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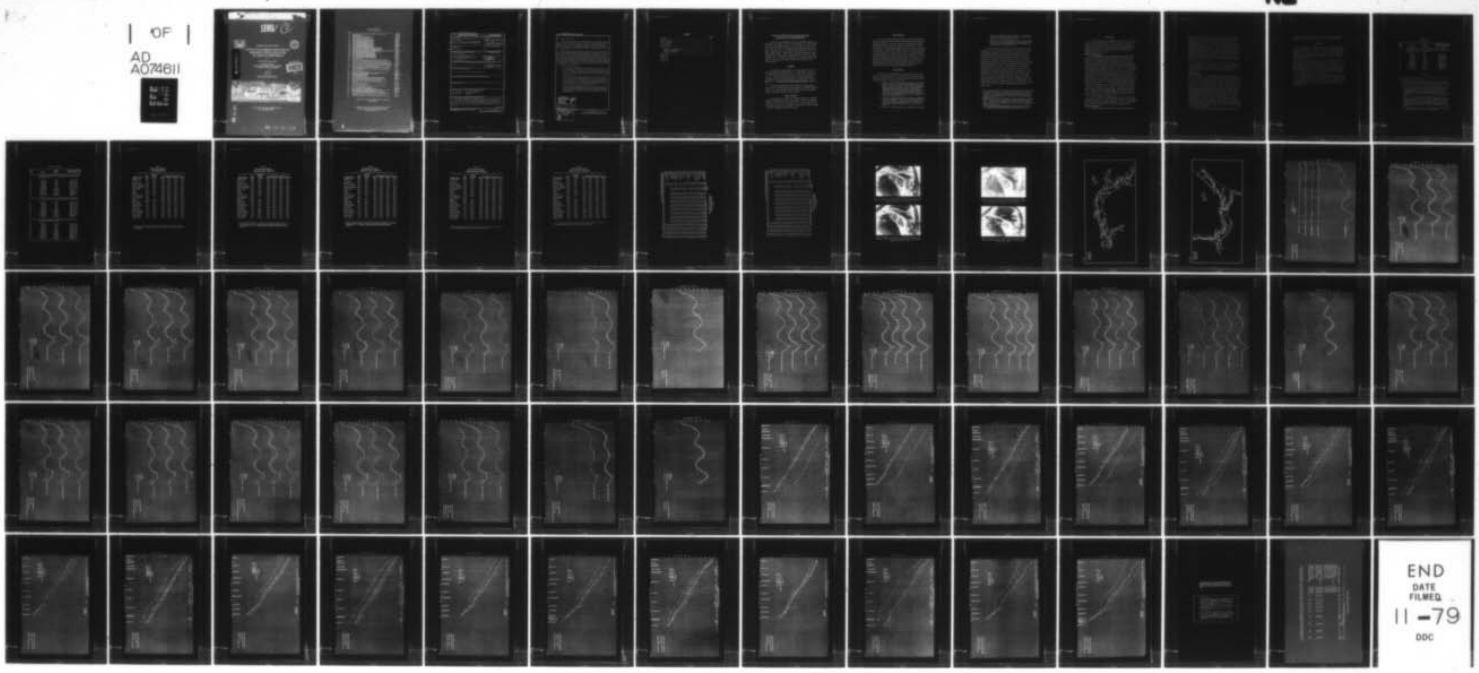

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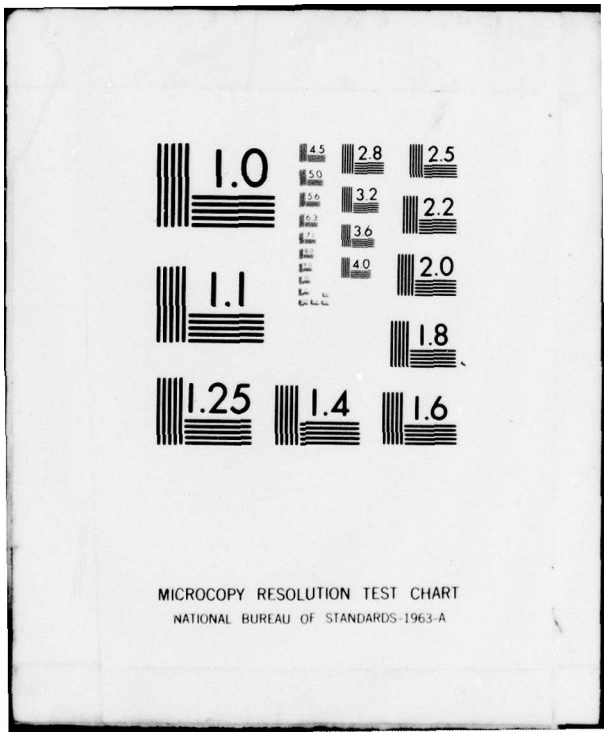
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MISSISSIPPI BASIN MODEL REPORT 81-6

EFFECTS OF OVERBANK VEGETATION ON MISSISSIPPI RIVER STAGES IN THE ST. LOUIS-TO-THEBES REACH

by

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MISSISSIPPI BASIN MODEL REPORTS

Issued Prior to and Including This Report

Report No.	Title	Date
1-1	Preliminary Report on Proposed Reservoir Operation Model, Mississippi River and Tributaries	October 1942
1-2	Report on Proposed Site	October 1942
1-3	Definite Project Report	April 1943
1-4	Description of the Mississippi Basin Model	July 1951
1-5	Automatic Instrumentation of the Mississippi Basin Model	November 1955
1-6	History and Description of the Mississippi Basin Model	August 1971
2-1	Report of First Meeting of Mississippi Basin Model Board	October 1945
2-2	Report of Second Meeting of Mississippi Basin Model Board	March 1947
2-3	Report of Third Meeting of Mississippi Basin Model Board	May 1948
2-4	Report of Fourth Meeting of Mississippi Basin Model Board	August 1948
2-5	Report of Fifth Meeting of Mississippi Basin Model Board	June 1949
2-6	Report of Sixth Meeting of Mississippi Basin Model Board	March 1950
2-7	Report of Seventh Meeting of Mississippi Basin Model Board	March 1951
2-8	Report of Eighth Meeting of Mississippi Basin Model Board	August 1952
2-9	Report of Ninth Meeting of Mississippi Basin Model Board	September 1953
2-10	Report of Tenth Meeting of Mississippi Basin Model Board	October 1954
2-11	Report of Eleventh Meeting of Mississippi Basin Model Board	October 1955
2-12	Report of Twelfth Meeting of Mississippi Basin Model Board	May 1956
2-13	Report of Thirteenth (Fiscal Year 1957) Meeting of Mississippi Basin Model Board	May 1957
2-14	Report of Fourteenth (Fiscal Year 1958) Meeting of Mississippi Basin Model Board	May 1958
2-15	Report of Fifteenth (Fiscal Year 1959) Meeting of Mississippi Basin Model Board	May 1959
2-16	Report of Sixteenth Meeting of Mississippi Basin Model Board, Fiscal Year 1960	June 1960
2-17	Special Report of the Mississippi Basin Model on Curtailment of Model Limits (Seventeenth Meeting of the Board)	September 1960
2-18	Report of Eighteenth Meeting of Mississippi Basin Model Board, Fiscal Year 1961	July 1961
2-19	Report of Nineteenth Meeting of Mississippi Basin Model Board	July 1962
2-20	Report of Twentieth Meeting of Mississippi Basin Model Board	August 1963
2-21	Report of Twenty-First Meeting of Mississippi Basin Model Board	April 1964
2-22	Report of Twenty-Second Meeting of Mississippi Basin Model Board	April 1965
2-23	Report of Twenty-Third Meeting of Mississippi Basin Model Board	May 1966
2-24	Report of Twenty-Fourth Meeting of Mississippi Basin Model Board	June 1967
2-25	Report of Twenty-Fifth Meeting of Mississippi Basin Model Board	June 1968
2-26	Report of Twenty-Sixth Meeting of Mississippi Basin Model Board	June 1969
2-27	Report of Twenty-Seventh Meeting of Mississippi Basin Model Board	June 1970
3-1	The Mississippi Basin Model	Rev April 1958
12-1	Verification of Sioux City-to-Hermann Reach, Missouri River and Tributaries, 1950 and 1947 Floods	April 1952
12-2	Verification of Sioux City-to-Mouth Reach, Missouri River and Tributaries, 1952 and 1951 Floods	June 1962
13-1	Verification of the Pickwick Dam-Kentucky Dam Reach, Tennessee River and Tributaries, 1950 and 1948 Floods	December 1960
14-1	Verification of Tulsa-to-Van Buren Reach, Arkansas River and Tributaries, Spring 1941 and 1943 Floods	July 1951
14-2	Verification of Van Buren-to-Pine Bluff Reach, Arkansas River and Tributaries, Spring 1941 and 1943 Floods	November 1952
15-1	Verification of Hannibal-to-St. Louis Reach, Mississippi River and Tributaries, 1947, 1944, and 1943 Floods	August 1951
15-2	Verification of Hannibal-to-Thebes Reach, Mississippi River and Tributaries, 1947, 1944, and 1943 Floods	May 1952
23-1	Effects of Reservoirs and Results of Steady-Flow Tests, Cumberland River	June 1965
23-2	Kentucky Reservoir Steady Flow Profiles and Effects of Pickwick Discharge Duration on Downstream Stages	July 1965
23-3	Effects of Cheatham and Barkley Reservoirs and Coordinated Operation of Barkley and Kentucky Reservoirs, Cumberland and Tennessee Rivers	May 1969
24-1	Flood-Routing and Reservoir-Operation Study, Tulsa-to-Van Buren Reach, Arkansas River and Tributaries	April 1961
29-1	Comprehensive Testing Program	November 1971
31-1	Operation of the Birds Point-New Madrid Floodway	July 1957
31-2	Adequacy of Project Levee Grades in Hannibal-to-Thebes Reach, Mississippi River and Tributaries	April 1957
31-3	Proposed Alignments for Columbia Bottoms Levee, St. Louis Industrial Park	January 1960
31-4	Mississippi River Hypothetical Flood 52A	September 1962
31-5	Flowline Study, Mississippi and Illinois Rivers	June 1977
31-6	Birds Point-New Madrid Floodway Operation	April 1970
31-7	Tests of Birds Point-New Madrid Floodway	March 1970
32-1	Effects of Agricultural Levees on Design Flood Profiles for Kansas City Local Protection	May 1955
32-2	Tests for Re-evaluation of Missouri River Agricultural Levees in the Kansas City District	December 1959
32-3	Tests for Re-evaluation of Missouri River Agricultural Levees in the Omaha District	May 1960
34-1	Effects of Project Levees Along Point Remove Creek, Tributary of Arkansas River	June 1956
34-2	Adequacy of Project Levee Grades Without and with Reservoir Modification, Van Buren to Pine Bluff, Arkansas River	April 1957
38-1	Effects of Height and Alignment of Levees at Confluence of Missouri and Mississippi Rivers	October 1971
42-1	Hypothetical Storms over the Iowa Tributaries	October 1956
43-1	The Ohio River Hypothetical Flood OR-1	February 1962
44-1	Determination of Discharge Hydrographs for Arkansas River and Tributaries, April 1927 Flood	June 1956
52-1	Tests of Channel Realignment near St. Joseph, Missouri	October 1956
81-1	Effects of Proposed Highway Fill Across Chesterman Island	January 1959
81-2	Effects of Proposed Chain of Rocks Dam, Mississippi River, Mile 190.1	September 1959
81-3	Effects of Roadway Construction on Mississippi River Flow, Lake County, Tennessee	December 1967
81-4	Report of Model Study, Effects of Modifying Operation of Old River Control Structure on 1945, 1961, 1967, and 1968 Flood Flows; Appendix A, Additional Hydrographs	March 1972
81-5	Report of Model Study Effects of Ultimate Channel Development in the Atchafalaya Basin	December 1972
81-6	Effects of Overbank Vegetation on Mississippi River Stages in the St. Louis-to-Thebes Reach	June 1979
86-1	Effects of Roadway Embankment and Waterway Openings of Proposed Interstate Highway 155 on Mississippi River Floods	July 1966
86-2	Effects of Southwind Maritime Centre on Ohio River Flow Conditions at Mount Vernon, Indiana	April 1972
92-1	Effects of Flood Heights of Levee, Railroad, and Highway Fills in the Flood Plain of the Missouri River	October 1955

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This model investigation was conducted on the St. Louis-to-Commerce Reach of the Mississippi Basin Model to determine stages to be expected along the Mississippi River with varying amounts of overbank vegetation between the river and its bluff line or levee. The data obtained from this study will be used to determine the sensitivity of the flow regime to land-use changes riverside of the levees.

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20. ABSTRACT (Continued).

The Mississippi Basin Model is a fixed-bed model of the Mississippi River and its tributary system built to a horizontal scale of 1:2000 and a vertical scale of 1:100. Prior to conducting this study, the model was adjusted to reproduce the 1973 flood. The overbank roughness was placed on the model at locations where aerial photographs showed timber to exist in the prototype in 1973. The density of this roughness was adjusted to reproduce prototype stages for the 1973 flood.

Four series of tests were conducted in this study. Each series simulated a different overbank vegetation condition between the river and its bluff line. For Series I, folded screen wire was installed on all areas between the river and its bluff line or levee to a density that simulated the effect of the overbank vegetation fully developed in its natural state. For Series II, folded screen wire was installed to the same density used for Series I only on overbank areas where vegetation existed in 1973. For Series III, folded screen wire was installed where overbank vegetation existed in 1973 to the density required to reproduce 1973 flood stages. For Series IV, folded screen wire was removed from overbank areas. Hydrograph flows of the 1973 flood and six steady flows were tested in each series of tests.

Test results indicate that:

a. If the existing overbank vegetation were allowed to develop fully in its natural state, the stages in the test reach would increase as much as 1.7 ft for the flows tested. This increase in density would cause a flow of 1,000,000 cfs, which would be essentially contained by 1973 levees with existing overbank vegetation, to overtop 1973 levee grades by as much as 1.1 ft.

b. If the vegetation were allowed to develop fully in its natural state over the entire overbank area from the river to its levee or bluff line, stages in the test reach would be increased by as much as 3.7 ft for the flows tested. This increase in area and density of overbank vegetation would cause a 1,000,000-cfs flow to overtop 1973 levee grades by as much as 1.6 ft. The 1973 levees would have to be raised 3.5 ft to contain this flow with this condition.

c. If the existing overbank vegetation were to be removed, stages in the test reach would be lowered by as much as 7.6 ft. With the overbank vegetation removed, all flows tested would be contained by the 1973 levees except the 1,300,000-cfs flow near Grand Tower and downstream of Devils Island.

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Contents

	Page
The Model	2
Purpose of Study	2
Model Adjustment	3
Test Procedure	3
Test Results	5
Series II vs Series III	5
Series I vs Series III	5
Series III vs IV	6
Conclusions	7
Tables 1-8	
Photos 1-4	
Plates 1-43	

EFFECTS OF OVERBANK VEGETATION ON MISSISSIPPI RIVER STAGES IN THE ST. LOUIS-TO-THEBES REACH

1. Model tests to determine the effects of overbank vegetation on Mississippi River stages in the St. Louis-to-Thebes reach were requested by the U. S. Army Engineer District, St. Louis (LMS), in letter dated 4 October 1977 to the U. S. Army Engineer Waterways Experiment Station (WES). Additional tests were requested during subsequent visits to the model by LMS personnel. Funds for the study were authorized in Intra-Army Orders No. ED 78-1, dated 4 October 1977 and No. ED 78-1R1, dated 30 August 1978. The study was conducted on the Mississippi Basin Model (MBM) at the Jackson Installation of WES during the period 8 June-11 October 1978.

The Model

2. The MBM is a fixed-bed model of the Mississippi River and its tributary system from Hannibal, Missouri, to Baton Rouge, Louisiana. It is constructed to a horizontal scale of 1:2000 and a vertical scale of 1:100. General features of this model, including appurtenances, instrumentation, and operating procedures, are described in detail in MBM Report 1-4, Description of the Mississippi Basin Model, dated July 1951.

3. The study reported herein was conducted on the Mississippi River portion of the MBM from St. Louis, Missouri, to Commerce, Missouri. Plates 1 and 2 show the model limits, streams, inflow points, gaging stations, and levee locations in the test reach.

Purpose of Study

4. These tests were conducted to determine stages to be expected along the Mississippi River with varying amounts of overbank vegetation between the river and its bluff line or levee. The data obtained from these tests will be used to determine the sensitivity of the flow regime to land-use changes riverside of the levees.

Model Adjustment

5. Prior to conducting this study, the test reach of the MBM was adjusted to reproduce the 1973 flood to ensure that the model reflected existing conditions. Levees were installed to alignments and grades furnished by the LMS the same as those that existed in 1973. Folded screen wire, cut to the average height of trees in the area, was placed on the model in locations where timber was shown on infrared photographs that were taken in 1973. Flows that occurred in the prototype during the period 3 March to 8 May 1973 (Plate 3) were introduced at model inflow points and routed to Grays Point, Missouri, where the water surface was held to elevations recorded in the prototype. The density of the screen wire and the length and spacing of channel roughness elements were adjusted until the model stage hydrographs agreed closely with those that occurred in the prototype during this period.

Test Procedure

6. Four series of tests (Table 1) were conducted in this study. Each series simulated different overbank vegetation conditions between the river and its bluff line or levee from Columbia Drainage and Levee District (mile 167) to Grays Point (mile 45).

a. Series I - Folded screen wire was installed to the density shown in Photo 1 on all overbank areas between the river and its levee or bluff line. This condition simulated the effect of overbank vegetation on the entire overbank area developed fully in its natural state. The density of screen wire to simulate this natural prototype state was determined from that required for adjustment of that portion of the model simulating areas of the Atchafalaya Basin where the overbank vegetation has developed naturally, over a long period of time.

b. Series II - Folded screen wire was installed on overbank areas where vegetation existed in 1973 to the density used in Series I (Photo 2). This condition simulated the effect of the overbank vegetation on only the areas covered by existing vegetation developed fully in its natural state.

c. Series III - Folded screen wire was installed on overbank

areas where vegetation existed in 1973 to the density required to reproduce 1973 stages (Photo 3). This condition simulated existing prototype conditions.

d. Series IV - All folded screen wire between the river and its bluff line or levee was removed. This condition simulates the effect of completely clearing the vegetation in the area along the river (Photo 4).

7. Eleven tests were conducted in each series using seven flows: prototype flows for the period 3 March-8 May 1973 (same as flows used for adjustment and shown in Plate 3) and six steady flows--600,000, 700,000, 872,000,* 889,000,** 1,000,000, and 1,300,000 cfs. These seven flows were introduced into the model and routed to Grays Point with levees to alignment and grade existing in 1973. Water-surface elevations at Grays Point were held to prototype stages for the period 3 March-8 May 1973; to the crest of the 1973 flood for steady flows of 872,000 and 889,000 cfs; and to a rating curve† for the remaining steady flows. Two of these flows, 1,000,000 and 1,300,000 cfs, were reintroduced and routed to Grays Point with the levees raised to confining grade. The water surface at Grays Point was held to the same elevation as for the corresponding flow with levees to 1973 grade. These two flows were reintroduced and routed to Commerce (7.0 miles downstream from Grays Point) with the levees to confining grade. The water-surface elevation at Commerce was held to a rating curve.† Water-surface elevations were recorded at model gaging stations shown in Plates 1 and 2.

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* Steady flow of 872,000 cfs reproduced crest stages of the 1973 flood. It consisted of 844,000 cfs on the Mississippi River at St. Louis; 11,000 cfs on the Meramec River; 8,000 cfs on the Kaskaskia River; 7,000 cfs on the Big Muddy River; and 2,000 cfs on the Little River Diversion Canal.

** Steady flow of 889,000 cfs simulated the crest discharge of the 1973 flood. It consisted of 850,000 cfs on the Mississippi River at St. Louis; 15,000 cfs on the Meramec River; 12,000 cfs on the Kaskaskia River; 10,000 cfs on the Big Muddy River; and 2,000 cfs on the Little River Diversion Canal.

† Rating curve was developed from model test results in MBM Report 31-5, Flowline Study, Mississippi and Illinois Rivers, June 1977.

Test Results

8. The stage and discharge hydrographs recorded for the four series of tests with 1973 flood flows are shown in Plates 4-25. The crest elevations are presented in Table 2. The water-surface elevations recorded for the four series of tests with the various steady flows are presented in Tables 3-8. These elevations are presented as water-surface profiles in Plates 26-43.

Series II vs Series III

9. Increasing the density of the overbank vegetation from that existing in 1973 raised the Mississippi River stages for all flows tested with the maximum increase for each flow in the vicinity of Brickeys and Little Rock Landing. The maximum increase in stages for flows of 600,000 and 700,000 cfs was only 0.3 and 0.6 ft, respectively; but for flows of the magnitude of the 1973 flood (872,000 cfs and above) the maximum increase in stages was from 1.4 to 1.7 ft. The increases in crest stages of the hydrograph flows were about the same as those for the steady flows simulating the crest stages (872,000 cfs) and discharges (889,000 cfs). With 1973 vegetation, the flow of 1,000,000 cfs overtopped the 1973 levee grades only at Waters Point and by only 0.1 ft. With this flow, increasing the density of overbank vegetation raised stages at Waters Point by 1.0 ft and caused the 1973 levees at Waters Point to be overtopped by 1.1 ft. With 1973 vegetation, the flow of 1,300,000 cfs overtopped 1973 levee grades in the entire test reach except for the area near Little Rock Landing. Increasing the density of the overbank vegetation increased stages for the flow of 1,300,000 cfs by as much as 1.7 ft (at Little Rock Landing) and caused the 1973 levees to be overtopped by as much as 3.3 ft.

10. Confining levee tests indicated that if the 1973 levees were high enough to contain the flows, increasing the density of the overbank vegetation would increase stages as much as 1.4 and 1.5 ft (at Waters Point) for flows of 1,000,000 and 1,300,000 cfs, respectively.

Series I vs Series III

11. Increasing the area and density of overbank vegetation from

that existing in 1973 raised Mississippi River stages for all flows tested with the maximum increase for the 600,000-cfs flow at Moccasin Springs and for all other flows tested at Little Rock Landing. The maximum increase was 0.9 ft for the 600,000-cfs flow, 1.6 ft for the 700,000-cfs flow, and from 3.4 to 3.7 ft for the remaining flows tested. Increasing the area and density of overbank vegetation with 1973 levees increased stages for 1,000,000 cfs to the point that the 1973 levee grades were exceeded up to 1.6 ft from Waters Point to Crawford Landing except for the area at Little Rock Landing. Increasing the area and density of the overbank vegetation with 1973 levees increased stages for 1,300,000 cfs to the point that 1973 levee grades were exceeded by as much as 4.0 ft.

12. Confining levee tests indicated that if the 1973 levees were high enough to contain the flows, increasing the area and density of overbank vegetation would increase stages as much as 4.6 and 6.2 ft (at Little Rock Landing) for flows of 1,000,000 and 1,300,000 cfs, respectively.

Series III vs IV

13. Clearing all of the overbank vegetation that existed in the area along the river in 1973 reduced Mississippi River stages throughout the test reach. The maximum reduction occurred at Waters Point for all flows except the 1,300,000 cfs; for this flow, the maximum reduction was at Brickeys. The maximum reduction with 1973 levees was from 1.9 ft for 600,000 cfs to 7.6 ft for 1,000,000 cfs. With no overbank vegetation, the only flow that overtopped the 1973 levees was 1,300,000 cfs which overtopped them only near Grand Tower and from Devils Island to Grays Point. Maximum overtopping was 3.3 ft at Grays Point. Part of this overtopping was because the Grays Point stages were held to the same elevation for all four series of tests. Test results indicate that holding stages at Commerce instead of at Grays Point would lower Grays Point stages about 2 ft, but would have little effect on the differences in stages caused by changing the density and location of overbank roughness upstream of Grays Point.

14. Confining levee tests indicated that if the 1973 levees were

high enough to contain the 1,300,000-cfs flow, clearing the overbank vegetation would reduce stages as much as 13.1 ft (at Waters Point).

Conclusions

15. If the existing overbank vegetation were allowed to develop fully in its natural state, the stages in the test reach would increase as much as 1.7 ft for the flows tested. This increase in density would cause a flow of 1,000,000 cfs, which would be essentially contained by 1973 levees with existing overbank vegetation, to overtop 1973 levee grades by as much as 1.1 ft.

16. If the vegetation were allowed to develop fully in its natural state over the entire overbank area from the river to its levee or bluff line, stages in the test reach would be increased by as much as 3.7 ft for the flows tested. This increase in area and density of overbank vegetation would cause a 1,000,000-cfs flow to overtop 1973 levee grades by as much as 1.6 ft. The 1973 levees would have to be raised 3.5 ft to contain this flow with this condition.

17. If the existing overbank vegetation were to be removed, stages in the test reach would be lowered by as much as 7.6 ft. With the overbank vegetation removed, all flows tested would be contained by the 1973 levees except the 1,300,000-cfs flow near Grand Tower and downstream of Devils Island.

Table 1

Test Conditions

Test No.	Flow*	Levee Grades	Water-Surface Elevation Controlled At
Series I - Overbank roughness simulating vegetation fully developed in its natural state on all overbank areas between channel and corresponding levee or high bank.			
1	1973 Hyd	1973	Grays Point
2	600,000	1973	Grays Point
3	700,000	1973	Grays Point
4	872,000	1973	Grays Point
5	889,000	1973	Grays Point
6	1,000,000	1973	Grays Point
7	1,000,000	Confined	Grays Point
8	1,000,000	Confined	Commerce
9	1,300,000	1973	Grays Point
10	1,300,000	Confined	Grays Point
11	1,300,000	Confined	Commerce

(Continued)

* Flows for tests were as follows:

a. Tests 1, 12, 23, and 34 - flows that occurred in the prototype during the period 3 March to 8 May 1973 were used. These flows were used in adjustment tests and are shown in Plate 3.

b. Tests 4, 15, 26, and 37 - steady flows reproducing crest stages of the 1973 flood were used. The total flow passing Grays Point was 872,000 cfs. It consisted of 844,000 cfs on the Mississippi River at St. Louis, Missouri; 11,000 cfs on the Meramec River; 8,000 cfs on the Kaskaskia River; 7,000 cfs on the Big Muddy River; and 2,000 cfs on the Little River Diversion Canal.

c. Test 5, 16, 27, and 38 - steady flows simulating the crest discharges of the 1973 flood were used. 889,000 cfs was the total flow passing Grays Point. It consisted of 850,000 cfs on the Mississippi River at St. Louis, Missouri; 15,000 cfs on the Meramec River; 12,000 cfs on the Kaskaskia River; 10,000 cfs on the Big Muddy River; and 2,000 cfs on the Little River Diversion Canal.

d. For all other tests, the total steady flow listed was introduced on the Mississippi River at St. Louis, Missouri.

Table 1 (Continued)

Test No.	Flow	Levee Grades	Water-Surface Elevation Controlled At
Series II - Overbank roughness simulating vegetation fully developed in its natural state only on overbank areas where vegetation existed in 1973.			
12	1973 Hyd	1973	Grays Point
13	600,000	1973	Grays Point
14	700,000	1973	Grays Point
15	872,000	1973	Grays Point
16	889,000	1973	Grays Point
17	1,000,000	1973	Grays Point
18	1,000,000	Confined	Grays Point
19	1,000,000	Confined	Commerce
20	1,300,000	1973	Grays Point
21	1,300,000	Confined	Grays Point
22	1,300,000	Confined	Commerce
Series III - Overbank roughness on areas where vegetation existed in 1973 to density required to reproduce 1973 flood stages.			
23	1973 Hyd	1973	Grays Point
24	600,000	1973	Grays Point
25	700,000	1973	Grays Point
26	872,000	1973	Grays Point
27	889,000	1973	Grays Point
28	1,000,000	1973	Grays Point
29	1,000,000	Confined	Grays Point
30	1,000,000	Confined	Commerce
31	1,300,000	1973	Grays Point
32	1,300,000	Confined	Grays Point
33	1,300,000	Confined	Commerce
Series IV - All overbank roughness removed between channel and corresponding levee or high bank.			
34	1973 Hyd	1973	Grays Point
35	600,000	1973	Grays Point
36	700,000	1973	Grays Point
37	872,000	1973	Grays Point
38	889,000	1973	Grays Point
39	1,000,000	1973	Grays Point
40	1,000,000	Confined	Grays Point
41	1,000,000	Confined	Commerce
42	1,300,000	1973	Grays Point
43	1,300,000	Confined	Grays Point
44	1,300,000	Confined	Commerce

Table 2

Water-Surface Elevations

1973 Hydrograph Tests

Gaging Station	River Mile	Existing Levee El ft msl	Water-Surface El, ft msl			
			Test 1	Test 12	Test 23	Test 34
Bissell Point	183.3	436.4	426.3	425.2	424.6	422.8
St. Louis	179.6	433.6	424.5	423.4	422.8	420.2
Engineer Depot	176.8	430.7	422.2	420.9	420.2	417.3
Mo. Pac. Elevator	172.6	425.5	420.3	418.9	417.9	414.6
Jefferson Barracks	169.3	424.2	418.8	417.0	416.4	412.1
Waters Point	158.5	415.4	413.2	411.9	410.6	405.4
Selma	146.0	409.5	406.8	405.2	403.9	399.4
Brickeys	136.0	405.2	401.1	399.4	398.4	395.4
Little Rock Ldg.	125.5	399.5	394.4	392.4	390.9	387.1
East Kaskaskia	116.2		389.7	388.6	388.2	384.1
Chester	109.5	390.0	385.9	384.6	384.1	379.5
Bishop Ldg.	100.8	385.4	381.6	379.6	379.0	375.4
Red Rock Ldg.	94.1	381.7	378.5	376.9	376.5	372.6
Cumberland Rock	87.0	377.2	373.9	372.1	371.9	368.3
Grand Tower	81.0	373.1	370.3	369.4	368.9	365.4
Crawford Ldg.	72.9	368.3	364.1	362.6	362.0	358.7
Moccasin Springs	66.3	364.6	360.2	358.8	358.0	354.7
Devils Island	57.3	360.3	356.4	355.4	355.2	353.4
Cape Girardeau	52.1	356.4	351.5	350.8	350.4	349.4
Grays Point*	46.3	350.4	345.8	345.8	345.8	345.8

* Water surface at Grays Point held to that recorded in the prototype during 1973 flood.

