

SURFACE WATER FEATURES OF FLORIDA

by
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Prepared by the
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in cooperation with the
BUREAU OF GEOLOGY
FLORIDA DEPARTMENT OF NATURAL RESOURCES
Tallahassee, Florida
1974

INTRODUCTION

The variety of surface-water features of Florida is the result of the State's location in the subtropical zone between the Atlantic Ocean and the Gulf of Mexico, its average rainfall of 53 inches, its relatively flat terrain, and the nature of its soils and underlying rocks. The surface-water features include extensive marshes and swamps, many streams, lakes, and ponds in certain parts of the State, few streams in the Central Highlands, and the extensive network of ditches and canals, particularly in the southeastern part. Major streams and lakes are listed in tables 1 and 2.

The great marshes and swamps, such as the Everglades, the Big Cypress Swamp, and St. Johns marsh, the coastal marshes, wooded flatlands and the other wetlands throughout the State are the most typical and outstanding surface-water features. Before man began to drain and develop the wetlands, they covered about half the State and exceeded the area of combined total wetlands of 37 other States in 1955 (U.S. Department of Agriculture, Yearbook of Agriculture, 1955.) These wetlands, which have been the habitat of subtropical and tropical wildlife in Florida, are continually being altered by the works of man through vast networks of ditches and canals for the development of land for citrus and other crops and for residential and recreational uses.

Another prominent surface-water feature is the large number of lakes and ponds, 7,712 that are 10 or more acres in area and 19 larger than 6,400 acres (10 square miles). Lake Okeechobee is the largest freshwater lake in the United States wholly within a single State. Some lakes are connected to the deep artesian aquifer and are called "sinkhole" lakes; some occupy depressions that were shallow marine basins or bays in past geologic time; others are underlain by peat or clay and are not well connected with water-bearing formations. Some large lakes, such as Lake Monroe and Lake George along the St. Johns River, are merely wide reaches in a river. Levels of many lakes are controlled by structures at their outlets.

Although rainfall and evapotranspiration are fairly evenly distributed in the State, surface runoff varies in quantity from place to place depending on the soil, the nature of the underlying rock formations and the topography. Stream density is low where downward movement of water to the limestone formations is facilitated by thin or porous soils overlying the limestone, as it is in the central ridge or highlands part of Florida. Stream density in some areas is high, as represented in the panhandle and part of southwest Florida. In the Everglades and Big Cypress Swamp the water moves slowly in broad bands to the sea.

Most of the drainage basins of some of the largest rivers in Florida are in Alabama and Georgia. Some streams are almost entirely spring-fed and have a well-sustained flow. The flow of other streams consists largely of surface runoff and to a minor extent of ground-water inflow from shallow sediments; the flow of these varies from little or no flow during dry periods to flashy and high flows during wet periods.

Most streams have low gradients and their flow is sluggish because of the relatively flat terrain and low altitudes characteristic of Florida. The St. Johns River, the longest within the State, has an average fall of less than 0.1 foot per mile in its 300-mile length. The topography is not favorable for high dams or deep reservoirs. The low gradients of streams and the many river channel and other easily accessible lakes provide Florida with extensive surface waters for recreation and for small boat navigation.

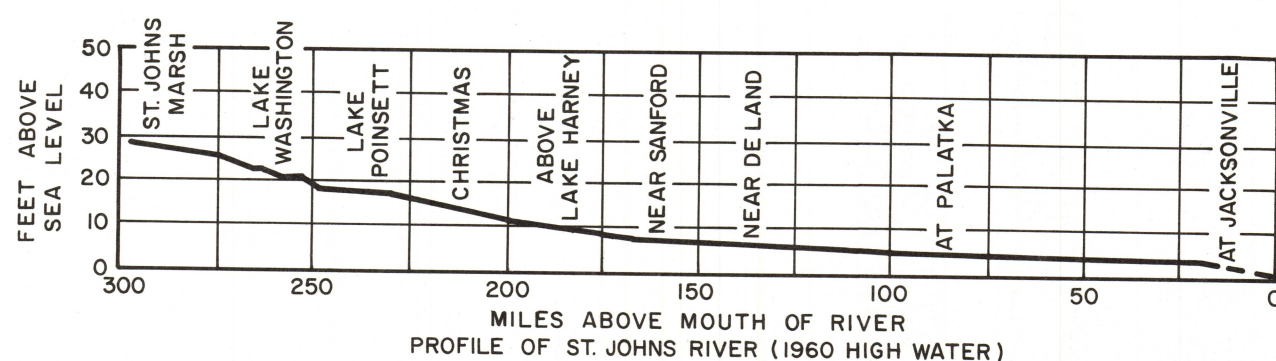
The Florida Department of Natural Resources divides the State into five regions comprising groups of river basins; the surface-water features are discussed herein on that basis although some features overlap. Of the five water management districts that manage these river basins, two have been in existence for many years and three were formed in 1973. The basins are shown on the large map and the water management districts are shown on the small map. The boundaries of the districts do not coincide with basin boundaries.

