Cook Inlet Basin

NAWQA News

National Water-Quality Assessment Program

Status Report, Fall 2000

What is NAWQA?

The Cook Inlet Basin in south-central Alaska (see map) is one of about 60 National Water-Quality Assessment (NAWQA) study units designed to assess the status and trends of the Nation's water quality. This program integrates the monitoring of surface- and ground-water chemistry with the study of aquatic ecosystems. The Cook Inlet Basin study began in 1997.

Has the NAWQA study addressed the quality of ground water in the Cook Inlet Basin?

In 1999, we sampled water from wells in unconsolidated glacial and alluvial deposits. Our goal was to assess the quality of water from the most important sources of present or future domestic, municipal, commercial, and industrial supplies in the Cook Inlet Basin. The data are available in "Water Resources Data–Alaska–Water Year 1999" or by request from the U.S. Geological Survey (USGS).

The USGS thanks the many landowners and officials of the cities of Kenai and Palmer, the Municipality of Anchorage, and the U.S. Army, who graciously allowed access to their properties and sampling of water from their wells.

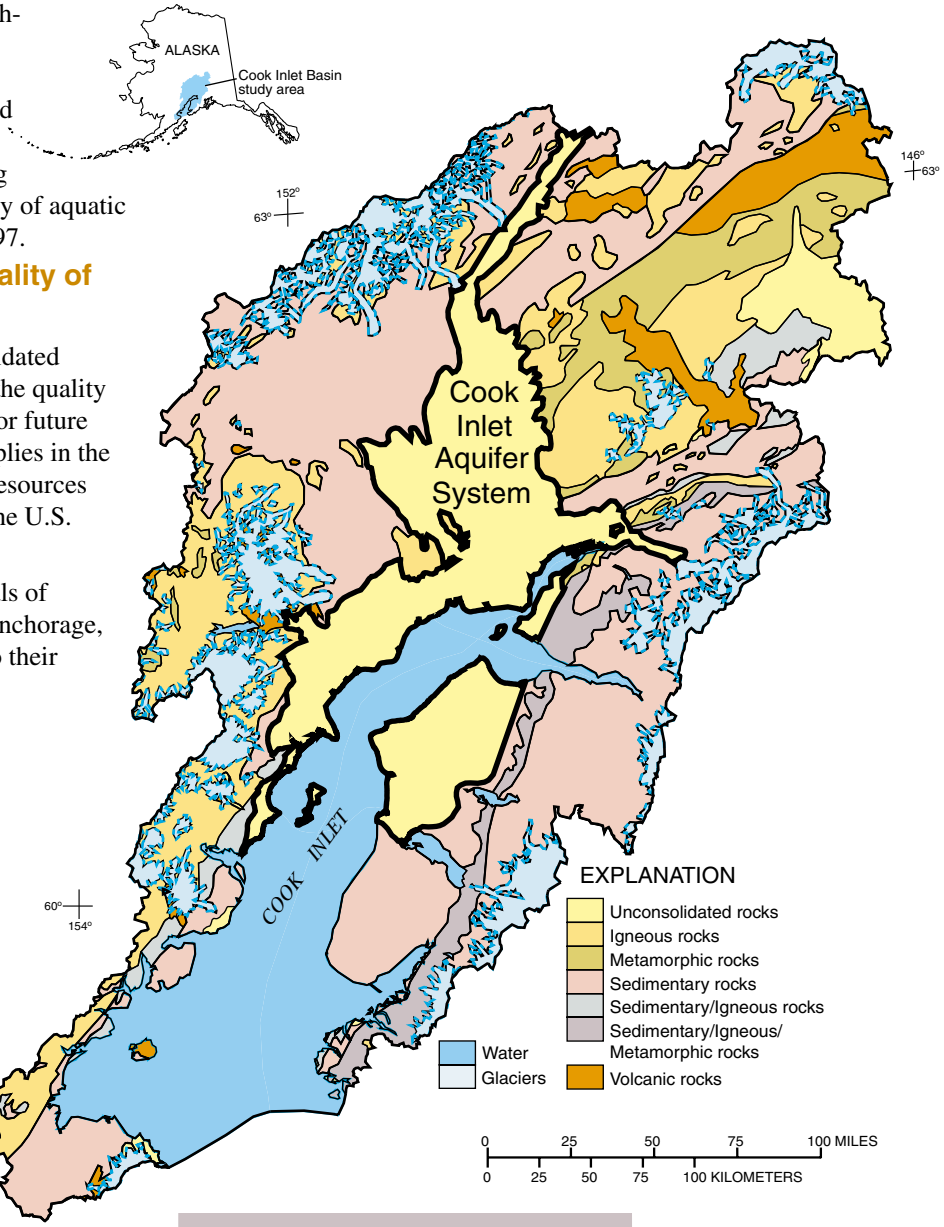
Significant Findings

Radon-222 concentrations in 39 percent of the wells sampled exceeded the proposed drinking-water standard of 300 picocuries per liter.

Arsenic concentrations in 26 percent of the wells sampled exceeded the proposed drinking-water standard of 5 micrograms per liter.

Nitrate concentrations, which may become elevated by human activities, were less than the maximum contaminant level of 10 milligrams per liter (as nitrogen) in all samples.

No pesticides or ***volatile organic compounds*** were detected at concentrations exceeding drinking-water standards or guidelines, and none were detected in half of the wells sampled.



Simplified geology of the Cook Inlet Basin, modified from Silberling and others (1994)

USGS science for a changing world

Cook Inlet Basin, Alaska
NAWQA News Number 3
Fall 2000
http://ak.water.usgs.gov/Projects/Nawqa

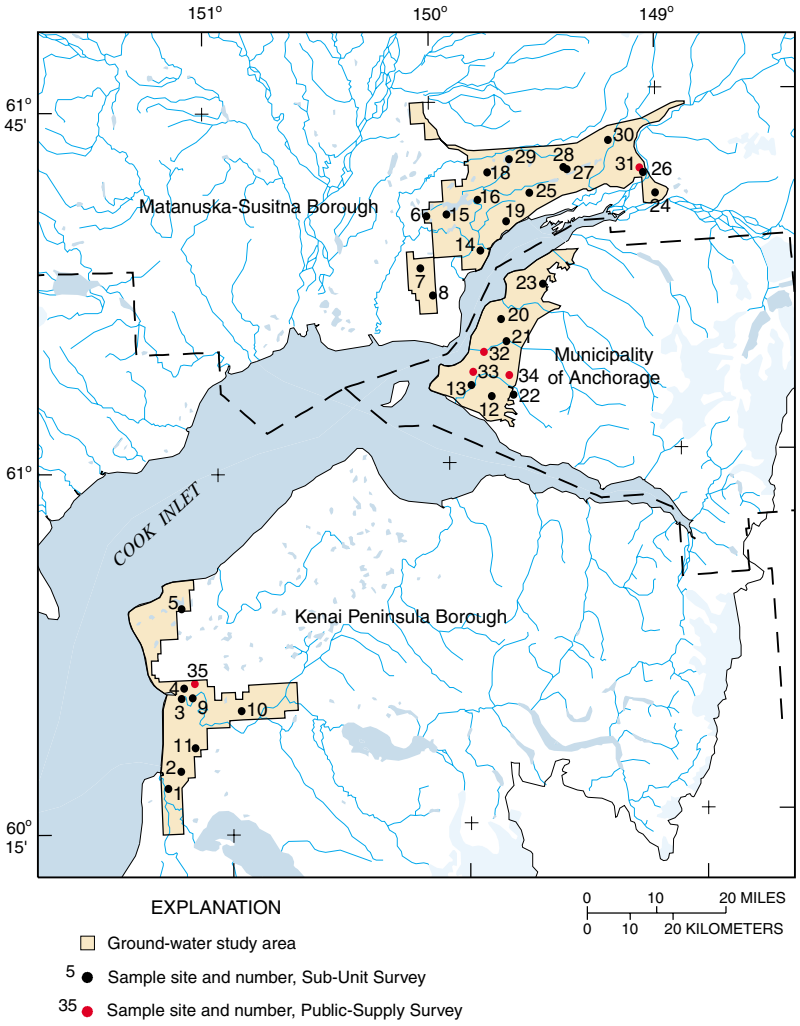
U.S. Department of the Interior
U.S. Geological Survey

Is ground water in the Cook Inlet Basin of adequate quality for drinking?