Table 3

Water-Surface Elevations

Steady Flow Tests - 600,000 cfs

Gaging Station	River Mile	Existing Levee El ft msl	Water-Surface El, ft msl			
			Test 2	Test 13	Test 24	Test 35
Bissell Point	183.3	436.4	416.3	415.9	415.9	415.3
St. Louis	179.6	433.6	414.4	414.0	414.0	413.1
Engineer Depot	176.8	430.7	412.4	412.0	412.0	411.0
Mo. Pac. Elevator	172.6	425.5	410.4	409.5	409.5	408.6
Jefferson Barracks	169.3	424.2	408.6	408.1	408.1	406.6
Waters Point	158.5	415.4	403.2	402.6	402.4	400.5
Selma	146.0	409.5	396.6	396.2	396.0	394.2
Brickeys	136.0	405.2	391.4	391.1	390.8	389.5
Little Rock Ldg.	125.5	399.5	385.0	384.4	384.4	383.3
East Kaskaskia	116.2		379.3	378.7	378.7	378.0
Chester	109.5	390.0	375.5	375.0	375.0	373.9
Bishop Ldg.	100.8	385.4	370.8	370.2	370.2	369.4
Red Rock Ldg.	94.1	381.7	367.4	366.7	366.7	365.5
Cumberland Rock	87.0	377.2	363.2	362.5	362.5	361.1
Grand Tower	81.0	373.1	360.3	359.6	359.5	358.4
Crawford Ldg.	72.9	368.3	354.4	353.7	353.6	352.3
Moccasin Springs	66.3	364.6	350.7	350.1	349.8	348.4
Devils Island	57.3	360.3	346.9	346.4	346.4	345.9
Cape Girardeau	52.1	356.4	343.0	342.4	342.3	341.7
Grays Point*	46.3	350.4	338.0	338.0	338.0	338.0

* Water surface was held to a rating curve developed from model test results in MBM report 31-5, Flowline Study, Mississippi and Illinois Rivers, June 1977.

Table 4

Water-Surface Elevations

Steady Flow Tests - 700,000 cfs

Gaging Station	River Mile	Existing Levee El ft msl	Water-Surface El, ft msl			
			Test 3	Test 14	Test 25	Test 36
Bissell Point	183.3	436.4	420.3	419.6	419.6	418.6
St. Louis	179.6	433.6	418.3	417.6	417.6	416.3
Engineer Depot	176.8	430.7	416.2	415.3	415.3	413.7
Mo. Pac. Elevator	172.6	425.5	414.2	413.1	412.9	411.0
Jefferson Barracks	169.3	424.2	412.6	411.6	411.4	409.0
Waters Point	158.5	415.4	407.0	406.1	405.7	402.6
Selma	146.0	409.5	400.4	399.6	399.2	396.4
Brickeys	136.0	405.2	395.1	394.2	393.6	392.0
Little Rock Ldg.	125.5	399.5	388.5	387.3	386.9	385.1
East Kaskaskia	116.2		383.2	382.4	382.2	380.5
Chester	109.5	390.0	379.4	378.7	378.6	376.0
Bishop Ldg.	100.8	385.4	374.8	373.5	373.5	372.0
Red Rock Ldg.	94.1	381.7	371.6	370.8	370.7	368.2
Cumberland Rock	87.0	377.2	367.2	366.0	366.0	363.9
Grand Tower	81.0	373.1	363.9	363.1	362.9	360.9
Crawford Ldg.	72.9	368.3	358.0	357.0	356.8	354.5
Moccasin Springs	66.3	364.6	354.0	353.2	352.9	350.4
Devils Island	57.3	360.3	350.2	349.7	349.6	348.5
Cape Girardeau	52.1	356.4	345.9	345.3	345.1	344.6
Grays Point*	46.3	350.4	340.7	340.7	340.7	340.7

* Water surface was held to a rating curve developed from model test results in MBM Report 31-5, Flowline Study, Mississippi and Illinois Rivers, June 1977.

Table 5

Water-Surface Elevations

Steady Flow Tests - 872,000 cfs

Gaging Station	River Mile	Existing Levee El ft msl	Water-Surface El, ft msl			
			Test 4	Test 15	Test 26	Test 37
Bissell Point	183.3	436.4	426.6	425.5	424.7	422.7
St. Louis	179.6	433.6	424.5	423.4	422.6	420.2
Engineer Depot	176.8	430.7	422.3	421.0	420.2	417.2
Mo. Pac. Elevator	172.6	425.5	420.4	418.6	417.8	414.4
Jefferson Barracks	169.3	424.2	419.1	417.3	416.4	412.1
Waters Point	158.5	415.4	413.4	412.1	410.8	405.5
Selma	146.0	409.5	406.9	405.3	404.0	399.3
Brickeys	136.0	405.2	401.4	399.7	398.4	395.2
Little Rock Ldg.	125.5	399.5	394.7	392.6	391.2	387.0
East Kaskaskia	116.2		390.1	388.7	388.2	383.9
Chester	109.5	390.0	386.4	384.7	384.1	379.3
Bishop Ldg.	100.8	385.4	382.1	379.7	379.1	375.2
Red Rock Ldg.	94.1	381.7	378.8	377.1	376.5	372.4
Cumberland Rock	87.0	377.2	374.4	372.3	371.9	368.1
Grand Tower	81.0	373.1	370.6	369.4	369.0	365.4
Crawford Ldg.	72.9	368.3	364.5	362.8	362.1	358.6
Moccasin Springs	66.3	364.6	360.5	359.0	358.3	354.5
Devils Island	57.3	360.3	356.8	355.4	355.2	353.4
Cape Girardeau	52.1	356.4	351.6	350.7	350.6	349.4
Grays Point*	46.3	350.4	345.8	345.8	345.8	345.8

* Water surface controlled to the crest of the 1973 flood.

Table 6

Water-Surface Elevations

Steady Flow Tests ~ 889,000 cfs

Gaging Station	River Mile	Existing Levee El ft msl	Water-Surface El, ft msl			
			Test 5	Test 16	Test 27	Test 38
Bissell Point	183.3	436.4	426.9	425.9	425.1	422.8
St. Louis	179.6	433.6	424.9	423.8	423.0	420.5
Engineer Depot	176.8	430.7	422.7	421.3	420.6	417.4
Mo. Pac. Elevator	172.6	425.5	420.8	419.1	418.1	414.6
Jefferson Barracks	169.3	424.2	419.5	417.7	416.7	412.3
Waters Point	158.5	415.4	413.8	412.4	411.2	405.6
Selma	146.0	409.5	407.4	405.8	404.5	399.5
Brickeys	136.0	405.2	401.8	400.1	398.8	395.4
Little Rock Ldg.	125.5	399.5	395.3	393.0	391.6	387.2
East Kaskaskia	116.2		390.7	389.3	388.8	384.1
Chester	109.5	390.0	387.0	385.2	384.6	379.6
Bishop Ldg.	100.8	385.4	382.7	380.1	379.6	375.5
Red Rock Ldg.	94.1	381.7	379.4	377.6	377.0	372.8
Cumberland Rock	87.0	377.2	375.0	372.7	372.3	368.5
Grand Tower	81.0	373.1	371.2	369.9	369.4	365.7
Crawford Ldg.	72.9	368.3	365.0	363.2	362.6	359.0
Moccasin Springs	66.3	364.6	360.9	359.4	358.7	354.7
Devils Island	57.3	360.3	357.2	355.7	355.6	353.6
Cape Girardeau	52.1	356.4	351.8	350.9	350.8	349.6
Grays Point*	46.3	350.4	345.8	345.8	345.8	345.8

* Water surface controlled to the crest of the 1973 flood.

Table 7

Water-Surface Elevations

Steady-Flow Tests - 1,000,000 cfs

Gaging Station	River Mile	Existing Levee El ft msl	Water-Surface Elevations, ft msl, for Test Nos. 6	17	28	39	7	18	29	40	8	19	30	41
Bissell Point	183.3	436.4	430.6	430.2	429.7	426.8	431.6	430.4	429.7	426.8	431.6	430.4	429.7	426.8
St. Louis	179.6	433.6	428.8	428.1	427.8	424.3	430.0	428.6	427.8	424.3	430.0	428.6	427.8	424.3
Engineer Depot	176.8	430.7	426.3	425.5	425.2	420.7	427.8	426.0	425.2	420.7	427.8	426.0	425.2	420.7
Mo. Pac. Elevator	172.6	425.5	424.1	423.1	422.5	417.4	425.7	423.9	422.8	417.4	425.7	423.9	422.8	417.4
Jefferson Barracks	169.3	424.2	422.5	421.6	421.1	414.9	424.6	422.4	421.3	414.9	424.6	422.4	421.3	414.9
Waters Point	158.5	415.4	417.0	416.5	415.5	407.9	418.9	417.1	415.7	407.9	418.9	417.1	415.7	407.9
Selma	146.0	409.5	410.7	409.6	408.6	401.8	412.3	409.9	408.6	401.8	412.3	409.9	408.6	401.8
Brickeys	136.0	405.2	405.4	403.8	402.5	397.8	406.4	403.8	402.6	397.8	406.4	403.8	402.5	397.8
Little Rock Ldg.	125.5	399.5	398.4	396.5	395.0	388.8	399.6	396.5	395.0	388.8	399.6	396.5	395.0	388.8
East Kaskaskia	116.2		393.7	393.2	392.5	386.5	395.3	393.2	392.5	386.5	395.3	393.2	392.5	386.5
Chester	109.5	390.0	390.2	388.9	388.4	382.2	391.5	388.9	388.4	382.2	391.5	388.9	388.4	382.2
Bishop Ldg.	100.8	385.4	386.5	383.9	383.2	377.9	387.5	383.9	383.2	377.9	387.5	383.9	383.2	377.9
Red Rock Ldg.	94.1	381.7	383.3	381.3	380.6	375.3	384.2	381.3	380.6	375.3	384.2	381.3	380.6	375.3
Cumberland Rock	87.0	377.2	378.4	376.1	375.6	371.2	379.4	376.1	375.6	371.2	379.4	376.1	375.6	371.2
Grand Tower	81.0	373.1	374.6	373.1	372.6	368.6	375.0	373.1	372.6	368.6	375.0	373.1	372.6	368.6
Crawford Ldg.	72.9	368.3	368.4	366.2	365.6	361.1	368.6	366.2	365.6	361.1	368.6	366.2	365.6	361.1
Moccasin Springs	66.3	364.6	364.1	362.3	361.7	356.7	364.1	362.3	361.7	356.7	364.1	362.2	361.7	356.7
Devils Island	57.3	360.3	360.3	358.4	358.3	355.7	360.3	358.4	358.3	355.7	360.3	358.2	358.2	355.7
Cape Girardeau	52.1	356.4	354.4	353.4	353.1	352.0	354.4	353.4	353.1	352.0	354.1	353.0	352.9	351.3
Grays Point*	46.3	350.4	347.6	347.6	347.6	347.6	347.6	347.6	347.6	347.6	347.3	347.1	347.0	346.9
Thebes	43.7										344.9	344.9	344.9	344.9
Counterfeit Rock	42.3										343.3	343.0	343.0	343.0
Commerce*	39.3										341.7	341.7	341.7	341.7

* Water surface at Grays Point was held to a rating curve developed from model test results in MRH Report 31-5, Flow-line Study, Mississippi and Illinois Rivers, June 1977.

Table 8

Water-Surface Elevations

Steady-Flow Tests - 1,300,000 cfs

Gaging Station	River Mile	Existing Levee El ft msl	Water-Surface Elevations, ft msl, for Test Nos. 9	20	31	42	10	21	32	43	11	22	33	44
Bissell Point	183.3	436.4	435.9	435.7	435.4	434.2	444.1	441.9	440.8	434.2	444.1	441.9	440.8	434.2
St. Louis	179.6	433.6	433.8	433.6	433.3	431.9	441.0	438.6	437.6	431.9	441.0	438.6	437.6	431.9
Engineer Depot	176.8	430.7	430.4	429.8	429.5	427.6	438.4	435.7	434.7	427.6	438.4	435.7	434.7	427.6
Mo. Pac. Elevator	172.6	425.5	427.2	426.4	426.0	423.0	436.3	433.6	432.4	423.0	436.3	433.6	432.4	423.0
Jefferson Barracks	169.3	424.2	425.0	424.5	424.1	420.7	435.2	432.0	430.9	420.7	435.2	432.0	430.9	420.7
Waters Point	158.5	415.4	419.0	418.5	418.1	412.2	429.6	426.8	425.3	412.2	429.6	426.8	425.3	412.2
Selma	146.0	409.5	412.4	411.8	411.2	405.9	423.5	419.5	418.2	405.9	423.5	419.5	418.2	405.9
Brickeys	136.0	405.2	409.2	408.5	407.6	401.5	417.3	413.3	411.8	401.5	417.3	413.3	411.8	401.5
Little Rock Ldg.	125.5	399.5	400.9	399.3	397.6	393.2	410.6	405.9	404.4	393.2	410.5	405.8	404.4	393.2
East Kaskaskia	116.2		395.6	395.3	395.0	391.8	406.6	403.1	402.3	391.9	406.5	403.0	402.3	391.9
Chester	109.5	390.0	391.1	390.8	390.4	386.9	402.5	398.3	398.0	387.1	402.4	398.2	397.9	387.0
Bishop Ldg.	100.8	385.4	388.0	387.2	386.8	383.3	398.7	393.4	392.5	383.5	398.5	393.2	392.3	383.3
Red Rock Ldg.	94.1	381.7	384.6	384.5	384.3	381.2	395.8	390.8	389.9	381.5	395.6	390.6	389.6	381.2
Cumberland Rock	87.0	377.2	379.5	379.1	378.8	376.9	390.3	384.8	384.4	377.4	390.0	384.5	384.1	377.0
Grand Tower	81.0	373.1	376.2	376.0	375.9	374.6	385.3	382.0	381.5	375.3	385.0	381.7	381.2	374.8
Crawford Ldg.	72.9	368.3	369.7	369.4	369.2	366.0	378.1	374.4	373.6	367.1	377.6	373.9	373.2	366.3
Moccasin Springs	66.3	364.6	365.3	365.1	365.0	361.8	372.8	370.0	369.5	362.8	372.2	369.4	368.9	361.8
Devils Island	57.3	360.3	362.2	361.9	361.7	361.2	369.3	366.2	366.0	362.5	368.6	365.6	365.4	361.2
Cape Girardeau	52.1	356.4	359.8	359.4	359.2	358.5	361.6	360.6	360.5	358.7	360.5	359.6	359.4	357.9
Grays Point*	46.3	350.4	353.7	353.7	353.7	353.7	353.7	353.7	353.7	353.7	352.0	352.0	352.0	351.3
Thebes	43.7										349.2	349.2	349.2	349.2
Counterfeit Rock	42.3										346.7	346.7	346.7	346.7
Commerce*	39.3										344.4	344.4	344.4	344.4

* Water surface at Grays Point was held to a rating curve developed from model test results in MRM Report 31-5, Flow-line Study, Mississippi and Illinois Rivers, June 1977.

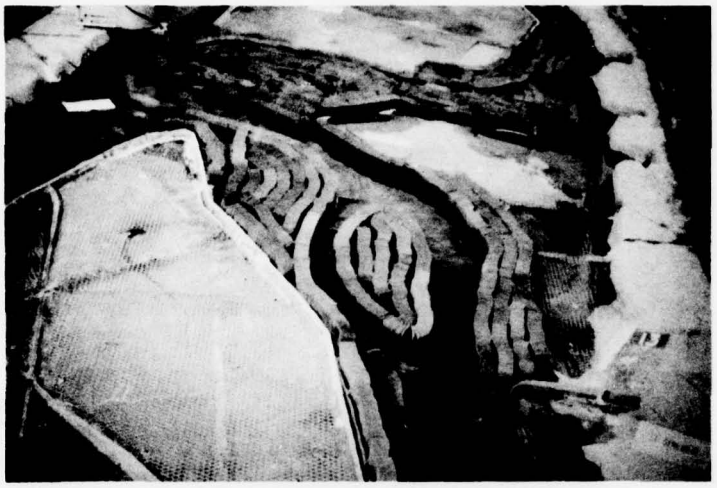


Photo 1. Series I - Folded screen wire simulating overbank roughness fully developed in its natural state on all areas between river and its bluff line or levee

Photo 2. Series II - Folded screen wire simulating overbank roughness fully developed in its natural state on areas where vegetation existed in 1973

Photo 3. Series III - Folded screen wire simulating overbank roughness where vegetation existed in 1973 installed to density required to reproduce 1973 flood stages

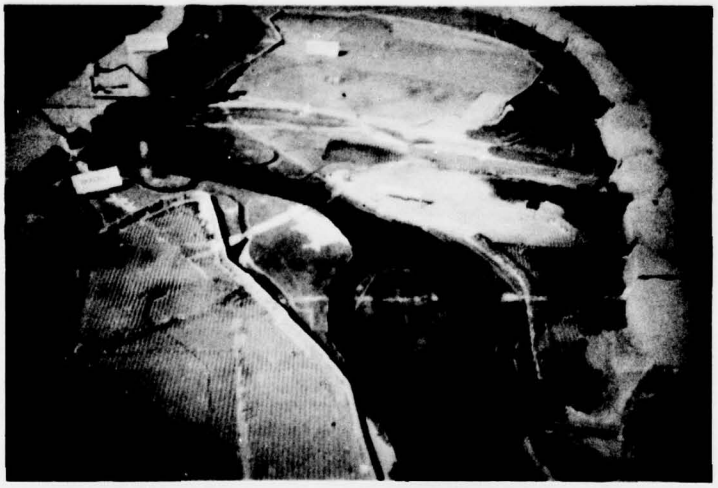
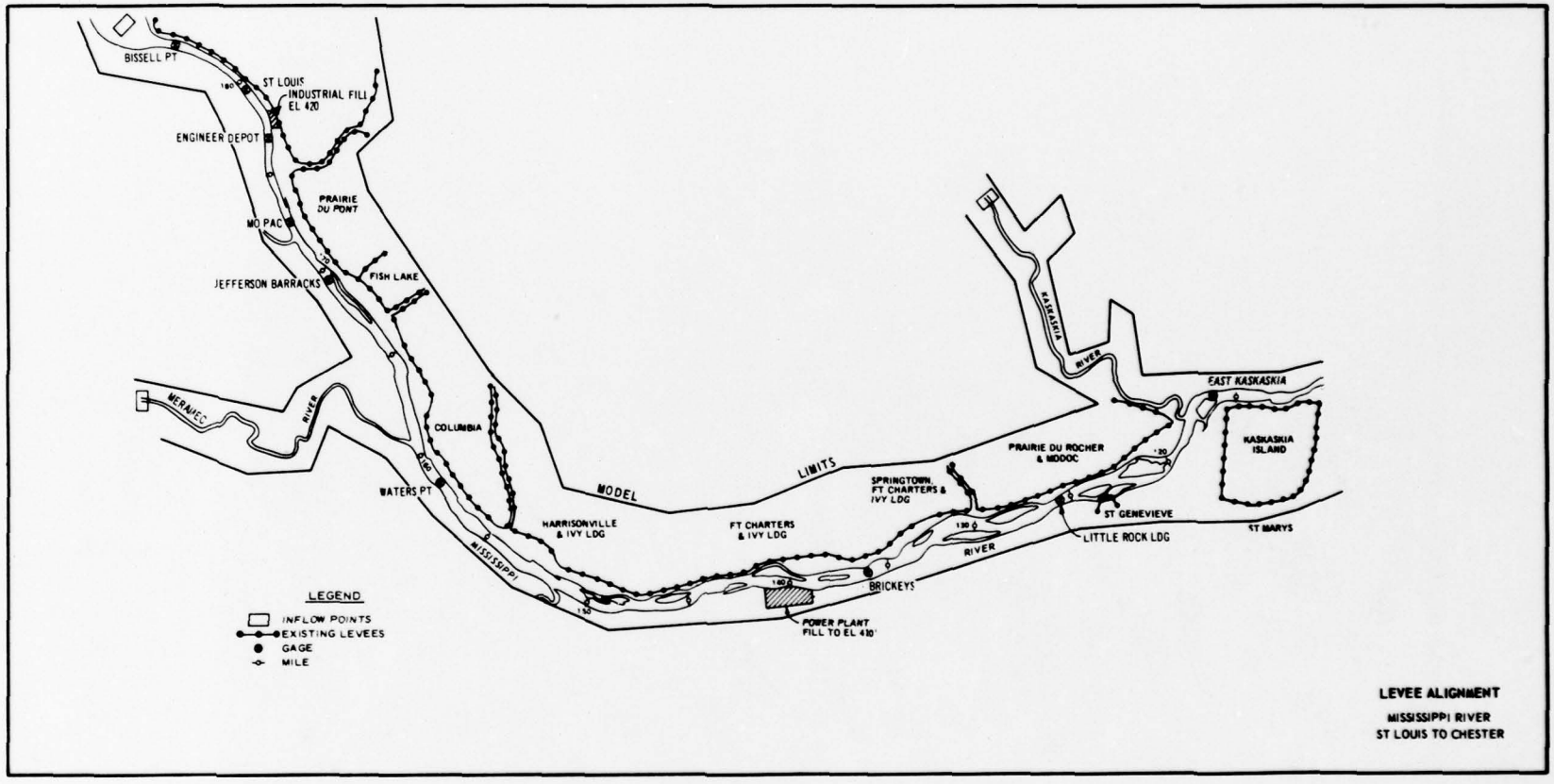


Photo 4. Series IV - Folded screen wire simulating overbank roughness removed from all areas between the river and its bluff line or levee



LEVEE ALIGNMENT

MISSISSIPPI RIVER
ST LOUIS TO CHESTER

PLATE 1

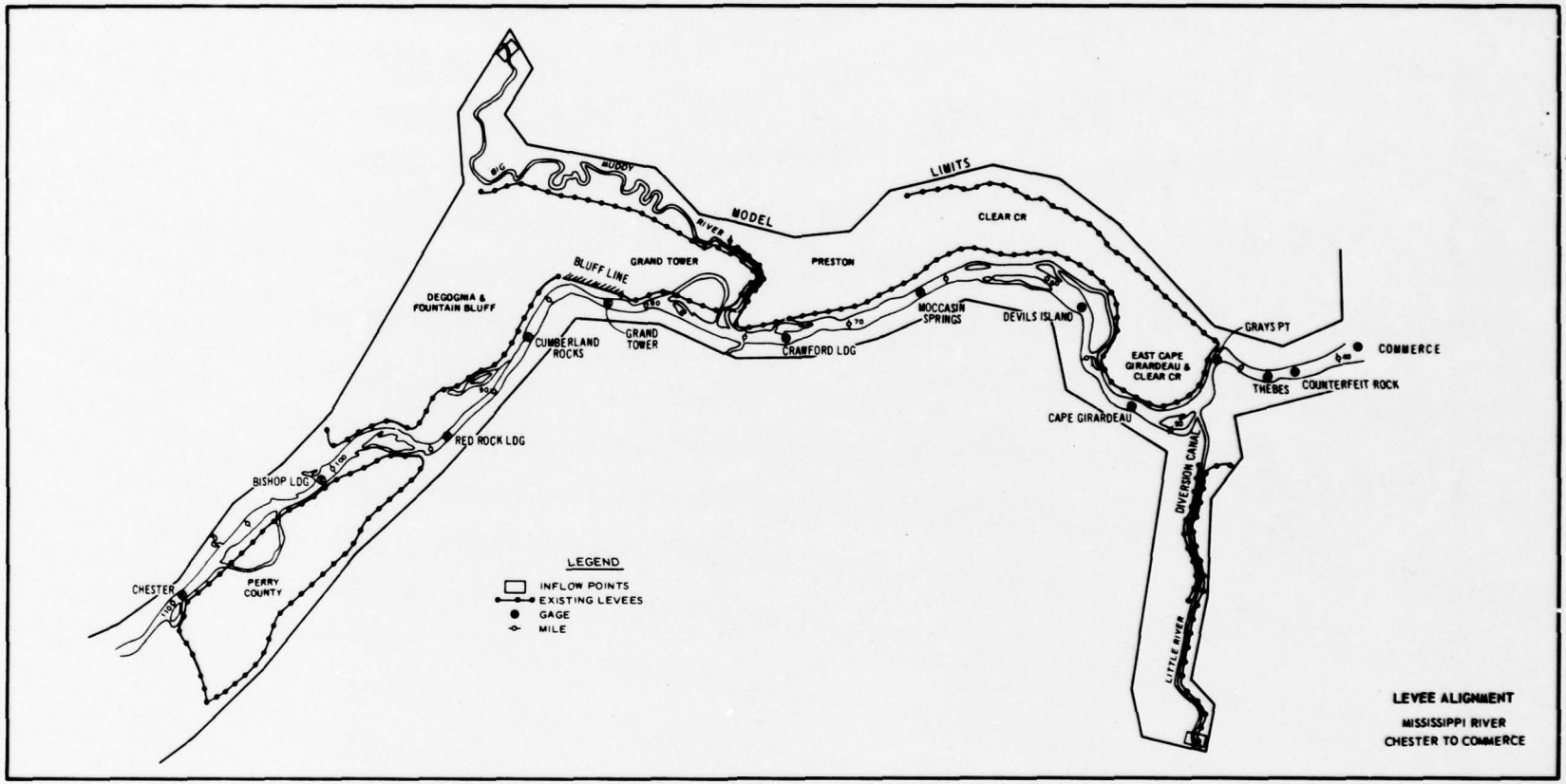

BIG
MUDDY
RIVER
MODEL
LIMITS
CLEAR CR
PRESTON
GRAND TOWER
BLUFF LINE
DEGOGNIA &
FOUNTAIN BLUFF
CUMBERLAND
ROCKS
GRAND
TOWER
CRAWFORD LDG
MOCCASIN
SPRINGS
DEVILS ISLAND
GRAYS PT
COMMERCE
EAST CAPE
GIRARDEAU &
CLEAR CR
THEBES
COUNTERFEIT ROCK
CAPE GIRARDEAU
DIVERSION CANAL
LITTLE RIVER
RED ROCK LDG
BISHOP LDG
CHESTER
PERRY
COUNTY
LEGEND
INFLOW POINTS
EXISTING LEVEES
GAGE
MILE
LEVEE ALIGNMENT
MISSISSIPPI RIVER
CHESTER TO COMMERCE

PLATE 2

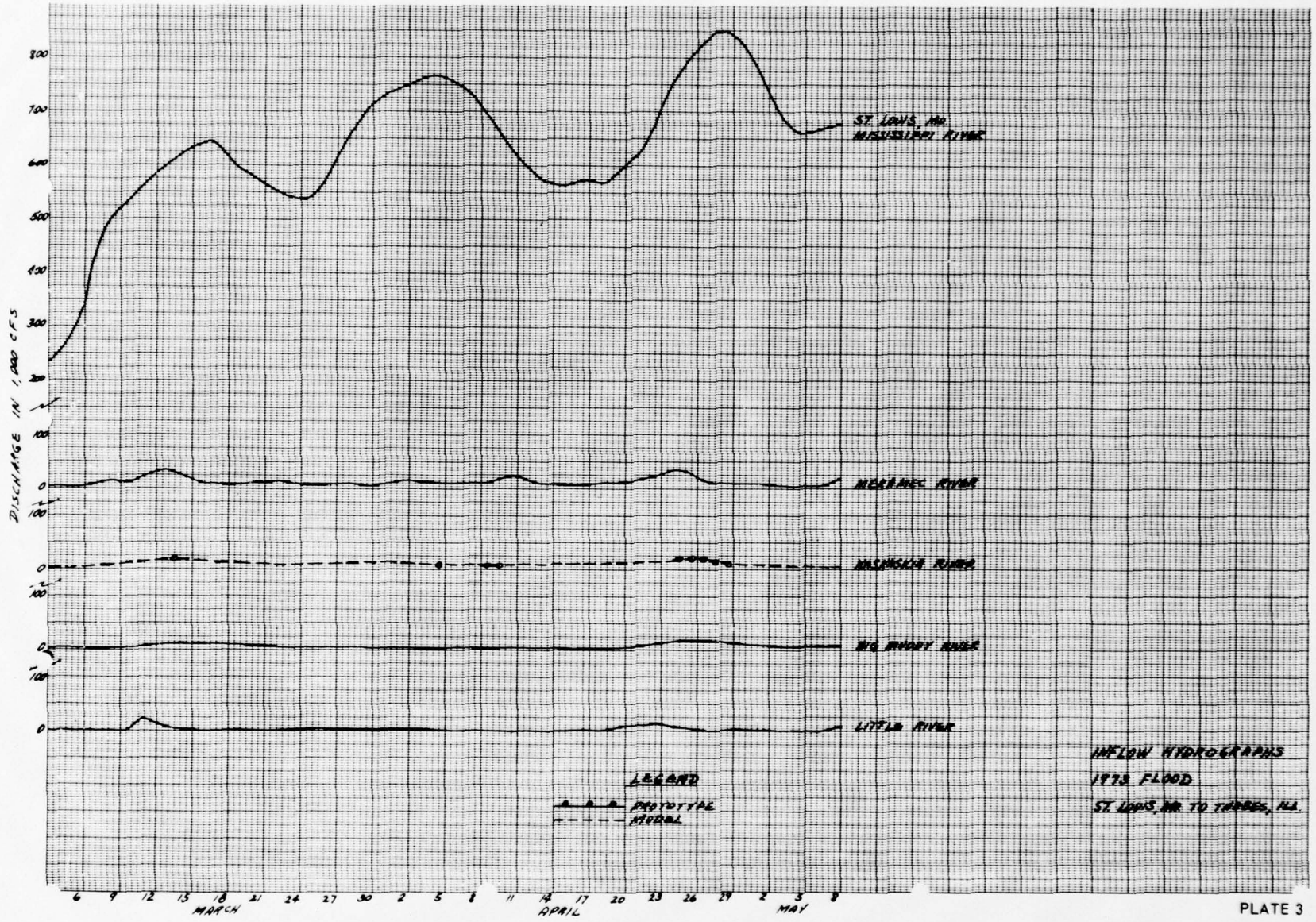

DISCHARGE IN 1,000 CFS
800
700
600
500
400
300
200
100
0
100
0
100
0
100
0
ST. LOUIS, MO.
MISSISSIPPI RIVER
MERAMEC RIVER
MISSOURI RIVER
WG RIVER
LITTLE RIVER
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
LEGEND
PROTOTYPE
MODEL
INFLOW HYDROGRAPHS
1973 FLOOD
ST. LOUIS, MO. TO THEBES, ILL.

