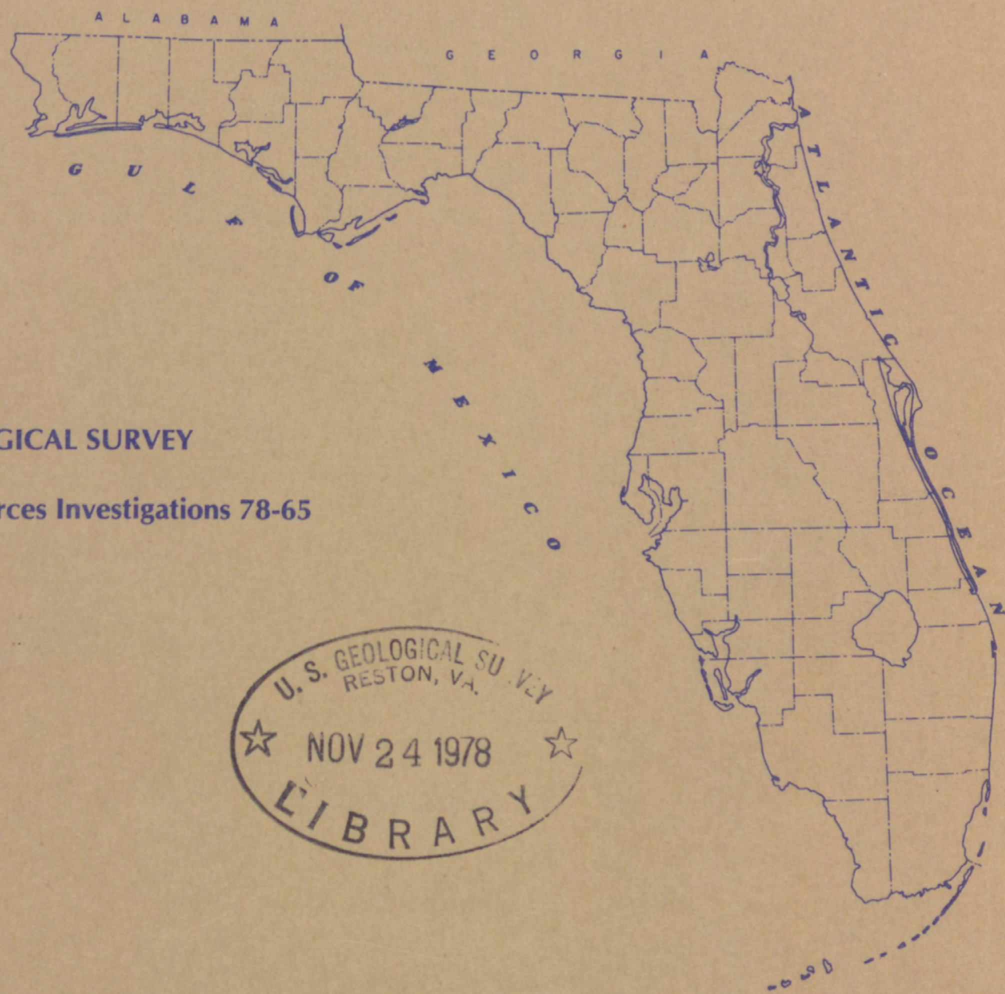
MAGNITUDE AND FREQUENCY OF FLOODING ON THE MYAKKA RIVER, SOUTHWEST FLORIDA



U.S. GEOLOGICAL SURVEY

Water-Resources Investigations 78-65

Prepared in cooperation with the
FLORIDA DEPARTMENT OF ENVIRONMENTAL REGULATION,
MANATEE AND SARASOTA COUNTIES, and the
RIDGE AND LOWER GULF COAST WATER MANAGEMENT DISTRICT

U.S. DEPARTMENT OF THE INTERIOR
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WRI 78-65 MAGNITUDE AND FREQUENCY OF FLOODING ON THE MYAKKA RIVER, SOUTHWEST FLORIDA WRI 78-65

MAGNITUDE AND FREQUENCY OF FLOODING ON THE MYAKKA RIVER, SOUTHWEST FLORIDA

By K. M. Hammett, J. F. Turner, Jr., and W. R. Murphy, Jr.

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1978

UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY

H. William Menard, Director

Open-File Report

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Tallahassee, Florida 32303

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U.S. customary	Multiply by	SI metric
ft^3/s (cubic foot per second)	2.832×10^{-2}	m^3/s (cubic meter per second)
ft (foot)	3.048×10^{-1}	m (meter)
mi (mile)	1.609	km (kilometer)
mi^2 (square mile)	2.590	km^2 (square kilometer)
ft/mi (foot per mile)	1.894×10^{-1}	m/km (meter per kilometer)
in (inch)	$2.540 \times 10^{+1}$	mm (millimeter)

GLOSSARY

Some of the technical terms used in this report are defined here for convenience. See Langbein and Iseri (1960) and Inter-Agency Committee on Water Resources (1966) for additional information regarding flood-frequency analysis and associated terminology.

Correlation coefficient is a statistical measure of the degree of linear relation between selected variables. A value of 1.0 is perfect correlation and a value of 0.0 indicates no correlation.

Discharge is the volume of water (or more broadly, total fluids), that flows past a given point within a specified period of time.

Drainage area of a stream at a specified location, is that area measured in a horizontal plane, which is enclosed by a topographic divide. Upstream from this specified location, direct surface runoff normally drains by gravity into the stream.

Flood-frequency distribution is a graph or table showing the magnitude of flood that will, on the average, be equaled or exceeded once within a specified number of years. The U.S. Geological Survey uses the log-Pearson Type III distribution for flood-frequency analyses at gaged sites. The distribution is described by the Water Resources Council (1976).

Flood-frequency relations are generalized relations developed for estimating the magnitude and frequency of floods at ungaged sites on streams. In this report, areal flood-frequency relations refer to relations developed using long-term streamflow data available for a large area of west-central Florida. Basin flood-frequency relations (natural and diked conditions) refer to relations developed for the Myakka River study area using estimates from the areal relations weighted with log-Pearson Type III distributions for Myakka River streamflow stations.

Flood height is the water-surface elevation of a stream at flood stage above a selected datum plane. Mean sea level datum plane of 1929 is used in this study.

Flood profiles provided in this report are plots of water-surface elevation at flood stage versus distance, measured in the upstream direction. A profile shows crests along the study reach for flood-peak discharges of specified recurrence intervals.

Manning's roughness coefficient, n, is a measure of channel boundary roughness used with open channel flow equations. Typical values of roughness are tabulated for a range of boundary conditions in Barnes (1967). In studies such as this, roughness coefficients are estimated from aerial photographs, available streamflow records and field site surveys.

100-year flood is a flood that is expected to occur, on the average, once every 100 years, or has a one percent chance of occurring each year. Percentage is determined by dividing one by the recurrence interval and multiplying by 100.

Recurrence interval is the average interval of time within which a flood of specified magnitude is expected to be equaled or exceeded at least once.

Regression analysis is a statistical technique used in finding the relation between selected variables. In multiple regression analysis, the value of a dependent variable is determined from two or more independent variables. In this report flood-peak discharges are dependent variables and selected basin parameters, such as drainage area, and stream length and slope, are the independent variables. Derived regression equations are used in estimating the magnitude of floods at ungaged sites.

Stage-discharge rating is a relation describing discharge as a function of stream stage. Stage-discharge ratings are empirical relations and are normally developed using actual field measurements of stage and discharge.

Stage-volume curve is a relation describing the volume of water that can be stored in a reservoir as a function of reservoir stage. Stage-volume curves are empirical relations and may be determined by planimetering detailed contour maps of the storage site.

Standard error of estimate is a measure of reliability for a regression equation. In this report, standard error is given as an average percentage value representing the average range about the regression relation that includes about 68 percent of all regression data points.

Step-backwater method is the procedure used by the U.S. Geological Survey to determine water-surface profiles along a stream reach. The method is based upon the principle of conservation of energy between cross sections. The technique is similar to the standard step method described by Chow (1959) and Posey (1950).

Streamflow station is a particular site on a stream where systematic observations of gage height and discharge are obtained.

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ABSTRACT

Myakka River is a coastal stream that drains approximately 550 square miles in southwest Florida. Under natural conditions, Tatum Sawgrass, a large depression, served as a flood overflow area for the upper part of the Myakka River basin. A recently constructed (1974) dike system across the lower part of Tatum Sawgrass has reduced previously available storage, thereby affecting downstream flooding.

An evaluation of the effects of Tatum Sawgrass dikes on flooding indicates that flood-peak discharges and flood heights having recurrence intervals of up to 25 years are increased. As a result, about 1,200 additional acres along Myakka River main stem may be inundated during 2-year flood conditions. Maximum effects include a 19 percent increase in flood-peak discharge at State Road 780 and a 0.8 foot increase in flood height near the downstream end of the study reach.

Floods having recurrence intervals of 50 years or greater will overtop dikes and the storage capacity of Tatum Sawgrass will revert to natural condition capacity.

As part of the evaluation, diked condition flood profiles, having recurrence intervals of 2, 5, 10, 25, 50, 100, 200, and 500 years were determined for the nontidal part of a 45-mile reach of Myakka River main stem, Clay Gully, and Blackburn Canal. These data indicate that Clay Gully flood water will overflow embankments at State Road 780 during the 2-year flood and will overflow the bridge on State Road 780 during the 25-year flood. Myakka River flood water will overflow embankments at State Road 72 and Border Road during 100-year flood conditions and at State Road 780 during 500-year conditions.

INTRODUCTION

Increasing numbers of urban and agricultural developments are being located on waterfront property in the Myakka River flood plain. Low-lying areas in and near these developments are subject to frequent and severe flooding because of low topographic relief, poor drainage and changing land-use practices. Flood-prone area identification is therefore essential for orderly basin development.

Under natural conditions, a large depression, Tatum Sawgrass, was available as a flood storage area in the upper Myakka River basin. Construction of dikes across the lower part of Tatum Sawgrass has restricted use of the depression for temporary storage of Myakka River flood water overflow, and has resulted in increased flood-peak discharges and flood heights in downstream reaches of the Myakka River.

Information provided in this report describes flooding for natural conditions and diked conditions existing in November 1974. The information may be used by local governmental agencies to delineate flood-prone areas and to aid in flood-plain management along the Myakka River main stem, Clay Gully, and Blackburn Canal, excluding tidal reaches. Topographic and drainage characteristics of Myakka River basin may undergo further change as a result of alterations in the dike system or as a result of future development. Flood information provided in this report may not accurately reflect the actual magnitude of flooding for altered conditions.

Purpose and Scope

The purpose of this report is to present results of a flood evaluation study of the Myakka River basin, including analysis of the effects of diking in the lower Tatum Sawgrass area. The difference between natural and diked condition flood-peak discharges and flood heights is presented to illustrate the effects of the dikes. Flood-peak discharges, water-surface elevations and flood profiles are also provided for diked conditions. Analytical procedures used to evaluate diking effects are described in detail because of possible application in other areas.

The study reach includes Myakka River main stem upstream from U.S. Highway 41, near Myakka Shores in Sarasota County, to State Road 70 near Myakka City in Manatee County (including Tatum Sawgrass and Clay Gully), and Blackburn Canal from Venice By-Way to Myakka River.

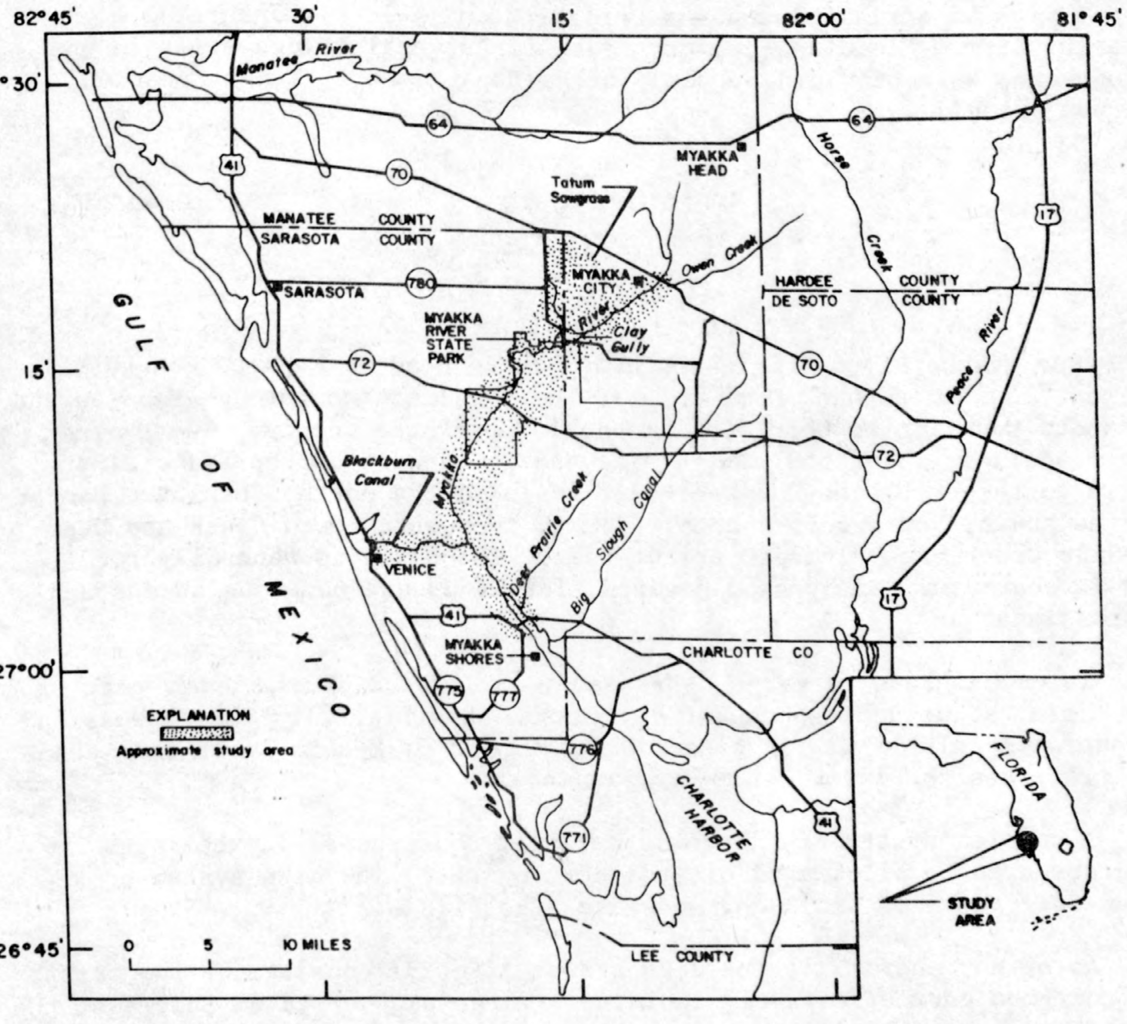

FIGURE 1.--Index map of Myakka River area.

