

STREAMFLOW VARIATION AND
DISTRIBUTION IN THE BIG CYPRESS
WATERSHED DURING WET AND DRY PERIODS

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PURPOSE AND SCOPE

A part of the water needs of Everglades National Park and the Lower Gulf Coast communities is fulfilled by water that drains from the Big Cypress Watershed. Therefore, streamflow variations in the area encompassed by the watershed, especially during wet and dry periods, are of particular concern. This report shows the magnitudes, direction, and distribution of surface-water flows through the watershed during periods of high and low flows.

DESCRIPTION OF WATERSHED

The Big Cypress Watershed in southwestern Florida encompasses an area of about 2,450 square miles, most of which lies in Collier County (see fig. 1). The area is water dominant and is characterized by flat, swampy topography consisting of cypress, pines, and hardwood forests and marshes and prairies as shown in figure 3. The southward movement of water is generally slow in sloughs and strands and then accelerates where man has dug canals to tidal channels.

In the rainy season from mid May to November, the area receives approximately 40 inches of its average yearly rainfall of 53 inches. During part of this season as much as 90 percent of the undrained area of the watershed is inundated (see fig. 4). On the other hand, in the middle of the dry season, as little as 10 percent of the area may be inundated (see fig. 5).

The ecology of the Big Cypress Watershed depends on water. Water, both in suitable quantity and quality, is required to promote a normal life cycle for biological communities. In addition to supplying enough water to support its own ecological needs, the Big Cypress Watershed, on the average, also supplies in excess of 541,500 acre-feet of water annually to Everglades National Park.

Urban areas along the Lower Gulf Coast depend on the Big Cypress Watershed as a source of municipal water supplies. Water in the western part of the watershed recharges the shallow aquifer, which is the source of water for the city of Naples and the Golden Gate Estates.

In addition to fulfilling the water needs of Everglades National Park and the urban areas along the Lower Gulf Coast, the Big Cypress Watershed loses a large quantity of water due to nature through evapotranspiration.

DRAINAGE PATTERNS

During the rainy season from mid May to November most of the Big Cypress Watershed is inundated and overland flow occurs, mostly in sloughs, strands, and canals. With the aid of streamflow measurements made in November 1969 and aerial photographs, directions of flow were determined, as shown in figure 1. The overall drainage pattern is divided into three subareas as shown in figure 1. Subarea A, located in the northeastern part of the watershed drains water southeastward into Water Conservation Area 3A of the Central and Southern Florida Flood Control Project. A majority of this flow is carried in the Levee-28 Interceptor Canal and much of the flow is overland by way of the Kissimmee Billy Strand and the Goddard Strand. Water in the western part of Big Cypress, subarea B, drains overland to the south and west in sloughs and strands and then is intercepted by a series of canals. The Fakahia Union and Henderson Creek Canals discharge water to the south toward the Gulf coast estuaries and water moves westward by way of the Golden Gate Canal and the Cocohatchee River Canal. Drainage in subarea C, the largest subarea, is from the central area of the Big Cypress and flows mainly in the Barron River and Turner River canals, and overland through the Okaloacoochee Slough and the Fakahatchee Strand and then moves directly south toward Everglades National Park. In the height of the dry period, as illustrated by the measurements made on March 9, 1971, (see fig. 2) flow is confined to canals, and most of the sloughs and strands go dry.

MAGNITUDE AND DISTRIBUTION OF FLOW

The magnitude and distribution of surface-water flow in the Big Cypress Watershed at times of high flow and low flow is shown in figure 2. Streamflow throughout the Watershed was determined from discharge measurements made at about 250 sites during November 18-20, 1969, in a period of high flow, and on March 9, 1971, in a period of low flow.

During November 18-20, 1969, the total flow through the outlets along Everglades Parkway between the Levee 28 Interceptor Canal and Naples was 1,603 cfs (cubic feet per second). This flow was distributed through canals and overland. On March 9, 1971, the flow through Everglades Parkway between the same two points was 40 cfs. There was no overland sheet flow through the outlets along this 50-mile stretch of Everglades Parkway. The flow was divided between just two canals, 29 cfs in Barron River Canal and 11 cfs in the Turner River Canal.

