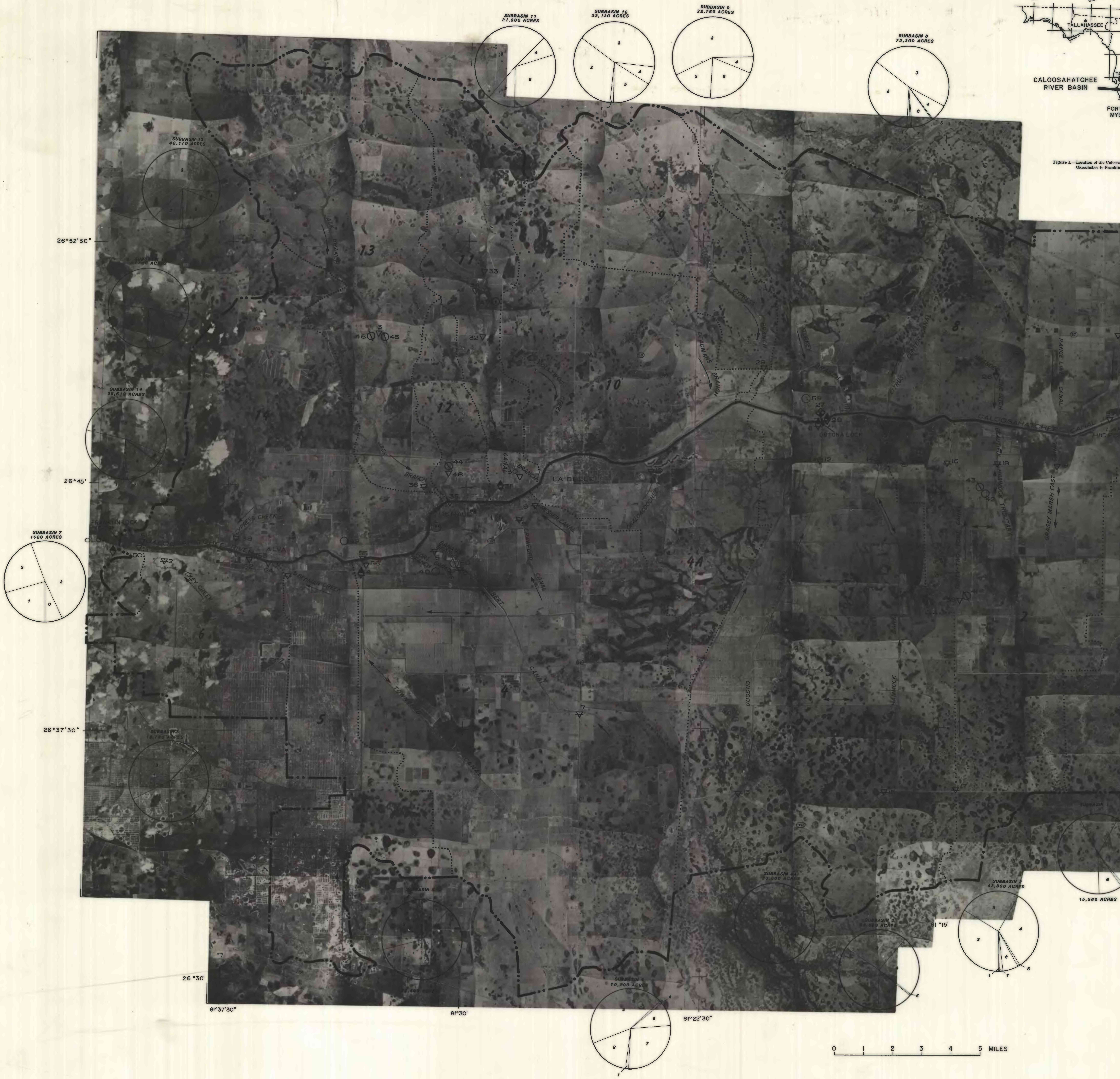
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
LEE COUNTY

