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A HYDROLOGIC DESCRIPTION OF KEYSTONE LAKE NEAR TAMPA, FLORIDA

By
Ronald C. Reichenbaugh

Prepared by the
U.S. GEOLOGICAL SURVEY
in cooperation with the
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

INTRODUCTION

Keystone Lake is in the northwest corner of Hillsborough County in west-central Florida, about 14 mi northwest of Tampa. The lake is about 2 mi south of the Pasco County line and 3 mi east of the Pinellas County line, and is an integral part of the Brooker Creek channel. Keystone Lake, with its surface area of 388 acres, is the largest of over three dozen lakes in a 36-square-mile area and is the second largest lake in the county. Most of the lakes in the area are popular nuclei of lakefront homesites. Keystone Lake is in the Northwest Hillsborough Basin, a hydrologic subdivision of the Southwest Florida Water Management District.

In the recent past, residents of the area have asked the Hillsborough Basin Board and the Southwest Florida Water Management District to consider implementing water-management practices designed to eliminate problems associated with extreme high and low lake levels on Keystone and nearby lakes.

In 1974, the U.S. Geological Survey in cooperation with the Southwest Florida Water Management District began a study of the hydrologic conditions in the Keystone Lake basin. The objectives of this study were to summarize historical hydrologic data and to document existing hydrologic conditions in the lake basin. This report was compiled from surface-water and ground-water records and related data gathered as part of the Survey's basic data network in northwest Hillsborough County.

PREVIOUS STUDIES

The geohydrology of the Keystone Lake area of northwest Hillsborough County has been studied extensively by the U.S. Geological Survey and other agencies. A comprehensive summary of the water resources of Hillsborough County by Menke, Meredith, and Wetterhall (1961) contains a brief section on the surface- and ground-water hydrology of the Keystone Lake area. Stewart (1968) presented detailed information on ground-water withdrawals from the Cosme well field and he also investigated the impact of those withdrawals on the Floridan aquifer, the water table, and lakes in the area.

In October 1973, the Southwest Florida Water Management District received a report from consulting engineers reviewing available data, and analyzing District staff proposals regarding Keystone Lake Water Management (Watson and Company, Commission Number T73005, dated October 1973). The Hillsborough County Environmental Protection Commission report (1974) summarizes the Commission's analyses of the lake waters and bottom sediments and contains recommendations regarding current water-management proposals being considered by the Southwest Florida Water Management District.

The hydrogeologic characteristics of the surficial aquifer in northwest Hillsborough County were described by Sinclair (1974). The report contained detailed analyses of materials penetrated in 59 test holes augered to the top of the Floridan aquifer in the area.

Records of water levels in the shallow aquifer and maps showing the potentiometric surface of the Floridan aquifer in the Keystone Lake area are published periodically through a cooperative program between the Southwest Florida Water Management District and the U.S. Geological Survey.

GEOLOGIC SETTING

Northwest Hillsborough County is a flat-to-slightly-undulating sandy plain, with a regional slope of about 4 ft/mi westward to the Gulf of Mexico. According to Sinclair (1974, p. 2), the plain is dotted by sinkholes with bottoms as much as 15 to 20 ft below land surface. These sinkholes result from local subsidence of the land surface, as surficial materials collapse and fill solution cavities in the underlying limestone. Sinkholes in the area represent all stages of development from small freshly collapsed pits to large lakes with irregular shorelines and bottoms formed by the coalescence of many sinkholes. The sinkholes permit local hydraulic connection between the surficial water-table aquifer and the Floridan aquifer, and are an important avenue of natural recharge to the Floridan aquifer in the area.

Sinclair (1974) described the hydrologic system in northwest Hillsborough County as consisting of surficial sand of relatively high permeability and large storage capacity, ranging in thickness from 0 to 35 ft. The sand is underlain by layers of sand and clay of lower permeability and storage capacity. These units are underlain by a relatively impermeable clay which overlies the permeable limestone of the Floridan aquifer. Leakage from the surficial aquifer to the Floridan aquifer occurs through the confining clay layer as well as through sinkholes that breach the confining layer. The clay unit is the most important unit in retarding recharge—the downward movement of water from the surficial aquifer to the Floridan aquifer.

The Tampa Limestone of Miocene age is consolidated bedrock underlying surficial deposits of unconsolidated sands and clays, and is the upper unit of the Floridan aquifer. The limestone is light gray, tan, or white, usually sandy, fossiliferous in places, and commonly contains clay lenses and cavities. Tests of wells in the Tampa Limestone indicate that the coefficient of permeability of the limestone in the area is about 130 ft^2/d; water movement is mostly along solution-enlarged bedding planes and joints.

A geologic section across Keystone Lake area is shown in figure 1 and is located on the photo-map base (section A-A'). Geologic data are from test holes numbered 1, 4, 6, and 7, reported by Sinclair (1974). In the Keystone Lake area, the surficial sand ranges in thickness from 17 ft west of the lake (test hole no. 1) to 20 ft east of the lake (test holes nos. 4 and 6). Throughout most of section A-A' the sand is underlain by about 25 ft of undifferentiated sand and clay. This sand and clay unit is underlain by 6 to 13 ft of poorly permeable clay. Together these units form the confining layer separating the underlying limestone (Floridan aquifer) from the surficial aquifer. The top of the limestone is 50 to 63 ft below land surface across the section.

HYDROLOGIC SETTING

Keystone Lake is an integral part of Brooker Creek which enters the southeast part of the lake near State Highway 587. The Keystone Lake-Brooker Creek drainage-basin area above the outlet of the lake is about 10 mi^2. The lake receives overland runoff from cypress swamps, pastures, citrus groves, and lakefront residential areas. Residences along the lake use septic tanks and obtain water from private wells. No central sewer system serves the area.

Keystone Lake empties through Brooker Creek into Island Ford Lake to the north. To control flow from the lake, two vertical-lift gates were constructed in May 1955 at the culvert beneath Tarpon Springs Road (State Highway 582). The lake overflows the gates when the stage exceeds 41 ft above msl. Flow out of Island Ford Lake is through a fixed weir which permits flow when the lake stage exceeds approximately 40 ft. Brooker Creek flows generally southwesterly from Island Ford Lake about 9.4 mi to its mouth at Lake Tarpon. Keystone Lake stages have been recorded since April 1946 (fig. 2).

Pumping from the St. Petersburg Cosme well field began about 1930 and continues at present (1976). The first production wells were in the area adjacent to Lake Rogers south of Keystone Lake (aerial photograph). In recent years additional production wells have been drilled along Gunn Highway (SR 587) east of Keystone Lake.

