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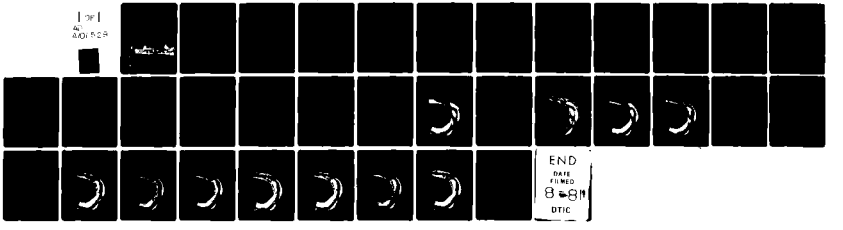

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INVESTIGATION OF PROPOSED DIKE SYSTEMS ON THE MISSISSIPPI RIVER

Report 2

NEW MADRID BAR REACH

Hydraulic Model Investigation

by

Thomas J. Pokrefke, Jr., John J. Franco

Hydraulics Laboratory
U. S. Army Engineer Waterways Experiment Station
P. O. Box 631, Vicksburg, Miss. 39180

May 1981

Report 2 of a Series

Sponsored by Mississippi River Commission
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This investigation is one phase of a general model study to determine the effectiveness of dike systems proposed for improvement of troublesome reaches on the Mississippi River. This report describes and gives results of tests concerned with the development of plans for the improvement of the New Madrid reach of the river, which is located about 890 river miles above Head of Passes. A movable-bed model reproducing approximately 11 miles of the Mississippi River to

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20. ABSTRACT (Continued).

a horizontal scale of 1:480 and a vertical scale of 1:60 was used to develop plans that would improve and stabilize the navigation channel through the reach and eliminate or reduce the need for maintenance dredging. The channel in the vicinity of New Madrid, Missouri, has been especially troublesome because of the divided flow and poor channel alignment. Flow near New Madrid is divided by a large island and further divided by a large sandbar between the channel along the left side of the island and the channel along the left bank. The navigation channel at the time of initiation of this study was along the left side of the island and then turned sharply toward the left bank before crossing back toward the right bank downstream of the island. Maintenance of the channel along the right side of the island was required as an access to the port facilities at the city of New Madrid.

The plans tested included the construction of four dikes along the left riverbank and the dredging of a pilot cut along the lower portion of New Madrid bar and modifications to the alignment or number of dikes. Results of this investigation indicated the following:

a. Developments in the reach were affected to some extent by division of flow around New Madrid bar, flow across the bar during high stages, erosion-resistant material in the riverbed, and tendency for the channel to meander within its banks.

b. Under most conditions, an adequate channel could be developed in the reach with the originally proposed plan. Some maintenance dredging might be required near the head of New Madrid bar, depending on the flow condition and movement of sand waves through the reach.

c. Conditions near the head of New Madrid bar could be improved with a chevron-type dike at the head of the bar, but would require an additional spur dike along the left bank upstream of the four original plan dikes.

d. None of the plans tested had any appreciable effect on conditions within the channel to the right of New Madrid bar.

e. Stabilization of the left side of New Madrid bar would be required to maintain a satisfactory alignment of the navigation channel along that side of the bar.

PREFACE

The investigation reported herein is one phase of a general model study to determine the effectiveness of dike systems proposed for improvement of troublesome reaches on the Mississippi River. It is part of Potamology Research Project No. 8, recommended by the Potamology Board and approved by the President, Mississippi River Commission.

The investigation was conducted during the period April 1977-March 1979 under the general supervision of Messrs. H. B. Simmons, Chief of the Hydraulics Laboratory, and F. A. Herrmann, Jr., Assistant Chief of the Hydraulics Laboratory, U. S. Army Engineer Waterways Experiment Station (WES), and under the direct supervision of Mr. J. E. Glover, Chief of the Waterways Division. The engineer in immediate charge of the investigation was Mr. T. J. Pokrefke, who was assisted by Messrs. C. W. O'Neal, R. K. Anglin, L. Brown, and D. M. Maggio. Mr. J. J. Franco, retired Chief of the Waterways Division, was a consultant on the investigation and assisted Mr. Pokrefke in the preparation of this report.

During the course of the model study, the U. S. Army Engineer District, Memphis, and the Lower Mississippi Valley Division were kept informed of the progress of the study through monthly progress reports and interim test results. Messrs. Bobby Littlejohn, Donald Jackson, Steve Smith, Andy Lowry, and Jerry Branum of the Memphis District made frequent visits to WES to observe model tests, discuss test results, and coordinate the testing program.

