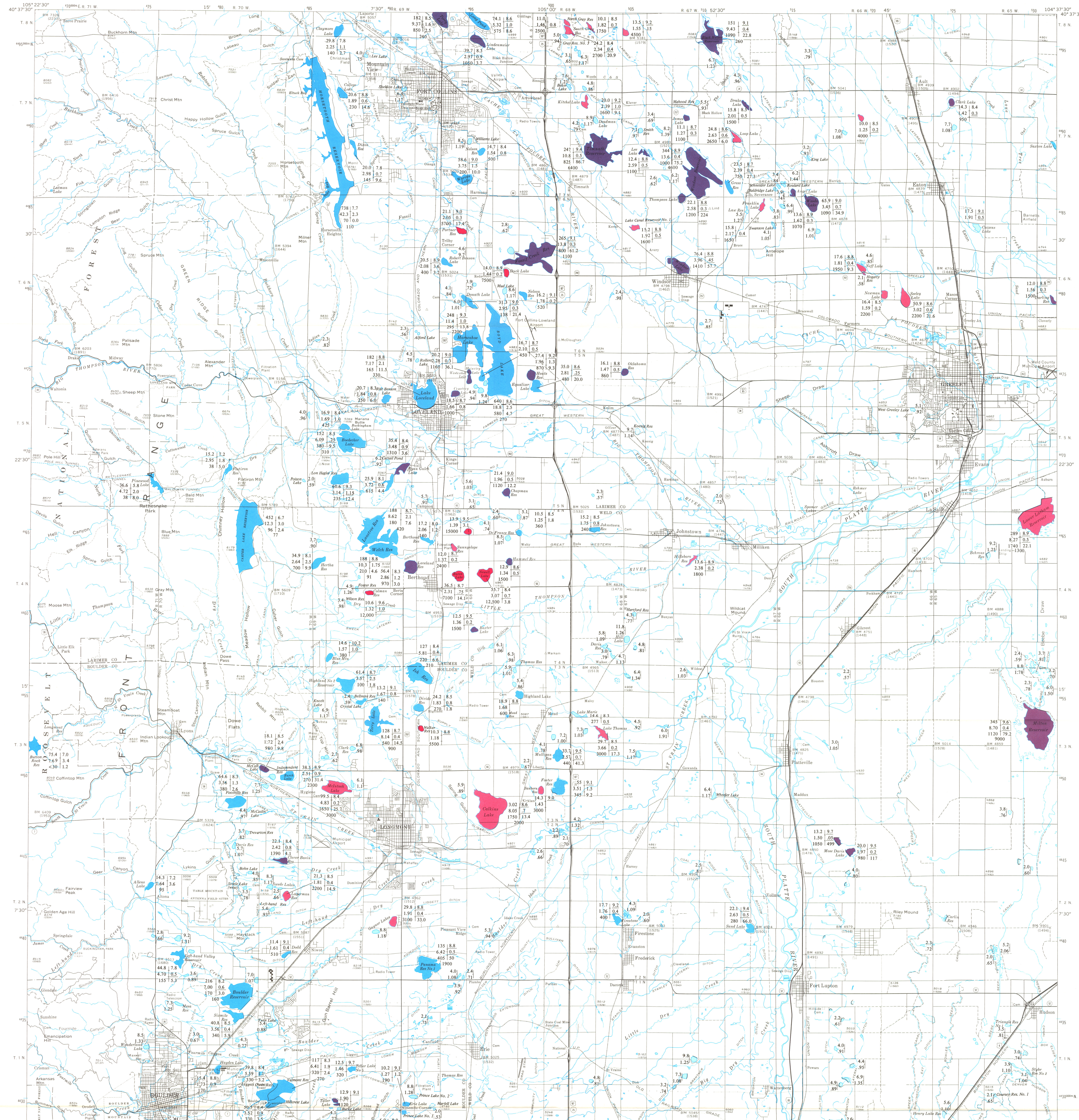


Base from U.S. Geological Survey, 1973
5000-meter Universal Transverse Mercator grid ticks, zone 13, shown in blue
Elevations in meters are shown in parentheses.