PLATE 3

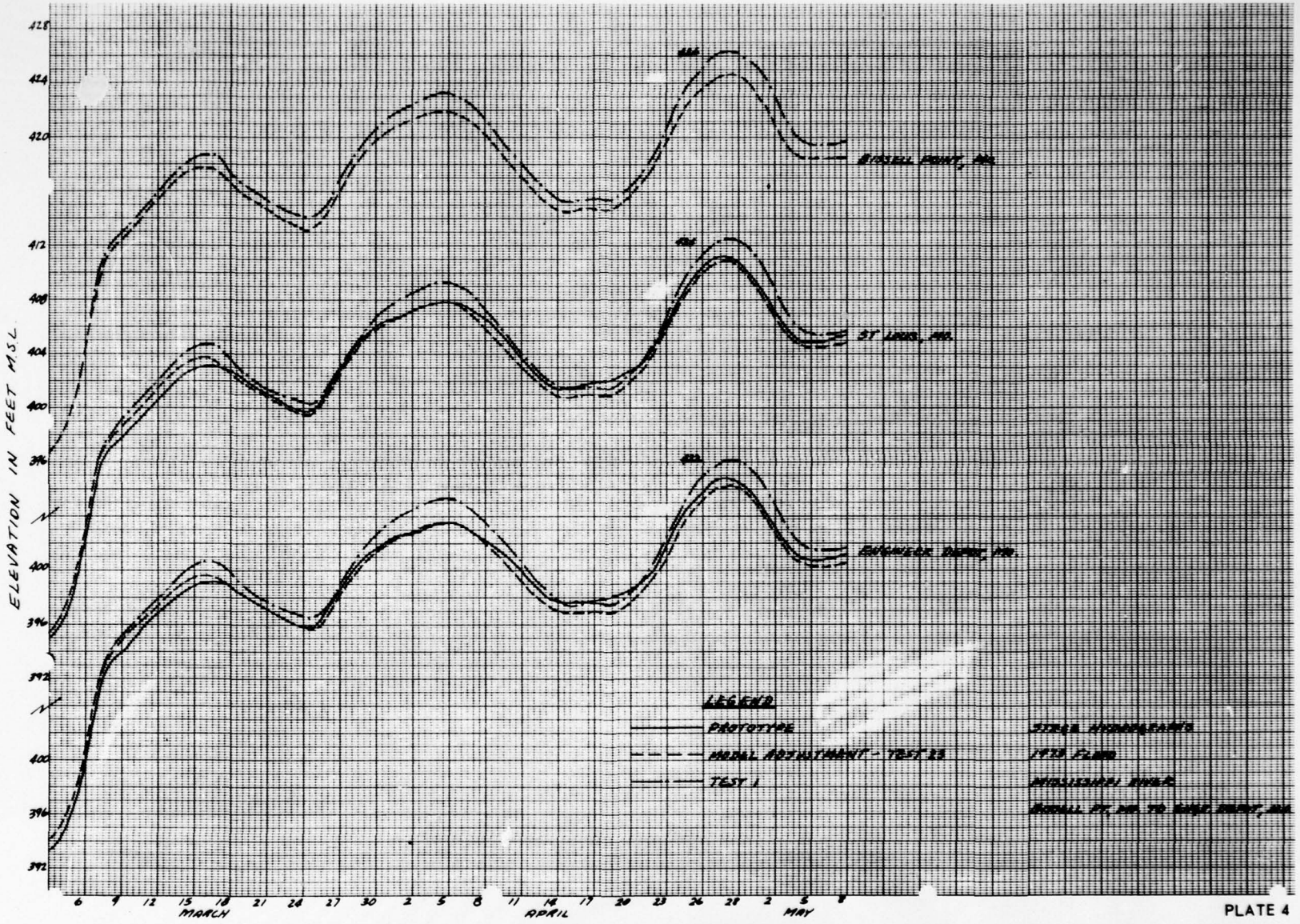

ELEVATION IN FEET MSL
428
424
420
416
412
408
404
400
396
392
400
396
392
400
396
392
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 28 2 5 8
MARCH
APRIL
MAY
BISSELL POINT, MO.
ST LOUIS, MO.
EUREKA DUNKE, MO.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 1
STAGE HYDROGRAPHS
1930 FLOOD
MISSISSIPPI RIVER
BISSELL PT. MO. TO EUREKA DUNKE, MO.

PLATE 4

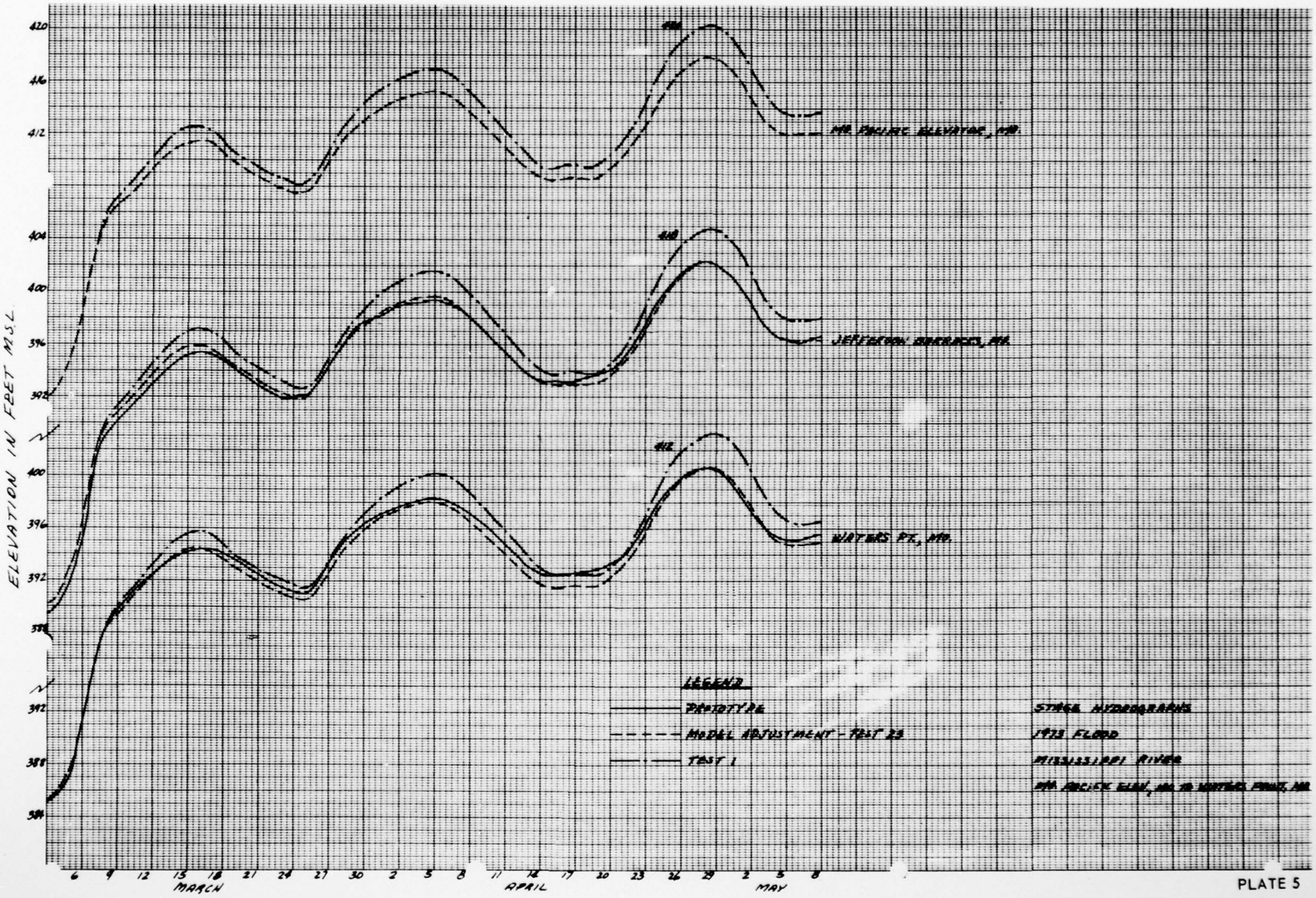

ELEVATION IN FEET M.S.L.
420
416
412
404
400
396
392
388
384
412
408
412
MR. PAULINE ELEVATOR, MP.
JEFFERSON BARRACKS, MO.
WATERS PT., MO.
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 1
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER

PLATE 5

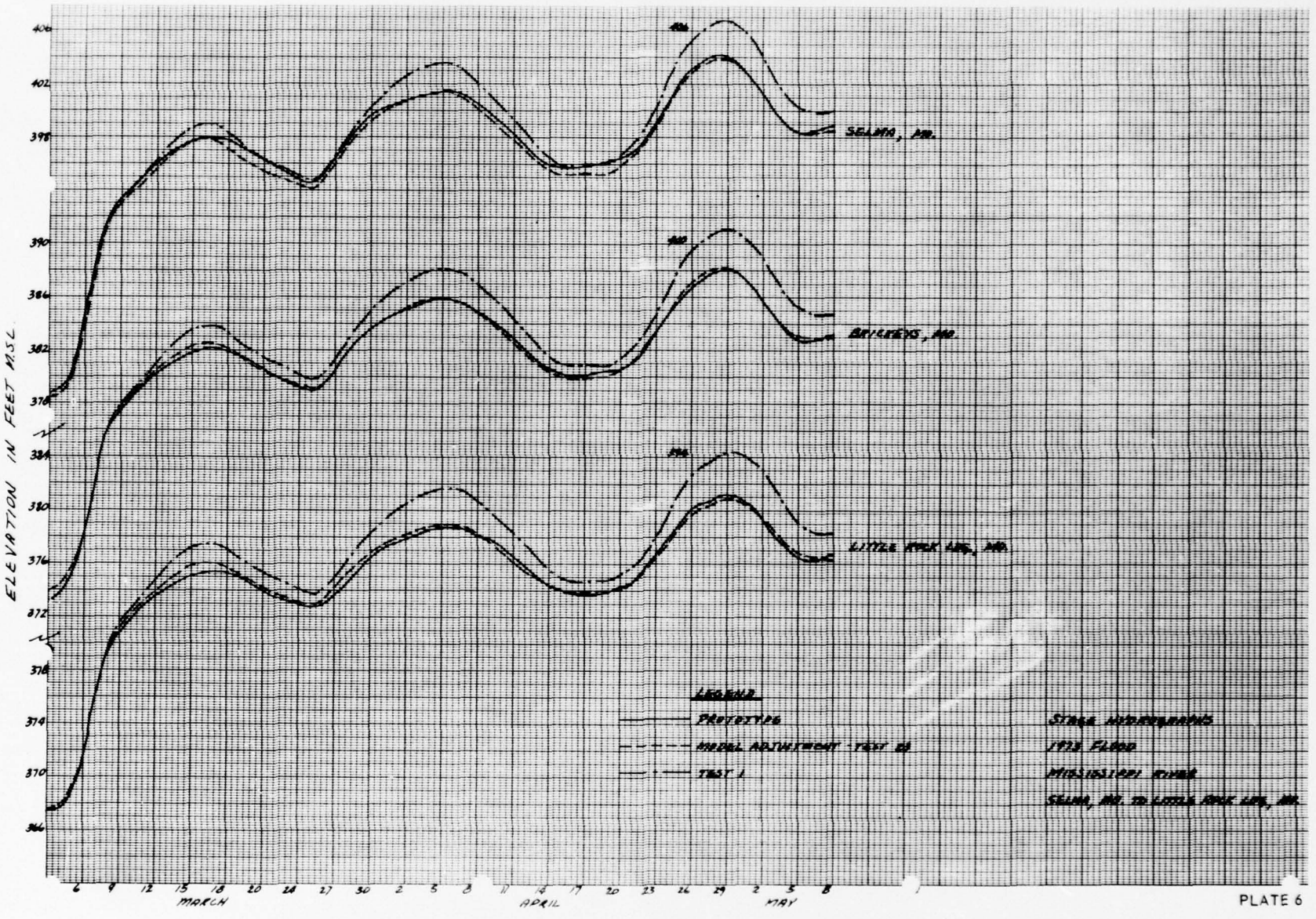

ELEVATION IN FEET M.S.L.
406
402
398
390
386
382
378
374
370
366
SELMA, ARK.
BRIGGS, MO.
LITTLE ROCK AIR., ARK.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 25
TEST 1
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
SELMA, ARK. TO LITTLE ROCK AIR., ARK.
6 9 12 15 18 20 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY

PLATE 6

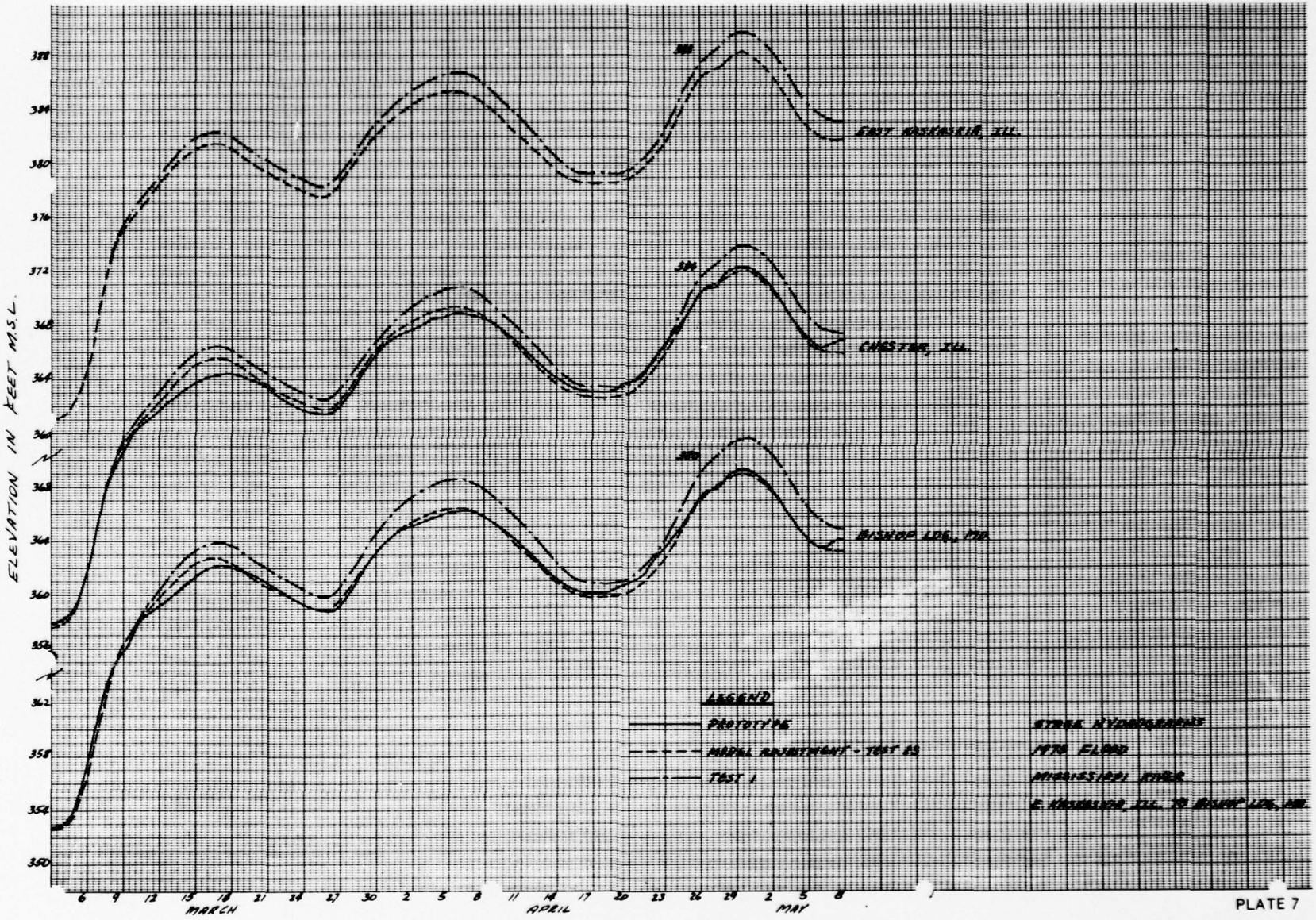

ELEVATION IN FEET M.S.L.
388
384
380
376
372
368
364
360
356
352
350
MARCH
APRIL
MAY
EAST ROSEDALE, ILL.
CHESTER, ILL.
BISHOP LDG., MO.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 69
TEST 1
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
E. ROSEDALE, ILL. TO BISHOP LDG., MO.

PLATE 7

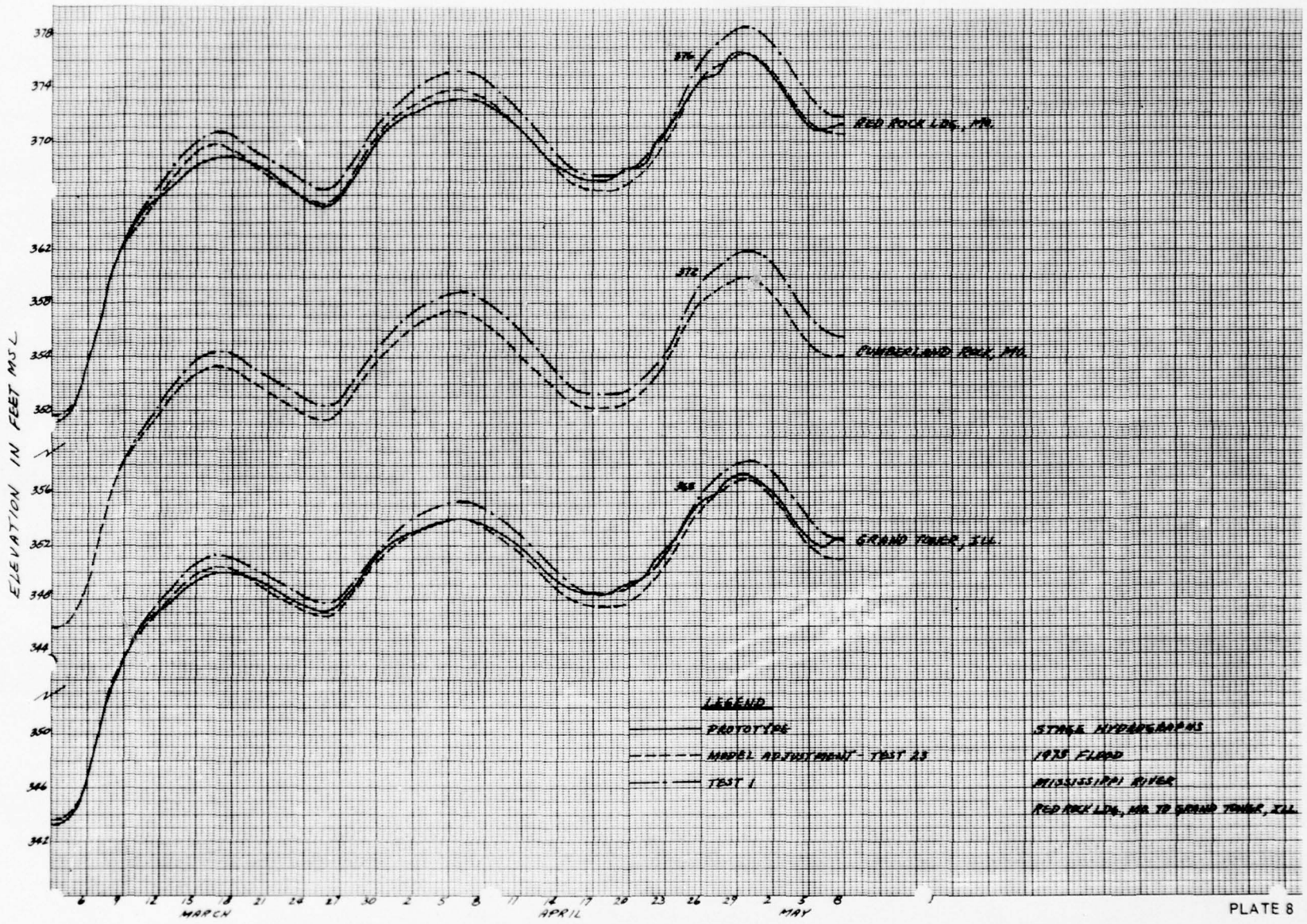

ELEVATION IN FEET MSL
378
374
370
362
358
354
350
356
352
348
344
360
346
342
376
372
368
RED ROCK LDG., MP.
CUMBERLAND ROCK, MP.
GRAND TOWER, ILL.
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 1
STAGE HYDROGRAPHS
1938 FLOOD
MISSISSIPPI RIVER
RED ROCK LDG., MP. TO GRAND TOWER, ILL.

PLATE 8

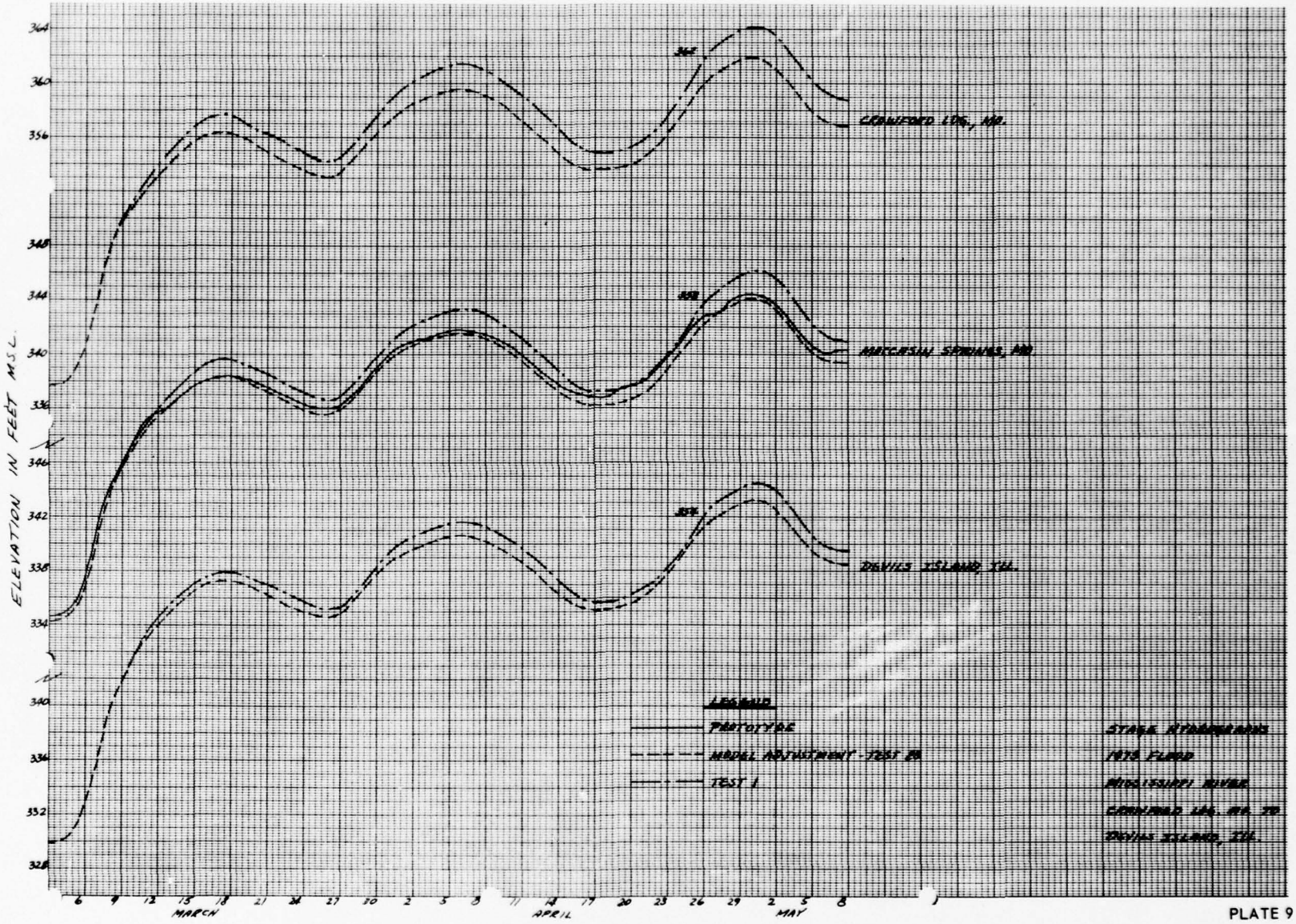
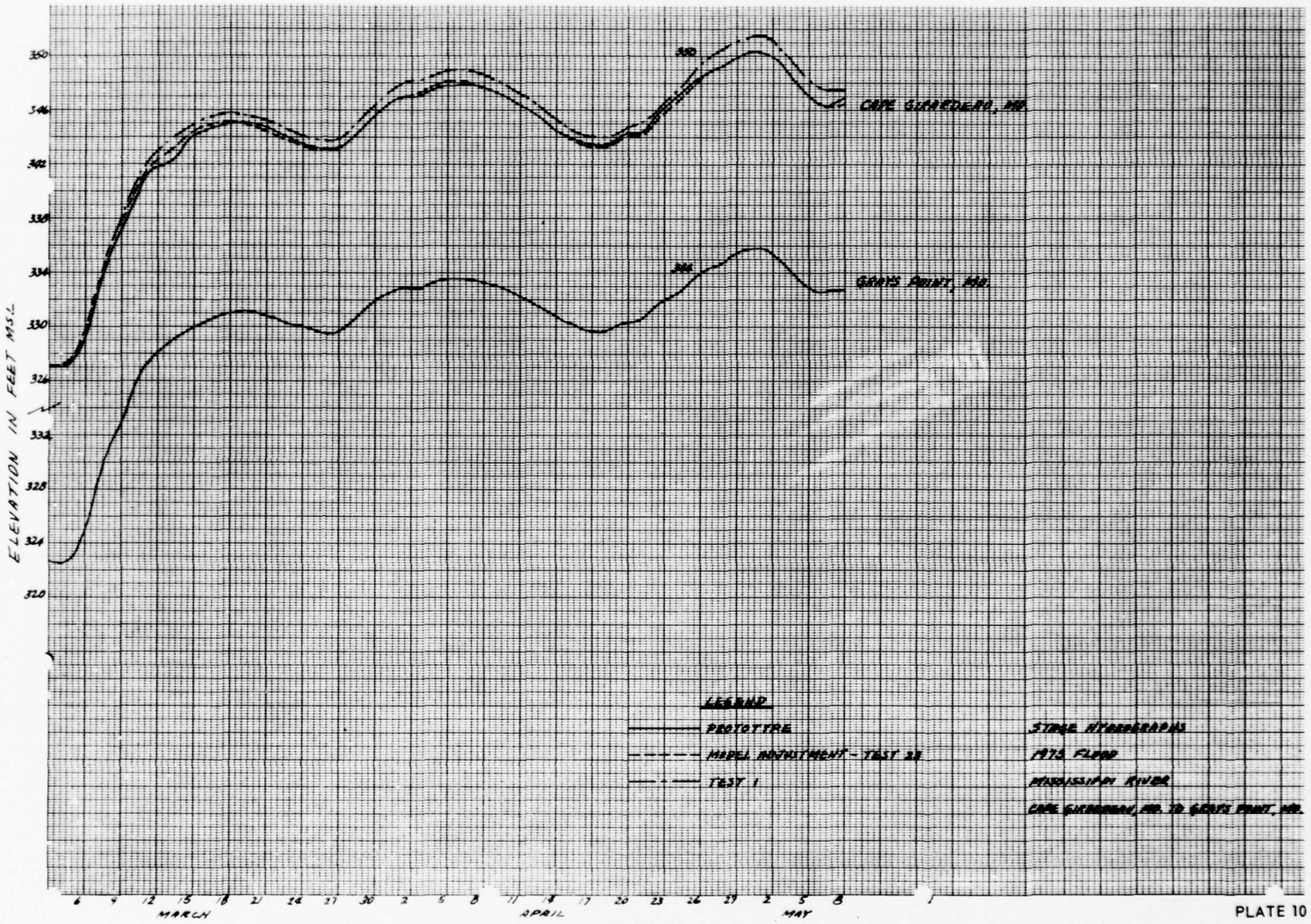