Conditions were similar at the Tamiami Canal outlets between 40-Mile Bend and Carnestown where the total flow of 1868 cfs was measured during November 18-20, 1969. Nearly all of this water was flowing overland through sloughs and strands. On March 9, 1971, the flow at Turner River Canal where it crosses the Tamiami Canal was only 3 cfs.

The flow in the Turner River Canal on March 9, 1971 decreased from 11 cfs at Everglades Parkway to 3 cfs at the Tamiami Canal. This decrease in flow in the canal was attributed to seepage into the shallow aquifer. Likewise, on March 9, 1971, the flow in Barron River Canal decreased along the stream from 29 cfs at Everglades Parkway to 8 cfs just above Tamiami Canal. This decrease was also attributed to recharge of the aquifer. During November 18-20, 1969, in the rainy season, flow in the Barron River Canal decreased from 218 cfs to 198 cfs between the two points mentioned above because water spilled over the low canal banks into adjacent sloughs.

The Fakahia Union Canal drains water from land which has recently been developed as a residential area. The flow in the Fakahia Union Canal was 637 cfs in the high-flow period and 34 cfs in the low-flow period. Flow in the Golden Gate Canal, which also drains water from residential areas, was 366 cfs in the high-flow period and 28 cfs in the low-flow period.

DISCHARGE DURATION

A discharge-duration curve for the Tamiami Canal outlets, 40-Mile Bend to Monroe, based on records from 1964-68 is shown in figure 6. This curve indicates the percentage of the time that a particular discharge is equalled or exceeded at that site. As can be seen from figure 6, the daily discharge of 973 cfs on November 19, 1969, was equalled or exceeded only 8 percent of the time during 1964-68 and greatly exceeded the average wet-season flow of 530 cfs for the same period and the average wet-season flow of 485 cfs for the period of record (1940-70) at the site. Drier than average conditions prevailed on March 9, 1971, as the streamflow was 0 cfs. The average dry-season flow during 1964-68 was 38 cfs and the average dry season flow for the period of record, 1940-70, was 74 cfs.

LONG TERM TREND

The long-term record of flow through the Tamiami Canal outlets, 40-Mile Bend to Monroe, is shown by figure 7. The hydrograph of monthly mean discharges from 1940 to 1970 shows the monthly variation in flow. During 1940-70, the monthly discharges for October, normally the wettest month of the year, ranged from 34 cfs in 1962 to approximately 2,700 cfs in 1949. The mean monthly discharge for October is 777 cfs. In April, normally the driest month, the monthly flows ranged from 0 cfs in many years to 381 cfs in 1970. The mean monthly discharge for April is 37 cfs. Periods of high and low flow are sure to occur in the future. However, discharge magnitudes will differ from year to year due to the inconsistencies of the climatological zone in which the Big Cypress Watershed is situated and due to any modifications caused by land development.

Water level fluctuations in the Big Cypress Watershed also differ from year to year in the wet and dry seasons. Figure 8 shows water levels for the Tamiami Canal at Bridge 105 for years of unusually high flow (1957-58) and very low flow (1970-71). During the wet season the water levels for the two years are nearly the same, but during the dry season the water level was almost 5 feet lower in 1971 than it was in 1958.

SELECTED REFERENCE

Klein, H.,
1970 (and Schneider, W. J.; McPherson, B. F.; and Buchanan, T. J.) Some hydrologic and biologic aspects of the Big Cypress Swamp drainage area, southern Florida: U. S. Geol. Survey open-file report 70003.