Cooperation and Acknowledgments

This investigation was conducted in cooperation with the Florida Department of Environmental Regulation, Manatee and Sarasota Counties, and the Ridge and Lower Gulf Coast Water Management District. Stream channel cross-section data used in this study were obtained under contract with an aerial photogrammetric firm and a local consulting engineering firm. Flood and geometry data for several bridge sites in the study area were provided by the Florida Department of Transportation, Bartow, Florida.

Area Description

The Myakka River originates near Myakka Head in Manatee County (fig. 1) and flows more than 50 mi in a southerly direction through Manatee and Sarasota Counties to Charlotte Harbor in Charlotte County. The Myakka River basin is about 550 mi^2 in size and is bounded by the Peace River basin to the east, the Manatee River basin to the north, Charlotte Harbor to the south, and a gulf coastal area to the west. Owen Creek and Deer Prairie Creek are principal tributaries. The basin is generally rural and is characterized by sand-covered flat lands and numerous swamps and depressions.

Tatum Sawgrass, a large depression, is located in the upper part of the basin, about 5 mi southwest of Myakka City (fig. 2). The depression is approximately 14 mi^2 in size. About 0.5 mi of Myakka River main channel traverses the lower Tatum Sawgrass area.

A complex system of dikes was recently constructed in the Tatum Sawgrass area to allow agricultural development. The dike system protects Tatum Sawgrass from small and moderate size floods.

As of November 1974, the dike system (fig. 3) consists of two parts. The northern part effectively isolates a large part of Tatum Sawgrass; the southern dike system isolates a small area lying between Myakka River main stem and Clay Gully. Dikes are also constructed along the west side of Myakka River downstream from State Road 780. There are approximately 13 mi of dikes in and near Tatum Sawgrass. Dikes average about 4 ft in height in Tatum Sawgrass and are constructed primarily of spoil from excavated drainage channels adjacent to the dikes. Pumps are used occasionally to augment drainage and remove water from within dike-enclosed areas. Dikes between Myakka River and Clay Gully and along the west side of Myakka River downstream from State Road 780 are higher than those in Tatum Sawgrass.

Clay Gully (fig. 4), a partially-cleared, natural drainage channel, diverts some flow from the Myakka River main stem, around Tatum Sawgrass, and then rejoins the main stem downstream from State Road 780 at Upper Myakka Lake. Upper and Lower Myakka Lakes are on the main stream channel and lie within Myakka River State Park (fig. 2). Blackburn Canal (fig. 5), a diversion channel in the lower basin, connects Myakka River with Roberts Bay near Venice.

Myakka River may be affected by high tides for more than 4 mi upstream (cross section 46, fig. 2) from U.S. Highway 41. Blackburn Canal may be affected for more than 5 mi upstream (cross section 54, fig. 5) from Venice By-Way.

The Myakka River flood plain varies in width from less than 1 mi in the upper basin to more than 3 mi in the lower basin. Topographic relief averages about 1.8 ft/mi and is greater in the upper basin than in the lower basin.

Mean annual precipitation for the study area ranges from about 50 to 55 in. Since 1963, mean annual runoff for the Myakka River near Sarasota (site 5, fig. 2) has averaged about 15 in.

GENERAL METHODOLOGY

The effects of diking in the Tatum Sawgrass area were evaluated by comparing flood heights and discharges for natural conditions with flood heights and discharges for diked conditions. Flood-peak discharges for natural conditions were taken from areal flood-frequency relations. Flood-peak discharges for diked conditions were based on natural condition discharges, adjusted to reflect the decrease in overflow storage capacity caused by the dikes.

Adjustment factors for flood-peak discharges were determined using results of a linear storage routing analysis. Observed flood hydrographs (1963-66) for the Myakka River streamflow station at Myakka City (site 1, fig. 2) were routed downstream through Tatum Sawgrass and through Upper Myakka Lake without dikes and then with dikes in place. Flood-peak discharges for diked conditions were compared to peak discharges for natural conditions. Adjustment factors used were the ratios of diked to natural discharges.

Routed flood-peak discharges were verified by comparison with observed flood-peak discharges at the streamflow station, Myakka River near Sarasota, (site 5, fig. 2). Discharges used in this comparison were for natural conditions.

Flood profiles developed in this study were based on flood heights for natural and diked conditions. Flood heights were computed from flood-peak discharges for natural and diked conditions using the U.S. Geological

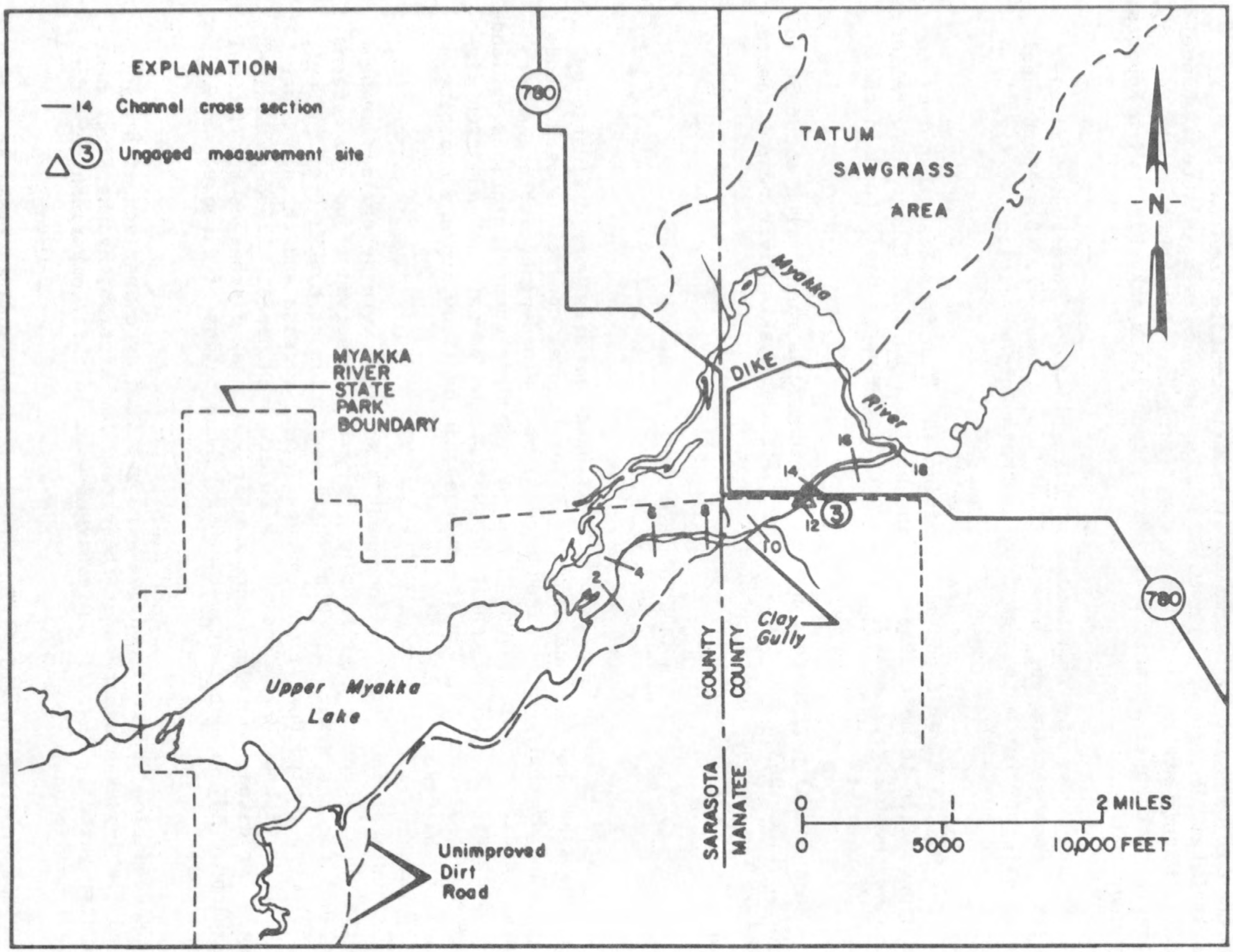

Figure 4. --Clay Gully - Showing approximate cross-section locations

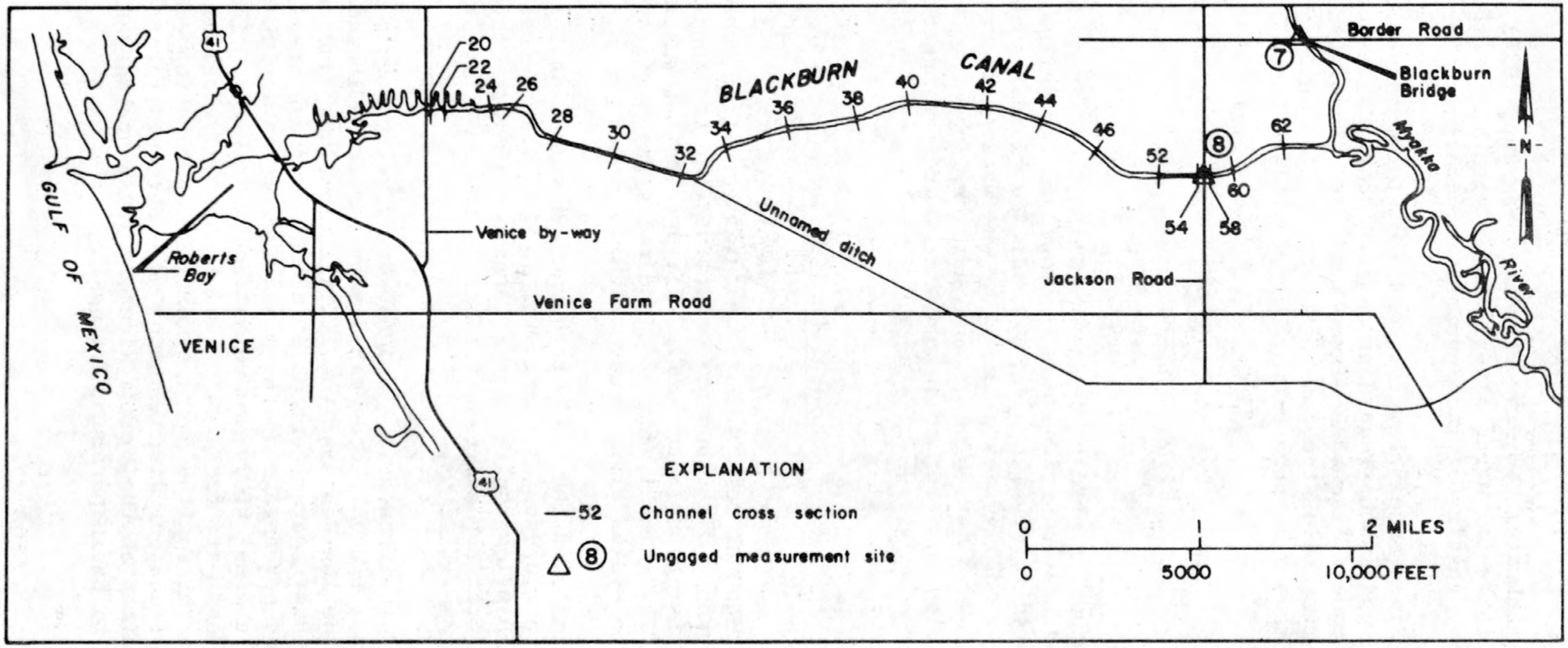

Figure 5. --Blackburn Canal - Showing approximate cross-section locations

Survey step-backwater computer program (Shearman, 1976). Stage-discharge ratings available for gaged sites located within the study reach were used to verify results of flood-height computations.