NORTHWEST REGION

The Northwest Region covers the panhandle of Florida. Major streams enter the State from Alabama and Georgia and include the Apalachicola, Choctawhatchee, Escambia, Ochlockonee, and Yellow Rivers. The general drainage pattern is dendritic and the stream density is high. Valleys of tributary streams are deeply incised and the flow somewhat flashy.

Few natural lakes exist except in Washington and Bay counties; five lakes or impoundments of more than 5,000 acres are in the region and small artificial ponds are numerous and are usually contained by earthen dams. Tidal bays and lagoons which line the entire coastline are now connected to form an important intracoastal waterway.

Seven first magnitude springs, defined as those springs that have an average flow of more than 100 ft³/s (cubic feet per second), or 64,600,000 gpd (gallons per day) are in the region. They are Gainer Springs (14) in Bay County, Wacissa Springs (4) in Jefferson County, Blue Springs (7) in Jackson County, Wakulla Springs (3), River Sink Spring (12), and Kinni Spring (10) in Wakulla County, and Natural Bridge Spring (20) in Leon County. The 21 major springs are numbered in order of magnitude (average flow) and are indicated on map.



SUWANNEE RIVER REGION

Low stream density and fairly low lake density are characteristics of the Suwannee River Region where porous limestone at or near the surface allows rainfall to infiltrate and to appear in the river channels without the need for extensive surface tributary systems. Six first magnitude springs and numerous smaller springs are in the region. The first magnitude springs are Blue Spring (17) in Madison County, Troy Springs (11) in Lafayette County, Fannin (21) and Manatee Springs (8) in Levy County, Falmouth Springs (16) in Suwannee County, and Ichatucknee Springs (5) in Columbia County. Lakes are small but marshlands are extensive in Lafayette, Dixie, and Gilchrist counties in the lower Suwannee River basin and in Hamilton, Columbia, and into Baker counties, where the marshlands are extensions of Georgia's Okefenokee Swamp. The Suwannee River is the nationally known "Swanee" River, which Stephen Foster made famous. Streams are generally sluggish because gradients are low.

SOUTHWEST REGION

The Southwest Region is marked by a dendritic stream pattern, many small lakes and ponds, and numerous and important marshlands which furnish recharge to the artesian aquifer. The larger streams empty into relatively large bays on the Gulf of Mexico; much of the coast is lined with lagoons.

The topography consists of low, level plains or marshlands along the west side and rolling hills that reach altitudes above 200 feet along the basin divide in the Central Highlands. Stream density and runoff vary from low in the highlands areas to some of the highest in the State along the coast, where numerous springs add to stream discharge.

Tsala Apopka Lake is the largest lake in the region and is partly controlled. Four first magnitude springs are Rainbow Springs (2) in Marion County, Chassahawitska (15) and Homosassa (6) Springs in Citrus County, and Weekiwachee Springs (9) in Hernando County. In addition the region contains numerous second magnitude springs (springs with a flow of between 10 and 100 ft³/s (0.28 to 2.8 m³/s) of which several are within 10 miles of Tampa Bay.

Several streams have been impounded near the coast and some wet areas have been drained for agriculture and for residential sites. The Southwest Florida Water Management District is the State regulatory agency responsible for managing surface waters in most of the region.

KISSIMMEE-EVERGLADES REGION

Kissimmee-Everglades Region encompasses all of Florida south of the St. Johns marsh and the Peace River divides, and the Kissimmee River Basin, which drains the southern part of the Central Highlands. Most of the region is less than 25 feet above sea level, seasonally inundated except where drained by ditches or canals. The most prominent wetlands are the Everglades and the Big Cypress Swamp. Urbanization and agriculture have, however, been highly developed in the eastern part.