SHORELINE AND BOTTOM CONFIGURATION

The bottom of Keystone Lake was mapped using fathometer readings from boat traverses made during May 1975. Depth-to-bottom contours, shown on the aerial photograph, are based on sonic soundings made when the lake stage was 39.24 ft above msl. The general configuration of the lake bottom is conformable with the irregular shoreline and the surrounding exposed surface topography, and suggests that the Keystone Lake basin is formed by the coalescence of many sinkholes. The northern and southern thirds of the lake contain many steep-sided depressions. The central basin of the lake is broad with more gently sloping sides.

Keystone Lake has been dredged at numerous places around the shoreline to provide fill material for elevated waterfront property and to construct beaches on those properties. The dredged depressions are generally small in area with steeply sloping sides, and irregular in shape. Dredged areas are too numerous and irregularly sized and shaped to be shown on the photo-map. The lake bottom is generally sandy, and where undisturbed by dredging the lake is generally 14 to 17 ft deep near the center. Maximum natural water depth detected during mapping was 18 ft near the west-central part of the lake. However, in many of the dredged depressions the water is as deep as 19 to 23 ft. The water was deepest in a 23-ft dredged hole located near the south end of the lake.

PRECIPITATION PATTERNS

The long-term average annual precipitation (1890–1974) at Tampa is 49.05 in. The average annual precipitation at Tampa for 1931–60 was 51.57 in. For 1941–70, the 30-year average declined to 49.38 in, showing the effect of the low annual rainfall during most of the 1960's. Monthly precipitation recorded at Tampa for the period 1946 to 1974 is shown in figure 2. Departures of annual precipitation from the long-term average, 1931–74, are shown in figure 3. From 1961 until 1974, annual rainfall measured at the National Weather Service station at Tampa International Airport did not exceed the long-term average of 49.05 in except in the 3 years 1964, 1969, and 1973.

From 1931 until 1960, cumulative departures from long-term average (49.05 in) rainfall, reached a maximum excess of 76.5 in (fig. 4). From 1960 until 1974, cumulative departure of rainfall was more than 86 in deficient (U.S. Department of Commerce, 1956, 1974).

About 60 percent of the annual rainfall, about 30 in, occurs during June, July, August, and September. The seasonal threat of tropical weather disturbances with their likely abundant rainfall is generally greatest between June and November. For example, a tropical storm July 28–29, 1960 brought Tampa's heaviest 24-hour total rainfall of 12.4 in.

At Tampa, 1959 was the wettest year on record when 76.57 in of rain was measured. The driest year on record was 1956 when only 28.89 in of rain fell (U.S. Department of Commerce, 1974).

SURFACE-WATER DISCHARGE

The surface runoff in the Keystone Lake basin is small compared to some other areas of Florida. This low runoff is attributed to the presence of numerous sinkholes in the Keystone Lake basin.

Mean monthly discharge of Brooker Creek near Tarpon Springs is shown in figure 5. The graph shows that discharges are highest in August and September, and lowest in May and June. August and September flows account for about 45 percent of the total annual streamflow. The annual mean discharges of Brooker Creek near Tarpon Springs are shown in figure 6. The mean annual discharge for the period was 23.8 ft^3/s.

Flow duration curves for two locations on Brooker Creek—Brooker Creek near Tarpon Springs and Brooker Creek near Lake Fern—are shown in figure 7. The curve for the Lake Fern gage does not accurately reflect high flows at the site because record collection commenced in 1970, and streamflows have been unusually low since that time. The median discharge (that discharge equaled or exceeded 50 percent of the time) for Brooker Creek near Tarpon Springs is about 4.5 ft^3/s. About 10 percent of the time, flows exceeded 60 ft^3/s at that site.

The flow of Brooker Creek near Tarpon Springs ceases in most years. During years of exceptionally low rainfall, such as 1956, 1961–62, and 1968, flow may cease for 100 days or more. Within the period of record (1950–73) water flow was continuous throughout the year only in 1959 and 1969.

LAKE STAGES

The Keystone Lake stage hydrograph for 1946–74 is shown on figure 2. The average stage for the 29-year period is 40.44 ft above mean sea level. Annual mean stages on Keystone Lake for 1947–74 are shown on figure 8. The annual mean stage was highest, 41.58 ft, in the 1959 water year (October 1, 1958–September 30, 1959), lowest, 39.17 ft, in the 1973 water year. From October 1946 until September 1975, the lake stage exceeded 42 ft on 252 days or 2.6 percent of the time.

The maximum monthly mean stage was 42.3 ft in September 1959 (the wettest year on record at Tampa). The minimum monthly mean stage was 38.1 ft in May 1968. Maximum recorded lake stage was 43.60 ft on March 19, 1960. The minimum observed stage was 37.88 ft on May 31, 1968.

The Southwest Florida Water Management District has defined flood stage on Keystone Lake as a water-surface elevation of 42.60 ft msl (John Westgate, written commun., 1976). Flood stage is defined by the District as the lake level which will cause significant physical and economic damage. The District also set the maximum operating stage at 42.24 ft, maximum desirable stage 41.75 ft, minimum desirable stage 39.50 ft, and minimum operating stage 37.50 ft.

Log Pearson Type III analysis of annual high and annual low stage records for Keystone Lake predicts the probability of occurrence for given lake stages (figs. 9 and 10). The curve of figure 9 represents the probability of a given 1-day high stage being exceeded as an annual event. The curve of figure 10 represents the probability that the lake level will decline below a given 1-day low stage as an annual event. The analysis predicts a recurrence interval of once every 4 years (or a probability of occurrence of 25 percent in any give year), for a flood stage of 42.6 ft for one day.

The aerial photograph-base map contains the approximate location of the contour representing a shoreline-area elevation of 44 ft above sea level. A 1-day stage of 44 ft has a low probability of being exceeded (0.5 percent in any year), and has a recurrence interval of once in 200 years. However, a 1-day stage of 43.8 ft has a predicted recurrence interval of once in 100 years; a 1-day stage of 43.6 ft (the maximum stage recorded on the lake during the period of record) has a predicted recurrence interval of once in 50 years.

Because the scale of the photograph-map in this report is not sufficiently large to depict shoreline elevations with great detail, it is difficult to identify on the photograph homes that are situated on the flood plain of the lake. However, some properties will be affected by high water when the lake stage exceeds 42.6 ft. Detailed photograph-base maps of the Keystone area are on file at the Southwest Florida Water Management District, Brooksville, Florida, showing land-surface elevations with 1-foot contour intervals.

The range of mean monthly lake stages for Keystone Lake for the period of record is shown in figure 11. The lake stage is typically highest in September and lowest in June. The lake stage duration curves for June and September and for the 9,800 days of record are shown in figure 12.