Myakka River streamflow stations are listed in table 1. Gage sites include four continuous record streamflow stations on the main stem and four miscellaneous discharge measurement sites consisting of two sites on the Myakka River main stem, and one each on Clay Gully and Blackburn Canal (fig. 2). Stage-discharge ratings are available for each site.

FLOOD-FREQUENCY RELATIONS

The procedures used to determine basin flood-frequency relations for natural and diked conditions are discussed in the following two sections. Techniques used to develop natural condition flood-frequency relations are based on guidelines established by the Water Resources Council (1976). Techniques used to determine diked condition flood-frequency relations may have application in other areas and are, therefore, presented in detail.

Natural Conditions

Flood-frequency relations for natural conditions were based on weighted flood-frequency distributions determined for one long-term streamflow station near Sarasota (site 5, fig. 2), one short-term streamflow station near Myakka City (site 1, fig. 2), and two ungaged sites (sites 2 and 7, fig. 2) in the Myakka River study reach.

One estimate of the flood-frequency distribution for each of the four sites was determined using results of an areal flood-frequency analysis of long-term streamflow records for 20 stations in west-central Florida. Locations of stations selected for use in the areal study are shown in figure 6.

Areal flood-frequency relations were developed in a multiple linear regression analysis of flood-peak discharges for selected recurrence intervals (from log-Pearson Type III distributions) and selected basin parameters. Basin parameters used include drainage area, stream length and slope, and percentage of the basin area which is lakes and swamps. Results of the areal study are summarized in table 2. The average standard error of estimate for areal flood-frequency relations shown in table 2 is 25.8 percent and the average multiple correlation coefficient is 0.98. Flood-frequency distributions were obtained for the two gaged and two ungaged sites on the Myakka River by applying regression coefficients from table 2 to basin parameter values.

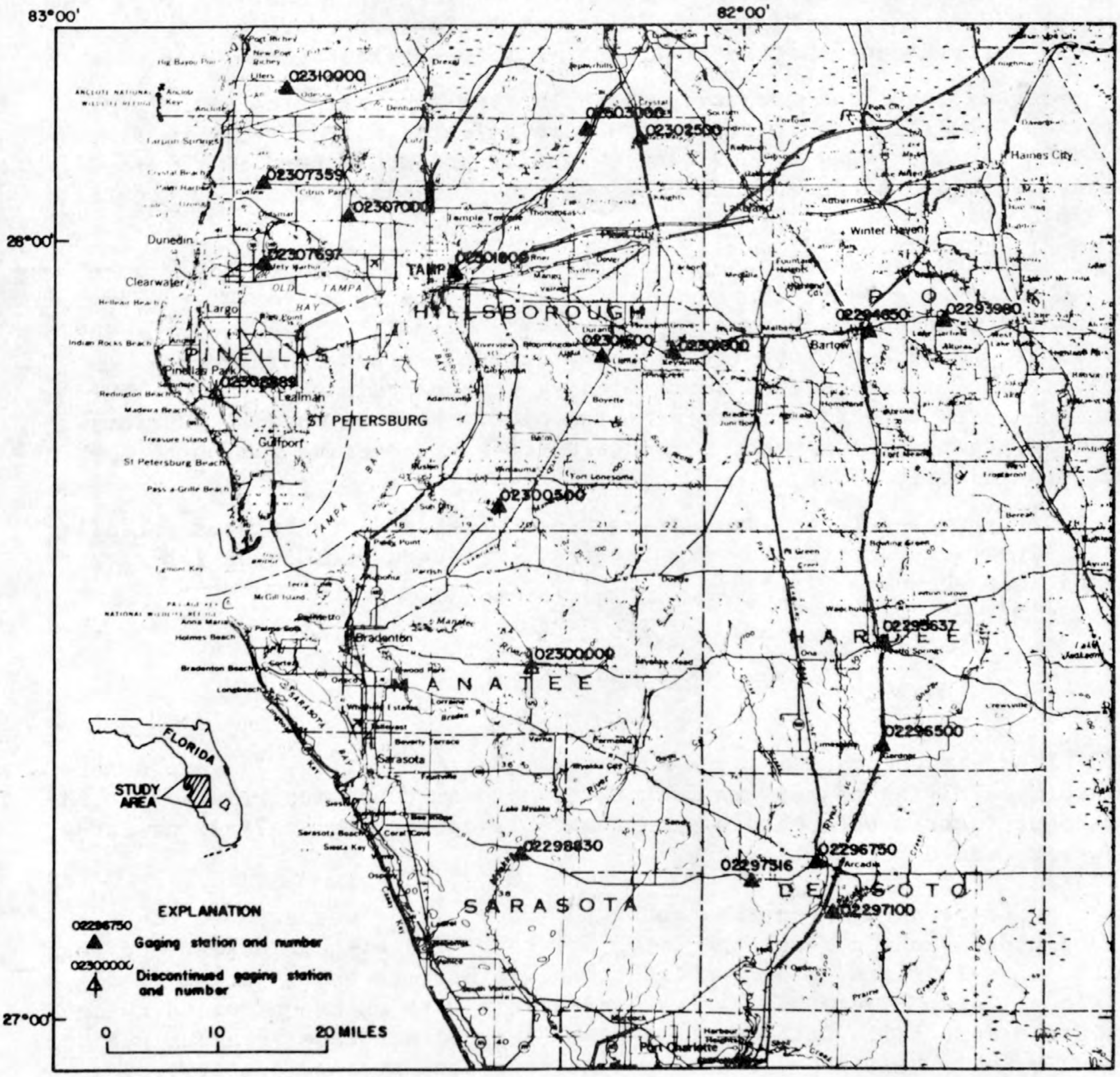

Figure 6. --Location of streamflow stations used in areal flood-frequency study

A log-Pearson Type III distribution was used as a second estimate of flood-frequency for the long-term station, Myakka River near Sarasota, (site 5, fig. 2). A log-Pearson Type III flood-frequency distribution for the short-term station, Myakka River at Myakka City, (site 1, fig. 2) was determined by correlation with a nearby, long-term station (02300000) on the Manatee River (fig. 6). This correlation procedure is described by the Water Resources Council (1976) as a two-station comparison.

Regression flood-frequency distributions were weighted with log-Pearson Type III distributions to obtain weighted flood-frequency distributions for the gaged sites. The weighting procedure used is referred to as weighting of independent estimates by the Water Resources Council (1976).

Weighted flood-frequency distributions for the ungaged sites were based on weighted distributions at the gaged sites. Ratios of regression distribution discharges to log-Pearson Type III discharges for the Sarasota and Myakka City stations were plotted versus drainage area on logarithmic paper. Ratios corresponding to the drainage areas of the ungaged sites were determined from the plot. Regression distributions for the ungaged sites were then multiplied by respective ratios to obtain weighted distributions.

Recurrence-interval discharges from weighted distributions for all four sites were plotted to form the flood-frequency relations for natural conditions shown in figure 7.

Diked Conditions

Flood-frequency relations for diked conditions (fig. 7) were determined by applying adjustment factors to natural condition relations. Adjustment factors were obtained through a flood-routing analysis of Tatum Sawgrass and Upper Myakka Lake.

A modified Puls routing technique (Chow, 1964) was used to route flood hydrographs through the Tatum Sawgrass area without dikes, and then with dikes in place. The routing technique assumes that, during flood periods, Tatum Sawgrass is a level reservoir with an uncontrolled outlet at State Road 780. Outflow from Tatum Sawgrass at State Road 780 was computed using a continuity relation that expresses average outflow, over any time period, as the difference between average inflow and change in storage. The procedure requires a stage-discharge relation for the outlet at State Road 780 and a stage-volume relation for Tatum Sawgrass depression.

A stage-discharge rating for Tatum Sawgrass outlet at State Road 780 was developed using available streamflow measurements and results of backwater computations at State Road 780 (cross-section 178). The stage-discharge rating at State Road 780 is unaffected by Tatum Sawgrass diking and was applicable for both natural and diked conditions.

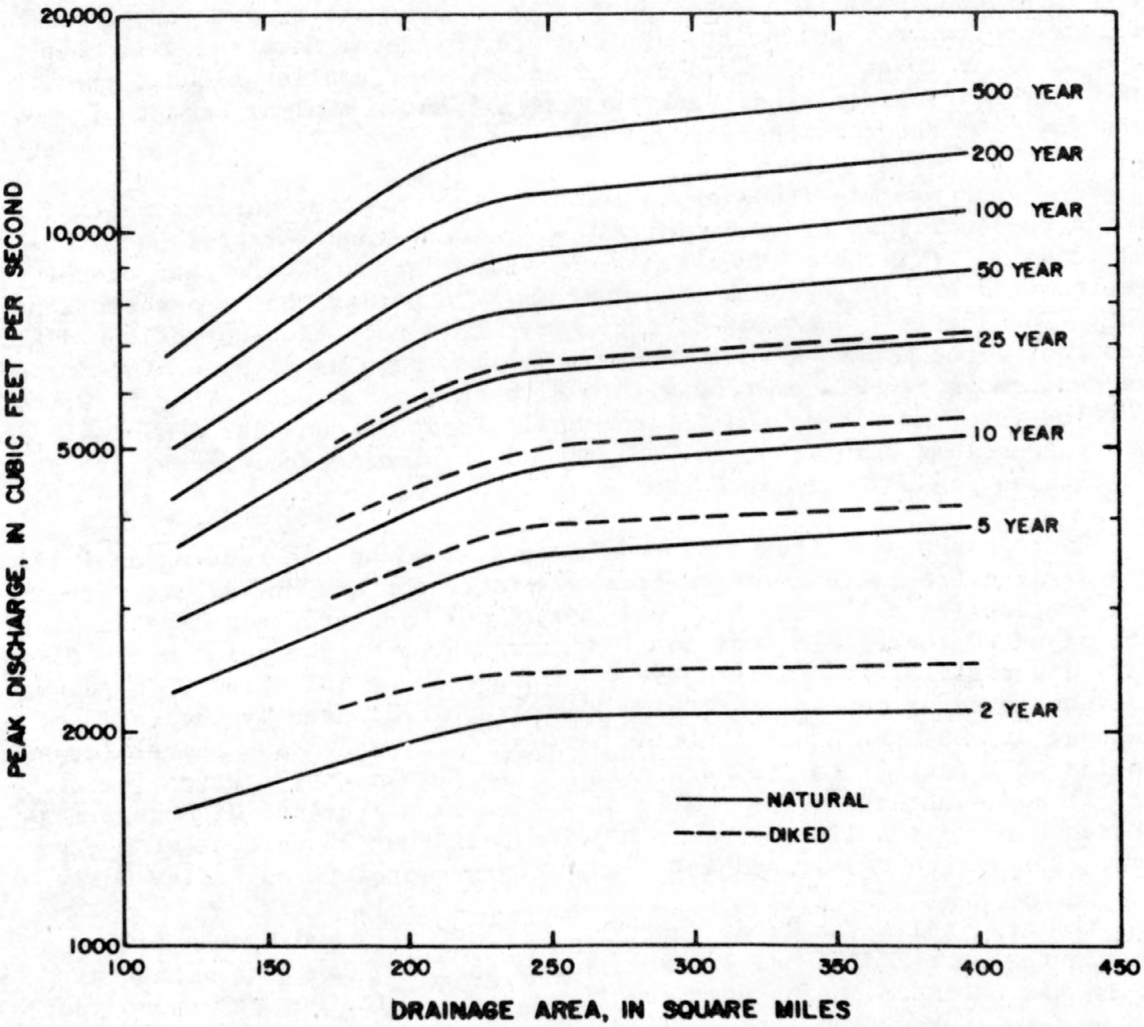

Figure 7. --Myakka River flood-frequency relations
for natural and diked conditions

Stage-volume relations developed for Tatum Sawgrass under natural and diked conditions are shown in figure 8. These curves were determined using planimetered areas from the topographic map of the Tatum Sawgrass area of November 1974 by Kucera and Associates, and considering the possibility of small volumes of flow entering dike-enclosed areas during flood periods.

For floods with recurrence intervals of 50 years or greater, dikes will be overtopped and the storage capacity of Tatum Sawgrass will then be equivalent to natural condition capacity. For smaller floods, the dike system and drainage ditches prevent all but a minimal amount of overflow from entering the depression.

The probable magnitude of inflow to Tatum Sawgrass during small floods was evaluated by comparing slope and conveyance at cross-sections A-A' and B-B' (fig. 3). Results of the comparison indicate that cross-section A-A' has at least 12 times more flow capacity than cross-section B-B'. In addition, drainage ditches serve to direct flow out of the diked area toward the Myakka River. Pumps have also been used to augment drainage and remove floodwater from within dike-enclosed areas. Therefore, overflow into the diked area during small floods is considered minimal and stage-volume relations (fig. 8), based on planimetered areas, are as accurate as can be determined from available data.

