QUALITY OF GROUND AND SURFACE WATERS

By S. K. Love

INTRODUCTION

The wide range in composition of waters available, or in use, in southeastern Florida is indicated by analyses of several hundred samples of surface and ground waters made during the course of this investigation. Except for its color, some of the water in the area would be classed as excellent for all ordinary uses. Some of the water can be made entirely satisfactory for all uses by fairly simple treatment, but water from other sources cannot be made suitable for general use by any practical treatment.

Because the most urgent need for information about the quality and quantity of water in southeastern Florida is in connection with municipal supplies for the cities of Miami, Miami Beach, and other nearby communities, most of the intensive analytical work has been done on samples from sources in, or near, the metropolitan area of Miami. The work has included determinations of the general character of surface water and its contamination by salt water. Information has been obtained about the general character of shallow ground water and of artesian water in the Miami area. A large number of determinations were made on samples of water from test wells, and analyses were made to show the extent of contamination of the public supply wells. Looking to the possibility of obtaining supplies at a greater distance from the Miami area, attention was given to the character of surface water and ground water in the Lake Okeechobee area and in the coastal areas of Broward and Palm Beach Counties.

EARLIER REPORTS ON QUALITY OF WATER

A few analyses of ground waters in southeastern Florida are reported by Sellards and Gunter (1913, p. 103-290), and by Matson and Sanford (1913). These analyses indicate that shallow ground water in the permeable aquifers near the coast (where uncontaminated with salt water) was hard, but otherwise suitable for domestic and industrial use. The authors of both reports point out that artesian water obtained from deep wells in West Palm Beach and farther south were highly mineralized and unsatisfactory for most uses.

A report by Collins and Howard (1928, p. 177-233) includes analyses of practically all of the public supplies in southeastern

Florida, together with analyses of several privately owned wells and of a few surface waters.

Prior to this investigation, a considerable number of chloride determinations were made by the cities of Miami and Miami Beach in an attempt to determine the extent of salt-water contamination in the Miami area. All of these records were made available to the Geological Survey and have proved invaluable in providing a background for the comprehensive investigation of water resources.

During the course of the investigation, information about the quality of surface waters was released in a progress report (Cross, Love, Parker, and Wallace, 1940), and in a paper by Cross and Love (1942, p. 490-504). A paper by Love and Swenson (1942, p. 1624-1628) gives analyses of the 25 public supplies in southeastern Florida.

The chemical character of ground water in the Everglades has been discussed by Stringfield (1933a), by Parker (1942, p. 47-76), and by Parker and Hoy (1943, p. 33-55).

METHODS OF INVESTIGATION

COLLECTION AND EXAMINATION OF SAMPLES

The general survey of southeastern Florida included a systematic study of the chemical character of all of the major streams, lakes, and canals. On the larger streams and canals, complete analyses were made of 10-day composites of samples collected daily for a period of a year. Less frequent analyses were made of samples collected from smaller and less important streams. Two surveys were made of the quality of water in Lake Okeechobee by making analyses of samples collected from about 40 points in the lake; one survey was made in 1940 when the lake was at a low stage, and another was made in 1941 when it was at a comparatively high stage.

Semimonthly samples were collected from several tidal canals in, and near, Miami throughout most of the period of the investigation in order to follow the trend of salt-water intrusion from Biscayne Bay.

Chloride was determined in a large number of samples collected in 1939 and 1940 from wells in the Miami area in order to determine the extent of contamination by sea water, and every month thereafter chloride was determined on samples collected from a group of key wells that would adequately reflect significant movements of salt water in the aquifers.

More complete analyses were made of several hundred samples from wells both in Miami and in other parts of southeastern Florida to obtain reliable information about the character of the ground waters.

A series of analyses were made of water samples collected from a large number of test wells that were drilled to obtain information on the geologic and hydrologic properties of the water-bearing formations and about the chemical character of the waters at different depths.

In addition to the regular program of sampling and analyses, several hundred chemical examinations and analyses were made of water samples that might furnish relevant information.

EXPRESSION OF RESULTS

The analyses are reported in parts per million for all mineral constituents. Specific conductance is reported in reciprocal ohms (mhos); pH is reported in standard pH units; and color is reported in dimensionless units defined by standard platinum-cobalt scale.

The analytical results obtained in chemical analyses are, strictly speaking, in milligrams per liter. For all practical purposes, however, for waters having a total concentration of dissolved mineral matter of less than 10,000 mg per liter, the units "milligrams per liter" and "parts per million" are essentially equal. For waters in which the content of dissolved solids is greater than 10,000 mg per liter, the two units can no longer be assumed to be equivalent. The increase in density of the waters having a concentration of over 10,000 mg per liter makes it necessary to use a correction factor to report the analysis in parts per million. Because chloride is the predominant constituent of most concentrated waters in southeastern Florida, and also because sea water is the chief source of mineral matter in the concentrated waters, it was found satisfactory to apply a correction factor to all waters in which chloride was found in excess of 5,000 mg per liter in order that the results of analysis could be expressed uniformly in parts per million.

CONSTITUENTS AND PROPERTIES OF NATURAL WATERS

The mineral constituents of natural waters generally reflect the composition and solubility of the rock materials with which the waters have been in contact. In southeastern Florida the mineral matter found in surface and ground waters is derived not only from rocks and rock material, but also through the medium of ion exchange from organic mucks and soils to which mineral matter has been adsorbed. It is also derived in some parts of the Everglades from saline residues remaining from former invasions of the sea which have not been completely flushed out by meteoric water. Still another source of mineralization is sea water that has contaminated some surface and ground waters near the coast and along the tidal canals.

COLOR

In water analysis the term "color" refers to the appearance of water that is free of suspended matter. Water for domestic use and for some industrial uses should be free from perceptible color. All of the surface waters and most of the ground waters in southeastern Florida are colored.

Natural color in surface and ground waters is caused almost entirely by organic matter extracted from leaves, roots, and other substances in the ground. The platinum-cobalt standard proposed by Hazen (1892, p. 300-310) is the commonly adopted standard for measuring color in water (Am. Public Health Assoc., 1936, p. 12-14) in the United States, the unit of color being that produced by 1 mg of platinum per liter, dissolved as platinic chloride, with the addition of enough cobalt chloride to give a color matching the shade of the natural water. The figures for color given in the table of analyses represent units on this platinum-cobalt scale.

Color was determined of almost all samples of surface and ground waters for which analyses are given in this report.

SPECIFIC CONDUCTANCE

The specific conductance of a water is a measure of its ability to conduct an electric current. Specific conductance, which is the reciprocal of specific resistance in ohms, is expressed in reciprocal ohms at 25° C (77° F). In order that the use of awkwardly small figures may be avoided, the measured values of specific conductance are multiplied by 10^5, as indicated in the heading at the top of the column in the tables of analyses.

The specific conductance of a water is a function of the amount and kind of the dissolved mineral matter. It varies with the concentration and also with the degree of ionization of the minerals in solution. It is of value in determining the volume to be used for analysis and, particularly in southeastern Florida, in determining the extent to which surface and ground water are contaminated with sea water.

SILICA

Silica (SiO_2) is dissolved from practically all rocks and rock materials. Its state in natural waters is not definitely known, but in reports of analyses it is assumed to be in the colloidal state, taking no part in the equilibrium between acids and bases. In southeastern Florida, the concentration of silica, in those waters in which it was determined, ranged from about 2 to 20 ppm, with an average of somewhat less than 10 ppm. The silica in a water may be precipitated with other scale-forming materials in steam boilers. This may be a serious matter in the operation of high-pressure boilers. Otherwise, silica is of comparatively little importance in determination of water use.

IRON

Iron (Fe) is dissolved from practically all soils and rocks and frequently from iron pipes. Soft waters low in mineral content and other waters of low pH will dissolve iron from iron pipes and particularly from hot-water lines and boilers. The quantity of iron in ground water is not so uniform over large areas as the quantity of calcium and other constituents. Wells, close together, have been found to differ considerably in the quantity of iron in their waters. Surface waters in southeastern Florida generally contain less than 0.1 ppm of iron but ground waters may contain from a few hundredths of a part to 3 or 4 ppm and even larger amounts have been found in some wells.

Water furnished to consumers by public supplies should not contain more than about 0.2 ppm of iron. Water that contains much more than this amount of iron is not suitable because of the appearance of "red-water," or reddish-brown sediment caused by the oxidation of the iron. The iron will make stains on white porcelain, enameled ware and fixtures, and on clothing or other fabrics. Many industrial plants, including those manufacturing and preparing foods, carbonated beverages, beer, textiles, dyed fabrics, high-grade paper, and ice, must have water practically free from iron. The excess iron may be removed by simple aeration and filtration from most waters but some waters require the addition of lime or some other substance.

CALCIUM

Calcium (Ca) is dissolved in large quantities from limestone, which is largely calcium carbonate. Corals and shells are also nearly all calcium carbonate. Calcium is, therefore, found in considerable quantities in all ground waters in southeastern Florida.

Calcium carbonate is not very soluble in pure water, but when enough carbon dioxide is available, large quantities of calcium carbonate go into solution as the bicarbonate. Calcium is the main cause of the hardness of waters in southeastern Florida.

MAGNESIUM

Magnesium (Mg) is dissolved from practically all rocks but mainly from dolomite and dolomitic limestones. The limestones of southeastern Florida contain little magnesium, therefore the ground waters carry only small quantities. Magnesium is one of the abundant constituents of sea water and therefore will be found in large quantities in ground water contaminated with sea water, or with salts embedded in the deposits of ancient seas. Magnesium and calcium are the only elements that cause appreciable hardness in most natural waters.

SODIUM AND POTASSIUM

Sodium (Na) and potassium (K) are dissolved from almost all rocks, but they make up only a small part of the dissolved mineral matter in most of the surface and ground waters in southeastern Florida. As sea water is mainly a solution of common salt (sodium chloride), considerable quantities of sodium are found in waters contaminated with sea water or in waters with salts enclosed in the older marine deposits. The quantity of sodium may be from 5 to 30 ppm in an ordinary surface or ground water or several hundred parts per million in a highly mineralized water. The quantity of potassium is generally comparatively small. Natural waters that contain only 3 or 4 ppm of sodium and potassium are likely to contain about equal quantities of the two. As the total quantity of these constituents increases, the proportion of potassium becomes less. In waters carrying from 30 to 50 ppm of both of these constituents, the ratio of sodium to potassium may vary from about 4:1 to 10:1. For waters that carry increasing amounts of sodium, the ratio of sodium to potassium may be even larger.

A calculated quantity of sodium and potassium is given in many analyses—the quantity that is needed, in addition to the calcium and magnesium, to balance the acid radicles: bicarbonate, sulfate, chloride, and nitrate. The quantity thus calculated is affected by any errors in the determination of the individual constituents. The calculation sometimes leads to a negative quantity for sodium, especially if no nitrate is reported in the analysis. In a few such analyses, the sodium and potassium are not reported.

BICARBONATE

Bicarbonate (HCO_3) in natural waters results from the action by carbon dioxide (dissolved in the water) on carbonate rocks. A few natural waters contain carbonate (CO_3), but generally its presence in samples is the result of the action of the water on the sample bottle or of previous treatment of the water.

Surface and ground waters that have not been in contact with limestone may have less than 20 ppm of bicarbonate. The ordinary surface and ground waters in southeastern Florida, however, have about 150 to 400 ppm of bicarbonate. In some parts of the Everglades, concentrations of 500 to 1,000 ppm of bicarbonate are not uncommon.

Bicarbonate is the principal acid radicle in nearly all waters used for public supplies. Its relationship to hardness is discussed below.

SULFATE

Sulfate (SO_4) is dissolved in large quantities from gypsum (calcium sulfate) in the rocks and soil. It is also formed by the oxidation of sulfides of iron, and sulfates from this source cause serious pollution of streams in parts of the country where the opening of mines has exposed large quantities of iron sulfide to the action of air and water. The waters in southeastern Florida that have large quantities of sulfate appear to have obtained it from solution of concentrated deposits of sodium sulfate or calcium sulfate.

Sulfate itself has little effect on the general use of a water. Magnesium sulfate and sodium sulfate may be present in sufficient quantity to give a bitter taste. Sulfate in a hard water may increase the cost of softening and will form a much more troublesome scale in a steam boiler.

CHLORIDE

Chloride (Cl) is an abundant constituent of sea water and is dissolved in small quantities from rock materials. Many of the surface waters of southeastern Florida have less than 15 ppm of chloride, but ground waters with 100 ppm, or more, are not uncommon. Along the coast, ground waters contain from 10 to 30 ppm of chloride, and in some parts of the Everglades shallow wells may contain several hundred parts per million. Deeper wells in the Everglades have been known to contain as much as 3,150 ppm of chloride.

Chloride, like sodium, with which it forms sodium chloride (common salt), has little effect on water for ordinary uses unless there is enough present to give a salty taste. Waters high in chloride may be corrosive to plumbing and steam boilers and harmful to irrigated crops.

FLUORIDE

Fluoride (F) has been reported to be as prevalent as chloride in rocks (Shepherd, 1940, p. 117-128). However, the quantity in natural waters is very much less than that of chloride. Surface waters in southeastern Florida do not contain more than 0.6 ppm of fluoride and usually less than 0.3 ppm was found. Fluoride concentrations in public supplies ranged from 0 to 0.3 ppm, except for one small supply obtained from a deep artesian well that contained over 2 ppm. (See analysis of public supply at LaBelle, Hendry County.)

Fluoride in water is associated with the dental defect known as mottled enamel (Dean, 1936, p. 1269-1272) if children drink the water during the calcification or formation of their teeth. Normally formed teeth have not been known to become mottled later, regardless of the fluoride content of the drinking water. Teeth having mottled enamel become a dull chalky white color, which, in many cases, later takes on a characteristic dark-brown stain. It is generally recognized that water containing 1 ppm, or less, of fluoride will have no deleterious effect on tooth enamel and waters with slightly higher concentrations are used for public supplies without noticeable effect. Except for the single public supply mentioned above, there is no evidence to show that fluoride concentrations in potable surface and ground waters in southeastern Florida are sufficient to produce mottled enamel on children's teeth. It has been reported (Dean, Jay, Arnold, and Elvove, 1941, p. 761-792) that quantities of fluoride not sufficient to produce mottled enamel may have a beneficial effect on teeth by reduction of the incidence of dental caries (decay).

NITRATE

Nitrate (NO_3) is a relatively unimportant constituent of most of the analyses given in this report. Nitrate may indicate previous contamination by sewage or other organic matter because it represents the final stage of oxidation in the nitrogen cycle. Most waters in southeastern Florida carry less than 2 ppm of nitrate. This small quantity has little effect on the value of water for ordinary uses.

DISSOLVED SOLIDS

The residue, on evaporation, of a water consists mainly of the rock materials reported in the analyses. A small quantity of organic material and a little water of crystallization are sometimes included. The amount of dissolved solids in the surface and ground waters of southeastern Florida range from less than 50 to several thousand parts per million. Waters with less than 500 ppm of dissolved solids are generally entirely satisfactory for domestic use, except for the difficulties resulting from their hardness. The waters with more than 1,000 ppm are likely to contain enough of certain constituents to produce a noticeable taste or to make the water unsuitable for many domestic and industrial uses.

HARDNESS

Hardness of a water is most commonly recognized by a lack of suds in washing. Most of the figures for hardness given in the tables of analyses were calculated from the determinations of quantities of calcium and magnesium. In some of the less complete analyses, the hardness was determined by the soap method. In addition to causing trouble in the use of soap, these constituents are active agents in the formation of scale in steam boilers and other vessels in which water is heated or evaporated.

Hardness may be of two kinds—carbonate and noncarbonate. Carbonate hardness, sometimes referred to as temporary hardness, is caused by calcium and magnesium bicarbonate. Much of the carbonate hardness can be removed by boiling or by treatment with lime. Noncarbonate hardness, often called permanent hardness, is caused by calcium and magnesium sulfate (chloride and nitrate) and is more difficult and costly to remove. Both forms of hardness may be entirely removed by passing the water through a zeolite-type of water softener, but water softened by this method still contains approximately the original quantity of dissolved mineral matter.

Water with a hardness of less than 60 ppm is generally rated as soft, and its treatment for the removal of hardness is rarely justified. Hardness between 60 and 120 ppm does not seriously interfere with the use of water for most purposes, but it does slightly increase the consumption of soap, and its removal by a softening process is profitable for laundries and allied industries. Hardness between 120 and 200 ppm is troublesome for many industrial processes and requires treatment for the prevention of scale in boilers. Hardness above 200 ppm is objectionable for most industrial and domestic uses. Water having a hardness of from 200 to 400 ppm is used by many people who obtain their water supplies from privately owned wells and is also furnished by some of the larger public supplies. There is an increasing tendency, however, for cities to soften their water supplies if the raw water has a hardness in excess of 150 ppm. Where municipal water supplies are softened, an attempt is generally made to reduce the hardness to about 85 ppm.

Waters of widely differing degrees of hardness are found in southeastern Florida. The surface waters flowing into Lake Okeechobee are very soft, but surface waters in canals and streams south and east of Lake Okeechobee have a hardness ranging from about 100 to 400 ppm. Practically all ground waters are decidedly hard, ranging from about 150 to 500 ppm.

HYDROGEN SULFIDE

Hydrogen sulfide (H_2S) was not detected in any samples of surface water and was found in only a few samples of ground water. Therefore this constituent is not shown in the tables of analyses. Hydrogen sulfide is a gas that gives the characteristic odor to sulfur waters. It is formed during the decomposition of eggs and other organic materials that contain considerable sulfur. Hydrogen sulfide in ground waters is commonly believed to be formed by the reduction of sulfates.

Many ground waters in Florida carry small quantities of hydrogen sulfide, but it usually disappears quickly when the water is allowed to stand in an open vessel. Treatment for the removal of iron will insure the removal of hydrogen sulfide from most of these waters.

HYDROGEN-ION CONCENTRATION (pH)

The degree of acidity or alkalinity of a water, as indicated by the hydrogen-ion concentration (Clark, 1928), is of importance with reference to the corrosiveness and the proper treatment for coagulation at the water-treatment plant. The hydrogen-ion concentration is commonly reported as pH.

Technically, pH is the number of moles of ionized hydrogen per liter, or to put it more simply, it is a number denoting the degree of acidity or alkalinity. A pH value of 7.0 represents neutrality, which means that the water is neither acid nor alkaline. Values higher than 7.0 denote increasing alkalinity; values lower than 7.0 denote increasing acidity. Waters that have a pH of less than 7.0 are likely to be corrosive, while waters that have a pH of more than 7.0 are less likely to be corrosive. Other factors entering into chemical equilibrium, however, make it impossible to correlate corrosive characteristics of waters on the basis of pH alone.

Inasmuch as most of the surface and ground waters in southeastern Florida are decidedly hard and are, therefore, generally noncorrosive, pH was not determined on most of the samples. However, pH is reported for practically all of the public water supplies.

CORROSIVENESS

The corrosiveness of water is that property which makes the water aggressive to metal surfaces and frequently causes trouble by the appearance of "red-water." The disadvantages of iron in a water supply have been previously discussed. However, in addition to the trouble caused by iron in water, corrosion causes the deterioration of water pipes, steam boilers, and water-heating equipment. Many waters that do not appreciably corrode cold-water lines will aggressively attack hot-water lines, because raising the temperature of the water greatly increases its corrosivity. Corrosion of pipe lines, resulting in tuberculation (Alexander, 1940, p. 371-385), causes economic losses due to increased friction and loss of flow. Speller (1935), in his book on corrosion, presents a comprehensive inventory of available information on the general principles, causes, and prevention of corrosion. Oxygen, carbon dioxide, free acid, and acid-generating salts are the principal constituents in water that cause corrosion. A method has been developed by Langelier (1936, p. 1500-1521) for computing the corrosive tendency of a water, providing that the content of calcium and dissolved mineral matter, the total alkalinity, and the pH of the water are known.

In a general way, very soft waters tend to be corrosive and hard waters tend to be noncorrosive. Most of the soft waters in southeastern Florida are found in the Kissimmee River and in smaller streams to the north and west of Lake Okeechobee. Although no factual data are available, it is probable that these waters are corrosive to plumbing and boilers. Generally, the hard surface and ground waters to the south and east of Lake Okeechobee are not noticeably corrosive. Waters containing appreciable amounts of sea water, however, and waters in which sodium chloride is present in moderately large amounts, are likely to be corrosive.

Corrosion may be checked by protective coatings, by the addition of lime, soda ash, or other chemicals that adjust the pH, and by the addition of sodium hexametaphosphate, sodium silicate, or certain other chemicals.

CHEMICAL CHARACTER OF SURFACE WATERS

Surface waters that discharge into Lake Okeechobee from the north and west are soft, low in dissolved mineral matter, and highly colored. South and east of Lake Okeechobee, surface waters, which usually flow away from the lake, are variable in character but are usually hard, contain moderate to large amounts of dissolved mineral matter, and are also highly colored. The amount of dissolved matter in Lake Okeechobee is intermediate between the soft inflowing water to the north and west and the hard water flowing seaward to the south and east.

KISSIMMEE RIVER

Complete chemical analyses were made on 10-day composites of daily samples collected from the Kissimmee River at Harding Bridge on State Highway 70, about 10 miles west of the town of Okeechobee, for a period of a year ending February 28, 1941 (see table 82). The analyses show that there was little variation in concentration of any of the chemical constituents throughout the year. Dissolved solids ranged from 61 to 80 ppm. The Kissimmee River is the largest source of soft water in southern Florida. The hardness ranged from only 17 to 26 ppm during the period of record, and it is probable that the hardness seldom exceeds 30 or 35 ppm. The river water is, however, highly colored with organic matter, the color remaining practically constant at 110 through the year. Although the Kissimmee River is the largest tributary to Lake Okeechobee, the composition of the river water is very different from the composition of the lake water. An explanation will be presented in the section on Lake Okeechobee.

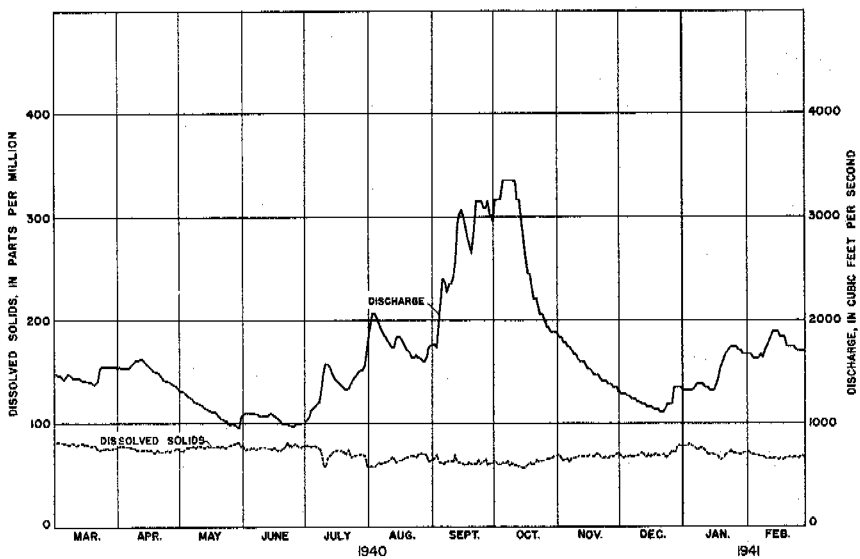

Figure 213. —Graph showing discharge and dissolved solids in the Kissimmee River near Okeechobee, 1940–41.

Table 82.—*Analyses, in parts per million, of water from the Kissimmee River near Okeechobee*

Date of collection	Mean discharge (cfs)	Color	Specific conductance (K x 10^5 at 25°C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1940																
Mar. 1-10	1,454	110	9.1	1.2	0.02	6.4	2.4	8.6	1.1	14	6.6	15	0.2	0.1	80	26
Mar. 11-20	1,410	110	8.9	1.3	.02	6.2	2.3	8.6	.6	15	6.5	14	.2	.1	79	25
Mar. 21-31	1,534	110	8.4	1.3	.02	6.0	2.2	8.4	.8	15	5.8	13	.2	.1	77	24
Apr. 1-10	1,560	110	8.1	1.5	.02	6.0	2.1	8.2	.6	15	5.3	13	.2	.1	76	24
Apr. 11-20	1,545	110	8.4	1.5	.04	5.9	1.7	8.6	.6	16	6.3	12	.2	.2	72	22
Apr. 21-30	1,384	110	8.3	1.4	.03	5.9	1.9	8.1	.6	15	6.5	12	.2	.2	73	23
May 1-10	1,242	110	8.6	2.0	.02	5.8	1.4	8.9	.5	16	6.7	12	.2	.2	76	20
May 11-20	1,113	110	8.7	1.6	.02	6.4	1.4	8.5	.6	14	7.2	12	.2	.2	76	22
May 21-31	1,011	110	9.2	1.3	.02	6.1	1.7	9.2	.6	15	7.6	13	.2	.2	79	22
June 1-10	1,088	110	8.9	1.7	.02	6.3	1.3	8.8	.5	15	7.2	14	.2	.2	76	21
June 11-20	1,050	110	8.8	1.6	.02	6.3	1.4	8.6	.7	15	7.4	12	.2	.2	76	22
June 21-30	989	110	9.1	2.2	.02	6.4	2.0	8.5	.6	15	8.1	13	.2	.2	79	24
July 1-10	1,232	110	8.1	1.6	.04	5.7	1.5	8.0	.7	15	6.3	12	.2	.2	73	20
July 11-20	1,429	110	7.6	1.6	.02	5.8	1.8	7.6	.6	14	8.6	12	.2	.2	72	22
July 21-31	1,505	110	7.2	3.3	.15	5.7	1.8	7.3	.8	14	4.8	9.5	.2	.2	66	22
Aug. 1-10	1,935	110	6.2	2.4	.13	5.2	1.6	6.6	.7	11	5.2	9.0	.2	.2	60	20
Aug. 11-20	1,765	110	6.5	2.7	.13	5.4	1.8	6.5	.7	12	4.6	10	.4	.2	64	21
Aug. 21-31	1,660	110	6.8	2.6	.12	5.6	1.9	6.6	.6	12	5.4	10	.2	.2	66	22
Sept. 1-10	2,178	110	6.2	2.7	.14	5.0	1.9	6.9	.6	11	4.9	9.0	.3	.1	62	20
Sept. 11-20	2,865	110	6.6	3.2	.02	5.1	1.6	4.6	.6	13	4.7	9.0	.1	.1	62	19
Sept. 21-30	3,087	110	6.6	3.4	.02	5.1	1.2	5.5	.6	13	4.3	9.5	.1	.0	63	18
Oct. 1-10	3,284	110	6.6	3.4	.02	4.8	1.4	5.8	.6	12	3.8	10	.1	.0	63	18
Oct. 11-20	2,753	110	6.6	2.5	.02	4.7	1.2	5.9	.6	12	3.8	9.5	.1	.2	61	17
Oct. 21-31	1,991	110	7.2	4.7	.02	5.0	1.6	6.6	.6	12	4.6	12	.1	.1	66	19
Nov. 1-10	1,741	110	7.8	2.2	.02	5.2	1.4	7.1	.7	13	4.9	12	.1	.0	69	19
Nov. 11-20	1,533	110	7.8	2.2	.02	5.2	1.7	7.1	.6	13	5.6	12	.1	.0	70	20
Nov. 21-30	1,380	110	8.2	1.9	.02	5.4	1.8	6.9	.8	12	6.0	13	.1	.1	70	21
Dec. 1-10	1,255	110	8.3	2.0	.02	5.4	1.6	7.0	.8	13	5.8	13	.1	.2	70	20
Dec. 11-20	1,158	100	8.6	1.8	.03	5.4	1.5	7.6	1.0	13	5.9	13	.1	.3	72	20
Dec. 21-31	1,241	100	9.4	3.4	.07	5.8	2.1	9.0	1.1	16	6.9	16	.1	.1	75	23

Table 82.—*Analyses, in parts per million, of water from the Kissimmee River near Okeechobee*—Continued

Date of collection	Mean discharge (cfs)	Color	Specific conductance (K x 10^5 at 25° C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941																
Jan. 1-10	1,347	110	10.1	3.3	0.07	5.6	2.1	10	1.0	16	7.1	17	0.1	0.1	80	23
Jan. 11-20	1,418	100	9.2	2.5	.05	5.5	2.0	9.0	1.2	15	6.3	16	.1	.4	71	22
Jan. 21-31	1,704	110	9.1	2.8	.07	5.3	1.8	9.4	1.0	15	6.3	16	.1	.1	73	21
Feb. 1-10	1,660	110	8.7	1.9	.04	5.4	1.8	8.6	1.1	15	5.1	15	.1	.2	70	21
Feb. 11-19	1,846	110	8.3	1.6	.03	5.0	1.7	8.2	1.1	13	5.5	14	.1	.2	67	19
Feb. 20-28	1,718	110	8.4	1.3	.05	5.2	1.8	8.0	1.2	14	5.4	14	.1	.2	69	20
Average	....	109	8.1	2.2	0.04	5.6	1.7	7.7	0.8	14	5.9	12	0.2	0.2	71	21

The range of dissolved solids in the samples analyzed during the year ending February 28, 1941, together with the daily discharge is shown in figure 213.

OTHER STREAMS CONTRIBUTING TO LAKE OKEECHOBEE

In addition to the Kissimmee River, the principal streams that flow into Lake Okeechobee are Fisheating Creek, Indian Prairie Canal, and Taylor Creek. Analyses of samples collected at irregular intervals from these streams indicate that Fisheating and Taylor Creeks are similar in composition to the Kissimmee River. (See table 101.) A single sample collected from Indian Prairie Canal contained considerably more dissolved matter than samples collected from the other two streams. Color in samples collected from three streams ranged from 180 to 380, whereas color in the Kissimmee River averaged 110.

LAKE OKEECHOBEE AND PRINCIPAL OUTFLOW CANALS

LAKE OKEECHOBEE

It would be reasonable to suppose that the composition of the water in Lake Okeechobee would be similar to the composition of the inflowing water. Actually, however, the concentration of dissolved matter in the lake is about three times as great as the concentration in the major tributary streams, and the hardness is about five to seven times as great as that of the inflowing water.

In order to study the composition of the water in different parts of Lake Okeechobee two series of samples were collected (fig. 214). The first series of samples was collected in July 1940, and the second series of samples was collected in March 1941, corresponding to a low stage and a relatively high stage, respectively (see table 83). Analyses of both series of samples show that the composition of the lake water during each of the two sampling periods was fairly uniform. An exception was observed in the 1941 series at sampling stations 59 and 60 near the mouth of the Kissimmee River. At these stations the concentration of dissolved solids in the lake water was lowered by the very dilute water from the river. In the 1940 samples, dissolved solids ranged from 189 to 207 ppm and hardness ranged from 134 to 148 ppm. In the 1941 samples, dissolved solids and hardness ranged from 167 to 197 and from 124 to 144 ppm, respectively, not including the results for samples collected near the Kissimmee River.

Several explanations have been advanced for the large difference in concentration of dissolved matter ordinarily found in the lake and the concentration found in the main tributary streams. It has

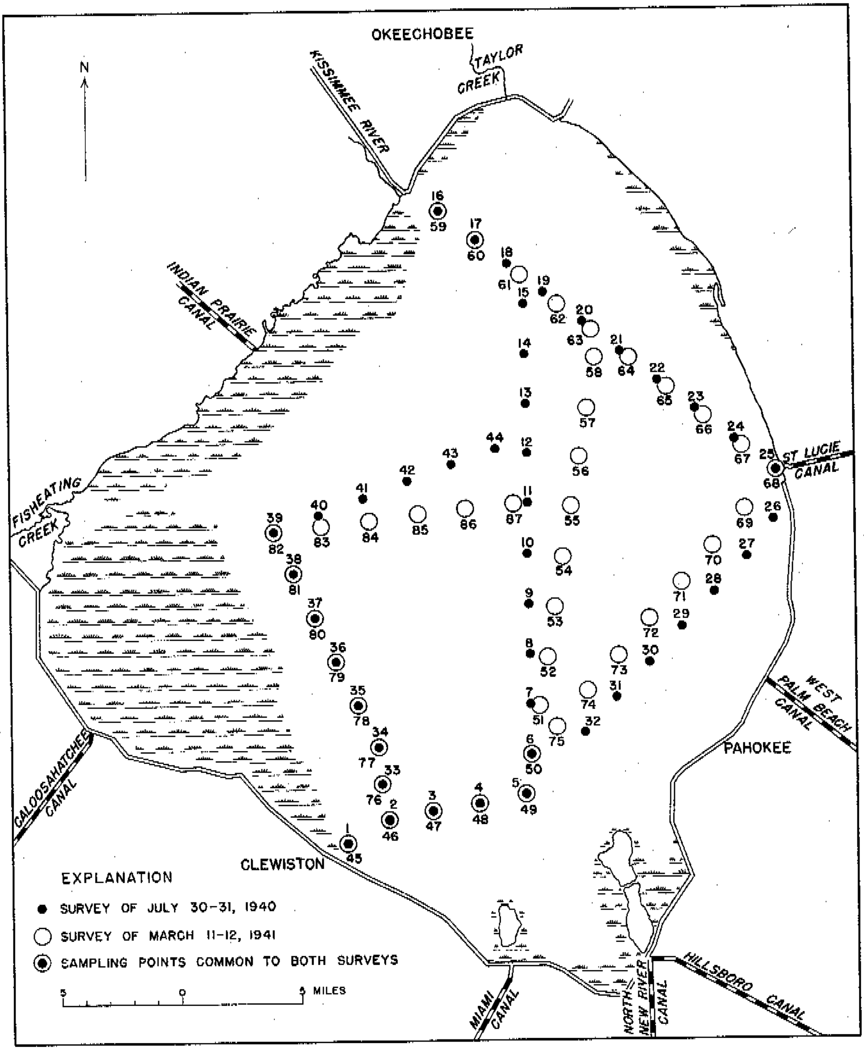

Figure 214. —Location of sampling stations in Lake Okeechobee.

been suggested that it is a result of springs in the bottom of the lake that contain much larger quantities of dissolved matter than is found in the inflowing water. If this were true, it is probable that the water near the springs would be more concentrated than at some distance from them. Analyses of surface and bottom samples from over 40 points in the lake did not support such an explanation.

