DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
GREATER DENVER AREA, COLO.
MAP I–856–B

Base compiled by U.S. Geological Survey in 1972
from 1:24,000 quadrangles dated 1965–1966.
Limited revision from aerial photographs
taken 1971

50,000-foot grid based on Colorado coordinate
system, north zone

5000-meter Universal Transverse Mercator
grid ticks, zone 13, shown in blue

Metric elevations are shown in parentheses

SCALE 1:100 000

1 0 1 2 3 4 5 MILES
5000 0 5000 10,000 15,000 20,000 25,000 FEET
1 0 1 2 3 4 5 KILOMETERS

DATUM IS MEAN SEA LEVEL

EXPLANATION

FOR MOST LAKES SMALLER THAN 10 HECTARES IN SURFACE AREA

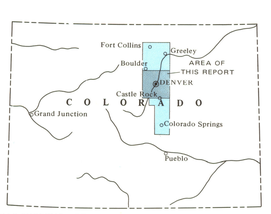
Surface area, in hectares — 5.54
Shoreline length, in kilometers — 1.16

FOR MOST LAKES LARGER THAN 10 HECTARES IN SURFACE AREA

Surface area, in hectares — 70.6 | 8.3 — pH (underscored when greater than 8.5)
Shoreline length, in kilometers — 4.43 | 0.5 — Secchi disk transparency, in meters (underscored when less than 1.2 meters)
Specific conductance, in micromhos per centimeter — 950 | 2,500 — Algal concentration, in cells per milliliter
Fecal/Total coliform bacteria in colonies per 100 milliliters — 16/20

COLORS SHOW RANGE OF SPECIFIC CONDUCTANCE, IN MICROMHOS PER CENTIMETER

No conductance data
Less than 350
351–750
751–950



MAP SHOWING AREA OF FRONT RANGE URBAN CORRIDOR

LAKES IN THE GREATER DENVER AREA, FRONT RANGE URBAN CORRIDOR, COLORADO

By
Terence W. Danielson

1975

INTRODUCTION

The many lakes in Colorado's semiarid Front Range Urban Corridor have an especially high value. In the past they were used primarily to store water for irrigation and domestic uses. Some were used for recreation. Today, rapid suburban development in the Front Range Urban Corridor is accompanied by a shift of the principal use of many lakes to recreation and to centers of real estate developments. These same lakes are threatened with a general deterioration of chemical and biological quality caused by heavy use and development of the surrounding area.

The purpose of this report is to present the results of an inventory of the lakes in the central one-third of the Colorado Front Range Urban Corridor. This inventory provides information that might be helpful in planning the best and most beneficial use of lakes in an area of rapid population growth. The report includes data on lake size and water quality. Size data are included on most of the lakes of 2 hectares (20,000 m², or about 5 acres) or greater, and water-quality data are provided on most lakes larger than 10 hectares (about 25 acres). Bodies of water resulting from excavation of gravel (borrow pits) were generally not included in the inventory.

Most of the lakes described in this report are owned by individuals, partnerships, or irrigation and ditch companies. Others are owned by municipalities and are used for public water supply. Many of these lakes are not normally accessible to the public. The U.S. Geological Survey gratefully acknowledges the fine cooperation of owners or leasees of lakes in the area who freely granted access to the field parties who sampled the lakes. The author also thanks Thomas G. Devenish, who assisted in the collection of data presented here. Assistance in map planimetry was provided by the Department of Civil Engineering, Colorado State University.

TYPES OF DATA INCLUDED

Data collected from map measurements and during midsummer field work in 1973 are summarized on the map. A two-position symbol is used to show surface area and length of shoreline for the smaller lakes. Data for lakes larger than 10 hectares are shown by seven-position symbols. As shown by the map explanation, data included are surface area, shoreline length, specific conductance, pH, Secchi disk transparency, algal concentration, and bacteriological quality. Samples for chemical, biological, and bacteriological analyses were collected at a depth of 0.5 meter (1.6 ft) near the center of the lake. The significance of these data is explained below.