Hydrographs of inflow to Tatum Sawgrass used in the routing analysis were derived from streamflow records available for the Myakka City streamflow station (site 1, fig. 2). Observed flood hydrographs at Myakka City were adjusted to reflect additional drainage area at the point where Clay Gully diverts flow from Myakka River (cross-section 191, fig. 2). Adjustment consisted of multiplying daily hydrograph ordinates by the ratio of drainage area at the upper junction of Clay Gully and Myakka River (cross-section 191, fig. 2) to drainage area at the Myakka City station (site 1, fig. 2) and subtracting Clay Gully flow diversion. Recent discharge measurements for sites listed in table 1 indicate that 35 percent of Myakka River flow is shunted around the Tatum Sawgrass area through Clay Gully.

The area below the upper junction of Clay Gully and Myakka River contributes some additional lateral inflow to Tatum Sawgrass. Lateral inflow was estimated using unit runoff values (cubic feet per second per square mile) taken from flood hydrographs at the Myakka City gaging station and combined with Myakka River main stem flow (cross-section 191, fig. 2) to provide inflow hydrographs for Tatum Sawgrass.

Selected inflow hydrographs were routed through Tatum Sawgrass under natural and diked conditions and outflow hydrographs were obtained for State Road 780. Outflow hydrographs were then combined with flow from Clay Gully and routed through Upper Myakka Lake (cross-section 154). Plots of routed flood-peak discharges, diked versus natural conditions, for Myakka River at State Road 780 and cross-section 154 are shown as logarithmic graphs in figures 9 and 10, respectively.

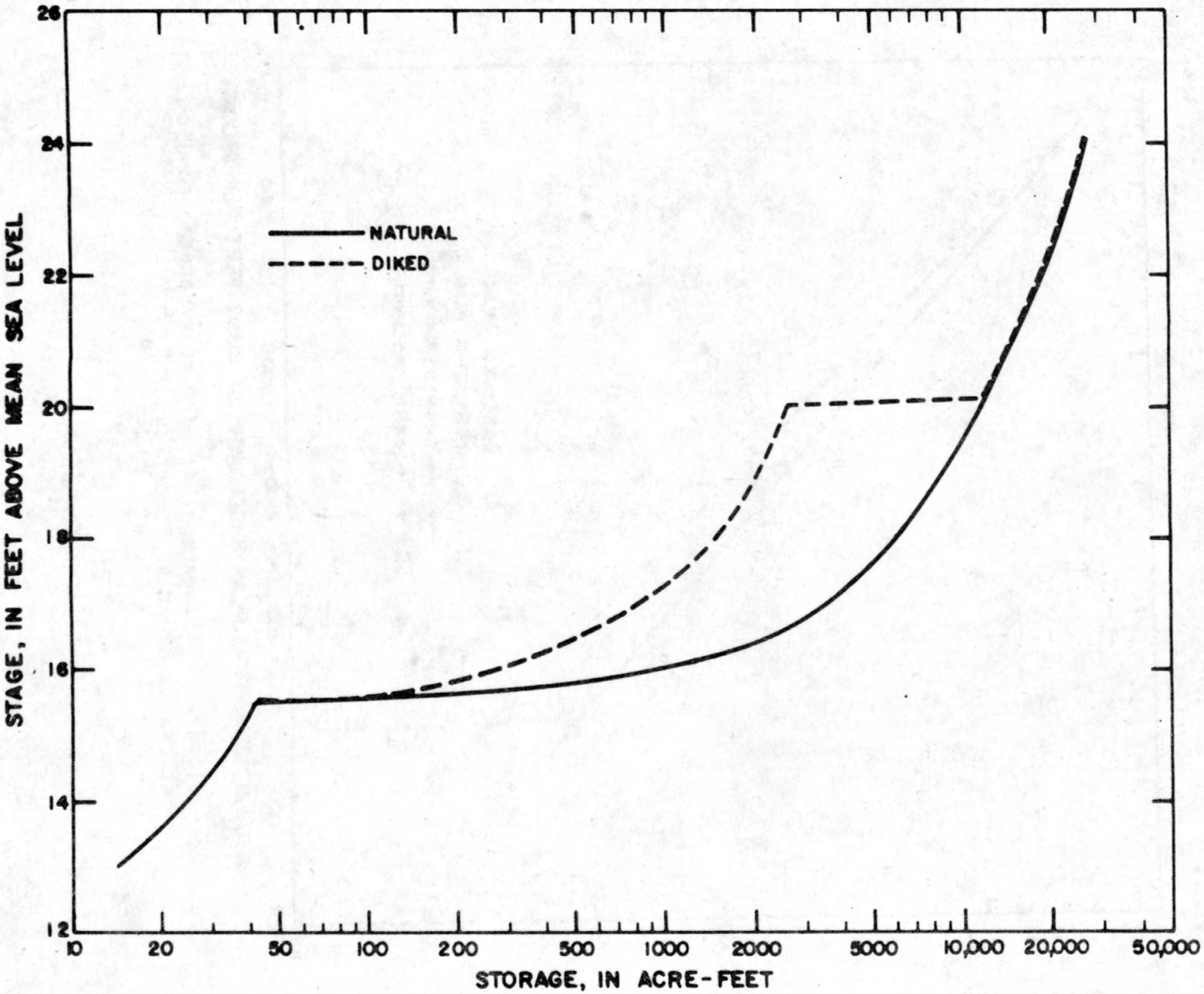

Figure 8. --Tatum Sawgrass stage-volume relations for natural and diked conditions

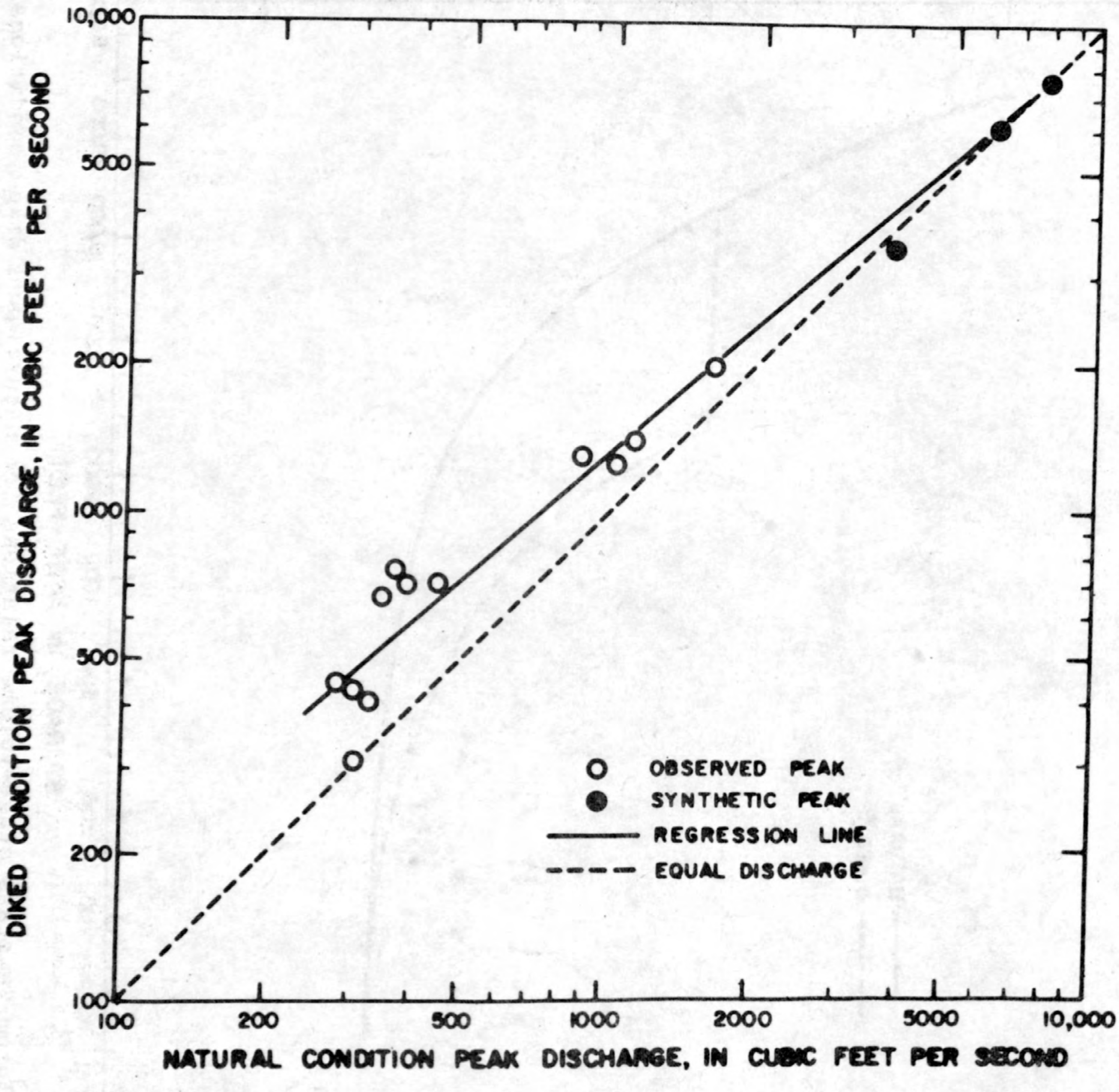

Figure 9. --Flood-peak discharges, diked versus natural conditions, at Myakka River at State Road 780

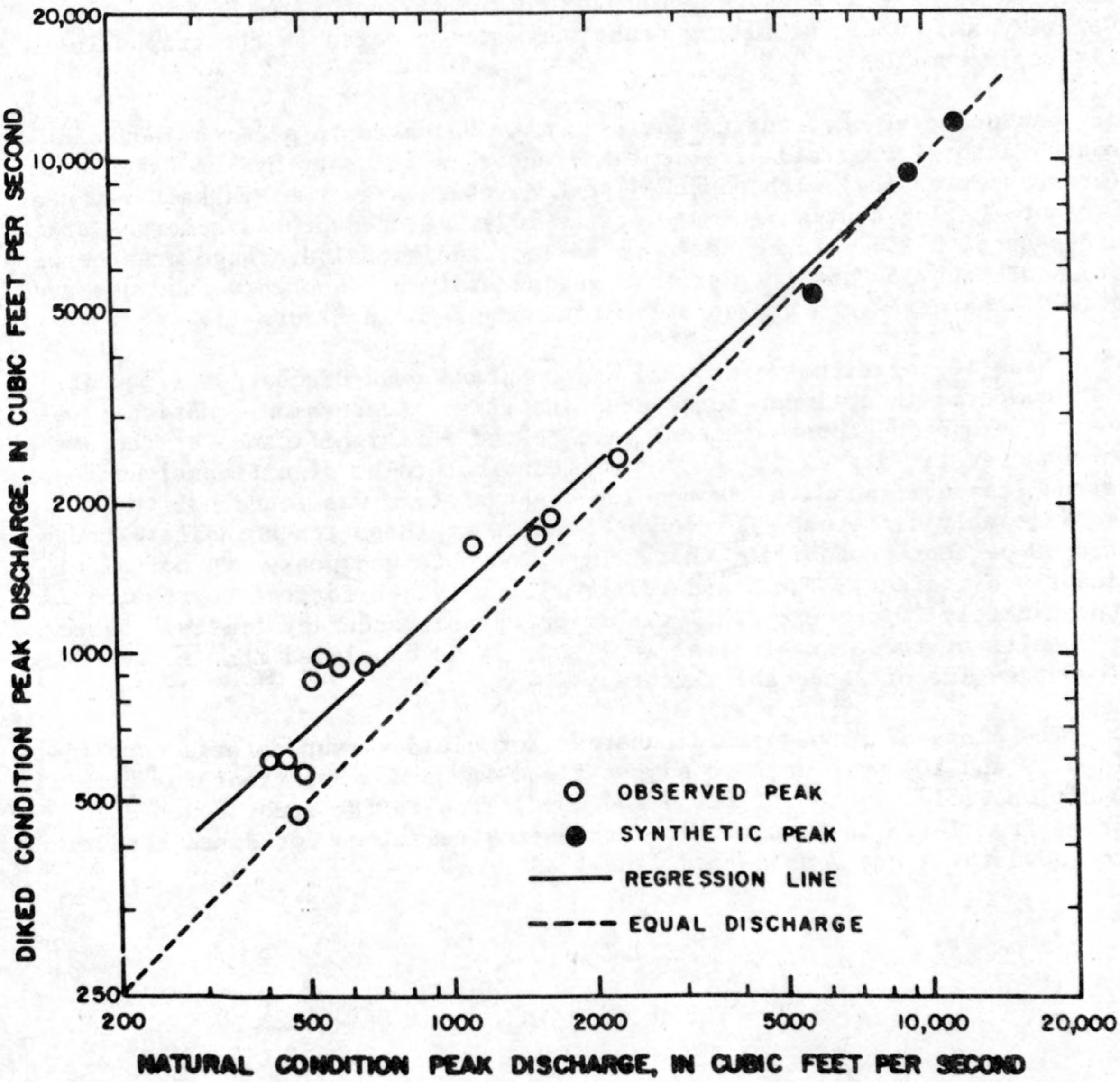

Figure 10. --Flood-peak discharges, diked versus natural conditions, at Upper Myakka Lake outlet (cross section 154)

Flood-peak discharges used in the routing analysis cover only recurrence intervals of less than 25 years. Therefore, flows from three synthetic flood hydrographs, having flood-peak discharges as large as those expected for the 200-year flood, were routed through Tatum Sawgrass and Upper Myakka Lake. Resulting peaks were also plotted on the graphs in figures 9 and 10.