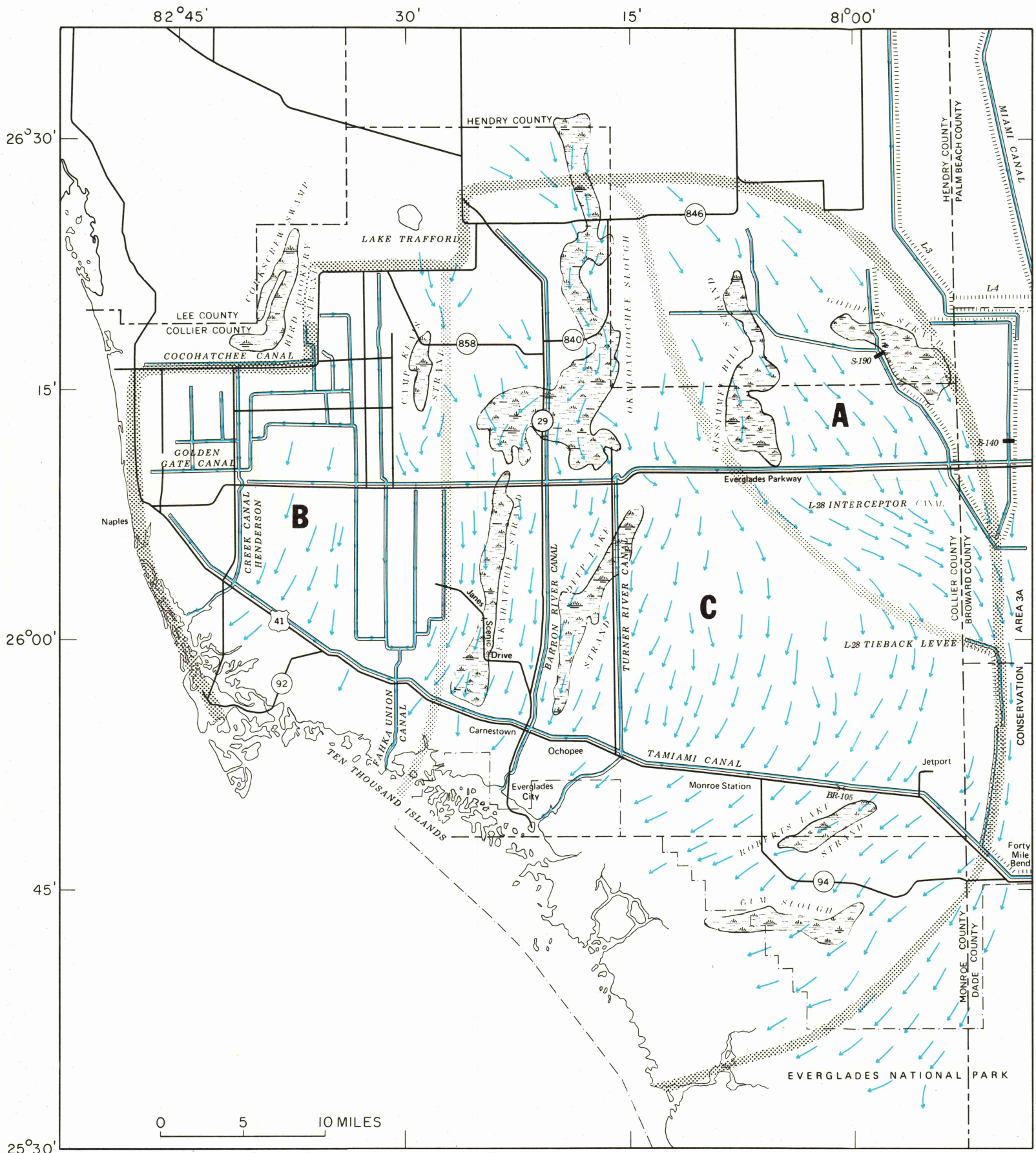


Figure 1. Map of the Big Cypress Watershed showing the direction of overland flow during November 18-20, 1969, and subareas A, B and C.