ELEVATION IN FEET M.S.L.
CRAWFORD LDG., MO.
MERCHSW SPRINGS, MO
DAVIES ISLAND, ILL.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 28
TEST 1
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
CRAWFORD LDG., MO. TO
DAVIES ISLAND, ILL.
MARCH
APRIL
MAY

PLATE 9


ELEVATION IN FEET MSL
350
346
342
338
334
330
326
324
320
CAPE GIRARDEAU, MO.
GIRARDEAU
GIRARDEAU
GIRARDEAU

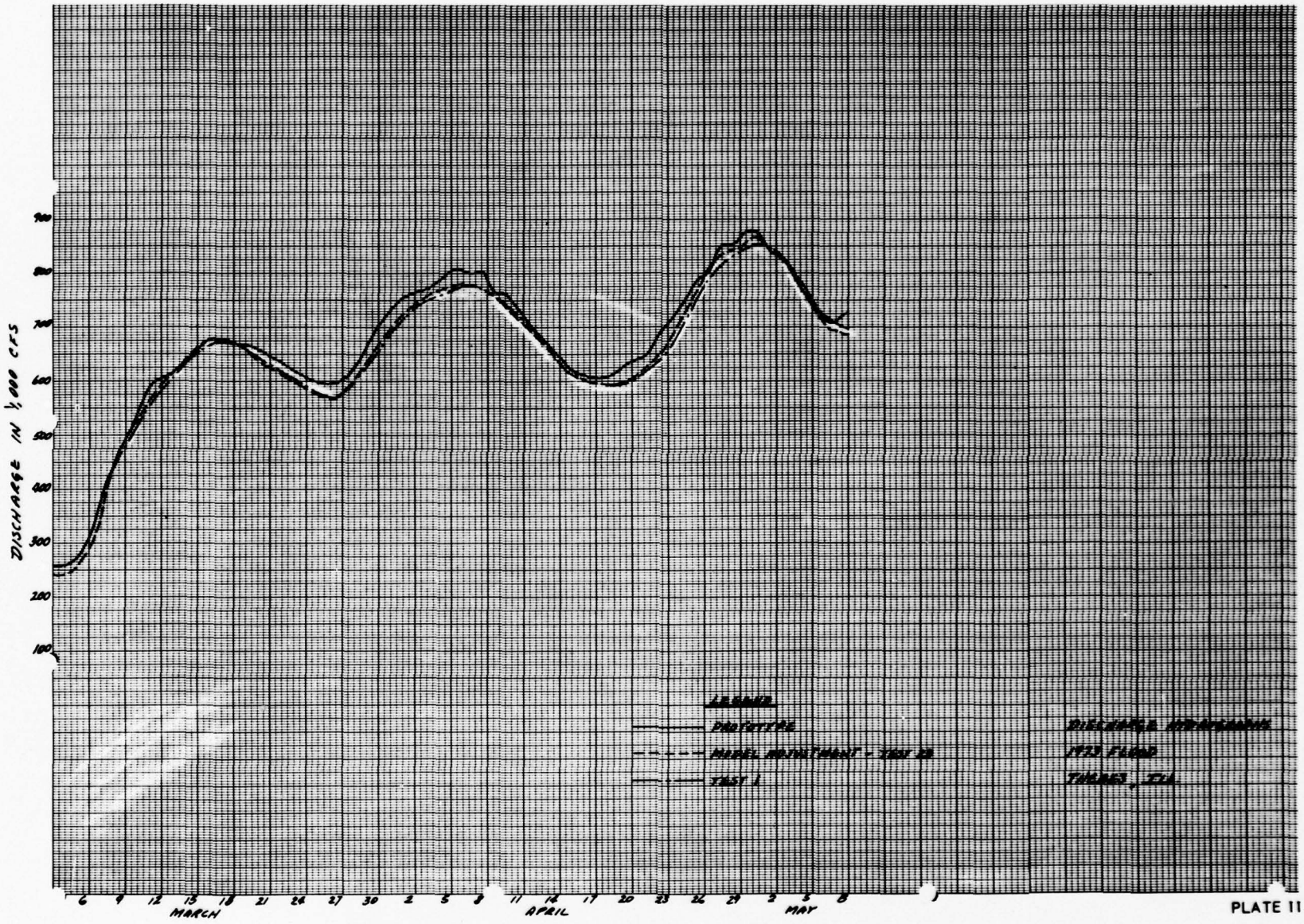

DISCHARGE IN 1,000 CFS
100
200
300
400
500
600
700
800
900
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
PROTOTYPE
TEST 1

PLATE 11

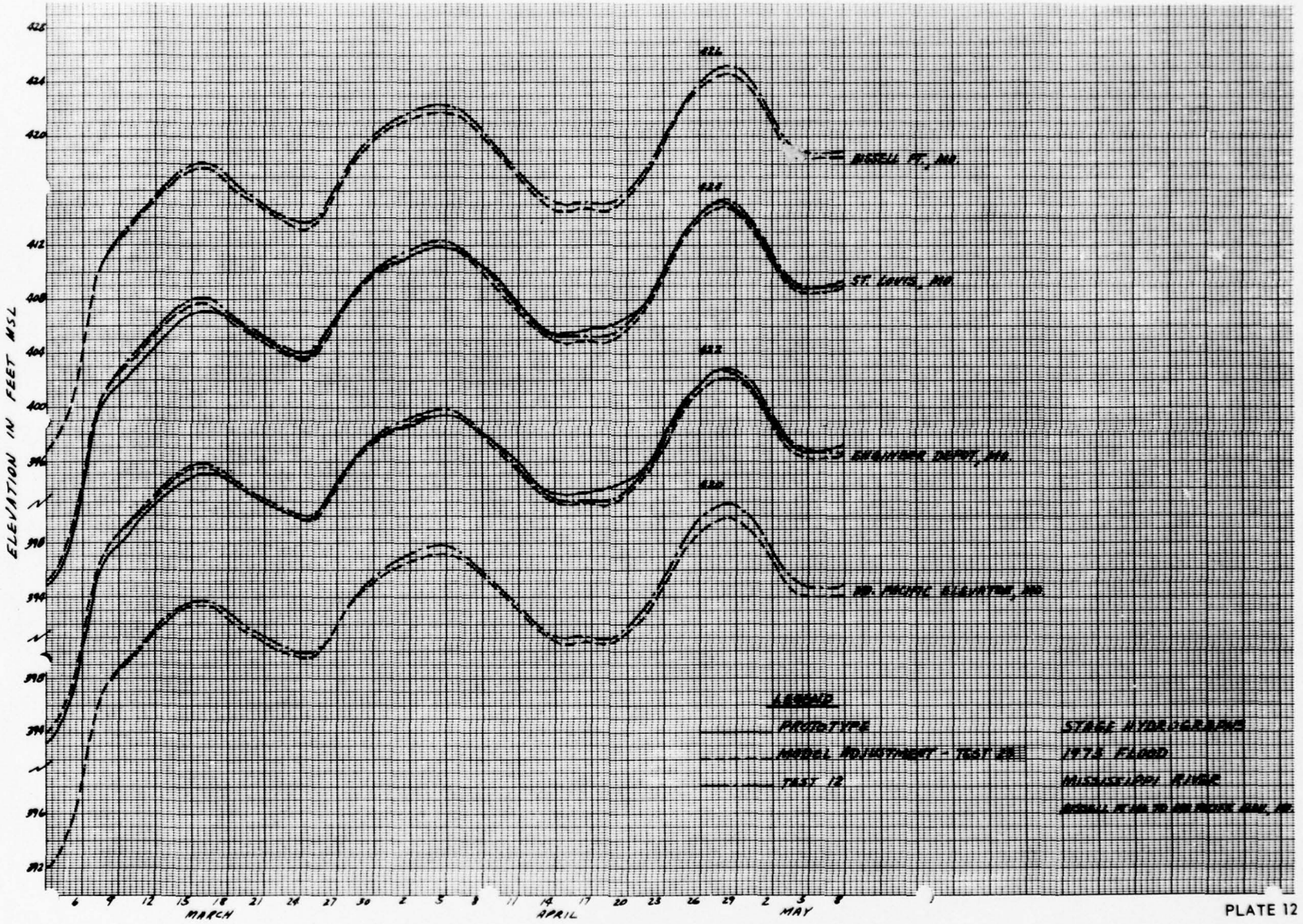

ELEVATION IN FEET MSL
426
424
420
412
408
404
400
396
392
MARCH
APRIL
MAY
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
432
432
432
430
BISSELL PT., MS.
ST. LOUIS, MO.
ENGINEER DEPOT, MS.
MP. PACIFIC ELEVATOR, MO.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 28
TEST 12
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
BISSELL PT., MS. TO MP. PACIFIC ELEV., MO.

PLATE 12

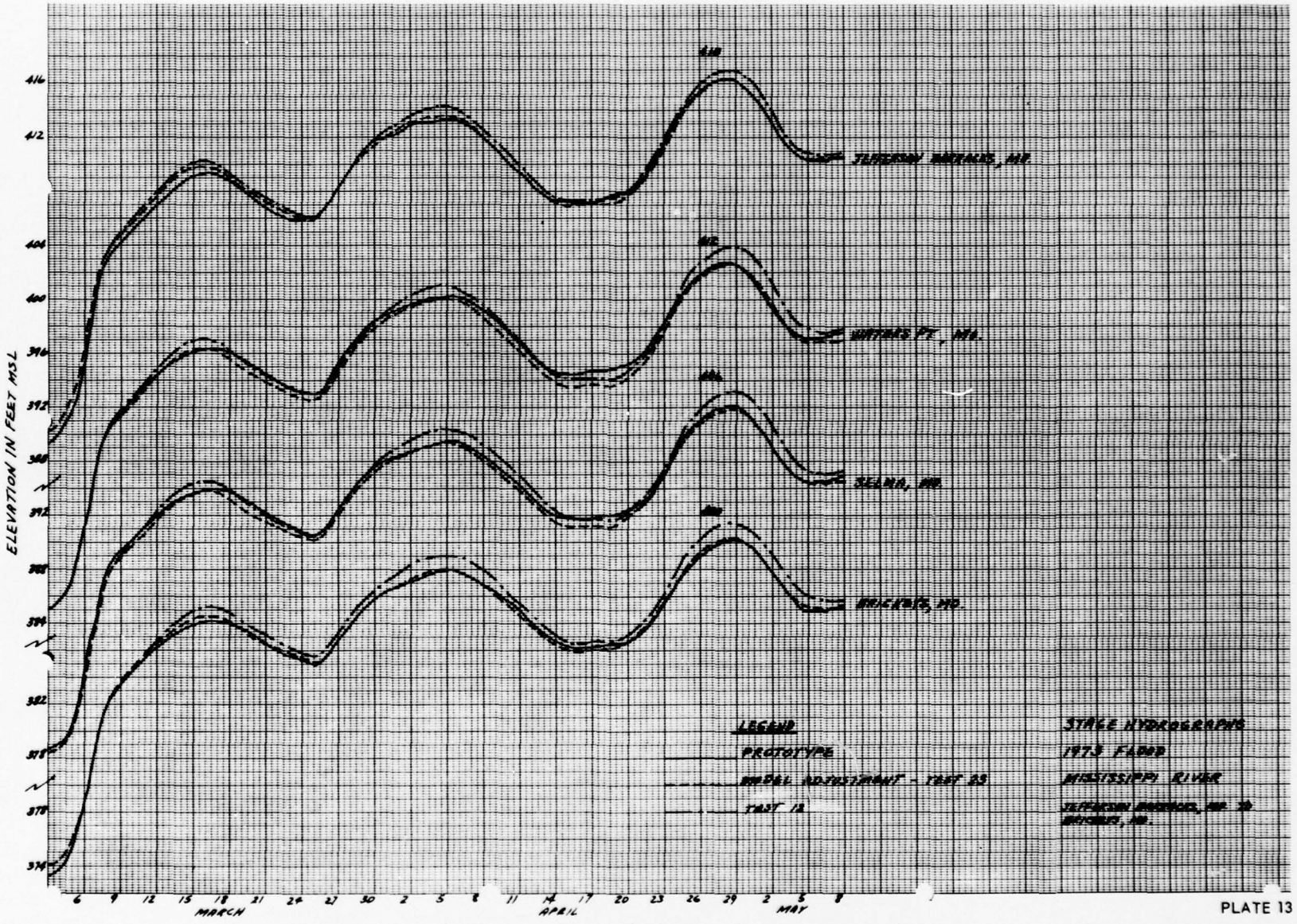

ELEVATION IN FEET MSL
416
412
408
404
400
396
392
388
384
380
376
372
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
TELLICO BRIDGE, MP
WATTS FT., MP
SLANA, MP
BRICKEYS, MP
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 25
TEST 12
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER

PLATE 13

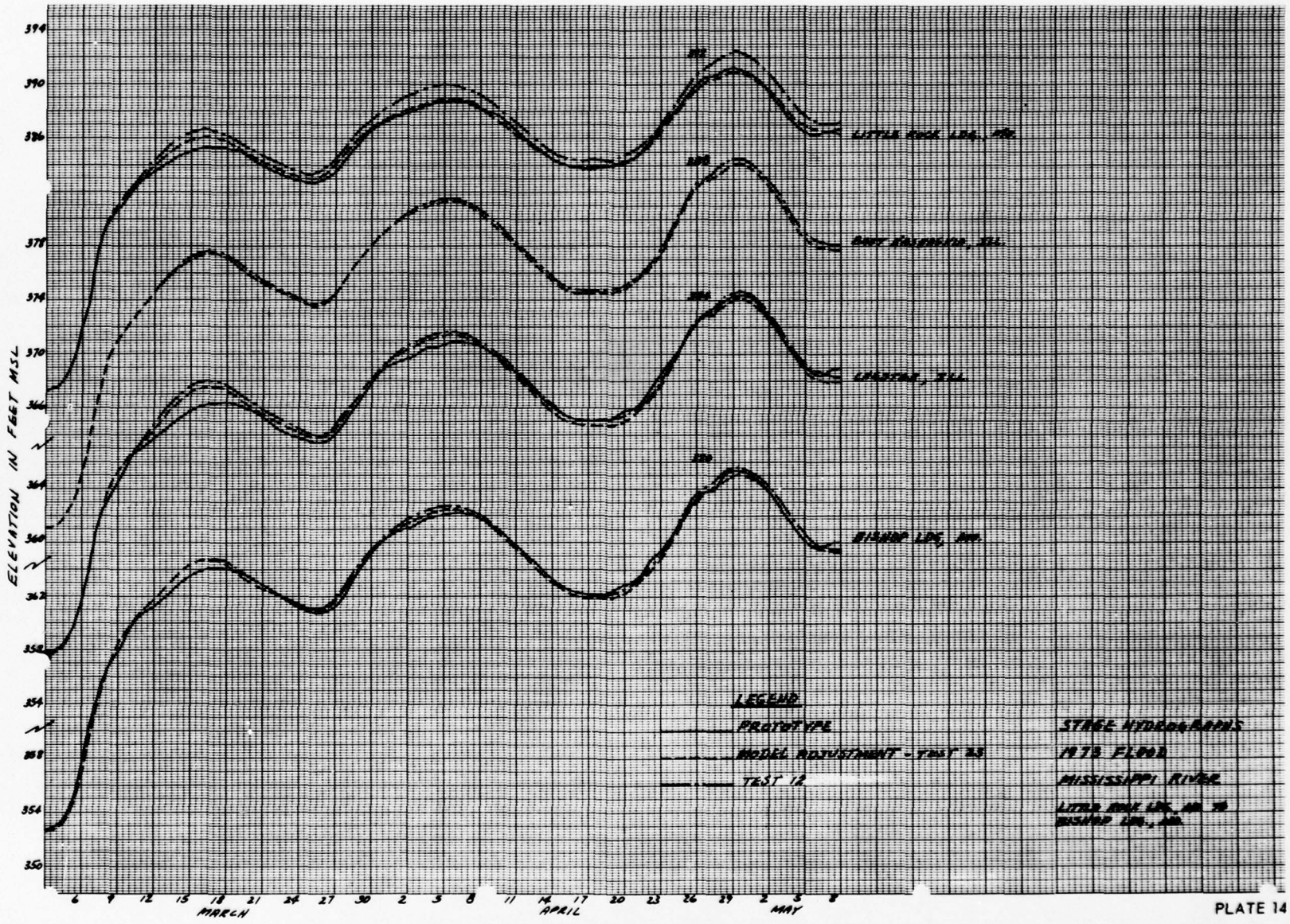

ELEVATION IN FEET MSL
394
390
386
382
378
374
370
366
362
358
354
350
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
LITTLE ROCK LOC., ARK.
EAST ARKANSAS, ILL.
LAKEVIEW, ILL.
BISHOP LOC., MO.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 12
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
LITTLE ROCK LOC., MO. TO
BISHOP LOC., MO.

PLATE 14

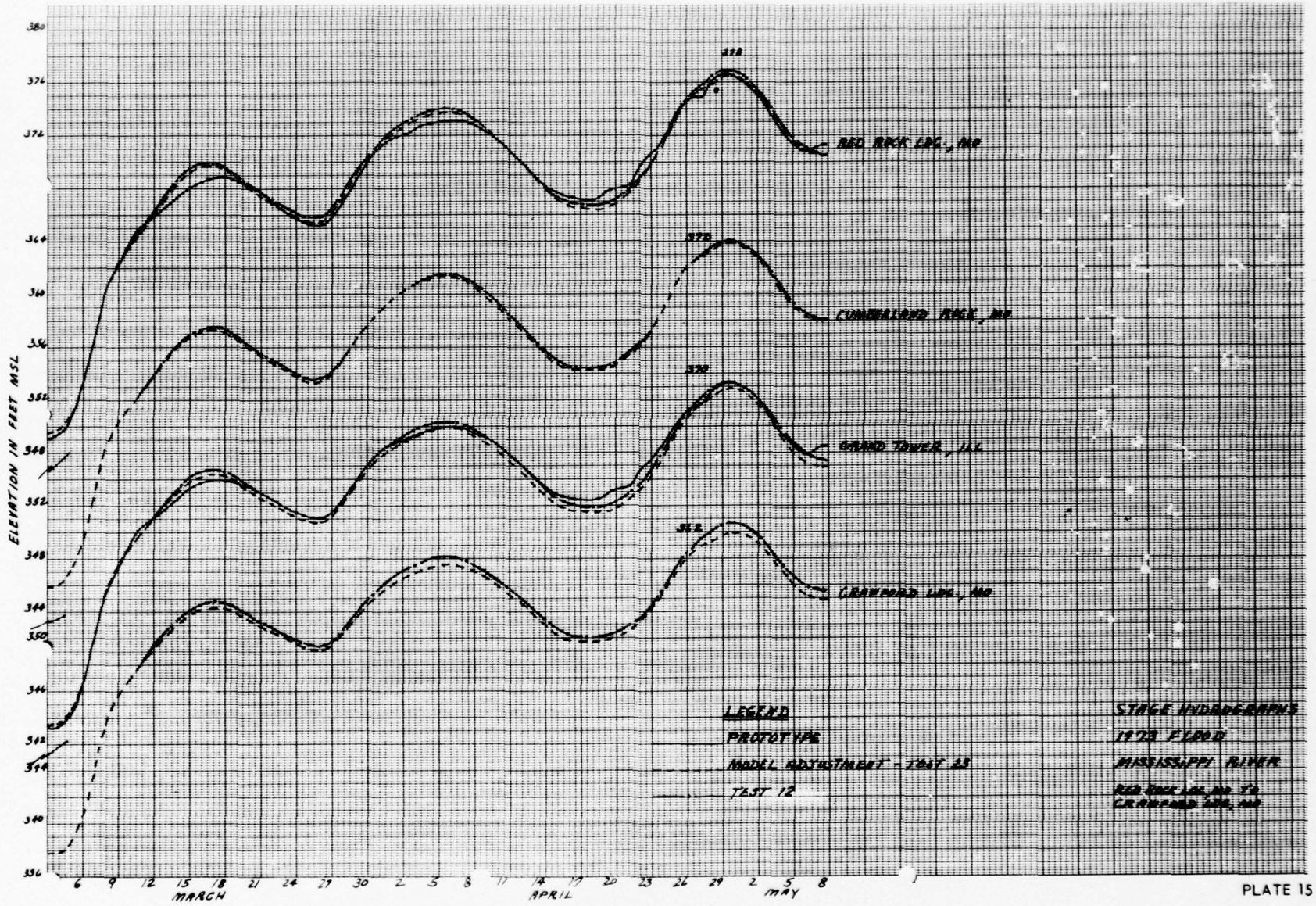

ELEVATION IN FEET MSL
380
376
372
368
364
360
356
352
348
344
340
336
MARCH
APRIL
MAY
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
RED ROCK LDG., MO
CUMBERLAND RACK, MO
GRAND TOWER, ILL
CRAWFORD LDG., MO
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 25
TEST 12
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
RED ROCK LDG, MO TO
CRAWFORD LDG, MO

PLATE 15

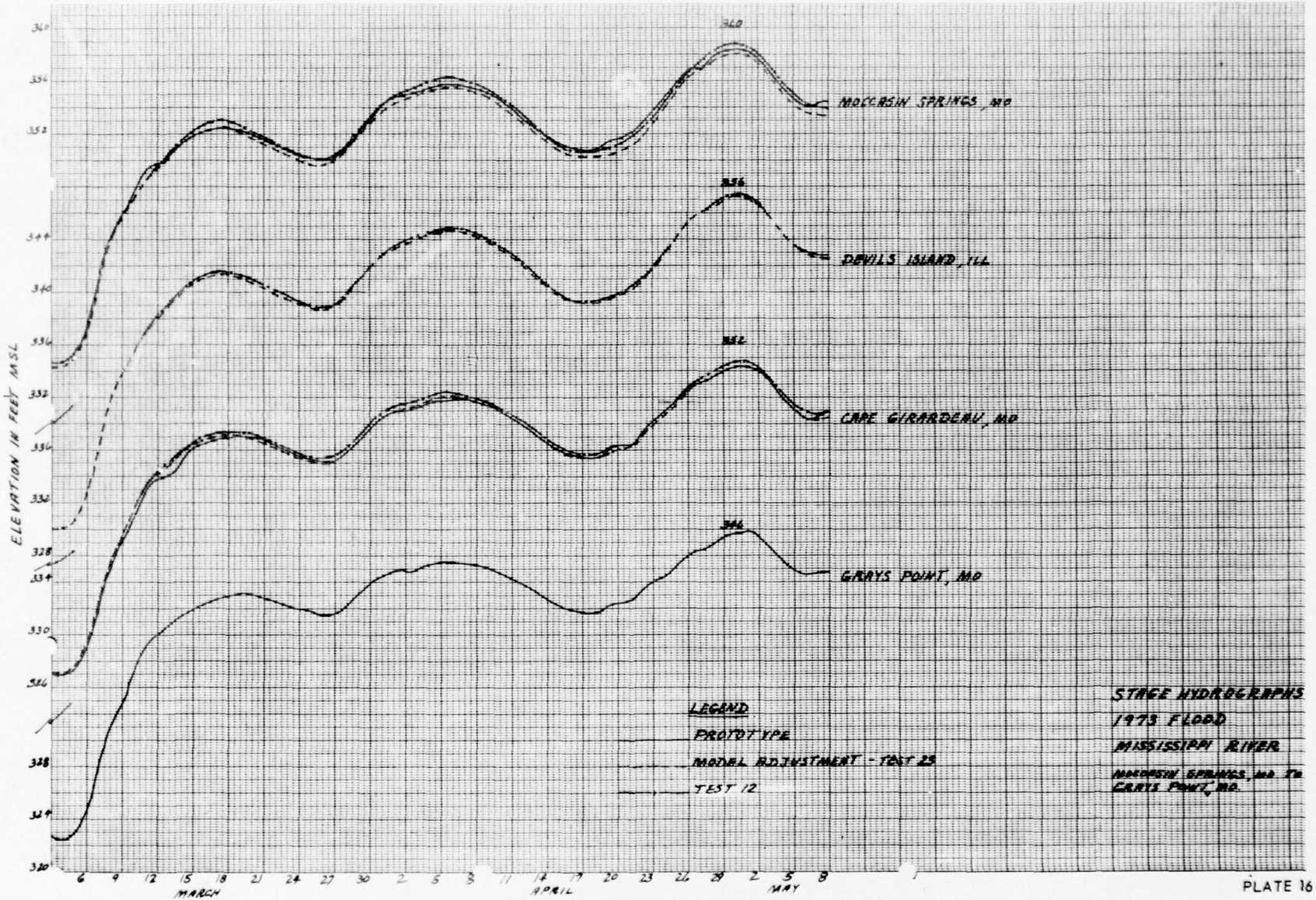

ELEVATION IN FEET MSL
340
336
332
328
324
320
MARCH
APRIL
MAY
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
360
356
352
348
344
340
336
332
328
324
320
MOCCASIN SPRINGS, MO
DEVILS ISLAND, ILL.
CAPE GIRARDEAU, MO
GRAYS POINT, MO
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 25
TEST 12
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
MOCCASIN SPRINGS, MO TO GRAYS POINT, MO.

PLATE 16

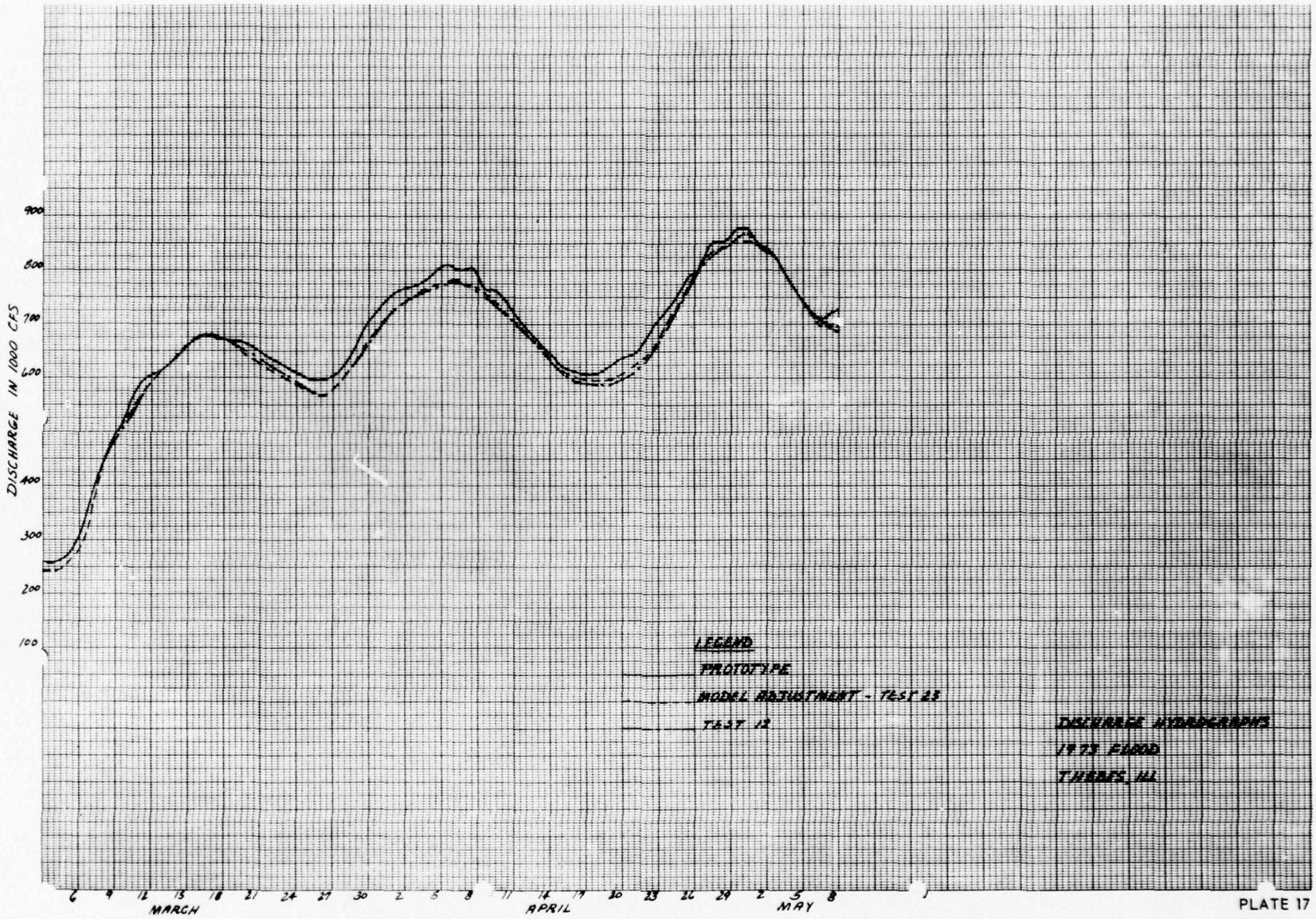

DISCHARGE IN 1000 CFS
900
800
700
600
400
300
200
100
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 12
DISCHARGE HYDROGRAPHS
1973 FLOOD
THEBES, ILL.