SCALE 1:100 000

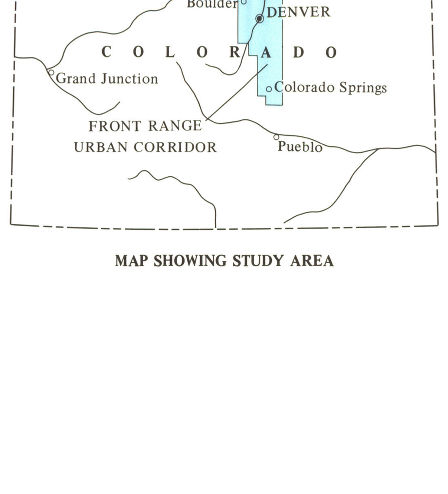
DATUM IS MEAN SEA LEVEL

EXPLANATION

FOR MOST LAKES SMALLER THAN 10 HECTARES IN SURFACE AREA
Surface area, in hectares — 6.4
Shoreline length, in kilometers — 1.17

FOR MOST LAKES LARGER THAN 10 HECTARES IN SURFACE AREA
Surface area, in hectares — 117
Shoreline length, in kilometers — 6.41
Specific conductance, in micromhos per centimeter — 320
Algal concentration, in cells per milliliter — 270
pH (underscored when greater than 8.5) — 8.3
Secchi disk transparency, in meters (underscored when less than 1.2 M) — 1.9
Chlorophyll a concentration in micrograms per liter — 2.4

COLORS SHOW RANGE OF SPECIFIC CONDUCTANCE, IN MICROMHOS PER CENTIMETER
No conductance data
Less than 750
751–1500
1501–4500
4501–15,000



MAP SHOWING STUDY AREA

INTRODUCTION

The many lakes in Colorado's semiarid Front Range Urban Corridor have an especially high value. In the past they have been used primarily to store water for irrigation and domestic uses, and some have been used for recreation. Today, rapid suburban development in the Front Range Corridor is accompanied by a shift of the principal use of many lakes to recreation and as 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 northern one-third of the Colorado Front Range Urban Corridor. This inventory was conducted to assemble 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 lake size and water-quality data. Size data are included for most of the lakes of 2 hectares (20,000 square meters, about 5 acres) or greater, and water-quality data are provided for most lakes larger than 10 hectares (about 25 acres).

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 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 authors also express their sincere thanks to Ralph Teller 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 late summer field work in 1972 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, chlorophyll *a* concentration, and algal concentration. Samples for chemical and biological analyses were collected at a depth of 0.5 meter (1.6 feet) 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 survey. 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 that 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 (DS) in water is provided by measurements of electrical conductance. Dissolved solids, in milligrams per liter (mg/1), of most waters can be estimated by multiplying the specific conductance, in micromhos per centimeter (μmho/cm) by about two-thirds. For example, water with a specific conductance of 1,200 μmho/cm will contain about 800 mg/1 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 μmho/cm (about 500 mg/1 DS) satisfies the recommended limits for maximum DS in drinking water (U.S. Public Health Service, 1962, Public Health Service drinking water standards: U.S. Public Health Service, Pub. 956, 61 p.). Water with specific conductance between about 750 and 1,500 μmho/cm (DS from about 500 to 1,000 mg/1) is regarded as marginal for drinking. Waters having conductance values of 1,500 to 4,500 μmho/cm (DS about 1,000 to 3,000 mg/1) can be considered too saline for drinking water, but meet Colorado water-quality standards for use in watering livestock. In most cases these waters can be used for irrigation. Waters with specific conductance in the range from 4,500 to 15,200 μmho/cm (DS about 3,000 to 10,000 mg/1) are considered moderately saline.

Although the previous paragraph discusses suitability of water use based on conductance and DS, one cannot assume that waters with low DS 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 indicate whether water is acidic or basic (alkaline) in its chemical nature. Water with pH 7.0 is said to be neutral, water with pH values less than 7.0 is termed acidic, and water with pH 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 the lake, and may influence the suitability of lake use 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 (U.S. National Technical Advisory Committee to the Secretary of Interior, 1968, Water quality criteria: Washington, D.C., U.S. Federal Water Pollution Control Admin., 234 p.).

Secchi disk transparency. – A Secchi disk is a black and white flat circular disk about 20 centimeters (8 inches) 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 cases 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 meter (about 4 feet) are underscored because such waters do not meet recommended standards for use for water-contact sports (U.S. National Technical Advisory Committee to the Secretary of Interior, 1968, Water quality criteria: Washington, D.C., U.S. Federal Water Pollution Control Admin., 234 p.).

Chlorophyll and algal concentration. – Concentrations of chlorophyll *a* algal cells indicate the biological condition of a lake. Generally a lake that is rich in nutrients will contain larger numbers of algae, hence higher concentrations of chlorophyll than will a lake poor in nutrients.

The map shows concentrations of chlorophyll *a* in 73 lakes. Data on algal concentrations are shown for 23 of the largest lakes. The reader should remember 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.