GROUND WATER

The first significant ground-water withdrawal for public supply in northwest Hillsborough County began in September 1930, when St. Petersburg started pumping six production wells in the Cosme well field (figs. 13 and 14). By 1950 the field had 13 producing wells, and by 1957, 23 wells were being pumped. The wells range in depth from 297 to 354 ft, and casing depths range from 60 to 149 ft. The production wells that make up St. Petersburg's Cosme well field are located south and east of Keystone Lake and tap the Floridan aquifer.

Annual production from the Cosme well field increased progressively from 2.3 Mgal/d in 1931 to a peak of 19.6 Mgal/d in 1961 (fig. 15). The large decrease in production beginning in 1963 was associated with an increase in pumpage from a new city well field centered about 5 mi east of the Cosme well field. Production from Cosme well field rose again in the early 1970's and continued to increase until 1973 when restrictions were put on pumpage because of lowered potentiometric surfaces and low lake levels in the Keystone Lake vicinity. No new production wells have been constructed in the Cosme field since 1959.

A hydrograph of end-of-month water levels in the abandoned Cosme No. 11 well for 1960–74 is shown in figure 2. The hydrograph generally reflects the response of the Floridan aquifer to variations in withdrawals from the Cosme well field, and recovery resulting from natural recharge. The potentiometric surface in June 1972 was the lowest for the period of record.

The potentiometric surface of the Floridan aquifer in the Keystone Lake-Cosme well field area in May 1975 is shown in figure 13. The center of the cone of depression is less than 1 mi south of the lake, where the altitude of the potentiometric surface was less than 20 ft. The altitude of the water table in the surficial aquifer in May 1975 was about 50 ft east of the lake, and about 35 ft 1 mi southwest of the lake (fig. 14). The head difference across the clayey confining layers separating the two aquifers near the lake was about 15 ft.

Comparison of the hydrograph of water levels in the Floridan aquifer with the Keystone Lake stage hydrograph shows the two to be remarkably similar in response to seasonal rainfall (fig. 2). As monthly rainfall increased, water levels in the lake and in the surficial aquifer rose, and recharge to the underlying Floridan aquifer increased locally and regionally. Concurrently, withdrawals from the aquifer for irrigation decreased, allowing the water levels in the Floridan aquifer to recover.

WATER QUALITY

Analyses of water from Keystone Lake and Brooker Creek are listed on table 1. The data show an increase in pH and dissolved solids concentration of water in Brooker Creek downstream from the lake, compared to the lake. Dissolved-oxygen levels in Brooker Creek were frequently low.

In a letter dated March 26, 1968 (based on a study of data collected in June and July, 1967) the (then) Hillsborough County Division of Environmental Engineering noted in part, "The water (in Keystone Lake) meets the standards of the Florida Department of Pollution Control Class III waters (recreation and propagation of fish and wildlife)." The criteria for class III waters include: pH shall be between 6.0 and 8.5, and not caused to vary by more than 1.0 unit above or below the normal pH; dissolved-oxygen concentration shall not average less than 5 mg/L in a 24-hour period, and never less than 4 mg/L; fecal coliform shall not exceed a monthly average of 200/400 ml of sample, nor exceed 400/100 ml in 10 percent of the samples, nor exceed 800 on any one day; total coliforms count not to exceed 1,000/100 ml as a monthly average, nor exceed 1,000/100 ml in more than 20 percent of the samples examined during any one month, nor exceed 2,400/100 ml on any day; the water is to be free from substances toxic to humans, animals or aquatic life, and free from substances, color, odor or other conditions in such degree as to create a nuisance; turbidity shall not exceed 50 Jackson units above background (Fla. Dept. Poll. Control, 1974).

The Hillsborough County Environmental Protection Commission compiled a report in September 1974 on the water quality of Keystone Lake, Lake Juanita, and Lake Rogers. The Commission report notes "that the waters of Keystone Lake were lower in chemical quality than those of Lakes Juanita and Rogers, though sediment in Keystone Lake was not judged to be a problem." The water of Lake Rogers, in comparison, was judged to be of the best quality of any lake in Hillsborough County. The water quality of Keystone Lake and Brooker Creek likely will fluctuate seasonally. The quality will be poorest during the wet months when increased volumes of runoff enter the lake increasing turbidity and carrying nutrients. Thus, although the water in Keystone Lake may be poorer in chemical quality than the water in nearby lakes Juanita and Rogers, the lake itself is not in an advanced stage of eutrophication, and water quality is adequate for its Class III status as defined above.

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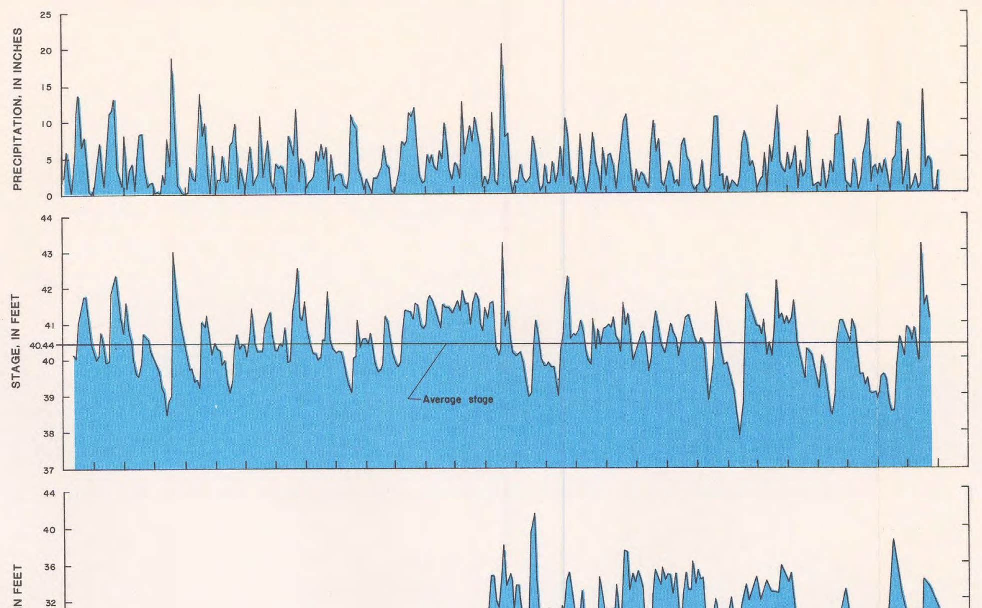


Figure 2. Monthly precipitation at Tampa and end-of-month stages of Keystone Lake, 1946–74, and altitude of water level in Cosme No. 11 abandoned production well, 1960–75.