Another view is that the high concentration of dissolved mineral matter in water discharged into the lake during short rainy periods from the Hillsboro and North New River Canals (and at times from the West Palm Beach Canal), may account for the increase in the concentration of dissolved matter in Lake Okeechobee. It is true that these canal waters are rather highly mineralized at certain times during the year. High and variable concentrations in the Hillsboro Canal have caused the town of Belle Glade much trouble in treating its public water supply during periods that the canal discharges into the lake. However, the amount of water discharged into the lake from these canals is relatively small and is considered to be insufficient to account for the concentrations of dissolved matter found in the lake.

Still another factor to be considered is the concentration resulting from evaporation. Tremendous quantities of water are evaporated from the lake during the course of a year. Measurements show that evaporation ranges from about 40 to 45 in. per year. Precipitation averages about 50 to 55 in. Hence, evaporation is more than counterbalanced by precipitation. Evaporation cannot, therefore, account for any large increase in concentration of dissolved solids in the lake.

The most probable explanation for the concentration of dissolved matter in Lake Okeechobee seems to be as follows:

The inflowing water is normally low in concentration because the rivers and creeks drain sandy soil which is relatively insoluble. When the water enters the lake it soon comes in contact with shell marls or other limestone formations, which are known to lie at or very near the surface of the ground over much of the area covered by the lake. The lake is very shallow even at the highest stages. The deeper parts of the lake are little more than 15 ft deep and the average is much less. As a result of its shallow depth, the surface of the lake is quickly affected by winds, and agitation of the water throughout probably takes place during relatively short periods of moderate wind velocities. The water becomes very turbid during storm periods and has noticeable turbidity even during extended periods of relative calm. The almost constant motion of the water brings it in ever-changing contact with the shell marls on the bottom of the lake; this facilitates solution of the calcium carbonate, thereby increasing the concentration of dissolved matter in the lake. Organic matter, growing, dying, and finally decaying on the lake bottom, also promotes solution of the limestone. It may be that this organic matter and the carbon dioxide dissolved from the air effectively controls the maximum concentration of dissolved matter, which is principally calcium carbonate.

Analyses of samples collected from Kissimmee River, Fisheating Creek, and Lake Okeechobee are shown graphically in figure 215.

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Table 83.—*Analyses, in parts per million, of water from Lake Okeechobee*

Date of collection	Station[1]	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
July 30, 1940	1	45	43.1	......	......	......	145	34	45	......	......	......
Do.	2	40	37.6	41	11	22	138	27	38	0.4	207	148
Do.	3	40	37.1	......	......	......	132	23	38	......	......	......
Do.	4	40	36.7	......	......	......	130	27	37	......	......	......
Do.	5	45	36.8	......	......	......	131	26	37	......	......	......
Do.	6	45	36.5	......	......	......	131	24	37	......	......	......
Do.	7	45	36.5	40	10	22	132	27	37	.8	202	141
Do.	8	45	35.8	......	......	......	131	26	36	......	......	......
Do.	9	45	36.7	......	......	......	130	26	38	......	......	......
Do.	10	45	36.6	......	......	......	130	26	38	......	......	......
Do.	11	50	36.2	......	......	......	131	23	37	......	......	......
Do.	12	50	36.2	41	11	20	134	27	37	.8	203	148
Do.	13	50	36.9	......	......	......	133	23	38	......	......	......
Do.	14	50	36.7	......	......	......	133	23	37	......	......	......
Do.	15	50	36.2	......	......	......	130	23	37	......	......	......
Do.	16	45	37.0	40	10	22	131	27	38	.2	202	141
Do.	17	45	36.1	......	......	......	131	26	38	......	......	......
Do.	18	45	37.0	......	......	......	133	23	37	......	......	......
Do.	19	45	36.4	......	......	......	131	25	36	......	......	......
Do.	20	45	36.5	......	......	......	130	23	37	......	......	......
Do.	21	45	36.4	40	9.9	22	131	27	37	.6	201	141
Do.	22	45	36.5	......	......	......	130	23	38	......	......	......
Do.	23	40	35.7	......	......	......	128	22	36	......	......	......
Do.	24	45	35.0	......	......	......	125	23	35	......	......	......
Do.	25	45	34.5	38	9.6	20	122	25	36	.4	189	134
Do.	26	45	35.0	......	......	......	124	25	35	......	......	......
Do.	27	45	35.9	......	......	......	128	25	36	......	......	......
Do.	28	50	36.3	......	......	......	132	26	36	......	......	......
Do.	29	45	36.2	41	11	17	131	26	36	.2	196	148
Do.	30	40	36.2	......	......	......	129	24	37	......	......	......
Do.	31	40	36.3	......	......	......	130	26	37	......	......	......
Do.	32	40	36.8	......	......	......	128	25	37	......	......	......

July 31, 1940	33	40	37.0				132	23	38			
Do	34	45	36.4				134	28	37			
Do	35	40	36.3	40	10	20	131	24	37	.2	196	141
Do	36	40	36.4				131	25	37			
Do	37	40	36.8				131	23	37			
Do	38	40	36.6				131	25	37			
Do	39	40	37.7	41	11	20	132	27	39	.4	203	148
Do	40	40	36.9				132	23	37			
Do	41	40	36.7				132	23	38			
Do	42	40	37.6	41	11	19	130	27	39	.2	201	148
Do	43	45	36.1				129	26	38			
Do	44	45	36.0				130	25	37			
Mar. 11, 1941	45		35.0				124	25	33			
Do	46	50	33.7	38	11	17	121	29	33	.4	188	140
Do	47	80	33.0				119	27	34			
Do	48	60	33.0				120	20	33			
Do	49	60	33.3	38	11	16	120	28	33	.5	186	140
Do	50	65	33.8				119	20	34			
Do	51	60	33.3				122	28	33			
Do	52	70	33.5				121	18	33			
Do	53	60	34.2				123	29	34			
Do	54	75	33.9	37	10	19	120	26	34	.7	186	133
Do	55	65	33.7				121	24	34			
Do	56	70	33.7				120	22	33			
Do	57	65	32.5				115	20	32			
Do	58	60	33.7				122	20	34			
Do	59	120	13.3	15	5.5	5.5	38	16	17	.2	78	60
Do	60	110	23.3				76	13	25			
Do	61	100	27.3				104	15	27			
Do	62	100	28.3				107	17	27			
Do	63	100	30.4	34	9.4	15	108	25	30	.2	167	124
Do	64	80	33.2				118	22	33			
Do	65	70	35.3				122	23	36			
Do	66	65	37.3				127	23	39			
Do	67	75	36.1				124	25	37			
Do	68	85	33.6	36	10	20	120	25	35	.2	186	131
Do	69	80	39.9				134	25	43			
Do	70	65	39.5				134	23	41			

Table 83.—*Analyses, in parts per million, of water from Lake Okeechobee*—Continued

Date of collection	Station[1]	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
Mar. 11, 1941												
Do..........	71	70	36.8	......	......	......	126	24	37	......	......	......
Do..........	72	75	36.0	38	12	19	126	28	37	1.0	197	144
Do..........	73	75	34.2	......	......	......	122	22	33	......	......	......
Do..........	74	70	33.3	......	......	......	122	22	33	......	......	......
Do..........	75	70	33.2	......	......	......	122	22	33	......	......	......
Mar. 12, 1941	76	90	32.1	......	......	......	116	23	31	......	......	......
Do..........	77	100	31.2	......	......	......	117	23	31	......	......	......
Do..........	78	90	31.8	32	12	16	112	25	33	.6	174	129
Do..........	79	75	32.1	......	......	......	119	24	33	......	......	......
Do..........	80	80	32.1	......	......	......	117	22	32	......	......	......
Do..........	81	95	31.8	......	......	......	117	20	32	......	......	......
Do..........	82	100	29.3	......	......	......	106	22	29	......	......	......
Do..........	83	90	30.9	30	12	17	116	24	29	.3	170	124
Do..........	84	80	31.9	......	......	......	115	18	31	......	......	......
Do..........	85	90	33.0	36	11	20	124	28	33	.4	190	135
Do..........	86	70	33.0	......	......	......	119	20	32	......	......	......
Do..........	87	75	32.1	......	......	......	117	23	33	......	......	......

[1] Numbers refer to locations of sampling stations in figure 214.

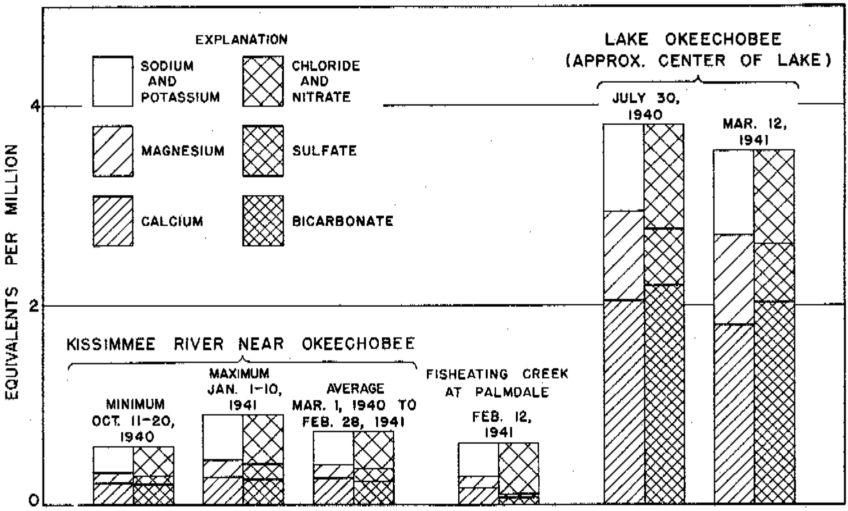

Figure 215.—Graph showing analyses of waters of the Kissimmee River, Fisheating Creek, and Lake Okeechobee.

ST. LUCIE CANAL

Daily samples were collected from the St. Lucie Canal about 200 ft from Lake Okeechobee during the 2-year period ending February 28, 1942 (table 84). Inasmuch as there is no tributary to Lake Okeechobee near the St. Lucie Canal, it is believed that the composition of the water flowing from the lake into the canal is fairly representative of the composition of the main body of the lake during a large part of the time. Analyses of 10-day composites of the daily samples show that dissolved solids ranged from 142 to 297 ppm, and that hardness ranged from 102 to 163 ppm during the period of record. The dissolved mineral matter consists chiefly of calcium and bicarbonate as well as relatively large amounts of sodium, sulfate, and chloride. Color ranged from 35 to 130 and averaged about 50, which is about one-half that of the color found in the Kissimmee River.

Table 84.—*Analyses, in parts per million, of water from St. Lucie Canal at lock 1, Lake Okeechobee*

Date of collection	Mean discharge (cfs)	Color	Specific conductance (K x 10^5 at 25 C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1940																
Mar. 1-10	488	45	35.2	8.7	0.03	36	9.2	25	1.8	128	27	36	0.2	0.1	227	128
Mar. 11-20	764	45	32.8	6.7	.04	35	8.4	22	1.8	121	23	34	.4	.1	211	122
Mar. 21, 24-31	1,406	45	34.1	8.2	.08	35	8.9	24	1.6	123	25	35	.2	.1	220	124
Apr. 1-10	3,554	50	36.0	11	.05	39	9.3	24	1.9	132	23	35	.2	.6	226	136
Apr. 11-20	4,007	50	35.0	9.0	.05	39	9.0	23	2.3	132	22	32	.2	.6	220	134
Apr. 21-30	3,618	45	36.0	8.6	.05	40	9.1	24	1.9	134	23	33	.2	.6	225	137
May 1-3, 5-10	3,263	45	36.3	9.0	.04	40	9.3	25	2.1	132	24	35	.2	.6	230	138
May 11-20	595	45	34.9	8.1	.08	39	9.1	23	1.7	132	23	35	.2	.6	225	135
May 21-31	62	45	36.6	7.9	.06	40	9.5	25	1.8	132	24	35	.4	.6	230	139
June 1-10	422	45	35.5	9.9	.05	38	9.1	24	1.7	128	24	35	.2	.6	227	132
June 11-20	2,206	50	33.7	9.8	.07	36	8.6	23	1.8	119	22	33	.2	.5	215	125
June 21-28, 30	2,534	45	35.9	8.6	.05	38	9.2	24	1.9	125	25	36	.4	.3	229	133
July 1-10	1,411	45	35.2	8.0	.05	38	9.0	24	1.6	125	24	35	.4	.4	224	132
July 11-13, 15-20	131	45	35.9	8.2	.10	39	9.2	24	2.1	128	26	36	.2	.5	227	135
July 21-31	293	50	35.4	8.5	.08	38	9.0	24	1.9	125	24	36	.2	.6	226	132
Aug. 1-10	402	45	35.1	14	.06	38	8.9	25	2.1	126	24	35	.2	.6	229	131
Aug. 11-20	441	45	34.4	7.6	.08	37	8.6	24	1.9	122	24	34	.4	.4	217	128
Aug. 21-31	50	50	31.7	4.9	.08	34	7.9	22	2.0	111	23	31	.1	.3	201	117
Sept. 1-10	1,523	55	36.4	7.2	.05	36	9.1	24	1.6	126	24	36	.3	.4	219	127
Sept. 11-18	3,438	70	42.5	10	.08	41	11	30	2.0	146	30	45	.4	.6	270	148
Sept. 21-30	3,502	70	46.7	12	.05	44	13	34	1.9	160	34	49	.4	.6	297	163
Oct. 1-10	3,858	45	41.3	9.6	.05	42	11	26	2.1	146	29	42	.2	.2	257	150
Oct. 11-20	3,731	40	38.2	9.1	.06	41	9.6	24	2.1	142	26	37	.3	.3	236	142
Oct. 21-31	1,865	35	37.3	8.1	.02	40	9.7	25	1.2	137	24	35	.1	.6	231	140
Nov. 1-10	1,258	35	38.8	8.0	.01	41	10	25	1.0	142	24	36	.1	.7	239	143
Nov. 11-16	275	35	38.6	9.4	.01	41	10	25	1.1	142	24	35	.1	.6	241	143
Nov. 26-30	496	35	38.2	6.2	.05	40	9.7	25	1.4	137	24	36	.2	1.0	238	140
Dec. 1-10	1,178	40	38.6	6.2	.03	40	10	25	1.0	139	26	35	.2	.9	243	141

Dec. 11-17	528	40	38.1	6.3	.02	40	10	24	1.0	136	25	35	.2	.6	232	141
Dec. 23-31	59	45	37.1	9.6	.04	41	10	24	1.0	136	25	34	.2	.8	237	143
1941																
Jan. 1-10	303	45	38.4	11	.04	40	10	25	1.0	137	25	36	.2	1.0	243	141
Jan. 11-20	233	45	37.9	11	.04	41	9.9	24	1.1	140	24	35	.2	1.2	244	143
Jan. 21-31	1,909	70	42.8	12	.12	42	12	31	1.4	144	28	44	.2	2.2	278	154
Feb. 1-10	3,157	55	42.0	8.6	.03	42	11	30	2.2	144	30	43	.2	1.0	263	150
Feb. 11-19	2,788	55	38.1	9.5	.04	39	9.4	26	2.0	135	24	38	.2	1.1	239	136
Feb. 20-28	2,718	50	44.7	11	.03	44	12	32	2.5	155	31	45	.2	2.1	282	159
Average	....	47	37.4	8.9	0.05	39	9.7	25	1.7	134	25	37	0.2	0.7	236	137
1941																
Mar. 1-10	2,620	65	38.3	....	....	38	10	24		128	27	39	....	.6	202	136
Mar. 11-20	2,476	100	37.3	....	....	38	10	26		132	26	41	....	.6	207	136
Mar. 21-31	665	90	38.5	....	....	38	11	26		136	28	40	....	.6	211	140
Apr. 1-10	652	75	37.7	....	....	36	10	28		138	23	38	....	2.0	205	131
Apr. 11-20	3,311	90	38.4	....	....	32	13	28		131	27	41	....	.6	206	133
Apr. 21-30	3,404	130	32.3	....	....	32	10	23		118	27	33	....	.7	184	121
May 1-10	3,427	50	34.0	....	....	34	9.0	23		121	21	36	....	.3	184	122
May 11-20	3,357	50	34.2	....	....	35	8.7	20		120	20	34	....	.3	177	123
May 21-31	3,025	80	34.3	....	....	35	9.2	22		126	20	35	....	.3	184	125
June 1-10	186	90	30.8	....	....	32	9.3	17		114	17	31	....	.3	163	118
June 11-20	36	60	30.8	....	....	32	9.1	18		114	20	30	....	.3	166	117
June 21-30	77	60	33.0	....	....	35	8.7	20		120	20	33	....	.3	176	123
July 1-10	410	45	32.4	....	....	35	8.5	18		115	21	32	....	.5	172	122
July 11-20	1,435	45	34.3	....	....	36	9.0	20		120	23	34	....	.6	182	127
July 21-31	3,309	60	29.2	....	....	30	7.0	19		104	18	29	....	.3	154	104
Aug. 1-10	3,631	80	28.1	....	....	29	6.9	18		99	18	28	....	.2	149	102
Aug. 11-20	3,569	60	30.8	....	....	32	8.6	17		111	19	30	....	.2	162	115
Aug. 21-31	3,495	70	27.9	....	....	29	7.6	14		98	17	26	....	.2	142	104
Sept. 1-10	3,345	65	32.2	....	....	33	9.3	17		113	21	31	....	.2	167	121
Sept. 11-20	1,470	60	32.9	....	....	33	8.6	21		117	22	32	....	.2	174	118
Sept. 21-30	3,483	70	36.9	....	....	36	10	24		127	25	38	....	.6	196	131
Oct. 1-10	2,695	100	42.2	....	....	40	13	25		144	27	43	....	1.0	220	153
Oct. 11-20	1,449	70	38.2	....	....	39	11	24		136	26	39	....	.4	206	143
Oct. 22-31	3,383	65	33.9	....	....	34	9.7	19		118	22	33	....	.2	176	125
Nov. 1-7	3,884	100	27.0	....	....	30	7.4	14		99	15	27	....	.2	142	105
Nov. 8-20	3,482	90	30.8	....	....	32	8.1	19		110	19	32	....	.5	165	113

Table 84.—*Analyses, in parts per million, of water from St. Lucie Canal at lock 1, Lake Okeechobee*—Continued

Date of collection	Mean discharge (cfs)	Color	Specific conductance (K x 10[5] at 25 C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941																
Nov. 21-30	559	100	35.3	....	....	36	8.8	25		126	24	36	....	0.5	192	126
Dec. 1-10	824	70	36.5	....	....	38	11	21		130	26	37	....	.4	197	140
Dec. 11-20	464	70	37.4	....	....	38	11	23		133	28	37		.4	203	140
Dec. 21-31	732	70	36.6	....	....	38	11	22		130	27	37	....	.4	199	140
1942																
Jan. 1-10	386	70	33.2	....	......	35	9.2	24		123	25	35	....	.4	189	125
Jan. 11-20	573	90	36.5	....	......	38	12	20		133	26	37	....	.4	199	144
Jan. 21-31	311	60	34.5	....	......	35	9.4	23		124	26	33	....	.3	188	126
Feb. 1-9	1,723	70	34.2	....	......	36	8.7	23		124	26	33	....	.3	188	126
Feb. 10-20	600	70	33.8	....	....	34	9.2	22		122	23	33	....	.2	182	123
Feb. 21-28	997	70	32.8	....	....	33	9.1	24		124	22	33	....	.1	182	120
Average	....	74	34.1	....	....	35	9.5	21		122	23	34	....	0.4	183	126

CALOOSAHATCHEE CANAL

Analyses of daily samples collected from the Caloosahatchee Canal at Moore Haven show that the water discharging from Lake Okeechobee at this point is variable in composition (see table 85). At times, the concentration of dissolved matter is similar to that in the main body of the lake, while at other times the concentration drops until it is little more than that found in the main tributary streams. Investigation showed that water discharging through the locks at Moore Haven does not come directly from Lake Okeechobee, instead, it comes from the deep floodway channel just inside the levee to the northwest and southeast of Moore Haven. Directly in front of the canal entrance is a dense growth of saw grass, covering several square miles, which effectively prevents discharge direct from the lake. A series of samples was collected from the floodway channel on October 27, 1941. Analyses of these samples (see table 86) show that the concentration of dissolved matter was progressively smaller north of Moore Haven and that it approached the low concentration found in the water in Fisheating Bay. They show also that samples collected from the channel southeast of Moore Haven contained about as much dissolved matter as is normally found in the main body of the lake.

It appears, therefore, that the water discharged from Lake Okeechobee into the Caloosahatchee Canal is composed of water from the lake, flowing through the floodway channel from the southeast, and of water from Fisheating Creek, flowing through the channel from the north, without mixing to an appreciable extent with water in the main body of the lake. Variations in the composition of the canal water are caused by changes in lake stage, direction of the wind, the amount of water discharging from Fisheating Creek, and, to some extent, the operation of the locks.

The ranges in concentration of dissolved mineral matter in samples collected from the Caloosahatchee and St. Lucie Canals are shown graphically in figure 216.

Table 85.—*Analyses, in parts per million, of water from Caloosahatchee Canal at Moore Haven*

Date of collection	Mean discharge (cfs)	Color	Specific conductance (K x 10⁵ at 25 C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and Potassium (Na) + (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941															
Mar. 4-10	3,971	90	33.5	......	......	36	9.0	19	118	26	31	......	0.6	180	127
Mar. 11-20	3,773	95	32.8	......	......	38	10	17	117	29	33	......	.3	198	136
Mar. 21-22, 27-28	......	95	32.2	......	......	32	10	21	118	23	32	......	.2	176	121
Apr. 1-10	......	100	41.4	......	......	47	10	24	144	35	39	......	.6	227	158
Apr. 11-20	......	120	29.9	......	......	35	7.5	14	104	22	28	......	.4	158	118
Apr. 21-30	4,062	120	33.1	......	......	34	9.8	24	118	29	34	......	2.0	191	125
May 1-10	3,503	70	34.0	......	......	36	9.2	21	121	25	34	......	.3	185	128
May 11-20	......	70	33.5	......	......	35	9.2	19	114	24	33	......	.3	177	125
May 21-31	......	60	34.2	......	......	34	8.7	21	116	21	35	......	.3	177	121
June 1-10	......	50	31.6	......	......	32	8.7	19	108	20	34	......	.3	167	116
June 11-20	......	45	31.6	......	......	30	8.6	22	110	20	33	......	.2	168	110
June 21-22, 26-30	......	50	30.5	......	......	28	8.1	21	103	17	33	......	.2	158	103
July 1-10	......	140	19.2	......	......	21	4.2	11	68	9.1	20	......	.7	100	70
July 11-20	......	200	19.3	......	......	23	3.6	11	72	13	16	......	.8	104	72
July 21-31	3,655	170	24.6	......	......	28	5.8	13	90	18	21	......	.4	130	94
Aug. 2-10	3,940	180	30.2	......	......	32	7.8	18	105	25	27	......	.4	162	112
Aug. 11-20	......	200	24.7	......	......	26	6.9	12	85	17	22		.4	126	93
Aug. 21-31	......	240	13.0	......	......	14	3.1	6.1	45	5.2	13	......	.4	64	48
Sept. 1-10	......	240	8.0	......	......	8.1	1.8	4.3	27	1	9.5	......	.5	38	28
Sept. 11-20	......	180	9.2	......	......	......	......	......	32	3.9	10	......	......	......	......
Sept. 21-29	3,096	110	23.3	......	......	24	6.4	9.8	81	12	20	......	.6	113	86
Oct. 5-20	......	190	13.8	......	......	14	3.4	6.9	45	1.4	18	......	.2	66	49
Oct. 21-31	3,975	110	27.9	......	......	30	7.5	13	98	16	26	......	.4	141	106
Nov. 1-10	3,976	80	33.4	......	......	36	9.2	16	114	23	32	......	.4	173	128
Nov. 11-20	......	100	30.6	......	......	31	7.9	19	104	20	31	......	.4	160	110
Nov. 21-30	......	90	38.1	......	......	40	9.9	23	133	28	37	......	.5	204	141
Dec. 2-10	......	70	42.4	......	......	46	12	22	154	30	39	......	.4	225	164
Dec. 12-20	......	70	43.7	......	......	47	12	25	159	32	41	......	.5	236	167
Dec. 21-25	......	70	43.0	......	......	45	12	26	153	33	41	......	.4	233	162

1942															
Jan. 7-10	....	70	39.7	....	......	41	13	20	143	30	36	....	.4	211	156
Jan. 11-19	....	60	38.9	....	......	38	11	27	143	25	39	....	.4	211	140
Jan. 22-31	....	90	32.4	....	......	30	7.6	25	114	19	34	....	.2	172	106
Feb. 1-10	....	110	26.6	....	......	26	6.1	18	88	16	29	....	.1	138	90
Feb. 11-20	....	90	27.4	....	......	28	7.1	18	97	15	30	....	.1	146	99
Feb. 21-27	....	60	32.6	....	......	33	8.2	23	128	15	33	....	.1	175	116
Average	....	111	29.7	....	......	32	8.0	18	107	20	30	....	0.4	161	113

Table 86.—*Analyses of water from Lake Okeechobee floodway channel near Moore Haven, October 27, 1941*

[Constituents in parts per millions]

Station	Distance of source from Moore Haven[1] (miles)	Sample	Color	Specific conductance (K x 10^5 at 25 C)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)
1	0	Composite	100	28.6	98	15	29
2	2 NW.	Surface	140	17.0	50	10	20
		Bottom	140	17.8	56	10	20
3	4 NW.	Surface	140	16.6	49	10	21
		Bottom	140	16.8	49	9	20
4	5.5 NW.	Surface	150	16.7	49	10	20
		Bottom	160	16.8	49	12	20
5	7.5 NW.	Surface	160	15.3	42	10	20
		Bottom	160	17.6	50	11	21
6	9 NW.	Surface	120	22.7	71	14	25
		Bottom	130	20.4	61	12	23
7	11 NW.	Surface	95	25.5	84	14	27
		Bottom	100	25.1	82	14	27
[2]8	10 NW.	Composite	240	6.2	10	1	13
9	2 SE.	Surface	70	38.5	140	27	35
		Bottom	70	38.6	140	26	35
10	4.5 SE.	Surface	75	43.4	153	34	39
		Bottom	80	45.3	163	38	39

[1] Distance measured along floodway channel.
[2] Near mouth of Fisheating Creek.

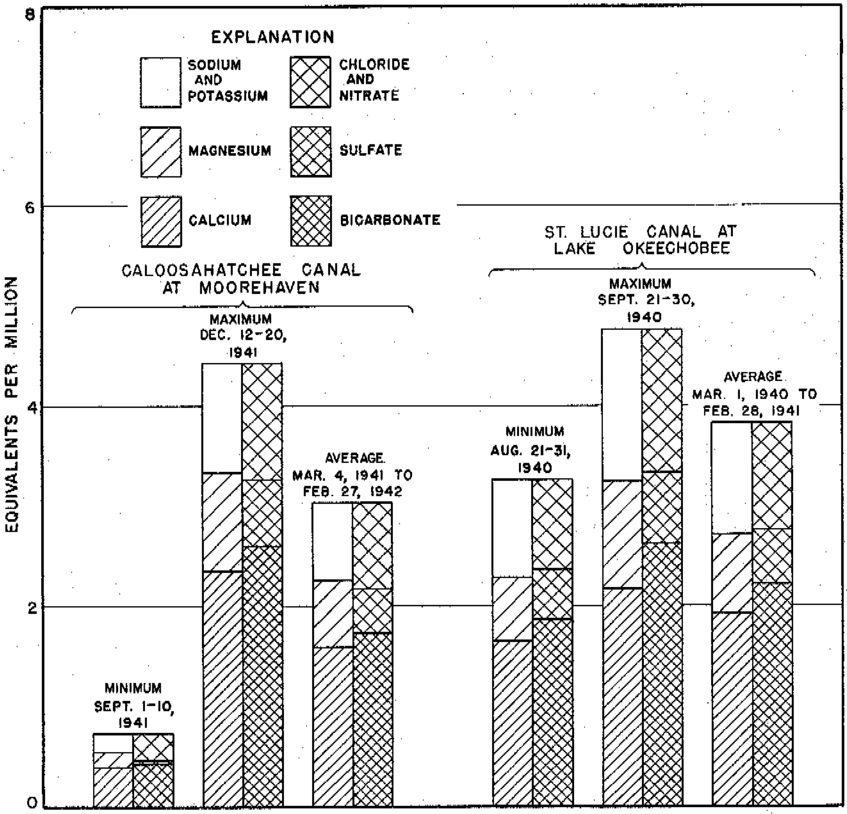

Figure 216.—Graph showing analyses of waters from Caloosahatchee and St. Lucie Canals.

MAJOR EVERGLADES DRAINAGE CANALS

WEST PALM BEACH CANAL

Samples were collected from West Palm Beach Canal at irregular intervals except for those collected monthly at the gaging station at West Palm Beach beginning in March 1941 (table 87).

The composition of water in the West Palm Beach Canal varies over a rather wide range, depending on the amount of rainfall in the area, the operation of large drainage pumps, and the point at which the samples are taken. Two series of samples were collected from the canal at points about 5 miles apart between Canal Point and West Palm Beach (see table 88). In the series collected on July 31, 1940, the hardness ranged from 124 to 471 ppm, and in the series collected on March 14, 1941, the hardness ranged from 158 to 281 ppm. The composition of the water at Canal Point was essentially the same as that of Lake Okeechobee, but at points 5 to 20 miles southeast of Canal Point the concentration of dissolved

Table 87.—*Analyses, in parts per million, of water from West Palm Beach Canal at West Palm Beach*

Date of collection	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941											
Mar. 14	220	75.0	54	19	75	224	42	105	....	405	213
Apr. 2	140	89.1	67	25	90	259	69	127	4.0	510	270
Apr. 23	170	75.8	60	20	76	230	53	107	2.0	431	232
May 21	190	87.2	65	25	84	258	56	125	2.0	484	265
July 17	220	17.4	20	2.5	13	73	6.2	16	.0	94	60
Aug. 21	280	41.3	40	11	30	144	20	50	.4	222	145
Sept. 19	280	42.6	36	9.4	36	137	16	54	3.1	222	128
Oct. 23	160	24.1	27	5.8	14	102	7.0	22	.2	76	91
Nov. 26	130	67.9	51	13	72	196	32	101	2.0	400	181
Dec. 26	130	86.4	57	18	98	233	42	138	1.2	469	216
1942											
Jan. 22	110	71.4	57	17	72	230	34	103	.4	392	212
Feb. 19	130	70.6	54	17	73	221	36	103	.5	392	205
Apr. 8	180	77.1	58	18	80	230	49	108	1.0	427	218
May 7	180	67.3	51	15	69	200	30	101	.4	366	189
June 4	140	18.0	19	3.6	15	61	14	22	.2	104	62
July 9	240	23.7	22	4.6	19	94	5.8	22	.1	120	74
Aug. 7	280	79.1	58	20	76	245	34	110	.4	419	226
Sept. 3	200	71.0	57	18	60	207	31	101	1.2	370	216
Oct. 8	80	79.9	55	18	84	212	47	121	1.2	431	212
Nov. 11	150	101	67	25	103	252	67	153	1.6	541	270
Dec. 10	65	91.3	56	19	105	214	50	154	2.2	492	218
1943											
Jan. 7	75	85.2	56	17	99	211	50	141	1.5	468	210
Feb. 4	60	75.5	54	16	77	194	45	115	.6	403	201
Mar. 4	65	78.4	59	16	79	210	46	116	.7	420	213
Apr. 1	42	60.6	56	14	47	188	36	77	.6	323	198
May 5	50	68.4	59	16	58	200	40	94	.8	366	213
June 2	55	74.5	58	16	72	206	41	110	.2	399	210
July 7	160	110	88	28	108	320	70	158	13	623	334
Aug. 5	180	70.7	63	17	56	218	39	92	1.4	376	227
Sept. 2	190	51.8	46	12	41	160	25	68	.4	271	164
Oct. 7	160	29.4	34	6.6	12	98	10	33	.3	144	112
Nov. 2	58	67.7	52	16	63	184	37	102	.8	361	196
Nov. 30	120	85.6	54	17	101	222	36	145	1.0	463	205
Dec. 31	95	107	62	22	132	252	58	188	.8	587	245
1944											
Jan. 31	70	85.7	59	17	97	220	49	138	1.0	469	217
Mar. 1	70	84.6	60	18	89	204	53	138	1.5	460	224
Mar. 31	65	88.8	62	17	100	222	54	144	1.5	488	224
May 3	55	64.3	57	13	60	196	37	89	.4	353	196
May 31	30	51.0	53	12	35	178	28	58	.4	274	182
July 1	70	105	60	20	133	272	49	175	.2	571	232
1945											
May 26	70	77.8	52	16	83	202	38	121	.0	410	196
Sept. 22	320	21.5	24	5.9	6.0	82	8	15	1.3	101	84

solids increased rapidly. The increase appears to have resulted from mixing with concentrated drainage waters that are discharged into the canal by large pumps. These pumps are located on ditches that are used to drain large areas planted with sugar cane. Analyses of samples of water collected from three of these drainage ditches show that the waters contain large quantities of dissolved

Table 88.—*Analyses, in parts per million, of water from West Palm Beach Canal from Canal Point to West Palm Beach*

Distance of source from Canal Point (miles)	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
July 31, 1940											
0	55	37.8	......	......	......	146	22	37	......	......	150
5	360	177	......	......	......	450	128	252	......	......	471
10	380	93.7	......	......	......	240	56	149	......	......	237
15	280	48.1	......	......	......	133	36	68	......	......	124
20	190	69.9	......	......	......	154	46	116	......	......	150
25	210	88.0	......	......	......	260	53	126	......	......	231
30	140	66.9	......	......	......	175	40	98	......	......	......
35	140	65.6	......	......	......	177	38	97	......	......	147
40	95	55.0	......	......	......	169	30	72	......	......	138
March 14, 1940											
0	80	42.1	42	13	27	141	37	45	......	234	158
5	180	102	62	28	115	292	62	153	......	564	270
10	190	89.0	66	27	80	236	84	119	......	492	276
15	220	87.8	62	26	83	248	62	123	......	478	262
20	260	74.7	54	21	70	224	43	103	......	401	221
25	200	66.6	52	17	60	196	43	89	......	358	200
30	280	92.4	68	27	90	274	78	121	......	519	281
35	260	81.4	52	21	88	234	45	119	......	440	216
40	230	72.5	54	20	64	216	39	98	......	381	217

mineral matter, and are particularly high in bicarbonate (table 101). Bicarbonate ranged from 632 to 728 ppm and hardness from 605 to 843 ppm. The waters were also highly colored, the color ranging from 280 to 440.