Accuracy of the routing analysis was evaluated in a comparison of routed natural condition flood-peak discharges at Upper Myakka Lake outlet (cross-section 154) with observed peak discharges at the Myakka River near Sarasota gaging station (cross-section 132). Routed peak discharges at cross-section 154 were adjusted to reflect additional drainage area between cross-section 154 and the Sarasota gaging station. Routed versus observed peak discharges are shown on a logarithmic graph in figure 11.

Base 10 logarithms of routed and observed peak discharges (fig. 11) were compared in a linear regression analysis. Regression equation parameters (slope and constant term) were tested for significance at the 99 percent level. Regression slope was found not to be significantly different from unity and the regression constant term was found not to be significantly different from zero. Results of these tests indicate there is a 99 percent probability that routed and observed peaks are not significantly different. The standard error of estimate for the regression is approximately 20 percent, well within acceptable accuracy limits. Based on results of these statistical analyses, it is concluded that routed peak discharges are of acceptable accuracy.

The plots of flood-peak discharges for diked versus natural conditions (figs. 9 and 10) were used to adjust flood-frequency relations for natural conditions (fig. 7) to reflect diked conditions in the study reach downstream from Tatum Sawgrass. Flood-frequency relations for diked conditions are shown in figure 7 as dashed lines.

FLOOD PROFILES

Flood heights were computed from flood-peak discharges for natural and diked conditions using the U.S. Geological Survey step-backwater computer program (E-431). Program data input requirements include land-surface elevations and values of Manning's roughness coefficient, _n_, for stream channel cross sections along the study reach.

Each Myakka River cross section was assigned a reference distance, measured upstream from U.S. Highway 41. A cross-section identification number was also provided at each location beginning with number 23 at U.S. Highway 41 near Venice and increasing upstream to number 238 at Myakka City (fig. 2).

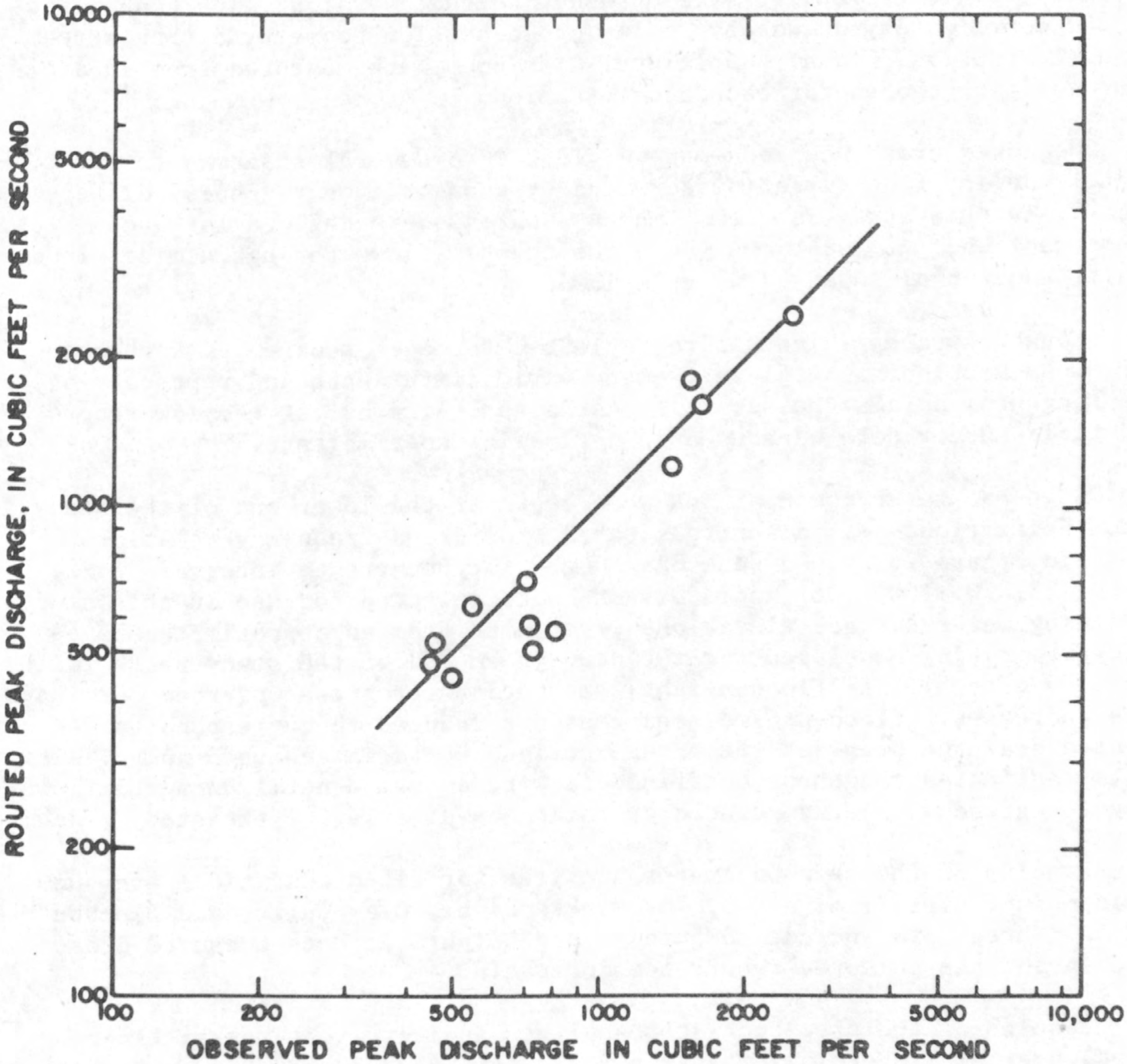

Figure 11. --Routed peak discharges versus observed peak discharges, Myakka River near Sarasota streamflow station

Cross sections were located at right angles to the streamflow and extend across the flood plain. Cross sections were also taken at bridge crossings to evaluate flow constrictions caused by road embankments, bridge openings, and bridge low-chord elevations. A sufficient number of land-surface elevations were obtained so that straight line connection of the coordinates adequately define cross-section geometry of the stream channel and flood plain. Horizontal distances were measured from an arbitrary origin, chosen for each cross section.

Measured cross sections were divided into several subareas to adequately define flow variations created by geometric or roughness differences. In this study, at least three subareas were defined for each cross section. At locations where the channel flows through a wide flood plain, additional subareas were defined.

Roughness coefficients were estimated for each subarea of each channel cross section. Coefficients were varied with depth and represent average roughness across the subarea. Aerial photographs, streamflow records, and field survey data were used in estimating coefficients.

Step-backwater computations were begun at the lower end of the study reach using flood-peak discharges taken from flood-frequency relations shown in figure 7. Flood-peak discharges for recurrence intervals of 2, 5, 10, 25, 50, 100, 200, and 500 years were selected for use in this study. Beginning water-surface elevations were taken from an approximate stage-discharge rating developed for the downstream end of the study reach (without tide effect). As flood-height computations progress upstream, drainage area decreases. Flood-peak discharges were reduced to correspond to decreased drainage areas at the cross sections noted in tables 3 and 4. Initially estimated roughness coefficients were adjusted until computed flood heights agreed with stage-discharge ratings available for the study reach.

Results of the step-backwater analyses for diked conditions are summarized in tables 3, 4, and 5, for Myakka River, Clay Gully, and Blackburn Canal. These data include computed flood heights at each measured cross section for the selected recurrence intervals.

Results of the step-backwater analyses indicate that Myakka River flood water will overflow embankments at State Road 72 and Border Road (fig. 2) during 100-year flood conditions and at State Road 780 during 500-year conditions. Clay Gully flood water will overflow embankments at State Road 780 during the 2-year flood and will overflow the bridge on State Road 780 during the 25-year flood.

Diked condition flood profiles were constructed for selected recurrence intervals using flood heights computed in the step-backwater analysis. Profiles along the Myakka River study reach, for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence intervals are shown in figures 12, 13 and 14.

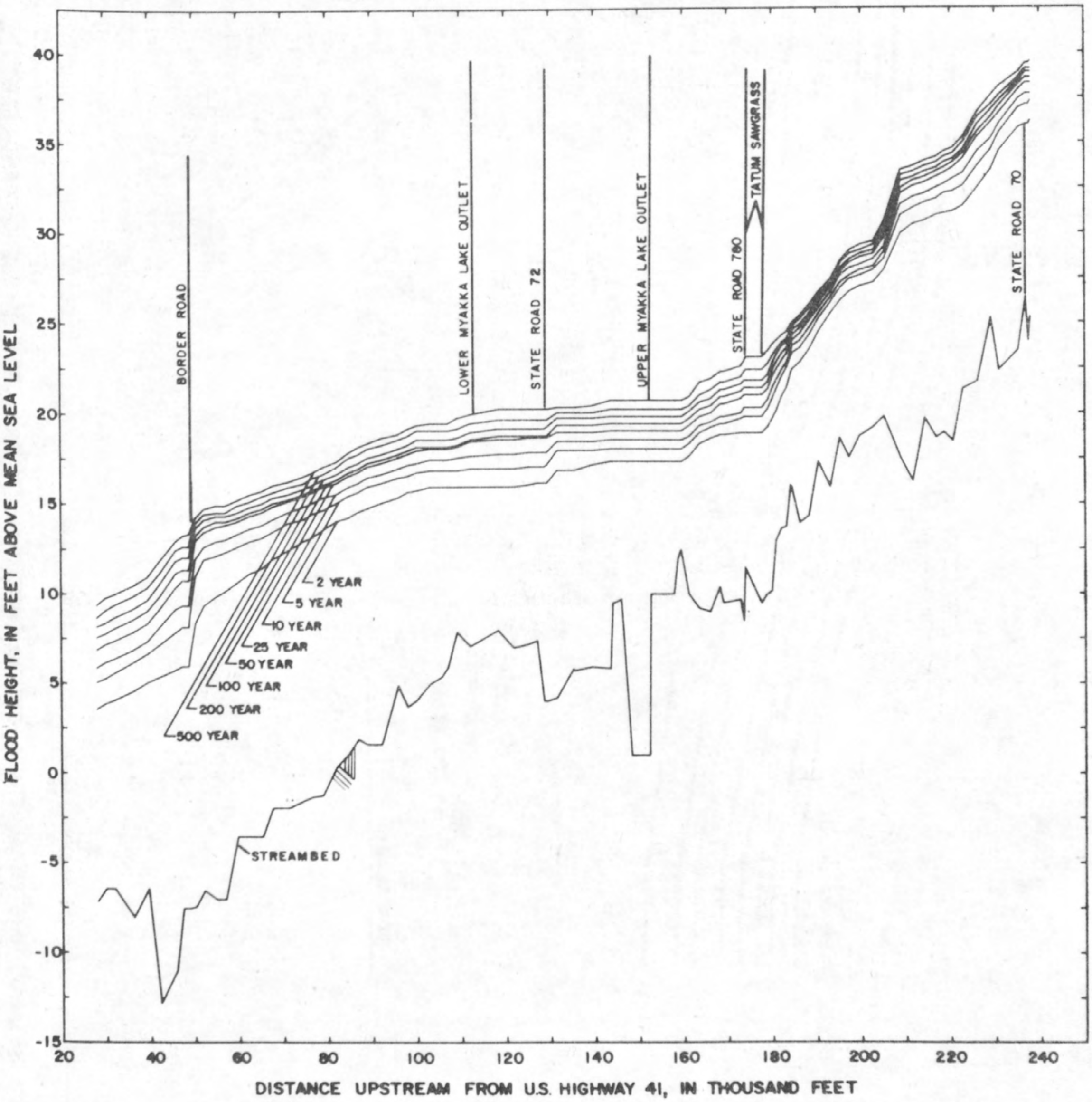

Figure 12. --Myakka River - Profiles for 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year floods, under diked conditions