WATER-RESOURCES INVESTIGATIONS
OPEN-FILE REPORT 80-732



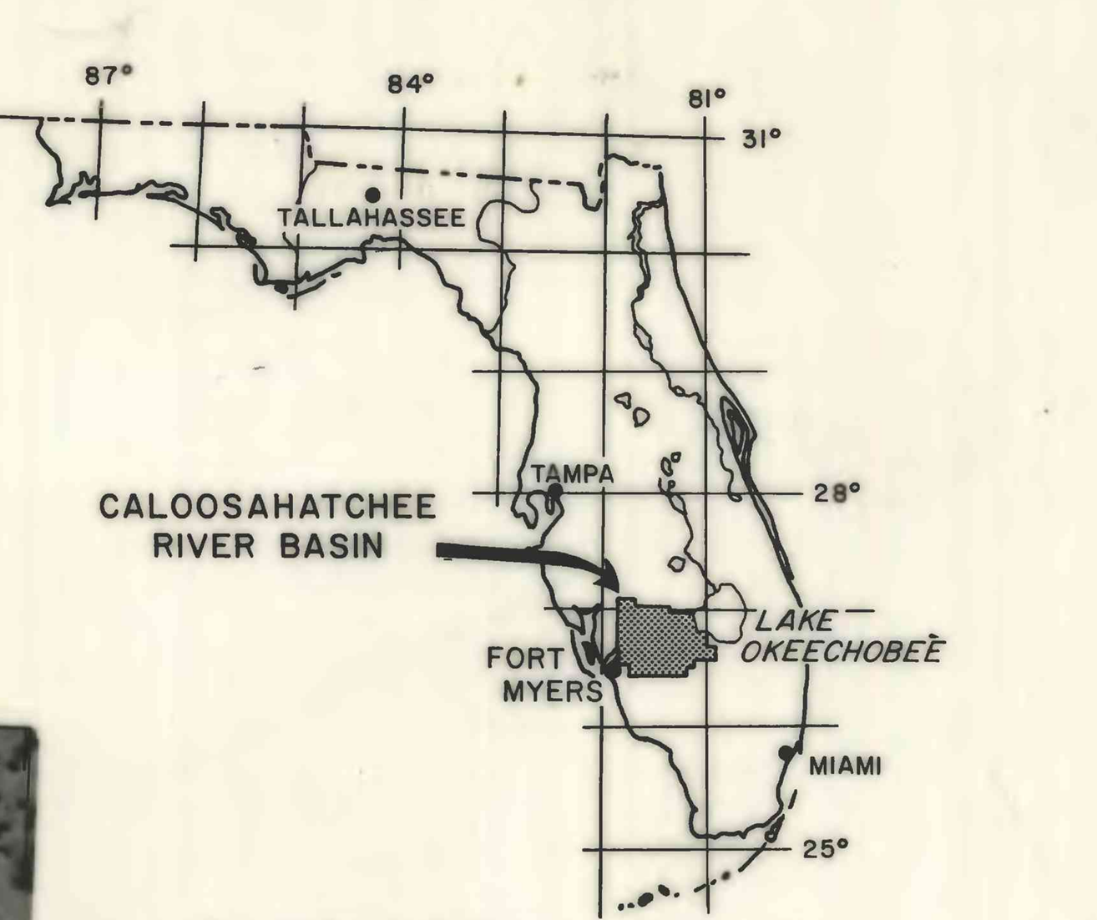


Figure 1.—Location of the Caloosahatchee River basin, Lake Okeechobee to Franklin Lock