PLATE 17

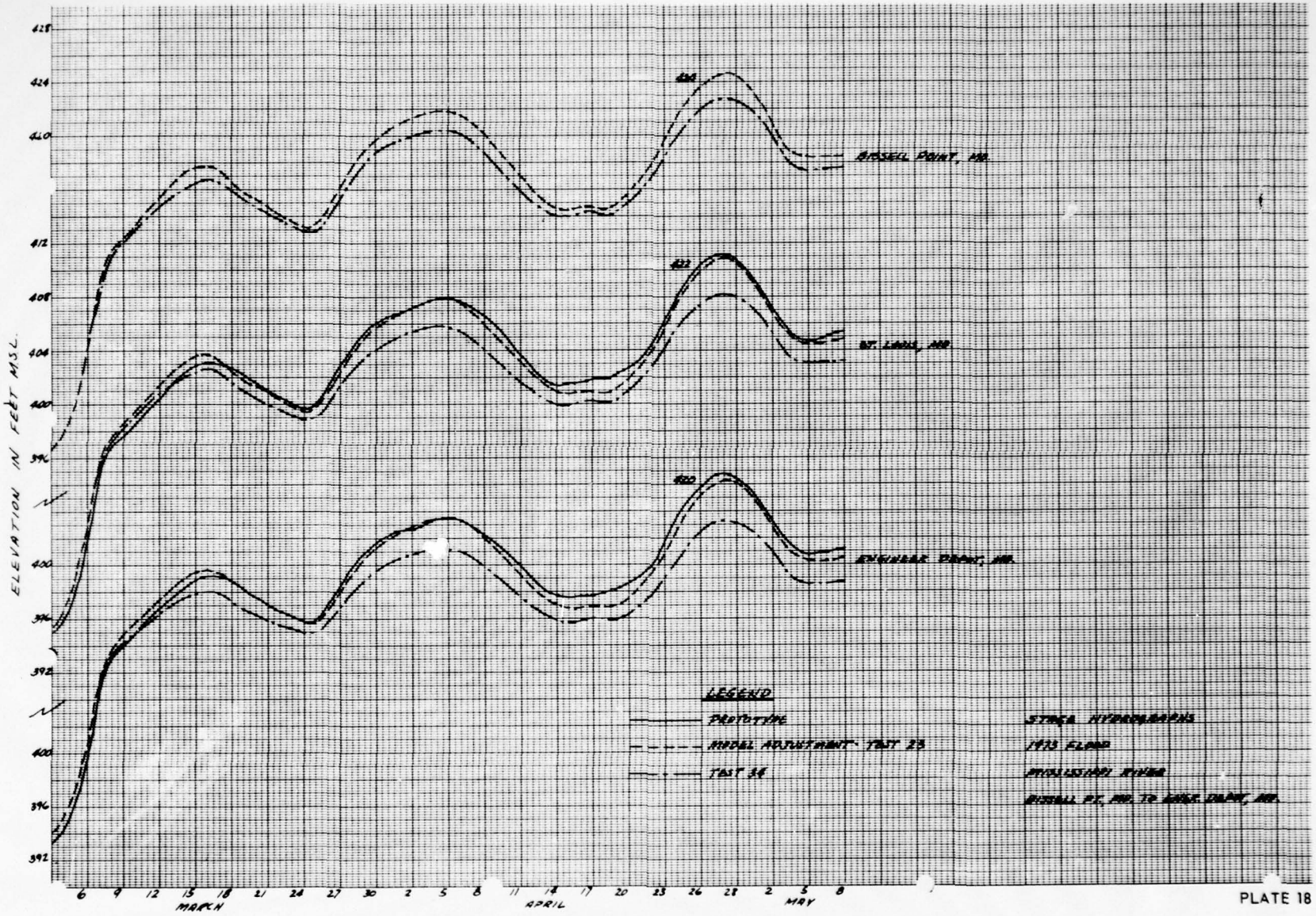

ELEVATION IN FEET MSL.
428
424
420
412
408
404
400
396
392
400
396
392
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 28 2 5 8
MARCH
APRIL
MAY
428
422
420
BISSELL POINT, MO.
ST. LOUIS, MO.
ENGINEER DEPOT, MO.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT: TEST 23
TEST 36
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
BISSELL PT. MO. TO ARSENAL ISLAND, MO.

PLATE 18

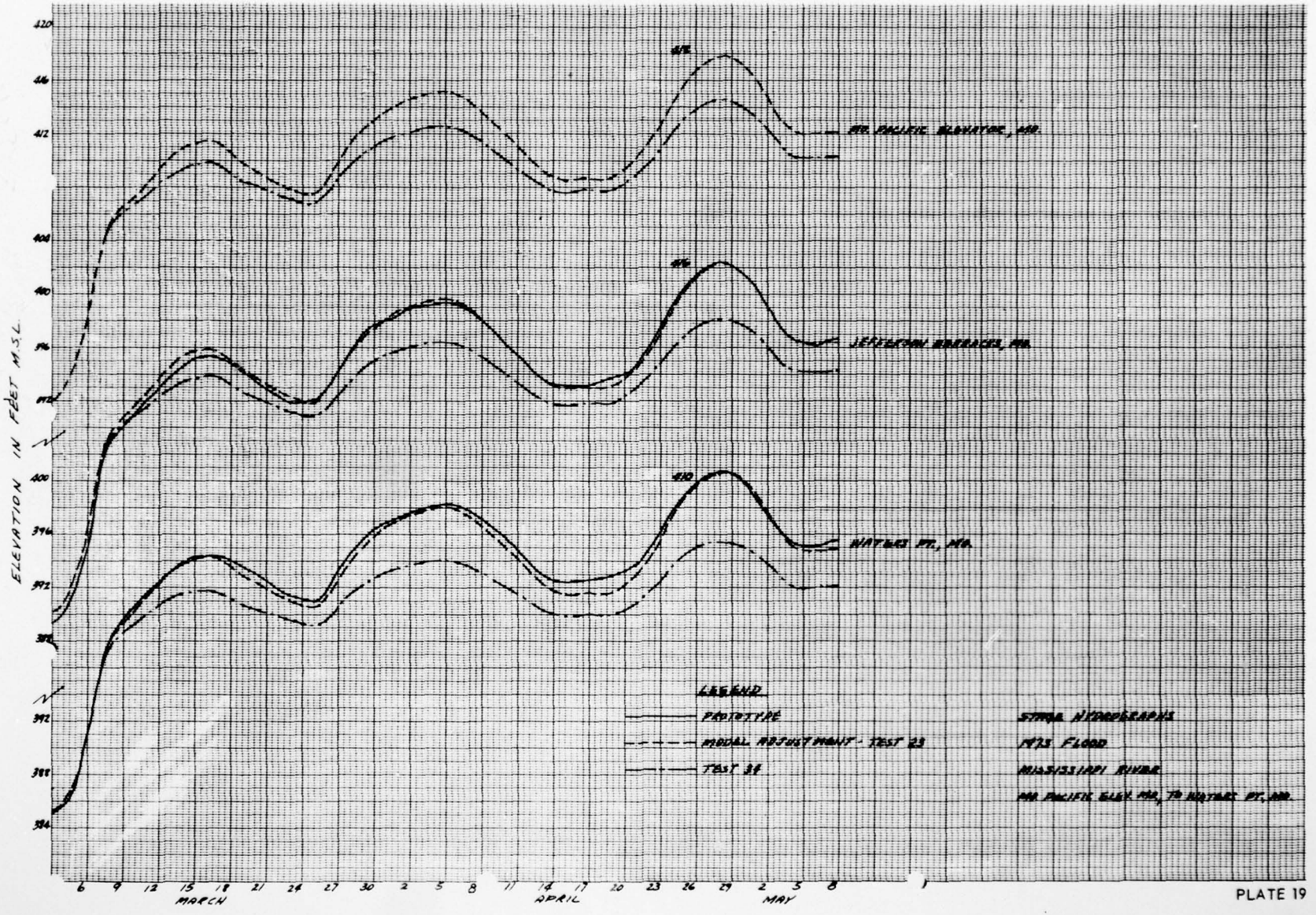

ELEVATION IN FEET M.S.L.
420
416
412
408
404
400
396
392
388
384
MEM. PACIFIC ELEVATION, MSD.
JEFFERSON BARRACKS, MO.
MEMPHIS, TENN.
VICKSBURG, MISS.
NATCHEZ, MISS.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 34
STAGE HYDROGRAPHS
1923 FLOOD
MISSISSIPPI RIVER
MEM. PACIFIC ELEV. MSD. TO NATCHEZ, MISS.
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY

PLATE 19

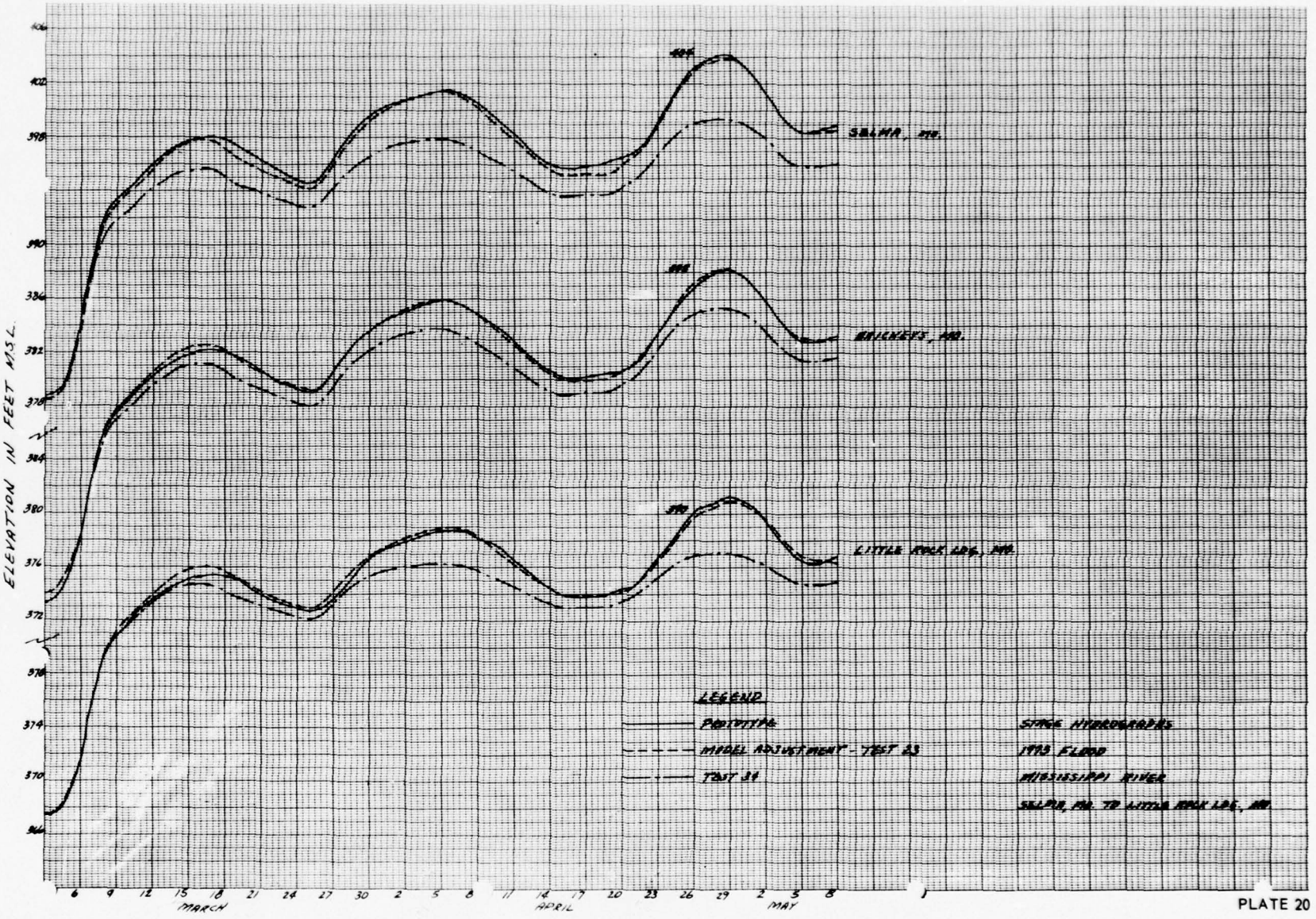

ELEVATION IN FEET M.S.L.
SELMA, ARK.
BRICKEYS, ARK.
LITTLE ROCK LDG., MISS.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 31
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
SELMA, ARK. TO LITTLE ROCK LDG., MISS.
MARCH
APRIL
MAY

PLATE 20

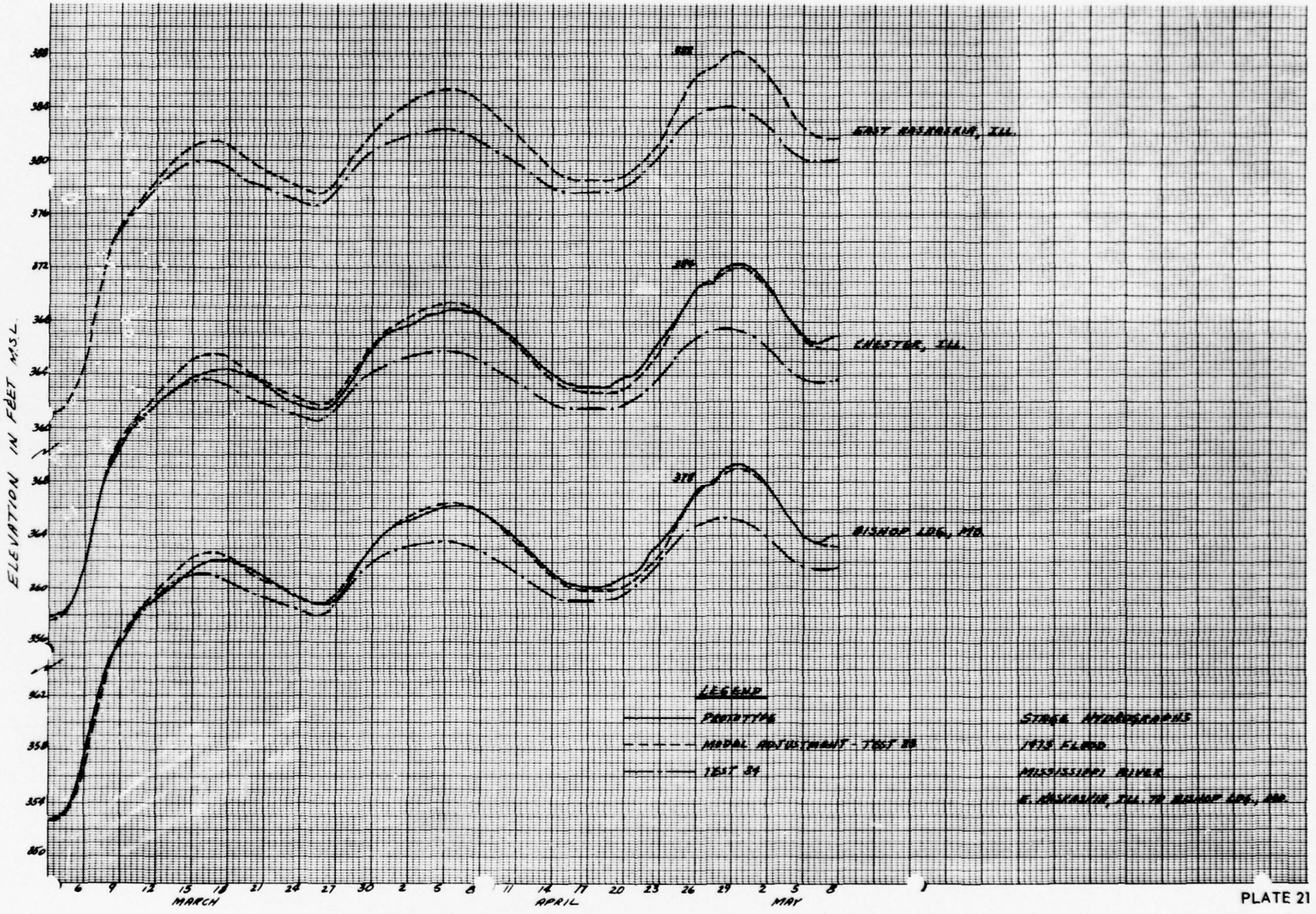

ELEVATION IN FEET M.S.L.
EAST ALTON, ILL.
CHESTER, ILL.
BISHOP LOCK, MO.
LEGEND
PROTOTYPE
MODAL ADJUSTMENT - TEST 88
TEST 84
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
E. ALTON, ILL. TO BISHOP LOCK, MO.
MARCH
APRIL
MAY

PLATE 21

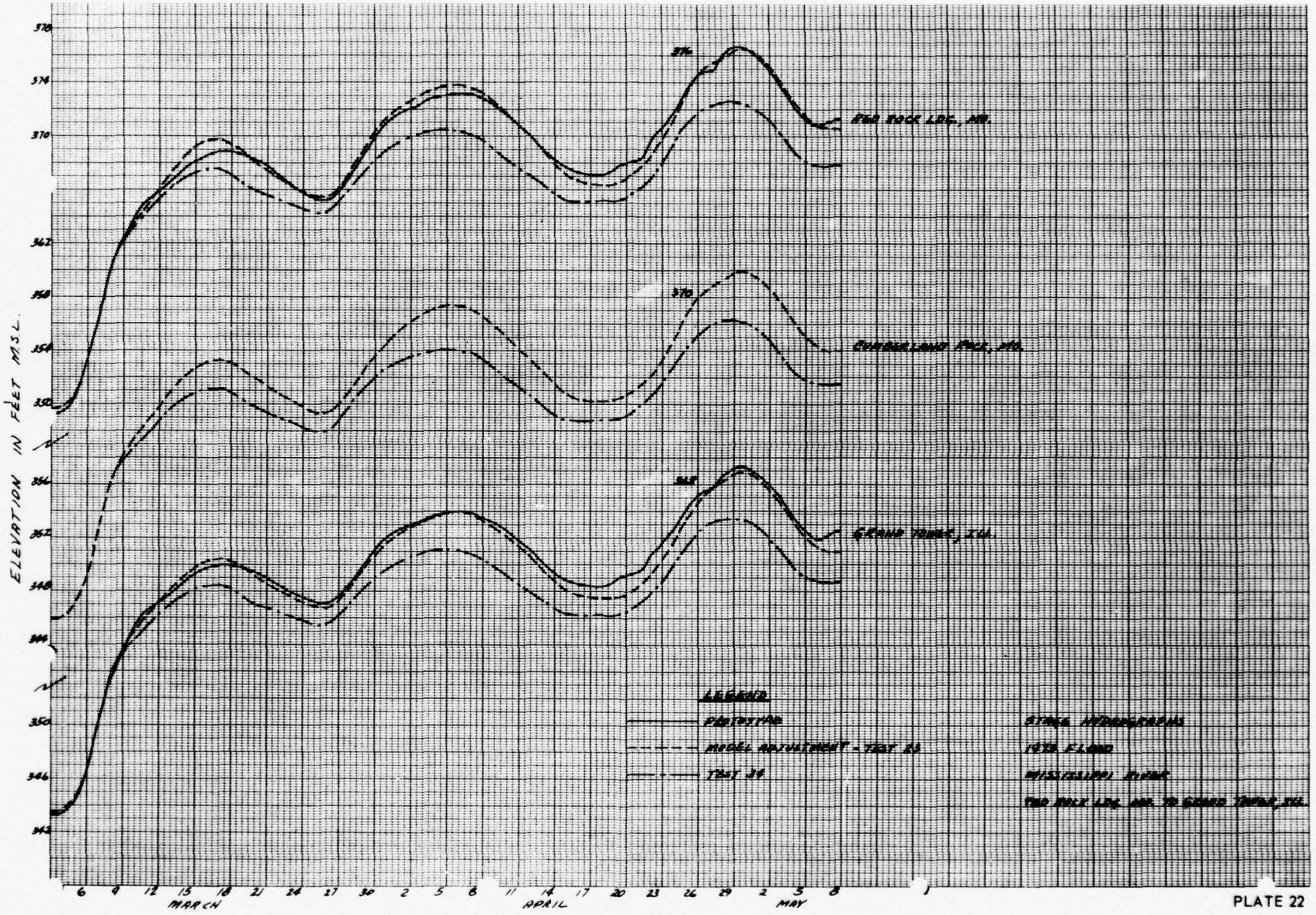

ELEVATION IN FEET M.S.L.
378
374
370
362
358
354
350
346
342
ROCK LDG., MO.
CUMBERLAND PROJ., KTY.
GRAND TOWER, ILL.
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 25
TEST 34
OTHER HYDROGRAPHS
OHIO RIVER
MISSISSIPPI RIVER
TWO RIVER LDG. NR. TO GRAND TOWER, ILL.

PLATE 22

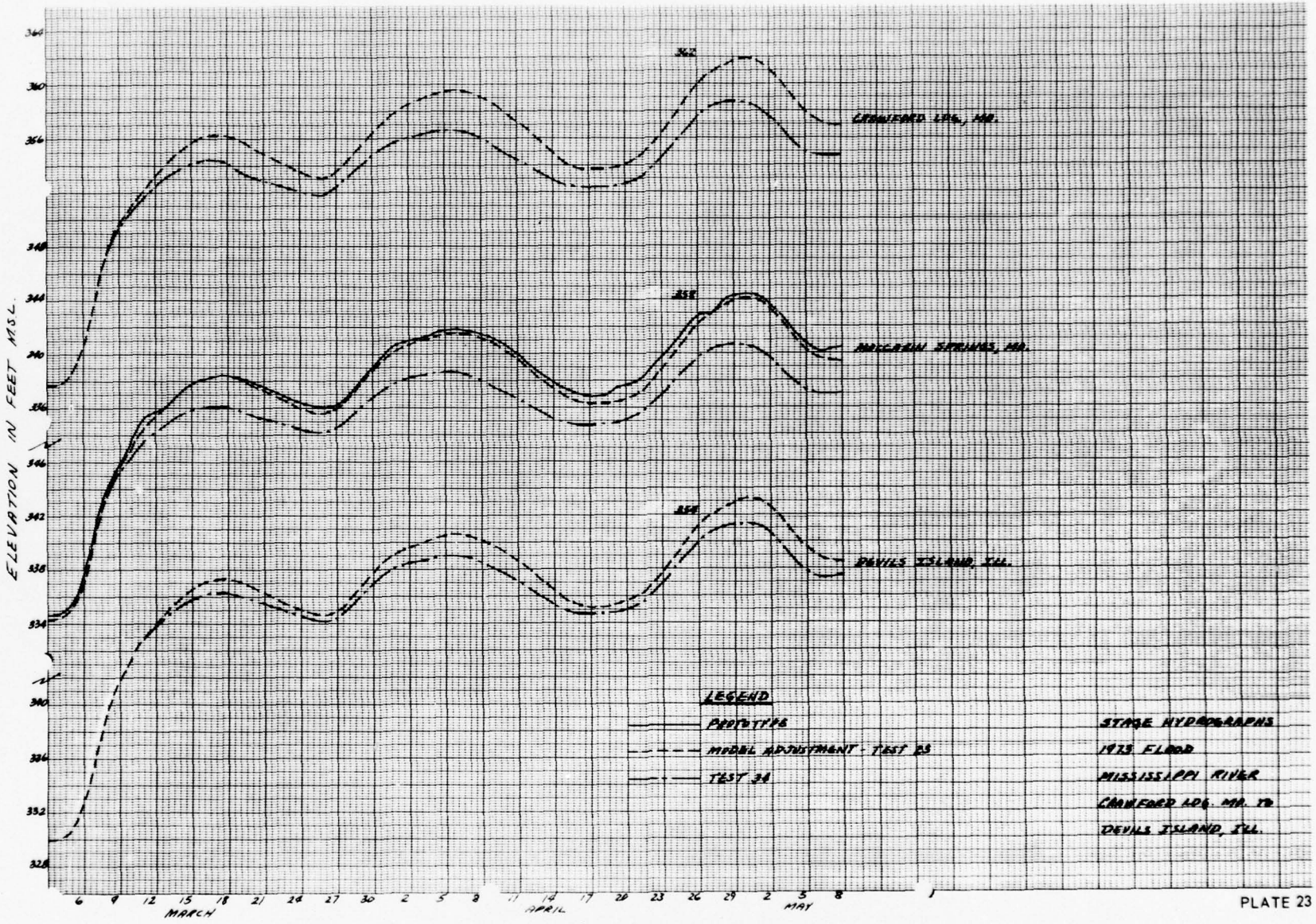

ELEVATION IN FEET MSL.
CRAWFORD LDG., MO.
BELGRAIN SPRINGS, MO.
DEVILS ISLAND, ILL.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 25
TEST 34
STAGE HYDROGRAPHS
1973 FLOOD
MISSISSIPPI RIVER
CRAWFORD LDG. MO. TO
DEVILS ISLAND, ILL.
MARCH
APRIL
MAY

PLATE 23

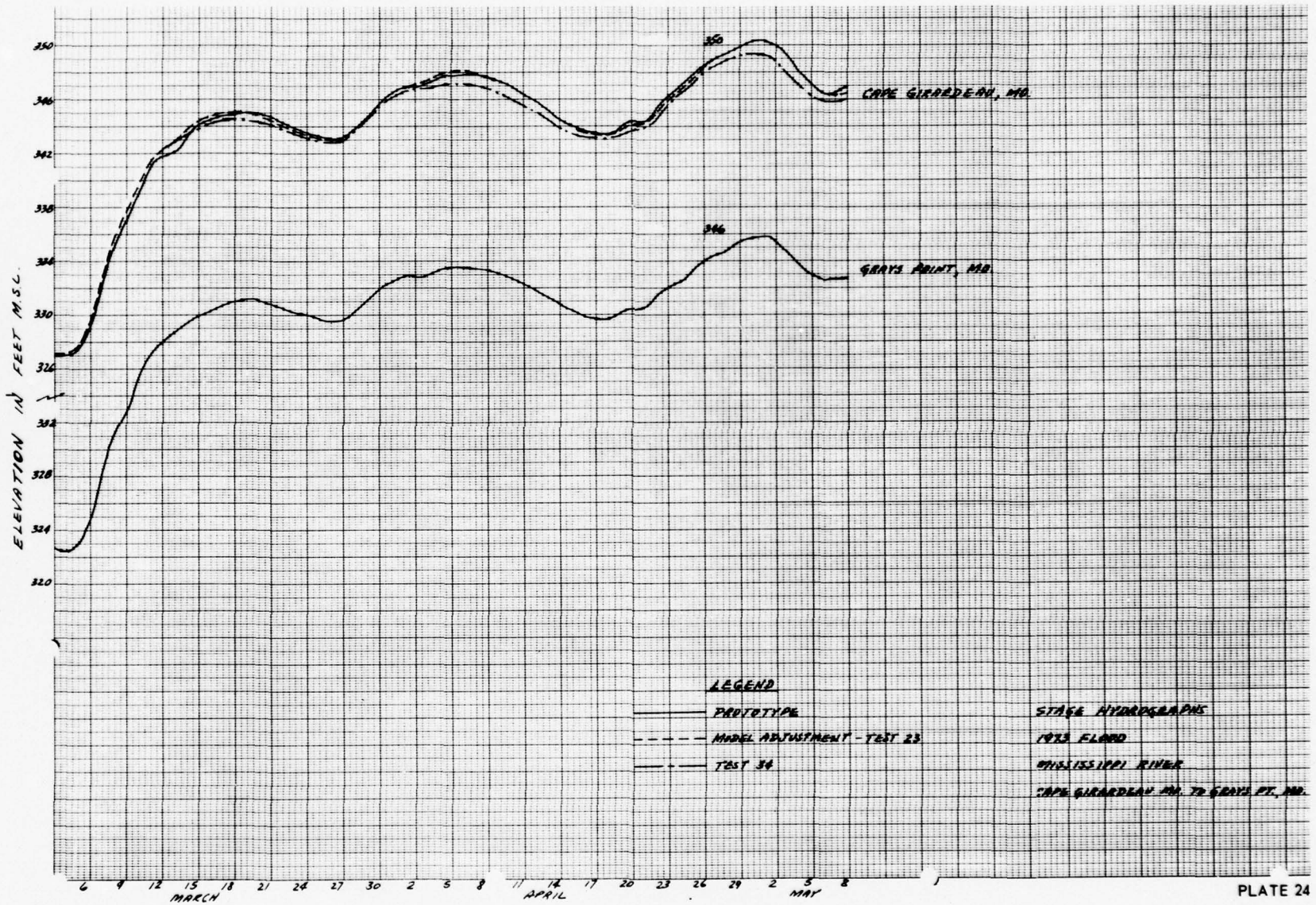

ELEVATION IN FEET M.S.L.
350
346
342
338
334
330
326
322
318
314
310
350
CAPE GIRARDEAU, MO.
346
GRAYS POINT, MO.
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 23
TEST 34
STAGE HYDROGRAPHS
1933 FLOOD
MISSISSIPPI RIVER
CAPE GIRARDEAU MO. TO GRAYS PT. MO.
6 9 12 15 18 21 24 27 30 2 5 8
MARCH
11 14 17 20 23 26 29 2 5 8
APRIL
MAY