Most chemicals detected in ground water in the Cook Inlet Basin were at levels typically found in ground water, and few exceeded drinking-water standards. The samples were collected from 5 major public supply wells and 29 sites chosen by a stratified random selection process (see map below).

Although many chemical constituents were measured in the water samples not all have established or proposed standards or guidelines for drinking water. Of those constituents that do have drinking water standards, few appear to be of potential concern in the Cook Inlet Basin. Radon-222, a naturally occurring radioactive gas, has a proposed maximum contaminant level (MCL) of 300 picocuries per liter (pCi/L). Samples from the Cook Inlet Basin had radon-222 concentrations ranging from 140 to 610 pCi/L.

Arsenic may occur naturally in large concentrations in the unconsolidated aquifer materials of the Cook Inlet Basin. Arsenic often is associated with the sulfide minerals (such as pyrite) and with organic carbon. The current MCL for arsenic is 50 micrograms per liter (µg/L); however, a 5 µg/L MCL has been proposed by the USEPA. Arsenic concentrations in water samples collected during 1999 ranged from less than 1 µg/L to 29 µg/L, and the median concentration was 1 µg/L. Nine of the wells sampled for arsenic had concentrations exceeding 5 µg/L.



Ground-water sampling sites, Cook Inlet Basin, Alaska, 1999

Processing ground-water samples for analysis of trace elements, Kenai Peninsula, August 1999 (photograph by R.L. Glass, U.S. Geological Survey)

Nitrate concentrations greater than about 3 mg/L (as nitrogen) may be indicative of human sources and a MCL for drinking water is set at 10 mg/L. Ground-water samples from wells in the Cook Inlet Basin generally had low nitrate concentrations; 13 of 34 samples had concentrations less than 0.05 mg/L. Nitrate concentrations were highest in water from wells in the eastern part of Anchorage and were as great as 4.8 mg/L.

Half of the wells sampled for both pesticides and volatile organic compounds (VOCs) had no detectable constituents in these categories. Eleven pesticide compounds were detected at very low concentrations. Nine VOCs were detected: all at less than 1 µg/L. No pesticides or VOCs were detected at concentrations exceeding MCLs or health advisories.

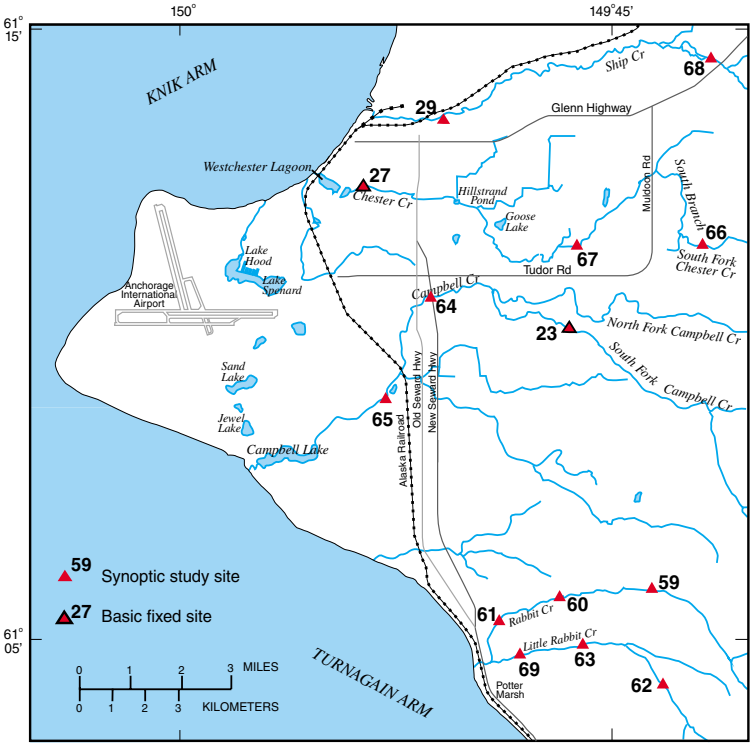
How old is the ground water?