Table 1.—U.S. Geological Survey sites in the Caloosahatchee River basin

Map identification number	Site number	Description	Map identification number	Site number	Description
1	02292900	Caloosahatchee River at Olga (S-79)	31	264511081285700	Bee Canal at SR-78
2	264253081402200	Hickey Creek at SR-80	32	264938081292000	Bee Branch at SR-720
3	264230081355800	Bedman Creek at SR-80	33	265137081293600	Bee Branch at Silver Lake Grade
4	02292780	Townsend Canal at SR-80	34	265100081295500	West Bee Branch, 1.5 miles north of SR-720
5	264315081310600	Banana Branch at SR-78A	35	02292700	Caloosahatchee River at Denaud
6	264346081301700	Roberts Canal at SR-80	36	264510081313100	Jacks Branch at Norris Road
7	263828081261200	Roberts Canal at SR-29	37	264939081330000	Jacks Branch at SR-720
8	264417081281700	Crawford Canal at SR-80	38	264332081373800	Cypress Creek at SR-78
9	264445081274400	Messer Canal at SR-80	39	264411081132900	Forty-two Foot Canal near Ortona
10	264546081240100	Okaloacoochee Branch at SR-80	40	264235081310602	HE-558; water table at 14 feet at SR-78A
11	264715081181700	Goodno Canal at Ortona Locks	41	264413081132701	HE-906; water table in pine land near Hendry Isles Boulevard
12	264605081181400	Goodno Canal at SR-80	42	264535081130701	HE-857; water table at 17 feet at Hendry Isles Boulevard
13	263607081204700	Goodno Canal at SR-832	43	264535081130702	HE-905; water table in pasture at Hendry Isles Boulevard
14	264605081161900	Long Hammock Canal at SR-80	44	264542081303901	HE-903; water table in pine land near Denaud
15	263616081155200	Long Hammock Canal at SR-832	45	264938081325801	GL-311; water table in cypress stand at SR-720
16	264604081140000	Forty-two Foot Canal at SR-80	46	264939081331501	GL-312; water table in pine land at SR-720
17	263618081133300	Forty-two Foot Canal at SR-832	47	265047081290301	GL-313; deep well near Bee Branch near SR-720
18	264604081121300	Beautiful Hammock Tributary at SR-80	48	264539081303900	Jacks Branch Tributary near Denaud
19	264602081102000	Grassy Marsh East Canal at SR-80	49	264329081340402	L-2202; water table at 17 feet at SR-78
20	264508081074800	Lake Hicpochee Canal at SR-80	50	264313081405900	Caloosahatchee River at oxbow at Lee County Water Plant
21	264509081064800	Whidden Corner Canal at SR-80	51	264319081405100	Caloosahatchee River oxbow at Lee County Water Plant
22	265029081051100	Lake Okeechobee at Rim Canal	52	264255081370900	Caloosahatchee River at first oxbow west of Alva
23	265029081051101	Rain Gage at Lake Okeechobee Rim Canal	53	264259081370800	Caloosahatchee River oxbow at first oxbow west of Alva
24	02292000	Caloosahatchee Canal at Moore Haven	54	02292795	Caloosahatchee River at Alva Bridge
25	265000081082200	Canal 19 at SR-27	55	264254081332300	Caloosahatchee River at first oxbow east of Townsend Canal
26	264844081122200	Meander Line Ditch at SR-78	56	264246081332700	Caloosahatchee River oxbow at first oxbow east of Townsend Canal
27	264718081181504	Rain Gage at Ortona Locks	57	264720081085900	Caloosahatchee Canal just west of Lake Hicpochee
28	02292480	Caloosahatchee Canal at Ortona	58	264734081073000	Lake Hicpochee at center of lake
29	264846081201000	Cypress Branch at SR-78	59	264757081185901	GL-314; water table at 14 feet near Ortona
30	264529081284000	Bee Branch at SR-78	60	264327081310401	HE-904; water table in pine land at SR-78A

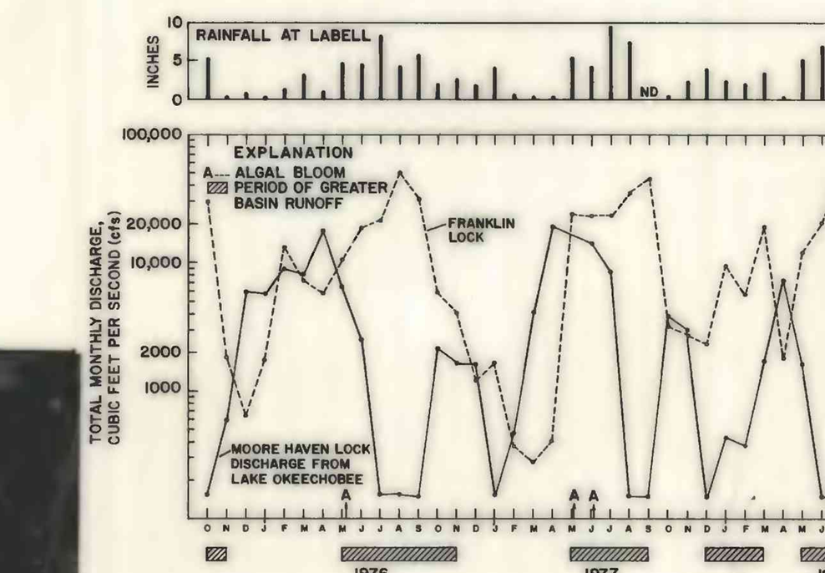


Figure 2.—Total monthly discharge at the Moore Haven and Franklin Locks and rainfall at La Belle, October 1975 to September 1978

EXPLANATION

STATIONS

- 1 CONTINUOUS-RECORD GAGING, WATER QUALITY, AND NUMBER
- 5 WATER QUALITY AND NUMBER
- 2 WATER QUALITY, STAGE AND NUMBER
- 23 WEATHER (PRECIPITATION) AND NUMBER
- 40 SHALLOW WELL AND NUMBER
- 47 DEEP WELL AND NUMBER
- 6 SOIL-WATER AND NUMBER
- DIRECTION OF FLOW
- FLOW IN EITHER DIRECTION
- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- 4 SUBBASIN NUMBER

0 1 2 3 4 5 MILES

Introduction

The Caloosahatchee River Basin, Lake Okeechobee to Franklin Lock, is an 850 square-mile area of relatively flat land in southwest Florida (fig. 1). The basin contains the Caloosahatchee River, its tributaries, and Lake Hicpochee.