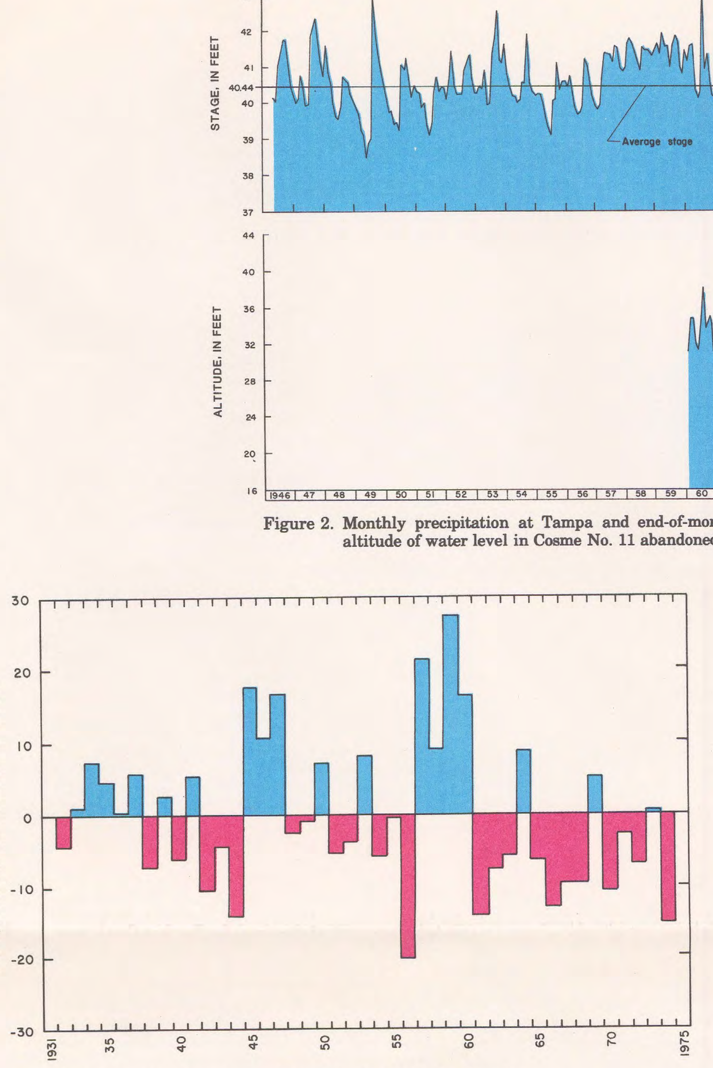


Figure 3. Departures of annual precipitation from the long-term average (49.05 inches) at Tampa, 1931–74.

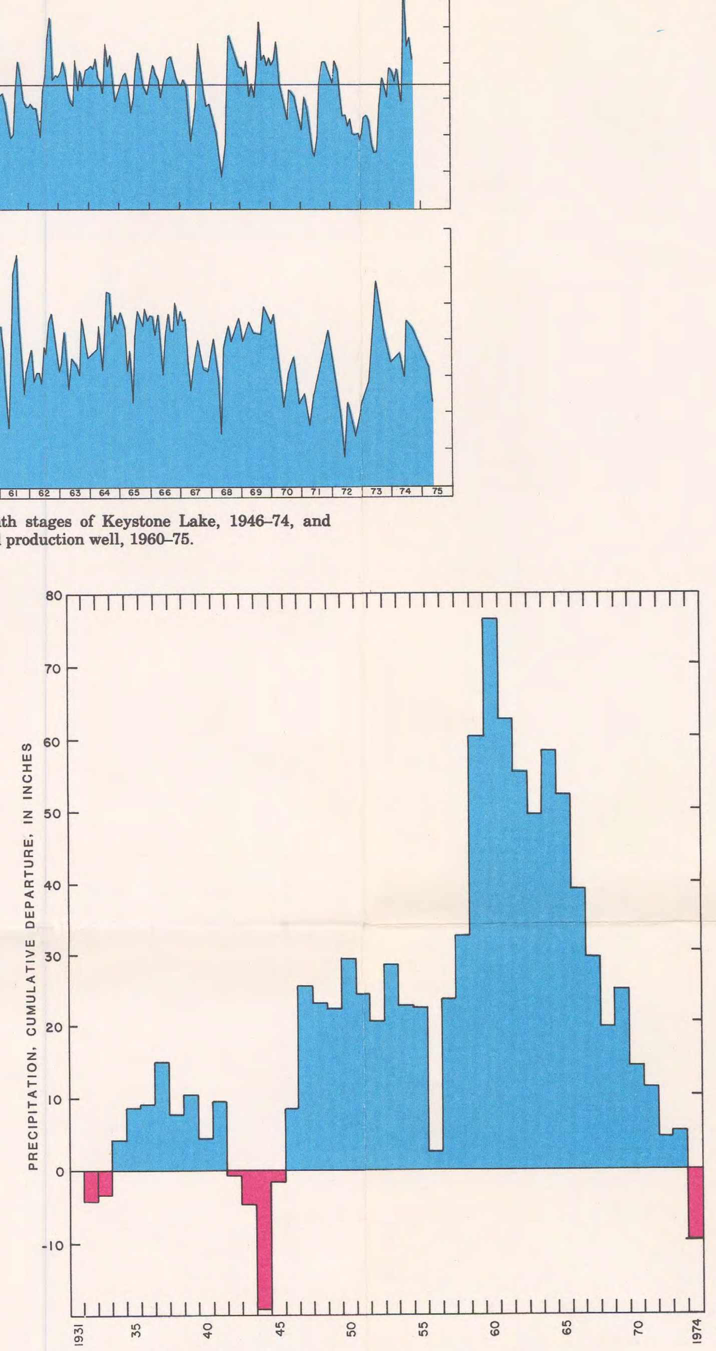


Figure 4. Cumulative departures of annual precipitation from the long-term average (49.05 inches) at Tampa, 1931–74.