Commanders and Directors of WES during the conduct of tests and the preparation and publication of this report were COL John L. Cannon, CE, and COL Nelson P. Conover, CE. Technical Director was Mr. F. R. Brown.

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INVESTIGATION OF PROPOSED DIKE SYSTEMS ON THE MISSISSIPPI RIVER

NEW MADRID BAR REACH

Hydraulic Model Investigation

PART I: INTRODUCTION

1. This report presents the results of one phase of a model investigation being conducted to obtain a general indication of the effectiveness of proposed dike systems for the improvement of troublesome reaches of the Mississippi River. The investigation is part of Potamology Research Project No. 8, Investigation of Proposed Dike Systems, recommended by the Potamology Board and approved by the President, Mississippi River Commission.

2. The study in this report was concerned with the development of plans for the improvement of the New Madrid reach. Plans tested were proposed by the U. S. Army Engineer District, Memphis, in collaboration with representatives of the U. S. Army Engineer Waterways Experiment Station (WES) and were designed to develop a stable navigation channel through the reach and also maintain access to harbor facilities located in the chute channel to the right of New Madrid bar.

3. The purposes of the study were to determine the effectiveness of the proposed dike system, to determine any unforeseen problem areas in the reach that could affect navigation, and to determine the effectiveness of dikes to reduce these navigation hazards.

Description of the Problem

4. The New Madrid reach of the Mississippi River is part of a large classical meander loop that has been stabilized and not allowed to migrate. This was accomplished by means of revetment and a long dike extending from the main-line levee along the left bank across the neck of the bend, which in conjunction with revetment prevented the possibility

of a natural cutoff. The loop is about 17 miles* long and only about 1 mile across the neck at its narrowest point (Figure 1). The low-water channel in the loop tends to meander within the banks, and a 9-ft* channel is being maintained with intermittent maintenance dredging at several crossings.

5. The channel in the vicinity of New Madrid, Missouri, has been especially troublesome because of the divided flow and poor channel alignment. Flow near New Madrid is divided by a large island, referred to as New Madrid bar, and further divided by a large sandbar between the channel along the left side of the island and the channel along the left bank. The navigation channel at the time of initiation of this study was along the left side of New Madrid bar and then turned sharply toward the left bank before crossing back toward the right bank downstream of the bar (Plate 1). Maintenance dredging has been required near the head of New Madrid bar and in the crossing from New Madrid bar toward the left bank. The channel along the right side of New Madrid bar has been used for access to the port facilities at the city of New Madrid, Missouri.

Purpose of the Model Study

6. Plans were proposed by the Memphis District for the improvement and stabilization of the channel through the New Madrid bar reach by means of a system of dikes designed to improve the alignment of the navigation channel and eliminate the need for maintenance dredging. Because of the complex nature of the reach and the processes involved in its development, the model study was undertaken to obtain some general indications as to the effectiveness of the proposed plan and to develop any modifications that might be required. The plan proposed for improvement of the reach involved the development of a channel along the left side of New Madrid bar with four dikes along the left riverbank located at miles 888.0, 887.2, 886.2, and 885.0 and the dredging of a pilot cut along the lower portion of the bar.

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* To convert miles to kilometres, multiply by 1.609344; to convert feet to metres, multiply by 0.3048.

PART II: THE MODEL

Description

7. The movable-bed model used for this study reproduced to a horizontal scale of 1:480 and a vertical scale of 1:60 the reach of the Mississippi River between miles 882.5 and 893.5* (Figure 1), which is a sufficient section of the river above and below the problem area at New Madrid bar to study all proposed plans. The scales selected were based on the space available and the need for reproducing riverbed movement; however, the resulting distortion of the linear scales of 8 is much larger than that normally used for model studies of this type. The bed material used was sand which had a median grain diameter of about 0.2 mm and specific gravity of 2.65.

8. The Mississippi River channel was reproduced to top bank elevation of about 40 ft above the 1974 low-water reference plane (LWRP).** The banks were protected in the model with sand-cement mortar or crushed rock to reproduce banks protected by revetment in the prototype or to prevent sloughing due to the model distortion. The model bed and banks were initially molded to the May 1976 prototype survey shown in Plate 1, and elevations on the top of New Madrid bar were obtained from the 1962 Geological Survey Quadrangle map of the area. Effects of trees and underbrush on New Madrid bar were simulated with folded screen wire.