It has been observed that high concentrations of dissolved matter in the West Palm Beach Canal in the vicinity of Canal Point may be expected during rainy periods. This is probably accounted for largely by the increased discharge of the drainage pumps during periods of high water. When the normal direction of flow toward the ocean is reversed toward Lake Okeechobee the high color of the water flowing into the lake frequently interferes with the operation of the plant that furnishes water from Lake Okeechobee to the town of Canal Point.

Analyses of samples collected about once a month from the West Palm Beach Canal at West Palm Beach from March 1941 to July 1944 (table 87) indicate that the concentration of dissolved matter at the sampling station ranged between rather wide limits. The minimum observed concentration of dissolved solids was 76 ppm in October 1941 and the maximum was 587 ppm in December 1943. It is probable that the concentration fluctuated considerably between sampling periods. In a general way, increases in concentration occurred at times of low discharge and decreases occurred at times of relatively high discharge. Hydrographs of the discharge of West Palm Beach Canal at West Palm Beach and at Canal Point are in the section on "Surface water."

HILLSBORO CANAL

Analyses of monthly samples collected from the Hillsboro Canal near Deerfield Beach from March 1941 to July 1944 (table 89) indicate that the range in composition was similar to that in the West Palm Beach Canal. Dissolved solids determined in samples collected during the period ranged from 98 to 841 ppm. The

Table 89.—*Analyses, in parts per million, of water from Hillsboro Canal near Deerfield Beach*

Date of collection	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941											
Mar. 19	140	67.5	53	17	65	213	28	98	2.0	368	202
Apr. 23	100	61.7	52	13	85	196	21	97	.5	366	135
May 21	200	84.0	58	18	96	256	21	139	.5	459	219
July 3	220	60.0	52	12	58	210	14	83	1.0	323	179
Aug. 22	240	34.4	32	9.2	26	131	6.6	42	.8	180	118
Sept. 19	......	36.3	29	8.1	35	130	6.6	48	1.1	192	106
Oct. 23	180	37.8	32	10	34	143	11	47	.4	205	121
Nov. 26	130	49.9	42	12	45	164	15	72	1.6	268	154
Dec. 26	110	65.4	52	15	69	217	22	100	.6	366	191
1942											
Jan. 22	100	17.8	22	1.6	14	69	6.4	20	.1	98	62
Feb. 19	110	78.4	62	14	83	239	25	12	1.0	482	212
May 7	180	35.7	32	9.2	26	122	5.3	48	.4	181	118
June 4	120	21.9	22	4.4	17	81	9.9	24	.1	117	73
July 9	180	22.0	22	5.5	14	84	3.3	25	.1	111	78
Aug. 7	240	99.4	72	23	98	314	21	148	.2	517	274
Sept. 3	180	59.0	56	17	33	205	14	71	.3	292	211
Oct. 7	160	114	89	27	114	365	42	167	2.4	620	333
Nov. 11	100	94.7	80	21	88	307	30	138	1.2	509	286
Dec. 10	90	94.4	85	21	86	329	31	129	1.6	516	298
1943											
Jan. 7	100	94.7	80	21	90	325	22	136	.2	509	286
Feb. 4	90	116	98	23	113	374	34	172	.5	625	339
Mar. 4	65	103	98	17	95	336	37	147	.2	560	314
Apr. 1	65	123	103	22	125	360	43	198	.3	669	348
May 6	80	120	104	22	121	377	36	188	.4	657	350
June 2	120	147	106	27	182	384	52	285	.0	841	376
July 7	90	144	106	26	166	395	47	255	.9	796	372
Aug. 5	186	115	102	29	104	442	21	152	.0	626	374
Sept. 2	170	105	99	26	86	394	34	134	.2	573	354
Oct. 7	300	51.2	55	13	30	190	16	60	.4	268	191
Nov. 2	240	59.3	54	15	43	194	16	80	.4	304	196
Nov. 30	190	113	25	7.4	12	72	5.6	38	.2	124	93
Dec. 31	150	52.2	46	12	40	156	12	79	.2	266	164
1944											
Jan. 31	120	79.4	70	15	74	242	23	123	.8	425	236
Feb. 29	82	103	99	17	97	334	33	156	.5	567	317
Mar. 31	66	94.6	82	18	92	288	39	144	.1	517	278
May 2	80	83.8	91	15	69	319	26	106	.1	464	288
May 31	90	131	92	26	147	388	34	216	.2	706	336
July 1	180	106	97	29	89	430	19	129	.2	575	361
1945											
May 26	160	156	121	21	186	412	57	280	.0	868	388

principal constituents of these samples were calcium, bicarbonate, sodium, and chloride. Hardness ranged from 62 to 376 ppm, and color, which was relatively high, ranged from 65 to 300. A single sample collected in 1945 showed dissolved solids of 868 ppm and a total hardness of 388 ppm.

NORTH NEW RIVER CANAL

Daily samples were collected for analysis from the North New River Canal at 26-Mile Bend from March 1 to October 5, 1941, and at the lock and dam near Fort Lauderdale from October 22, 1941, to February 28, 1942. It was intended that daily samples should be collected at 26-Mile Bend throughout the year ending February 28, 1942, but because of inability to keep an observer at this isolated place the station was abandoned early in October. The station near Fort Lauderdale is about 19 miles downstream from 26-Mile Bend. Analyses of several series of samples collected all along the canal indicate that the composition of the water at the lock and dam is probably similar to the composition of the water at 26-Mile Bend.

Generally, analyses of 10-day composites of the daily samples show that the composition may fluctuate rapidly and between wide limits. (See tables 90 and 91.) Ranges in concentrations of dissolved matter and their relations to changes in discharge are

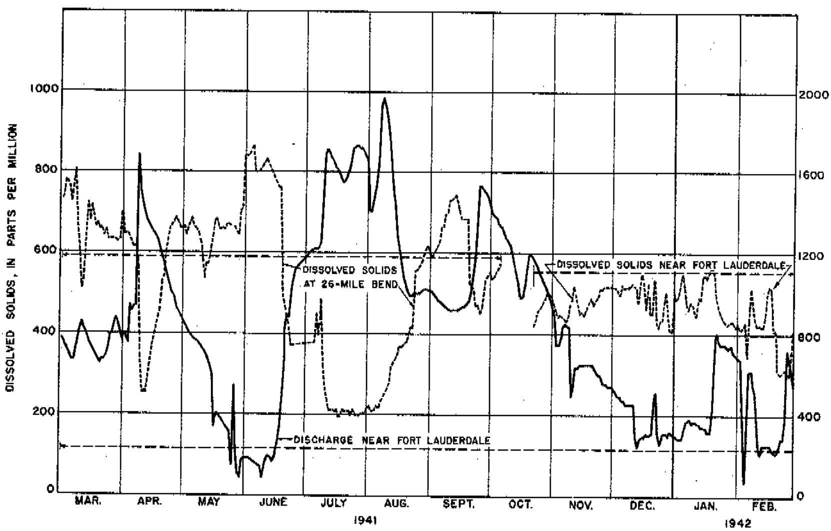

Figure 217.—Graph showing discharge and dissolved solids in North New River Canal at 26-Mile Bend and near Fort Lauderdale, 1941-42.

Table 90.—*Analyses, in parts per million, of 10-day composite samples of water from North New River Canal near Fort Lauderdale*

Date of collection	Mean discharge	Color	Specific conductance (K x 10^5 at 25 C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
At 26-Mile Bend																
1941																
Mar. 1-10	....	170	110	20	0.06	106	38	77	5.1	382	99	119	0.5	2.2	738	421
Mar. 11-20	....	180	98.5	16	.06	89	31	74	5.3	356	62	115	.5	1.3	647	350
Mar. 21-24, 28-31	....	180	100	16	.08	91	33	81	4.5	366	57	119	.3	1.1	648	362
Apr. 1-8	....	160	97.7	15	.08	86	32	79	4.5	360	48	118	.4	1.2	626	346
Apr. 14-16, 19-20	....	240	58.7	7.8	.12	72	20	31	3.2	245	48	43	.2	1.7	420	262
Apr. 21-27, 29-30	....	180	93.8	16	.12	94	31	70	4.5	358	68	98	.4	1.1	637	362
May 1-3, 5-9	....	170	98.6	16	.08	94	33	74	5.1	363	64	112	.4	1.5	651	370
May 11-13, 16-17, 19-20	....	190	92.0	17	.10	91	31	65	4.6	358	69	95	.3	1.9	619	354
May 21-31	....	180	105	18	.14	97	35	82	4.5	396	52	124	.4	1.4	682	386
June 2, 4-7, 11	....	180	125	22	.12	112	43	101	5.6	462	66	154	.5	2.0	813	456
June 17-19, 21, 23	....	180	86.1	12	.18	85	27	62	5.3	330	38	93	.4	1.6	562	323
July 3-9	....	340	55.2	9.4	.14	60	19	37	3.5	218	30	51	.1	1.3	395	228
July 11-20	....	320	26.4	5.6	.12	39	7.6	8.9	2.5	138	6.0	13	.2	1.2	210	128
July 21-27, 29-31	....	320	25.8	8.3	.14	38	7.5	8.8	2.2	140	5.2	12	.3	.8	205	126
Aug. 2-7	....	310	27.7	8.1	.14	39	8.4	10	2.6	145	4.9	16	.2	.7	217	132
Aug. 11-12, 14-20	....	300	47.8	13	.16	58	15	24	4.1	228	14	38	.4	.6	344	206
Aug. 22-25, 27, 29-31	....	260	77.4	18	.28	83	26	52	5.9	326	37	76	.6	1.0	537	314

Sept. 1-10	....	220	95.7	19	.18	96	33	70	5.9	376	57	103	.6	1.4	642	375
Sept. 11-13, 16-20	....	180	102	21	.16	99	36	75	6.7	392	65	110	.6	1.5	681	395
Sept. 21-26, 28-30	....	260	72.2	14	.16	75	25	47	5.6	267	56	69	.6	2.2	498	290
Oct. 1-5	....	260	80.8	18	.14	79	27	58	6.2	310	51	85	.5	1.1	551	308
Near Fort Lauderdale																
Oct. 22-31	1,070	180	68.1	12	0.16	80	21	43	4.8	273	52	58	0.4	1.6	471	286
Nov. 3-10	790	170	65.3	12	.22	77	18	40	2.6	278	34	58	.5	2.2	449	266
Nov. 11-20	642	160	69.6	12	.19	80	20	45	2.6	284	39	66	.5	2.2	475	282
Nov. 21-26	582	160	73.4	14	.16		21	47	6.9	310	42	72	.6	.7	491	294
Dec. 1-8, 10	480	130	77.2	15	.14	87	23	52	6.1	324	39	79	.5	1.1	509	312
Dec. 11-20	310	120	76.3	15	.08	81	23	53	5.3	306	46	80	.5	1.0	496	296
Dec. 21-31	337	110	69.3	13	.06	74	20	46	5.3	279	40	70	.4	.8	448	266
1942																
Jan. 1-6	311	95	75.7	15	.12	77	24	54	5.4	294	54	79	.5	.8	498	290
Jan. 7-20	388	100	80.3	19	.01	83	23	56	3.4	313	40	86	.4	1.1	514	302
Jan. 21-31	745	110	69.4	13	.04	77	19	45	2.6	281	30	69	.4	1.4	447	270
Feb. 1-10	473	110	68.6	12	.09	77	18	44	2.4	281	27	69	.4	1.2	438	266
Feb. 11-19	239	90	70.9	12	.02	76	19	47	2.6	282	35	71	.3	1.1	452	268
Feb. 20-28	433	90	51.5	8.0	.02	62	13	28	1.5	218	27	42	.2	1.1	330	208

Table 91.—*Analyses, in parts per million, of water from North New River Canal near Fort Lauderdale*

Date of collection	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941											
Mar. 19	150	78.7	82	27	56	324	37	94	2.0	458	316
Apr. 22	220	63.3	78	20	35	282	39	56	2.0	369	277
May 21	220	92.8	94	33	64	372	60	101	.8	536	370
July 3	320	42.9	52	13	19	182	16	41	.5	231	183
Aug. 1	360	27.7	42	8.5	.9	148	3.3	12	.2	140	140
Aug. 22	320	48.4	61	15	23	236	11	42	.8	269	214
Sept. 26	280	50.0	55	16	34	237	30	37	.4	289	203
1942											
Apr. 9	160	103	108	36	62	387	83	105	1.6	586	418
May 7	220	74.9	88	21	41	320	30	72	1.5	411	306
June 4	220	88.7	99	30	56	348	76	90	.4	523	370
July 9	360	31.9	46	7.4	5.0	160	3.7	15	.1	156	145
Aug. 6	240	79.0	90	24	37	329	44	63	.2	420	323
Sept. 3	220	84.2	93	29	36	315	70	69	.1	452	351
Oct. 8	180	94.4	106	33	48	368	81	83	1.8	534	400
Nov. 11	100	72.2	74	21	47	280	37	74	.4	391	271
Dec. 10	50	50.8	54	16	29	190	36	50	.4	279	201
1943											
Jan. 7	75	68.5	72	20	43	269	33	70	.4	371	262
Feb. 4	50	59.3	64	17	34	227	38	56	.2	321	230
Mar. 5	50	65.9	67	19	95	250	36	148	.5	489	245
Mar. 31	40	52.5	58	17	26	204	38	46	.4	286	214
May 5	40	51.9	60	16	23	203	34	45	.2	278	216
June 3	85	81.3	83	27	49	318	42	86	.2	444	318
July 8	120	104	106	36	67	384	78	116	.3	592	412
Aug. 5	150	95.2	94	31	64	362	50	109	.0	526	362
Sept. 2	160	75.1	82	24	20	300	38	78	.4	391	303
Nov. 30	90	58.1	79	16	21	268	26	44	.6	319	263
1944											
Jan. 7	80	53.5	67	16	23	232	26	46	.5	293	233
Jan. 31	70	55.2	76	16	14	248	23	42	.3	294	256
Feb. 29	85	64.2	91	17	23	312	22	49	.3	356	297
Mar. 31	62	62.9	84	16	28	286	29	51	.2	349	276
May 1	85	70.8	79	23	42	290	54	63	.2	404	292
June 1	50	54.5	60	14	34	220	29	50	.2	296	207
June 30	90	79.1	89	22	47	342	36	69	.2	432	312
1945											
May 25	45	58.8	60	15	42	222	40	58	.8	326	216
Sept. 21	280	74.6	100	26	14	262	107	43	.4	420	356

Note.—For analyses of 10-day (generally) composite samples Oct. 22, 1941, to Feb. 28, 1942, see table 90.

shown graphically in figure 217. When the discharge is high, the concentration of dissolved matter is generally low, and when the discharge is low, the concentration of dissolved solids increases to high values.

At irregular intervals, series of samples were collected at several points along the North New River Canal between South Bay and State Highway 7 (table 92). Chloride was the only constituent

Table 92.—*Analyses, in parts per million, of water from North New River Canal from South Bay to State Highway 7 near Fort Lauderdale*

Distance of source from South Bay (miles)	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
July 28, 1940											
0	65	52.4	57	15	20	172	28	54	....	259	204
4[1]	65	48.6	52	15	15	162	24	47	....	233	192
8	150	55.7	62	15	28	204	34	53	....	292	216
13	150	62.2	69	19	35	236	40	65	....	344	250
18	150	78.8	78	21	59	278	50	92	....	437	281
20	150	81.5	78	24	58	290	44	96	....	443	293
21	150	82.2	80	23	59	294	46	95	....	448	294
23	150	85.5	82	27	53	304	46	103	....	461	316
27	150	91.8	86	28	63	318	44	114	....	492	330
32	160	87.0	83	27	61	316	40	106	....	473	318
35	160	86.6	84	27	64	316	50	105	....	486	321
38	160	87.0	86	26	59	318	36	103	....	467	322
41	160	85.1	83	24	55	318	34	91	....	444	306
49	160	78.6	82	24	48	302	36	87	....	426	303
54	150	73.8	84	24	55	306	46	91	....	451	308
56	140	76.8	83	22	51	304	36	87	....	429	298
Feb. 13, 1941											
0	110	....	119	52	108	446	168	146	....	813	511
4[1]	190	....	184	65	52	466	310	95	....	936	726
18	260	....	105	34	22	268	139	61	....	493	402
23	260	....	104	34	16	264	131	58	....	473	399
27	250	....	100	34	18	268	116	63	....	463	389
32	250	....	84	14	67	276	92	64	....	457	267
35	250	....	75	25	4.8	224	35	57	....	307	290
41	220	....	77	25	12	232	51	55	....	334	295
49	220	....	82	24	20	224	81	56	....	373	303
54	210	....	88	24	20	240	80	58	....	388	318
56	200	....	74	21	19	208	67	51	....	334	271
March 10, 1941											
0	75	79.4	64	25	66	244	70	93	1.6	440	263
4[1]	220	140	174	63	48	468	274	88	5.0	882	693
10	240	92.0	104	36	43	312	130	77	1.6	545	408
15	220	92.7	95	34	55	304	110	93	1.0	538	377
20	260	84.8	82	31	51	287	70	94	4.0	473	332
25	260	79.9	78	28	47	288	51	86	3.0	435	310
30	240	79.4	75	28	58	292	55	92	2.0	454	302
35	220	85.8	79	30	68	310	70	100	1.4	501	321
41	160	90.4	88	20	59	332	49	105	.6	495	343
49	150	84.3	86	27	57	324	46	96	1.2	473	326
54	180	88.0	91	29	55	334	56	94	1.2	491	346
56	170	75.8	81	25	48	296	49	82	1.2	432	305
Aug. 1, 1941											
7	280	29.3	46	8.3	2.9	170	2.9	9	.2	153	149
16	440	32.6	48	12	2.6	188	6.2	10	.2	172	169
26	440	30.4	42	11	3.6	166	4.5	12	.2	155	150
35	360	27.0	38	8.7	4.3	150	1.2	11	.2	137	131
46	280	33.8	54	8.7	4.6	190	8.2	11	1.0	181	171
54	360	27.7	42	8.5	.9	148	3.3	12	.2	142	140

[1] About 500 ft north of Bolles Canal.

determined in most of the samples, but the wide range in chloride concentration at different times and between different sampling points in a single day indicate that all of the chemical constituents varied similarly. The range in chloride is shown graphically in figure 218.

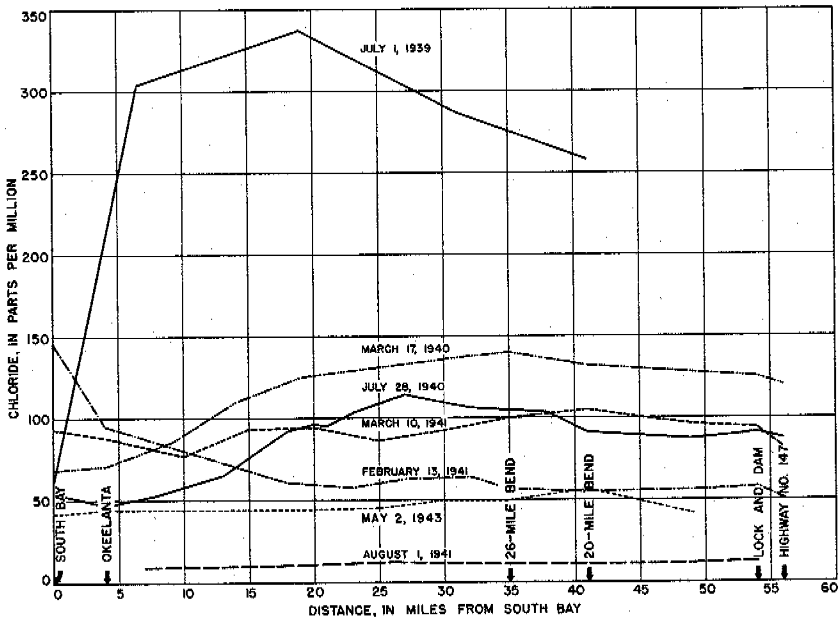

Figure 218. —Graph showing chloride concentrations in North New River Canal between South Bay and State Highway 7.

Several suggestions have been offered to explain the high concentration of dissolved mineral matter in the North New River Canal. Probably, several factors should be considered in arriving at the correct explanation.

One factor is indicated by analyses of water samples (collected during the drilling of test wells), which show that highly mineralized water lies underneath large areas of the Everglades. At many places it is only a few feet beneath the surface of the ground. During periods of high discharge in the canal, very little of the underlying mineralized water discharges from the ground, and, as a result, the concentration of dissolved matter in the canal is relatively low. When the canal discharge is low, however, a fairly large proportion of the water comes from the ground, including some of the more highly mineralized water. As a consequence, the concentration of dissolved matter in the canal is relatively high. The available data indicate that there is an area reaching 10 to 15 miles along the canal north from 20-Mile Bend where the concentration is slightly higher than it is in either direction from this area, particularly during periods of low flow. A decrease in concentration is especially noticeable in the vicinity of Okeelanta, which is about 4 miles from South Bay. This decrease near Okeelanta presumably is caused by the lower concentration of dissolved matter that is usually found in inflowing water from Bolles Canal and in water released from Lake Okeechobee. (See table 101.) A more complete discussion of the composition of ground water in the Everglades is given on pages 818–822.

A second factor that affects the composition of water in North New River Canal is water discharged from Lake Okeechobee. Records of discharge at South Bay show that the flow at this point is only a small proportion of the flow at the lock and dam near Fort Lauderdale and that during periods of high water the direction of flow at South Bay is reversed so that some of the water flows toward Lake Okeechobee. During periods of moderate to low flow, however, some lake water is discharged through North New River Canal. When this occurs, the concentration of dissolved matter at 26-Mile Bend is rather high. It seems probable, however, that the water from Lake Okeechobee has a beneficial effect on the quality of the canal water at 26-Mile Bend because it has a diluting effect on the more concentrated inflowing ground water. Inflowing water from Bolles Canal, as mentioned above, apparently has a similar diluting effect.

A third factor that affects the quality of water in the North New River Canal is the quantity and composition of water discharged from drainage pumps in the agricultural area near Lake Okeechobee. During the growing seasons large pumps are operated to lower the water table in the cultivated fields. The water discharged by these pumps is usually much more concentrated than water from the surface of the Everglades, as shown by analyses of a few samples. (See table 101). There are several of these drainage pumps in the vicinity of South Bay and Okeelanta and on the Hillsboro Canal in the vicinity of Belle Glade. At times, concentrated water from Hillsboro Canal flows into the North New River Canal through a connection on the landward side of the levee on the southeast side of Lake Okeechobee.

A fourth factor that has an effect on the quality of the water in the North New River Canal is the surface inflow from the Everglades during rainy periods. Most of this water flows from the surface of the muck and saw grass areas and although it is usually highly colored, it generally contains only a small amount of dissolved mineral matter. During these periods, the volume of surface flow is large in comparison with ground-water discharge and, as a result, the concentration of dissolved matter in the canal is relatively low.

It is readily seen that changes in the composition of water in the North New River Canal are the results of several variable factors. In a general way, however, when the discharge is high the concentration of dissolved matter is relatively low, and when the discharge is low the concentration is relatively high. Any development in southeastern Florida that involves the use of large quantities of water from North New River Canal must make allowance for rapid and large changes in the composition of the water.

SOUTH NEW RIVER CANAL

No regular series of samples was collected from South New River Canal. Analyses of occasional samples indicate that the water in this canal is usually similar in composition to water in Miami Canal north of the dam at the Dade-Broward County line. The two canals are connected at a point about 8 miles west of State Highway 25 and about 10 miles northwest of the Dade-Broward County line. Partial analyses (table 93) suggest that both the concentration of dissolved solids and the hardness of water in the canal west of State Highway 25 ranges from about 150 to 200 ppm. A dam about ½ mile east of Highway 25 prevents free flow throughout the canal. Analyses of a few samples collected from South New River Canal near Davie, which is about 7 miles east of Highway 25, indicate that water in this part of the canal may contain slightly more dissolved mineral matter and may be a little harder than water west of Highway 25 (see table 101).

Table 93.—*Analyses, in parts per million, of water from South New River Canal west of bridge on State Highway 25*

Date	Distance of source from bridge on Highway 25 (miles)	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941												
Feb. 19	0	110	34.2	60	6.1	2.9	197	1.2	13	.....	180	175
Apr. 25	0	110	35.7	61	6.8	5.4	207	1	15	0.2	191	180
June 5	0	......	40.3	......	......	......	239	.....	19	.....	......	......
July 29	0	......	29.1	......	......	......	158	.....	9	.....	......	......
Aug. 28	0	......	32.2	......	......	......	178	.....	13	.....	......	......
Oct. 8	0	......	25.1	......	......	......	136	.....	13	.....	......	......
Dec. 31	0	......	39.3	......	......	......	220	.....	19	.....	......	......
Apr. 25	2	110	36.6	60	6.6	10	214	1	16	.1	199	177
Aug. 28	2	......	29.5	......	......	......	165	.....	12	.....	......	......
Oct. 8	2	......	25.3	......	......	......	127	.....	19	.....	......	......
Nov. 25	2	......	36.7	......	......	......	191	.....	26	.....	......	......
Dec. 31	2	......	40.3	......	......	......	226	.....	18	.....	......	......
Feb. 19	5	110	34.2	59	10	......	196	1.0	16	.....	188	188

MIAMI CANAL

Miami Canal is not excavated in rock north of a point about ¼ mile north of its junction with the South New River Canal. Consequently, the discharge of the canal consists largely of runoff derived from areas south of the junction with South New River Canal. During rainy periods, considerable surface water flows from the Everglades through breaks in the rock spoil banks into the excavated part of Miami Canal and also into South New River Canal. There is a dam in Miami Canal at the Dade-Broward County line that prevents direct flow from the upper to the lower part of the canal. The excess water spills into the Everglades at this point and some of it probably finds its way back into the lower part of the canal through the ground. Gates have been placed in the dam so that water can be discharged directly from the upper to the lower part of the canal. Normally, however, all of the flow in Miami Canal, as measured at Water Plant, Hialeah, is derived from surface and ground water inflow below the County Line Dam.

Analyses of 10-day composites of daily samples collected from Miami Canal at Water Plant during the year ending February 28, 1942, show that the composition of the water was fairly uniform. (See table 94.) Dissolved solids ranged from 282 to 328 ppm and hardness from 207 to 254 ppm. Color ranged from 80 to 120 in the same period. Table 95 contains additional analyses for the period August 1943 to June 1948. Variations in dissolved solids and discharge are compared graphically in figure 219.

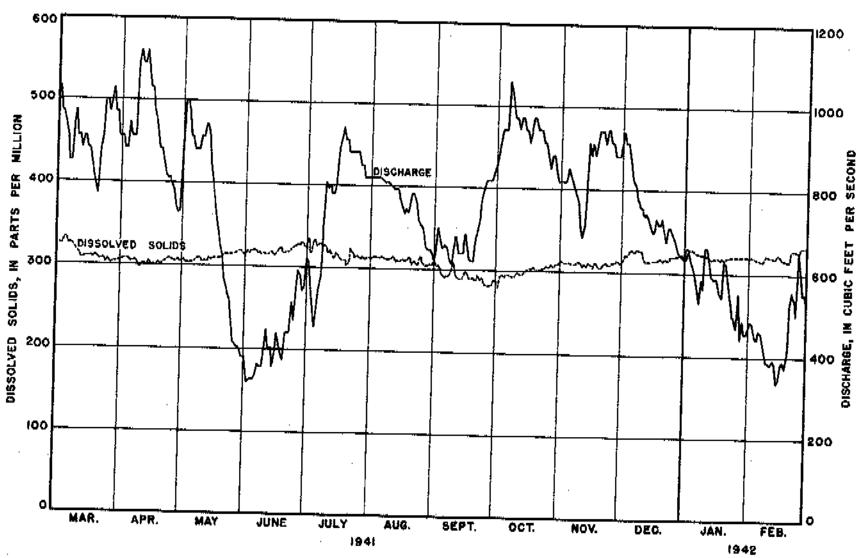

Figure 219. —Graph of discharge and dissolved solids in Miami Canal at Water Plant, Hialeah, 1941-42.