The largest streams, the Kissimmee and the Caloosahatchee Rivers, have been dredged and modified, and their flows are controlled. The Kissimmee contributes large flows to Lake Okeechobee, the largest water storage reservoir in the Central and Southern Florida Flood Control District. Controlled flows of the Caloosahatchee River regulate the level of Lake Okeechobee. Short streams drain the narrow coastal fringes; sheet flow and broad sloughs move water through the Everglades and the Big Cypress Swamp into ill-defined tidal channels along the Gulf and Florida Bay.

Lake Okeechobee, the largest fresh water lake, is very shallow. Lake Trafford, in Collier County, with an area of 1,490 acres, is one of the few large lakes in the region; however, many small lakes and ponds dot the marshlands. About a quarter of Florida's lakes are in the Kissimmee River basin. The Flood Control District manages the water in large diked water-conservation areas covering about 1,350 square miles in Palm Beach, Broward, and Dade counties to store excess water. Eastward seepage and releases to coastal canals recharge the shallow aquifers that are the sources of water for the populous metropolitan areas of southeast Florida and southward releases through spillways maintain water levels in Everglades National Park. Beginning in the 1880's extensive areas east and south of Lake Okeechobee in the Everglades have been drained and diked for intensive use of the peat and muck lands.

THE ST. JOHNS RIVER REGION

The St. Johns River Region covers the eastern two-thirds of peninsular Florida north of the St. Johns marsh in Indian River County and includes the Oklawaha River basin, which is mostly in the Central Highlands. The land surface reaches altitudes more than 250 feet above sea level, but much is less than 25 feet; lands below 40 feet are generally marshy.

The gradient in the St. Johns is so low that the river is sluggish and affected by tides as far upstream as Lake Monroe, 161 miles from the mouth. Tide-induced reverse flow occurs and strong upstream flow sometimes lasts several days. The river flows successively through some of Florida's largest lakes. Matanzas River, Halifax River, Indian River, and Banana River, into which the many small coastal streams flow are salt-water lagoons between the coast and the offshore barrier islands.

Stream density and runoff are very low in the central highlands because drainage is predominantly underground. An example of low runoff is that of Orange Creek, which averages only about 2.3 inches for the 1,110 square-mile drainage area, low compared to the average of 14 inches for the State.

The Oklawaha River drains much of the highlands and lake country of Florida. In addition to large lakes such as Apopka, Harris, and Orange, dozens are more than a thousand acres in area and more than 2,400 are smaller. The moderating effect of the lakes on the water, coupled with the well-drained rolling hills, make this area a belt of citrus production. Some lake levels are controlled by outlet structures and some streams have been dredged to improve capacity to carry flood waters.

First magnitude springs in the region include Silver Springs (1), the largest in the United States, and Silver Glen Springs (19) in Marion County, Blue Springs (13) in Volusia County, and Alexander Springs (18) in Lake County; lesser springs are numerous, mostly within 10 miles of the St. Johns River.

Marshes and swamps cover much of this region and tend to reduce the extremes of flow as the marshes store excessive precipitation and allow flood water to drain slowly. Drainage and wetland reclamation for agriculture is carried on extensively in the upper reaches of the basin; drainage for residential developments is extensive near the Atlantic coast.

COASTAL FEATURES

The length of the general coastline of Florida is 1,197 miles, the general tidal shoreline is 2,276 miles, and the detailed tidal shoreline is 8,426 miles (from U.S. Coast and Geodetic Survey, the Florida Handbook, 1966). (The general tidal shoreline includes bays, sounds and other water bodies to points where they narrow to 3 miles; the detailed shoreline includes waterbodies to the head of tide-water or where waters narrow to 100 feet). This enormous shoreline frontage is an important asset to Florida's economy although it is also a problem to the agencies responsible for shoreline control of dredging, filling, and bulkheading.

NAVIGATION

Streams, lakes and lagoons contributed much to the early development of Florida. The slow-moving streams allowed entry to central areas and the lagoons offered protected waters to coastal shipping during hurricanes. Inland waterways and the intracoastal waterways are shown on the map. Lagoons have been connected and channels deepened until a navigable channel now extends along the entire east coast and about half of the Gulf coast.