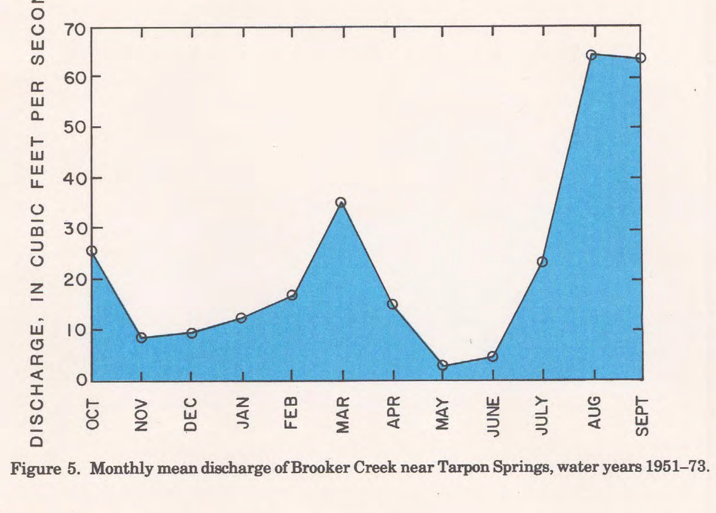


Figure 5. Monthly mean discharge of Brooker Creek near Tarpon Springs, water years 1951–73.

Table 1. CHEMICAL ANALYSES OF THE WATERS OF KEYSTONE LAKE AND BROOKER CREEK (milligrams per liter of filtered water, except where noted).

Station	Date	Time	Specific Conductance (micromhos/cm at 25° C)	pH (at time of collection)	Temperature (° C)	Dissolved oxygen	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Chloride (Cl)	Fluoride (F)	Sulfate (SO_4)	Alkalinity (as $CaCO_3$)	Hardness (Ca, Mg)	Non-Carbonate Hardness	Total Organic Nitrogen (N)	Total Phosphorus (P)	Total Carbon (C)	Dissolved Silica (SiO_2)
Keystone Lake	5/24/65	–	65	5.7	–	–	4.4	0.7	4.8	1.4	3	9.9	0.1	10	2	14	12	–	–	–	0.5
	3/29/72	1420	84	5.3	–	–	–	–	–	–	3	10	–	14	2	–	–	–	0.03	–	–
	12/12/72	0940	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.56	–	–	–
	10/31/74	1410	91	–	26.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2/27/75	1404	86	–	20.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brooker Creek near Odessa	5/24/66	–	76	5.8	–	–	3.7	1.9	5.4	1.2	6	12	0.1	5.2	5	17	12	–	–	–	–
	5/16/67	–	91	6.3	30.6	2.3	6.5	1.8	5.6	1.4	12	12	0	10	10	24	14	–	–	–	1.9
	5/21/68	0945	150	6.9	23.0	–	15	1.9	8.2	2.0	41	16	0.2	11	34	46	12	–	–	–	1.5
	5/15/69	1230	78	–	29.0	7.6	4.2	1.9	–	–	–	11	–	13	–	19	–	–	–	–	–
	5/11/70	1145	78	6.1	26.0	–	3.6	1.2	5.0	1.6	3	12	0.2	11	2	14	12	0.44	–	–	0.8
	5/12/71	0940	–	–	24.0	1.0	–	–	–	–	–	–	–	–	–	–	–	1.5	–	–	0.2
	2/14/73	1605	78	–	19.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	6/05/73	1720	110	–	30.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1/17/74	1840	75	–	26.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	8/20/74	1705	80	–	31.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brooker Creek near Tarpon Springs	1/14/64	–	92	7.0	–	–	6.0	1.7	9.1	0.4	13	19	0.4	5.2	11	22	12	–	–	–	2.7
	4/21/65	–	175	7.2	–	–	19	2.0	12	0.6	44	26	0.2	4.4	36	56	20	–	–	–	3.5
	5/24/66	–	160	7.0	–	–	19	2.1	12	1.1	50	26	0.2	0.4	41	56	15	–	–	–	0
	5/18/67	–	206	6.7	22.0	4.4	19	2.5	15	1.4	40	36	0.2	0.4	33	58	25	–	–	–	2.8
	5/27/68	0915	432	7.7	25.0	–	51	4.3	32	0.8	136	60	0.6	8.2	112	144	32	–	–	–	9.3
	5/08/69	1415	105	–	27.0	3.5	8.6	1.9	–	–	–	19	–	1.6	30	–	–	–	–	–	–
	5/07/70	1040	75	6.1	20.0	–	5.8	1.6	6.3	1.0	11	13	0.2	0.8	9	21	12	0.90	–	–	3.2
	10/28/70	0810	116	6.4	21.5	–	12	2.5	9.1	1.6	36	19	0.2	2.7	30	42	12	0.78	–	–	6.7
	4/29/71	1020	180	7.0	23.0	1.9	20	2.4	12	1.3	50	27	0.2	0.8	41	60	19	1.30	–	–	3.0
	5/11/71	1335	–	–	24.0	3.6	–	–	–	–	–	–	–	–	–	–	–	1.50	–	–	1.0
	10/06/71	1300	75	6.0	25.0	2.8	6.3	1.7	5.7	1.6	12	14	0.2	1.3	10	23	13	2.40	0.10	–	3.6
	4/19/72	1700	165	6.6	27.0	3.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	9/12/72	1545	–	–	29.0	4.0	–	–	–	–	–	–	–	–	–	–	–	–	–	74	–
	11/02/72	1045	198	8.0	26.5	–	–	–	–	–	30	–	–	–	25	–	–	2.60	0.03	–	1.5
	2/13/73	1530	238	–	14.0	5.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4/26/73	1145	–	–	23.0	5.6	–	–	–	–	–	–	–	–	–	–	–	–	–	45	–
	6/07/73	1250	255	–	25.0	2.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	9/28/73	1130	–	–	24.5	3.0	–	–	–	–	–	–	–	–	–	–	–	–	–	68	–
	11/12/73	1430	–	–	24.0	3.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	5/01/74	1030	–	–	24.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	29	–
	8/20/74	1125	123	–	27.0	2.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	10/01/74	1445	155	–	25.0	3.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	10/21/74	1145	99	–	20.0	5.9	–	–	–	–	–	–	–	–	–	–	–	–	–	34	–
	11/26/74	1255	81	–	20.0	6.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1/30/75	1205	92	–	22.0	5.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4/02/75	1535	140	–	28.0	4.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	4/18/75	1625	201	–	26.5	3.5	–	–	–	–	–	–	–	–	–	–	–	–	–	34	–

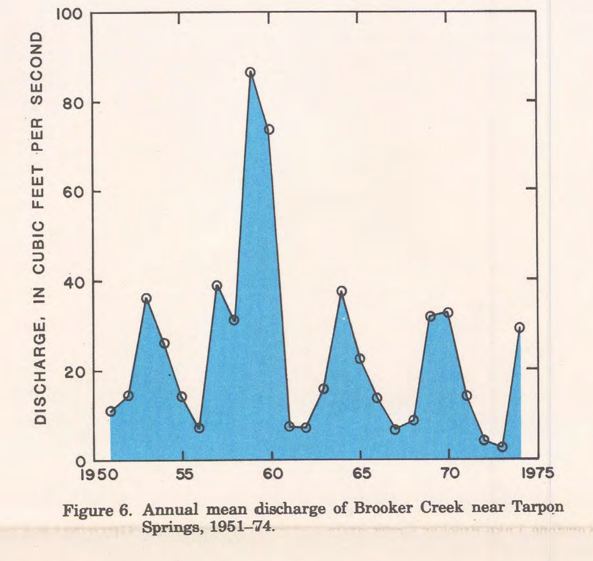


Figure 6. Annual mean discharges of Brooker Creek near Tarpon Springs, 1951–74.