Model Verification

9. The reliability and accuracy with which movable-bed models reproduce prototype conditions are usually based on the model verification. The normal verification is the process of adjusting the model hydraulic forces, time scale, rate of introducing bed material, and operating technique until the model demonstrates its ability to reproduce,

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* River miles above Head of Passes.

** Elevations (el) cited herein are in feet referenced to the LWRP.

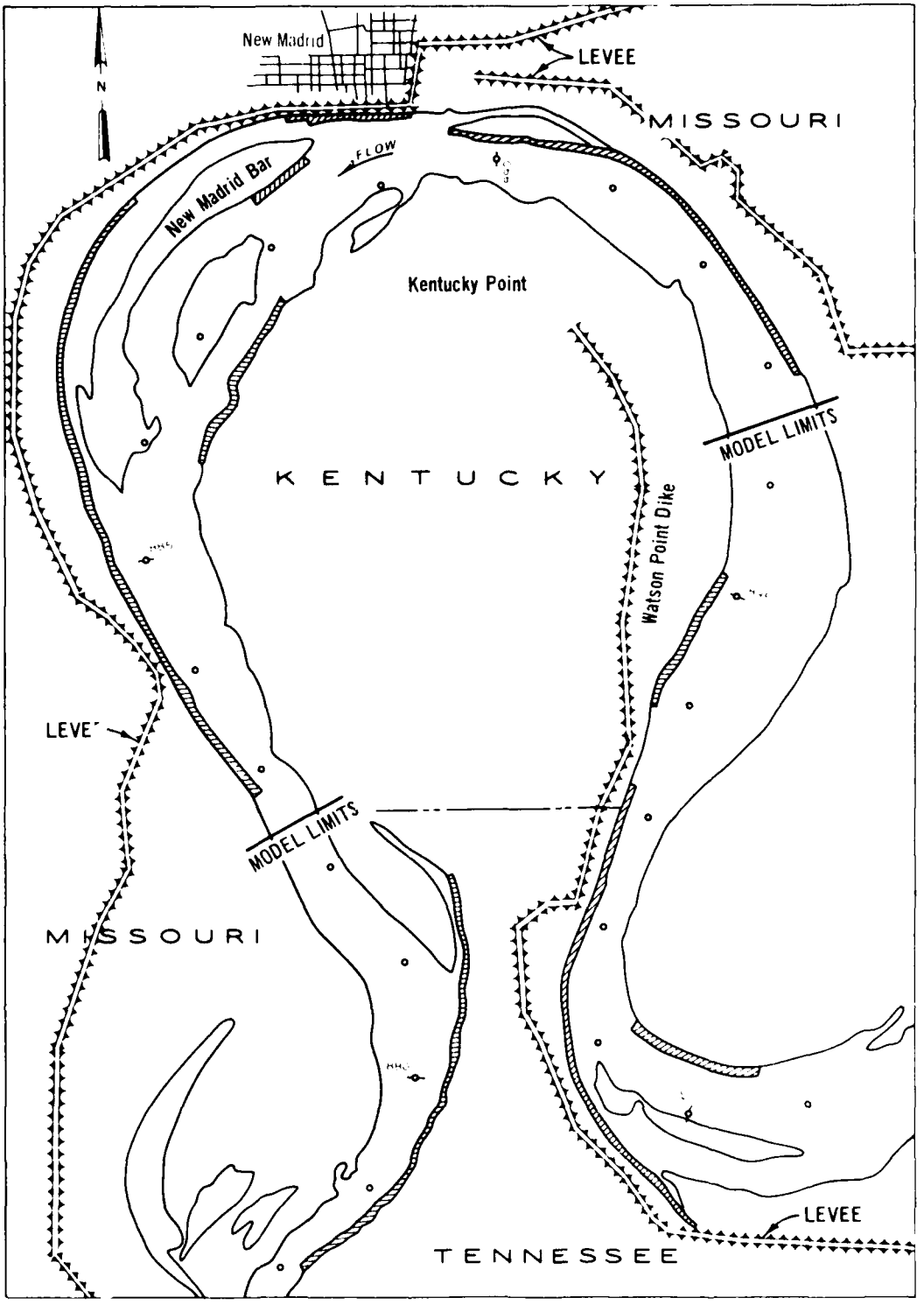

Figure 1. Vicinity map

with a reasonable degree of accuracy, changes known to have occurred in the prototype during a given period. The accuracy with which a distorted model can be adjusted depends on the characteristics of the reach involved, prototype data available, linear scales, and time available.