Table 94.—*Analyses, in parts per million, of 10-day composite samples of water from Miami Canal at Water Plant, Hialeah*

Date of collection	Mean discharge (cfs)	Color	Specific conductance (K x 10^5 at 25 C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941																
Mar. 2–10	925	90	47.4	....	0.08	84	7.1	14	1.0	266	5.4	21	0.1	1.4	326	239
Mar. 11–20	862	80	46.8	7.5	.05	84	6.5	13	1.0	264	5.4	21	.1	1.4	308	236
Mar. 21–31	960	85	46.1	6.0	.12	83	6.8	12	.9	258	5.0	21	.1	1.4	303	235
Apr. 1–10	965	85	45.7	4.6	.12	81	6.4	13	1.0	257	5.1	22	.1	1.3	300	228
Apr. 11–20	992	90	45.4	5.6	.14	80	6.3	13	.9	256	4.7	21	.1	1.1	299	226
Apr. 21–30	796	90	45.8	5.6	.18	82	6.6	13	1.0	259	4.8	21	.1	1.1	303	232
May 1–10	926	90	45.9	5.2	.20	82	6.6	12	1.0	259	4.7	21	.1	1.5	304	232
May 11–20	787	90	46.6	6.8	.27	83	6.4	12	1.0	262	4.8	21	.1	1.4	309	233
May 21–31	459	90	47.4	4.5	.22	85	6.8	12	.8	267	4.9	22	.1	1.7	314	240
June 1–10	347	90	47.8	6.3	.26	86	7.0	13	1.1	271	4.2	25	.1	2.1	317	243
June 11–20	409	90	48.3	8.3	.04	85	7.0	13	1.2	270	4.8	24	.2	1.2	316	241
June 21–30	532	85	49.5	7.8	.10	87	7.1	13	1.1	278	3.0	22	.2	1.0	324	246
July 1–10	606	90	49.6	8.2	.10	86	7.0	13	1.2	276	10	20	.2	1.0	326	244
July 11–20	861	90	46.6	9.0	.07	82	5.9	11	1.2	254	13	18	.2	1.1	314	229
July 21–23, 25–31	853	110	45.9	7.9	.03	83	6.7	11	1.2	262	10	18	.2	1.0	315	234
Aug. 1–4, 6–10	814	110	45.8	8.1	.05	82	6.6	11	1.1	263	7.0	20	.1	.7	311	232
Aug. 11–20	767	110	45.7	8.3	.06	81	6.8	12	1.2	261	5.7	20	.2	.8	311	230
Aug. 21–31	688	110	45.2	11	.02	80	6.7	13	1.3	259	4.7	20	.2	.9	311	227
Sept. 1–10	655	110	44.3	7.1	.05	78	6.4	12	1.1	253	4.1	19	.2	1.0	302	221
Sept. 11–20	648	110	44.0	5.5	.04	78	6.5	12	1.0	258	3.9	20	.2	.9	298	221
Sept. 21–30	796	120	40.7	6.2	.13	73	6.1	10	1.6	236	4.0	16	.3	.9	282	207
Oct. 1–10	1,010	120	41.8	5.8	.02	76	6.3	11	1.3	239	4.9	18	.3	1.0	287	216
Oct. 11–18, 20	922	120	43.1	5.3	.13	78	7.0	11	1.3	249	4.3	20	.3	.9	296	224
Oct. 21–31	837	110	44.0	5.6	.08	79	6.6	12	1.2	253	4.0	19	.3	.9	304	224
Nov. 1–10	797	110	44.8	6.6	.07	80	6.3	12	1.2	255	5.1	20	.3	1.5	308	226
Nov. 11–20	869	110	44.8	7.2	.13	81	6.4	12	1.2	257	5.4	19	.3	1.3	306	228
Nov. 21–30	848	95	44.6	8.3	.07	81	7.2	12	2.0	257	5.0	20	.2	1.0	305	232
Dec. 2–10	781	95	45.0	6.0	.08	82	6.9	12	1.9	261	5.0	20	.2	1.4	313	233

Dec. 11-20	698	95	46.1	6.1	.12	84	7.3	12	1.4	268	5.2	20	.2	1.4	310	240
Dec. 21-31	643	90	46.6	6.0	.13	85	7.0	11	1.5	269	5.2	19	.2	1.7	314	241
1942																
Jan. 1-10	602	90	46.5	5.6	.17	85	7.3	12	1.8	275	5.2	20	.2	1.6	316	242
Jan. 11-20	602	90	48.9	5.9	.08	87	6.7	13	1.3	277	5.2	20	.1	1.8	318	244
Jan. 21-31	526	90	49.3	5.7	.07	88	6.9	12	1.4	279	5.1	20	.1	2.0	322	248
Feb. 1-10	477	90	49.1	5.5	.09	88	6.9	13	1.4	281	4.7	20	.1	1.8	321	248
Feb. 11-19	440	90	48.9	5.7	.10	88	7.0	12	1.4	280	4.3	21	.0	2.0	320	248
Feb. 20-28	494	90	49.8	5.2	.16	90	7.2	12	1.2	289	5.5	20	.1	2.0	328	254
Average	....	97	46.2	6.6	0.11	83	6.7	12	1.2	263	5.4	20	0.2	1.3	310	235

Table 95.—*Analyses, in parts per million, of water from Miami Canal at Water Plant, Hialeah*

Date of collection	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1943											
Aug. 3	60	52.2	97	8.3	....	294	16	17	0.2	....	276
Sept. 2	55	51.7	97	9.4	....	288	19	18	.5	....	280
Oct. 8	100	47.7	91	8.7	....	266	19	15	.2	....	263
Nov. 4	105	50.1	96	8.1	....	288	13	16	.3	....	273
Dec. 2	90	48.5	90	9.2	1.4	278	11	18	.6	267	262
Dec. 30	90	52.1	96	10	2.1	306	6.6	18	1.7	285	280
1944											
Feb. 1	90	55.8	99	12	....	292	7.2	20	1.3	....	297
Mar. 1	90	52.8	96	10	3.9	308	7.2	20	1.3	290	280
Mar. 31	63	51.9	94	8.3	5.8	302	3.1	21	1.1	282	268
May 3	60	50.1	87	9.2	8.0	282	4.5	26	.8	274	255
May 31	65	53.8	94	8.2	10	306	7.4	22	.5	293	268
June 30	65	51.7	91	7.2	9.0	292	5.3	22	.3	279	256
Aug. 4	80	51.8	90	7.6	8.7	284	13	19	1.0	279	256
Sept. 5	100	54	102	6.6	2.3	304	10	19	.2	290	282
Dec. 11	90	52.5	96	7.2	7.6	308	3	20	2.2	288	269
1945											
Jan. 11	64	53.5	97	7.6	8.3	320	3	18	.5	292	273
Feb. 1	62	53.8	96	7.3	8.3	314	1	20	1.2	288	270
Mar. 1	65	53.5	94	7.3	9.0	310	1	20	1.2	285	264
Apr. 5	65	52.5	91	7.4	9.0	298	1	22	1.2	278	258
May 7[1]	60	303	90	32	509	264	113	800	......	1,670	356
June 2[1]	50	823	108	137	1,600	228	368	2,650	......	4,980	833
July 13	60	53.3	92	8.3	8.5	308	1	20	.6	282	264
July 30	65	54.9	98	8.3	6.4	315	4	21	1.4	294	278
Aug. 31	60	53.8	94	8.2	9.0	307	4	22	1.3	290	268
Sept. 24	75	57.2	102	8.3	8.7	308	20	24	.2	315	288
1946											
Apr. 22	80	54.2	97	8.3	5.5	296	14	22	.2	293	276
May 23	75	55.4	98	6.8	7.8	304	16	17	.2	296	272
July 16	95	56.2	98	7.0	11	320	10	18	.2	302	274
Sept. 24	100	53.5	98	7.2	4.4	314	6	14	.6	285	274
Oct. 31	100	52.5	93	7.4	8.5	300	9	18	.2	284	262
Dec. 20	90	52.9	94	7.2	5.1	296	4	20	.6	277	264
1947											
Mar. 31	80	54.5	94	8.2	8.0	300	4	24	2.0	288	268
July 27	95	54.7	95	8.4	6.2	300	10	20	.8	288	272
Aug. 7	110	46.2	81	6.2	4.1	264	1.3	13	.2	236	228
Dec. 4	60	36.5	64	5.1	3.9	212	2.0	10	.2	190	180
1948											
May 6	62	49.4	94	6.8	2.4	292	4.1	17	.4	268	262
June 15	94	52.1	92	7.5	12	310	5.8	18	.3	288	260

[1] Graph of discharge of Miami Canal during this period shows that net discharge was zero. See figures 117-123.

The nearly uniform composition of the water in Miami Canal may be explained as follows:

The saline ground waters known to be present in the vicinity of North New River Canal and also along the middle reaches of Miami Canal apparently have been flushed out of the shallow strata south of South New River Canal. Consequently, the only source of mineral matter is the limestone rock through which most of the water percolates before reaching the canal. Since there is little direct runoff into the canal, except during rains of high intensity, most of the surface water travels at least a short distance through the permeable limestone and becomes charged with a fairly uniform amount of calcium bicarbonate and other soluble constituents.

See table 96 for analyses of samples north of the dam at the Dade-Broward County line and table 97 for samples between Biscayne Bay and Pennsuco. Analyses of samples at Lake Harbor are given in table 101. The ranges in concentration of dissolved mineral matter in Miami and North New River Canals are shown graphically in figure 220.

Table 96.—*Analyses, in parts per million, of water from Miami Canal north of dam at Dade-Broward County line*

Date	Distance of source from dam (miles)	Color	Specific conductance ($K \times 10^5$ at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941												
Feb. 19	0.1	100	34.0	55	7.0	5.4	183	1.0	19	....	178	166
Apr. 25	.1	100	36.0	58	6.7	8.1	196	1	20	0.1	190	172
June 5	.1	....	41.8	....	....	....	239	....	23	....	....	....
July 29	.1	....	30.4	....	....	....	166	....	13	....	....	....
Aug. 28	.1	....	33.2	....	....	....	180	....	18	....	....	....
Oct. 8	.1	....	32.7	....	....	....	172	....	21	....	....	....
Nov. 25	.1	....	36.7	....	....	....	198	....	27	....	....	....
Dec. 31	.1	....	41.9	....	....	....	228	....	22	....	....	....
Feb. 19	[1]5.6	100	34.6	56	6.2	6.7	185	1.4	19	....	180	165
Apr. 25	[1]5.6	105	35.6	59	6.6	7.1	194	1	21	.2	190	174
June 5	[1]5.6	....	43.4	....	....	....	243	....	23	....	....	....
Aug. 28	[1]5.6	....	34.5	....	....	....	187	....	20	....	....	....
Nov. 25	[1]5.6	....	37.3	....	....	....	202	....	19	....	....	....
Feb. 19	[2]10.1	100	29.8	48	5.8	5.4	160	.2	17	....	155	144
Apr. 25	[2]10.1	100	35.5	59	6.1	7.4	196	1	19	.1	189	172
June 5	[2]10.1	....	45.6	....	....	....	262	....	25	....	....	....
July 29	[2]10.1	....	25.9	....	....	....	143	....	10	....	....	....
Aug. 28	[2]10.1	....	29.3	....	....	....	159	....	14	....	....	....
Oct. 8	[2]10.1	....	60.6	....	....	....	169	....	18	....	....	....
Nov. 25	[2]10.1	....	33.9	....	....	....	185	....	18	....	....	....
Dec. 31	[2]10.1	....	39.2	....	....	....	220	....	20	....	....	....
Feb. 19	[3]10.3	100	20.0	27	4.1	7.3	91	.6	18	....	102	84
Apr. 26	[3]10.3	110	23.0	32	5.8	6.8	114	1	17	.1	119	104
June 5	[3]10.3	....	29.6	....	....	....	204	....	26	....	....	....
July 29	[3]10.3	....	23.4	....	....	....	120	....	12	....	....	....

Aug. 28	[3]10.3	....	26.6	....	....	....	131	....	19	....	....	....
Oct. 8	[3]10.3	....	27.2	....	....	....	142	....	17	....	....	....
Nov. 25	[3]10.3	....	28.1	....	....	....	143	....	19	....	....	....
Dec. 31	[3]10.3	....	44.6	....	....	....	252	....	23	....	....	....

Table 97.—*Analyses, in parts per million, of water from Miami Canal between Royal Palm Dock in Biscayne Bay and Pennsuco, near Hialeah*

Date	Distance of source from Royal Palm Dock (miles)	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1939												
Dec. 10	[1]0	....	1,740	188	400	3,240	239	828	5,750	....	10,500	2,110
Dec. 10	1.2	....	683	128	143	1,130	261	294	2,020	....	2,830	907
Dec. 10	1.7	....	469	115	97	737	264	210	1,320	....	2,600	686
Dec. 10	[1]1.6	....	196	102	35	246	268	81	446	....	1,040	398
Dec. 10	3.8	....	55.3	91	9.5	14	269	24	36	....	308	266
Dec. 9	7.6	....	50.5	90	8.0	8.5	277	20	20	....	283	258
Dec. 13	15.0	....	49.2	87	7.9	6.8	273	12	20	....	268	250

[1] Contaminated with sea water.

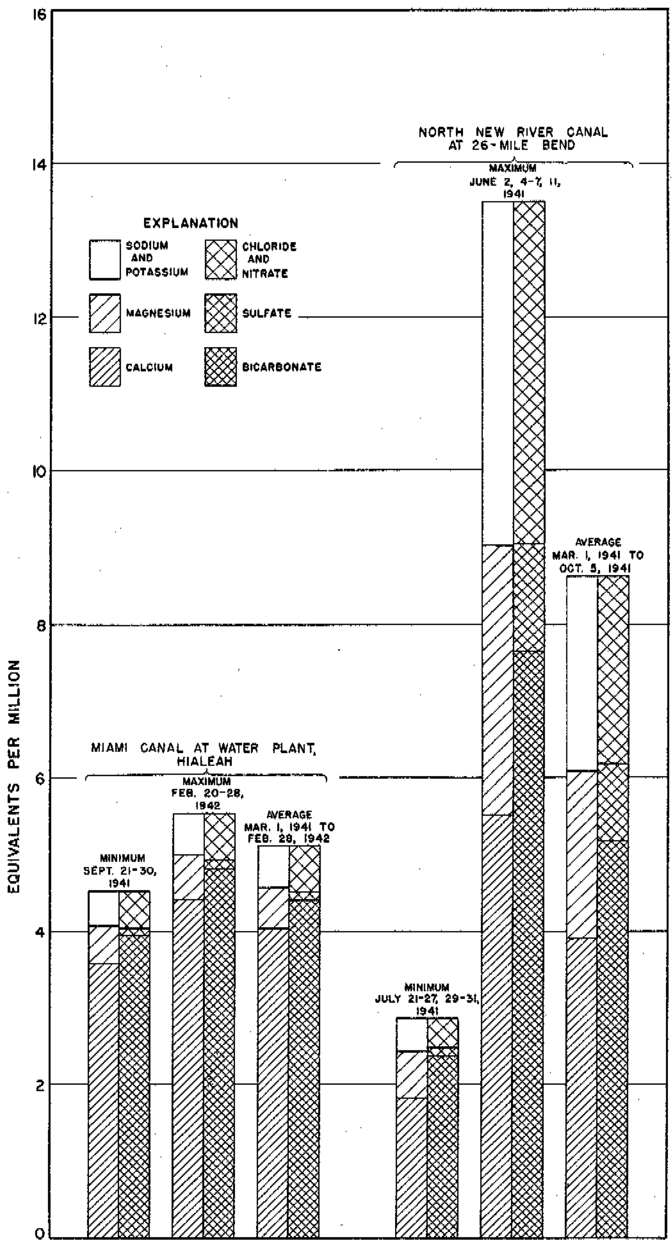

Figure 220. —Graph showing analyses of waters of Miami and North New River Canals.

Table 98.—*Analyses, in parts per million, of water from Cypress Creek Canal, at Pompano*

Date of collection	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941											
Mar. 26	70	50.4	92	6.1	14	254	35	29	0.4	302	255
Apr. 22	70	44.2	84	3.5	8.8	238	16	22	.5	307	224
May 21	50	44.1	83	3.5	10	242	13	21	2.5	252	222
July 3	100	52.6	102	3.9	7.4	257	33	29	.5	302	271
Aug. 22	120	50.1	93	4.6	11	264	23	25	.4	287	251
Sept. 26	240	28.2	40	3.1	20	147	13	15	.0	164	113
Oct. 23	90	46.9	96	3.3	9.2	268	20	23	.4	284	253
Nov. 26	90	48.3	88	2.8	14	245	21	27	.5	274	231
Dec. 26	70	47.7	89	3.3	11	258	14	23	.3	268	236
1942											
Jan. 22	100	26.1	38	1.6	14	102	24	16	.6	144	101
Feb. 19	90	44.5	80	3.1	12	235	15	21	.2	247	212
Apr. 8	60	49.2	93	3.5	8.3	258	16	26	.2	274	246
May 7	90	45.4	80	4.1	11	234	16	22	.4	249	216
June 4	130	44.2	74	3.7	17	204	33	25	.0	253	200
July 9	110	43.9	79	3.1	11	232	12	22	.1	242	210
Aug. 6	95	47.1	86	4.1	4.5	247	10	20	.1	246	231
Sept. 3	120	40.0	67	6.8	2.8	160	39	21	.2	216	194
Oct. 8	45	48.8	90	2.6	10	260	14	21	.3	266	235
Nov. 11	45	45.2	86	2.2	7.8	244	12	20	.3	248	224
Dec. 10	150	47.4	70	7.0	21	187	38	38	2.6	269	204
1943											
Jan. 7	60	48.3	87	4.4	9.2	258	12	22	.1	262	235
Feb. 4	60	64.5	90	8.7	33	282	18	59	.4	348	260
Mar. 4	45	45.3	86	3.3	5.3	252	10	16	.2	245	228
Apr. 2	40	44.4	86	3.9	3.6	246	12	17	.4	244	231
May 6	40	44.6	86	4.1	3.8	252	8.6	17	.2	244	232
June 2	60	57.5	98	5.9	16	286	16	38	.0	315	269
July 7	55	50.9	93	4.4	9.4	265	15	27	.2	280	250
1945											
May 26	40	46.9	89	2.5	6.4	264	7	16	.0	251	232
Sept. 21	80	66.2	99	5.5	35	256	59	53	.1	378	270

CYPRESS CREEK CANAL

Analyses of monthly samples collected from Cypress Creek Canal at Pompano, covering the period March 1941 to June 1943, indicate that the composition of the water varies considerably but not so extensively as that of West Palm Beach, Hillsboro, or North New River Canals (see table 98). Dissolved solids during that period ranged from 144 to 315 ppm, and hardness ranged from 101 to 271 ppm. Color varied inversely with dissolved solids and ranged from 40 to 240. Samples taken during the drought of 1945 showed higher dissolved solids.

TAMIAMI CANAL

Samples were collected from Tamiami Canal at Krome Road, 10 miles west of Coral Gables, from March 1941 to September 1944, and at a point ½ mile west of Coral Gables from March 1941 to June 1948. (See tables 99 and 100.) Analyses of these samples indicate that the concentration of dissolved solids usually was somewhat lower at Krome Road than at Coral Gables. At Krome

Table 99.—*Analyses, in parts per million, of water from Tamiami Canal at Krome Road, near Miami*

Date of collection	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941											
Mar. 25	90	27.3	48	5.0	6.0	149	4.9	18	1.0	156	140
Apr. 29	80	28.2	48	4.8	15	150	23	18	.5	183	140
May 27	70	34.0	57	7.2	8.6	181	9.1	23	.5	195	172
July 15	70	24.4	38	3.1	11	126	4.7	14	3.1	136	108
Aug. 25	160	30.0	48	4.8	7.7	156	1	19	.8	158	140
Sept. 24	70	26.2	42	3.5	7.8	134	33	16	.4	169	119
Oct. 23	60	24.6	40	3.7	9.3	132	4.1	16	.2	138	115
Nov. 18	60	27.8	44	4.1	9.3	139	5.8	18	2.0	152	127
Dec. 27	60	31.5	52	5.5	6.5	162	3.7	21	.3	169	152
1942											
Jan. 20	100	33.5	54	4.1	13	177	1.9	23	.3	184	152
Feb. 16	70	42.7	70	5.7	14	233	4.9	23	.4	233	198
Apr. 9	60	53.5	95	4.8	13	301	1.6	26	.5	289	256
May 20	40	51.0	88	7.0	14	286	7.0	26	.2	283	248
June 4	70	37.4	64	4.8	11	206	4.9	20	.2	216	179
July 15	120	27.0	42	3.3	9.8	150	1	11	.1	142	118
Aug. 5	90	28.0	45	4.8	.8	143	1	11	.1	134	132
Sept. 1	100	27.5	46	6.6	....	134	2.5	15	.1	....	142
Oct. 16	40	28.4	48	3.7	5.1	150	2.7	14	.4	148	135
Nov. 3	50	33.3	57	4.4	5.3	175	2.7	17	1.1	174	160
Dec. 9	50	53.7	97	7.0	11	312	4.9	23	2.8	299	271
1943											
Jan. 5	50	56.0	101	7.4	12	327	4.7	23	4.2	313	282
Feb. 5	35	57.3	104	8.3	6.9	332	5.8	20	2.9	312	294
Mar. 8	35	58.5	108	7.4	6.2	340	4.3	20	3.2	317	300
Apr. 2	36	58.5	110	8.3	4.1	342	3.9	21	4.6	320	308
May 7	38	55.7	103	8.3	3.9	324	3.5	20	2.9	301	291
June 5	40	61.6	107	9.2	12	338	7.2	32	2.2	336	305
July 6	37	52.0	90	7.6	9.4	264	14	31	2.1	284	256
Oct. 11	35	44.6	86	6.8	1.2	256	13	15	.6	249	242
Nov. 7	45	44.5	84	7.2	....	254	8.0	15	.5	....	239
Dec. 8	60	44.7	83	8.3	....	252	8.4	18	.8	....	241
Dec. 30	58	44.0	81	8.7	....	248	8.4	18	.6	....	238
1944											
Jan. 27	53	42.4	79	7.4	2.3	242	6.4	19	.6	234	228
Mar. 1	57	46.7	88	7.4	2.3	272	6.0	18	.8	256	250
Mar. 28	40	44.6	82	6.3	4.6	252	6.4	19	.8	243	230
May 3	34	41.4	78	5.9	6.0	238	8.8	19	1.3	236	219
May 30	30	48.0	88	5.9	5.5	268	10	18	.4	260	244
July 3	35	44.4	79	5.6	6.9	246	9.3	17	.3	239	220
Aug. 10	65	49.2	86	6.3	13	274	9.3	24	.5	274	240
Sept. 6	60	48.0	88	8.5	1.2	274	5.6	18	1.0	257	254

Table 100.—*Analyses, in parts per million, of water from Tamiami Canal, near Coral Gables*

Date of collection	Color	Specific conductance ($K \times 10^5$ at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1941											
Mar. 25	70	42.5	78	4.6	11	246	9.9	18	1.0	228	214
Apr. 21	60	40.8	77	6.3	5.8	238	7.0	19	2.0	234	218
May 26	....	41.8	......	....	....	240	....	19	......	....	....
July 15	70	41.4	76	5.7	4.3	238	7.4	14	.0	225	213
Aug. 25	60	42.3	86	5.0	7.0	256	18	15	.8	258	235
Sept. 24	90	40.8	73	4.1	8.2	232	2.9	16	1.5	220	199
Oct. 23	65	37.8	70	5.0	8.0	223	5.1	17	.8	226	195
Nov. 18	70	40.5	73	5.2	11	236	8.6	17	2.0	233	204
Dec. 27	90	42.7	77	5.7	7.3	245	4.9	18	.3	234	216
1942											
Jan. 20	120	43.3	79	5.0	8.0	251	2.5	19	.1	237	218
Feb. 17	110	45.5	82	5.7	7.8	266	1.6	18	.1	246	228
Apr. 9	80	47.0	86	5.0	7.4	269	4.9	18	.3	254	235
May 20	70	45.2	80	5.9	7.3	250	13	15	.2	245	224
June 5	70	46.3	86	5.2	9.7	268	16	15	.2	264	236
July 15	120	41.4	74	3.5	10	232	9.1	15	.2	226	199
Aug. 5	90	41.5	72	6.1	2.5	226	3.5	15	.2	211	205
Sept. 1	100	41.5	72	7.4	2.3	228	2.3	18	.1	214	211
Oct. 16	70	41.6	74	4.6	4.8	232	3.5	14	1.2	216	204
Nov. 3	65	43.0	79	3.1	7.4	243	5.6	14	1.4	230	210
Dec. 11	70	44.7	82	5.7	7.1	258	4.9	18	3.2	248	229
1943											
Jan. 5	80	45.0	84	6.1	6.2	263	7.6	16	2.7	252	234
Feb. 5	60	46.4	87	6.6	1.2	268	4.5	15	1.8	248	244
Mar. 8	55	44.9	84	6.6	2.1	258	7.4	15	1.2	243	236
Apr. 2	60	42.1	80	5.4	1.1	238	5.3	16	1.3	226	222
May 7	70	45.0	84	5.7	3.8	257	7.2	16	.8	244	233
June 8	38	46.6	88	7.0	.9	267	9.5	15	.4	252	248
July 6	45	45.8	88	7.0	1.4	260	12	18	.7	255	248
Aug. 2	33	46.7	87	7.0	3.2	264	13	16	.6	257	246
Sept. 4	32	46.5	90	7.2	....	260	16	15	.4	....	254
1944											
Oct. 4	60	49.8	......	....	....	272	5	17	1.0	....	268
1945											
Jan. 11	43	52.0	92	5.2	8.0	288	9	16	.8	273	251
Feb. 1	40	49.9	91	5.2	5.3	286	2	16	1.0	261	248
Mar. 1	42	50.1	92	5.2	6.4	292	2	16	1.2	267	251
Apr. 5	42	46.1	83	5.2	6.9	264	2	17	1.5	246	228
May 2	35	39.3	68	5.2	6.2	216	4	16	1.0	207	191
June 4	32	41.7	70	5.0	12	228	6	20	.8	226	195
July 3	35	39.2	66	5.5	9.0	212	8	17	.4	210	187
Aug. 1	37	44.2	80	6.0	2.3	228	17	17	.7	235	224
Aug. 30	37	48.2	86	6.1	7.4	251	24	17	1.0	265	240
Sept. 24	38	55.3	118	6.3	1.4	292	54	19	1.6	344	320
1946											
Apr. 18	75	50.6	90	5.4	6.0	264	18	17	.4	268	246
May 23	100	51.7	92	5.4	7.6	292	7	15	.2	273	252
July 16	55	50.7	94	5.5	2.3	272	16	16	.2	268	257
Sept. 27	65	46.7	84	5.8	6.7	260	12	16	.2	253	234
Oct. 31	80	47.5	84	6.2	4.4	264	4	17	.2	246	235
Dec. 20	55	48.2	88	6.7	....	266	4	17	.8	....	247
Feb. 27	50	49.6	92	6.7	2.3	280	5	19	.8	264	257
Mar. 31	50	49.7	90	6.1	9.4	276	15	20	.8	277	250
1947											
June 5	38	51.1	90	5.6	8.5	286	5.8	18	.2	269	248
Aug. 7	54	45.4	80	4.9	7.6	252	8.2	15	.2	240	220
Nov. 26	40	38.2	68	4.0	4.8	216	2.6	12	.2	198	186

Table 100.—*Analyses, in parts per million, of water from Tamiami Canal, near Coral Gables*—Continued

Date of collection	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
1948											
Feb. 5	52	43.2	82	5.7	2.9	254	6.0	14	.3	236	228
May 6	132	46.7	91	5.8	.8	274	4.9	16	.5	254	251
June 24	42	47.6	91	5.9	5.5	280	12	15	.3	268	251

Road, dissolved solids ranged from 134 to 336 ppm and total hardness ranged from 108 to 308 ppm. At Coral Gables, dissolved solids ranged from 198 to 344 ppm, and total hardness ranged from 186 to 320 ppm. Presumably, the slightly greater concentration at Coral Gables during most of the period of record was caused by the higher mineral content of ground water that seeped into the canal between these two collection points.

MISCELLANEOUS SAMPLING

The results of analyses of miscellaneous samples collected from the major canals at points other than regular sampling points and from the smaller streams and canals are given in table 101. Additional analyses of samples from the major canals, made for special studies in regard to effects of drought, are given in table 102.

Table 101.—*Analyses, in parts per million, of miscellaneous surface waters in southeastern Florida, 1939–42*

Source	Date	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
Fisheating Creek at Palmdale	Dec. 20, 1939	......	9.1	......	......	......	10	1	19	......	......	16
Do	Feb. 12, 1941	180	......	3.5	1.3	7.6	5	1	18	......	34	14
Do	Oct. 27, 1941	240	6.0	2.5	1.7	6.3	9	2.3	12	0.3	30	13
Indian Prairie Canal near Okeechobee	Feb. 12, 1941	380	......	42	12	......	12	87	21	......	......	154
Taylor Creek near Okeechobee	Oct. 27, 1941	240	7.2	7.0	1.2	6.0	22	2.9	10	.3	38	22
Arbuckle Creek near De Soto City	Dec. 18, 1939	......	7.5	......	......	......	10	12	8	......	......	22
Istokpoga Canal near Cornwell	Dec. 19, 1939	......	9.1	......	......	......	9	10	10	......	......	34
Bolles Canal at Okeelanta	July 28, 1940	320	61.4	82	21	5.8	250	42	39	......	313	291
Do	Feb. 13, 1941	240	......	54	15	......	122	37	30	......	......	196
Do	Mar. 10, 1941	280	79.3	94	30	26	248	115	64	1.6	453	358
South New River Canal near Davie	Dec. 8, 1939	......	51.5	91	8.0	9.0	292	13	19	......	284	260
Do	Mar. 26, 1941	70	50.1	90	8.5	8.3	278	13	24	3.0	284	260
Do	Apr. 22, 1941	70	33.0	44	12	13	188	8.2	17	2.0	189	159
Do	May 21, 1941	65	47.4	82	9.2	8.5	262	14	22	.8	266	242
Do	July 3, 1941	110	35.3	54	5.7	15	194	12	13	1.4	197	158
Miami Canal at Lake Harbor	Dec. 18, 1939	......	42.5	45	13	22	152	32	39	......	226	166
Do	July 28, 1940	190	66.6	......	......	......	231	108	50	......	......	273
Do	Mar. 10, 1941	200	35.1	49	11	8.3	152	23	26	.4	270	168
Do	Oct. 26, 1941	280	19.4	28	5.2	2.9	94	5.8	10	.6	99	91
Deep Lake near Immokalee	Dec. 16, 1939	......	47.4	85	5.8	9.2	277	2	19	......	254	236
Lake Trafford near Immokalee	....do....	......	11.5	13	1.7	7.0	47	2	10	......	57	39
Still Lake near Fort Myers	May 11, 1943	22	......	52	9.9	31	192	6.3	52	.0	253	170
Twelvemile Creek near Fort Myers	Dec. 16, 1939	......	68.4	93	20	27	351	18	47	......	378	314
Imperial River near Bonita Springs	....do....	......	44.4	76	4.8	11	241	1	25	......	236	209
Shark River Canal at Tamiami Trail Bridge 169	Dec. 9, 1939	......	30.0	48	3.7	8.2	153	2	18	......	155	135

Boynton Canal at Boynton	May 7, 1942	130	29.2	48	3.9	6.8	132	12	21	.4	157	136
Drainage ditch 2.4 miles southeast of Canal Point[1]	Mar. 14, 1941	280	223	147	84	236	649	267	294	....	1,350	712
Drainage ditch 5.5 miles southeast of Canal Point[1]	.....do	440	240	178	97	231	728	308	303	....	1,480	843
Drainage ditch 8.7 miles southeast of Canal Point[1]	.....do	440	201	132	67	210	632	120	297	....	1,140	605
Drainage ditch at South Bay[2]	Mar. 13, 1941	280	153	200	74	57	554	336	87	1.6	1,030	803
Drainage ditch at Okeelanta[3]	Mar. 10, 1941	220	158	208	68	57	506	340	109	1.0	1,030	799
Drainage ditch 18 miles south of South Bay[4]	Feb. 13, 1941	440	....	33	8.7	....	76	11	29	....	....	118
Drainage ditch 27 miles south of South Bay[4]	July 28, 1940	160	92.2	110	24	56	390	34	99	....	515	373
Do	Feb. 13, 1941	220	....	29	9.0	1.0	76	9.5	28	....	114	109
Borrow ditch 41 miles south of South Bay	July 28, 1940	150	64.2	104	11	18	338	8	41	....	349	305
Do	Mar. 10, 1941	120	29.8	44	9.2	4.0	156	5.3	16	.5	156	148

[1] At pumphouse on State Highway 716.
[2] At pumphouse 0.1 mile north of railroad bridge over North New River Canal.
[3] West of State Highway 25 and south of Bolles Canal.
[4] Along SCS dike west of State Highway 25.
[5] Along west side of State Highway 25 at 20-Mile Bend.