SUMMARY OF LAKE CHARACTERISTICS

Size. – Data are included in this report for 116 lakes with surface areas greater than 10 hectares (about 25 acres). These lakes have a total combined area of 8,160 hectares (20,163 acres), and a total shoreline of 460 kilometers (286 miles). The largest are Horsetooth Reservoir, 738 hectares (1,824 acres); Boyd Lake, 640 hectares (1,581 acres); and Carter Lake Reservoir, 452 hectares (1,117 acres). Horsetooth Reservoir also has the longest shoreline–42.3 kilometers (26.3 miles)–more than twice as long as the next longest, Boyd Lake, 18.8 kilometers (11.7 miles).

In addition, the area contains 166 lakes ranging in size from 2 to 10 hectares (5 to 25 acres). These have a total area of 794 hectares (1,962 acres), and a total shoreline of 157 kilometers (97 miles).

Chemical and physical quality. – As expressed by values of specific conductance, most of the lakes contained water of good quality. Conductance was 750 μmho/cm or less in 57 of the 115 lakes measured; it ranged from 750 to 1,500 μmho/cm in 30 lakes, ranged from 1,500 to 4,500 umho/cm in 21 lakes, and exceeded 4,500 μmho/cm in only 7 lakes. Samples from Button Rock Reservoir, Flatiron Reservoir, and Pinewood Lake had specific conductance less than 40 μmho/cm. The highest conductance waters were from Coleman Reservoir (12,000 μmho/cm), Newell Lake (12,500 μmho/cm), and an unnamed lake (15,000 μmho/cm) located 3.5 kilometers (2.2 miles) north-northeast of Berthoud.

Most of the lakes in the corridor contained water that is alkaline. Slightly acidic water was found only in Pinewood Lake (pH = 5.8) and in Carter Lake Reservoir (pH = 6.7). The highest pH (10.2) was found in Blue Mountain Reservoir. Of the 115 lakes in which pH was measured, values of 8.5 or less were found in 43 lakes, and values greater than 8.5 were found in 72 lakes.

Transparency, as measured by a Secchi disk, was less than 1.2 meters (4 feet) in 87 of the 112 lakes in which it was measured. It ranged from 1.2 to 3.6 meters (4 to 12 feet) in the other 25 lakes. Transparency was 3.4 meters (11 feet) in Button Rock Reservoir, and 3.6 meters (12 feet) in Allens Lake and Robert Benson Lake, and was 0.2 meter (8 inches) or less in 12 of the lakes measured.

Biological factors. – Algal concentrations ranged from 77 to 13,000 cells/ml (cells per milliliter) in the samples collected from 23 lakes. Largest concentrations were in Milton Reservoir, 9,000 cells/ml; Fossil Creek Reservoir, 11,000 cells/ml; and Lower Latham Reservoir, 13,000 cells/ml. Concentrations were greater than 1,000 cells/ml in 10 lakes. Smallest algal concentrations were found in samples from Carter Lake Reservoir, 77 cells/ml; and fron Welch Reservoir, 91 cells/ml.

Chlorophyll *a* concentration was determined for more lakes than was algal concentration. It ranged from below detection limits (labeled zero on the map) in Horsetooth Reservoir to 117 μg/1 (micrograms per liter) in Mose Davis Lake. Concentrations greater than 70 μg/1 also were found in Milton Reservoir, 79.2 μg/1; Timnath Reservoir, 86.7 μg/1; and Windsor Reservoir, 75.2 μg/1. In addition to Horsetooth Reservoir, other lakes containing concentrations less than 2 μg/1 were Button Rock Reservoir, Divide Reservoir, and Highland No. 2 Reservoir.

Sixteen different genera of algae were found as dominants or codominants (genera comprising more than 10 percent of the algal population) in samples from 23 largest lakes. One genus, *Oscillatoria,* was found as a dominant or codominant in 10 lakes: Horseshoe Reservoir, Panama No. 1 Reservoir, Black Hollow Reservoir, Timnath Reservoir, Lower Latham Reservoir, Fossil Creek Reservoir, Terry Lake (north of Fort Collins), Welch Reservoir, Boyd Lake, and Windsor Reservoir. *Oscillatoria* is a blue-green alga that frequently occurs in large numbers or "blooms" in polluted water. Its presence in large numbers may cause undersirable tastes and odors and is often associated with filter clogging in water-treatment plants. It frequently blooms in late summer.