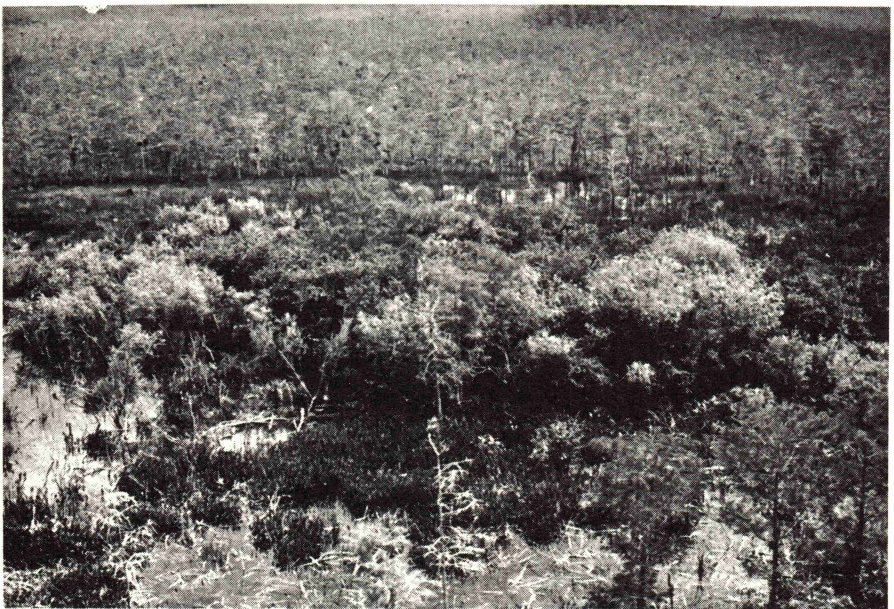


Figure 3. A typical view of the topography in the Big Cypress Watershed.