Table 102.—*Analyses, in parts per million, of miscellaneous surface waters in southeastern Florida, May and September 1945*

Source	Date	Color	Specific conductance (K x 10^5 at 25 C)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
Miami Canal at Lake Harbor	May 29	180	147	168	39	99	568	69	178	8.3	841	580
Do.	Sept. 23	190	41.8	65	11	12	186	57	14	.4	251	207
North New River Canal at South Bay	May 25	50	52.8	52	15	32	160	48	53	7.0	286	192
Do.	Sept. 21	300	111	147	48	6.7	380	212	22	20	643	564
North New River Canal at Okeelanta	May 25	...	60.7	...	...	...	204	55	58	...	...	210
Do.	Sept. 21	...	134	...	...	...	...	...	85	...	...	...
North New River Canal 16 miles south of South Bay	May 25	50	52.1	49	15	37	180	36	56	.2	282	184
Do.	Sept. 21	340	93.8	125	36	28	308	173	52	18	584	460
North New River Canal at Palm Beach-Broward County line	May 25	...	55.6	...	...	...	204	50	56	...	...	180
Do.	Sept. 21	...	111	...	...	...	...	...	110	...	...	...
North New River Canal at 26-Mile Bend	May 25	50	54.7	54	15	35	202	26	57	.0	286	196
Do.	Sept. 21	320	82.7	109	31	22	280	133	47	16	496	400
North New River Canal at 20-Mile Bend	May 25	...	61.1	...	...	...	240	50	57	...	...	...
Do.	Sept. 21	...	82.2	...	...	...	...	...	52	...	...	...
North New River Canal 8 miles west of State Highway 7	May 25	...	62.7	...	...	...	282	34	58	...	...	216
Do.	Sept. 21	...	92.3	...	...	...	...	...	88	...	...	...
North New River Canal near Fort Lauderdale	May 25	45	58.8	60	16	42	222	40	58	.8	326	216
Do.	Sept. 21	280	74.6	100	26	14	262	107	43	.4	420	356
South New River Canal at State Highway 25	May 26	60	34.5	51	7.6	6.4	172	5	18	.7	173	158
Do.	Sept. 27	110	52.9	90	7.9	12	224	63	22	2.8	308	257
South New River Canal above lock and dam, near Davie	May 25	140	55.2	84	10	19	288	10	32	.0	297	250
Do.	Sept. 21	82	60.2	102	8.8	20	310	32	29	5.6	350	290

South New River Canal above Snake Creek Canal, near Davie	May 25	55	44.7	65	9.0	16	224	10	28	.6	239	199
Do	Sept. 25	55	57.8	102	7.6	11	311	18	22	4.3	318	286
Hillsboro Canal at Belle Glade	May 25	50	52.7	54	17	28	168	44	54	9.0	289	205
Do	Sept. 23	400	148	154	61	95	504	238	122	12	930	635
Hillsboro Canal at junction with Cross Canal	May 25	...	52.6	...	...	...	188	30	52	...	...	162
Do	Sept. 23	...	119	...	...	...	...	...	115	...	...	...
Hillsboro Canal at Shawano	May 25	560	122	101	38	110	520	10	150	.2	665	408
Do	Sept. 23	360	119	108	43	99	520	44	129	8.4	688	446
Hillsboro Canal at Indian Run	May 26	80	216	160	39	244	488	72	435	1.2	1,190	560
Do	Sept. 23	400	50.0	47	15	36	196	20	52	2.6	269	178
Hillsboro Canal at State Highway 7	May 26	...	227	...	...	...	450	110	490	...	...	435
Do	Sept. 23	...	49.7	...	...	...	...	...	62	...	...	...
Hillsboro Canal near Deerfield Beach	May 26	160	156	121	21	186	412	57	280	.0	868	388
Do	Sept. 23	320	47.8	52	11	27	178	20	48	.2	246	175
West Palm Beach Canal at Canal Point	May 26	30	46.0	43	12	38	164	32	50	1.4	257	157
Do	Sept. 22	640	78.3	83	29	40	286	76	71	.2	440	326
West Palm Beach Canal at Big Mound Canal	May 26	...	64.9	...	...	...	256	24	68	...	...	186
Do	Sept. 22	...	38.2	...	...	...	...	...	32	...	...	...
West Palm Beach Canal at Range Line	May	...	75.1	...	...	...	224	52	106	...	...	192
Do	Sept. 22	...	22.0	...	...	...	...	...	18	...	...	...
West Palm Beach Canal at West Palm Beach	May 26	40	67.5	56	14	64	200	40	92	.7	365	197
Do	Sept. 22	200	21.6	28	4.0	7.1	84	10	16	.1	107	86
Cypress Creek Canal at Pompano	May 26	40	46.9	89	2.5	6.4	264	7	16	.0	251	232
Do	Sept. 21	80	66.2	99	5.5	35	256	59	53	.1	378	270

EFFECT OF DROUGHT CONDITIONS ON CHEMICAL QUALITY OF EVERGLADES CANALS

Drought conditions in southeastern Florida during 1945 resulted not only in unusual inland penetration of salt water from the ocean, but also in increased concentration of dissolved salts in the Everglades canals. Owing to greatly deficient rainfall during this period the runoff in the major drainage canals was derived largely from ground-water storage, which generally contains higher concentrations of dissolved salts than does direct surface inflow.

By May 1945, the accumulated deficiencies in precipitation for the year amounted to more than 11 inches in the Miami area. Because the summer rain ordinarily begins in late May or early June, it was decided to collect a series of samples of surface waters in the major Everglades canals prior to the rainy season. Another series was scheduled for collection in the early fall, which normally coincides with the end of the rainy season. It was anticipated that the samples collected in May would contain much larger amounts of dissolved salts then would the samples collected in September.

The results of the analyses of the two series of samples are shown in table 102. Contrary to expectation, the concentrations found in the September samples, for a majority of the sampling locations, were considerably higher than the concentrations found in the May samples. Because the two series of single samples could not possibly reflect all the changes that took place in the Everglades canals during the period, it is impossible to explain satisfactorily why most of the September samples were more concentrated than the May samples and, at the same time, to explain why the reverse was true for other sampling locations.

During the extremely dry months it is possible that the heavy draft on the water table by vegetation resulted in an accumulation of salts at, or near, the surface of the ground as a result of transpiration. With the coming of the rains and the rising of the water table to the surface of the ground, the accumulated salts would have been dissolved and gradually discharged into the canals. It is probable that many other factors were to some degree responsible for the increase in concentration in the canal samples in September over that in May, but the above explanation may account for a part of the increase.

CHEMICAL CHARACTER OF NONARTESIAN GROUND WATERS

Nonartesian ground waters along the low coastal ridge in Dade and Broward Counties are, in general, moderately hard waters in which the dissolved mineral matter consists largely of calcium and bicarbonate. Hardness ranges from about 150 to 300 ppm.

Shallow ground waters in the Everglades are generally harder and more concentrated than the shallow coastal ground waters because of remnants of saline residues resulting from former invasions of the area by the sea. Maps showing the locations of the wells that were sampled are in the Appendix.

METROPOLITAN AREA OF MIAMI

Most of the public and private supply wells in the Miami area are less than 100 ft deep and, of those over 100 ft deep, not many exceed 120 ft. The dissolved mineral matter in the water, unless contaminated with salt water, consists essentially of calcium and bicarbonate with smaller amounts of magnesium, sodium, sulfate, chloride and other constituents. From 70 to 80 percent of the dry residue remaining after evaporation of the water consists of calcium carbonate. (See table 103.)

The calcium ordinarily ranges from about 90 to 110 ppm and the magnesium ranged from about 4 to 8 ppm. Hardness ranges from about 200 to 300 ppm (expressed as calcium carbonate). Sulfate in the uncontaminated ground water ranges from about 30 to 50 ppm, and the chloride ranged from about 15 to 25 ppm. Sodium and potassium are usually present in concentrations that are nearly equivalent to the chloride. Iron is present in amounts that range from 0.1 ppm (or less) to about 3 ppm.

Table 103.—*Analyses, in parts per million, of nonartesian waters in the Miami metropolitan area*

[See plates 21 and 22]

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
S- 1	Miami Springs, Hialeah well field..	Sept. 25, 1940	67	77	60	64.2	......	......	....	....	268	....	46	......	....	....
S- 2	..........do..........................	.....do..........	96	78	65	54.7	......	......	....	....	266	....	20	......	....	....
S- 3	..........do..........................	.....do..........	62	77	60	74.5	......	117	8.0	27	258	61	77	......	417	325
S- 4	..........do..........................	.....do..........	94	78	65	138	......	142	11	125	264	67	273	......	748	400
S- 5	..........do..........................	.....do..........	100	76	65	59.8	......	105	6.4	15	274	47	33	......	341	288
S- 6	..........do..........................	.....do..........	62	77	65	53.0	......	......	....	....	273	....	19	......	....	....
S- 7	..........do..........................	.....do..........	62	78	60	53.3	......	......	....	....	276	....	18	......	....	....
S- 8	..........do..........................	June 30, 1941	64	......	45	51.0	0.8	94	6.8	5.9	266	31	17	1.3	288	263
S- 11	..........do..........................	Sept. 26, 1940	91	78	65	54.1	......	96	6.9	11	276	38	19	......	307	268
S- 12	..........do..........................	.....do..........	90	77	80	56.1	......	99	7.8	10	274	41	24	......	317	279
S- 13	..........do..........................	.....do..........	55	76	65	77.3	......	97	12	48	278	44	86	......	424	291
S- 14	..........do..........................	.....do..........	73	76	75	76.1	......	97	12	45	282	47	78	......	418	291
S- 15	..........do..........................	.....do..........	85	76	65	85.9	......	118	10	44	281	47	108	......	465	336
S- 16	..........do..........................	.....do..........	90.5	76	65	56.2	......	......	....	....	271	....	21	......	....	....
S- 17	..........do..........................	.....do..........	87	77	90	59.0	......	104	6.8	10	291	43	19	......	326	288
S- 23	NW. 32d Ave. and 79th St..........	Sept. 26, 1940	64	79	50	47.3	......	92	4.0	2.0	238	42	9.0	......	266	246
S- 35	2741 NW. 27th Ave..................	July 17, 1940	51	77	3	70.0	.56	115	5.0	29	291	52	55	.4	400	308
S- 52	7580 NE. 4th Ct......................	Sept. 26, 1940	60	80	5	69.4	......	104	5.0	36	297	31	59	......	381	280
S- 58	U. S. Hwy. 1 and Sunny Isles Road..	Nov. 15, 1940	36	77	30	151	......	......	....	....	318	....	308	......	....	....
S- 70	47 NW. 6th St..........................	Jan. 23, 1941	100.5	......	5	59.0	......	......	....	....	66	....	1,640	......	....	....
S- 72	70 NW. 11th St........................	Oct. 4, 1940	32	82	5	1,050	......	183	220	1,790	206	655	3,120	......	6,070	1,360
S- 73	N. Miami Ave. and 16th St.........	Oct. 19, 1940	37	80	25	818	......	155	168	1,370	290	348	2,450	......	4,620	1,080
S- 89	92-99 NW. 7th Ave..................	July 25, 1940	50	80	5	48.3	1.0	92	3.6	5.1	235	37	17	.6	272	244
S-112	NW. 11th Ave. and 22nd St.........	Oct. 2, 1940	90	80	5	104	......	106	9.0	97	248	40	189	......	563	302
S-145	..........do..........................	Oct. 2, 1940	63	79	5	202	......	102	35	256	264	70	472	......	1,060	398
S-150	Dixie Hwy. and Douglass Road......	Oct. 3, 1940	66	79	5	132	......	124	8.5	132	252	21	285	......	695	344
S-153	SW. 6th Ave. and 8th St............	Jan. 18, 1941	45-50	......	5	63.7	......	90	4.2	37	251	22	67	......	344	242
S-278	Ojus, Greynolds Park................	Oct. 11, 1940	80	77	15	94.4	......	135	5.4	50	284	25	148	......	503	359
S-301	North Miami, U. S. Hwy. 1, 0.2 mile North of NE. 111th St.......	Oct. 15, 1940	100	......	20	89.2	......	116	10	58	269	83	106	......	506	331
S-304	North Miami Beach, public supply..	Jan. 31, 1944	60	......	35	167	......	150	14	167	296	44	358	1.8	881	432
S-376	NW. 10th Ave. and 76th St..........	Nov. 4, 1940	75	......	35	51.5	......	101	3.5	5.0	274	29	16		290	266
S-384	Biscayne Gardens, NE. 2d Ave. and 143rd St........................	Oct. 24, 1940	63.5	76	75	57.8	......	101	6.8	19	324	5.3	35	......	327	280

F- 1	Miami Springs, Canal St. and The Parkway	Jan. 25, 1941	52.7	....	50	53.5	....	....	....	....	258	....	33	....	....	....
F- 2	Miami Springs, Riverside and De Leon Drives	do.	73.4	....	70	51.2	....	....	....	....	254	....	21	....	....	....
F- 3	Miami Springs, De Leon and Morningside Drives	do.	48.2	....	70	90.0	....	....	....	....	256	....	132	....	....	....
F- 4	Miami Springs, South and Pinecrest Drives	do.	68.2	....	120	110	....	....	....	....	262	....	191	....	....	....
F- 5	Miami Springs, LaVilla and Pinecrest Drives	do.	53	....	120	92.6	....	....	....	....	254	....	144	....	....	....
F- 6	Miami Springs, La Baron and De Leon Drives	do.	47.7	....	60	54.4	....	....	....	....	272	....	11	....	....	....
F- 7	Miami Springs, Minola and La Baron Drives	do.	54.8	....	120	58.4	....	....	....	....	267	....	33	....	....	....
F- 8	Miami Springs, Mokena and Oakwood Drives	do.	54.8	....	70	54.2	....	....	....	....	263	....	17	....	....	....
F- 9	Miami Springs, De Soto and Oakwood Drives	do.	48.8	....	60	49.7	....	....	....	....	236	....	13	....	....	....
F- 10	Miami Springs, Oakwood and Palmetto Drives	do.	80.7	....	70	50.4	....	....	....	....	257	....	13	....	....	....
F- 11	Miami Springs, Eastward Drive between De Leon and De Soto Drives	Aug. 31, 1940	59.3	77	105	55.2	....	100	6.9	9.7	263	49	23	0	318	278
F- 12	Miami Springs, Hunting Lodge Drive and The Esplanade	do.	56.9	76	160	135	....	156	9.1	106	255	71	265	0	733	477
F- 13	Miami Springs, Hunting Drive Lodge and Sunset Way	Jan. 25, 1941	73.3	....	90	54.8	....	....	....	....	272	....	17	....	....	....
F- 14	Miami Springs, Hunting Lodge and Melrose Drives	Aug. 31, 1940	59.7	74	115	52.6	....	94	6.2	11	268	33	21	0	297	260
F- 15	Miami Springs, Hunting Lodge and Glendale Drives	Jan. 25, 1941	73.1	....	110	53.4	....	....	....	....	295	....	19	....	....	....
F- 53	NW. 6th Ave. and 79th St.	Jan. 2, 1941	110	80	15	45.6	....	....	....	....	277	....	19	....	....	....
F- 62	NW. 9th Ave. and 54th St.	do.	82.9	....	5	45.0	....	....	....	....	253	....	15	....	....	....
F- 64	NW. 10th Ave. and 36th St.	July 20, 1940	114	78	10	57.4	.83	94	3.8	22	262	13	49	.3	312	250
F- 80	NW. 15th Ave. and 14th Ter.	Jan. 22, 1941	95.4	....	90		....	....	....	....	227	....	12,000	....	....	....
F- 85	NW. 15th Ave. and 77th St.	do.	58.6	....	5		....	....	....	....	254	....	20	....	....	....
F-102	NW. 18th Ave. and 19th St.	July 17, 1940	118.8	76	10		....	102	4.0	23	289	1	59	.2	332	271
F-109	NW. 19th Ave. and 79th St.	Jan. 9, 1940	51.4	79	....		....	....	....	....	250	28	16	....	....	....
F-117	NW. 22d Ct. and 20th St.	Jan. 5, 1941	55.4	77	....	170	....	....	....	....	285	....	372	....	....	....
F-120	NW. 23rd Ct. and 7th St.	July 20, 1940	120	78	5	45.7	....	82	3.3	12	250	6	23	.3	250	218
F-131	NW. 34th Ave. and 17th St.	Mar. 12, 1940	49.7	78	....	69.9	....	....	....	....	254	....	89	....	....	....
F-155	SW. 24th Ave. and 24th Ter.	Jan. 9, 1940	60.5	80	....	83.6	....	....	....	....	258	30	124	....	....	279
F-158	SW. 27th and Andros Avenues	Oct. 31, 1940	83.4	78	15	4,400	....	460	1,070	8,810	230		15,800	....	28,400	5,540
F-168	SW. 27th Ave. and 28th Lane	Jan. 21, 1941	107.1	....	....	4,480	....	....	....	....	139	....	16,400	....		
F-172	SW. 30th Ave. and 16th St.	Oct. 12, 1940	87.5	78	5	50.6	....	96	3.3	9.5	254	21	31	....	286	253

Table 103.—*Analyses, in parts per million, of nonartesian waters in the Miami metropolitan area*—Continued

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10[5] at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
F-173	SW. 30th Ave. and 27th St.	Oct. 12, 1940	60.2	78	5	180	......	157	9.4	204	258	29	448	......	974	430
F-174	SW. 31st Ave. and 12th St.	Jan. 9, 1940	67.0	80	......	49.1	......	......	......	......	252	28	24	......	......	240
F-186	SW. 58th Ave. and 4th St.	.....do.....	63.1	78	......	49.9	......	......	......	......	268	30	14	......	......	249
F-188	Bird Road and Mary St.	Jan. 21, 1941	115.3	......	140	4,880	......	......	......	......	79	......	18,000	......	......	......
F-202	Shipping Ave. and Mary St.	Jan. 18, 1941	62	......	5	204	......	......	......	......	264	......	502	......	......	......
F-205	N. Miami Ave. and 59th St.	July 17, 1940	50	80	5	50.6	.52	94	2.9	14	254	37	21	.0	295	247
F-212	Le Jeune Road at Municipal Airport.	Aug. 24, 1940	53	78	95	48.4	......	89	3.3	8.4	254	25	14	.0	265	236
F-219	NE. 2d Ave. and 61st St.	July 19, 1940	90	79	5	56.6	.97	97	2.9	21	262	42	29	.1	322	254
F-223	NE. 2d Ave. and 82d St.	July 25, 1940	48.9	78	5	52 3	.58	96	3.3	13	261	37	20	.4	299	253
F-225	NE. 3rd Ct. and 76th St.	July 19, 1940	70	78	15	59.6	.76	102	2.8	23	260	45	40	.3	342	266
F-226	NE. 4th Ave. and 59th St.	Aug. 24, 1940	85.8	79	5	67.6	1.7	127	3.6	18	391	7	31	.0	381	332
F-228	NE. 4th Ave. and 108th St.	.....do.....	114.1	78	65	56.0	.70	101	3.5	16	271	53	17	.0	325	266
F-233	NW. 31st Ave. and 8th St.	July 5, 1940	48.9	78	......	44.9	.12	84	2.8	11	248	18	17	.1	255	221
F-245	Hialeah, E. 5th Ave. and 54th St.	Aug. 24, 1940	93.1	76	95	55.3	1.0	95	8.0	10	304	13	21		298	270
F-248	Hialeah, Palm Ave. and 51st St.	July 5, 1940	56.2	77	50	53.0	1.1	94	11	6.8	287	27	20		305	280
F-263	Hialeah, E. 2d Ave. and 4th St.	Aug. 24, 1940	101.7	77	100	52.4	.60	94	6.7	11	272	37	17		300	262
F-266	Hialeah, E. 2d Ave. and 17th St.	Nov. 22, 1940	45	77	......	53.3	......	......	......	......	269	......	16		......	......
F-268	Hialeah, E. 1st Ave. and 5th St.	Dec. 27 1940	54.6	77	60	50.8	......	......	......	......	257	......	15		......	......
F-275	North Miami, NE. 10th Ave. and 128th St.	Aug. 24, 1940	51.7	78	45	54.2	.43	104	3.5	8.3	231	77	16	.0	323	274
F-284	North Miami, NW. 11th Ave. and 128th St.	July 5, 1940	59.2	78	40	44.0	......	84	4.4	5.8	255	8	16	.5	244	228
F-296	North Miami, U. S. Hwy. 1 and NE. 138th St.	.....do.....	46.7	79	20	66.4	3.0	108	4.4	25	284	2	75	1.0	358	288
F-297	North Miami, NE. 10th Ave. and 132d 132d St.	.....do.....	85.5	78	120	57.2	8.8	115	4.0	11	301	52	19	.8	359	303
F-299	Biscayne Park, NE. 8th Ave. and 119th St.	Aug. 24, 1940	204.5	76	30	106	1.2	108	111	95	320	10	177	.0	560	315
F-300	North Miami Beach, Flagler Blvd. and Arriola Way.	July 5, 1940	91.1	77	20	49.2	2.3	95	2.9	16	279	21	21	5.6	301	249
F-301	Coral Gables, Menores Ave. between Galiano St. and Douglass Road.	Oct. 4, 1940	57.5	80	3	49.8	......	96	3.7	7.4	267	27	17	......	283	255
F-304	Coral Gables, Le Jeune Road and Coral Way.	.....do.....	18.0	82	3	48.9	......	94	3.7	5.6	263	23	16	......	272	250
F-307	Coral Gables, San Antonio Ave. and Segovia St.	.....do.....	18.3	80	3	48.3	......	94	3.3	6.8	267	18	18	......	272	248

F-309	Coral Gables, Riviera Drive and Toledo St.	do.	13.9	82	3	53.0	......	98	4.3	9.3	278	28	18	......	294	262
G- 42	North Miami Beach, at gas plant	Oct. 31, 1940	14.3	100	560	184	......	34	3.1	357	464	110	268	......	1,000	93
G- 48	Abaco Ave. and Lucaya St.	do.	13.1	79	5	54.1	......	94	3.6	14	260	19	34	......	293	249
G-158A	SW. 27th and Andros Avenues	do.	16.7	82	3	61.3	......	105	3.8	24	302	17	46	......	345	278
G-182	Miami Springs, Morningside Drive and The Parkway	Aug. 27, 1940	19.0	82	......	78.2	......	108	4.3	63	279	102	63	.0	478	287
	do.	do.	24.4	78	......	132	......	152	6.4	120	286	76	250	.0	745	406
	do.	Aug. 28, 1940	50.4	80	......	133	......	130	12	127	236	60	280	.0	725	374
	do.	Aug. 29, 1940	88.8	......	......	121	......	123	13	101	229	57	236	.0	643	360
	do.	do.	104.1	78	......	91.8	......	132	17	48	487	12	65	.0	514	399
	do.	Aug. 30, 1940	162.4	77	......	73.1	......	56	32	55	338	14	70	.0	394	271
	do.	Aug. 31, 1940	218.8	78	......	81.8	......	81	31	53	409	19	13	.0	257	208
	do.	Sept. 4, 1940	291.6	78	......	78.8	......	30	25	108	340	29	74	.0	434	178
	NE. 2d Ave. and 65th St.	Sept. 10, 1940	5.9	80	......	46.4	......	78	3.3	18	256	19	13	......	257	208
	do.	do.	28.6	80	......	50.0	......	84	3.1	23	278	18	18	......	283	222
	do.	do.	45.4	81	......	49.4	......	67	3.9	24	220	21	23	......	247	183
	do.	Sept. 11, 1940	50.6	81	......	53.1	......	85	3.5	27	253	38	27	......	305	277
	do.	do.	90.7	80	......	47.9	......	82	4.4	14	234	26	25	......	267	223
	do.	do.	98.8	80	......	49.6	......	86	3.7	16	242	26	28	......	279	230
	do.	Sept. 12, 1940	101.2	81	......	47.2		78	5.2	14	226	19	30	......	258	216
	do.	do.	105.0	82	......	82.3		100	7.1	57	241	23	129	......	435	279
	do.	do.	108.3	80	......	118		124	6.1	105	253	34	227	......	621	335
	do.	do.	111.9	81	......	88.3	......	107	6.0	64	230	34	146	......	470	292
	do.	Sept. 14, 1940	128.8	80	......	863	......	351	113	1,380	269	293	2,700	......	4,970	1,340
	do.	Sept. 17, 1940	174.6	80	......	2,130	......	342	436	3,950	274	874	7,160	......	970	2,650
	do.	do.	178.4	80	......	2,230	......	352	463	4,170	289	919	7,560	......	13,600	2,780
	do.	do.	182.5	80	......	2,280	......	354	479	4,480	301	949	7,700	......	14,100	2,850
	do.	do.	186.4	80	......	2,130	......	341	433	3,920	276	861	7,120	......	12,800	2,630
	do.	Sept. 18, 1940	275.4	78	......	150	......	46	3	224	359	103	255	......	844	275
	do.	Sept. 20, 1940	306.9	79	......	578	......	94	114	965	270	283	1,620	......	3,210	703
	do.	do.	331.2	79	......	318	......	38	44	578	318	301	680	......	1,800	276
	Miami Gardens Drive and Douglass Road	Oct. 22, 1940	52.6	76	110	39.0	......	74	5.2	3.6	225	12	12	......	218	206
	do.	do.	57.1	77	120	39.0	......	74	5.2	1.4	221	12	11	......	212	206
	do.	Oct. 23, 1940	68.3	77	80	42.3	......	74	6.1	7.0	236	14	12	......	229	210
	do.	do.	86.4	78	30	46.4	......	81	7.3	9.2	256	19	16	......	259	232
	do.	do.	99.0	77	75	58.8	......	102	8.6	12	322	19	23	......	323	290
	do.	Oct. 25, 1940	113.0	77	85	59.0	......	104	9.0	11	327	20	23	......	328	297
	do.	do.	120.7	78	30	72.7	......	110	14	55	394	6.2	50	......	429	280
	do.	Oct. 26, 1940	198.4	78	20	188	......	52	39	303	416	85	368	......	1,050	290
G-186	NW. 17th Ave. and 55th Ter.	Nov. 1, 1940	41.6	78	3	47.5	......	89	2.8	9.8	256	19	18	......	265	234
	do.	Nov. 2, 1940	68.2	77	15	47.2	......	87	4.3	8.0	257	17	17	......	260	235
	do.	do.	88.9	77	10	48.5	......	90	4.3	9.0	267	17	18	......	270	242
	do.	Nov. 4, 1940	109.2	77	15	51.6	......	95	5.1	11	298	4.7	23	......	286	258

Table 103.—*Analyses, in parts per million, of nonartesian waters in the Miami metropolitan area*—Continued

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
G-186	NW. 17th Ave. and 55th Ter...	Nov. 4, 1940	130.2	77	10	53.0	......	97	5.5	11	305	4.9	24	......	293	265
	do.	do.	144.3	77	5	54.1	......	96	6.2	16	318	3.3	25	......	303	265
	SW. 27th Ave. and Dixie Hwy..	Dec. 11, 1940	34.4	79	5	66.4	......	104	3.8	45	316	52	43	......	404	276
	do.	do.	48.0	79	5	64.6	......	95	3.4	49	279	43	60	.5	388	251
	do.	Dec. 12, 1940	63.6	79	5	208	......	146	20	260	272	65	512	......	1,140	447
	do.	Dec. 13, 1940	81.6	79	10	3,140	......	428	689	6,010	259	1,380	10,900	......	19,500	3,900
	do.	Dec. 17, 1940	143.0	79	5	5,060	......	444	1,230	10,400	148	2,500	18,400	......	33,000	6,150
	do.	Dec. 18, 1940	217.2	79	5	3,090	......	439	701	5,950	235	1,590	10,700	......	19,500	3,980
G-193	NW. 36th St. and Miami Canal.	Dec. 21, 1940	17.7	76	60	73.4	......	94	12	48	277	38	87	......	416	284
	do.	Dec. 24, 1940	49.4	76	40	151	......	103	25	183	263	100	310	......	851	360
	do.	Jan. 2, 1941	66.2	76	30	225	......	123	35	305	288	128	528	......	1,260	451
	do.	do.	77.0	77	30	1,260	......	229	246	2,220	289	577	3,950	......	7,360	1,580
G-195	NW. South River Drive, 0.8 mile NW. of 36th St.	Jan. 11, 1941	62.4	77	......	118	......	109	16	113	256	67	215	......	646	338
	do.	do.	68.7	77	......	118	......	112	16	110	268	64	212	......	646	345
	do.	Jan. 13, 1941	71.9	77	......	106	......	107	14	......	257	......	181	......	......	325
	do.	do.	82.1	77	......	91.7	......	101	14	66	264	47	133	......	491	306
	do.	do.	83.1	77	......	86.2	......	98	13	......	264	......	121	......	......	298
	do.	do.	89.1	77	......	116	......	111	16	102	268	45	211	......	617	343
G-196	Le Jeune Road, 0.2 mile S. of NW. 36th St.	Feb. 28, 1941	11.8	77	65	51.9	.43	92	5.5	11	232	48	26	......	297	252
	do.	do.	42.0	76	95	54.2	.30	90	7.4	16	238	44	35	......	310	
	do.	Mar. 1, 1941	65	77	55	130	.80	122	14	122	249	62	255	......	698	
	do.	Mar. 3, 1941	75.6	77	70	290	.31	162	37	384	259	116	750	......	1,580	556
	do.	Mar. 5, 1941	92	77	......	810	.35	219	141	1,300	276	317	2,410	......	4,520	1,130
G-197	Hialeah, SE. 10th St. and 14th St.	Mar. 11, 1941	52	77	......	50.7	.25	92	.2	20	250	35	23	......	294	230
	do.	Mar. 15, 1941	67.2	77	50	85.0	.20	84	13	78	254	47	125	......	472	263
	do.	Mar. 18, 1941	90.5	77	50	840	.20	200	156	1,380	294	342	2,520	......	4,740	1,140
G-198	Coral Gables, 0.2 mile S. of Coral Way and 0.7 mile W. of Ludlum Road	Apr. 15, 1941	41.7	76	......	52.7	.20	100	6.3	3.6	278	33	15	.0	295	275
	do.	Apr. 16, 1941	58.1	75	......	38.9	.20	76	4.6	1.3	206	22	14	.0	220	209
	do.	Apr. 17, 1941	73.2	75	......	50.2	.30	102	7.0	.9	293	23	15	.0	292	283
	do.	Apr. 18, 1941	84.9	75	......	52.8	.20	102	6.3	4.1	306	14	17	.0	294	280
	do.	Apr. 21, 1941	101.7	75	......	57.3	.20	101	15	5.8	345	5.3	27	.0	324	314

G-199	0.2 mile W. of Le Jeune Road and 0.1 mile N. of NW. 36th St.	June 6, 1941	56.3	77	......	60.6	......	109	9.6	6.0	244	83	27	.0	355	312
	do.	June 7, 1941	71.2	77	......	99.4	......	125	10	67	280	59	148	......	547	353
	do.	June 9, 1941	85.8	77	......	364	......	178	46	503	274	136	965	......	1,960	633
	do.	June 13, 1941	888.5	77	......	406	.15	191	56	576	305	165	1,090	......	2,230	707
	do.	June 14, 1941	92	78	40	486	.15	189	75	728	287	189	1,370	......	2,690	780

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COASTAL AREAS SOUTH OF MIAMI

All of the coastal area south of Miami is within Dade County, reaching from the southern edge of the area of Miami near South Miami to Florida Bay south of Homestead and Florida City. The samples from this area were collected from 4 supply wells, 2 fire wells, and 14 test wells in the vicinity of Homestead and Florida City. Most of the test wells were drilled in connection with the development of a public supply for Key West.

Analyses of the uncontaminated ground waters south of Miami show that they contained somewhat less dissolved mineral matter and less color than ground waters in the Miami area. (See table 104.) Dissolved solids in the analyzed samples ranged from 187 to 252 ppm, and hardness ranged from 134 ppm in well G216 to 208 ppm in wells not contaminated with sea water. The dissolved matter consisted primarily of calcium and bicarbonate. Sulfate ranged from 2 to 12 ppm and chloride ranged from 10 to 22 ppm in uncontaminated water.

Some test wells encountered salty water at depths of only 20 ft at localities several miles south of Florida City; salty water was found at somewhat greater depths in the vicinity of Florida City. Essentially, these test wells were exploratory wells to determine the characteristics of the water-bearing formations and to determine the extent to which the Biscayne aquifer had been invaded by salt water. (See section on Salt-water encroachment.)