LOCATIONS

Several systems of expressing geographic location have been devised, including: latitude and longitude; the public land survey system of ranges, townships, and sections; and the UTM (Universal Transverse Mercator) grid. Table 1 lists the locations of the 171 named lakes shown on the map by their UTM coordinates. A UTM "north" coordinate is the distance in meters of a point north of the earth's equator; and in this case the "east" coordinate is the distance in meters east of the western boundary meridian of UTM Zone 13. The borders of figure 1 show the 5,000-meter (5-kilometer) ticks of the UTM grid. In most cases the last three zeros are not shown, and numerals representing hundred-thousand meters are in smaller type. For example, the tick representing 510,000 meters east is marked $^{5}10$, and the tick representing 4,450,000 meters north is marked $^{44}50$. 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.

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

Lake name	UTM coordinates North (meters)	East (meters)
Alford Lake	4,477,030	492,200
Allens Lake	4,443,180	475,840
Angel Lake	4,485,690	515,355
Bacon Lake	4,461,840	494,830
Baker Lake	4,492,200	501,530
Baldridge Lake	4,486,020	514,320
Baxter Lake	4,458,690	495,590
Behrens Reservoir	4,463,300	527,620
Bellmire Reservoir	4,454,650	488,225
Berthoud Reservoir	4,464,150	493,050
Black Hollow Reservoir	4,495,230	510,980
Blue Mountain Reservoir	4,457,280	486,970
Boedecker Lake	4,470,990	487,430
Bohn Lake	4,443,870	481,960
Boulder Reservoir	4,435,900	481,750
Boyd Lake	4,473,380	497,000
Buckingham Lake	4,471,240	487,380
Burch Lake	4,449,590	483,730
Burke Lake	4,429,220	487,420
Button Rock Reservoir	4,451,700	469,310
Calkins Lake (Union Reservoir)	4,446,746	496,270
Carlin Reservoir	4,441,040	525,050
Carter Lake Reservoir	4,463,570	482,040
Cattail Pond	4,469,070	490,340
Cemetery Lake	4,473,210	494,270
Chapman Reservoir	4,466,990	497,985
Clark Lake	4,491,300	525,250
Clark Reservoir	4,451,380	488,160
Claymore Lake	4,496,190	487,300
Clover Basin Reservoir	4,444,570	484,180
Coleman Reservoir	4,460,990	489,350
Colfer Sloughs (North)	4,438,980	528,030
Colfer Sloughs (South)	4,438,580	528,100
College Lake	4,491,700	487,420
Coursey Reservoir No. 1	4,430,360	528,180
Cozzens Lake	4,483,553	527,004
Crystal Lake	4,454,250	488,690
Darling Reservoir	4,479,140	531,680
Davis Reservoir	4,445,330	480,820
Davis Reservoir	4,457,780	503,950
Deadman Lake	4,490,130	503,120
Defrance Reservoir	4,464,660	498,530
Divide Reservoir	4,453,870	492,530
Dixon Reservoir	4,487,860	488,280
Dodd Reservoir	4,438,600	483,975
Donath Lake	4,478,740	495,780
Drake Lake	4,490,996	512,822
Duck Lake	4,481,128	497,444
Equalizer Lake	4,473,560	499,560
Erie Lake	4,429,510	491,700
Eshelman Reservoir	4,433,550	528,670
Firestone Lake	4,440,700	504,590
Flatiron Reservoir	4,468,890	480,630
Foothills Reservoir	4,448,540	481,320
Fossil Creek Reservoir	4,482,140	500,440
Foster Reservoir	4,461,210	488,470
Foster Reservoir	4,448,780	500,590
Franklin Lake	4,484,751	513,411
Gaynor Lake (East)	4,440,540	490,830
Gaynor Lake (West)	4,440,120	489,610
Gray Reservoir No. 3	4,494,390	501,300
Gress Reservoir	4,485,822	511,431
Hartford Reservoir	4,459,720	505,690
Hayden Lake	4,431,470	479,930
Heinricy Lake	4,474,715	496,210
Henry Lake Reservoir	4,429,100	525,130
Hertha Reservoir	4,463,160	486,460
Highland Lake	4,454,630	498,580
Highland No. 2 Reservoir	4,455,820	488,270
Hill Lake	4,458,090	505,170
Hillcrest Lake	4,429,370	483,040
Hillsboro Reservoir	4,463,470	509,550