Shallow wells typically are sampled because they have the greater potential to be affected by human activities on the land surface. To measure how long it has been since the ground water has been exposed to the atmosphere or land surface, two "age-dating" techniques were used. Tritium and chlorofluorocarbons (CFCs) have been added to the atmosphere in large quantities in the past 50 years. In the atmosphere, tritium and CFCs dissolve in water and fall to the earth in precipitation. Water infiltrating into the ground contains these substances and transports them with ground water. Concentrations of tritium and CFCs from the wells sampled in 1999 indicate that the water was exposed to the atmosphere during the last 50 years.

Most shallow ground water in the Cook Inlet Basin is classified as "modern"; that is, it was exposed to the atmosphere in the past 50 years.

Are some streams in Anchorage contaminated with waste from warm-blooded animals or humans?

Specific sources of contamination are difficult to determine; however, some types of bacteria are useful indicators of contamination from warm-blooded animals, including humans. Monitoring of indicator bacteria was done at 14 sites in Anchorage during 2000 (see map below). The concentrations of three groups of indicator bacteria–fecal coliform, *Escherichia coli (E. coli)*, and enterococci–were measured from water samples collected during late-winter low-flow, snowmelt, and summer baseflow. Various volumes of water were filtered in order to achieve a colony count within the ideal range. Often even the largest volumes of water, 100 milliliters (mL), did not yield sufficient colonies for an ideal count. Rarely, the smallest volumes of water filtered, 1 mL, produced too many colonies for an ideal count (see photo at right).

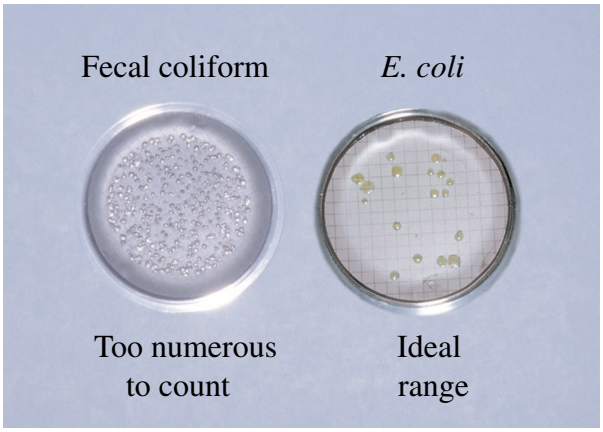


Location of sampling sites in the Anchorage area

Anchorage sampling sites

23	South Fork Campbell Creek near Anchorage
27	Chester Creek at Arctic Blvd. at Anchorage
29	Ship Creek below Power Plant at Elmendorf Air Force Base
59	Rabbit Creek at Hillside Dr. near Anchorage
60	Rabbit Creek at East 140th Ave. near Anchorage
61	Rabbit Creek at Porcupine Trail near Anchorage
62	Little Rabbit Creek at Nickleen St. near Anchorage
63	Little Rabbit Creek at Goldenview Dr. near Anchorage
64	Campbell Creek at New Seward Highway near Anchorage
65	Campbell Creek at C St. near Anchorage
66	So. Branch of So. Fork Chester Creek at Tank Trail near Anchorage
67	So. Branch of So. Fork Chester Creek at Boniface Pkwy. near Anchorage
68	Ship Creek at Glenn Hwy. near Anchorage
69	Little Rabbit Creek near Anchorage

At the two sites (27 and 67) in the Chester Creek Basin within the developed area of Anchorage, indicator bacteria concentrations were consistently higher than at other sites. Sites in the developed areas of Rabbit and Little Rabbit Creeks tended to have higher concentrations during the summer low flow than at other times we sampled.