Table 104.—*Analyses, in parts per million, of nonartesian waters in Dade County, outside Miami metropolitan area*

[See plate 6]

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
S-194	Homestead public supply..........	Mar. 5, 1941	62	75	5	37.9	0.02	63	6.5	6.8 0.4	218	8.3	10	0.3	206	184
S-381	Greynolds Park..........................	Oct. 11, 1940	116	......	35	52.4	......	93	4.7	16	308	1	23	......	289	251
S-480	South Dade Project, F. S. A., near Homestead..................	Oct. 17, 1941	48 57	......	5	39.9	.04	74	1.7	8.8	227	9.3	10	1.1	217	192
S-480	..........do..........................	Oct. 13, 1941	46 53	......	5	39.2	.04	73	1.1	11	227	7.4	11	1.2	217	187
F-378	Florida City, Palm Drive and Roberts Road..........................	Jan. 9, 1941	24.1	76	5	36.6	......	71	2.9	3.8	218	3	11	......	199	189
F-379	U. S. Hwy. 1, E. of Naranja Rd....	.....do..........	20.7	76	5	39.8	......	77	1.6	3.8	226	6	11	......	211	199
G- 20	U. S. Hwy. 1, 5 miles S. of Florida	.....do..........	7.4	76	5	44.8	......	76	4.6	14	244	5	24	......	244	209
	City........................	.....do..........	7.4	76	5	44.8	......	76	4.6	14	244	5	24	......	244	209
G- 21	Tennessee Road, 1 miles S. of Florida City..........................	.....do..........	9	76	5	40.2	......	75	3.4	21	266	8	14	......	252	201
G- 22 1	Redland Road, 2 miles S. of Florida City..........................	.....do..........	8.6	76	5	39.5	......	79	2.6	6.1	244	4	12	......	224	208
G-187	Pennsuco, near Miami Canal.......	Nov. 13, 1940	23.3	75	140	53.5	......	96	8.6	6.5	305	6.4	23	......	291	275
	..........do..........................	Nov. 14, 1940	49.0	75	95	55.0	......	97	8.8	10	312	11	24	......	304	278
	..........do..........................	Nov. 15, 1940	91.1	74	50	55.4	......	90	9.9	15	310	5.6	27	......	300	265
	..........do..........................	Nov. 16, 1940	105.6	74	40	69.6	......	87	19	36	370	6.2	46	......	376	295
	..........do..........................	.....do..........	117.2	74	45	65.4	......	88	15	58	350	5.6	42	......	376	226
	..........do..........................	.....do..........	132.6	74	30	79.8	......	85	25	55	416	4.9	63	......	438	315
	..........do..........................	Nov. 18, 1940	171.8	74	15	70.4	......	46	31	62	346	12	57	......	378	242
	..........do..........................	.....do..........	222.4	75	20	67.4	......	24	24	96	363	10	42	......	375	159
G-188	Krome Road and Tamiami Trail...	Nov. 20, 1940	22.0	77	65	52.7	......	88	7.5	16	305	3.5	23	......	288	250
	..........do..........................	.....do..........	44.3	76	80	54.0	......	90	7.5	19	320	1	23	......	298	255
	..........do..........................	Nov. 21, 1940	76.6	77	15	66.6	......	74	12	56	327	14	52	......	369	234
	..........do..........................	Nov. 22, 1940	124.0	77	15	71.2	......	46	24	72	298	19	75	......	383	213
	..........do..........................	.....do..........	164.2	76	15	81.7	......	36	29	99	308	30	99	......	445	209
	..........do..........................	Nov. 23, 1940	200	77	15	79.6	......	26	26	113	358	24	71	......	436	172
G-207	Florida City..........................	Jan. 28, 1941	48.2	......	......	35.9	......	70	2.2	5.3	215	2	12	......	......	184
G-208	1 mile SW. of Florida City..........	Feb. 22, 1941	48.2	77	5	36.5	.05	68	2.8	6.5 .4	214	3.7	11	.0	201	181
G-209	U. S. Hwy. 1, 6.0 miles SE. of Florida City..........................	Mar. 18, 1941	24.1	75	......	343	.20	110	65	504	252	129	920	......	1,850	542

Table 104.—*Analyses, in parts per million, of nonartesian waters in Dade County, outside Miami metropolitan area*—Continued

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
G-209	U. S. Hwy. 1, 6.0 miles SE. of Florida City	Mar. 18, 1941	37.1	76	......	2,370	0.39	840	158	4,520	230	1,060	7,990	......	1,470	2,750
	do.	Mar. 20, 1941	59	77	......	4,120	......	410	986	8,310	198	1,990	14,800	......	26,600	5,080
G-210	5 miles S. of Florida City and 1 mile W. of U. S. Hwy. 1	Mar. 27, 1941	45.6	75	......	41.8	......	67	6.3	12	216	12	21	0.1	225	193
	do.	do.	53.3	76	......	37.7	......	60	5.5	19	209	11	22	.1	221	172
G-211	1.5 miles S. of Florida City and 0.05 mile W. of Florida East Coast Ry. grade	Mar. 29, 1941	33.9	76	......	34.9	......	67	5.0	.2	204	5.3	11	.1	189	188
	do.	Mar. 31, 1941	45.1	76	5	36.2	.24	73	3.7	.3	218	3.7	11	.1	199	197
	do.	Apr. 2, 1941	59.4	76	......	34.5	......	73	3.7	2.3	220	6.2	11	.1	205	197
	do.	do.	72	77	......	35.4	......	73	4.4	.8	220	4.5	12	.1	203	200
	do.	Apr. 3, 1941	81.9	77	5	36.5	.30	71	4.6	2.2	218	3.7	13	.1	202	196
G-212	U. S. Hwy. 1, 1.4 miles SE. Florida City	Apr. 10, 1941	35.0	77	......	37.9	......	72	4.8	9.6	227	14	14	.0	226	199
	do.	Apr. 11, 1941	53.3	77	......	36.1	......	72	4.8	2.6	214	9.9	14	.0	209	199
	do.	Apr. 12, 1941	72.2	77	......	42.7	......	67	7.6	18	223	13	29	.0	244	198
	do.	Apr. 15, 1941	78.6	76	5	108	......	76	18	116	221	31	215	......	565	264
G-213	0.45 mile SE. of Florida City and 3 miles E. of U. S. Hwy. 1	Apr. 16, 1941	22	76	......	56.6	......	68	4.8	31	212	17	53	.8	281	198
	do.	Apr. 18, 1941	55.9	76	......	71.4	......	67	7.6	57	186	23	104	......	350	198
	do.	Apr. 19, 1941	77.6	76	5	104	......	86	13	109	228	33	201	......	554	268
G-214	Longview Road, mile N. of Lucille Drive, SW. of Florida City	May 14, 1941	37.2	76	......	37.6	......	70	4.4	.4	202	6.6	15	......	196	193
	do.	do.	50.8	76	......	38.5	......	68	3.1	12	224	5.3	13	.0	212	182
	do.	May 15, 1941	61.4	76	......	39.2	......	66	4.8	6.7	210	8.2	13	.0	202	184
G-216	South Campbell Drive and Tallahassee Road, 3 miles E. of Homestead	Aug. 11, 1941	25.5	76	......	38.5	......	74	3.9	5.5	219	16	11	1.3	220	201
	do.	do.	43.5	76	......	37.2	......	70	3.3	4.8	208	11	11	1.5	204	188
	do.	Aug. 14, 1941	71.1	76	......	38.9	......	70	3.5	8.6	219	8.6	13	1.2	213	189
	do.	do.	82.0	76	......	38.7	......	60	4.4	17	205	16	14	.3	213	168
G-217	U. S. Hwy. 1, 1.6 miles N. of Campbell Drive	Aug. 20, 1941	45.7	76	......	37.3	......	68	1.7	12	214	9.5	11	1.2	209	177
	do.	Aug. 22, 1941	67.8	76	......	36.2	......	62	2.6	8.6	193	7.4	12	1.5	189	165
	do.	Aug. 26, 1941	87.8	76	......	37.6	......	67	3.5	7.2	212	8.2	10	1.0	201	182

	............do............................	Aug. 27, 1941	108.5	76	......	38.8	......	64	5.5	14	219	17	11	.8	220	182
G-218	Near Russian Colony Canal, 7 miles W. of Hialeah..............	Aug. 28, 1941	19.6	76	70	53.5	.03	97	6.3	15	328	5.8	19	.0	305	268
	............do............................	Aug. 28, 1941	64.4	74	70	52.7	.03	93	6.8	11	312	2.5	18	.0	285	260
	............do............................	Aug. 29, 1941	96.3	77	5	63.1	.03	48	16	36	255	3.3	48	.0	277	186
	............do............................	Aug. 30, 1941	105.2	75	5	77.2	.03	61	25	69	351	7.0	78	.0	413	255
	............do............................	Sept. 2, 1941	141.4	77	5	98.8	.03	73	32	98	450	5.3	108	.0	538	314
	............do............................	.....do..........	158.8	77	5	99.4	.03	58	36	108	436	10	114	.0	541	293
G-222	U. S. Hwy. 94, 30 miles W. of Miami................................	Dec. 31, 1941	41.5	77	20	130	......	160	30	92	688	3.1	110	.1	1,470	523
G-224A	1.5 miles W. of Milam Diary Road and 1.0 mile N. of Milam Dairy Canal........................	Mar. 9, 1942	36.6	74	70	56.6	......	102	9.6	3.7	300	28	19	.0	310	294
	............do............................	Mar. 10, 1942	91.3	74	....	60.6	......	99	11	9.7	318	18	24	.0		
	............do............................	Mar. 11, 1942	99	76	....	54.5	......	76	11	18	253	19	33	.0	282	234
	............do............................	.....do..........	102	76	....	69.6	......	69	9.6	58	275	12	71	.0	355	212
G-225	Dade-Broward Levee..................	Apr. 7, 1942	23.7	72	100	48.4	.15	88	8.7	5.8	284	5.8	19	2.5	270	256
	............do............................	Apr. 8, 1942	43.8	72	130	51.4	.20	92	7.9	6.0	296	1.2	21	2.5	277	262
	............do............................	Apr. 28, 1942	100	75	10	121	.10	77	34	142	524	11	141	.2	663	332
G-270	NW. 103rd St., 2.6 miles W. of Miami Canal............................	Mar. 6, 1941	4.6	....	......	46.6	......	82	4.4	13	268	3.3	18	2.0	255	223
G-271	Near Snapper Creek Canal, 5.3 miles N. of U. S. Hwy. 94........	.....do..........	7.3	....	......	52.0	......	93	6.2	11	304	2.7		3.0	285	258
G-272	1.0 mile W. of Milam Dairy Road and 3 miles N. of Flagler St.......	.....do..........	5.5	....	......	51.1	......	96	6.3	8.5	289	22	16	2.0	293	265
G-273	2.5 miles W. of Milam Dairy Road and 3 miles N. of Flagler St.......	.....do..........	5.5	....	......	42.0	......	100	5.2	5.6	304	17	11	1.0	290	271
G-274	1.0 miles W. of Milam Dairy Road and 2 miles N. of Flagler St......	.....do..........	5.1	....	......	48.9	......	95	4.9	5.7	274	25	13	1.0	280	257
G-275	Near Snapper Creek Canal, 2 miles N. of Flagler St.....................	.....do..........	5.4	....	......	39.8	......	76	4.7	6.5	237	6.2	15	1.5	227	209
G-276	2.6 miles N. of U. S. Hwy. 94 and 2 miles E. of Krome Ave.........	.....do..........	7.0	....	......	33.5	......	60	4.7	7.0	189	3.7	17	2.0	188	169
G-447	W. of Kendall..........................	Aug. 28, 1946	30	....	15	....	.3	81	3.2	4.5	....	16	10	....	254	215
	............do............................	Aug. 29, 1946	40	....	15	....	.8	80	3.5	3.0	....	9.9	11	....	247	211
	............do............................	Aug. 30, 1946	60	....	18	....	.6	81	2.8	5.0	....	13	9	....	250	211
	............do............................	Sept. 4, 1946	80	....	5	....	.2	79	4.6	7.0	....	5.8	13	....	264	216
G-448	W. of Howard...........................	Aug. 21, 1946	37.8	....	13	....	.8	100	4.0	8.0	....	46	13	....	327	265
	............do............................	Aug. 26, 1946	68.1	....	11	....	.5	94	4.0	8.0	....	23	11	....	282	251
	............do............................	Sept. 23, 1946	81.2	....	10	....	.5	92	4.0	3.0	....	13	11	....	285	246
G-449	Rockdale.................................	Sept. 11, 1946	40	....	3	....	.1	80	2.8	4.6	....	1.6	14	....	250	211
	............do............................	Sept. 13, 1946	80	....	3	....	.05	78	2.4	4.0	....	0.5	12	....	225	206
G-450	E. of Rockdale..........................	Sept. 15, 1946	40	....	5	....	.45	91	2.7	13	....	22	18	....	301	238
	............do............................	Sept. 16, 1946	60	....	3	....	.15	84	2.0	29	....	4.5	15	....	257	218

Table 104.—*Analyses, in parts per million, of nonartesian waters in Dade County, outside Miami metropolitan area*—Continued

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
GS-14	12-14 miles N. of 40 Mile Bend in U. S. Hwy. 94	Sept. 24, 1942	([1])	94	50	27.0	0.10	41	3.1	8.6	125	1.4	20	2.2	138	115
	do	Sept. 25, 1942	18.5	77	20	90.0	.10	140	10	78	523	5.8	51	.2	543	390
	do	do	40.4	77	20	111	.10	128	14	99	480	29	120	....	627	377
	do	Sept. 26, 1943	51	....	10	147	.10	108	18	205	508	49	228	.5	859	344
GS-30	13 miles S. of Royal Palm State Park on Cape Sable Road	Sept. 7, 1943	16.3	78	10	199	.04	94	33	262	224	62	490	....	1,050	370
	do	Sept. 8, 1943	28	76	7	951	.05	254	149	1,580	234	364	2,920	....	5,380	1,250
	do	do	34	76	7	1,190	.02	272	218	2,030	242	475	3,750	....	6,860	1,580
	do	Sept. 10, 1943	64	....	75	256	.10	70	47	368	122	99	685	....	1,230	368

[1] Surface sample from Everglades near site of Well GS-14.

COASTAL AREAS NORTH OF MIAMI

BROWARD COUNTY

Most of the wells in the coastal area in Broward County from which samples were collected are located on the low sandy ridge that occupies a narrow strip about 10 miles wide between the Everglades and the ocean. Most of the population and all of the urban communities, including Deerfield Beach, Pompano Beach, Fort Lauderdale, Dania, and Hollywood, are in this area. (See fig. 222.) All of the public supplies for these towns are obtained from wells.

The composition of ground water in the coastal strip in Broward County is similar to that in Dade County, except that the total mineral content is somewhat less. (See table 105.) The dissolved matter was composed primarily of calcium and bicarbonate. Concentrations of magnesium were usually less than 5 ppm, and concentrations of sulfate and chloride were usually less than 25 ppm.

Table 105.—*Analyses, in parts per million, of nonartesian waters in Broward County*

[See plates 19 and 20]

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
S-332 S-333	Hollywood, public supply (raw water)....	Dec. 10, 1941	70 70	......	40	53.1	0.24	103	2.6	11	301	19	17	0.1	333	268
S-336	Oakland Park, Old Dixie Hwy. opposite Florida East Coast Ry. station..........	Nov. 19, 1940	60.9	77	130	46.8	......	89	3.1	7.6	265	5.8	20	......	256	235
S-337	Fort Lauderdale, Old Dixie Hwy. and Middle River..........	Oct. 18, 1940	72	......	50	64.3	......	113	3.1	18	297	1	64	......	345	295
S-340	Pompano Beach, public supply..........	Nov. 29, 1941	170 190	76	20	26.8	.16	47	2.3	8.5	136	11	15	.1	165	127
S-341	Pompano Beach, NE. Ave. and 4th St...	Oct. 18, 1940	189	......	20	30.7	......	56	2.5	5.8	173	1	14	......	164	150
S-342	Deerfield Beach, public supply..........	Nov. 29, 1941	72	79	25	28.0	.65	51	3.1	5.6	153	7.6	13	.0	164	140
S-366 S-369	Fort Lauderdale, public supply..........	Dec. 4, 1941	81 106	......	110	45.8	1.9	88	3.3	12	266	2.4	18	2.1	294	233
S-372	Pompano Beach, old race track..........	Oct. 18, 1940	120	......	40	38.9	......	74	2.7	5.4	226	1	15	......	209	196
S-393	Dania, public supply..........	Dec. 10, 1941	103	......	100	56.6	.20	107	4.0	14	307	27	24	.1	355	283
S-427	Davie Air Field..........	Jan. 27, 1941	99.2	77	......	34.5	......	52	6.6	6.5	177	7.4	13	......	173	157
S-427	..........do..........	Jan. 29, 1941	103.2	76	140	49.5	......	92	7.8	6.9	292	21	11	......	282	262
S-428	..........do..........	Jan. 30, 1941	92	77	......	43.8	......	80	6.9	4.0	245	17	13	......	242	228
S-440	..........do..........	Jan. 31, 1941	53.2	......	......	36.2	......	69	5.2	.3	216	4.4	9	......	194	194
S-441	..........do..........	Feb. 1, 1941	53	77	......	31.9	......	62	2.9	14	212	12	8	......	203	167
S-452	Perry Air Field..........	Feb. 21, 1941	52.2	77	......	40.0	1.8	82	2.8	.9	210	32	9	......	230	216
S-454	North Perry Air Field..........	Feb. 24, 1941	100.4	77	......	52.0	2.4	98	8.1	3.5	295	19	17	......	291	278
S-455	..........do..........	Mar. 3, 1941	78.5	77	90	34.6	.80	65	5.6	3.0	210	8	8	......	193	185
S-463	..........do..........	Mar. 12, 1941	67.0	77	110	42.0	.90	81	5.5	.2	247	.7	11	.0	226	225
F-292	Hollywood, 24th Ave. and Adams St....	July 5, 1940	72.4	78	40	55.6	1.9	110	3.7	14	296	42	23	.5	339	290
F-294	Hollywood, 24th Ave. and Hayes St......	.....do..........	133.4	......	30	50.4	2.5	100	5.7	13	294	24	23	3.0	314	273
G-184	Hollywood Blvd., 7 miles W. of State Hwy. 7..........	Oct. 15, 1940	46.1	77	45	71.8	......	128	11	15	386	43	25	......	412	365
	..........do..........	.....do..........	62.2	78	20	56.1	......	90	11	16	282	33	27	......	316	270
	..........do..........	Oct. 16, 1940	78.5	78	25	55.1	......	86	9.4	18	285	16	30	......	300	253
	..........do..........	.....do..........	92.4	78	25	48.8	......	68	10	22	243	15	31	......	266	211
	..........do..........	.....do..........	108.0	75	30	60.6	......	103	8.6	15	343	1	31	......	328	292
	..........do..........	Oct. 17, 1940	144.7	77	20	104	......	97	22	102	487	2	108	......	571	333
G-190	State Hwy. 25, 12 miles N. of 20-Mile Bend..........	Nov. 27, 1940	17.1	78	35	71.2	......	79	26	40	365	28	44	......	397	304

	............do..................................	Nov. 30, 1940	55.0	76	20	350	....	110	87	523	710	56	800	....	1,930	632
	............do..................................	Dec. 1, 1940	103.4	77	25	408	....	102	95	641	674	74	1,000	....	2,240	645
	............do..................................	.....do..........	129.3	77	25	475	....	115	108	769	746	81	1,210	....	2,650	731
	............do..................................	Dec. 2, 1940	154.8	75	40	485	....	116	111	775	728	96	1,230	....	2,690	746
	............do..................................	Dec. 3, 1940	225.0	77	35	808	....	77	97	1,600	840	338	2,140	....	4,670	591
	State Hwy. 25, at South New River Canal..................................	Dec. 6, 1940	66.1	74	170	58.3	....	101	9.1	12	336	5.3	25	....	318	289
	............do..................................	Dec. 7, 1940	117.8	77	35	384	....	102	67	618	389	206	950	....	2,130	530
	............do..................................	.....do..........	158.7	77	25	419	....	83	76	693	358	243	1,050	....	2,320	520
	............do..................................	Dec. 9, 1940	203.6	76	25	411	....	74	82	675	371	237	1,020	....	2,270	522
G-219	Near Miami Canal at Dade-Broward County line dam..............................	Sept. 18, 1941	32.1	83	110	39.8	.07	61	10	5.0	214	1	19	....	202	193
	............do..................................	Sept. 19, 1941	55.8	77	110	42.6	.04	70	8.3	8.2	242	1	19	....	226	209
	............do..................................	Sept. 23, 1941	90.5	77	20	87.7	....	50	28	91	321	25	105	....	457	240
	............do..................................	Sept. 24, 1941	134.0	76	20	143	.04	48	48	202	444	26	230	....	763	276
	............do..................................	Sept. 25, 1941	173.3	76	20	164	.03	42	42	257	458	33	282	....	875	249
	............do..................................	Sept. 26, 1941	198.3	77	20	213	....	33	33	378	518	39	408	....	1,150	218
G-220	State Hwy. 25, at 20-Mile Bend..........	Oct. 23, 1941	36.6	73	160	58.0	.10	94	9.4	18	325	6.6	28	.3	316	273
	............do..................................	Oct. 25, 1941	62.3	73	120	59.4	.10	96	9.4	18	326	5.3	31	.3	321	278
	............do..................................	Oct. 28, 1941	133.4	75	20	218	.07	70	34	351	558	43	408	....	1,181	314
	............do..................................	Oct. 30, 1941	190.3	76	20	238	....	56	45	407	672	31	445	....	1,315	325
G-221	Fort Lauderdale, near Fort Lauderdale														1,315	325
	water plant..................................	Dec. 3, 1941	124	77	5	43.6	.35	84	1.7	9.5	252	12	13	.0	245	217
	............do..................................	Dec. 5, 1941	147.1	77	5	48.4	.25	80	22	11	250	2	18	.2	257	209
	............do..................................	Dec. 6, 1941	171.2	76	5	50.0	.15	71	2.6	13	226	2.1	21	.2	221	188
	............do..................................	Dec. 17, 1941	227.5	77	5	96.0	....	82	19	98	332	2.7	157	.0	522	283
	............do..................................	Dec. 18, 1941	263	77	5	362	....	69	57	572	342	2.3	970	....	1,840	407
	............do..................................	Dec. 23, 1941	313.9	76	5	894	....	110	139	1,650	300	333	2,720	....	5,100	846
G-261	Everglades near spoil banks of Miami Canal, ¼ mile NW. of South New River Canal..................................	Mar. 3, 1941	11	....	....	37.0	1.4	62	7.9	6.8	209	1	21	....	202	187
	............do..................................	Mar. 4, 1941	20	....	....	44.3	1.1	76	7.2	11	256	1	23	....	244	219
	............do..................................	Mar. 5, 1941	26	....	....	42.4	.70	74	7.6	5.8	238	1	23	....	229	216
G-262	Everglades near spoil banks of Miami Canal, 6 miles NW. of G-261.........	Mar. 14, 1941	11.5	......	....	46.3	.26	83	8.5	5.6	264	9.1	20	.2	257	242
	............do..................................	.....do..........	21	......	....	62.1	.16	109	13	16	386	5.8	26	.2	360	325
	............do..................................	Mar. 15, 1941	31.3	......	....	95.8	.14	130	23	56	526	8.2	71	.2	548	419
G-263	Everglades near spoil banks of Miami Canal, 12 miles NW. of G-261........	Mar. 23, 1941	10	......	....	55.0	.22	92	12	11	315	7.0	27	.2	305	11
	............do..................................	Mar. 24, 1941	20	......	....	70.4	.27	119	14	18	407	9.5	35	.3	397	355
G-264	Everglades near spoil banks of Miami Canal, 18 miles NW. of G-261.........	Apr. 1, 1941	(1)	......	220	47.3	....	75	11	9.6	259	2.7	27	.2	253	232
	............do..................................	.....do..........	11	......	120	67.2	....	102	12	28	344	19	45	....	376	304
	............do..................................	.....do..........	20	......	70	95.2	....	148	12	47	495	15	71	.2	537	419
	............do..................................	Apr. 2, 1941	30.7	......	70	95.8	....	149	12	47	494	12	75	.2	538	421

Table 105.—*Analyses, in parts per million, of nonartesian waters in Broward County*—Continued

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10⁵ at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
G-269	Near Miami Canal at Dade-Broward County line dam	Mar. 2, 1941	20.1	......	......	36.6	0.10	64	7.6	2.0	203	2	19	......	195	191
G-340	5 miles NW. of Dade-Broward County line	Feb. 21, 1942	8.0	72	......	41.0	......	68	6.6	9.7	224	3.1	22	0.1	220	197
G-341	mile NE. of G-340	Feb. 25, 1942	17.1	72	......	43.3	......	72	5.7	13	239	3.7	22	.1	234	203
	do	Feb. 27, 1942	34.2	72	......	44.8	......	72	7.6	15	255	2.7	23	.1	246	211
G-342	mile NE. of G-340	Feb. 28, 1942	10.7	58	......	48.5	......	76	6.6	17	253	4.3	29	.8	258	216
G-343	mile NE. of G-340	Mar. 4, 1942	4.4	70	......	106	......	222	15	12	593	104	34	.1	679	616
G-344	1 mile NE. of G-340	Mar. 7, 1942	11.0	......	......	58.8	......	97	6.1	20	315	6.8	33	.1	318	267
G-345	1 miles NE. of G-340	do	9.8	......	......	87.0	......	164	10	21	522	25	30	.1	507	450
G-346	1 mile SE. of G-344	Mar. 4, 1942	(1)	60	90	60.9	......	98	10	17	316	10	38	.1	329	286
G-347	1 mile NW. of G-344	Mar. 5, 1942	5.7	68	......	58.0	......	94	11	14	316	7.6	31	.1	313	280
GS- 1	State Hwy. 25, 6 miles N. of 20-Mile Bend	June 3, 1942	14	74	140	75.6	.05	105	19	29	366	52	37	.1	422	342
	do	do	39.9	76	......	93.0	......	112	21	59	396	56	79	.0	522	366
	do	June 4, 1942	55	76	......	173	......	168	31	165	669	7.8	248	......	949	547
GS- 9	State Hwy. 7, at Hillsboro Canal	July 2, 1942	32.5	76	......	84.5	......	161	5.5	17	492	12	33	.0	471	424
GS-10	Near Hammonsville, 5.9 miles W. of State Hwy. 149 at Cypress Creek Canal	July 7, 1942	21.4	......	100	50.6	.30	94	3.3	12	294	2.1	22	.0	278	248
GS-13	Jct. Miami and S. New River canals	Sept. 4, 1942	48.4	74	70	58.6	.08	97	11	11	322	9.1	27	.1	314	288
GS-15	Broward-Palm Beach County line, 11 miles W. of State Hwy. 25	Jan. 12, 1942	7.9	76	65	83.2	.05	142	16	18	502	1.6	33	.1	458	420
	do	Jan. 13, 1943	18.3	73	30	116	.05	154	25	64	568	4.9	111	.1	639	488

[1] Surface water.

PALM BEACH COUNTY

The chemical character of ground water in coastal areas in Palm Beach County differs considerably from the character of ground water in coastal areas of Dade and Broward Counties. (See table 106.) In an area about 10 miles inland from the coast and about 35 miles north and south, extending from the Broward County line to near the Martin County line, water samples were collected for analysis from about 80 wells. The wells range from a few feet to over 100 ft in depth.

There are a large number of wells in the coastal area of Palm Beach County, most of which are used by owners of small farms for domestic purposes or for watering stock and for irrigation.

The public supplies of Lantana, Lake Worth, Boynton Beach, Delray Beach, Boca Raton, Riviera, and Lake Park are taken from wells. The public supply of West Palm Beach is obtained from surface sources. In West Palm Beach, ground water is used by several light industries. Some of the wells near the coast, both in West Palm Beach and in other places in the county, have been contaminated with sea water.

Wells, less than 50 feet deep, within 1 to 3 miles from the coast usually yield relatively soft water—less than 100 ppm hardness; farther inland, they are likely to yield somewhat harder water. Water from wells over 50 ft deep, both near the coast and farther inland, is usually harder than water from shallow wells.

Table 106.—*Analyses, in parts per million, of nonartesian waters in eastern Palm Beach County*

[See plates 19 and 24]

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
S- 359	Lake Worth, public supply	Mar. 15, 1941	135	....	40	43.7	0.15	74	3.1	20	220	20	25	4.0	287	197
S- 360	Boca Raton, public supply (raw water)	Oct. 21, 1941	104	....	10	32.1	.06	59	3.1	30	168	2.0	18	.7	195	160
S- 361	Lantana, public supply	Oct. 24, 1941	65	....	10	30.5	.06	54	3.3	3.9	152	3.0	20	.2	182	148
S-1000 S-1002	Boynton Beach, public supply	Oct. 24, 1941	57	....	30	37.2	.04	66	2.8	7.9	178	16	21	.5	227	176
S-1003-1008	Delray Beach, public supply	Oct. 31, 1941	....	....	35	38.8	.20	70	2.8	8.8	205	4.9	22	.8	234	186
S-1009	Riviera, public supply	Mar. 14, 1941	165	....	15	30.5	.12	48	1.9	17	153	2.8	25	1.0	194	128
S-1011	Yamato	Apr. 10, 1941	20-25		60	35.8	.02	64	4.4	6.7	159	39	13	4.0	209	178
S-1012	Boca Raton Road	do.	150	74	25	49.5	.02	93	4.1	18	286	2.5	36	.0	295	249
S-1018	State Hwy. 7, 6.1 miles N. of Hillsboro Canal	do.	84	74	50	57.0	.02	100	4.8	20	315	2.5	37	.2	320	269
S-1020	State Hwy. 7, 6.2 miles N. of Hillsboro															
	Canal	Apr. 17, 1941	25	73	160	66.6	.25	130	5.0	18	389	2.5	44	.2	392	345
S-1025	Germantown Road and canal E-1	do.	67	....	15	34.9	.02	64	3.3	9.0	196	2.5	21		196	173
S-1026	do.	do.	20	74	80	10.8	.50	12	7.4	2.1	24	23	15		72	60
S-1027	Germantown Road at South Bend	do.	20	74	220	32.2	.10	42	5.2	13	48	56	37	7.0	184	126
S-1028	Delray Beach Country Club	do.	....	....	25	37.8	.10	73	5.7	3.1	212	1.2	23	6.0	216	206
S-1030	Barwick Road, 1.5 miles N. of Atlantic Ave.	do.	30	72	280	20.8	.15	16	5.0	22	60	4.1	39	.3	116	60
S-1037	U. S. Hwy. 1, 3 miles S. of Delray Beach	Apr. 18, 1941	80	79	30	31.5	.20	69	4.8	0.58	202	6.0	15	.3	195	192
S-1038	U. S. Hwy. 1, 3 miles S. of Delray Beach	do.	55	....	20	43.3	.40	77	6.3	7.3	186	40	28	.5	251	218
S-1039	Military Trail and Atlantic Ave.	do.	111	....	40	57.6	.10	108	6.3	18	335	2.1	40	2.0	342	295
S-1041	Atlantic Ave., 1 mile W. of Canal E-3	do.	34.6	76	25	23.4	.50	7	8.7	26	27	3.3	60	.1	119	53
S-1050	Atlantic Ave., 0.4 mile W. of canal	May 16, 1941	15-											3.5	292	211
	E-2	May 16, 1941	20	73	100	49.5	.40	73	7.0	26	212	51	27	3.5	292	211
S-1053	State Hwy. 7, 1.1 miles N. of Atlantic Ave.	do.	20	74	180	35.8	.30	63	4.4	14	202	7.8	23	.2	212	175
S-1056	0.4 mile E. of Military Trail and 0.2 mile N. of lateral No. 30	do.	38	....	10	29.1	.15	32	4.6	21	91	6.6	45	.6	155	99
S-1059	0.3 mile W. of Military Trail and 0.2 mile N. of lateral No. 29	do.	30-40	75	40	24.6	.12	12	8.5	18	4.0	69	21	.0	131	65
S-1063	Military Trail and Boynton Road	May 17, 1941	100	76	50	57.8	.15	97	5.2	22	270	8.6	56	2.0	324	263
S-1065	Boynton Road, 0.3 mile W. of Military Trail	do.	25	74	190	42.0	.15	80	3.7	4.1	185	44	17	3.0	243	215

S-1066	U. S. Hwy. 1, 1.4 miles S. of Boynton Road Road........	June 27, 1941	35-50	....	10	30.6	.40	49	2.0	12	146	7.0	21	.2	164	131
S-1067	U. S. Hwy. 1, 1.8 miles S. of Boynton Road........	.....do........	50	....	40	42.2	.50	74	5.0	7.1	220	7.4	23	.2	226	205
S-1069	U. S. Hwy. 1, 3.3 miles S. of Boynton Road........	.....do........	40-42	....	5	18.1	.20	30	2.8	5.3	81	14	12	.1	104	86
S-1071	Gulfview Drive, 2 miles S. of Boynton Beach........	June 27, 1941	20	75	20	158	.20	134	1.1	189	250	69	335	......	852	339
S-1073	State Hwy. 7 and Lantana Road........	June 30, 1941	....	....	30	52.9	.20	101	4.4	6.0	271	25	24	1.5	296	270
S-1074	Lantana Road, 1.2 miles W. of canal E-3...	.....do........	11	79	120	91.2	.20	120	5.2	71	312	77	98	1.2	526	321
S-1078	0.2 mile W. of Military Trail at lateral No. 18........	.....do........	25	75	50	61.6	.20	95	2.4	34	298	1	54	.0	333	247
S-1080	Military Trail at lateral No. 14........	July 3, 1941	75	....	70	62.4	.10	87	4.6	42	300	1.2	57	.0	340	236
S-1083	Lake Worth Road, 0.2 mile W. of Military Trail........	.....do........	43	77	100	30.5	1.1	46	3.3	15	160	2.9	19	.8	167	128
S-1085	Lake Worth Road, 1 mile W. of canal E-3..	.....do........	40	75	80	46.2	.15	72	3.5	20	225	2.7	35	.0	244	194
S-1088	Lake Worth Road and Deweese Road........	.....do........	36	....	230	21.8	.23	22	2.4	18	60	18	25	1.8	117	65
S-1090	North Lake Worth Road and Deweese Road..	.....do........	204	....	10	86.6	.03	120	8.7	61	432	1.4	80	.0	484	335
S-1091	Greenacres City, 4th St. and Swain Blvd.....	.....do........	50-60	....	60	41.9	.55	66	3.9	21	224	15	16	5.3	231	181
S-1093	State Hwy. 7, 0.8 miles N. of Lantana Road.	July 7, 1941	35	75	30	61.6	.06	114	2.4	12	318	4.3	38	3.0	330	294
S-1096	State Hwy. 7, 2.2 miles S. of State Hwy. 80.	.....do........	28	74	10	67.6	.10	124	5.5	15	382	8.6	30	1.7	373	332
S-1099	Military Trail, 0.5 mile N. of Lake Worth Road........	July 9, 1941	49	....	45	60.0	.60	92	5.9	29	299	1.4	50	.0	326	254
S-1100	0.2 mile W. of State Hwy. 7 and 0.8 mile N. of Boynton Road........	June 19, 1941	80	75	50	70.0	.20	80	4.8	74	360	5.3	56	.0	398	219
S-1101	..........do........	.....do........	18-20	75	75	86.2	.60	70	2.0	136	443	30	60	.0	517	183
S-1102	State Hwy. 7, 1.2 miles N. of Boynton Road.	.....do........	80	75	60	75.9	.30	116	3.7	52	377	12	68	.0	438	305
S-1104	State Hwy. 7, 1.5 miles N. of Boynton Road	.....do........	15	74	150	65.4	.20	115	2.0	32	399	6.2	23	.0	375	295
S-1105	Boynton Road, 0.2 mile W. of canal E-4....	June 20, 1941	82	....	70	83.0	.15	131	7.4	42	336	133	25	.2	504	357
S-1106	Boynton Road, 0.6 mile E. of Military Trail........	.....do........	68	....	60	39.6	.35	58	2.2	26	194	9.1	30	.0	221	154
S-1108	Boyton Road and State Hwy. 7........	.....do........	90	....	40	62.7	.20	78	.7	68	329	6.2	49	.0	364	197
S-1110	0.3 mile N. of Boynton Canal and 0.3 mile E. of Lawrence Road........	.....do........	35	75	70	22.9	.20	36	5.9	4.4	120	9.5	11	.0	126	114
S-1114	U. S. Hwy. 1, 2.1 miles S. of Boynton Road.	June 21, 1941	60	....	50	40.6	.35	71	5.5	8.1	212	12	22	.2	224	200
S-1115	Davis Road and lateral No. 14........	July 9, 1941	32	....	40	46.2	1.3	72	6.1	15	234	4.1	30	.0	244	205
S-1116	Military Trail and lateral No. 8........	.....do........	75	78	50	66.6	.22	100	11	27	317	2.3	65	.0	362	295
S-1118	0.1 mile S. of West Palm Beach Canal and 0.1 mile E. of canal E-3........	July 10, 1941	68	77	45	50.8	.60	82	4.6	21	256	31	19	.0	284	224
S-119	0.1 mile S. of West Palm Beach Canal and 300 feet E. of canal E-3........	.....do........	28	78	35	56.4	.40	90	5.5	20	275	14	35	2.5	303	247
S-1125	State Hwy. 80, 1.3 miles E. of State Hwy. 7........	July 11, 1941	65	75	45	101	.20	134	10	67	382	11	139	1.6	551	376