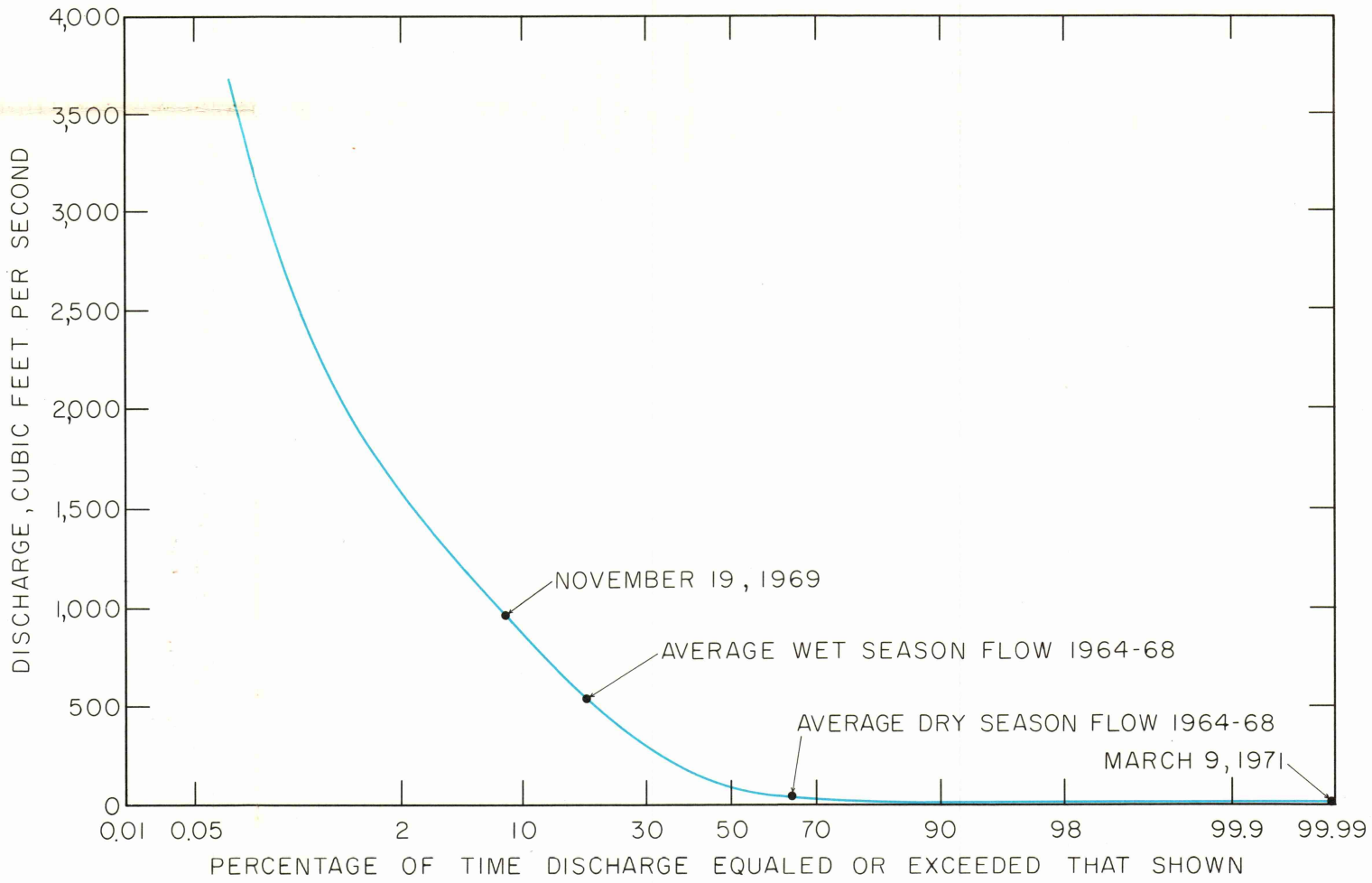


Figure 6. Discharge-duration curve for the Tamiami Canal outlets, 40-Mile Bend to Monroe, for the period 1964-68.

