins, G. C., and Maxwell, K. F., 1985, Arsenic, nitrate, iron, and hardness in ground water, Goldstream Road, Yankovich Road, and Murphy Dome Road areas (T. 1N., R. 2W., FM) Fairbanks, Alaska: U. S. Geological Survey Open-File Report 85-341, 1 sheet.

Knott, J. M., and Lipscomb, S. W., 1985, Sediment discharge data for selected sites in the Susitna River basin, Alaska, October 1982 to February 1984: U.S. Geological Survey Open-File Report 85-157, 68 p.

Knott, J. M., Lipscomb, S. W., and Lewis, T. W., 1986, Sediment transport characteristics of selected streams in the Susitna River basin, October 1983 to September 1984, U.S. Geological Survey Open-File Report 86-424W, 78 p.

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