Table 106.—*Analyses, in parts per million, of nonartesian waters in eastern Palm Beach County*—Continued

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
S-1126	State Hwy. 80, 1.7 miles E. of State Hwy. 7..	July 11, 1941	61	76	40	73.0	0.25	110	6.3	17	274	3.9	75	2.7	350	300
S-1130	State Hwy. 80, 1.5 miles W. of canal E-3.....	.....do..........	40	77	45	28.0	.15	44	1.7	15	164	6.2	6.0	.2	154	117
S-1131	State Hwy. 80 and West Trail Drive...........	.....do..........	57	....	90	69.4	.40	117	5.0	13	325	2.1	60	3.2	351	313
S-1132	East Palm Beach Canal, 0.1 mile E. of canal E-4 extension..........................	.....do..........	50	....	100	10.7	2.4	10	4.8	2.6	11	22	13	.0	60	45
S-1134	N. of Belvedere Road and canal E-3..........	.....do..........	45	77	60	66.6	1.6	106	4.6	26	341	2.3	41	.0	350	283
S-1135	West Palm Beach, 1403 Georgia Ave..........	Sept. 26, 1941	49	....	5	19.3	.05	27	3.1	6.0	52	28	10	9.0	109	80
S-1141	Lake Park, public supply.........................	Oct. 31, 1941	49.5	....	10	32.9	.04	58	2.3	8.4	162	9.5	17	6.5	200	154
S-1144	Lake Worth, Dixie Hwy. and N. 18th St.......	July 23, 1941	58.5	79	20	35.3	.00	57	2.4	12	165	12	19	4.8	188	152
S-1148	Intracoastal Waterway, 2.8 miles N. of Canal Road....................................	Sept. 5, 1941	28	....	45	87.2	.00	120	10	63	442	4.1	79	.0	494	341
S-1152	0.6 mile W. of State Hwy. 7 and 1 mile S. of Indiantown Road............................	.....do..........	35	....	50	101	.00	146	12	56	437	4.1	123	.0	556	414
S-1156	State Hwy. 78, 2.6 miles W. of Post Office Road..	.....do..........	20	....	40	65.0	.20	132	5.7	.5	340	14	43	.2	363	353
S-1159	Jupiter, Seminole Golf Club.....................	.....do..........	182	76	45	67.2	.05	102	7.0	41	336	6.6	63	1.0	386	283
S-1163	Lake Park, 0.2 mile E. of Dixie Hwy. and 2.8 miles N. of State Hwy. 811............	.....do..........	40	....	100	42.4	.02	58	5.0	23	168	8.6	47	3.6	228	165
S-1170	West Palm Beach, North Poinsettia Blvd. and 25th St....................................	Sept. 8, 1941	....	79	5	40.0	.02	58	2.4	25	170	22	33	.3	224	155
S-1171	West Palm Beach, 500 Datura St...............	.....do..........	70	79	40	24.6	.52	38	1.3	4.8	109	4.1	12	.2	115	100
S-1172	West Palm Beach, North Sapodilla Ave. and 2d St...	.....do..........	85	78	110	52.7	1.0	90	4.1	40	270	71	24	.0	363	241
S-1173	West Palm Beach, Okeechobee Road and Seaboard Ry.....................................	.....do..........	116	78	70	46.0	.05	80	3.1	14	234	11	25	5.7	254	212
S-1176	West Palm Beach, Charlotte Ave. and Frederick St.......................................	.....do..........	100	76	120	36.7	.08	62	3.1	10	179	8.6	22	3.4	197	167
S-1177	West Palm Beach, Flamingo Drive and Florida East Coast Ry.........................	.....do..........	84	79	20	36.2	.04	55	2.4	30	139	63	23	.6	243	147
S-1183	West Palm Beach, North Railroad Ave. and 11th St...	Sept. 9, 1941	80-85	79	5	44.0	.10	66	3.7	19	162	48	27	1.6	245	180
S-1185	West Palm Beach, 504 Railroad Ave..........	.....do..........	30	....	5	129	.05	79	19	148	215	80	239	......	671	275
S-1186	West Palm Beach, 1115 North Poinsettia Ave..	.....do..........	64	....	20	49.4	.05	60	3.4	39	160	49	47	.6	278	164
S-1245	Loxahatchee, packing plant.....................	Oct. 24, 1941	44	....	40	40.7	.15	100	3.3	14	273	17	37	.2	306	263
S-1246	Loxahatchee, public supply well..............	.....do..........	126	....	30	58.2	.05	110	7.9	49	339	19	82	.2	435	307
S-1247	Loxahatchee, Negro quarters...................	.....do..........	19	76	10	41.9	.20	96	3.5	15	227	69	20	.2	316	254

PB 93		Feb. 2, 1945	32	76	35	35.8	....	....	....	....	202	....	8	....	....	....
		Feb. 3, 1945	43	78	80	35.5	.08	66	.8		176	16	16	.2	193	168
		Feb. 5, 1945	53	77	70	36.2	....	....	....		170	....	14	....	....	....
		Feb. 5, 1945	63	78	80	32.5	....	....	....		174	....	10	....	....	....
		Feb. 6, 1945	74	78	80	33.2	....	....	....		175	....	13	....	....	....
		Feb. 6, 1945	85	78	50	34.1	.10	60	1.3	11	171	10	19	1.0	187	155
		Feb. 7, 1945	95	78	40	37.4	....	....	....	....	189	....	19	....	....	....
GS- 8	State Hwy. 80, 0.3 mile W. of State Hwy. 7......................................	June 30, 1942	44.1	76	....	163	....	143	17	175	473	13	288	....	869	427
GS-12	6 miles W. of State Hwy. 7 and 4 miles N. of Hillsboro Canal.........................	Aug. 13, 1942	29.8	75	60	95.0	....	160	9.4	22	470	9.9	63	.1	496	439
	............do......................................	Aug. 14, 1942	50.2	77	40	77.6	.03	121	6.6	23	390	9.5	35	.1	387	330

AREAS SURROUNDING LAKE OKEECHOBEE

In the areas adjacent to Lake Okeechobee private water supplies for domestic use and for watering stock are generally obtained from wells less than 100 ft deep. The town of Moore Haven obtains part of its public supply from three wells, 28 ft deep, near the Caloosahatchee Canal. Most of the wells start in muck soils, although nearly all of them terminate in shell marl or lime rock beneath the muck. In Okeechobee County, on the north side of the lake, the muck layer is very thin, or entirely absent, and the surface soils are sandy.

As indicated in the following discussion of counties, the ground water in wells within a few miles of Lake Okeechobee usually contains considerably more dissolved matter than is found in the ground water in the coastal areas of southeastern Florida or in the lake. The lake water is not readily available to individual farms, which must, therefore, use the less desirable well water.

GLADES COUNTY

Samples were collected from 20 wells in Glades County near the northwestern, western, and southwestern border of Lake Okeechobee. (See table 107.) Most of the wells are less than 100 ft deep. Dissolved solids ranged from 366 to 2,276 ppm and hardness ranged from 255 to 833 ppm. The most characteristic constituent of the dissolved mineral matter in these samples was bicarbonate, which ranged in concentration from 250 to 632 ppm. Samples collected from wells north of Moore Haven were usually less concentrated than samples collected south and southeast of Moore Haven.

Water from wells south and southeast of Moore Haven contained relatively large amounts of sodium, sulfate, and chloride, in addition to bicarbonate. Sodium concentrations in these well waters ranged from 47 to 559 ppm, sulfate ranged from 27 to 212 ppm, and chloride ranged from 133 to 1,008 ppm. Chloride was sometimes present in amounts more than equivalent to the sodium. Although specific information as to the corrosiveness of these waters was not available, waters that contain more chloride than sodium are frequently corrosive to plumbing. The concentration of dissolved solids was so high in many of the wells that the water probably would not be used for domestic purposes if more suitable water were readily procurable.

Table 107.—*Analyses, in parts per million, of nonartesian waters in Glades County*

[See plate 20]

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
GL 12	Brighton Indian School, 7 miles S. of Brighton	Sept. 24, 1941	120	74	120	117	0.05	110	22	113	351	101	153	3.0	675	365
GL 13	State Hwy. 78, 13.3 miles W. of Kissimmee River	Sept. 25, 1941	48	77	240	128	.25	176	14	86	425	96	163	6.0	751	497
GL 14	0.1 mile W. of State Hay. 78, 1.9 miles S. of Brighton Road	do.	35	76	80	226	.10	51	31	414	512	133	422	......	1,300	255
GL 6	State Hwy. 78, 100 feet N. of south line of Section 22	Sept. 23, 1941	22	77	......	68.2	.05	93	21	33	325	87	21	3.6	419	318
GL 7	State Hwy. 29, 150 feet S. of north line of Section 27	do.	18	76	......	66.8	.05	98	19	28	385	37	20	2.7	394	323
GL 15	Lakeport, at post office	Sept. 25, 1941	20-25	76	160	89.2	.25	89	22	73	349	14	121	.6	492	313
GL 16	State Hwy. 78, 8 miles N. of Moore Haven	do.	25	75	100	110	.05	114	32	84	632	10	49	.4	601	416
GL 17	State Hwy. 25, 2.1 miles W. of State Hwy. 78	do.	......	77	360	132	.10	104	10	193	501	83	159	.2	796	301
GL 20	Moore Haven, public supply (part)	Sept. 24, 1941	28	78	110	63.2	.50	90	11	30	250	71	37	3.3	366	270
GL 8	State Hwy. 25, 0.5 mile N. of State Hwy. 78	do.	104	76	......	352	.50	172	46	528	460	110	905	......	1,990	618
GL 9	State Hwy. 78, 1 mile E. of State Hwy. 67	do.	52	76	......	212	.05	140	33	268	465	125	395	......	1,190	485
GL 10	Gramling Village, U. S. Sugar Corp.	do.	85	......	......	204	.05	128	32	261	387	53	458	......	1,120	451
GL 4	Benbow Village, U. S. Sugar Corp.	do.	80	......	40	339	.05	148	61	504	528	201	762	......	1,940	620
GL 3	Gramling Village, U. S. Sugar Corp.	do.	92	74	30	366	.05	149	55	558	403	212	895	......	2,070	598
GL 18	Liberty Point Village, U. S. Sugar Corp.	do.	20-30		80	412	.05	217	71	559	616	118	1,010	......	2,280	833
GL 19	do.	do.	20-30	76	100	388	.05	181	66	518	492	162	905	......	2,070	723
GL 11	0.8 mile E. of State Hwy. 78 and 1.5 miles N. of State Hwy. 80	do.	102	......	10	99.0	.05	153	13	47	393	27	133	.0	567	435
GS 18	NE. of Lakeport	July 21, 1943	35	......	80	154	.02	134	33	166	534	113	195	.2	904	470
	do.	July 22, 1943	75	......	45	179	.10	103	40	241	528	129	268	.0	1,041	422
GS-28	Moore Haven	Aug. 28, 1943	17	......	65	109	.03	156	13	66	484	79	75	3.8	631	443
	do.	Aug. 28, 1943	47	......	90	95.4	.05	144	12	175	468	10	280	......	852	409

346881 O—55——53

Table 107.—*Analyses, in parts per million, of nonartesian waters in Glades County*—Continued

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
GS 28	Moore Haven	Aug. 28, 1943	63	....	42	115	0.02	156	17	83	476	88	112	0.2	691	460
GS 29	do	Aug. 31, 1943	33.7	....	90	161	.06	174	31	135	464	154	218	9.6	950	562
	do	Sept. 1, 1943	51	....	20	153	.07	78	36	201	384	96	258	.1	858	342
	do	Sept. 1, 1945	75	....	....	160	......	....	....	....	374	......	270	......	....	....

HENDRY COUNTY

Water samples from wells near Lake Okeechobee contained moderately large amounts of dissolved matter and generally contained much less sulfate than was shown in samples from wells in Glades County. (See table 108.) Dissolved solids ranged from 238 to 1,230 ppm and hardness ranged from 233 to 469 ppm. Calcium and bicarbonate were the characteristic constituents. Calcium ranged from 67 to 165 ppm and bicarbonate ranged from 253 to 683 ppm. Chloride exceeded sodium in two samples by small amounts.

Well GS 4 is about 12 miles southwest of Lake Okeechobee, and well GS 5 is about 20 miles southwest of the Lake. Water collected when well GS 4 was 18.9 ft deep contained 292 ppm of calcium, 31 ppm of bicarbonate, 628 ppm of sulfate, and 45 ppm of chloride. Calcium and sulfate concentrations decreased with depth, while sodium bicarbonate and chloride increased with depth.

The concentration of dissolved matter in samples collected from well GS 5 did not change appreciably with depth, as indicated by results of preliminary examination of the samples. Only one analysis is given in the table. The concentration of dissolved solids in this sample was 455 ppm.

Table 108.—*Analyses, in parts per million, of nonartesian waters in Hendry County*

[See plate 19]

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
HE 15	Intersection State Hwys. 80 and 25.....	Sept. 24, 1941	130	77	....	59.8	0.40	111	9.0	19	380	5.8	26	1.2	360	314
HE 13	State Hwy. 8, 1.6 miles W. of Atlantic Coast Line R. R. crossing...	.....do............	34	76	....	40.8	.70	79	8.7	1.5	253	13	10	.8	238	233
HE 14	0.8 mile S. of State Hwy. 80 and 5.6 miles W. of Atlantic Coast Line R. R. crossing..........................	.....do............	315	....	....	154	.05	67	56	161	329	100	264	.4	811	397
HE 16	Clewiston, U. S. Sugar Corp...........	Sept. 23, 1941	114	74	80	81.0	.10	121	11	23	367	7.8	63	.0	407	347
HE 10	...........do..............................	.....do............	87.5	77	80	69.4	.05	88	9.4	68	390	4.1	58	.0	420	258
HE 12	...........do..............................	Sept. 24, 1941	107	75	....	89.6	.05	106	12	201	683	30	113	1.5	800	314
HE 18	...........do..............................	Mar. 13, 1941	110	....	240	99.2	.27	165	14	48	568	20	62	.0	589	469
HE 11	Hookers Point..............................	Sept. 23, 1941	55-60	....	80	103	.07	92	11	123	558	2.5	58	.1	562	275
HE 7	Bare Beach Village.........................	.....do............	70	74	40	223	.05	129	17	310	333	186	425	......	1,230	392
GS 4	W. of Clewiston............................	June 16, 1942	50	79	....	83.8	......	144	11	45	440	2.9	59	.1	457	350
GS 5	...........do..............................	June 17, 1942	25.7	76	....	82.3	......	126	12	39	466	1	47	.1	455	364
HE 4	...........do..............................	Apr. 23, 1943	96	....	22	....	.03	144	19	52	512	17	80	......	565	438

PALM BEACH COUNTY

Samples were collected from 20 supply wells in Palm Beach County in the vicinity of Lake Okeechobee (see table 109). Concentrations of dissolved mineral matter in these samples were among the highest found in shallow ground water in southeastern Florida. Dissolved solids ranged from 557 to 5, 670 ppm and in 9 of the 20 samples the amount of dissolved solids was in excess of 1, 000 ppm. Only two of the wells are over 50 ft deep.

Bicarbonate is the most characteristic constituent of the dissolved matter in all of the samples. Some of the samples contained large amounts of sodium, while in others the sodium concentration was relatively low. Several hundred parts per million of sulfate and chloride were found in some samples, but in other samples these constituents were present in amounts less than 100 ppm.

Almost all of the wells from which the 20 samples were collected are located in areas where the top soil consists of several feet of muck, and it is possible that some of the most shallow wells terminate in the muck. Most of the wells terminate in marl or lime rock beneath the muck.

The maximum concentration of dissolved mineral matter in shallow wells in Palm Beach County near Lake Okeechobee was found in a sample collected from well S 350, which is 66 ft deep and located at Miami Locks just south of the south border of Lake Okeechobee. The sample contained 5, 670 ppm of dissolved solids, 2, 300 parts of which consisted of chloride.

Test well GS 3 was drilled to a depth of 50 ft near well S 1212 about 1 mile south of Florida Highway 80 and 3 miles west of Florida Highway 25. Analyses were made of three samples collected during the drilling operations at depths of 18. 9, 34. 6, and 50 ft. The maximum concentrations of dissolved solids and sulfate, and the maximum hardness were found at 18. 9 ft. Concentrations were less at 34. 6 ft and were least at 50 ft. Sodium and chloride increased with depth. The water in all three samples was reported to have a strong odor of hydrogen sulfide. It seems probable that reduction of sulfate by decomposing organic matter or by bacterial action was responsible for the decrease in sulfate concentration and also for the presence of hydrogen sulfide.

Table 109.—*Analyses, in parts per million, of nonartesian waters in western Palm Beach County*

[See plate 19]

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
S- 350	Miami Locks Camp, U. S. Sugar Corp........	Sept. 23, 1941	66	....	50	908	0.05	160	148	1,761	769	925	2,300	....	5,670	1,008
S- 352	Belle Glade, State Prison Farm................	Sept. 22, 1941	35	76	360	254	.05	114	83	371	776	295	340	13	1,598	626
S- 355	Belle Glade, 0.2 mile E. of Hillsboro Canal and 0.6 mile N. of State Hwy. 15........	.....do..........	47	75	180	148	.05	124	50	130	484	149	169	9.6	870	515
S- 356	...........do..	.....do..........	47	74	180	209	.05	118	50	276	520	181	340	7.5	1,229	500
S- 358	Ritta Village, U. S. Sugar Corp...............	Sept. 23, 1941	36.4	....	320	388	.25	225	145	452	725	579	670	....	2,428	1,158
S-1188	State Hwy. 15 between Pahokee and Canal Point..	Sept. 10, 1941	20	....	140	92.2	.10	111	46	29	480	96	41	.0	560	466
S-1189	Pahokee, State Hwy. 15, 1.6 miles S. of Pahokee water tower..........................	.....do..........	18	....	520	543	.05	237	128	862	849	661	1,140	....	3,450	1,118
S-1190	State Hwy. 80, 1 mile E. of Hillsboro Canal.	.....do..........	45	....	280	156	.10	84	61	159	582	77	177	....	845	460
S-1201	State Hwy. 15, 0.8 mile S. of Martin County line..	Sept. 12, 1941	14	....	260	116	.10	166	64	94	952	66	23	.4	882	677
S-1202	State Hwy. 15, 0.9 mile N. of West Palm Beach Canal..	.....do..........	20	....	260	263	.10	80	130	372	1,319	25	308	.6	1,566	734
S-1203	State Hwy. 15, 3.8 miles N. of West Palm Beach Canal..	.....do..........	13	71	220	143	.10	221	62	36	744	143	90	.2	919	806
S-1204	State Hwy. 15, 3.9 miles N. of West Palm Beach Canal..	.....do..........	22	75	180	182	.33	201	143	38	609	537	80	2.5	1,302	1,090
S-1205	State Hwy. 15, 4.1 miles N. of West Palm Beach Canal..	.....do..........	20	77	400	143	.10	166	90	29	765	127	62	.4	651	784
S-1208	State Hwy. 80, 0.4 mile E. of North New River Canal..	Sept. 22, 1941	60	....	60	138	.10	80	76	143	751	57	104	.1	830	512
S-1209	Torry Island, N. of Chosen......................	.....do..........	12.5	73	280	126	.10	152	75	42	740	77	65	1.2	777	688
S-1210	Belle Glade, 0.9 mile N. of Belle Glade water plant..	.....do..........	20	80	280	127	.07	137	1.7	154	414	170	113	11	791	349
S-1211	South Bay, 200 feet N. of intersection of State Hwys. 80 and 25..........................	.....do..........	20	....	280	138	.10	160	67	91	588	320	49	.2	959	675
S-1212	South Shore Camp, 1 mile S. of State Hwy. 80 and 3 miles W. of State Hwy. 25........	.....do..........	35.5	76	80	181	.15	80	90	229	622	370	123	.2	1,199	570
S-1215	Miami Locks, Plantation.........................	Sept. 23, 1941	31	76	180	212	.07	44	59	396	621	319	265	.2	1,389	352
S-1216	Lake Harbor, at Atlantic Coast Line R. R. station..	.....do..........	20	....	360	103	.15	84	50	64	550	54	34	.3	557	415

GS- 2	State Hwy. 25, 3.5 miles S. of Bolles Canal, along North New River Canal..............	June 5, 1942	16.5	75	360	113	.15	172	55	7.6	576	144	35	.2	698	655
	...........do..	June 8, 1942	30.4	76	....	150	......	149	69	80	770	36	115	.2	828	656
	...........do..	June 9, 1942	50	76	....	189	......	197	78	107	924	12	195	....	1,044	812
GS- 3	South Shore Camp, 1 mile S. of State Hwy. 80 and 3 miles W. of State Hwy. 25.......	June 11, 1942	18.9	75	220	186	.05	292	88	31	538	628	45	.1	1,349	1,090
	...........do..	.....do...........	34.6	76	....	197	......	190	102	127	684	406	133	.0	1,295	894
	...........do..	.....do...........	50	77	....	166	......	102	68	168	686	101	165	.0	942	534
GS- 6	State Hwy. 827, 7.2 miles SE. of State Hwy 80, along Hillsboro Canal..................	June 19, 1942	14.3	74	280	103	.10	100	34	69	480	17	91	.1	548	390
	...........do..	June 24, 1942	55	74	280	120	.80	88	44	106	563	4.1	117	.1	637	400
GS- 7	State Hwy. 80, 0.5 mile W. of State Hwy. 194..	June 25, 1942	50	76	....	615	......	80	71	1,225	1,097	305	1,375	....	3,600	492
GS- 11	S. side of Hillsboro Canal, 11 miles W. of State Hwy. 7................................	Aug. 4, 1942	14	76	220	59.6	.05	89	13	27	322	11	41	.1	340	276
	...........do..	Aug. 5, 1942	50.2	75	70	1,190	.1	218	166	2,299	836	716	3,400	....	7,210	1,226
GS- 24	State Hwy. 15, 3.5 miles N. of Canal Point..	Aug. 13, 1943	23.4	76	380	338	.09	188	192	378	1,470	400	325	1.5	2,209	1,258
	...........do..	.....do...........	30.5	74	380	479	.0	157	200	758	1,634	326	840	....	3,090	1,214
	...........do..	Aug. 14, 1943	43.3	74	312	642	.04	232	95	1,222	1,780	254	1,350	....	4,030	970
	...........do..	Aug. 16, 1943	60.5	....	55	315	.08	154	123	404	1,050	270	445	....	1,913	890
GS- 25	State Hwy. 15, 1.8 miles S. of Pahokee......	Aug. 18, 1943	27	75	320	246	.13	210	124	197	1,120	231	215	.9	1,530	1,034
	...........do..	.....do...........	45	75	252	306	.20	204	103	1,357	1,155	267	1,885	....	4,390	932
GS- 26	Kraemer Island, 8 miles NW. of Belle Glade..	Aug. 20, 1943	14.5	76	450	442	.20	414	199	343	1,050	639	760	....	2,870	1,852
	...........do..	Aug. 21, 1943	41.7	76	240	454	.04	176	180	646	1,305	221	910	....	2,780	1,179
	...........do..	Aug. 23, 1943	78.5	....	95	487	.06	184	152	685	640	667	960	....	2,960	1,084
GS- 27	State Hwy. 80, 1.7 miles W. of Lake Harbor..	Aug. 25, 1943	29	....	23	58.3	.04	64	22	25	292	10	36	4.0	305	250
	...........do..	Aug.	39	....	33	161	.04	88	44	209	564	84	215	3.7	922	400
	...........do..	.....do...........	56.5	....	25	561	.02	165	98	1,013	882	605	1,180	....	3,500	815

MARTIN COUNTY

Samples were collected from six wells near the eastern edge of Lake Okeechobee in Martin County. (See table 110.) The muck soil in Martin County is relatively thin and occupies only a narrow strip of land near the lake. Some of the wells from which samples were collected are located in sand lands, and all of the wells are less than 50 ft deep.

Samples from wells located in the muck soil were high in calcium and bicarbonate, while samples from wells in the sandy soil contained much smaller amounts of these constituents. Water from the sandy soil was very low in sulfate and chloride.

Table 110.—*Analyses, in parts per million, of nonartesian waters in Martin County*

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
M 11	State Hwy. 15, 3.8 miles S. of Okeechobee County line	Sept. 11, 1941	40	77	120	92.5	0.10	156	24	87	616	86	56	4.4	717	488
M 15	Farm Security Administration project	Oct. 3, 1941	40	76	150	88.7	.91	124	10	51	396	24	79	.1	484	351
M 16	Port Mayaca	Sept. 12, 1941	48	78	200	30.9	.38	54	2.6	11	182	8.6	6.5	1.8	175	145
M 17	do	Oct. 3, 1941	32	78	160	32.7	.79	59	5.0	1.2	189	8.0	5	.1	172	168
M 18	do	Sept. 12, 1941	30	78	50	44.9	.10	83	5.7	3.2	269	9.7	5	.0	239	231
M 9	50 ft N. of St Lucie Canal and 150 ft E. of Lake Okeechobee	do	27	77	140	80.2	.40	148	19	6.7	489	39	10	8.2	472	447
GS 23	S. of Indian Town	Aug. 10, 1943	28	....	29	63.6	.05	127	4.8	7.6	356	31	20	.9	367	336
	do	Aug. 12, 1943	90.5	....	12	156	.03	128	26	182	418	139	239	.6	920	426

OKEECHOBEE COUNTY

Okeechobee County is north of Lake Okeechobee and only a narrow strip immediately adjacent to the lake is covered with muck soil. This strip of muck is usually very thin and it disappears at some places.

Twelve wells, for which analyses are available (see table 111), are located in areas where the muck layer is thin or nonexistent. Dissolved solids ranged from 37 to 1,800 ppm and hardness ranged from 23 to 587 ppm. Most of the samples contained over 300 ppm of bicarbonate. One sample contained 860 ppm of chloride. The dissolved minerals in shallow ground waters in wells in the sandy areas to the north of Lake Okeechobee consist primarily of calcium and bicarbonate. The composition of these waters is similar to that of shallow ground water in the metropolitan area of Miami.

Table 111.—*Analyses, in parts per million, of nonartesian waters in Okeechobee County*

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10⁵ at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
OK 14	Farm Security Administration project..	Oct. 3, 1941	80	75	15	59.2	0.10	103	6.6	12	344	2.1	19	0.0	312	284
OK 15	...........do..........	.....do...........	95	73	30	55.7	.10	108	4.1	6.1	343	2.9	11	.0	301	286
OK 8	State Hwy. 15, 1 mile E. of State Hwy. 78..........	Sept. 11, 1941	75	74	25	313	.05	99	40	499	286	170	770	......	1,720	412
OK 9	State Hwy. 15, 0.4 mile E. of Taylor Creek..........	.....do...........	48	......	60	122	.05	105	14	147	380	34	207	.2	694	320
OK 13	State Hwy. 78, 3.2 miles W. of State Hwy. 15..........	Sept. 25, 1941	65	74	20	135	.10	109	15	152	390	32	221	.2	721	334
OK 10	State Hwy. 15, 1.2 miles E. of levee crossing..........	Sept. 11, 1941	100	74	60	82.8	.05	90	12	87	371	44	80	.2	496	274
OK 11	State Hwy. 15, 4.9 miles E. of levee crossing..........	.....do...........	57	74	520	142	.38	200	28	72	543	86	168	.4	822	614
OK 12	State Hwy. 15, 7.5 miles E. of levee crossing..........	.....do...........	105	75	40	326	.10	110	68	492	411	71	860	......	1,800	554
GS 16	Fort Drum..........	July 12, 1943	6	......	850	7.7	.02	3.6	4.3	6.0	4.0	24	8	.3	48	27
	...........do..........	.....do...........	19.9	......	175	4.4	.04	5.2	2.5	4.5	18	9.3	6	.2	37	23
	...........do..........	July 14, 1943	90	......	20	46.3	.07	90	7.0	....	278	11	10	.1	255	254
GS 17	S. of Okeechobee..........	July 16, 1943	44	79	300	31.7	2.5	41	7.2	5	122	5	4	.0	....	132
	...........do..........	July 17, 1943	49	78	38	206	.08	184	31	225	730	5	335	.0	1,140	586
	...........do..........	July 19, 1943	90.3	......	35	307	.04	120	38	501	470	288	610	.0	1,789	456
	...........do..........	July 20, 1943	131	78	60	166	.15	92	24	233	376	116	288	.0	938	328
GS 19	SE. of Okeechobee..........	July 23, 1943	19	78	55	155	.05	168	35	129	514	109	218	2.8	915	564
		.....do...........	49	......	32	304	.03	139	55	424	392	63	785	......	1,659	573

SUMMARY OF QUALITY OF GROUND WATER IN LAKE OKEECHOBEE AREA

Analyses of samples collected from about 80 wells, located in five counties near the shores of Lake Okeechobee, show that most of the ground water in this region is highly mineralized. Most of the wells are less than 100 ft deep and terminate in lime rock or shell marl. With few exceptions, the surface soil consists of muck ranging from a few inches to several feet in depth. It appears that high mineral concentrations in the ground waters are related to the occurrence of the muck soils and to the low permeability of both the muck and the underlying marls.

Saline waters and residues left by Pleistocene invasions of the area by the sea have never been completely flushed out of the formations in much of the Everglades, particularly in areas near the borders of Lake Okeechobee. Saline waters are present in the formations, and it is probable that the muck and rock contain much soluble material other than carbonates. Some wells less than 50 ft deep yield water high in sulfate and chloride.

The high concentrations of bicarbonate cannot be explained by entrapment of ancient sea water, because brines ordinarily contain only small amounts of bicarbonate. The high concentrations of bicarbonate found in most of the ground waters near Lake Okeechobee are associated with the presence of muck soils that have high percentages of organic matter. The decaying organic matter facilitates the solution of calcium carbonate by furnishing carbon dioxide, which, when it reacts with water to form carbonic acid, reacts with calcium carbonate to give soluble calcium bicarbonate.

It has long been known that certain organic soils play an active role in cation exchange. It is probable that the organic muck soils have played a large part in transforming calcium-bicarbonate waters into sodium-bicarbonate waters. Because large concentrations of calcium bicarbonate are not ordinarily found in natural waters, it is possible that several stages of solution of lime rock, and subsequent transformation into sodium bicarbonate by cation exchange, have been necessary to produce the high concentration of bicarbonate found in some of the waters.

The phenomenon of cation exchange is discussed more fully below under the heading "Source of Mineralization of Ground Waters in the Everglades," and in the section on "Salt-water encroachment."

THE EVERGLADES

The chemical character of ground water in the Everglades has been discussed briefly by Stringfield (1933a), Parker (1942, p. 47-76), and Parker and Hoy (1943, p. 33-55), and is touched upon in this report in the discussion of ground waters in the vicinity of Lake Okeechobee. Outside the Lake Okeechobee area, most of the information about the character of the ground water was obtained from test wells, drilled for the purpose of collecting samples of water and rock and for determining the geologic and hydrologic characteristics of the water-bearing formations.

Water samples were collected at intervals of only a few feet while the wells were being drilled. Chloride and specific conductance were determined on all samples, and more complete analyses were made on samples that seemed (from the chloride and conductance values) to represent different types of water.

Analyses of a large number of samples collected from wells scattered over the Everglades indicate that the most concentrated waters are found in the Lake Okeechobee area and that the least concentrated waters are found in the southern and southeastern parts of the Everglades. In general, water from wells less than 20 ft deep contains less dissolved mineral matter than water from greater depths. Some very shallow wells, however, yield rather highly concentrated water.