Area and shoreline length. – U.S. Geological Survey topographic maps at the scale 1:24,000 were used in determining most of the values of surface area and shoreline length reported here. Special maps or field-mapped changes of the lake configurations were used for the few lakes that obviously had been modified since the topographic maps were published. Measurements were made by means of a computer-linked planimetry device owned by Colorado State University.

Owners may find that lake sizes reported here differ from sizes obtained in their own surveys. Most owner's surveys report maximum sizes, whereas U.S. Geological Survey maps show the outline of the lake at the time the map was made. Shoreline lengths reported represent total shoreline lengths, including the shoreline along roads or landfills which cross some lakes.

Area and perimeter are expressed in metric units. A user interested in converting areas to English units can convert hectares to acres by multiplying by 2.47. Shoreline lengths given in kilometers can be converted to feet by multiplying by 3,281, or to miles by multiplying by 0.6214.

Specific conductance. – An estimate of the dissolved solids in water is provided by measurements of electrical conductance. Dissolved-solids concentration, in milligrams per liter (mg/l), of most waters can be estimated by multiplying the specific conductance, in micromhos per centimeter (μ mhos/cm), by about two-thirds. For example, water with a specific conductance of 1,200 μ mhos/cm will contain about 800 mg/l dissolved solids. On the map, color codes have been used to designate water quality, as described by specific conductance. Water with conductance less than 750 μ mhos/cm (about 500 mg/l dissolved solids) satisfies the recommended limits for maximum dissolved solids in drinking water.[1] Water with specific conductance between 750 and 1,500 μ mhos/cm (about 500 to 1,000 mg/l dissolved solids) is regarded as marginal for drinking and can have detrimental effects on sensitive crops.[2]

Although the previous paragraph discusses suitability of water use based on specific conductance and dissolved solids, one cannot assume that waters with low concentrations of dissolved solids are suitable for drinking water or other uses. Water-quality standards for drinking water and other uses list many chemical and biological characteristics which must be met. The reconnaissance data reported here are not sufficient to totally evaluate the lake waters for drinking and other uses.

pH. – Numbers on the pH scale describe whether water is chemically acidic or basic (alkaline). Water with a pH of 7.0 is said to be neutral, water with pH values of less than 7.0 is termed acidic, and water with a pH of greater than 7.0 is called basic, or alkaline. The pH of lake water is important because it affects the chemical reactions and biological activity in a lake and may influence the suitability of a lake for such purposes as swimming and water skiing. Values of pH greater than 8.5 are underscored to indicate that they are outside the desirable range for water-contact sports.[3]

Secchi disk transparency. – A Secchi disk is a black and white flat circular disk about 20 centimeters (8 in.) in diameter. The depth to which it is visible in a lake is a measure of the transparency, or visibility, of the water. In most lake waters, transparency is decreased either by sediment or by algae. Poor transparency in a lake can limit biological activity by reducing light penetration, and it also makes the waters undesirable for swimming. Values of Secchi disk transparency measured near the lake center are expressed in meters but can be converted to feet by multiplying by 3.28. Values less than 1.2 meters (about 4 ft) are underscored because such waters do not meet recommended standards for use for water-contact sports.[3]

Algal concentration. – Generally, a lake that is rich in nutrients will contain higher concentrations of algae than will a lake poor in nutrients. Data on algal concentrations are shown for 12 of the largest lakes. The reader should note that these data represent conditions during a single sampling of the lakes. Algal populations are dynamic; therefore, the values shown may represent a period of large population in some lakes and a period of small population in others.

Coliform bacteria. – This group of organisms is considered to be an indicator of the possible presence of pathogenic bacteria or viruses.