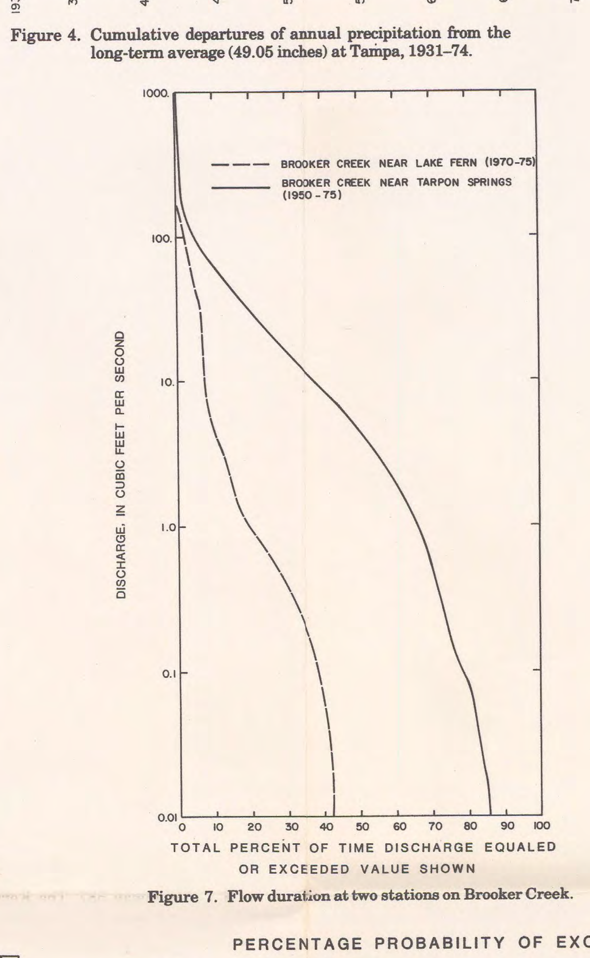
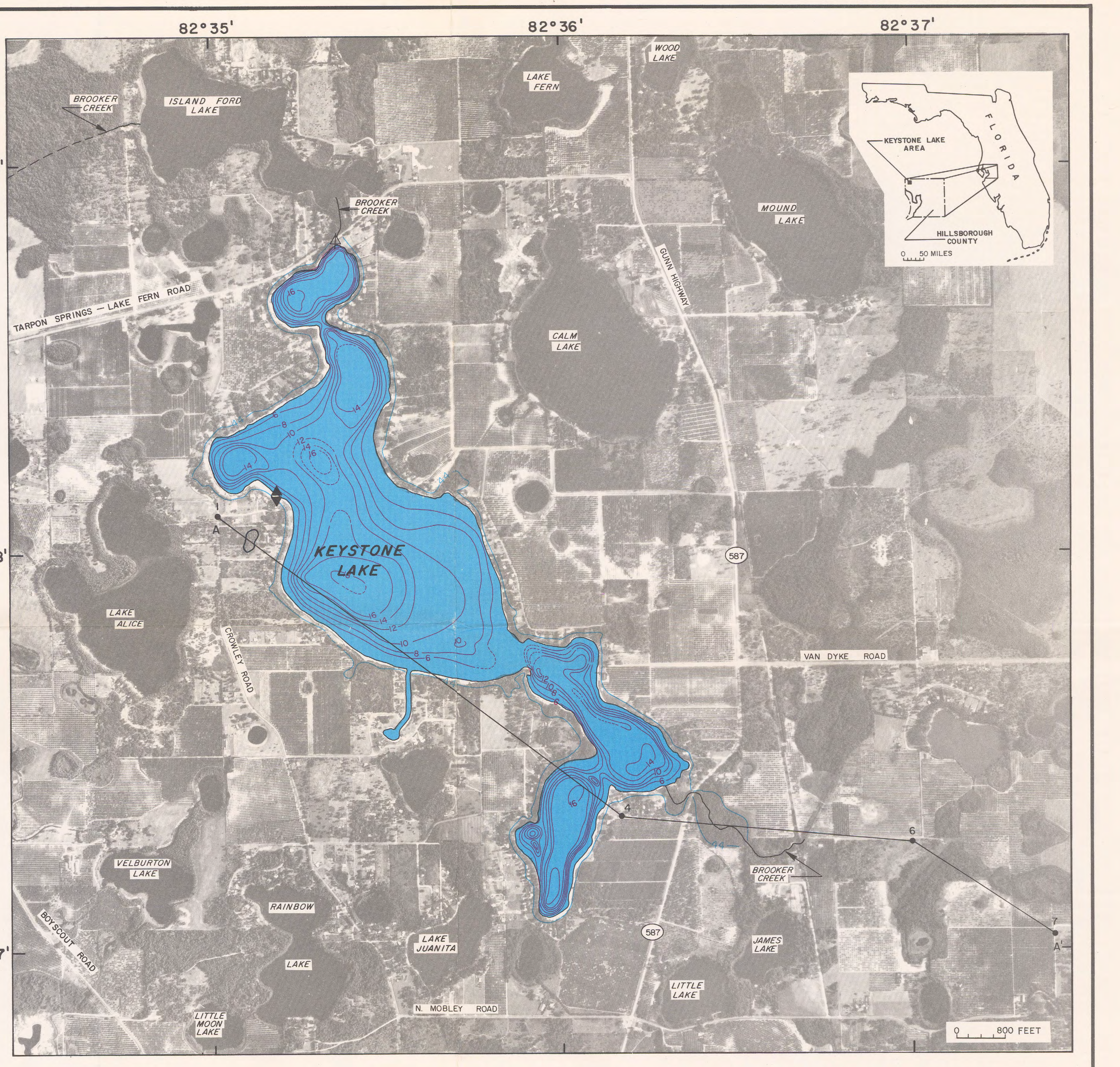


Figure 7. Flow duration at two stations on Brooker Creek.