Hogarty Reservoir	4,480,880	519,950
Horseshoe Lake	4,475,090	496,110
Horsetooth Reservoir	4,494,080	485,600
Houts Reservoir	4,474,330	499,170
Hummel Reservoir	4,462,920	497 920
Independent Reservoir	4,449,581	483,270
Ish Reservoir	4,455,580	493,050
James Lake	4,490,310	508,750
Johnstown Reservoir	4,464,880	503,170
King Lake	4,487,890	516,284
Kitchel Lake	4,491,060	502,600
Knoth Reservoir	4,453,801	485,940
Koenig Reservoir	4,470,960	505,780
Lagerman Reservoir	4,442,120	484,065
Lake Canal Reservoir No. 1	4,483,540	505,590
Lake Loveland	4,474,290	493,000
Lake Marie	4,453,490	502,345
Lake Thomas	4,452,250	504,030
Law Reservoir	4,484,640	512,533
Lee Lake	4,488,110	506,520
Lee Lake	4,494,380	488,770
Left-hand Reservoir	4,441,765	483,336
Left-hand Valley Reservoir	4,438,630	477,600
Leggett Owen Reservoir	4,429,720	482,940
Lindenmeier Lake	4,494,830	496,071
Lon Hagler Reservoir	4,468,234	487,876
Lonetree Reservoir	4,466,120	490,190
Long Pond Reservoir No. 5	4,496,240	495,590
Loop Lake	4,489,000	511,741
Loveland Reservoir	4,462,324	491,957
Lower Hoffman Lake	4,473,480	496,060
Lower Latham Reservoir	4,467,100	531,110
Mahood Reservoir	4,491,310	509,410
Marfell Lake	4,429,220	493,290
McCall Lake	4,450,010	482,770
McCaslin Lake	4,447,841	481,910
McIntosh Lake	4,448,670	487,368
Mesa Reservoir	4,435,700	477,665
Milton Reservoir	4,454,084	530,842
Mose Davis Lake	4,445,090	518,940
Mud Lake	4,480,050	497,550
Mulligan Reservoir	4,451,620	500,980
Neff Lake	4,481,050	519,686
Nelson Reservoir	4,479,320	498,900
Nelson Reservoir	4,488,160	496,050
Newell Lake	4,461,800	496,670
Newman Lake	4,479,410	521,790
North Gray Reservoir	4,496,120	501,460
Oklahoma Reservoir	4,474,560	504,900
Panama Reservoir No. 1	4,437,800	493,480
Pinewood Lake	4,468,420	476,290
Poison Lake	4,467,960	485,180
Portner Reservoir	4,483,620	495,010
Prince Lake No. 1	4,428,990	491,350
Prince Lake No. 2	4,429,980	492,120
Rist Benson Lake	4,472,810	490,180
Robert Benson Lake	4,481,295	494,140
Rollers Lake	4,475,350	492,100
Roulard Lake	4,486,274	514,870
Ryan Gulch Lake	4,469,160	491,560
Sanborn Reservoir	4,448,715	499,980
Sand Lake	4,440,210	513,120
Schneider Lake	4,486,147	514,553
Seeley Lake	4,478,980	522,315
Sequine Reservoir	4,431,880	529,770
Sheldon Lake	4,492,076	491,170
Sixmile Reservoir	4,435,060	481,460
Smith Reservoir	4,489,575	505,890
South Gray Reservoir	4,494,530	501,770
Steele Lakes (West)	4,442,990	481,620
Stybr Reservoir No. 2	4,431,790	530,100
Sunnyslope Reservoir	4,463,700	494,490
Swanson Lake	4,484,777	514,210
Swede Lakes (East)	4,442,930	483,840
Swede Lakes (West)	4,443,000	483,258
Teller Lake	4,429,550	487,260
Teller Lake No. 5	4,431,600	488,160
Terry Lake	4,452,350	490,410
Terry Lake	4,496,056	493,580
Thomas Reservoir	4,456,990	498,515
Thompson Lake	4,485,270	508,500
Timnath Reservoir	4,487,600	503,520
Trevarton Reservoir	4,446,190	481,640
Triangle Reservoir No. 1	4,434,480	528,940
Twin Lake	4,434,610	483,170
Upper Hoffman Lake	4,473,755	495,745
Valmont Reservoir	4,430,900	484,450
Walker Reservoir	4,452,570	492,470
Warren Lake	4,486,920	495,430
Welch Reservoir	4,463,260	490,060
West Greeley Lake	4,472,660	522,944
Westerdoll Lake	4,474,290	495,480
Wheeler Lake	4,448,880	510,700
Williams Lake	4,488,820	495,240
Wilson Reservoir	4,461,320	488,480
Windsor Lake	4,480,880	508,400
Windsor Reservoir	4,485,890	509,140
Wonderland Lake	4,433,090	475,590
Woods Lake	4,484,790	516,550

LAKES IN THE BOULDER–FORT COLLINS–GREELEY AREA, FRONT RANGE URBAN CORRIDOR, COLORADO

By
John F. Ficke and Terence W. Danielson

1973