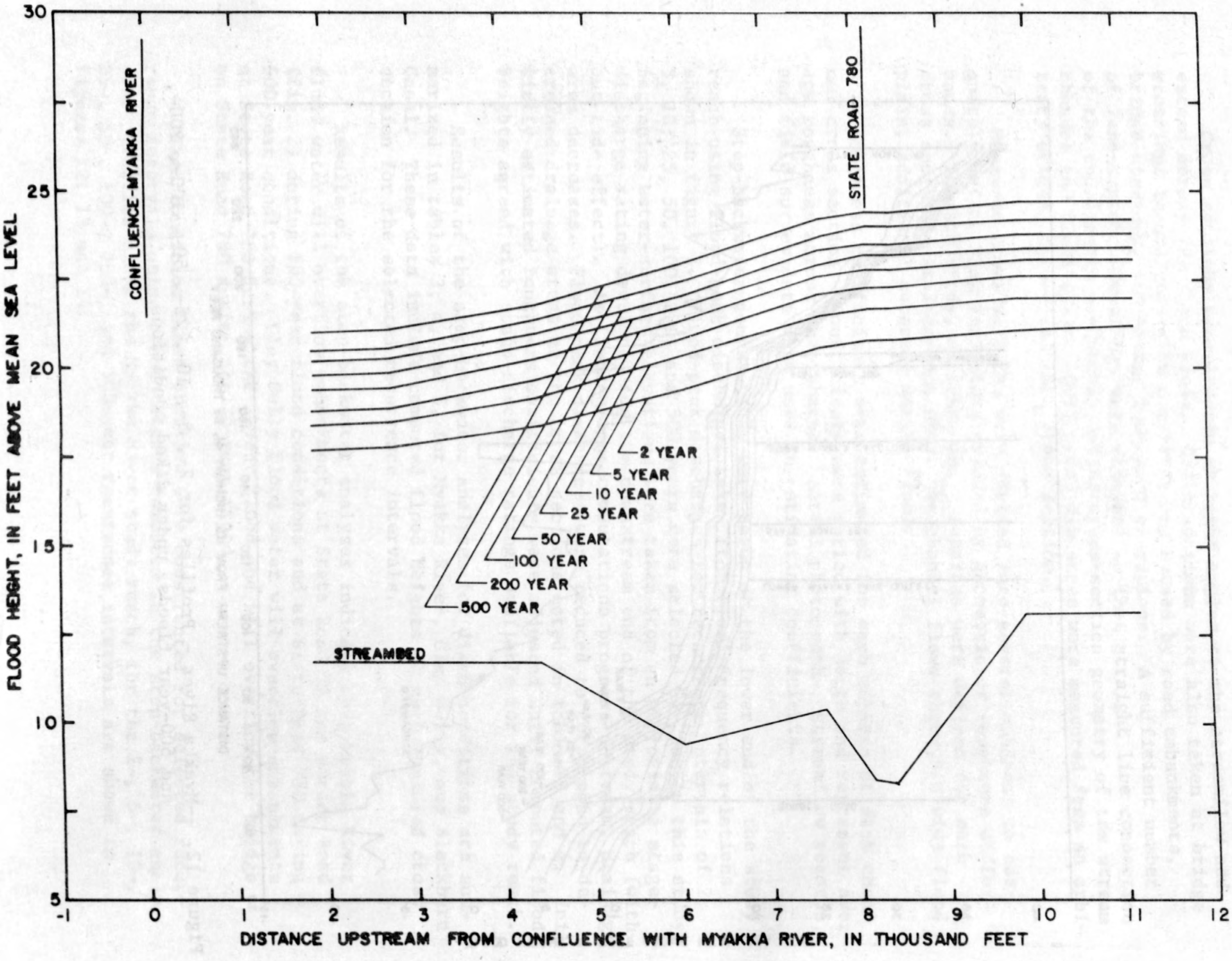

Figure 13. --Clay Gully - Profiles for 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year floods, under diked conditions

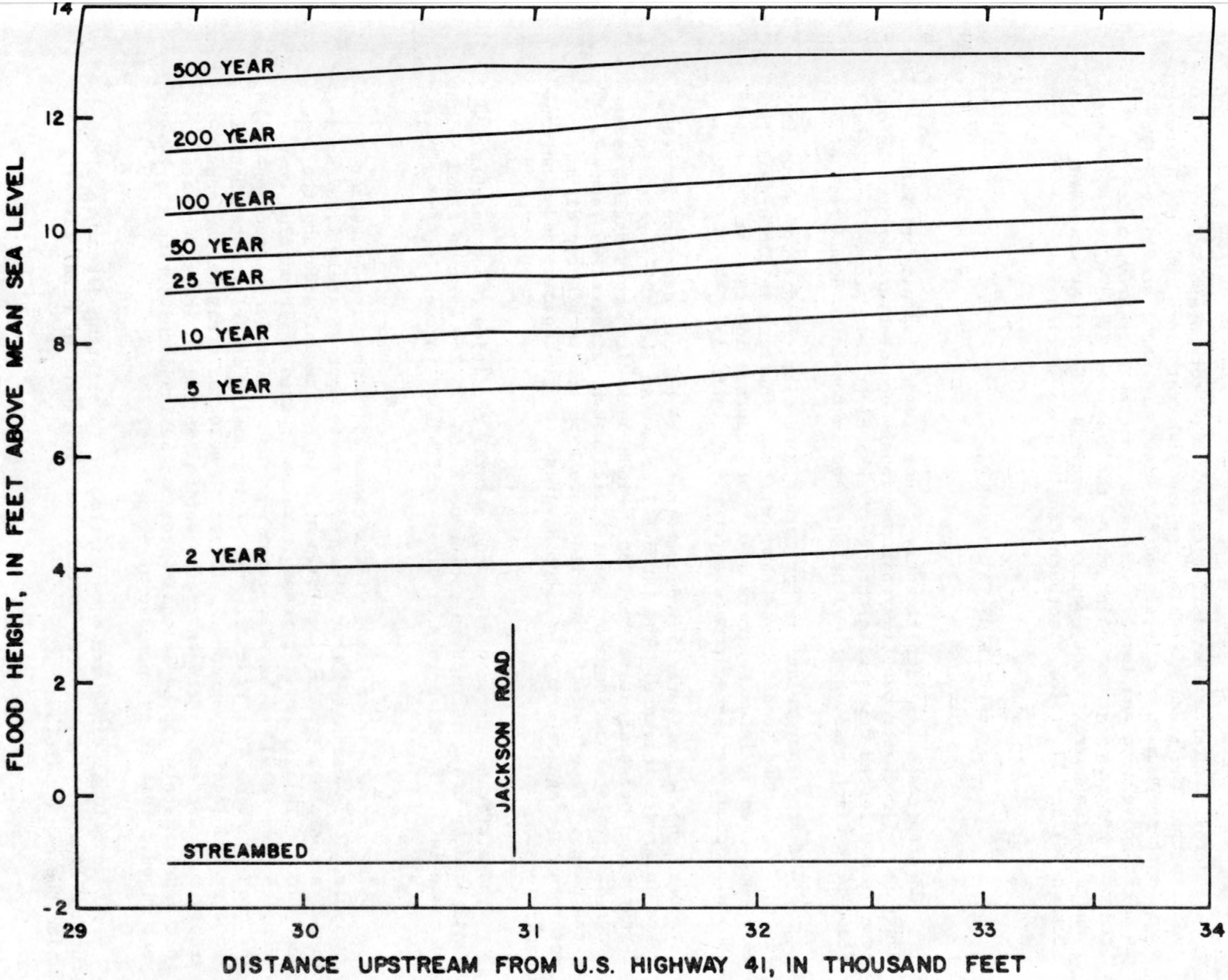

Figure 14. --Blackburn Canal - Profiles for 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year floods, under diked conditions

Federal Insurance Administration rate maps for Sarasota County (1976) indicate that the tidal elevation for the 100-year flood for U.S. Highway 41 is 8 ft above mean sea level and for Blackburn Canal at Venice By-Way is 11 ft above mean sea level. Computed flood heights are, therefore, presented beginning at the point where the 100-year flood elevation, when rounded to the nearest foot, equals or exceeds 8 ft for Myakka River (cross-section 46) and 11 ft for Blackburn Canal (cross-section 54).

EFFECTS OF TATUM SAWGRASS DIKES

Constructed dikes significantly reduce storage capacity in Tatum Sawgrass. Floodwater overflow that previously could enter the depression area is now forced downstream through Myakka River main stem. As a result, flood-peak discharges and flood heights are increased in downstream areas.

Flood-frequency relations for natural and diked conditions shown in figure 7 were used to determine the percentage increase in flood-peak discharges caused by Tatum Sawgrass dikes. Percentage increase at State Road 780 is plotted versus recurrence interval in figure 15.

Data shown in figure 15 indicate that dike effects decrease as recurrence intervals increase. The largest increase is about 19 percent for 2-year flood peaks at State Road 780. Flood-peak discharges having recurrence intervals of 50 years or greater will not be affected by Tatum Sawgrass dikes. Floods of this magnitude are expected to overtop dikes, returning storage capacity in Tatum Sawgrass to its capacity under natural conditions.

The difference between diked and natural condition flood heights are summarized by cross section in tables 6, 7 and 8. The maximum flood height increase is 0.8 ft and occurs at cross-sections 66 through 76, for a 2-year flood.

Using cross-section flood widths computed in the step-backwater analysis, it is estimated that diking may cause approximately 1,200 additional acres along Myakka River main stem to be inundated during the 2-year flood. This is an 11 percent increase in area of inundation when averaged over the 33 mi between Tatum Sawgrass outlet (cross-section 178) and cross-section 48. However, area of inundation is related to channel geometry and local topography. Effects in selected areas may be considerably more extreme. Between cross-sections 66 and 76 it is estimated that approximately 350 additional acres may be inundated during the 2-year flood. This is an increase of 62 percent.

If additional dikes are constructed, or if existing dikes are altered, further study may be required to evaluate the extent of areal flooding under the new conditions.

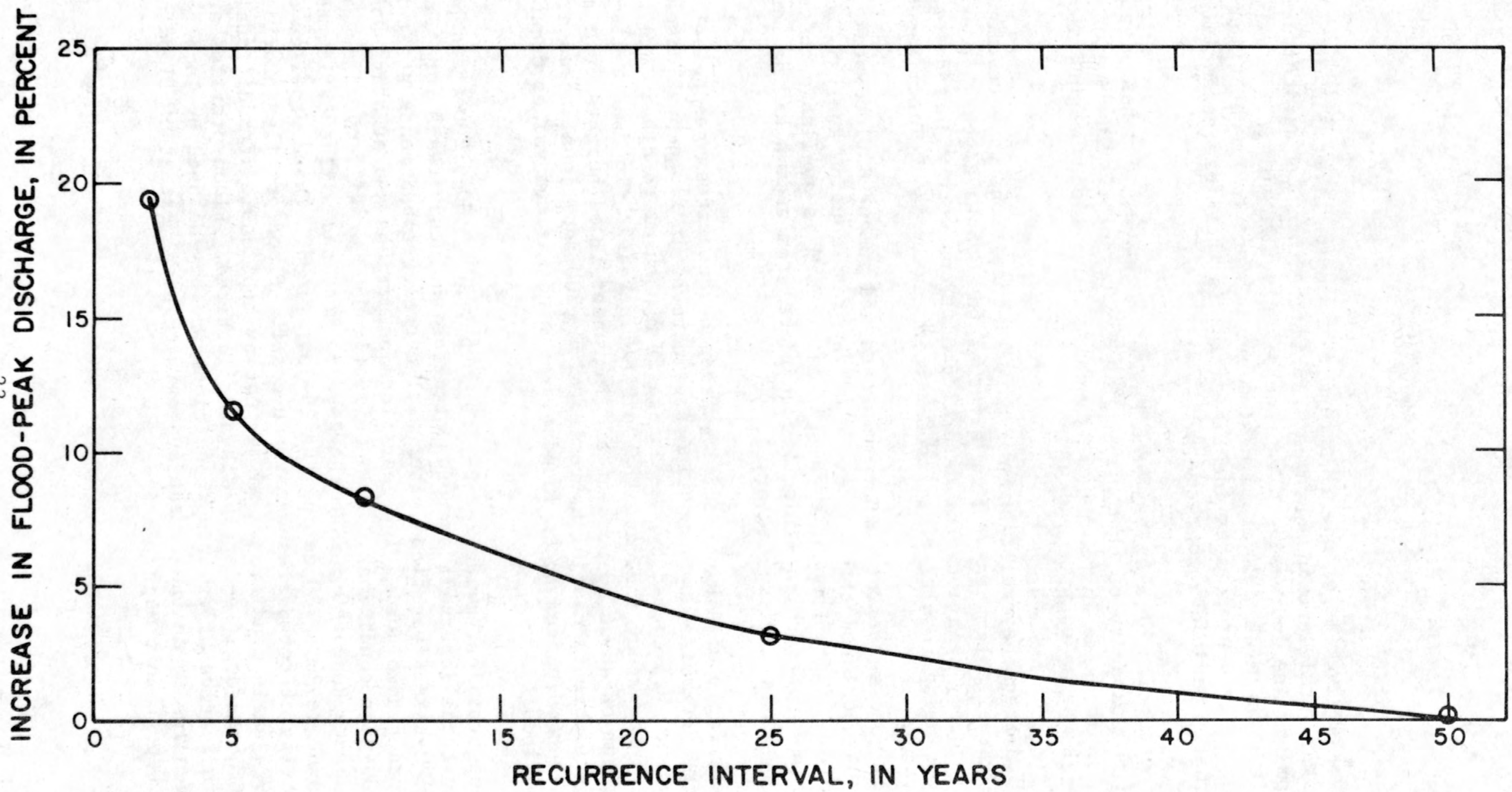

Figure 15. --Percentage increase in flood-peak discharges at Myakka River at State Road 780 caused by Tatum Sawgrass dikes

SUMMARY

Myakka River is a coastal stream that drains about 550 mi^2 of predominantly rural land in southwest Florida. Urban and agricultural developments are increasing along the river's flood plain. Low-lying areas near the Myakka River main stem are subject to frequent and severe flooding. Flood-prone area identification is therefore essential to insure orderly basin development.