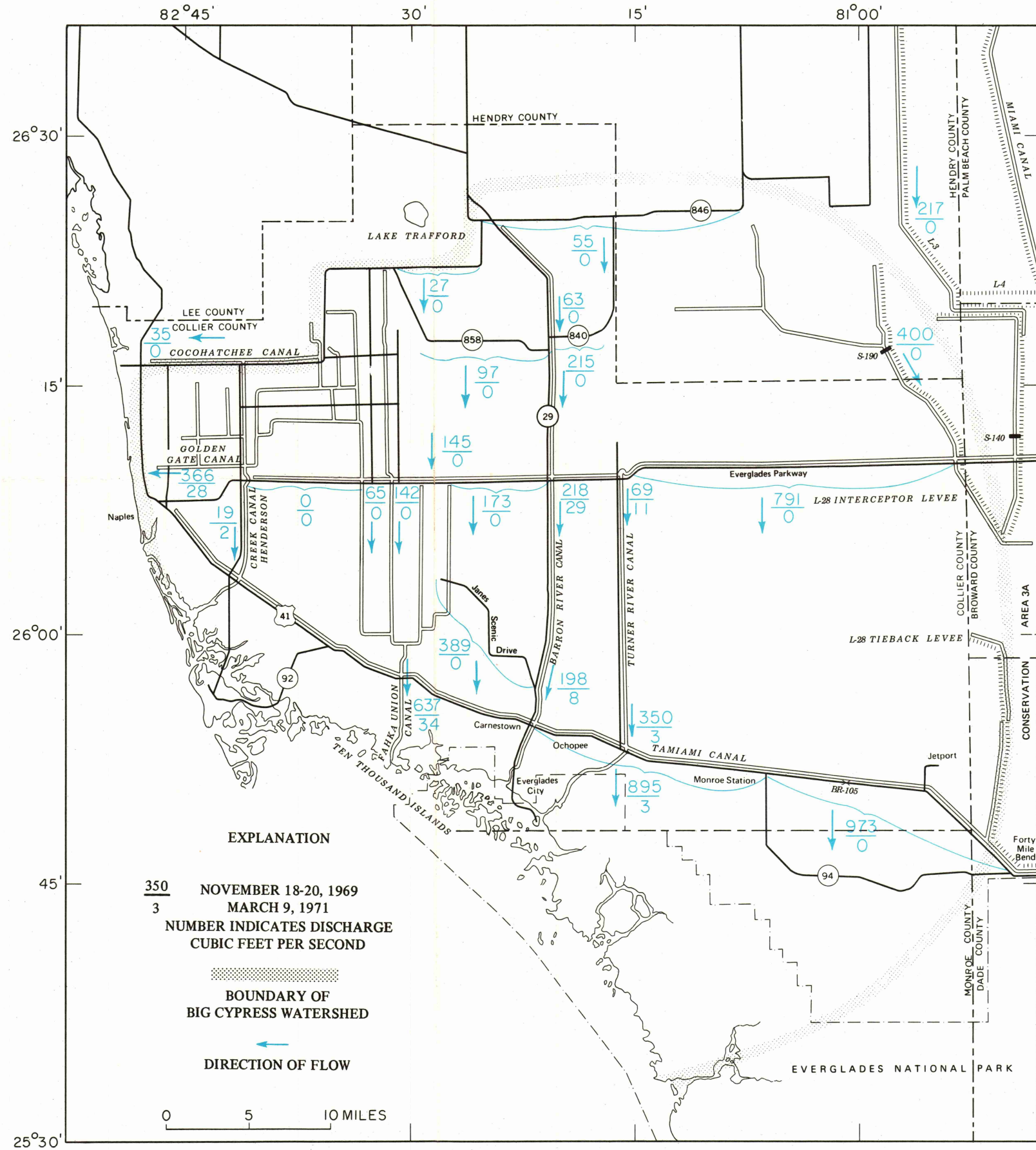


Figure 2. Map of the Big Cypress Watershed showing distribution and magnitude of flow during November 18-20, 1969 and March 9, 1971.



Figure 4. A typical cypress strand just south of Monroe Station during a period of high flow.

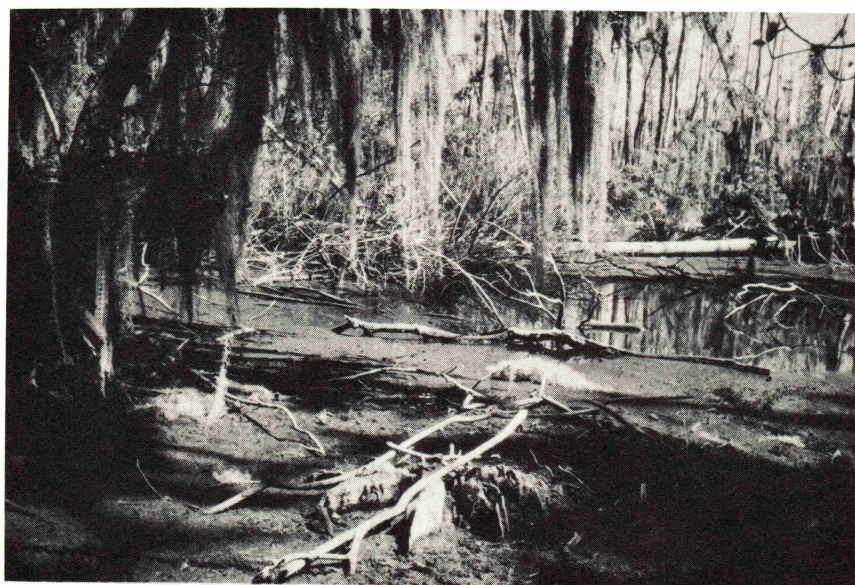


Figure 5. A typical cypress strand just south of Monroe Station during a period of low flow.