In the vicinity of Lake Okeechobee, some well waters contain large, but variable, amounts of sodium and bicarbonate and others contain relatively large amounts of sulfate and chloride. Farther south, calcium and bicarbonate are the major constituents of the dissolved matter in many well waters, although chloride may be present in relatively large amounts.

To show in a general way the range in concentration of dissolved matter in ground water in the Everglades, the range in chloride concentration for different depths was chosen to represent approximate ranges in the degree of mineralization. It is recognized that other constituents, particularly in water from wells near Lake Okeechobee, may make up a greater part of the dissolved mineral matter than chloride. Considering the Everglades as a whole, however, it is believed that ranges in chloride concentration give a more reliable index to the various degrees of mineralization.

Figure 221 shows, in a general way, the ranges in chloride concentration that may be expected in three depth intervals in all except the western part of the Everglades. The metropolitan area of Miami and the eastern part of Palm Beach County are not included because the character of ground water in these areas is treated more fully in other sections and also because very little of these coastal strips lies within the Everglades proper.

Lines between any two chloride ranges in figure 221 indicate the approximate boundaries between chloride concentrations in the

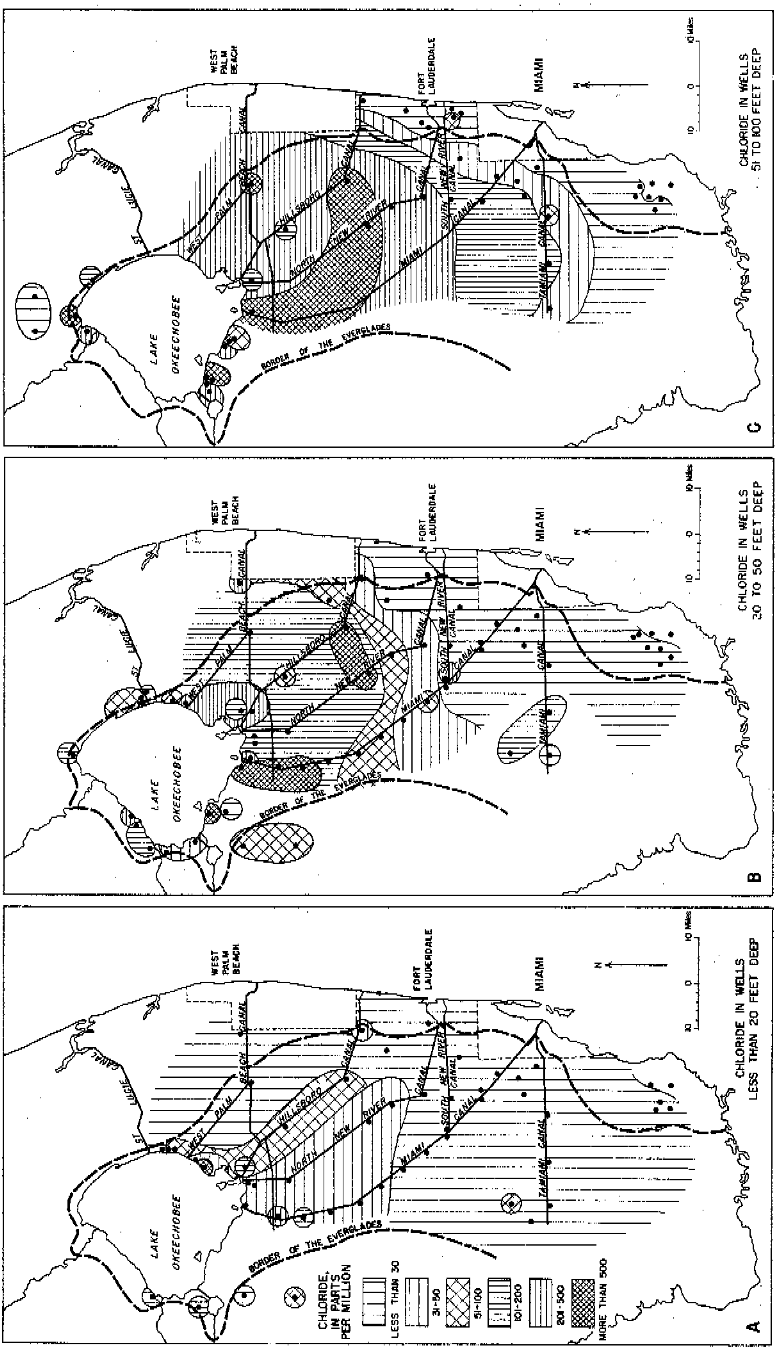

Figure 221. —Maps showing chloride concentrations in ground water at different depths in the Everglades; *A*, wells less than 20-ft deep; *B*, wells 21–50 ft deep; *C*, wells 51–100 ft deep.

two areas. Exceptions to the concentrations generally found within an area are shown as islands of a different concentration. Undoubtedly, many other exceptions would be found with the drilling of additional wells. It is entirely possible that the shading of a whole area might be changed as a result of additional information. It is believed, however, that the three illustrations give an approximate representation of the distribution of chloride in the three depth ranges.

The hachures on the fringes of the main body of the shaded area have been left without boundary lines to indicate that chloride concentrations in the several ranges may be found for some distance beyond the areas already shaded. Boundary lines have been placed around small islands outside the main shaded area, not to convey the idea that these islands may not be of larger extent, but instead, to make the different concentration ranges more discernible.

It should be emphasized that the chloride concentrations in ground water in the Everglades are not the result of recent sea-water contamination but rather that saline residues of ice-age invasions of the sea have not been entirely flushed out.

Figure 221 does not show the effect of present sea-water contamination of ground water near the coast except to show the approximate boundary at different depths in the vicinity of Homestead in the southeastern part of Dade County. This area is outside the border of the Everglades.

SOURCE OF MINERALIZATION OF GROUND WATERS IN THE EVERGLADES

The mineral content of ground waters in the Everglades has resulted partly from remnants of saline residues that have not been completely flushed out of the ground and partly from cation-exchange processes. In the Miami area, it is postulated that organic colloids, saturated with sodium and magnesium from ancient brines, were brought in contact with calcium-bicarbonate solutions derived from rainwater, lime rock, and carbon dioxide, with the result that the adsorbed sodium and magnesium were exchanged for calcium. All of the saline residues were completely flushed from the formations and were replaced with fresh ground water in which calcium and bicarbonate were the chief constituents.

In the Everglades area, the organic matter and rocks were undoubtedly exposed to the same processes, but the action is not complete. Because the muck and rock of the Everglades are much less permeable than the sandstones and limestones of the Biscayne aquifer, the saline residues have not been entirely flushed out, and the organic colloids are still partly saturated with sodium and magnesium, presumably adsorbed from ancient sea water. Calcium bicarbonate is readily brought into solution in the presence of carbon dioxide furnished, in large part, by decomposing organic matter. When brought in contact with sodium and magnesium-bearing clays, the calcium in the solution is exchanged for sodium and magnesium in the clays. The water then comes in contact with more lime rock, which dissolves to form more calcium bicarbonate. Repetition of the process increases the bicarbonate concentration to high values. In many waters, bicarbonate is present in concentrations in excess of 500 ppm and concentrations of 1,000 ppm are not unusual. The cations in solution may consist largely of sodium, or sodium and magnesium, but in some waters they consist largely of calcium. The proportion of each cation in solution is apparently determined, in part, by the composition of the exchangeable clays and organic colloids and, in part, by the number of times that the solution and exchange cycle is repeated. The high concentrations of sulfate and chloride in many of the ground waters in the Everglades are apparently derived from saline residues from earlier invasions by the sea.

COLLIER COUNTY

Only seven samples of ground water were collected from shallow aquifers in Collier County. The analyses show that dissolved solids ranged from 70 to 115 ppm and hardness ranged from 25 to 62 ppm (see table 112). Except for the high color—60 to 160—these waters are suitable for almost all purposes. Unfortunately, large yields are not obtainable from shallow aquifers in Collier County. See table 113 for analyses of artesian waters.

Table 112.—*Analyses, in parts per million, of nonartesian waters in Collier County*

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance (K x 10^5 at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
C 20	Marco Isle	Oct. 28, 1940	12	76	60	19.5	......	12	3.2	18	24	6	40	......	91	43
C 18	do	do	......	78	160	13.9	......	6.0	2.5	18	28	4	26	......	70	25
C 17	Collier City	do	22	......	160	24.2	......	6.6	7.3	27	18	6	59	......	115	46
C 15	Caxambas	do	13	78	85	15.0	......	22	1.7	4.7	63	2	13	......	74	62
C 16	do	do	6.9	77	65	28.5	......	......	......	......	8.0	12	70	......	......	34
C 12	Hoar's Isle	do	16	81	140	19.3	......	7.6	3.1	22	22	10	37	......	90	32
C 43	do	do	12	81	......	19.0	......	......	......	......	16	14	39	......	......	56

Table 113.—*Analyses, in parts per million, of artesian waters in southeastern Florida*

Well no.	Location	Date of collection	Depth (feet)	Temperature (°F)	Color	Specific conductance ($K \times 10^5$ at 25 C)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na + K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
						Dade County										
S- 125	NW. Miami Ct. and 14th St.	Oct. 15, 1940	1,950	76	15	1,950	...	214	464	3,650	129	1,030	6,520	...	11,900	2,440
S- 142	47 NW. 6th St.	Mar. 15, 1940	1,165	71	...	585	...	...	...	...	154	...	1,580	...	...	...
S- 144	3250 S. Miami Ave.	Oct. 14, 1940	1,000	71	15	576	...	...	...	...	183	...	1,480	...	...	...
S- 155	Miami Beach, Palm Island	do.	1,000	70	10	554	...	...	...	...	150	...	1,470	...	...	...
S- 158	Miami Beach, Jefferson Ave. and 17th St.	do.	1,066	70	5	913	...	161	199	1,520	148	575	2,700	...	5,230	1,220
S- 160	Miami Beach, Blackhawk Ave. and 51st Ter.	do.	1,000	79	20	615	...	82	133	1,010	29	370	1,800	...	3,410	752
S- 161	0.5 mile S. of Kendall	do.	5,432	76	10	692	...	78	133	1,190	65	379	2,040	...	3,850	742
S- 450	Everglades No. 2, Dade-Collier County line	Feb. 4, 1941	585	78	140	80.5	...	15	16	155	447	21	37	...	464	103
F- 152	SW. 24th Ave. and 16th Ter.	Oct. 14, 1940	990	72	5	593	...	...	...	...	182	...	1,540	...	...	...
G- 101	Miami, W. Flagler St., 3 miles W. of Red Road	June 14, 1940	534	...	...	216	...	21	16	451	419	292	320	...	1,310	118
	do.	June 15, 1940	552.6	...	...	324	...	22	33	666	444	507	725	...	1,980	191
	do.	June 18, 1940	607	...	...	425	...	20	49	887	409	791	725	...	2,670	251
	do.	June 25, 1940	716.8	...	...	473	...	22	67	928	366	748	900	...	2,850	330
	do.	July 1, 1940	785.1	...	...	524	...	48	107	952	303	594	1,250	...	3,100	560
	do.	July 8, 1940	812	72	...	579	...	77	121	1,020	313	619	1,420	...	3,410	690
	do.	Jan. 13, 1942	113.8	77	...	77.3	...	84	24	39	397	12	39	.0	394	308
	do.	Jan. 21, 1942	234.1	77	...	56.2	...	35	21	60	319	5.8	27	.0	306	174
	do.	Feb. 3, 1942	411	78	...	47.4	...	12	7.9	89	267	4.5	23	.0	268	62
	do.	Feb. 27, 1942	600	80	...	58.1	...	20	14	84	233	4.9	67	.0	305	108
						Palm Beach County										
S- 353	Belle Glade, University of Florida Everglades Experiment Station	Sept. 12, 1941	1,332	78	10	616	0.03	166	131	864	22	5.8	1,990	...	3,170	953
S- 382	West Palm Beach	Oct. 28, 1940	1,080	73	5	810	...	140	181	1,354	186	481	2,400	...	4,650	1,094
S- 383	do.	do.	1,050	73	5	802	...	141	180	1,320	182	479	2,350	...	4,560	1,092
S-1184	West Palm Beach, North Railroad Ave. and 4th St.	Sept. 9, 1941	1,035	73	5	726	.10	127	161	1,207	194	449	2,110	...	4,150	979

Okeechobee County

OK 16	Farm Security Administration project	Oct. 3, 1941	996	80	20	142	0.20	62	42	156	120	160	285	......	764	327
OK 1	Okeechobee, block 134, lot 5	Sept. 11, 1941	718	79	5	210	.05	102	57	270	129	233	515	......	1,240	489
OK 7	Okeechobee School	do	......	78	5	187	.05	59	48	254	129	228	392	......	1,040	345

Hendry County

HE 2	La Belle, Everett Hotel	Sept. 24, 1941	650	81	......	224	0.05	55	44	344	118	323	450	......	1,270	318
HE 14	0.8 mile S. of State Hwy. 80 and 5.6 miles W. of Atlantic Coast Line R. R. crossing	do	315	......	......	154	.05	67	56	161	329	100	264	0.4	811	397

Collier County

C 21	State Hwy. 29, 0.7 mile S. of Hendry-Collier County line	Dec. 15, 1941	566	82	5	331	0.10	108	99	433	180	302	820	......	1,850	677
C 222	Humble Oil Company concession, 60 ft E. of West line of Section 33	Dec. 11, 1941	753-775	81	5	430	.12	78	87	741	255	645	910	......	2,590	552
	do	Dec. 12, 1941	786	81	5	425	1.4	79	89	711	255	633	980	......	2,520	563
	do	Dec. 13, 1941	819	......	5	420	.12	101	114	640	182	558	980	......	2,480	721
	do	do	829	81	5	420	.12	98	113	650	196	556	980	......	2,490	709
	do	Dec. 15, 1941	845	82	5	420	.14	98	113	650	192	560	980	......	2,500	709
C 37	Immokalee	Sept. 22, 1940	590	......	5	422	......	92	109	624	74	488	1,040	......	2,390	678
C 19	Marco Isle	Oct. 28, 1940	800-900	80	5	1,280	......	258	286	2,150	183	749	3,950	......	7,580	1,820
C 14	Caxambas	do	376	78	5	770	......	88	103	1,370	17	114	2,480	......	4,160	643
C 13	do	do	200-300	78	5	866	......	177	197	1,390	193	505	2,550	......	4,910	1,250
C 11	Kice's Island	do	......	78	35	894	......	180	207	1,450	189	497	2,680	......	5,110	1,300
C 36	Ochopee	Oct. 29, 1940	446	72	5	566	......	101	122	917	231	465	1,470	......	3,190	754
C 4	Everglades City, public supply	Aug. 17, 1941	521	......	5	141	.02	32	44	199	308	91	246	0.1	764	261

CHEMICAL CHARACTER OF ARTESIAN WATERS

Artesian water of the Floridan aquifer is encountered in wells at depths of 800 to 1,000 ft in, and near, Miami, and at somewhat shallower depths north of Miami. Much of this water is brackish and unfit for domestic use and most other purposes. In general, the chloride concentration ranged between 500 and 4,000 ppm. The higher concentrations in some wells may have resulted from a mixture of sea water through leaky casings.

The public supply at La Belle, Hendry County, is artesian and it contains 2.4 ppm of fluoride, the highest found in samples taken in southeastern Florida. See pages 188–196 for a discussion of artesian water. Table 113 contains analyses of artesian waters from various wells in southeastern Florida.

PUBLIC WATER SUPPLIES

In 1941–42, chemical analyses were made on water samples collected from 25 public water supply systems in Broward, Dade, Glades, Hendry, Okeechobee and Palm Beach Counties. In 1948, these public supplies were resampled and additional samples were collected from six towns in Collier, Indian River, Martin, Monroe, and St. Lucie Counties. Results of analyses for the two periods are shown in tables 114 and 115.

Miami, the largest city in southeastern Florida, obtains its water supply from wells and furnishes water to Miami Beach, Coral Gables, Miami Shores, El Portal, Surfside, Indian Creek Village, Hialeah, and Miami Springs. Other places using ground water are: Boca Raton, Boynton Beach, Dania, Deerfield Beach, Delray Beach, Everglades, Fort Lauderdale, Hobe Sound, Hollywood, Homestead, Indian Town, Key West, La Belle, Lake Park, Lake Worth, Lantana, North Miami, North Miami Beach, Opa Locka, Pompana Beach, Riviera, and Stuart.

Key West had no public supply system prior to 1942 and was dependent on rainwater and on water that was transported from the mainland for domestic use. A few privately owned shallow wells yielded small quantities of relatively fresh water during periods of heavy rainfall, but nearly all these wells became salty soon after the end of the rainy periods. A supply of fresh water is now piped to Key West from near Homestead (where it is obtained from wells). The ground water is softened before transmission to Key West. Several fishing camps, and other private users, along the pipe-line route over the Florida Keys obtain water from the Key West supply.

West Palm Beach is the largest city in southeastern Florida that uses surface water. Palm Beach is also supplied by this system. Other towns supplied with surface water are: Belle Glade, Canal Point, Clewiston, Moore Haven, Okeechobee, and Pahokee. These six towns are located on, or near, Lake Okeechobee and are normally supplied with lake water. Fort Pierce obtains about 80 percent of its supply from surface water and obtains the remainder from wells. The hardness of the finished water from 25 supplies sampled in 1941–42 is indicated in figure 222.

The largest use of water from the public supplies is for domestic purposes; agricultural use of water from public supplies is very small. Irrigation is practiced during dry periods, but water for this purpose is usually obtained from shallow wells or drainage canals.

There is practically no heavy industry in the southeastern part of the State. Most of the industrial plants in the coastal cities are connected directly, or indirectly, with the building trades or public

Table 114.—*Analyses, in parts per million, of public water supplies in southern Florida, 1941–42*

Municipality	Date of collection	Type of water	Color	pH	Specific conductance (K x 10^5 at 25 C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
Broward County																		
Dania	Dec. 10, 1941	D	90	7.8	56.2	7.6	0.12	104	3.5	17		302	25	25	0.3	0.7	365	274
Deerfield Beach	Nov. 29, 1941	D	25	7.4	28.0	8.0	.65	51	3.1	5.6		153	7.6	13	.2	.0	164	140
Fort Lauderdale	Dec. 4, 1941	R	110	7.3	45.8	11	1.9	88	3.3	11		266	2.4	18	.1	2.1	294	233
Do	....do	F	35	7.7	18.0	6.8	.05	21	2.9	10		44	16	18	.2	3.2	..5	64
Hollywood	Dec. 10, 1941	R	40	7.1	53.1	3.2	.24	103	2.6	11		301	19	17	.2	.1	333	268
Do	....do	F	40	7.7	55.0	4.0		40	1.0	91		307	20	20	.2	.1	437	104
Pompano	Nov. 29, 1941	D	20	7.2	26.8	4.8	.16	47	2.3	8.5		136	11	15	.4	.1	165	127
Dade County																		
Homestead	Mar. 5, 1941	D	5	......	37.9	2.8	.02	63	6.5	6.8	.4	218	8.3	10	.2	.3	212	184
Miami	Feb. 3, 1942	R	85	6.8	57.7	7.4	1.3	94	9.6	22	2.2	266	34	38	.1	1.5	370	274
Do	....do	F	20	8.5	31.8	8.5	.01	27	6.1	25	2.0	248	38	48	.2	.1	204	92
North Miami	Dec. 10, 1941	R	60	7.5	51.6	5.2	.32	99	3.8	8.5		255	47	16	.2	.1	363	263
Do	....do	F	20	8.4	21.9	7.6	.12	29	2.4	9.9		338	47	16	.3	.5	178	82
North Miami Beach	....do	R	40	7.1	155	7.6	1.5	176	3.3	132		285	25	340	.2	.0	826	453
Do	....do	F	20	8.0	107	10	.08	80	2.4	114		417	26	295	.3	.0	536	210
Opa Locka	....do	R	70	7.2	39.7	6.0	.68	72	4.5	5.5		216	16	11	.3	.1	244	198
Do	....do	F	40	7.8	20.0	6.0	.08	30	4.2	1.3		70	20	11	.3	.5	138	92
Glades County																		
Moore Haven	Mar. 12, 1941	R	80	......	64.5	8.4	2.2	104	13	25		312	44	43	.3	5.0	487	313
Do	....do	F	30	......	79.0	7.2	.15	88	12	70		282	117	45	.0	5.0	534	269
Hendry County																		
Clewiston	Oct. 27, 1941	D	5	7.0	40.5	3.5	.03	41	9.7	24	2.0	76	75	36	.1	2.1	248	142
La Belle	Mar. 12, 1941	D	5	......	233	26	.16	65	53	353		118	325	500	2.4	......	1,600	380
Okeechobee County																		
Okeechobee	Oct. 27, 1941	D	8	6.8	18.8	1.3	.06	19	3.1	9.	1.6	22	40	17	.1	.2	114	61
Palm Beach County																		
Belle Glade	Mar. 13, 1941	D	40	......	92.0	13	.09	91	31	64		218	185	83	.1	5.0	692	355
Boca Raton	Oct. 21, 1941	R	10	7.2	32.1	9.6	.06	59	3.1	3.0		168	2.0	18	.3	.7	195	160
Do	....do	F	10	7.4	16.8	5.2	.02	22	1.6	8.7		56	9.1	17	.3	.2	97	61

Boynton Beach......	Oct. 24, 1941	D	30	7.3	37.2	5.2	.04	66	2.8	7.9		178	16	21	.3	.5	227	176
Canal Point.........	Mar. 13, 1941	D	25	....	45.1	3.8	.13	46	12	29		127	54	47	.1	1.0	311	164
Delray Beach.......	Oct. 31, 1941	D	35	7.6	38.8	3.2	.20	70	2.8	8.8		205	4.9	22	.2	.8	234	186
Lake Park	.....do..........	D	10	7.5	32.9	6.4	.04	58	2.3	8.4		162	9.5	17	.2	6.5	200	154
Lake Worth..........	Mar. 15, 1941	D	40	....	43.7	4.8	.72	74	3.1	20		220	20	25	.1	4.0	287	197
Lantana..............	Oct. 24, 1941	D	10	7.2	30.5	6.8	.06	54	3.3	3.9		152	3.0	20	.3	.2	182	148
Pahokee..............	Mar. 13, 1941	D	35	....	51.6	7.6	.06	56	16	30		160	67	47	.3		371	206
Riviera...............	Mar. 14, 1941	D	15	7.8	30.5	6.8	.17	48	1.9	17		153	2.8	25	.3	1.0	194	128
West Palm Beach....	Oct. 22, 1941	R	55	6.4	6.51	1.0	.04	7.0	.9	4.8	.9	16	1.6	9.5	.1	1.0	49	21
Do................	.....do..........	F	5	9.0	13.5	3.6	.02	17	1.1	5.2	1.1	[6]26	23	11	.1	.0	87	47

[1]D, delivered; R, raw; F, finished.
[2]Includes equivalent of 3.9 ppm of CO_3.
[3]Includes equivalent of 9.8 ppm of CO_3.
[4]Includes equivalent of 4.9 ppm of CO_3.
[5]Formerly Kelsy City.
[6]Includes equivalent of 6.9 ppm of CO_3.

Table 115.—*Analyses, in parts per million, of public water supplies in southern Florida, 1948*

Municipality	Date of collection	Type of water	Color	pH	Specific conductance (K x 10^5 at 25 C)	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Total hardness as $CaCO_3$
Broward County																		
Dania	Mar. 29, 1948	R	86	6.9	56.9	......	0.12	104	4.3	16		308	25	23	0.2	1.8	326	277
Do.	....do.	F	57	7.4	57.5	......	.04	103	4.4	19		314	22	25	.0	.1	328	275
Deerfield Beach	Mar. 25, 1948	D	6	7.4	31.2	......	.04	58	2.1	7.8		176	5.8	14	.1	.3	175	153
Hollywood	Mar. 29, 1948	R	25	6.8	63.2	......	.08	102	4.4	31		306	28	42	.1	.7	359	273
Do.	....do.	F	19	6.7	62.0	......	.06	30	2.7	116		300	35	40	.0	.3	372	86
Pompano	Mar. 29, 1948	D	4	7.6	27.1	......	.04	46	2.0	12		138	9.7	15	.2	.4	153	123
Collier County																		
Everglades	Mar. 22, 1948	D	4	7.4	142.0	......	.01	34	43	204		312	94	245	1.4	2.4	779	262
Dade County																		
Homestead	Mar. 31, 1948	D	1	7.2	42.4	......	.02	80	2.6	4.3		232	11	12	.0	1.6	228	210
Miami	November 1948	R	80	7.3	....	9.0	.9	98	7.1	27		266	37	35	......	......	350	250
Do.	....do.	F	23	8.7	....	9.0	.02	25	4.0	27		55[2]	40	35	......	......	190	80
North Miami	Mar. 30, 1948	D	27	7.2	53.7	......	.04	98	5.2	17		268	30	36	.1	1.2	319	266
North Miami Beach	Mar. 29, 1948	R	17	7.2	51.7	......	.08	103	3.8	4.1		280	28	16	.1	.4	293	273
Do.	....do.	F	4	10.2	32.9	......	.02	43	1.6	19		30	33	18	.2	.1	167	114
Opa Locka	Mar. 30, 1948	R	52	7.2	37.6	......	.23	66	4.9	5.9		196	18	12	.2	1.6	205	185
Do.	....do.	F	17	7.2	40.3	......	.03	40	4.4	8.9		118	21	12	.2	2.2	147	118
Glades County																		
Moore Haven	Mar. 22, 1948	D	4	5.9	42.6	......	.05	34	1.7	55		22	145	29	.1	.8	276	92
Hendry County																		
Clewiston	Mar. 22, 1948	D	7	7.4	41.6	......	.02	46	9.8	24		84	80	38	.2	1.2	243	155
La Belle	Mar. 22, 1948	D	3	7.1	230.0	......	.09	70	51	352		122	351	480	2.4	1.2	1,370	384
Martin County																		
Hobe Sound	Mar. 24, 1948	D	6	7.1	23.3	......	.01	39	2.1	9.7		120	5.1	16	.1	.6	132	106
Indian Town	Mar. 23, 1948	D	13	7.0	16.9	......	.12	12	2.7	19		60	.6	22	.0	1.0	87	41
Stuart	Mar. 24, 1948	R	7	6.9	70.1	......	.04	102	4.6	35		224	12	108	.1	.8	373	273
Do.	....do.	F	6	7.0	71.1	......	.01	100	4.5	39		218	14	112	.1	.5	378	268
Monroe County																		
Key West	Apr. 2, 1948	R	1	7.4	38.1	......	.02	68	2.9	16		222	14	14	......	.1	224	182
Do.	....do.	F	3	7.2	26.8	......	.04	44	2.9	....	....	134	8.8	14	.1	.1	144	122

Okeechobee County																	
Okeechobee........	Mar. 23, 1948	D	3	7.0	25.1	......	.01	30	4.4	10	26	67	17	.1	.1	141	93
Palm Beach County																	
Belle Glade.........	Mar. 22, 1948	D	8	9.3	31.5	......	.02	38	4.2	11	52	59	22	.2	1.0	161	112
Boca Raton.........	Mar. 25, 1948	R	11	7.4	33.5	......	.18	58	2.4	12	174	10	19	.1	.3	187	155
Do...............	.....do...........	F	4	7.6	33.2	......	.30	58	2.7	10	174	8.0	19	.1	.4	184	156
Boynton Beach.....	.....do...........	D	17	7.2	40.4	......	.15	68	2.6	16	198	20	22	.1	.2	226	180
Canal Point.........	Mar. 23, 1948	D	11	6.5	31.0	......	.0	35	9.4	33	86	73	36	.0	1.0	230	126
Delray Beach.......	Mar. 25, 1948	R	17	7.3	41.5	......	.05	70	2.3	22	286	12	24	.1	1.0	272	184
Do..............	.....do...........	F	16	7.7	40.3	......	.12	68	3.1	14	204	12	23	....	.2	221	182
Lake Park...........	Mar. 24, 1948	D	37	6.9	44.3	......	.61	71	2.6	46	240	55	24	.0	.1	318	188
Lake Worth.........	Mar. 25, 1948	D	12	7.4	33.3	......	.01	57	2.5	25	164	16	40	.0	.4	222	152
Lantana.............	.....do...........	D	11	7.1	31.8	......	.14	54	2.2	17	170	12	20	.1	.0	189	144
Pahokee............	Mar. 22, 1948	D	18	7.9	39.4	......	.03	54	9.9	15	118	53	39	.1	.7	230	175
Riviera..............	Mar. 25, 1948	D	18	7.2	36.5	......	.05	63	2.6	28	202	33	21	.1	.1	247	168
West Palm Beach..	.....do...........	D	6	7.0	15.4	......	.02	18	2.5	10	32	22	20	.0	.0	88	55
St. Lucie County																	
Fort Pierce..........	Mar. 24, 1948	R[4]	58	7.1	64.9	......	.16	98	3.3	42	316	5.6	60	.1	.4	364	258
Do...............	.....do...........	F	6	9.2	38.9	......	.02	38	4.3	43	88	57	52	.0	.0	238	112

[1]D, delivered; R, raw; F, finished.
[2]Includes equivalent of 5.0 ppm of CO_3.
[3]Sample contained 14 ppm of OH and 33 ppm of CO_3
[4]Composite of two wells.
[5]Approximately 80% surface water; 20% ground water.

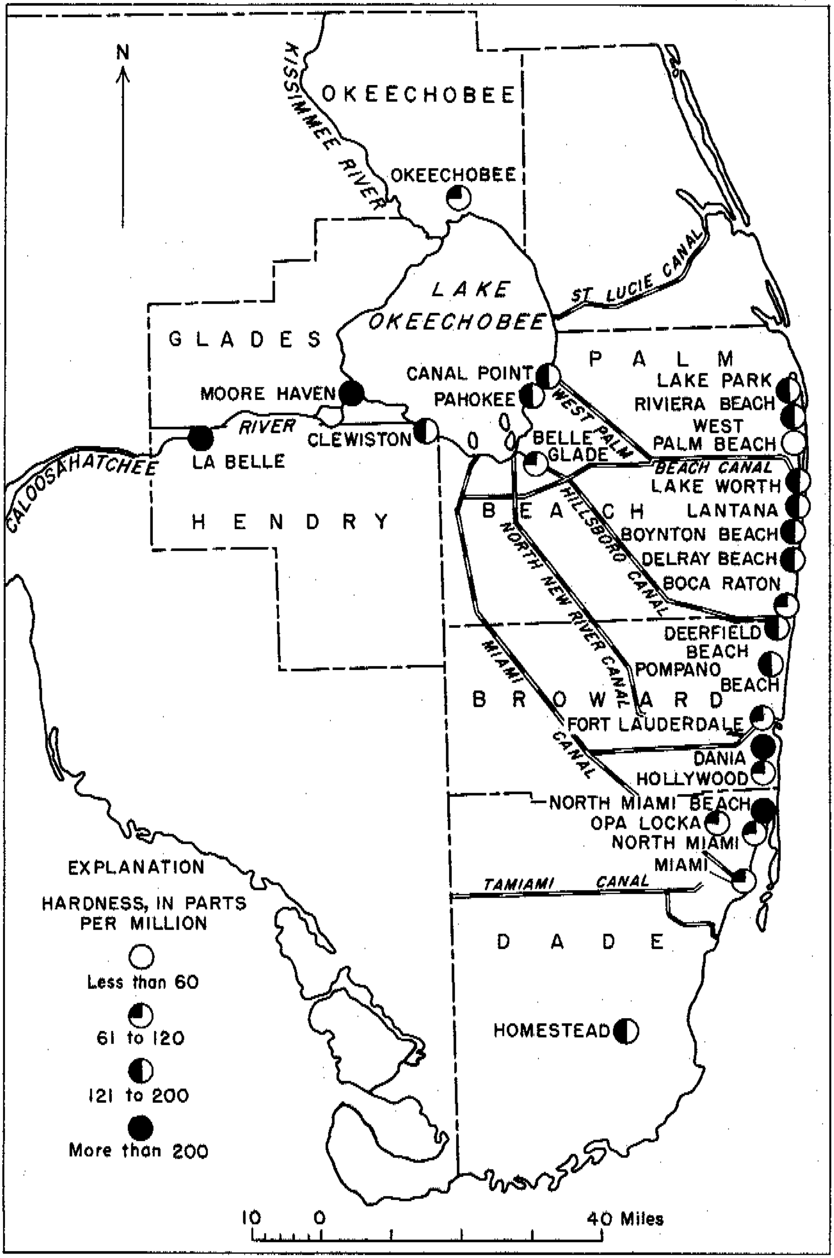

Figure 222.—Map showing hardness of public water supplies in southeastern Florida, 1941.

services and a large part of the water used by them is obtained from privately owned wells.

Several Army and Navy air fields and training bases were established during the war along the lower east coast of Florida and in the north-central part of the area covered by this report. Existing public supplies furnish water to some of them and others have installed their own supplies. Water from public supply systems is also furnished to shipping at Miami, Port Everglades, and the Port of Palm Beach.