PLATE 24

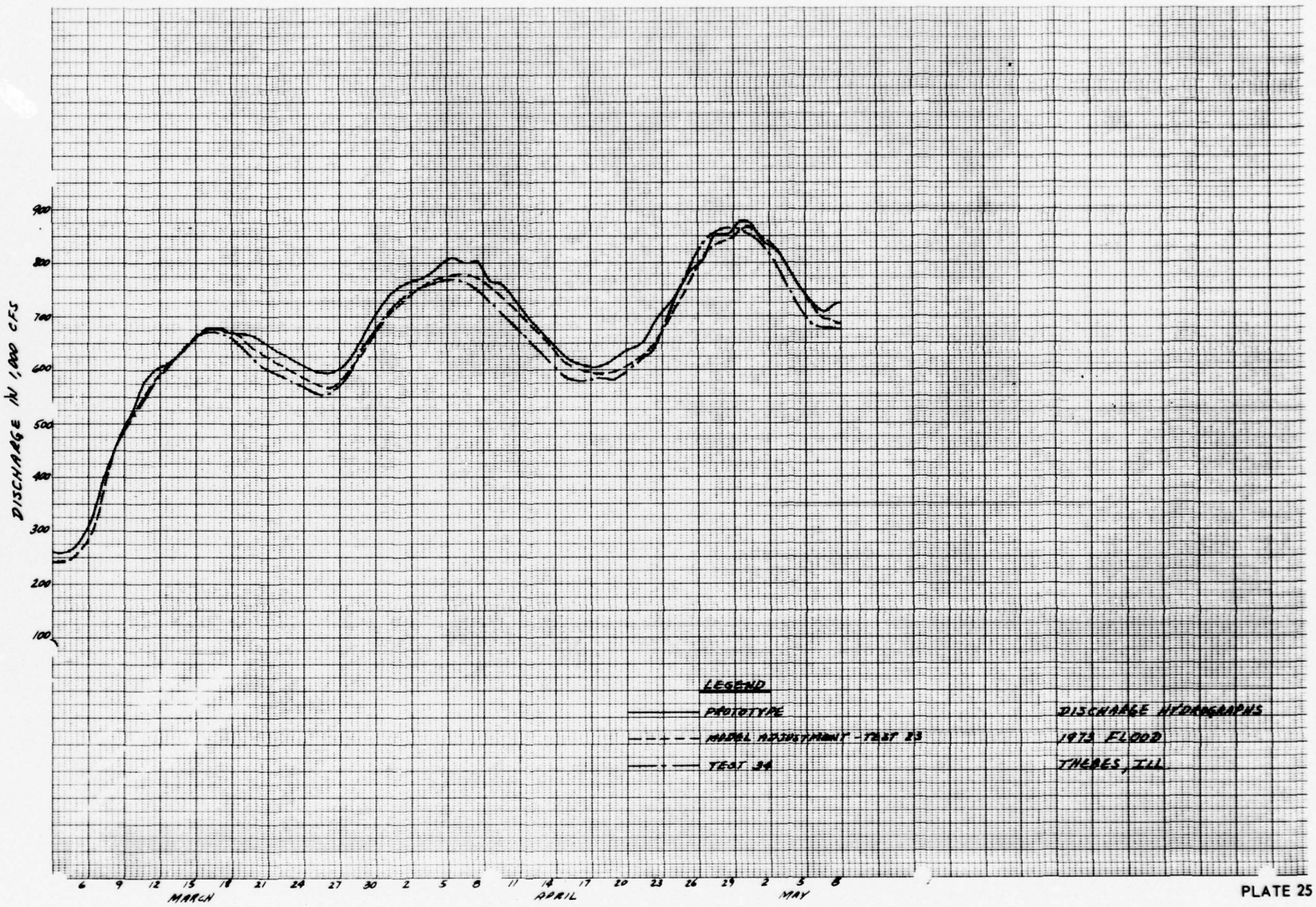

DISCHARGE IN 1,000 CFS
900
800
700
600
500
400
300
200
100
6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 29 2 5 8
MARCH
APRIL
MAY
LEGEND
PROTOTYPE
MODEL ADJUSTMENT - TEST 33
TEST 34
DISCHARGE HYDROGRAPHS
1973 FLOOD
THEBES, ILL.

PLATE 25

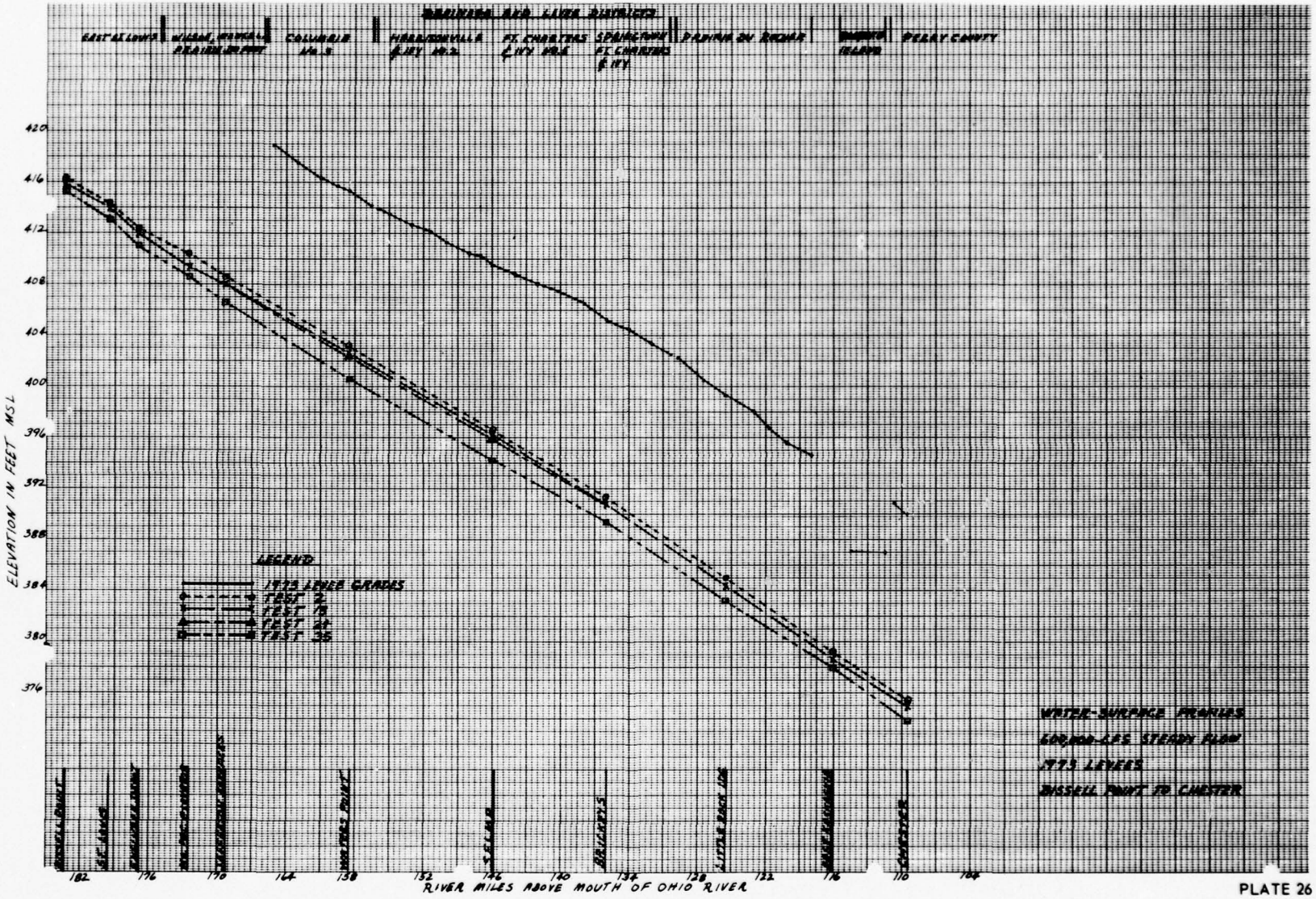

MISSISSIPPI RIVER LEVEE DISTRICTS
EAST ST. LOUIS
WILLIAM J. MURPHY
COLUMBIA
HARRISONVILLE
FT. CHARTRES
SPARTA-CHESTER
PRAIRIE DU ROCHER
PERRY COUNTY
ELEVATION IN FEET MSL
420
416
412
408
404
400
396
392
388
384
380
376
LEGEND:
1973 LEVEE GRADES
TEST 2
TEST 10
TEST 20
TEST 35
WATER-SURFACE PROFILES
600,000 CFS STEADY FLOW
1973 LEVEES
RIVER MILES ABOVE MOUTH OF OHIO RIVER
182
176
170
164
158
152
146
140
134
128
122
116
110
104

PLATE 26

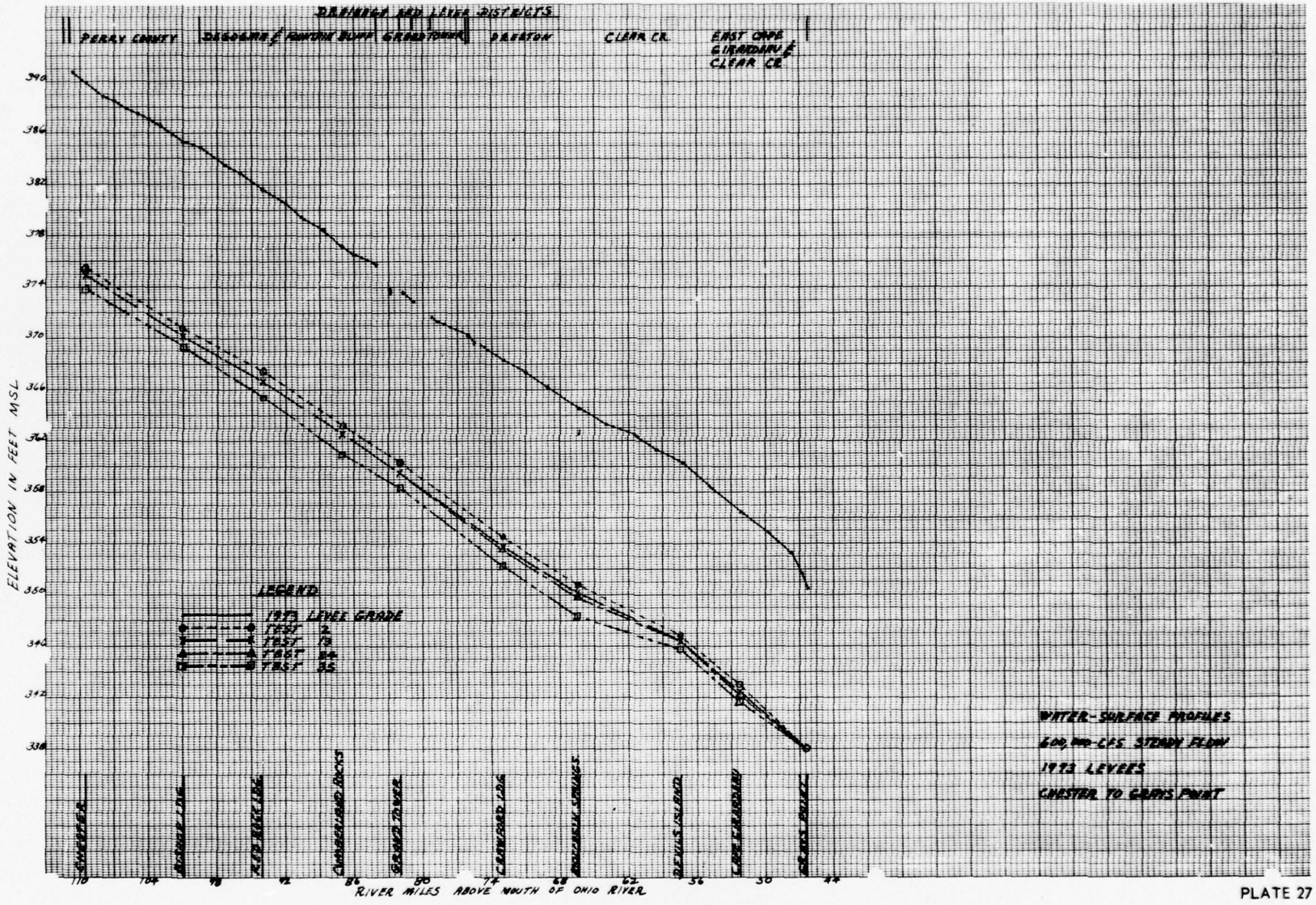

DRAINAGE AND LEVEE DISTRICTS
PERRY COUNTY
DEGOGNIA & FOUNTAIN BLUFF
GRAND TOWER
BRETON
CLEAR CR.
EAST CAPE GIRARDEAU & CLEAR CR.
ELEVATION IN FEET MSL
390
386
382
378
374
370
366
362
358
354
350
346
342
338
LEGEND
1973 LEVEE GRADE
FREQ. 2
FREQ. 10
FREQ. 50
FREQ. 100
CHESTER
RANDOL LOG
RED BIRD ISLAND
CUMBERLAND POINT
GRAND TOWER
CRAWFORD LOG
BRUSHY SPRINGS
LEWIS LANDING
CAPE GIRARDEAU
GRAYS POINT
110
104
98
92
86
80
74
68
62
56
50
44
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
600,000-CFS STEADY FLOW
1973 LEVEES
CHESTER TO GRAYS POINT

PLATE 27

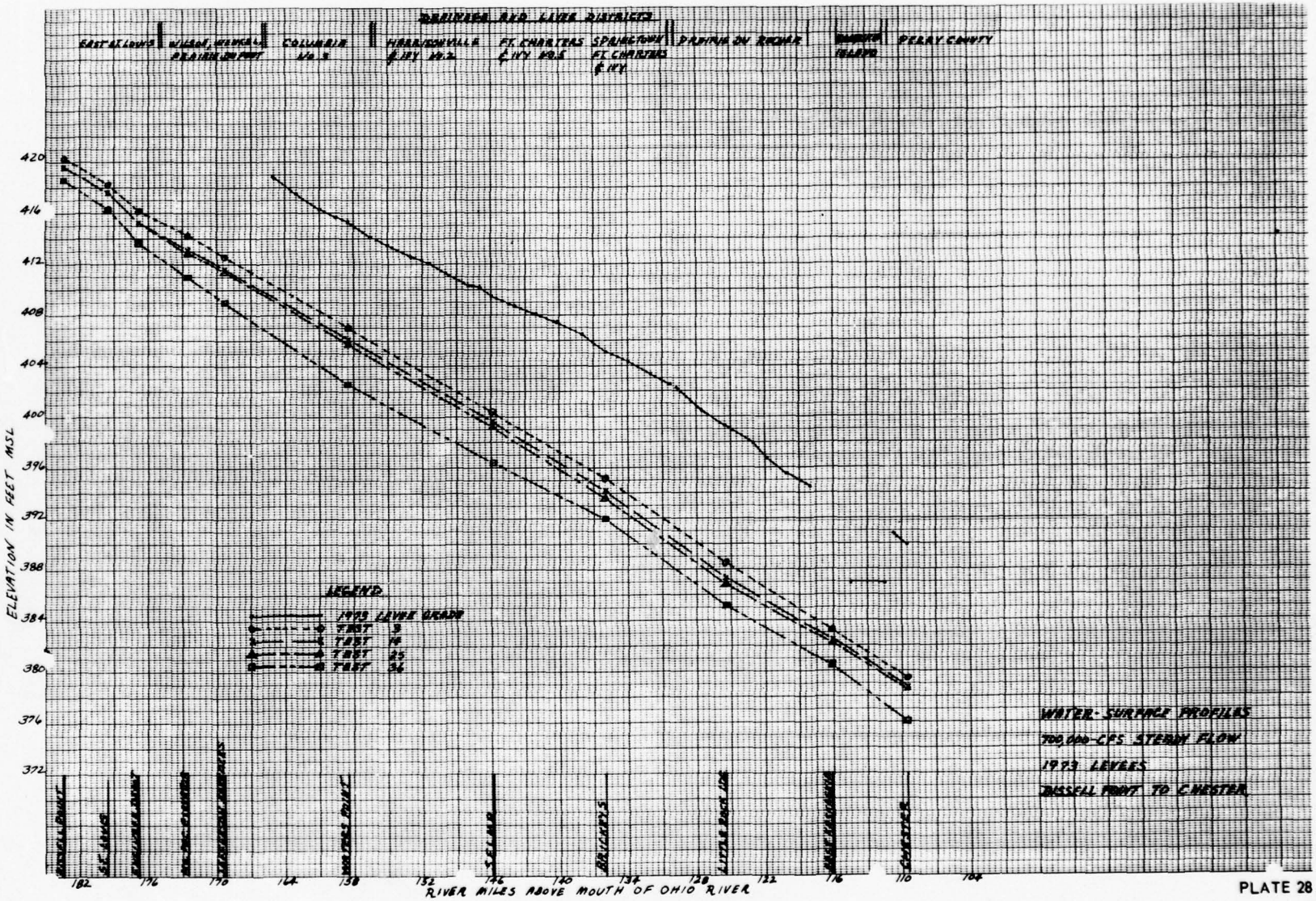

DRAINAGE AND LEVEE DISTRICTS
EAST ST LOUIS
WILSON, MELVIN & DRAINAGE DIST
COLUMBIA NO 2
HURRICANE
FT CHARTRES & IVY
SPRINGTOWN FT CHARTRES & IVY
PRAIRIE DU ROCHER
MARKHAM
PERRY COUNTY
420
416
412
408
404
400
396
392
388
384
380
376
372
ELEVATION IN FEET MSL
LEGEND
1973 LEVEE GRADE
TEST 9
TEST 19
TEST 25
TEST 34
WATER SURFACE PROFILES
700,000-CFS STEADY FLOW
1973 LEVEES
CHESTER
182
176
170
164
158
152
146
140
134
128
122
116
110
104
RIVER MILES ABOVE MOUTH OF OHIO RIVER

PLATE 28

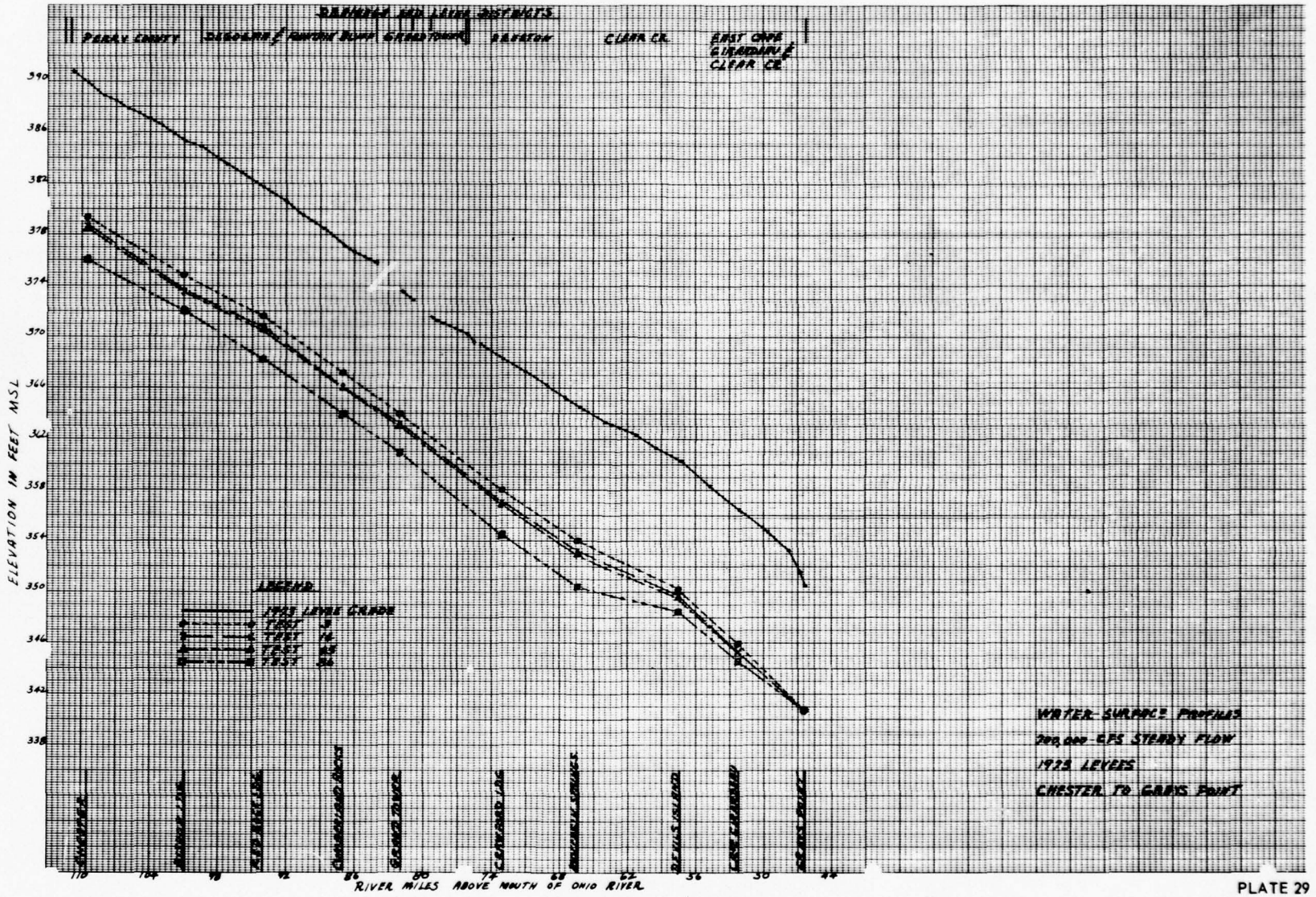

DRAINAGE AND LEVEE DISTRICTS
PERRY COUNTY
DESOTO-CRAIG-FOURTEEN MILE-WOODSON
DEVIATION
CLARK CR.
EAST CAPE GIRARDEAU & CLEAR CR.
ELEVATION IN FEET MSL
390
386
382
378
374
370
366
362
358
354
350
346
342
338
LEGEND
1928 LEVEE GRADE
FIRST
FIRST
FIRST
FIRST
110
104
98
92
86
80
74
68
62
56
50
44
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER SURFACE PROFILES
300,000 CFS STEADY FLOW
1928 LEVEES
CHESTER TO GRAYS POINT

PLATE 29

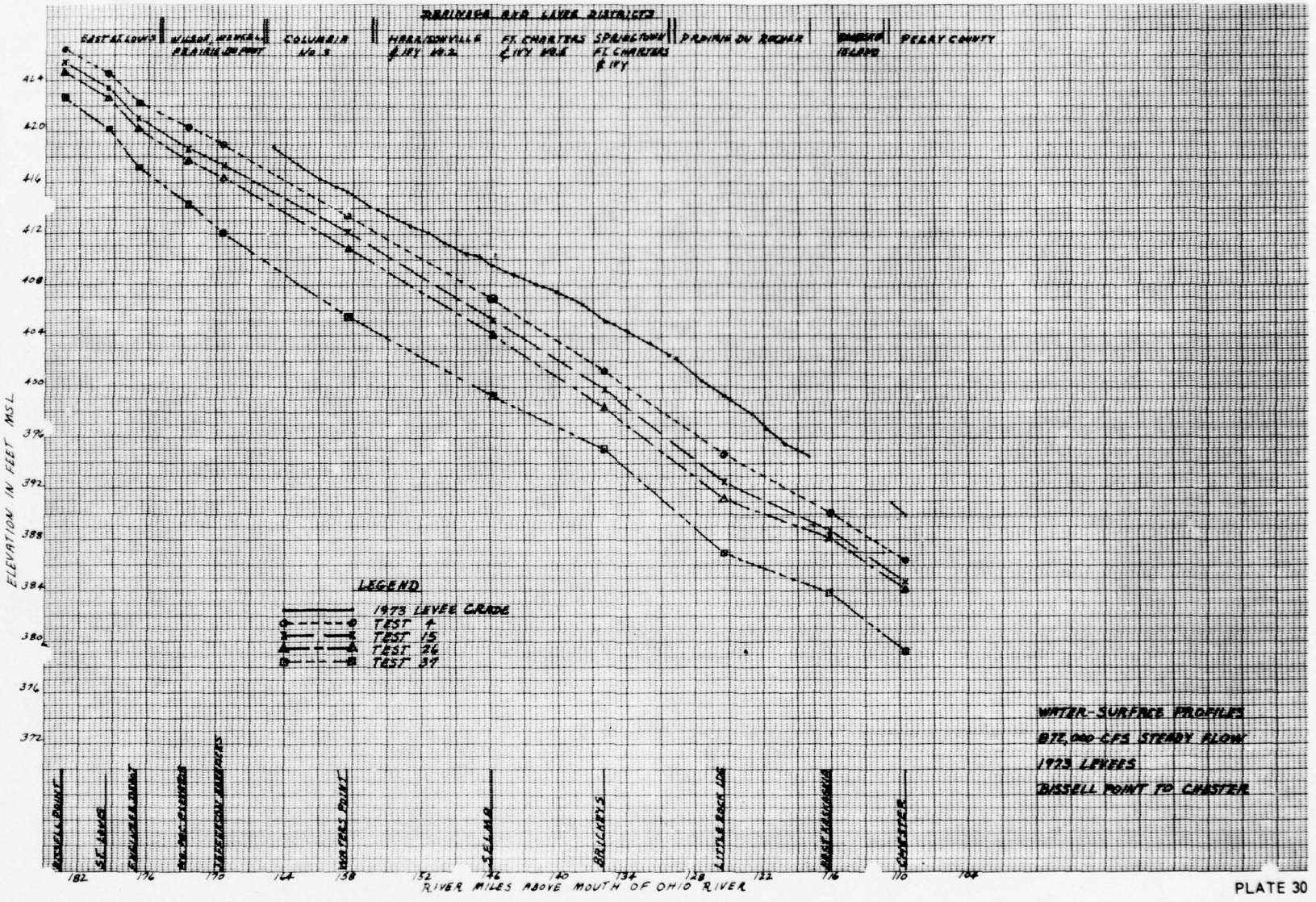

DRAINAGE AND LEVEE DISTRICTS
EAST ST. LOUIS
WILSON, MITCHELL, PRAIRIE DU PONT
COLUMBIA No. 8
HARRISONVILLE & IVY No. 2
FT. CHARTRES & IVY No. 6
SPARROWTOWN, FT. CHARTRES & IVY
PRAIRIE DU ROCHER
MARAIS TEMBEAU
PERRY COUNTY
ELEVATION IN FEET MSL
414
420
416
412
408
404
400
396
392
388
384
380
376
372
LEGEND
1973 LEVEE GRADE
TEST 4
TEST 15
TEST 26
TEST 37
RUSSELL POINT
S.E. LEVEE
EVANSVILLE CREVASSE
NEW MADRID FLOODWAY
STEPHENSON CREVASSES
WALTERS POINT
S.E. BAR
BRICKEYS
LITTLE ROCK ISLE
KASKASKIA CREVASSES
CHESTER
182
176
170
164
158
152
146
140
134
128
122
116
110
104
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
810,000 C.F.S. STEADY FLOW
1973 LEVEES
BISSELL POINT TO CHESTER