Construction of a system of dikes in Tatum Sawgrass has significantly reduced the capacity of that depression for temporary flood-water storage, causing an increase in flood-peak discharges and flood heights along downstream reaches of Myakka River.

Flood-frequency relations for natural conditions were developed from weighted areal estimates at four sites on the Myakka River main stem. Flood-frequency relations for natural conditions were adjusted for diked conditions using results of a flood-routing analysis in Tatum Sawgrass.

Very good agreement between observed and computed flood-peak discharges was achieved through the Tatum Sawgrass routing analysis. However, only a limited amount of historical record is available to verify the routing procedure; all flood records are from storms having less than a 25-year recurrence interval.

The effects of diking Tatum Sawgrass on downstream reaches of Myakka River were determined by computing the increase in flood-peak discharges and flood heights caused by the change from natural to diked conditions. Results of the study indicate that diking increases flood-peak discharges by a maximum of about 19 percent and increases flood heights by a maximum of 0.8 ft (table 6) causing approximately 1,200 additional acres along Myakka River main stem to be inundated. These maximum values occur for a 2-year flood.

Flood profiles having 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence intervals are presented for the study reach for diked conditions. Myakka River flood water will overflow embankments at State Road 72 and Border Road during 100-year flood conditions and at State Road 780 during 500-year conditions. Clay Gully flood water will overflow embankments at State Road 780 during the 2-year flood and will overflow the bridge on State Road 780 during the 25-year flood. These profiles do not cover tidally affected areas near the coast. Flood profiles provided represent 1974 basin conditions and may not be applicable if additional dikes are constructed or if existing dikes are altered. Flood profiles are considered indicative of existing conditions and may be used by local governmental agencies to delineate the approximate areal extent of flooding on detailed topographic maps.

Table 1.--Myakka River streamflow stations

Site number	Name	Location	Cross-section number	Drainage area (mi^2)	Type of record	Period of record
1	Myakka River at Myakka City	at State Road 70, Manatee County	238[1]	125	Daily stage and discharge	1963-66
2	Myakka River at outlet of Tatum Sawgrass	at State Road 780, Sarasota County	178[1]	174	Miscellaneous stage and discharge	1974, 1976
3	Clay Gully	at State Road 780, Manatee County	12[2]	Indeterminate	Miscellaneous stage and discharge	1974, 1976
4	Myakka River below Upper Myakka Lake near Sarasota	in boat basin on south shore of Upper Myakka Lake, Sarasota County	154[1]	220	Daily stage and discharge	1946-51
5	Myakka River near Sarasota	14 mi southeast of Sarasota, Sarasota County	132[1]	235	Daily stage and discharge	1937-77
6	Myakka River below Lower Myakka Lake near Sarasota	900 ft upstream from Lower Myakka Lake outlet, Sarasota County	112[1]	240	Daily stage and discharge	1946-51

Footnotes are at end of table.

Table 1.--Myakka River streamflow stations - continued

Site number	Name	Location	Cross-section number	Drainage area (mi^2)	Type of record	Period of record
7	Myakka River near Venice	at Blackburn Bridge (Border Road), Sarasota County	65[1]	270	Crest stage and miscellaneous discharge	1962-66
8	Blackburn Canal near Venice	at Jackson Road, 5.3 mi northeast of Venice, Sarasota County	54[3]	Indeterminate	Miscellaneous stage and discharge	1959, 1963

1/ See figure 2.

2/ See figure 4.

3/ See figure 5.

Table 2.--Areal flood-frequency relations

Flood-peak discharge prediction equation	Average standard error of estimate	Multiple correlation coefficient
$Q_2 = 23.281 A^{.817} L^{.184} S^{.546} P^{-.446}$	27.3	0.97
$Q_5 = 38.994 A^{.688} L^{.400} S^{.582} P^{-.450}$	23.7	.98
$Q_{10} = 49.88 A^{.624} L^{.516} S^{.601} P^{-.453}$	23.0	.98
$Q_{25} = 64.269 A^{.557} L^{.642} S^{.620} P^{-.458}$	23.4	.98
$Q_{50} = 74.817 A^{.515} L^{.724} S^{.634} P^{-.461}$	24.6	.98
$Q_{100} = 85.507 A^{.479} L^{.799} S^{.645} P^{-.465}$	26.1	.97
$Q_{200} = 95.940 A^{.446} L^{.869} S^{.656} P^{-.468}$	27.8	.97
$Q_{500} = 109.901 A^{.407} L^{.954} S^{.668} P^{-.472}$	30.4	.97

A - Drainage area in mi^2

S - Main-channel slope, in ft per mi is the average slope of the main channel between points 10 and 85 percent of the distance upstream from the gaging site to the basin border

Q_{50} - Flood-peak discharge, in ft^3/s, for the 50-year recurrence-interval flood

L - Main-channel length in mi from gaging site to basin border

P - Percent of drainage basin as lakes and swamps

Table 3.--Myakka River flood heights, diked conditions

Cross-section number[1]	Distance upstream from U.S. Highway 41 (feet)	Flood heights (feet above mean sea level)							
		Recurrence interval (years)							
		2	5	10	25	50	100	200	500
46	25,130	3.4	4.8	5.7	6.6	7.2	7.8	8.2	8.9
48	28,160	3.6	5.1	5.9	6.9	7.6	8.2	8.7	9.4
50	30,090	3.8	5.3	6.2	7.2	7.8	8.4	9.1	9.8
52	32,050	4.1	5.6	6.4	7.4	8.1	8.7	9.4	10.0
54	36,330	4.6	6.2	6.9	7.9	8.6	9.2	9.9	10.5
56	39,650	5.1	6.7	7.4	8.4	9.1	9.7	10.4	11.0
58	42,375	5.4	7.2	8.2	9.2	9.9	10.6	11.2	11.9
60	45,990	5.8	7.9	9.2	10.4	11.2	11.9	12.5	13.0
62	47,550	6.0	8.2	9.4	10.8	11.4	12.1	12.7	13.3
[2]64	49,000	6.0	8.2	9.4	10.8	11.4	12.1	12.7	13.4
[3]65	49,150	6.4	8.7	9.9	11.1	11.7	12.4	13.0	13.5
66	50,450	8.4	11.0	12.0	12.9	13.3	13.7	14.0	14.3
68	52,380	9.4	12.0	12.7	13.5	13.8	14.2	14.5	14.8
70	55,100	9.9	12.2	13.0	13.8	14.1	14.4	14.6	15.0
72	57,200	10.2	12.4	13.1	13.9	14.1	14.4	14.6	15.0
74	59,960	10.7	12.7	13.4	14.1	14.3	14.6	15.0	15.3
76	62,730	11.2	13.0	13.7	14.4	14.6	14.9	15.2	15.6
78	65,600	11.5	13.2	13.9	14.6	14.8	15.1	15.5	15.8
80	67,920	12.0	13.5	14.2	14.9	15.1	15.4	15.7	16.1
82	71,520	12.5	14.0	14.6	15.2	15.3	15.6	16.0	16.3
84	74,960	13.0	14.2	14.9	15.5	15.6	15.9	16.2	16.6
86	76,880	13.2	14.5	15.1	15.7	15.8	16.1	16.5	16.8
88	79,300	13.6	14.7	15.4	16.0	16.1	16.4	16.7	17.1
90	82,470	14.1	15.1	15.6	16.2	16.4	16.7	17.1	17.4

Footnotes are at end of table.

Table 3.--Myakka River flood heights, diked conditions - continued

Cross-section number 1/	Distance upstream from U.S. Highway 41 (feet)	Flood heights (feet above mean sea level)							
		Recurrence interval (years)							
		2	5	10	25	50	100	200	500
92	85,170	14.3	15.5	16.0	16.6	16.8	17.1	17.6	17.9
94	87,320	14.6	15.7	16.2	16.8	17.0	17.3	17.8	18.2
96	89,360	14.8	16.0	16.5	17.1	17.3	17.6	18.1	18.4
98	92,560	15.1	16.2	16.7	17.3	17.5	17.8	18.3	18.7
100	96,270	15.4	16.5	17.0	17.6	17.8	18.1	18.6	18.9
102	98,390	15.7	16.6	17.2	17.8	18.0	18.3	18.8	19.2
104	100,510	15.8	16.8	17.3	18.0	18.2	18.6	19.1	19.4
106	103,460	16.0	16.9	17.5	18.1	18.2	18.6	19.1	19.5
108	106,130	16.0	16.9	17.5	18.1	18.2	18.6	19.1	19.5
110	107,480	16.0	16.9	17.5	18.1	18.2	18.6	19.1	19.5
4/ 112	109,570	16.0	16.9	17.6	18.2	18.3	18.7	19.2	19.8
114	112,500	16.0	17.0	17.7	18.5	18.6	19.0	19.5	20.0
120	118,750	16.0	17.0	17.8	18.6	18.8	19.2	19.7	20.3
122	122,290	16.0	17.0	17.8	18.6	18.8	19.2	19.7	20.3
124	125,660	16.1	17.1	17.9	18.7	18.8	19.2	19.7	20.3
126	127,620	16.2	17.1	17.9	18.7	18.8	19.2	19.7	20.3
2/ 128	129,150	16.2	17.1	17.9	18.7	18.8	19.2	19.7	20.3
130	129,820	16.2	17.2	17.9	18.7	18.8	19.3	19.7	20.3
5/ 132	132,120	16.9	18.0	18.5	19.0	19.4	19.8	20.1	20.4
134	134,880	16.9	18.0	18.5	19.0	19.4	19.8	20.1	20.4
136	135,820	16.9	18.0	18.5	19.0	19.4	19.8	20.1	20.4
138	136,090	16.9	18.0	18.5	19.0	19.4	19.8	20.1	20.4
140	139,970	17.2	18.0	18.5	19.0	19.4	19.8	20.1	20.5
142	144,240	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8

Table 3.--Myakka River flood heights, diked conditions - continued

Cross-section number[1/]	Distance upstream from U.S. Highway 41 (feet)	Flood heights (feet above mean sea level)							
		Recurrence interval (years)							
		2	5	10	25	50	100	200	500
144	144,720	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
146	145,160	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
148	146,670	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
150	149,000	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
152	151,280	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
[2/][6/] 154	153,070	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
155	153,400	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
156	153,750	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
157	156,300	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
158	157,000	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
159	158,600	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
160	159,400	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
164	160,120	17.4	18.1	18.6	19.1	19.5	19.9	20.3	20.8
[2/] 166	161,940	17.7	18.4	18.8	19.4	19.8	20.2	20.5	21.0
168	164,260	18.4	19.0	19.4	19.9	20.3	20.7	21.1	21.8
170	166,790	18.7	19.3	19.6	20.1	20.5	20.9	21.4	22.0
172	168,940	18.9	19.5	19.9	20.6	21.0	21.4	21.8	22.4
174	169,700	18.9	19.5	19.9	20.6	21.0	21.4	21.8	22.4
176	173,550	19.0	19.8	20.1	20.9	21.3	21.7	22.1	22.7
177	174,300	19.0	19.9	20.4	21.1	21.5	21.9	22.4	23.0
[7/] 178	174,650	19.0	19.9	20.4	21.1	21.5	21.9	22.5	23.2
[2/] 183C	178,300	19.0	19.9	20.4	21.1	21.5	21.9	22.5	23.2
185	179,450	19.3	20.3	20.8	21.4	21.8	22.2	22.8	23.5
188	179,550	19.3	20.3	20.8	21.4	21.8	22.2	22.8	23.5

Table 3.--Myakka River flood heights, diked conditions - continued

Cross-section number[1/]	Distance upstream from U.S. Highway 41 (feet)	Flood heights (feet above mean sea level)							
		Recurrence interval (years)							
		2	5	10	25	50	100	200	500
188B	180,650	19.8	20.9	21.5	22.1	22.5	22.9	23.3	23.9
189A	181,500	20.2	21.4	21.9	22.5	22.9	23.3	23.6	24.1
190	182,750	21.0	22.1	22.5	23.0	23.4	23.8	24.0	24.4
191	183,850	21.5	22.6	22.9	23.4	23.7	24.0	24.2	24.6
192	184,750	22.3	23.2	23.5	23.9	24.2	24.5	24.7	25.0
194	185,050	22.5	23.4	23.8	24.1	24.4	24.7	24.9	25.1
196	186,850	22.9	23.7	24.1	24.5	24.8	25.0	25.3	25.5
198	188,900	23.6	24.4	24.8	25.2	25.4	25.6	25.9	26.1
200	191,000	24.6	25.3	25.6	25.9	26.2	26.4	26.6	26.8
202	193,700	25.6	26.2	26.5	26.8	27.1	27.2	27.4	27.5
204	195,850	26.3	27.0	27.3	27.7	27.9	28.1	28.4	28.5
206	197,950	26.8	27.5	27.7	28.1	28.4	28.6	28.9	29.1
208	200,300	27.1	27.9	28.0	28.3	28.7	28.9	29.1	29.4
209	203,400	27.3	28.0	28.2	28.6	28.9	29.1	29.4	29.6
210	205,800	28.0	28.6	29.0	29.3	29.8	30.1	30.4	30.7
212	209,500	30.0	31.0	31.6	32.2	32.5	32.9	33.2	33.5
214	212,250	30.5	31.4	32.0	32.6	32.9	33.1	33.4	33.7
216	214,950	30.7	31.7	32.2	32.8	33.1	33.4	33.7	34.0
218	217,550	31.0	31.9	32.5	33.1	33.4	33.6	33.9	34.2
220	219,250	31.1	32.2	32.7	33.3	33.6	33.9	34.2	34.5
222	221,300	31.2	32.3	33.0	33.6	33.9	34.1	34.4	34.7
224	223,550	31.5	32.6	33.3	34.1	34.4	34.6	35.0	35.3
226	226,800	32.5	33.7	34.5	35.3	35.6	36.0	36.4	36.7
228	229,800	33.5	34.6	35.2	36.1	36.4	36.8	37.1	37.6

Table 3.--Myakka River flood heights, diked conditions - continued

Cross-section number[1/]	Distance upstream from U.S. Highway 41 (feet)	Flood heights (feet above mean sea level)							
		Recurrence interval (years)							
		2	5	10	25	50	100	200	500
230	231,550	34.5	35.5	36.0	36.6	37.0	37.3	37.6	38.1
232	235,900	35.8	36.9	37.4	37.9	38.2	38.4	38.6	38.9
[2/]234	237,550	36.0	37.1	37.7	38.3	38.6	38.9	39.1	39.4
236	238,200	36.0	37.1	37.7	38.3	38.6	38.9	39.1	39.4
[8/]238	238,600	36.2	37.3	37.7	38.3	38.6	38.9	39.1	39.5

1/ Cross-section numbers refer to location of stream channel cross sections shown in figure 2.