Originally, the Caloosahatchee River flowed as a shallow, meandering stream from its headwaters in the vicinity of Lake Hicpochee to the Gulf of Mexico (Heilprin, 1887). The river was navigable by a shallow-draft schooner from the Gulf to the rapids at Fort Thompson 1-3/4 miles east of present-day La Belle. Upstream of the rapids, small boats could ascend several miles before the channel disappeared into marshes (Heilprin, 1887).

The Caloosahatchee River has been extensively modified. In 1881 Hamilton Disston of Philadelphia initiated a dredging project in the river that was intended to drain parts of the Everglades and lower the water level in Lake Okeechobee. The project included clearing and dredging of the lower river, removal of the rapids at Fort Thompson, and construction of a shallow canal from Fort Thompson to Lake Okeechobee (Wills, 1964, p. 111). Heilprin traversed the newly dug canals in 1886, and reported water depths of 4 to 6 feet and currents flowing west at 2 to 3 miles an hour or more. This part of the river system is the Caloosahatchee Canal, which extends from just east of La Belle to Lake Okeechobee. In this report the term, "Caloosahatchee River," includes both the canal and the river.

The most extensive modifications of the Caloosahatchee River were made in the 1930s. The Rivers and Harbor Act of 1930 authorized the Federal Government to support drainage and navigation projects. The U.S. Army Corps of Engineers began to straighten, widen, and deepen the river in that year. The character of the river was further altered by locks that controlled discharge and tidal effects. The locks at Moore Haven and Ortona were completed by the Corps in 1935 (Fritz, 1963, p. 161).

In the 1960s the Corps of Engineers carried out extensive dredging in the Caloosahatchee River and installed at Olga the largest lock on the river, the Franklin Lock. The river, from Franklin Lock to Lake Okeechobee, was deepened to about 24 feet and widened to about 130 feet (Fritz, 1963, p. 161.)

The Caloosahatchee River basin no longer has a natural flow regime. The basin contains a maze of canals and ditches. Parts of some tributaries have been channeled, and in some places the direction and period of natural runoff have been altered by interconnecting canals and pumping activities.

The Caloosahatchee River is used for navigation and recreation, and also as a source of freshwater for agricultural and municipal needs. Large quantities of water are withdrawn from the river system primarily for irrigating citrus and other crops. The river is a major source of water for the Lee County water system and for the city of Fort Myers, which collectively serve an estimated population of 70,000. Use of the river as a source of water for public supply is presently under consideration by the city of La Belle in Hendry County. As the demand for water increases, the Caloosahatchee River will become an increasingly important source of water for all types of uses.

Purpose and Scope

The purpose of this map report is to present a recent overview of the major physical features of the freshwater part of the Caloosahatchee River basin, and to present selected information on water flow, water quality, land cover, and land use. The report includes a map showing the major tributaries, U.S. Geological Survey data-collection sites, land-cover and land-use diagrams, and arrows indicating the direction of water flow. The map provides a work base for future interpretive reports and for water-resource management. The map allows a synoptic view and provides detail of physical features.

Acknowledgments

The map report was prepared in cooperation with Lee County. Special thanks are given to the following water-management districts that provided information on their canal systems: East County Control District; Barron Water Management District; Devils Garden Water Control District; and Flaghole Water Control District, Richard Irons of the South Florida Water Management District gave assistance.

Methods

The photomosaic was produced from black and white infrared photographs taken at an altitude of 18,800 feet on January 10, 1979. Black and white infrared photography is useful for delineating water bodies and areas of surface inundation, because wet areas appear blacker than dry areas. The aerial photography was preceded by two cold fronts with associated rainfall. About 1 inch of rainfall was recorded at Fort Myers between January 1–10, and the water table in the basin was about 1 foot above average for January.