PLATE 30

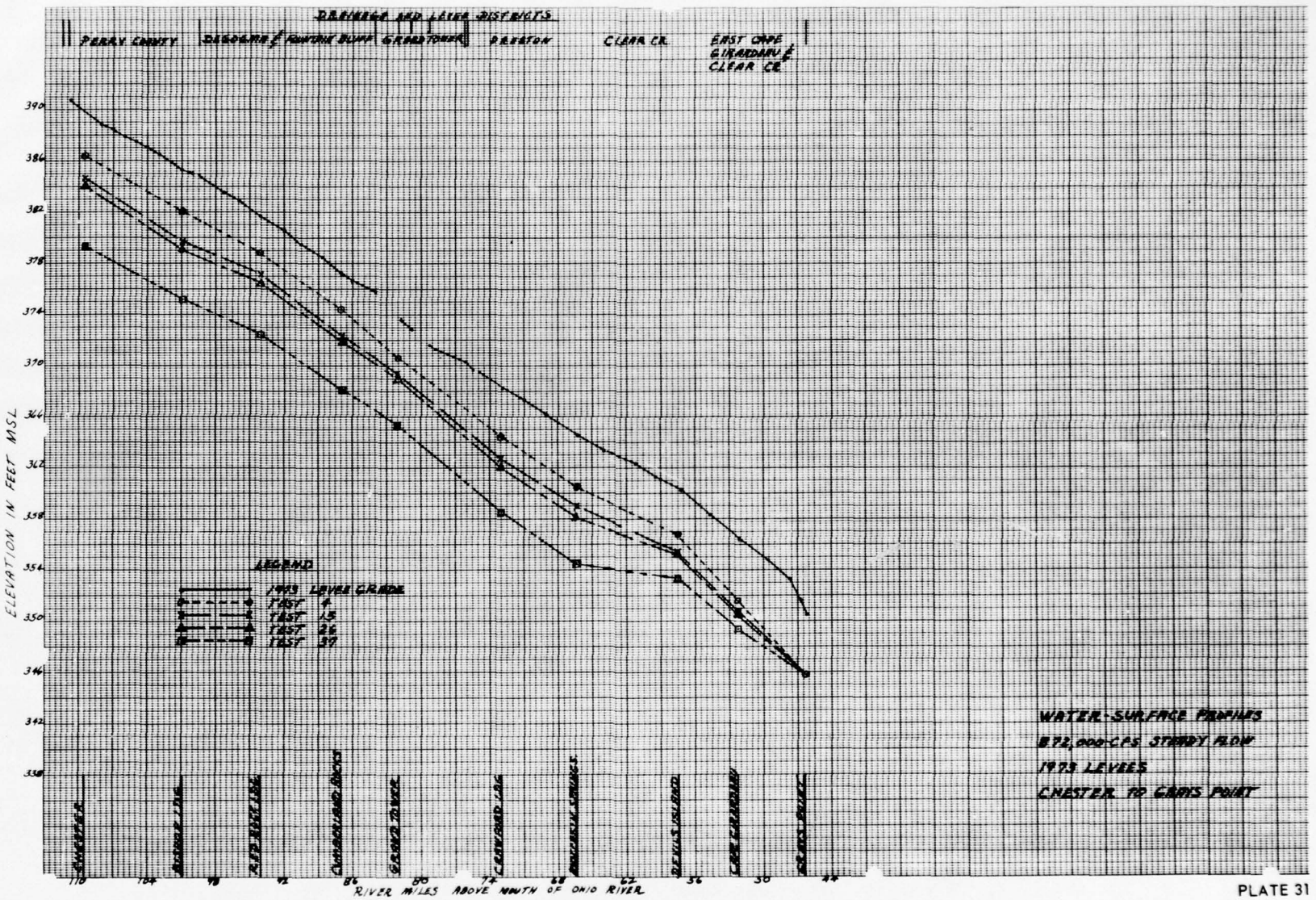

DRAINAGE AND LEVEE DISTRICTS
PERRY COUNTY
DEGOGNIA & ROWTOWN BLUFF
GRAND TOWER
PRATON
CLEAR CR.
EAST CAPE GIRARDEAU & CLEAR CR.
ELEVATION IN FEET MSL
390
386
382
378
374
370
366
362
358
354
350
346
342
338
LEGEND
1979 LEVEE GRADE
TEST 1
TEST 15
TEST 26
TEST 37
CHESTER
KASKASKIA R.
KINCAID LDG.
CHARLESTON BEND
GRAND TOWER
CRAWFORD LDG.
BRICKEY CREEK
DEVILS ISLAND
LEE LANDING
CAPE GIRARDEAU
110
104
98
92
86
80
74
68
62
56
50
44
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
372,000 CFS STEADY FLOW
1979 LEVEES
CHESTER TO CAPE GIRARDEAU

PLATE 31

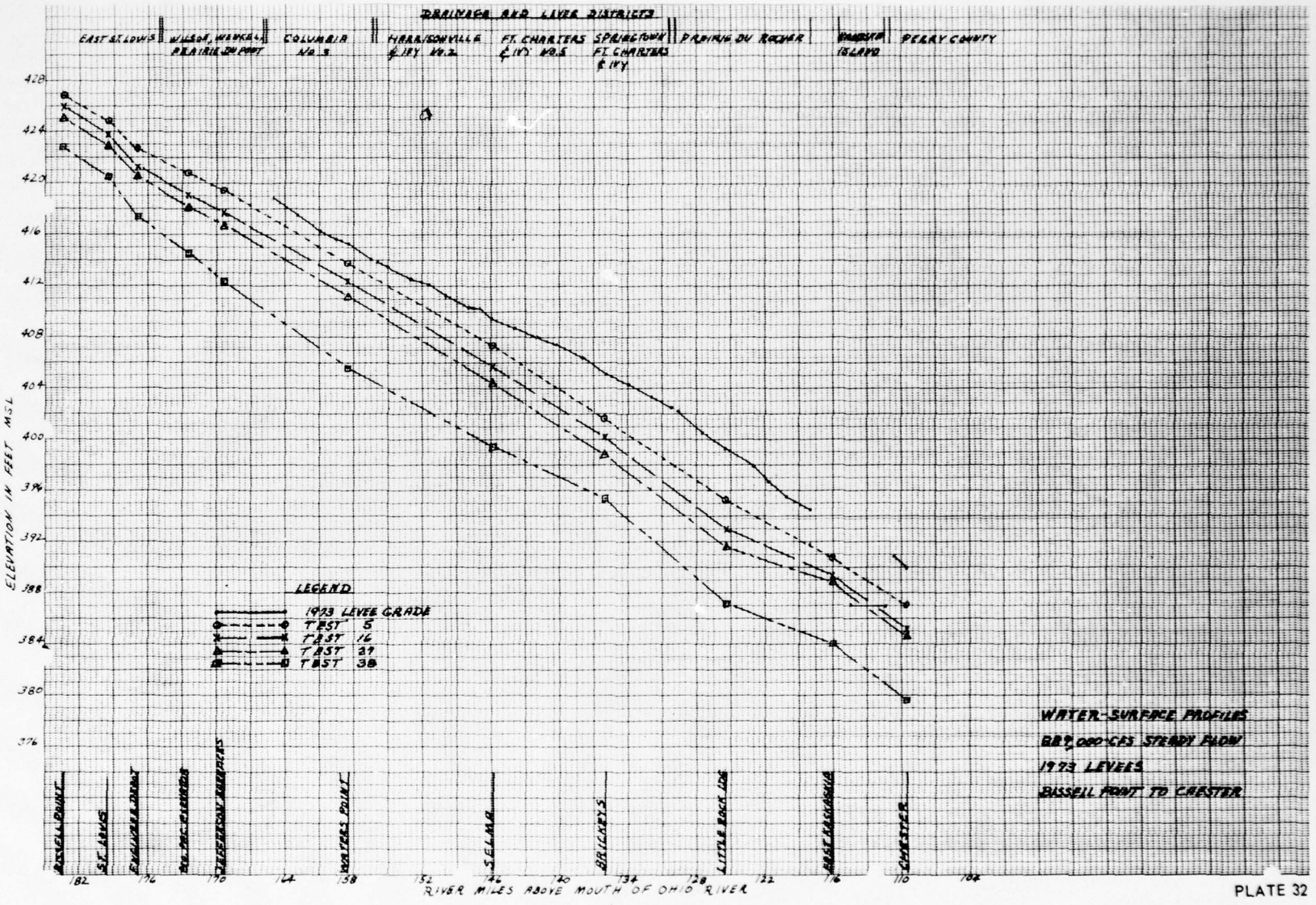

DRAINAGE AND LEVEE DISTRICTS
EAST ST. LOUIS
WILSON, WORTHAM PRAIRIE DU PONT
COLUMBIA No. 9
HARRISONVILLE & IRY No. 2
FT. CHARTERS & IRY No. 5
SPRINGTOWN FT. CHARTERS & IRY
PRAIRIE DU ROCHER
MARISTA ISLAND
PERRY COUNTY
ELEVATION IN FEET MSL
428
424
420
416
412
408
404
400
396
392
388
384
380
376
LEGEND
1973 LEVEE GRADE
TEST 5
TEST 16
TEST 27
TEST 38
ROSCELLA POINT
S.E. ARMS
EVANSVILLE BEND
MILLSTADT CUTOFF
TREMENTINA CUTOFF
WOLFES POINT
S.E. MAG
BRICKEYS
LITTLE ROCK IDS
FORT KASKASKIA
CHESTER
182
176
170
164
158
152
146
140
134
128
122
116
110
104
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
680,000 CFS STEADY FLOW
1973 LEVEES
BISSELL POINT TO CHESTER

PLATE 32

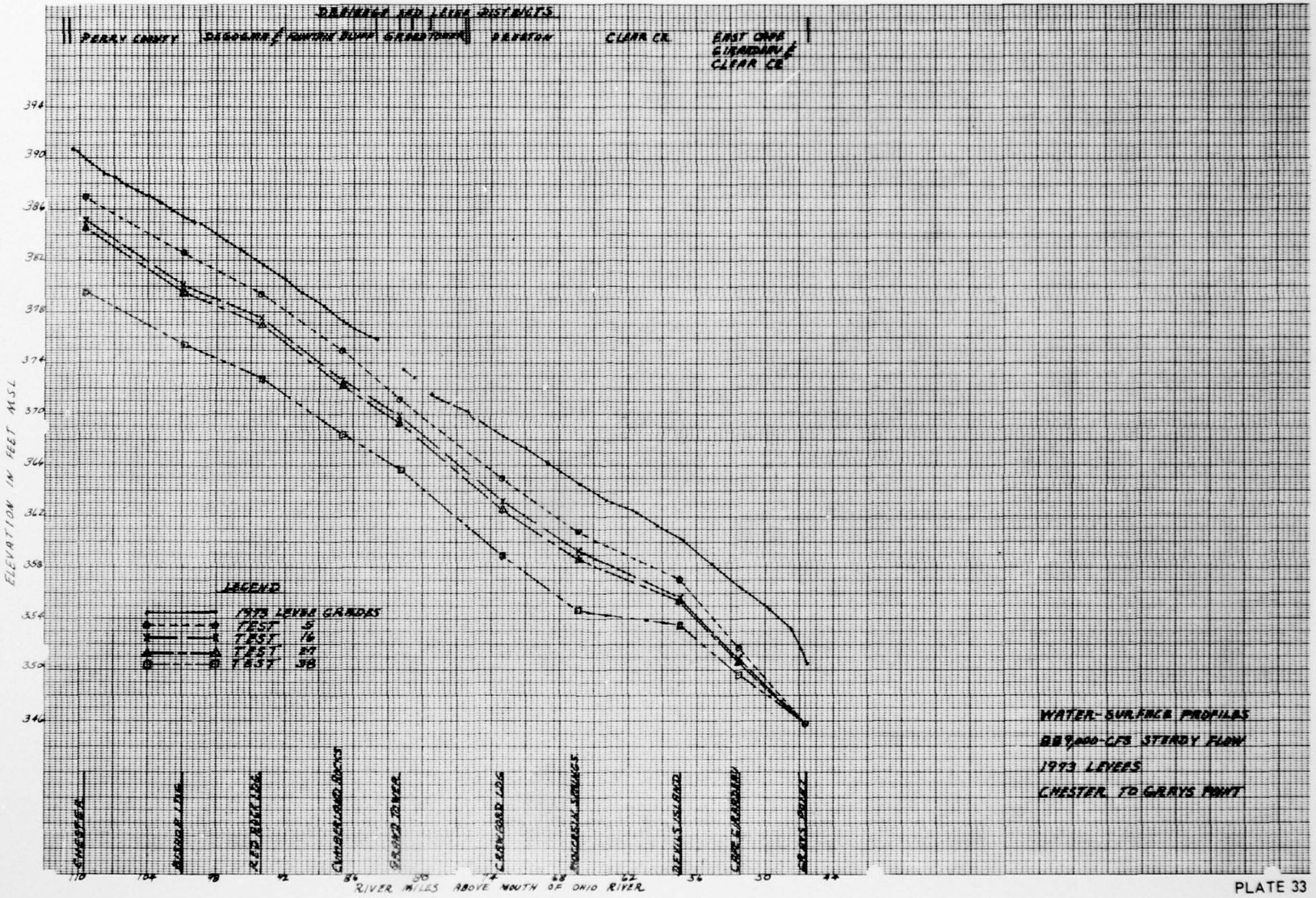

DRAINAGE AND LEVEE DISTRICTS
PERRY COUNTY
DRAINAGE & IMPROVEMENT DIST. NO. 1
GRAND TOWER
DRAINAGE DIST. NO. 2
DEVILS ISLAND
CLEAR CK.
EAST CAPE GIRARDEAU & CLEAR CK.
ELEVATION IN FEET M.S.L.
394
390
386
382
378
374
370
366
362
358
354
350
346
LEGEND
1973 LEVEE GRADES
TEST 5
TEST 16
TEST 27
TEST 38
CHESTER
RANDOL LDG.
RED ROCK LDG.
CUMBERLAND ROCKS
GRAND TOWER
CLEAR CREEK LDG.
PONCE DE LEON SPRINGS
DEVILS ISLAND
CAPE GIRARDEAU
CAPE GIRARDEAU
110
104
98
92
86
80
74
68
62
56
50
44
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
800,000-CFS STEADY FLOW
1973 LEVEES
CHESTER TO GRAYS POINT

PLATE 33

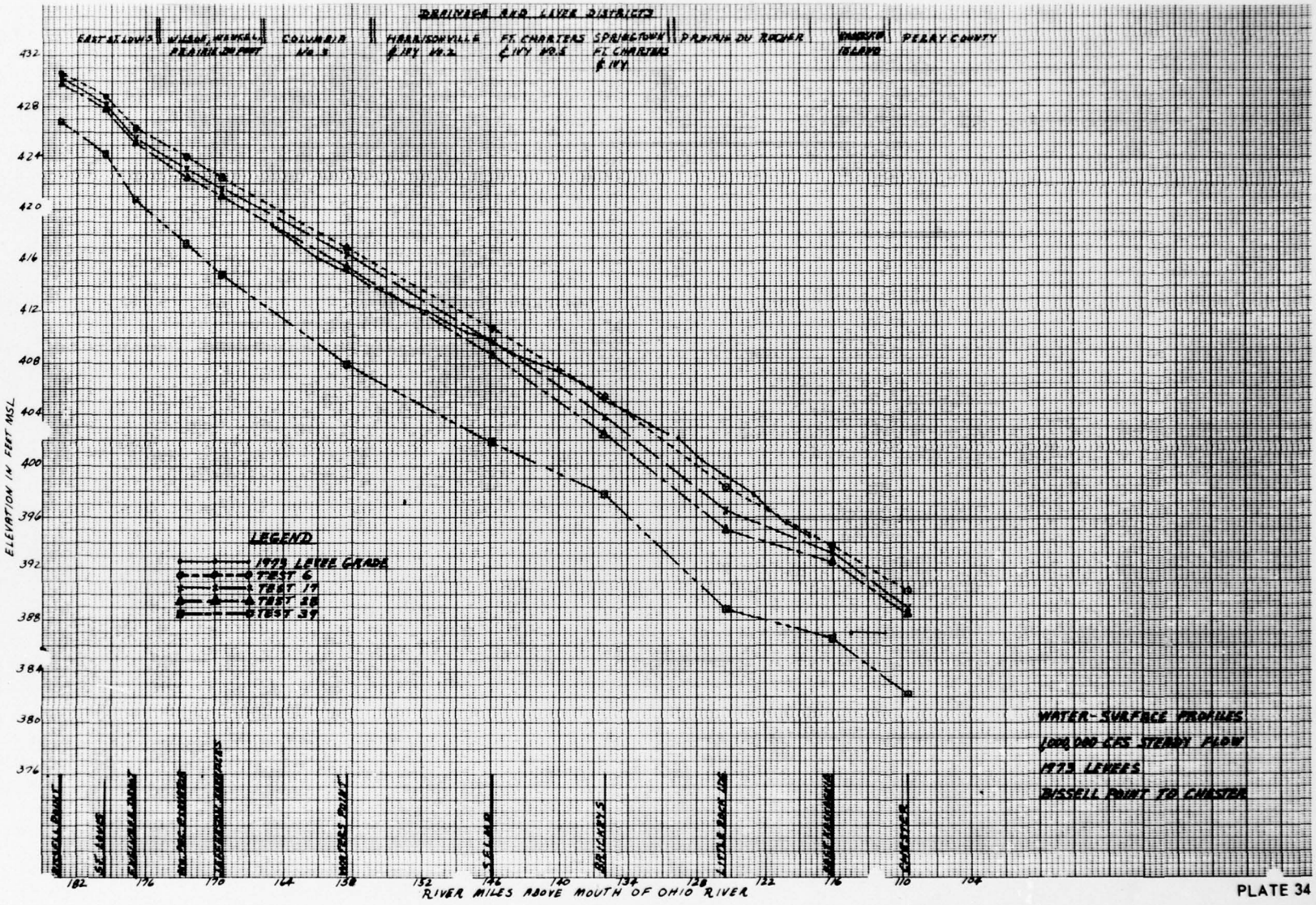

DRAINAGE AND LEVEE DISTRICTS
EAST ST. LOUIS
WILSON, MERIDEN PRAIRIE DU PONT
COLUMBIA No. 3
FIDELITY No. 2
FT. CHARTERS LEVY NO. 5
SPRINGTOWN FT. CHARTERS LEVY
PRAIRIE DU ROCHER
MARAIS ISLAND
PERRY COUNTY
ELEVATION IN FEET MSL
LEGEND
1973 LEVEE GRADE
TEST 6
TEST 17
TEST 28
TEST 39
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
1,000,000 CFS STEADY FLOW
1973 LEVEES
BISSELL POINT TO CHESTER

PLATE 34

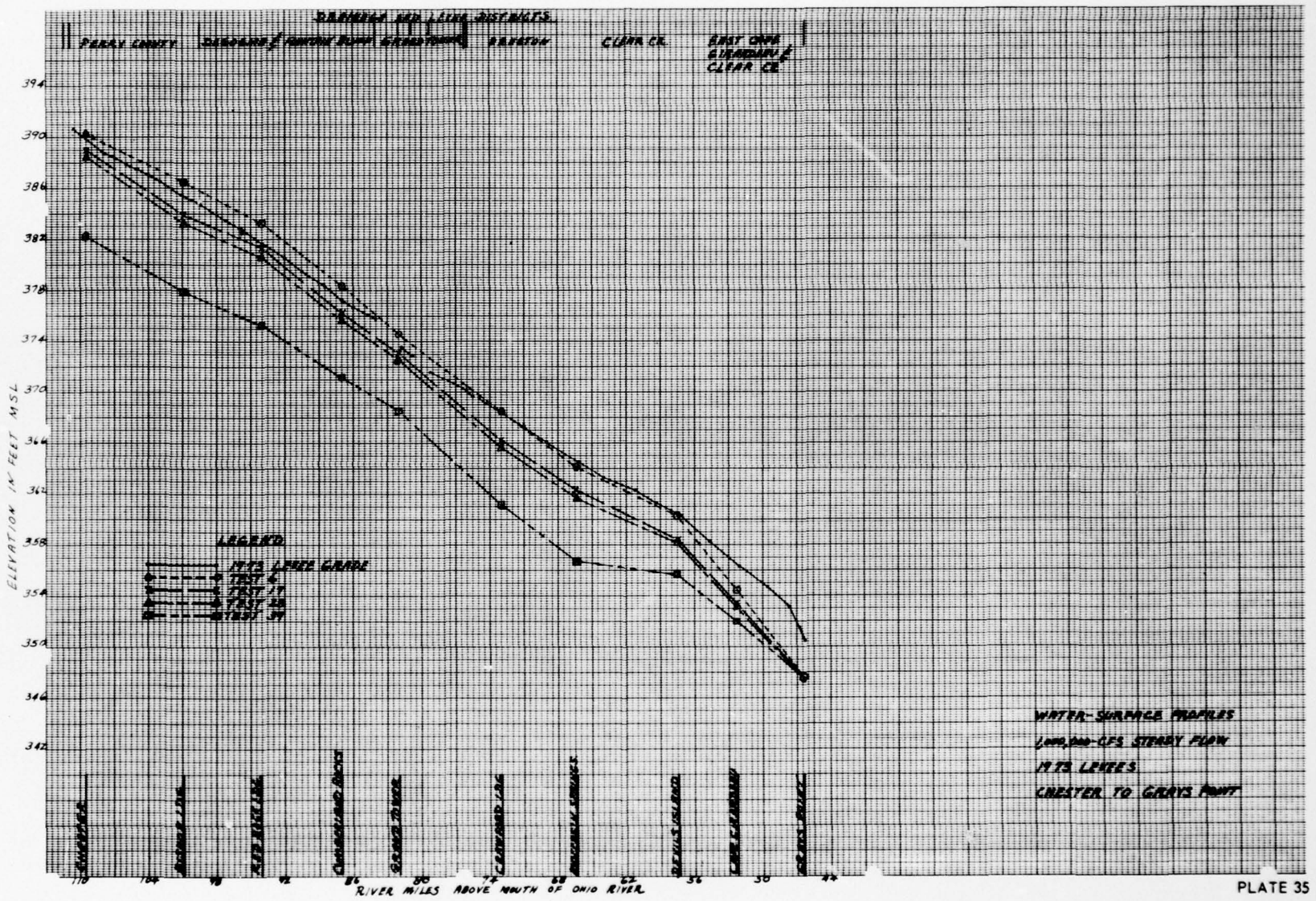
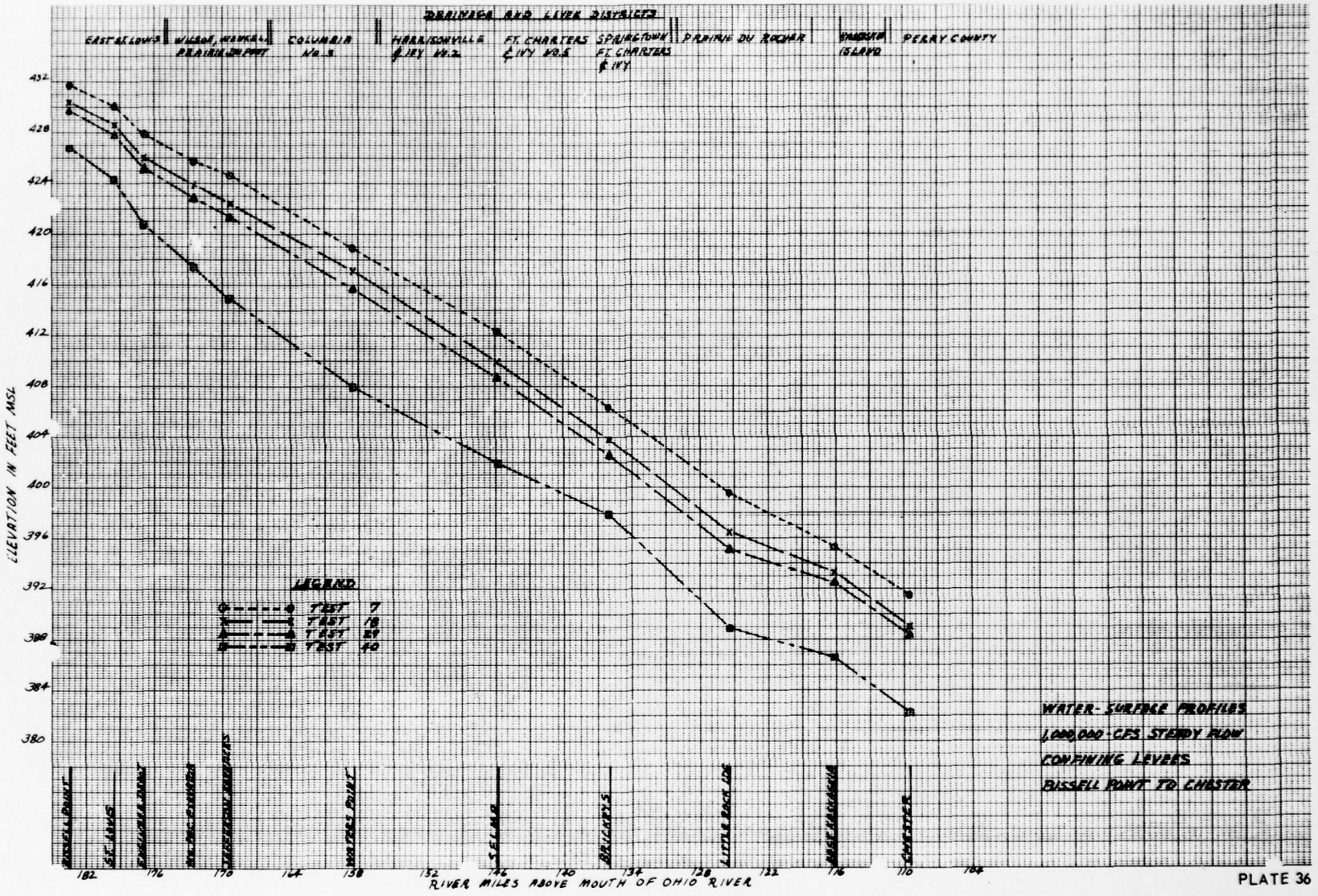

DRAINAGE AND LEVEE DISTRICTS
PERRY COUNTY
CLARK CR.
EAST CAPE GIRARDEAU & CLARK CR.
ELEVATION IN FEET MSL
394
390
386
382
378
374
370
366
362
358
354
350
346
342
LEGEND
M.T.B. LEVEE GRADE
TEST 4
TEST 17
TEST 28
TEST 39
RIVER MILES ABOVE MOUTH OF OHIO RIVER
110
104
98
92
86
80
74
68
62
56
50
44
WATER-SURFACE PROFILES
1,000,000-CFS STEADY FLOW
M.T.B. LEVEES
CHESTER TO GRAYS POINT

PLATE 35



WATER-SURFACE PROFILES
1,000,000-CFS STEADY FLOW
CONFINING LEVEES
BISSELL POINT TO CHESTER

PLATE 36

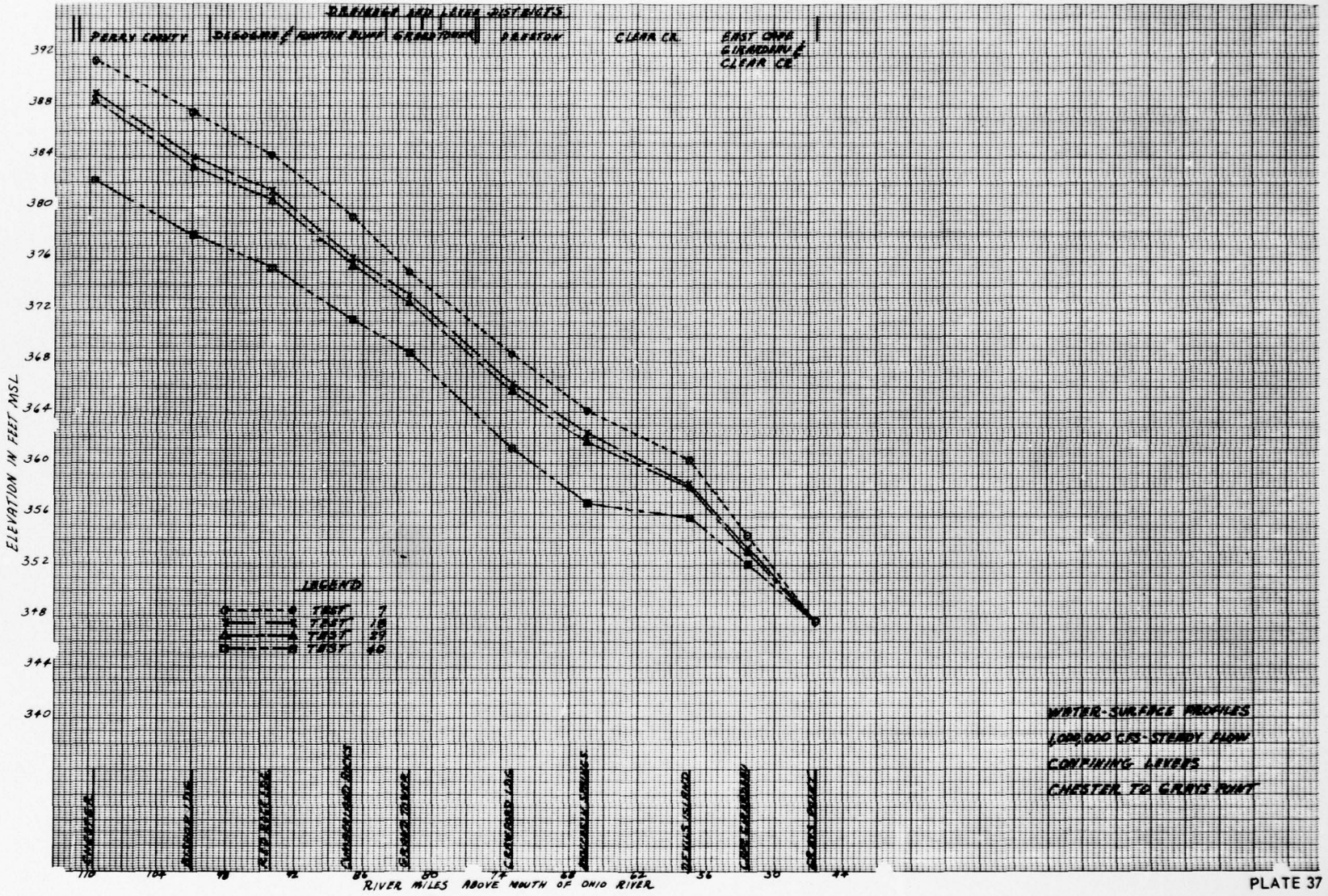

DARDANELLE AND LEVEE DISTRICTS
PERRY COUNTY
DECATUR & FOURTH BLUFF
GREENTOWN
DEARTON
CLEAR CR.
EAST CADE & GIRARDEAU & CLEAR CR.
ELEVATION IN FEET MSL
392
388
384
380
376
372
368
364
360
356
352
348
344
340
LEGEND
TEST 7
TEST 16
TEST 29
TEST 40
110
104
98
92
86
80
74
68
62
56
50
44
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
1,000,000 CFS-STEADY FLOW
CONFINING LEVEES
CHESTER TO CRAIG POINT