EXPLANATION

▲ Continuous-record gaging station

△ Discontinued gaging station

▼ Active quality-of-water site

4 Test hole and number

A–A' Line of geologic section in figure 1

44 LAND-SURFACE CONTOUR—shows limits of inundation by 200-year flood. Dashed where approximately located. Datum is mean sea level. See text for explanation of flood stage and probability.

16 LAKE-BOTTOM CONTOUR—May 1975—Dashed where approximately located. Interval 2 feet (0.61 m). Datum is 39.24 ft above sea level.

Lake stage on date of photograph (May 26, 1975) was 39.09 ft above sea level.

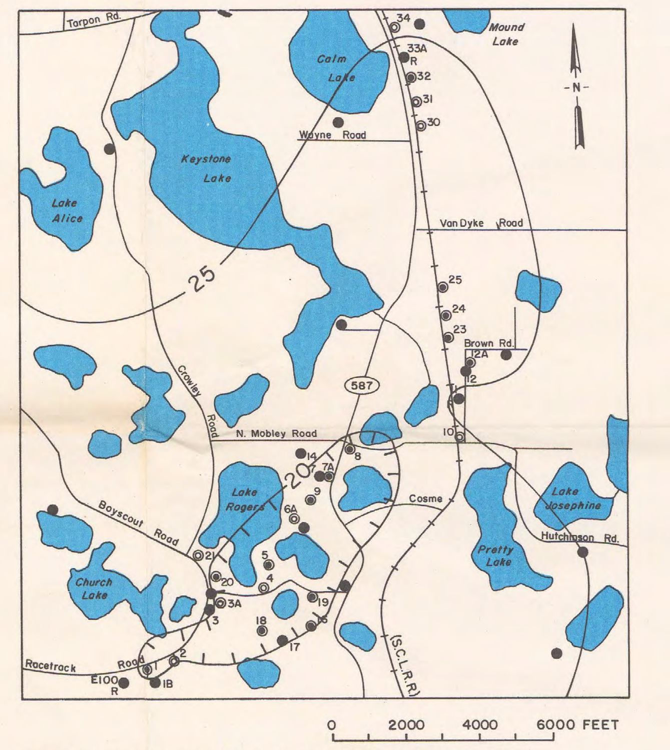


Figure 13. The Cosme well field showing altitude and configuration of the potentiometric surface of the Floridan aquifer near Keystone Lake, May 1975 (Mills and Hutchinson, 1975).

EXPLANATION

25 Pumping well used for public water supply

31 Idle public-supply well

17 Observation well

R Water-level recorder on well

–20– POTENTIOMETRIC CONTOUR—Shows altitude at which water level would have stood in tightly-cased wells, May 1975. Contour interval 5 feet. Datum is mean sea level.

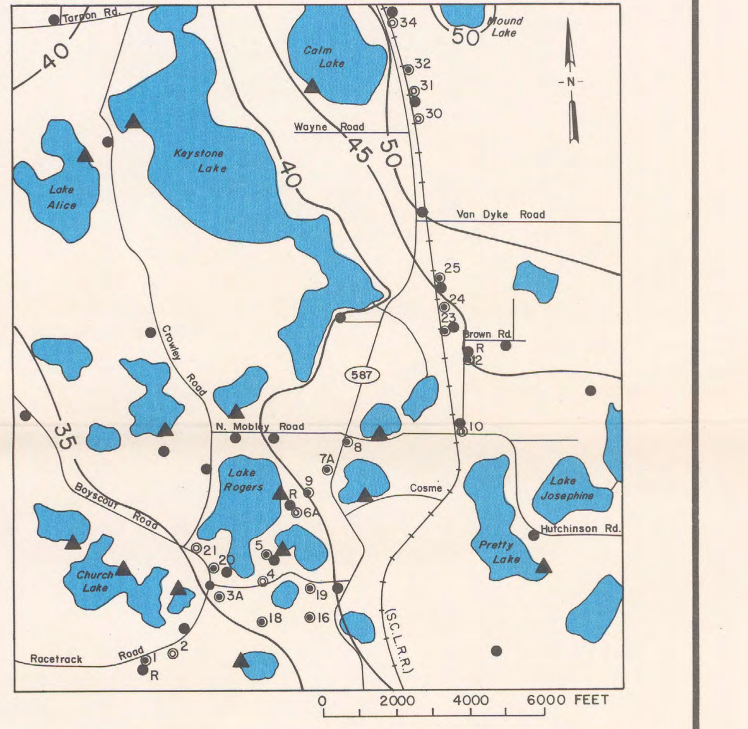


Figure 14. The Cosme well field showing altitude and configuration of the water table in the surficial aquifer near Keystone Lake, May 1975 (Mills and Hutchinson, 1975).

EXPLANATION

16 Pumping well used for public water supply

31 Idle public-supply well

Observation well

R Water-level recorder on well

▲ Continuous-record gaging station

–35– WATER-TABLE CONTOUR—Shows altitude of water table, May 1975. Contour interval 5 feet. Datum is mean sea level.

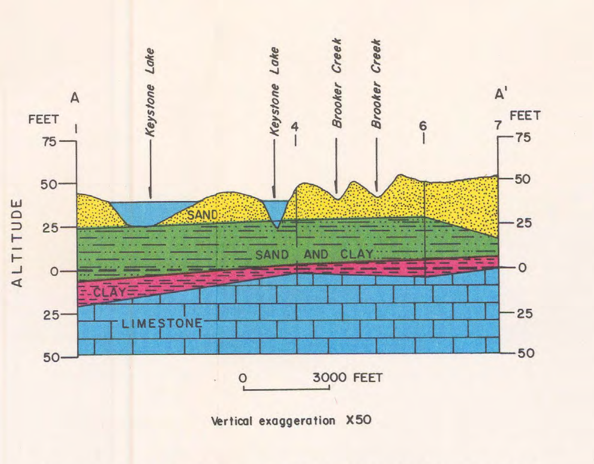


Figure 1. Generalized geologic section across the Keystone Lake area. Line of section A-A' is shown on the aerial photo-base map.

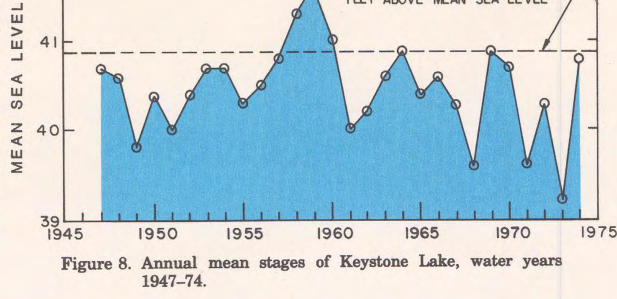


Figure 8. Annual mean stages of Keystone Lake, water years 1947–74.