The photomosaic was constructed using U.S. Geological Survey 1:24,000 topographic maps for horizontal control. The black and white infrared photographs were laid on photo-reduced prints of the topographic maps. The resultant image is designated a semicontrol photomosaic.

Selected hydrologic, land cover, and cultural features were delineated on clear overlays. These features were derived from 1:24,000 topographic maps and from a 1973 U.S. Geological Survey 1:250,000 land-use and land-cover map. The categories of land use and land cover are the first level of a hierarchical classification system developed by Anderson and others (1976). The delineation of the hydrologic basin and subbasin boundaries was based on land-altitude data from the 1:24,000 topographic maps, on map boundaries given by the water-control districts, and on field surveys. The delineations on the overlays, along with the location of U.S. Geological Survey sampling sites and selected hydrologic data, were photographically composited with the photomosaic.

Location and Description of Data-Collection Sites

The data-collection sites shown on the map are listed in table 1 by map identification numbers, site numbers, and brief descriptions. Data collection at most of the sites began after 1975, but at a few sites such as 1, 24, and 28, data collection began much earlier. For example, site 24, the Caloosahatchee Canal at Moore Haven, has a continuous record of discharge from 1939 to the present (1979). At this site water-quality data was collected in the early 1940s and from the mid-1950s to the present.

A program for the collection of water-quality and discharge data for the tributaries of the Caloosahatchee River was initiated by the U.S. Geological Survey in October–November 1976. This program was expanded and modified in 1977 and 1978. Generally, discharge, nutrients, and field parameters including specific conductance, water temperature, pH, and dissolved oxygen have been collected monthly. Total organic carbon, common ions, phytoplankton, and algal growth potential have been periodically sampled. Two gages were installed in 1978 to collect rainfall and dry fallout monthly for analyses of nutrients and field parameters and quarterly for analyses of common ions and trace elements. Selected wells have also been sampled periodically for water-quality parameters.

Hydrologic Basin and Subbasins

The basin boundary on the map encompasses only the freshwater reach of the Caloosahatchee River east of Franklin Lock. Within this boundary, the basin is subdivided into 16 subbasins based on hydrologic and land-altitude information. Nine subbasins are south of the river, and seven are north. The subbasins range in size from about 1,520 to 79,200 acres. Lake Hicpochee, which lies in the basin, occupies an additional 4,970 acres.

Land Cover and Land Use

The Caloosahatchee River basin is predominantly agricultural land and rangeland. These categories account for about 34 and 37 percent of the land in the basin, respectively. About 14 percent of the basin is forest, of which 4 percent is wetland forest. Another 10 percent of the basin is nonforest wetland. About 3 percent of the basin is barren land, which mainly is transitional land that has been cleared for residential or other types of development. Built-up land, including residential, commercial, commercial industrial, and transportation corridors, covers 2 percent of the basin. Streams, canals, ponds, and Lake Hicpochee account for the remaining 1 percent of the land cover.

The circular pie diagrams on the margin of the map are divided into sections that represent the percentages of the different land-cover and land-use categories for each subbasin. These categories are: (1) urban or built-up land; (2) agricultural land; (3) rangeland; (4)-forest land; (5) water; (6) wetland (forest and nonforest); and (7)-barren land (including transitional land).

Agricultural land covers about 184,000 acres, of which about 120,000 acres are on the south side of the river. On the north side about 25,000 acres of agricultural land is in subbasin 8. Subbasin 15 in the extreme east has the highest percentage (84) of agricultural land, and subbasins 11 and 13 in the northwest have the lowest percentage (11).

Rangeland covers about 200,000 acres, of which about 120,000 acres are on the north side of the river. Subbasin 13 has the highest percentage of rangeland (64), and subbasin 15 has the lowest percentage (6).

Forests cover about 55,000 acres, of which about 36,000 acres are in the extreme southeast, mainly in the southern parts of subbasins 1, 2, and 3. In these subbasins forest land exceeds 20 percent of the total land cover.

Wetlands occupy about 72,600 acres or 14 percent of the basin. The acreage of wetlands in the subbasins ranges from about 6 to 30 percent. Subbasins 9, 10, 11, 12, and 13 are more than 15 percent wetlands.

Barren land occupies about 19,000 acres, of which 82 percent is in subbasins 5 and 6. This land has been cleared for residential development.

Surface Water

Water flows into the Caloosahatchee River from its tributaries and from Lake Okeechobee at Moore Haven. Discharge from Lake Okeechobee is usually maximal in late winter or spring and minimal during summer (fig. 2). However, in August 1978 about 90,000 ft³/s were discharged into the river at Moore Haven due to above normal lake levels. Runoff from the basin tends to predominate during late spring and summer, as indicated by the large releases at Franklin Lock and the small releases from the lake (fig. 2).