PLATE 37

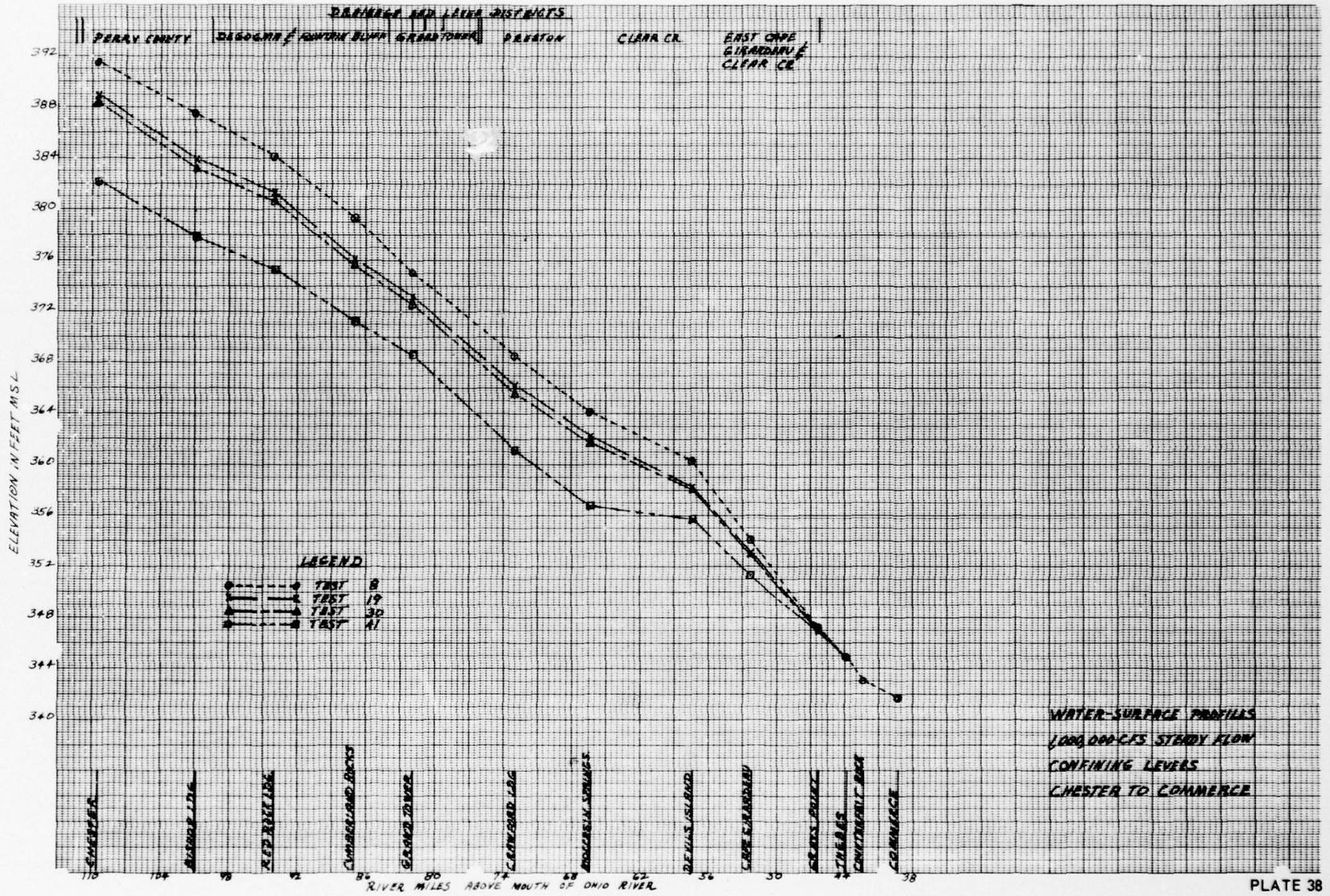

DRAINAGE AND LEVEE DISTRICTS
PERRY COUNTY
DAGGOHR & FOUNTAIN BLUFF
GRAND TOWER
PRATON
CLEAR CR.
EAST CAPE GIRARDEAU & CLEAR CR.
ELEVATION IN FEET MSL
392
388
384
380
376
372
368
364
360
356
352
348
344
340
LEGEND
TEST 8
TEST 19
TEST 30
TEST 41
CHESTER
BRIDGE LDG.
RED RIVER LDG.
CUMBERLAND ROCK
GRAND RIVER
CAIRO LDG.
BOULDIN SPRINGS
DEVILS ISLAND
CAPE GIRARDEAU
CRUMS POINT
THEBES
CONTINENTAL ROCK
COMMERCE
118
104
98
92
86
80
74
68
62
56
50
44
38
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
1,000,000 CFS STEADY FLOW
CONFINING LEVEES
CHESTER TO COMMERCE

PLATE 38

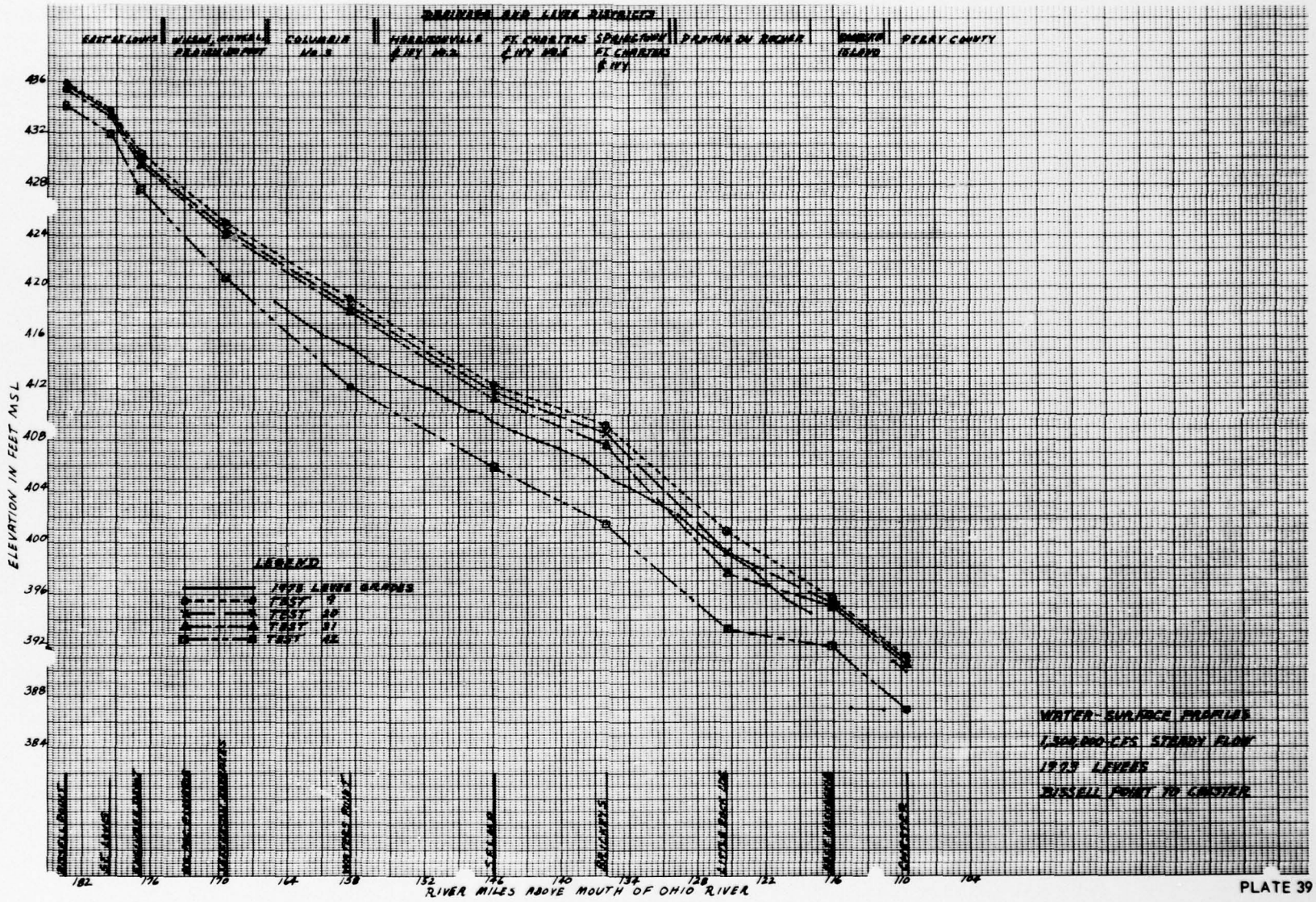

DARDENNE AND LUZA DISTRICTS
EAST ST LOUIS
WILLIAM CHOUTEAU BRIDGE OR PORT
COLUMBIA No. 2
HARRISONVILLE & HWY No. 2
FT CHARTRES & HWY No. 5
SPRINGFIELD FT CHARTRES & HWY
DARDENNE ON ROCKER
DARDENNE ISLAND
PERRY COUNTY
ELEVATION IN FEET MSL
436
432
428
424
420
416
412
408
404
400
396
392
388
384
LEGEND
1973 LEVEE GRADES
TEST 9
TEST 10
TEST 11
TEST 12
RIVER MILES ABOVE MOUTH OF OHIO RIVER
182
176
170
164
158
152
146
140
134
128
122
116
110
104
WATER-SURFACE PROFILES
1,300,000 CFS STEADY FLOW
1973 LEVEES
BISSELL POINT TO CHESTER

PLATE 39

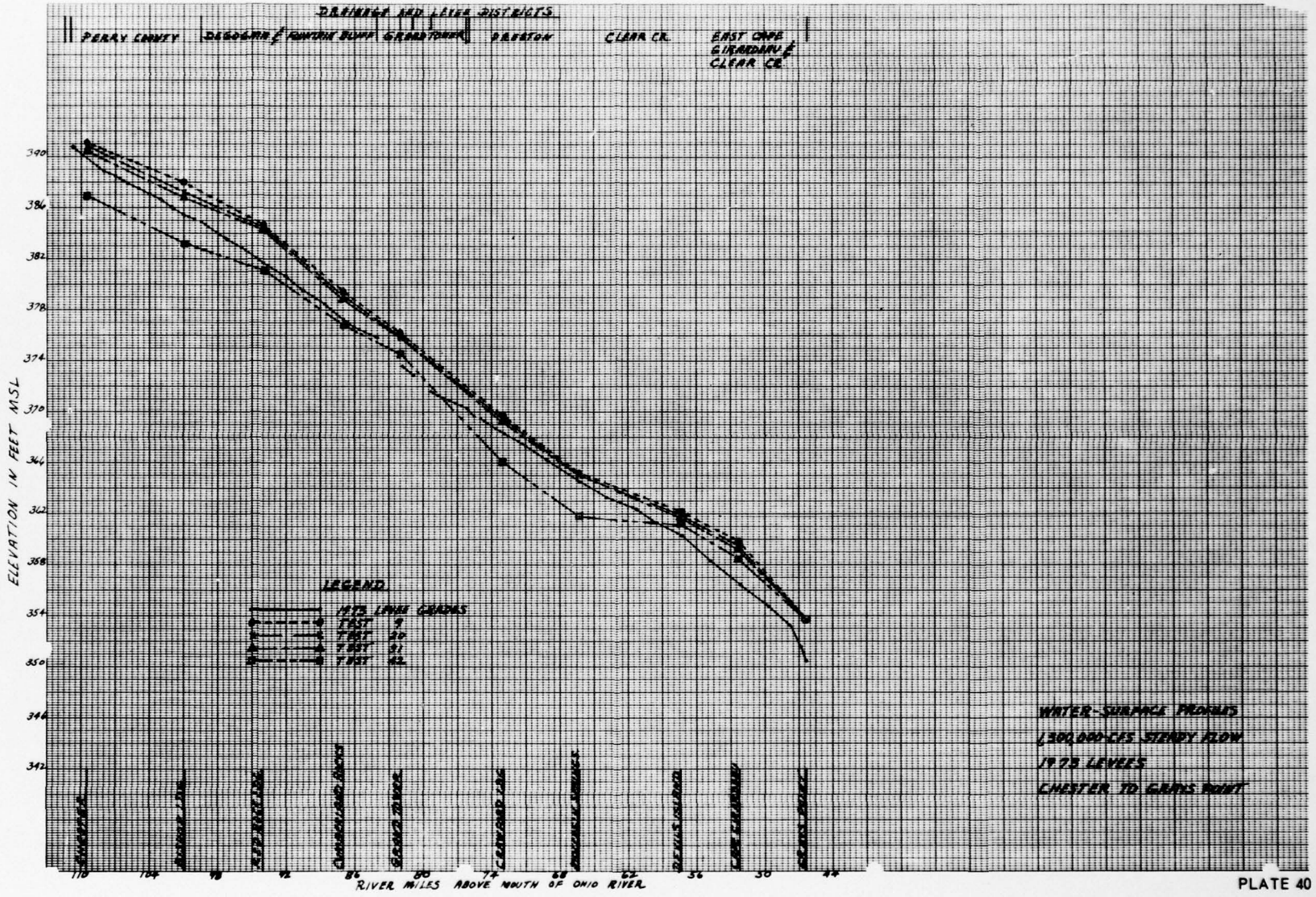

DRAINAGE AND LEVEE DIST. NO. 5
PERRY COUNTY
DEGOGNIA & FOUNTAIN BLUFF
GRAND TOWER
BRENTON
CLEAR CR.
EAST CAPE GIRARDEAU & CLEAR CR.
ELEVATION IN FEET MSL
390
386
382
378
374
370
366
362
358
354
350
346
342
LEGEND
1973 LEVEE GRADES
FAST 9
FAST 20
FAST 51
FAST 62
RIVER MILES ABOVE MOUTH OF OHIO RIVER
110
104
98
92
86
80
74
68
62
56
50
44
WATER-SURFACE PROFILES
1,300,000 CFS STEADY FLOW
1973 LEVEES
CHESTER TO GIANTS POINT

PLATE 40

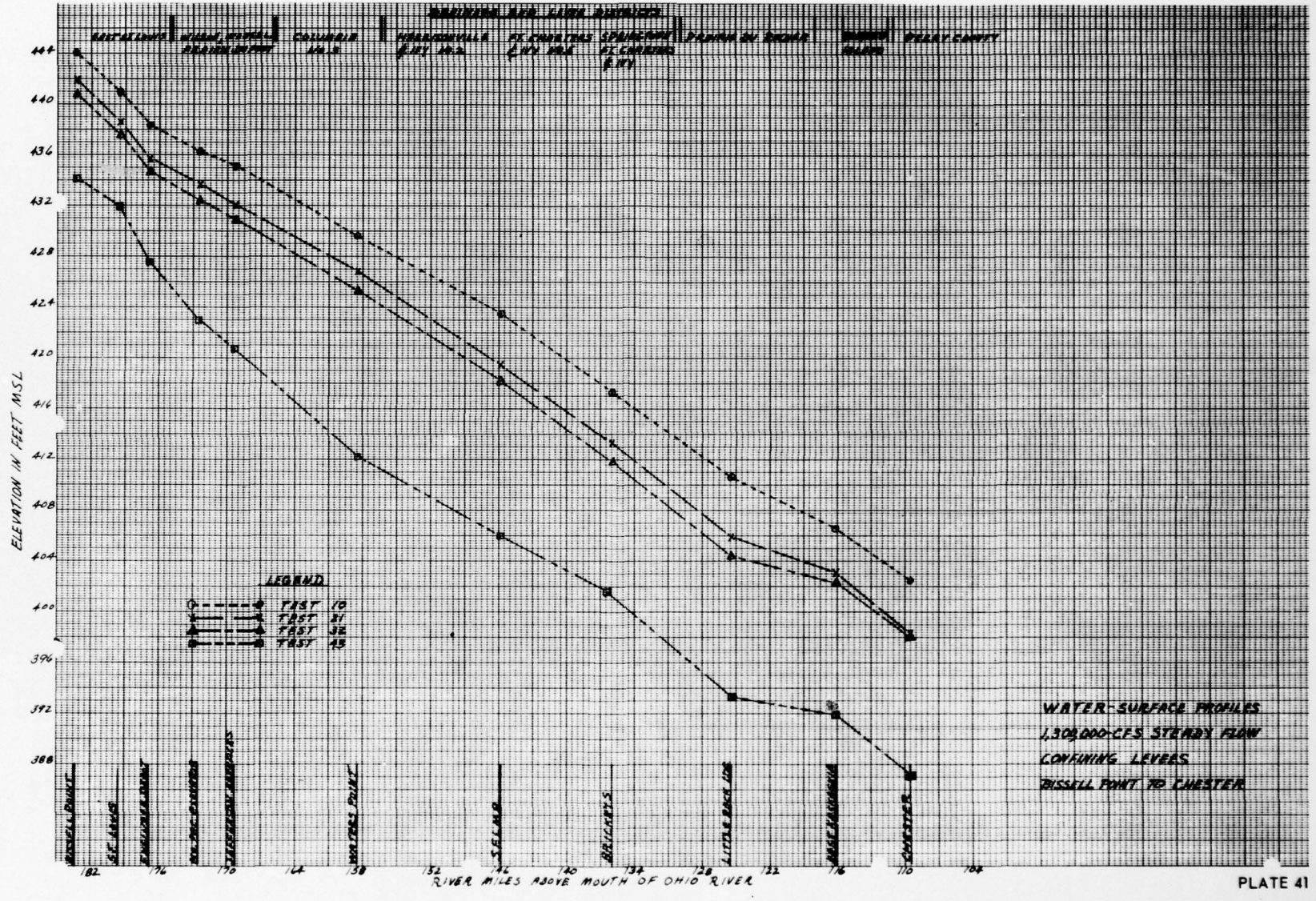
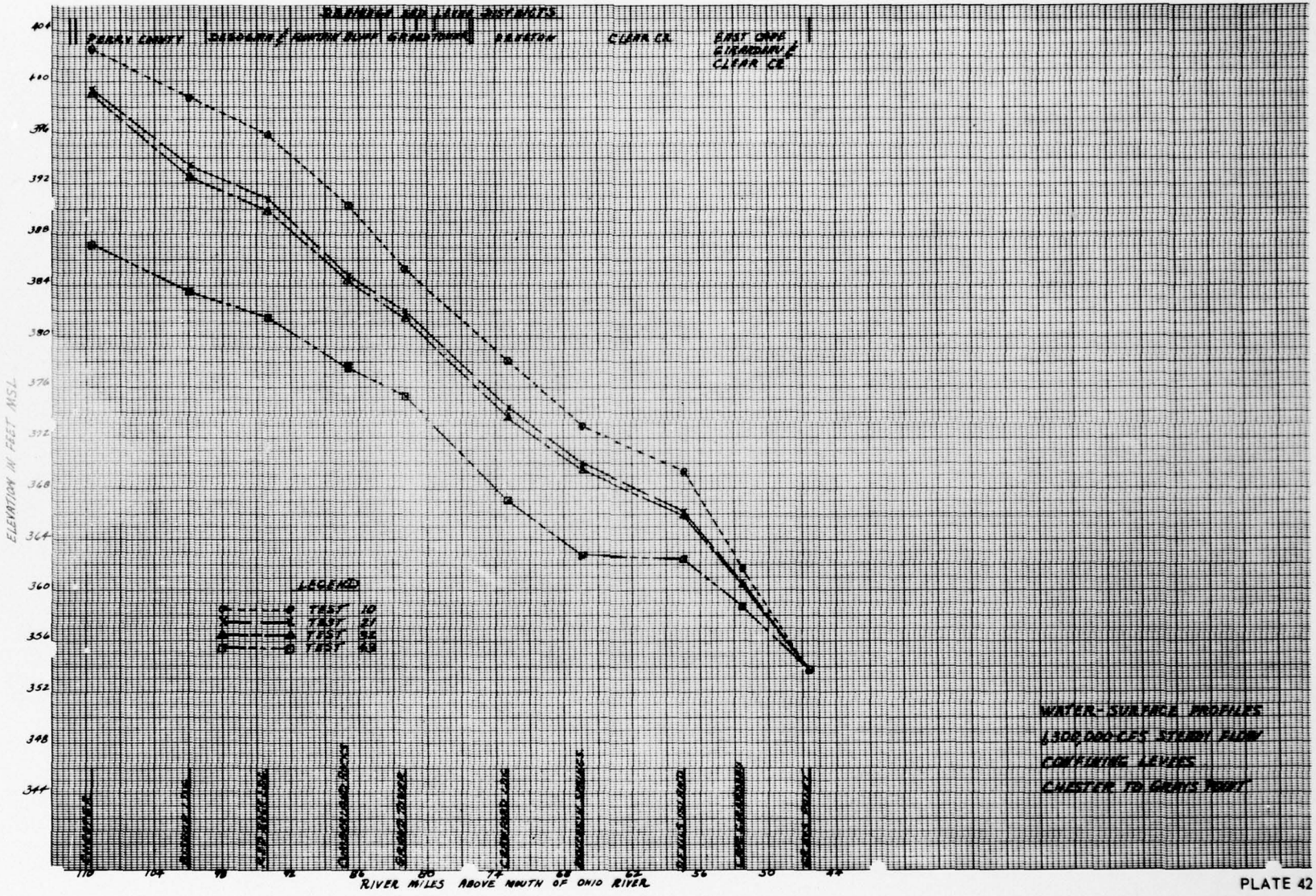

ELEVATION IN FEET MSL
444
440
436
432
428
424
420
416
412
408
404
400
396
392
388
LEGEND
TEST 10
TEST 21
TEST 32
TEST 45
RIVER MILES ABOVE MOUTH OF OHIO RIVER
182
176
170
164
158
152
146
140
134
128
122
116
110
104
WATER-SURFACE PROFILES
1,300,000 CFS STEADY FLOW
CONFINING LEVEES
BISSELL POINT TO CHESTER

PLATE 41


DRAINAGE AND LEVEE DISTRICTS
PERRY COUNTY
DIGGINGS & CANTON BLUFF
GRADETOWN
DEXTER
CLEAR CR.
EAST CAPE GIRARDEAU & CLEAR CR.
ELEVATION IN FEET MSL
404
400
396
392
388
384
380
376
372
368
364
360
356
352
348
344
LEGEND
TEST 10
TEST 21
TEST 23
TEST 25
CHESTER
RUSHELLVILLE
KELLERVILLE
CAPE GIRARDEAU
SCOTT CITY
SCOTT CITY
SCOTT CITY

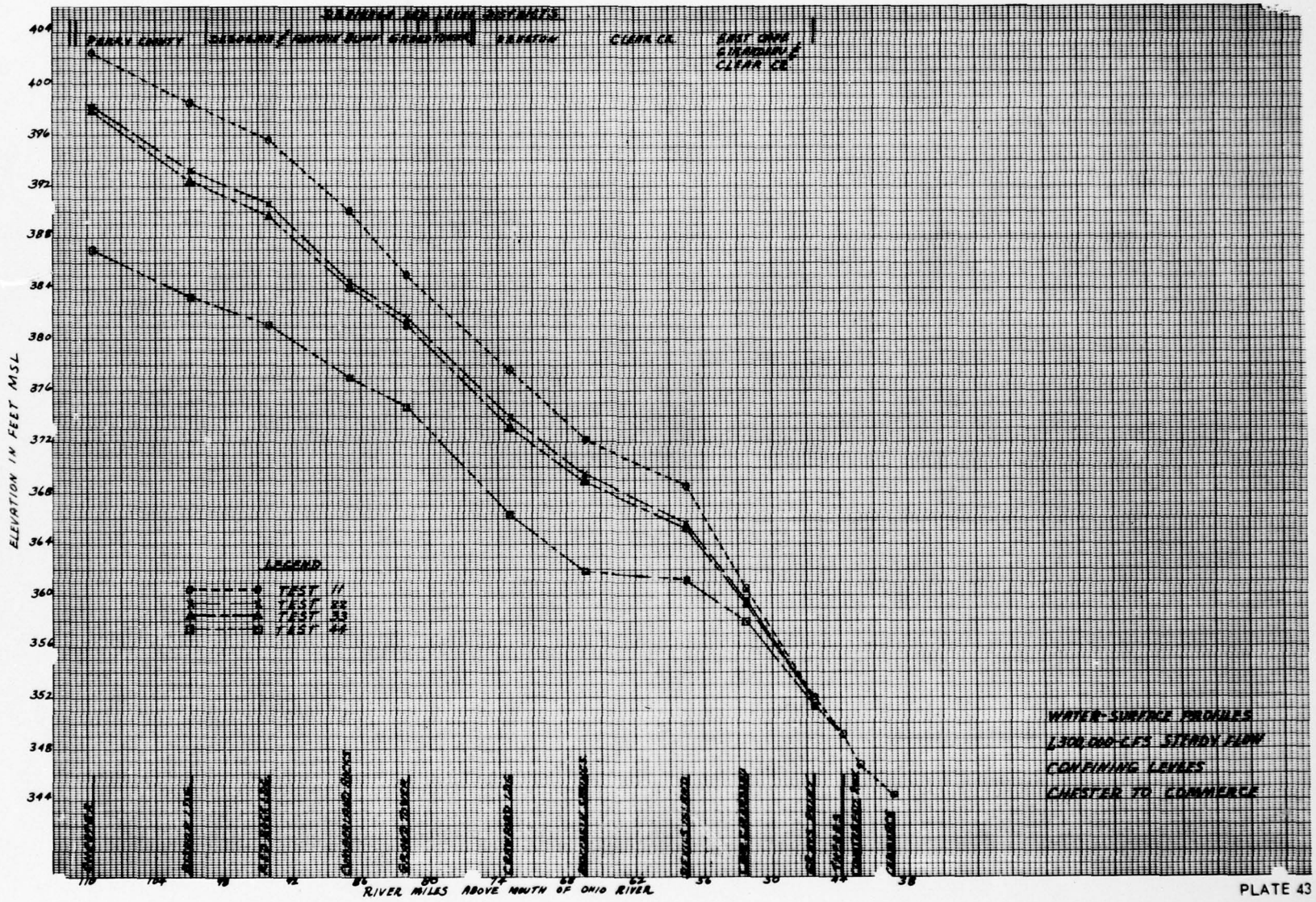

ELEVATION IN FEET MSL
404
400
396
392
388
384
380
376
372
368
364
360
356
352
348
344
LEGEND
TEST 11
TEST 22
TEST 33
TEST 44
110
104
98
92
86
80
74
68
62
56
50
44
38
RIVER MILES ABOVE MOUTH OF OHIO RIVER
WATER-SURFACE PROFILES
1,300,000 CFS STEADY FLOW
CONFINING LEVEES
CHESTER TO COMMERCE

PLATE 43

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Foster, James E
Effects of overbank vegetation on Mississippi River stages in the St. Louis-to-Thebes Reach / by James E. Foster, James V. Allen. Vicksburg, Miss. : U. S. Waterways Experiment Station ; Springfield, Va. : available from National *Technical Information Service, 1979.*
7, [11] p., 43 leaves of plates : ill. ; 36 cm. (Mississippi basin model report - U. S. Army Engineer Waterways Experiment Station ; 81-6)
Prepared for U. S. Army Engineer District, St. Louis, St. Louis, Missouri.

1. Fixed-bed models. 2. Mississippi River. 3. Overbank flow. 4. St. Louis-to-Thebes Reach. 5. Streamflow records. 6. Vegetation. I. Allen, James V., joint author. II. United States. Army. Corps of Engineers. St. Louis District. III. Series: United States. Waterways Experiment Station, Vicksburg, Miss. Mississippi basin model report ; 81-6.
TA7.W34b no.81-6

Key to Numbering of MRM Reports*

Test of Report or Test	Office for Which Conducted									
	General	LMVD	MRD	ORD	SWD	UMVD	Outside Agencies	Reserved for Future	Division	Basin-wide
General Reports	1-series									
MRM Board Meetings	2-series									
Papers in Technical Journals	3-series									
Reserved for Future	4-series									
Reserved for Future	5-series									
Reserved for Future	6-series									
Reserved for Future	7-series									
Reserved for Future	8-series									
Reserved for Future	9-series									
Verification Studies	10-series	11-	12-	13-	14-	15-	16-	17-	18-	19-
Reservoir-Operation Studies	20-series	21-	22-	23-	24-	25-	26-	27-	28-	29-
Levee Studies	30-series	31-	32-	33-	34-	35-	36-	37-	38-	39-
Flood-Routing Studies	40-series	41-	42-	43-	44-	45-	46-	47-	48-	49-
Changes in Regimen	50-series	51-	52-	53-	54-	55-	56-	57-	58-	59-
Reserved for Future	60-series									
Reserved for Future	70-series									
Miscellaneous Studies	80-series	81-	82-	83-	84-	85-	86-	87-	88-	89-
Combined Purpose Studies	90-series	91-	92-	93-	94-	95-	96-	97-	98-	99-

* First digit indicates type of report or test; second digit (for 10-series and above) indicates office for which performed. Numbers following dashes indicate chronological order in respective series.

DATE
FILME