Fecal coliform bacteria are associated with the intestinal tract of warm-blooded animals. Human and animal waste products contain large numbers of these organisms; therefore, their appearance in any body of water represents a potential or possible health hazard depending on the use of the water. The National Technical Advisory Committee on Water Quality Criteria[3] has made recommendations concerning the sanitary quality of bodies of water used for primary-contact recreation (such as wading, swimming, and water skiing). They suggest that for a minimum of 5 samples per 30-day period, no more than 10 percent of the samples should exceed 400 fecal coliform colonies per 100 milliliters.

Total coliform bacteria include the fecal group and also may be associated with the waste products of warm-blooded animals. However, they also may exist from natural sources in soils, water, and vegetation. Nevertheless, waters containing appreciable coliform counts should be looked upon with suspicion.

[1] U.S. Department of Health, Education, and Welfare, Drinking water standards, 1962: Public Health Service Pub. 956, 61 p.
[2] Report of the Committee on Water Quality Criteria, FWPCA, U.S. Department of the Interior, 1968.
[3] U.S. National Technical Advisory Committee to the Secretary of the Interior, 1968, Water Quality Criteria: Washington, D.C., U.S. Federal Water Pollution Control Administration, 234 p.

SUMMARY OF LAKE CHARACTERISTICS

Size. – Data are included in this report for 49 lakes that have surface areas greater than 10 hectares (about 25 acres). These lakes have a total combined area of 3,686 hectares (9,108 acres) and a total shoreline of 185 kilometers (115 miles). The largest are Barr Lake, 708 hectares (1,750 acres); Standley Lake, 492 hectares (1,216 acres); and Chatfield Lake, 465 hectares (1,149 acres). Barr Lake also has the longest shoreline, 15.6 kilometers (9.69 miles), and Gross Reservoir has the next longest, 14.9 kilometers (9.26 miles).

In addition, 113 lakes range in size from 2 to 10 hectares (5 to 25 acres). These have a total area of 526 hectares (1,300 acres) and a total shoreline of 110 kilometers (68 miles).

Chemical and physical quality. – Based on values of specific conductance, most of the lakes contain water of good quality. Conductance was 750 μ mhos/cm or less in 47 of the 51 lakes measured; it ranged from 350 to 750 μ mhos/cm in 19 lakes, and was less than 350 μ mhos/cm in 28 lakes. Samples from Evergreen Lake, Gross Reservoir, and Ralston Reservoir had specific conductance of less than 60 μ mhos/cm. The highest conductance waters were from Sloans Lake (950 μ mhos/cm), Lake Arbor (900 μ mhos/cm), Lake Sangraco (850 μ mhos/cm), and Lake Rhoda (850 μ mhos/cm).

Most of the lakes in the corridor contained water that was alkaline. Slightly acidic water occurred only in Marshall Lake (pH = 5.5). The highest pH (10.3) was measured in water from Reservoir E on the Rocky Mountain Arsenal grounds; Kendrick Reservoir was nearly as high with a pH of 10.0. Values of pH of 8.5 or less occurred in 29 of the 49 lakes measured.

Transparency, as measured by a Secchi disk, was less than 1.2 meters (4 ft) in 17 of the 51 lakes in which it was measured. It ranged from 1.2 to 5.5 meters (4 to 18 ft) in the other 34 lakes. Transparency was 5.0 meters (16.4 ft) in Gross Reservoir, 5.5 meters (18 ft) in McLellan Reservoir, and 0.5 meter (20 inches) or less in 8 of the lakes measured.

Biological factors. – Algal concentrations ranged from 57 to 170,000 cells/ml (cells per milliliter) in the samples collected from 12 lakes. Concentrations were greater than 1,000 cells/ml in only 4 lakes: Barr Lake, 170,000 cells/ml; Standley Lake, 4,000 cells/ml; Sloans Lake, 2,500 cells/ml; and Gross Reservoir, 1,300 cells/ml. Smallest algal concentrations were found in samples from Upper Long Lake, 57 cells/ml, and Great Western Reservoir, 86 cells/ml.