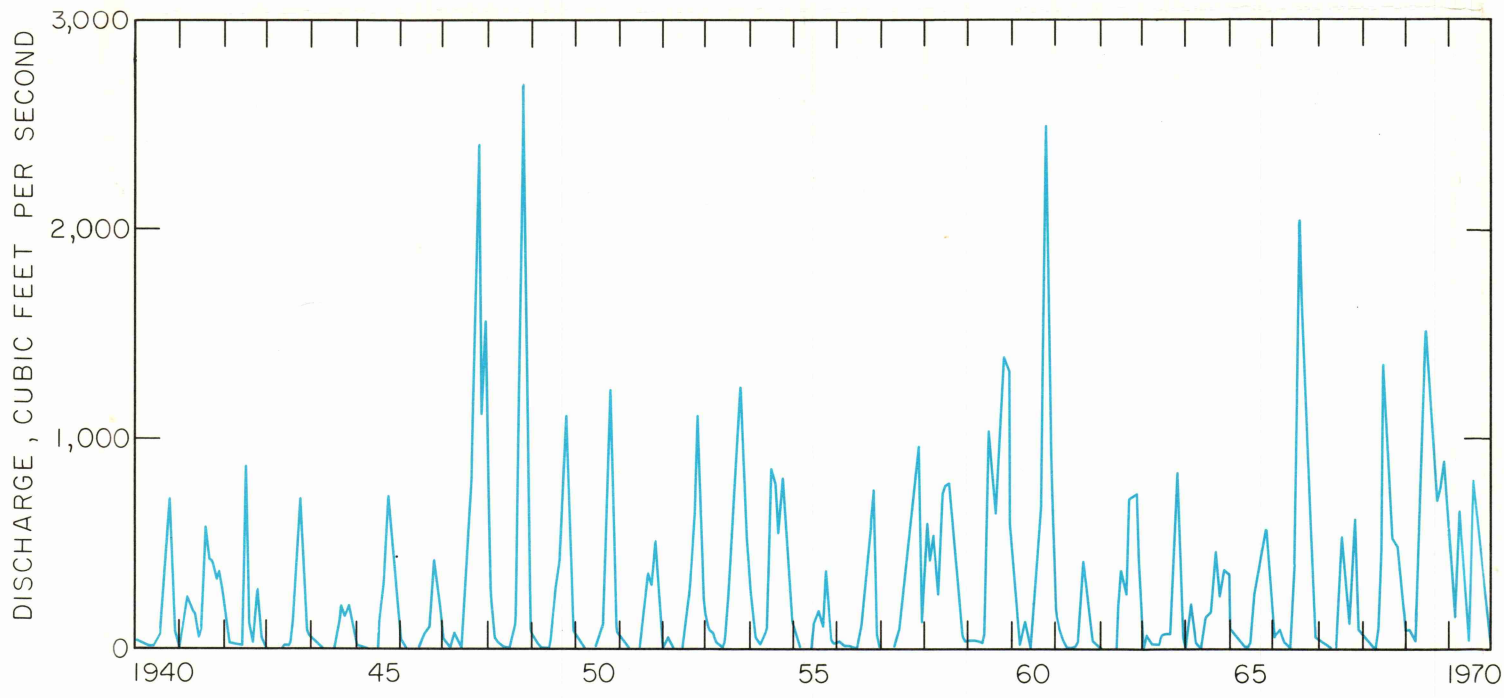


Figure 7. Hydrograph of monthly mean discharges of the Tamiami Canal outlets, 40-Mile Bend to Monroe.

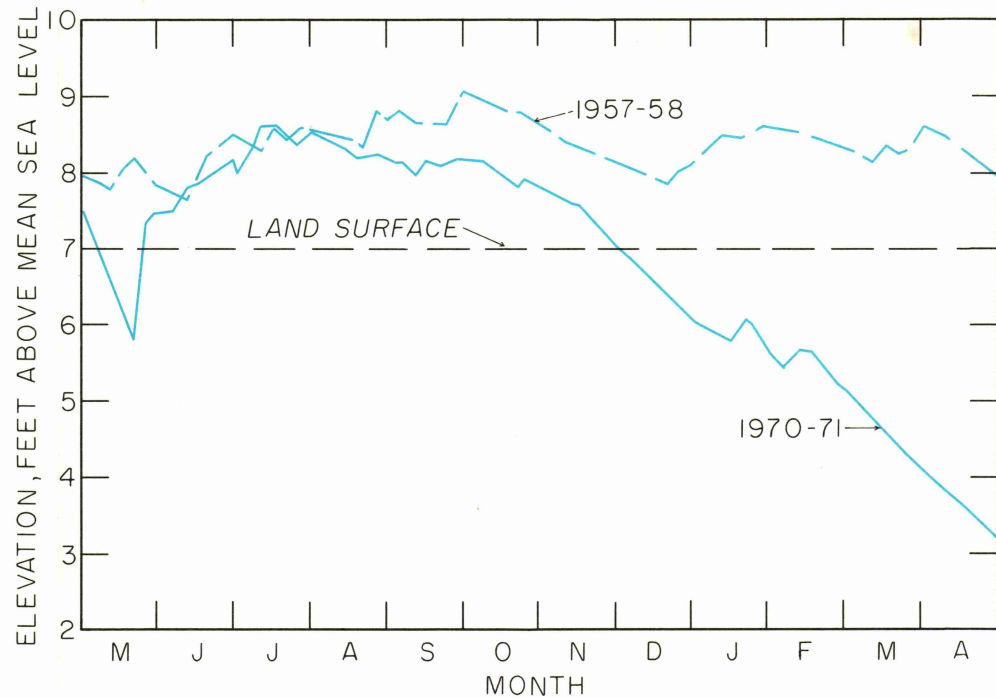


Figure 8. Hydrographs showing water levels at bridge 105 from May to April during 1957-58 and 1970-71.