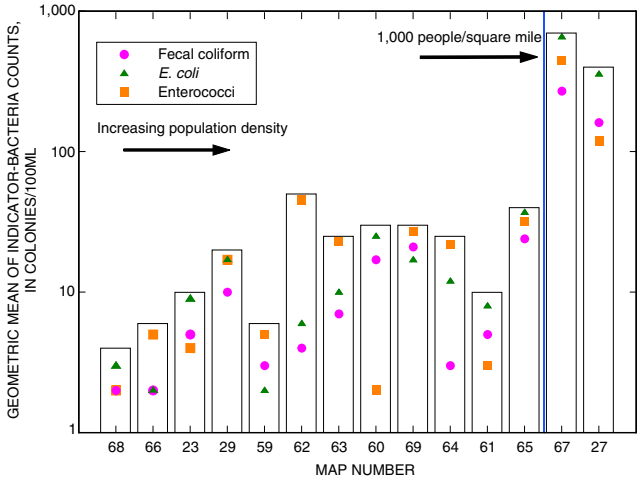
Water-quality standards

Our sampling program was not designed to determine whether water-qualilty violations occurred at any site. Furthermore, no water-quality standards currently exist for *E. coli* or enterococci bacteria. However, a standard of 100 fecal coliform colonies per 100 mL (col/100 mL) of water is applied to waters used for secondary contact recreation. That standard is based on the geometric mean of samples collected during a 30-day period. Additionally, no more than 10 percent of those samples may be over 200 col/100 mL.

Results

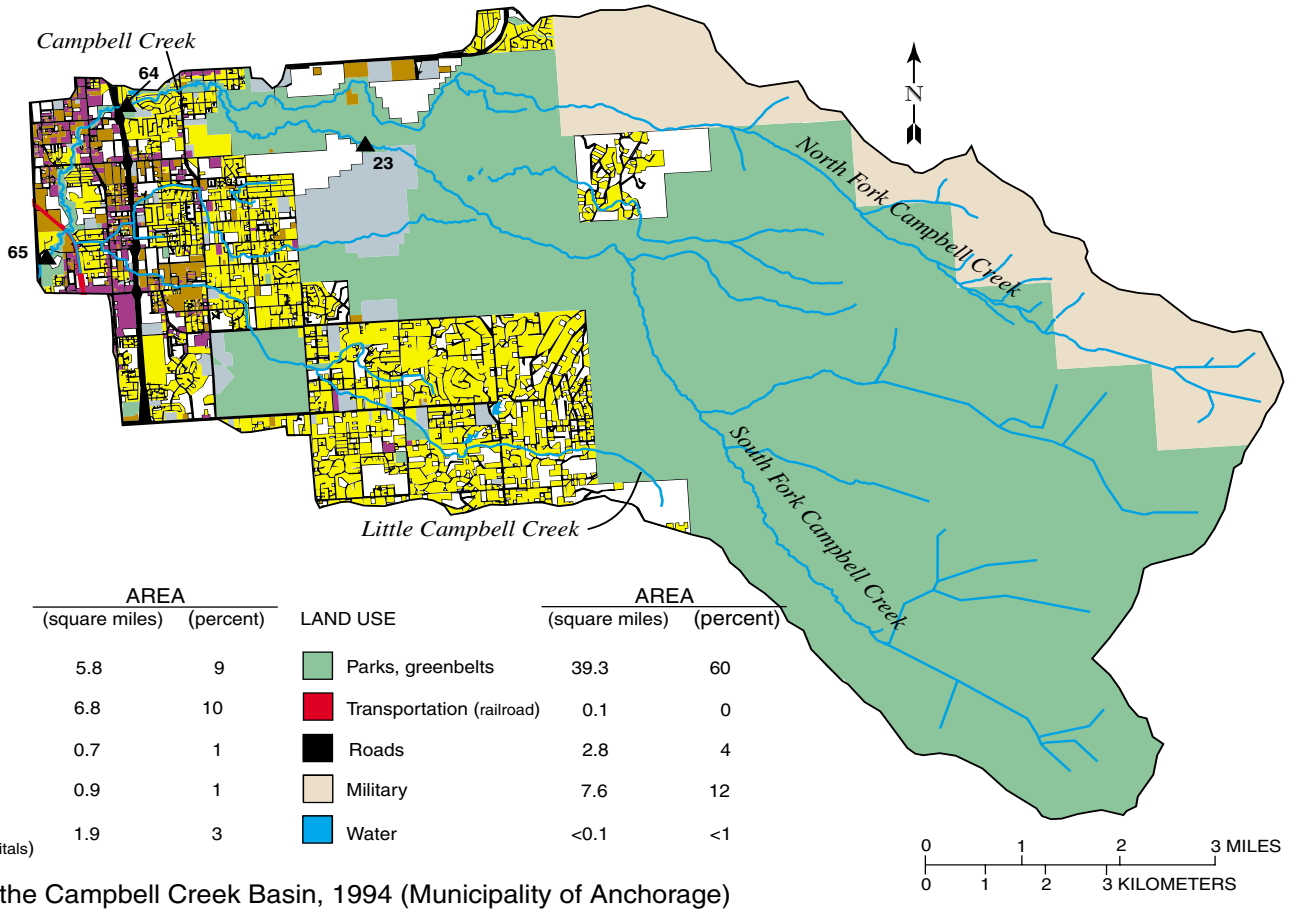
Fecal coliform, *E. coli*, and enterococci counts were quite variable among the sites and the different seasons. For example, samples that were collected to represent snowmelt peaks tended to have the lowest concentrations of all three indicator bacteria due to the diluting affects of high elevation snowpacks. Concentrations of indicator bacteria ranged from less than 1 to an estimated 3,380 (enterococci) col/100 mL. The largest concentration of fecal coliform bacteria was 1,460 col/ 100 mL from Chester Creek at Arctic Boulevard.