Twelve different genera of algae were dominants or codominants (genera comprising more than 10 percent of the algal population) in samples from the 12 largest lakes. One genus, *Fragilaria*, was dominant or codominant in one-half of these lakes: Upper Long Lake, Ralston Reservoir, Marston Reservoir, Marshall Lake, Baseline Reservoir, and Standley Lake. *Fragilaria* is a diatom, a multicellular alga having a silicious shell. Depending on species and abundance, it can cause taste and odor in water supplies and also can be responsible for filter-clogging problems in water-treatment plants. However, most problems associated with *Fragilaria* can be eliminated rather simply because these algae are very susceptible to low concentrations of the commonly used algicides.

Coliform bacteria. – Samples of 100-ml volumes were taken from 16 lakes and analyzed for coliform bacteria. Highest fecal-coliform counts were in samples taken from Pomona Lake (38 colonies), Sloans Lake (16 colonies), and Barr Lake (15 colonies). Average colony development in the remaining lakes was about 2 colonies per 100 ml. Although the three lakes mentioned had fecal-coliform populations much greater than the average, their concentrations were much below the recommended limit for primary-contact recreation lakes. Total coliform bacteria ranged from 20 to 1,000 colonies per 100 ml.

LOCATIONS

Several systems of expressing geographic location have been devised, including: Latitude and longtitude; the public land survey system of ranges, townships, and sections; and the UTM (Universal Transverse Mercator) grid. Table 1 lists the locations of the 109 named lakes shown on the map by their UTM coordinates.

TABLE 1. – *Locations of named lakes using Universal Transverse Mercator (UTM) coordinates*