The subbasins south of the Caloosahatchee River have been extensively modified. Tributaries have been converted to canals, in which water can flow either toward or away from the river. The arrows on the map indicate usual direction of surface-water flow. A double-headed arrow indicates water may flow in either direction. For example, water in one canal can be pumped upstream away from the river and discharged downstream in another canal into the river. For this reason discharge from a canal may represent pumpage from the river plus natural drainage. The major southern canals that discharge into the river are Banana Branch, Crawford Canal, Goodno Canal, Forty-Two Foot Canal, and Bedman Creek. Major southern canals that may either discharge to the river or convey water away from the river are Townsend Canal, Beautiful Hammock Tributary, Grassy Marsh East Canal, Lake Hicpochee Canal and Whidden Corner Canal.

The subbasins north of the Caloosahatchee River are less altered than those to the south, and tributary flow is predominantly toward the river. The major tributaries are Bee Canal, Jacks Branch, and Cypress Creek, each with an average daily discharge of about 20 ft³/s. Canal 19 in subbasin 8 is an overflow conveyance for Lake Okeechobee, and at times of high lake levels contributes significant discharge to the river.

Water Quality

Saline water can enter the Caloosahatchee River upstream of Franklin Lock from its estuary and from ground-water sources. The Franklin Lock prevents extensive saltwater intrusion from the estuary; however, some saltwater moves upstream in the river during boat lockage (Boggess, 1972). Numerous artesian wells in the basin are a source of saline ground water.

The average of all monthly values of specific conductance (a measure of salinity) of the Caloosahatchee River and its tributaries, from October 1976 to May 1979, ranged from 395 to 741 micromhos per centimeter (μmho/cm) at 25°C. Specific conductance varied areally and seasonally within the basin. It decreased in the tributaries and canals with distance from the river. For example, average values (1976–79) in Goodno Canal decreased from 492 μmho/cm at the river to 486 μmho/cm half a mile upstream, and 408 μmho/cm 12 miles upstream. Specific conductance tended to be highest in the late spring and lowest in late summer. The maximum average monthly value of 741 μmho/cm (1976–79) occurred in April, and the minimum monthly value of 395 μmho/cm occurred in August.

A few tributaries have higher specific conductance values than those in the river, because salty ground water used to irrigate citrus trees drains into these tributaries. Bee Branch at State Road 78 (site 31) had the highest average value, 894 μmho/cm. A sample of irrigation water collected on December 13, 1978 at site 47 near Bee Branch had a specific conductance of 2,000 μmho/cm.

Specific conductance in the Caloosahatchee at Moore Haven has increased over the years. In the early 1940s most values ranged from 200–500 μmho/cm, while in the late 1970s most values were above 500 μmho/cm.

Nitrogen and phosphorus are essential elements for growth, and are important in characterizing water quality. High concentrations indicate enriched waters capable of supporting algal blooms and other plant growth. Average concentrations of these nutrients, in samples collected from October 1976 to May 1979, were higher in the Caloosahatchee River than in its tributaries. Concentrations of total phosphorus and orthophosphate averaged 0.11 milligrams per liter (mg/L) and 0.08 mg/L, respectively, at 6 river sites compared with 0.06 mg/L and 0.05 mg/L at 22 tributary sites. All forms of nitrogen also had higher average concentrations in the river than in the tributaries. Nitrite plus nitrate nitrogen, the two forms most available for plant growth, averaged 0.21 mg/L in the river compared with 0.08 mg/L in the tributaries.

A few canals had average nutrient concentrations that exceeded those in the river. Lake Hicpochee Canal and Long Hammock Canal had average total phosphorus concentrations of 0.18 mg/L and 0.15 mg/L, respectively. Townsend Canal, Crawford Canal, and Messer Canal, all in subbasin 4, had average concentrations of nitrite plus nitrate nitrogen of 0.33, 0.50, and 0.30 mg/L, respectively.

Algal blooms were visible in the Caloosahatchee River in May 1976 and May–June 1977. These blooms coincided with the beginning of the summer rainy season and the period of greater basin runoff (fig. 3).

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HYDROLOGIC AND LAND-COVER FEATURES OF THE CALOOSAHATCHEE RIVER BASIN, LAKE OKEECHOBEE TO FRANKLIN LOCK, FLORIDA

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1980