2/ Reduced flood-peak discharges are introduced into step-backwater computations at this cross section to account for decreased drainage area.

3/ Myakka River near Venice (site 7, fig. 2, table 1).

4/ Myakka River below Lower Myakka Lake near Sarasota (site 6, fig. 2, table 1).

5/ Myakka River near Sarasota (site 5, fig. 2, table 1).

6/ Myakka River below Upper Myakka Lake near Sarasota (site 4, fig. 2, table 1).

7/ Myakka River at outlet of Tatum Sawgrass (site 2, fig. 2, table 1).

8/ Myakka River at Myakka City (site 1, fig. 2, table 1).

Table 4.--Clay Gully flood heights, diked conditions

Cross-section number 1/	Distance upstream from confluence with Myakka River (feet)	Flood heights (feet above mean sea level)							
		Recurrence interval (years)							
		2	5	10	25	50	100	200	500
2	1,850	17.7	18.4	18.8	19.4	19.8	20.2	20.5	21.0
4	2,750	17.8	18.5	18.9	19.5	19.9	20.3	20.6	21.1
6	4,400	18.4	19.2	19.7	20.3	20.7	21.0	21.4	21.8
8	6,000	19.4	20.3	20.8	21.3	21.7	22.0	22.4	22.9
10	7,600	20.6	21.5	22.1	22.6	22.9	23.3	23.7	24.2
2/ 12	8,150	20.8	21.7	22.3	22.8	23.2	23.5	24.0	24.4
14	8,400	20.8	21.7	22.3	22.8	23.2	23.5	24.0	24.4
3/ 16	9,900	21.1	22.0	22.6	23.1	23.4	23.8	24.2	24.7
18	11,200	21.2	22.0	22.6	23.1	23.4	23.8	24.2	24.7

1/ Cross-section numbers refer to location of stream channel cross sections shown in figure 4.

2/ Clay Gully at State Road 780 (site 3, fig. 2, table 1).

3/ Reduced flood-peak discharges are introduced into step-backwater computations at this cross section to account for decreased drainage area.

Table 5.--Blackburn Canal flood heights, diked conditions

Cross-section number[1/]	Distance upstream from U.S. Highway 41 (feet)	Flood heights (feet above mean sea level)							
		Recurrence interval (years)							
		2	5	10	25	50	100	200	500
[2/]54	30,800	4.1	7.2	8.2	9.2	9.7	10.6	11.7	12.9
58	31,200	4.1	7.2	8.2	9.2	9.7	10.7	11.8	12.9
60	32,000	4.2	7.5	8.4	9.4	10.0	10.9	12.1	13.1
62	33,700	4.5	7.7	8.7	9.7	10.2	11.2	12.3	13.1

1/ Cross-section numbers refer to location of stream channel cross sections shown in figure 5.

2/ Blackburn Canal near Venice (site 8, fig. 2, table 1).

Table 6.--Increase in Myakka River flood heights caused by diking

Cross-section number[1/]	Distance upstream from U.S. Highway 41 (feet)	Diked minus natural condition flood heights (feet)			
		Recurrence interval (years)			
		2	5	10	25
46	25,130	0.5	0.2	0.2	0.1
48	28,160	0.5	0.2	0.1	0.1
50	30,090	0.6	0.2	0.1	0.1
52	32,050	0.6	0.2	0.1	0.1
54	36,330	0.6	0.2	0.1	0.1
56	39,650	0.6	0.2	0.1	0.1
58	42,375	0.6	0.2	0.3	0.1
60	45,990	0.7	0.5	0.4	0.1
62	47,550	0.7	0.5	0.4	0.1
64	49,000	0.7	0.5	0.4	0.1
[2/] 65	49,150	0.7	0.5	0.4	0.1
66	50,450	0.8	0.5	0.2	0.0
68	52,380	0.8	0.5	0.2	0.0
70	55,100	0.8	0.4	0.2	0.0
72	57,200	0.8	0.3	0.2	0.1
74	59,960	0.8	0.3	0.2	0.1
76	62,730	0.8	0.3	0.2	0.1
78	65,600	0.7	0.3	0.2	0.1
80	67,920	0.7	0.3	0.2	0.1
82	71,520	0.4	0.3	0.1	0.0
84	74,960	0.4	0.3	0.1	0.0
86	76,880	0.4	0.3	0.1	0.0
88	79,300	0.4	0.3	0.1	0.0
90	82,470	0.4	0.2	0.1	0.0
92	85,170	0.4	0.2	0.1	0.0
94	87,320	0.4	0.2	0.1	0.0
96	89,360	0.4	0.3	0.1	0.0
98	92,560	0.4	0.3	0.1	0.0
100	96,270	0.3	0.3	0.1	0.0
102	98,390	0.3	0.2	0.1	0.0
104	100,510	0.2	0.2	0.1	0.1
106	103,460	0.3	0.2	0.1	0.0
108	106,130	0.3	0.2	0.1	0.0
110	107,480	0.3	0.2	0.1	0.0
[3/] 112	109,570	0.3	0.2	0.1	0.1

Footnotes are at end of table.

Table 6.--Increase in Myakka River flood heights caused by diking - continued

Cross-section number[1/]	Distance upstream from U.S. Highway 41 (feet)	Diked minus natural condition flood heights (feet)			
		Recurrence interval (years)			
		2	5	10	25
114	112,500	0.3	0.2	0.1	0.2
120	118,750	0.3	0.2	0.1	0.1
122	122,290	0.3	0.2	0.1	0.1
124	125,660	0.3	0.2	0.1	0.1
126	127,620	0.2	0.2	0.1	0.1
128	129,150	0.2	0.2	0.1	0.1
130	129,820	0.2	0.2	0.1	0.1
[4/] 132	132,120	0.3	0.2	0.1	0.0
134	134,880	0.3	0.2	0.1	0.0
136	135,820	0.3	0.2	0.1	0.0
138	136,090	0.3	0.2	0.1	0.0
140	139,970	0.3	0.2	0.1	0.0
142	144,240	0.3	0.2	0.1	0.0
144	144,720	0.3	0.2	0.1	0.0
146	145,160	0.3	0.2	0.1	0.0
148	146,670	0.3	0.2	0.1	0.0
150	149,000	0.3	0.2	0.1	0.0
152	151,280	0.3	0.2	0.1	0.0
[5/] 154	153,070	0.3	0.2	0.1	0.0
155	153,400	0.3	0.2	0.1	0.0
156	153,750	0.3	0.2	0.1	0.0
157	156,300	0.3	0.2	0.1	0.0
158	157,000	0.3	0.2	0.1	0.0
159	158,600	0.3	0.2	0.1	0.0
160	159,400	0.3	0.2	0.1	0.0
164	160,120	0.3	0.2	0.1	0.0
166	161,940	0.3	0.2	0.1	0.0
168	164,260	0.3	0.2	0.1	0.0
170	166,790	0.3	0.2	0.1	0.0
172	168,940	0.3	0.2	0.1	0.0
174	169,700	0.3	0.2	0.1	0.0
176	173,550	0.4	0.3	0.1	0.0
177	174,300	0.4	0.3	0.1	0.0
[6/] 178	174,650	0.4	0.3	0.1	0.0
183C	178,300	0.4	0.3	0.1	0.0

Table 6.--Increase in Myakka River flood heights caused by diking - continued

Cross-section number 1/	Distance upstream from U.S. Highway 41 (feet)	Diked minus natural condition flood heights (feet) Recurrence interval (years)			
		2	5	10	25
185	179,450	0.1	0.1	0.0	0.0
188	179,550	0.1	0.1	0.0	0.0
188B	180,650	0.1	0.0	0.0	0.0
189A	181,500	0.0	0.0	0.0	0.0
190	182,750	0.0	0.0	0.0	0.0
191	183,850	0.0	0.0	0.0	0.0

1/ Cross-section numbers refer to location of stream channel cross sections shown in figure 2.

2/ Myakka River near Venice (site 7, fig. 2, table 1).

3/ Myakka River below Lower Myakka Lake near Sarasota (site 6, fig. 2, table 1).

4/ Myakka River near Sarasota (site 5, fig. 2, table 1).

5/ Myakka River below Upper Myakka Lake near Sarasota (site 4, fig. 2, table 1).

6/ Myakka River at outlet of Tatum Sawgrass (site 2, fig. 2, table 1).

Table 7.--Increase in Clay Gully flood heights caused by diking

Cross-section number 1/	Distance upstream from confluence with Myakka River (feet)	Diked minus natural condition flood heights (feet)			
		Recurrence interval (years)			
		2	5	10	25
2	1,850	0.3	0.2	0.1	0.0
4	2,750	0.3	0.2	0.1	0.0
6	4,400	0.4	0.3	0.1	0.1
8	6,000	0.5	0.3	0.1	0.1
10	7,600	0.5	0.2	0.1	0.1
2/ 12	8,150	0.5	0.2	0.1	0.1
14	8,400	0.5	0.2	0.1	0.1
16	9,900	0.4	0.2	0.1	0.1
18	11,200	0.2	0.1	0.1	0.1

1/ Cross-section numbers refer to location of stream channel cross sections shown in figure 4.

2/ Clay Gully at State Road 780 (site 3, fig. 2, table 1).

Table 8.--Increase in Blackburn Canal flood heights caused by diking

Cross-section number 1/	Distance upstream from U.S. Highway 41 (feet)	Diked minus natural condition flood heights (feet)			
		Recurrence interval (years)			
		2	5	10	25
2/ 54	30,800	0.5	0.3	0.2	0.1
58	31,200	0.5	0.3	0.2	0.1
60	32,000	0.5	0.4	0.2	0.1
62	33,700	0.5	0.4	0.2	0.1

1/ Cross-section numbers refer to location of stream channel cross sections shown in figure 5.

2/ Blackburn Canal near Venice (site 8, fig. 2, table 1).

SELECTED REFERENCES

Barnes, H. H., Jr., 1967, Roughness characteristics of natural channels: U.S. Geol. Survey Water-Supply Paper 1849, 213 p.

Bryant, Edward C., 1960, Statistical analysis: New York, McGraw-Hill, 321 p.

Chow, V. T., 1959, Open channel hydraulics: New York, McGraw-Hill, p. 106-109, 265, 268.

__________, 1964, Handbook of Applied Hydrology: New York, McGraw-Hill Book Co., Inc., 1,468 p.

Department of Housing and Urban Development, 1976, Sarasota County, Florida, FIA flood insurance rate map No. I-35: Federal Insurance Administration, 1 p. (map).

Inter-Agency Committee on Water Resources, 1966, Methods of flow frequency analysis: Soil Conservation Service, Notes on Hydrologic Activities Bulletin No. 13, 42 p.

Langbein, W. B., and Iseri, K. T., 1960, General introduction and hydrologic definitions: U.S. Geol. Survey Water-Supply Paper 1541-A, 29 p.

Posey, D. J., 1950, Gradually varied channel flow, in Rouse, H., ed., Engineering Hydraulics: New York, John Wiley and Sons, p. 625-629.

Rabon, James W., 1971, Evaluation of stream flow-data program in Florida: U.S. Geol. Survey open-file rept. 70-008, 70 p.

Shearman, J. O., 1976, Computer applications for step-backwater and floodway analyses: U.S. Geol. Survey open-file rept. 76-499.

Water Resources Council, 1976, Guidelines for determining flood-flow frequencies: Hydrology Committee Bulletin No. 17, U.S. Government Printing Office, Washington, D. C.

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