Lake name	UTM coordinates North (meters)	East (meters)
Ashwood Reservoir	4,426,060	507,560
Aurora Rampart Reservoir	4,366,030	494,500
Autrey Reservoir	4,419,780	488,000
Barr Lake	4,422,940	520,940
Baseline Reservoir	4,426,470	482,190
Bates Lake	4,406,380	495,000
Berkeley Lake	4,403,310	495,780
Blackmer Lake	4,386,620	505,560
Bowles Lake	4,384,910	496,030
Bowles Reservoir No. 1	4,385,310	493,770
Bowles Reservoir No. 1	4,426,250	524,090
Bowles Reservoir No. 2	4,427,590	524,780
Calhoun Reservoir	4,426,880	525,440
Chatfield Lake	4,378,570	494,650
Cherry Creek Lake	4,388,810	512,560
Cherry Hills Lake	4,387,470	503,380
Copeland Lake	4,406,000	501,750
Cowdrey Reservoir No. 2	4,422,250	482,340
Croke Lake	4,413,280	501,160
Croke Reservoir	4,415,060	500,310
Crown Hill Lake	4,400,410	491,090
Crystal Lake	4,361,840	471,000
Derby Lake	4,407,250	514,160
Dewey Lake	4,405,380	501,030
Duck Lake	4,399,530	504,120
East Reservoir	4,393,220	490,720
Eggleston Reservoir No. 4	4,420,440	481,280
Evergreen Lake	4,386,780	472,375
Gallup Reservoir	4,383,720	500,160
Garfield Lake	4,393,750	496,910
Golden Reservoir	4,397,660	479,660
Gordon Lake	4,406,500	499,531
Grant A Lake	4,385,160	491,190
Grant B Reservoir	4,384,560	493,120
Grant C Reservoir	4,384,880	493,470
Grasmere Lake	4,393,530	502,660
Great Western Reservoir	4,416,190	487,340
Gross Reservoir	4,421,780	469,530
Harriman Lake	4,387,030	490,030
Henry Lake	4,387,470	492,310
Higgins Lake	4,421,880	517,340
Huston Lake	4,394,310	498,780
Hyatt Lake	4,405,690	485,625
Jackson Lake	4,417,280	498,620
Johnson Reservoir	4,383,500	492,820
Kelly Lake	4,405,380	485,440
Kendrick Lake No. 1	4,392,000	490,190
Kendrick Reservoir	4,392,500	491,090
Ketner Reservoir	4,414,410	490,780
Kossler Reservoir	4,425,120	471,810
Ladora Lake	4,407,875	512,780
Lake Arbor	4,409,980	494,620
Lake Erie	4,419,940	503,500
Lake Mary	4,407,440	511,910
Lake Rhoda	4,403,030	495,090
Lake Sangraco	4,405,880	497,440
Lakes Lake	4,386,780	492,560
Leyden Lake	4,410,030	485,810
Louisville Reservoir	4,426,440	486,620
Lower Church Lake	4,415,220	493,310
Lower Long Lake	4,407,530	480,620
Lower Tule Lake	4,384,520	496,250
Lutz Reservoir	4,421,560	517,310
Magers Reservoir	4,421,840	517,620
Main Reservoir	4,393,310	490,030
Maple Grove Reservoir	4,400,440	488,220
Marshall Lake	4,422,120	482,120
Marston Lake	4,385,540	494,400
Mayham Lake	4,407,280	496,220
McKay Lake	4,422,010	498,970
McLellan Reservoir	4,379,690	497,880
Meeks Reservoir No. 1	4,425,840	523,380
Meeks Reservoir No. 2	4,424,780	523,560
Mower Reservoir	4,414,080	486,580
Nissen Reservoir No. 2	4,420,470	494,250
North Henry Lee Reservoir	4,401,340	491,660
Oberon Lake	4,407,530	491,120
Platte Canyon Reservoir	4,370,660	492,910
Pomona Lake	4,411,060	491,280
Ralston Reservoir	4,407,560	478,660
Reservoir E	4,410,020	512,590
Rocky Flats Lake	4,413,560	480,470
Rocky Mountain Lake	4,403,250	497,344
Signal Reservoir No. 1	4,427,120	508,840
Signal Reservoir No. 2	4,426,940	509,220
Skeel Reservoir	4,389,160	505,060
Skeel Reservoir No. 1	4,425,530	517,720
Sloans Lake	4,399,160	496,840
Smith Lake	4,394,660	502,530
Smith Reservoir	4,424,780	509,160
Smith Reservoir	4,392,310	490,380
Soda Lake	4,387,560	485,690
Standley Lake	4,412,720	490,690
Stearns Lake	4,421,840	491,190
Stouffer Reservoir	4,427,000	511,470
Stouffer Reservoir No. 1	4,426,910	511,750
Tom Frost Reservoir	4,419,690	496,780
Tucker Lake	4,408,720	483,250
Upper Church Lake	4,416,840	491,160
Upper Derby Lake	4,407,190	514,720
Upper Long Lake	4,407,910	479,870
Upper Tule Lake	4,384,640	495,810
Upper Twin Lake	4,411,500	486,160
Ward Reservoir No. 1	4,391,220	494,310
Ward Reservoir No. 5	4,391,720	496,190
Webster Lake	4,417,531	501,438
Windsor Lake	4,394,090	510,720
Wolcott Lake	4,390,880	495,910
Wolhurst Lake	4,379,380	496,840

A UTM "north" coordinate is the distance, in meters, of a point north of the earth's equator; in table 1, the "east" coordinate is the distance, in meters, east of the western boundary meridian of UTM Zone 13. The borders of the map show the 5,000-meter (5-km) ticks of the UTM grid. For most of the grid values, the last three zeros are not shown, and numerals representing hundred-thousand meters are in smaller type. For example, the tick representing 520,000 meters east is marked ²20, and the tick representing 4,360,000 meters north is marked ⁴60. Interpolation between ticks on the map is simplified by the 1:100,000 scale (1 cm = 1 km). Interpolation can be done with a centimeter scale or with the kilometer scale printed at the bottom of the map.

For sale by U. S. Geological Survey
Denver, Colo. 80225 and Reston, Va. 22092, price $1.00