The graph (below) shows the geometric mean concentration of each type of indicator bacteria based on samples collected in 2000. The sites are located on the graph in order of increasing population density. A population density of 1,000 people per square mile is used by the U.S. Census Bureau to separate rural and urban areas. We sampled two sites with population densities in the urban category and they had substantially higher concentrations of indicator bacteria than those sites in the rural category.



What are the land uses within the Campbell Creek Basin?

Campbell Creek drains an area of about 66 square miles above the site at C Street (65). The creek has two major forks (South and North Forks) that are primarily undeveloped and one minor fork (Little Campbell Creek) that has undergone extensive urbanization. Land uses of the Campbell Creek Basin (as of 1994) are shown below.



LAND USE	AREA (square miles)	(percent)	LAND USE	AREA (square miles)	(percent)
Vacant	5.8	9	Parks, greenbelts	39.3	60
Residential	6.8	10	Transportation (railroad)	0.1	0
Commerical	0.7	1	Roads	2.8	4
Industrial	0.9	1	Military	7.6	12
Institutional (schools, hospitals)	1.9	3	Water	<0.1	<1

Land use in the Campbell Creek Basin, 1994 (Municipality of Anchorage)

This newsletter was prepared by the Cook Inlet Basin study team. The purpose of the newsletter is to keep members of the Cook Inlet NAWQA liason committee informed of our activities. The newsletter represents the views of the COOK NAWQA team and is intended for information purposes only. It is not intended for redistribution or publication and should not be cited. If you would like your name removed from or a name added to the mailing list for this newsletter, or if ou have any comments regarding this newsletter or our work plans, please contact project chief Steve Frenzel at (907)786-7107, or write to COOK NAWQA, U.S. Geological Survey, 4230 University Drive, Suite 201, Anchorage, AK 99508-4664, or send email to sfrenzel@usgs.gov.

NAWQA News
National Water-Quality Assessment Program

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