Commercial waterways in the interior include the St. Johns River upstream to Lake Monroe; the St. Lucie canal and Caloosahatchee River, which cross the State through Lake Okeechobee; the Apalachicola River from the Gulf to Jim Woodruff Dam; and short waterways in bays and estuaries. The Cross-Florida Barge Canal is partly completed, from the Gulf to Dunnellon on the west, and from the St. Johns River to Rodman pool on the east.

REFERENCES

- Florida Division of Water Resources
1969 *Florida Lakes*.
Ferguson, G. E.
1974 (and others) *Springs of Florida*: Florida Geol. Survey Bull. 31.
Rosenau, Jack C. and Faulkner, Glen L.
1974 *An Index to Springs of Florida*: Florida Bur. Geol. Map Series 63.
U.S. Geological Survey
1970 *Water Resources Data for Florida, pt. 1, Surface Water Records*.
Allen Morris
1966 *The Florida Handbook*.

FLORIDA DEPARTMENT OF NATURAL RESOURCES
BUREAU OF GEOLOGY

This public document was promulgated at a total cost of \$270.00 or a per copy cost of \$.18 for the purpose of disseminating hydrologic data.

EXPLANATION

- Regional Basin Boundaries (Division of Natural Resources)
Stream-gaging Station
Major Spring, Number listed in order of average flow.
Intracoastal and Inland Waterways
Dam, Lock and Dam, or Other Control Structure



View of St. Johns Marsh showing ditching and drainage operations in Indian River County.

TABLE 2. — Largest lakes in Florida. (larger than 10 square miles in area)

NAME	COUNTY	RIVER BASIN	SURFACE AREA (sq. mi.)
Okeechobee	Palm Beach-Glades	Kissimmee	700
George	Volusia-Putnam	St. Johns	72
Kissimmee	Osceola	Kissimmee	54.2
Apopka	Orange-Lake	St. Johns	47.9
Istokpoga	Highlands	Kissimmee	43.0
Tsala-Apopka	Citrus	Withlacoochee	30
Tohopekaliga	Osceola	Kissimmee	29.4
Harris	Lake	Oklawaha-St. Johns	27
Orange	Alachua	Oklawaha-St. Johns	25.9
Crescent	Putnam-Flagler	St. Johns	24.9
E. Tohopekaliga	Osceola	Kissimmee	18.6
Jessup	Seminole	St. Johns	15.5
Griffin	Lake	Oklawaha-St. Johns	14
Monroe	Volusia-Seminole	St. Johns	13.7
Weohyakapa	Polk	Kissimmee	11.8
Eustis	Lake	Oklawaha-St. Johns	11
Talquin	Gadsden-Leon	Ochlockonee	10.7
Blue Cypress	Indian River	St. Johns	10.2

TABLE 1. — Largest rivers in Florida. (by discharge, at gaging stations indicated)

NAME	DRAINAGE AREA (square miles)	AVERAGE DISCHARGE (cfs)	REMARKS
Apalachicola River near Blountstown	17,600	23,200	Drainage area is approximate.
Suwannee River near Wilcox	9,700	10,400	Includes Santa Fe River
St. Johns River at Palatka	7,300	8,000	Includes Oklawaha River - Discharge is approximate.
Choctawhatchee River near Bruce	4,380	6,900	Drainage area is approximate.
Escambia River near Century	3,820	5,900	
Kissimmee River near Okeechobee	2,900	2,200	
Oklawaha River near Orange Springs	2,840	2,000	
Withlacoochee River near Inglis	2,000	2,000	Data are approximate.
Santa Fe River near Fort White	1,080	1,670	
Ochlockonee River near Bloxham	1,720	1,610	
Withlacoochee River (north) near Pinetta	2,120	1,600	
Chipola River near Altha	781	1,500	
St. Marys River near Gross	1,360	1,300	Data are approximate.
Peace River at Arcadia	1,370	1,250	
Yellow River at Milligan	624	1,120	
Shoal River near Crestview	474	1,060	

Note. — Data are for period ending 1970, if available; the drainage areas and discharges listed are approximate for some streams because of indefinite drainage divides and lowland overflows.

EXPLANATION

- MARSHLANDS
STATE WATER MANAGEMENT DISTRICTS (EFFECTIVE 1973)