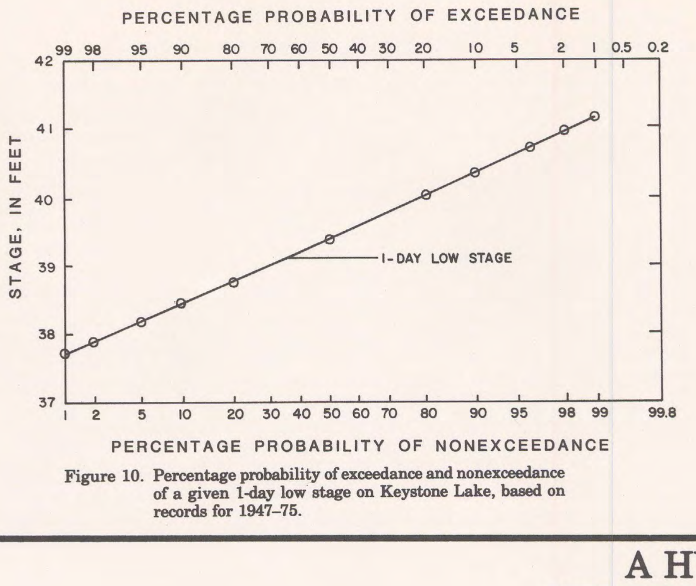


Figure 10. Percentage probability of exceedance and nonexceedance of a given 1-day low stage on Keystone Lake, based on records for 1947–75.

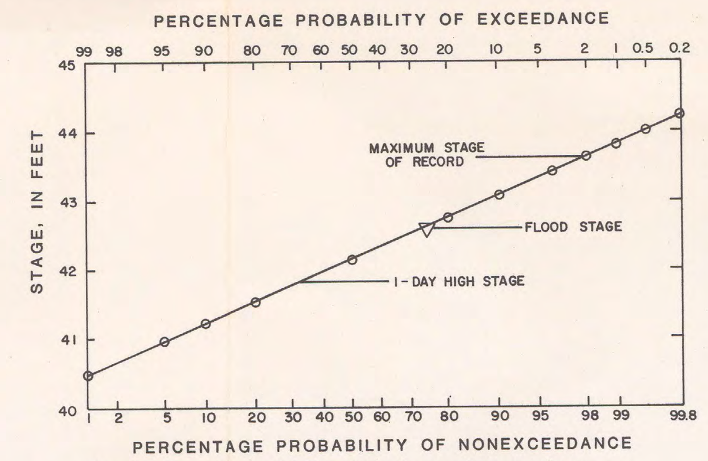


Figure 9. Percentage probability of exceedance and nonexceedance of a given 1-day high stage on Keystone Lake, based on records for 1947–75.

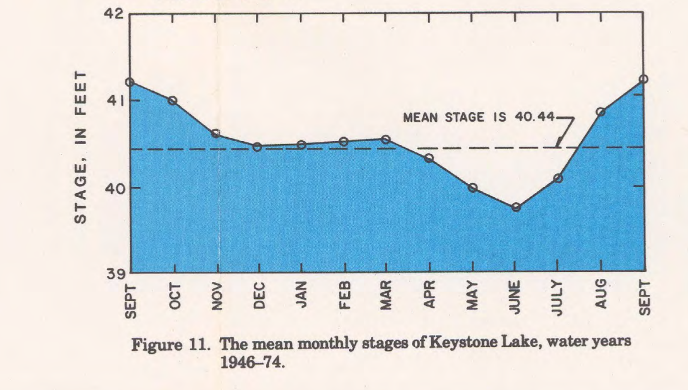


Figure 11. The mean monthly stages of Keystone Lake, water years 1946–74.

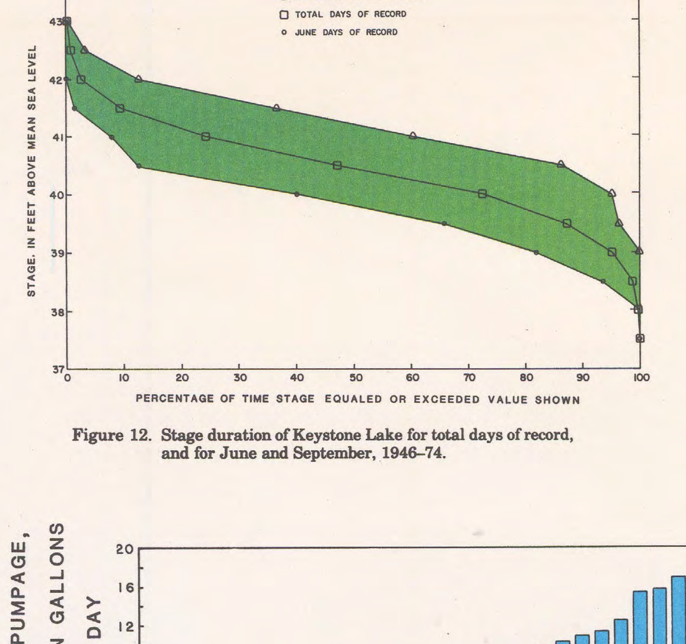


Figure 12. Stage duration of Keystone Lake for total days of record, and for June and September, 1946–74.

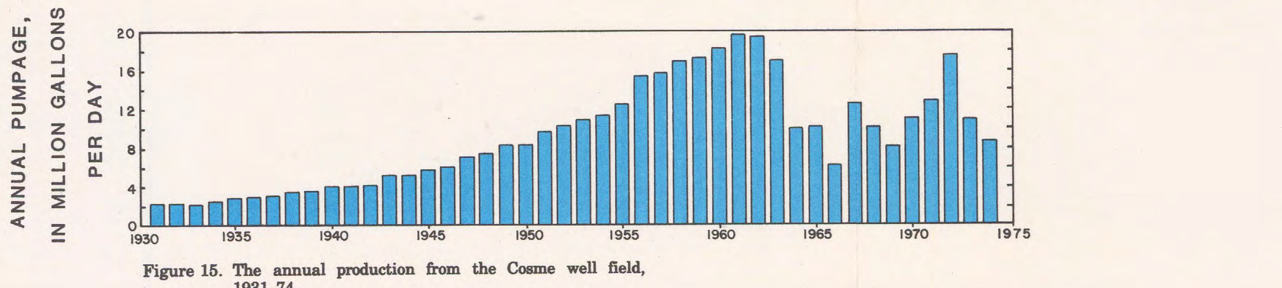


Figure 15. The annual production from the Cosme well field, 1931–74.

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