10. Adjustment of the model of the New Madrid reach was undertaken with the channel bed molded to the conditions indicated by the prototype survey of May 1976. The model was then operated by reproducing the prototype flow hydrograph from May 1976 to May 1977 (Plate 2). Adjustment of the model was complicated by prototype construction in progress of Kentucky Point dikes 1 and 2 at miles 888.0 and 887.2, respectively; three maintenance dredge cuts, at miles 888.5, 887.0, and 884.6; divided flow in the New Madrid bar area; and erodibility of the downstream end of New Madrid bar which was not known. Dike construction and maintenance dredging were reproduced in the model based on the actual stages of construction and dredging occurrences during the verification period. Information made available during the course of the adjustment indicated that the downstream end of New Madrid bar at mile 886 consisted of gravel, sand, and clay which had to be simulated in model with an erosion-resistant material. Tests were repeated and adjustments made until the model reproduced generally the conditions indicated by the prototype survey of May 1977 (Plate 3).

11. Results of the final adjustment test shown in Plate 4 indicate that the model reproduced the general characteristics of the prototype reach, and the verification was considered adequate for the purpose of the study. Comparison of the results of the model verification with the prototype survey of May 1977 (Plate 3) indicates that the model had a greater tendency to shoal near the head of the New Madrid bar, along the left side of the bar at mile 887.6, and in the crossing from the left to right bank at mile 885.0. These differences and the greater tendency for the sandbar along the left bank to erode in the model have to be considered in the evaluation of the results of tests of improvement plans.

PART III: TESTS AND RESULTS

Base Test

12. During the period between the time of the May 1977 prototype survey and the survey of April 1978, dike 4 (mile 885.0) of the originally proposed plan had been completed and a 500-ft-wide dredge cut to el -20 had been made through the erosion-resistant material along the left side of New Madrid bar, from miles 885.2 to 886.7, in an effort to realign the navigation channel. Construction of dike 3 (mile 886.2) could not be undertaken until an adequate navigation channel was maintained through the dredge cut. By April 1978, the dredge cut had shoaled to above el -10 near the lower end of New Madrid bar (Plate 5). The sandbar off the river ends of dikes 1 and 2 had eroded to some extent and the area near the old crossing at mile 886.5 had shoaled. Also, there was some scour downstream of dike 4, indicating considerable flow over the dike during higher stages.

13. A base test was conducted in order to obtain some indication of future development with the conditions existing at the time of the April 1978 prototype survey. This was necessary since the April 1978 prototype survey was a high-water survey, and it was desired to project the channel configuration into low-water conditions for construction of plan dikes. The model bed was remolded to the April 1978 prototype survey (Plate 5), and the model was subjected to the hydrograph shown in Plate 6, which represents the crest and falling side of an average annual hydrograph characteristic of this reach.

Results

14. Results of the base test, shown in Plate 7, indicate that a channel at or below el -10 existed throughout the reach except at the downstream end of the dredged channel downstream of New Madrid bar. Also, the channel near the head and along the upper reach of New Madrid bar had shoaled somewhat and there was some scour off the river end of dikes 1 and 4. Some shoaling also occurred in the channel to the right of New Madrid bar.

15. It should be considered that the developments during this test were the effects of an extended high-water period with very little medium and low flows. The effects of any erosion-resistant material in the prototype on developments would not be reproduced in the model since all material simulating such conditions was removed from the model prior to initiation of the base test.

Tests of Improvement Plans

Test procedure

16. Tests of improvement plans involved the installation of the remainder of the originally proposed plan and modifications of that plan. The proposed plan was submitted by the Memphis District and modifications were developed based on the results of completed tests and in collaboration with representatives of WES. Tests of the proposed plan and modifications were conducted by reproducing the hydrograph shown in Plate 8, which was considered to be typical of the average annual flow hydrograph for the reach. Each reproduction of the hydrograph is herein referred to as a "run."

Plan A

Description

17. Initial conditions for Plan A were the same as those obtained at the end of the base test (Plate 7) except for a 1500-ft extension of dike 2 and installation of dike 3, as shown in Plate 9. Dike 3 was 2800 ft long with a break in the dike alignment downstream approximately 1050 ft from the left bank. Elevations of the extension and new dike are also shown in Plate 9. This plan includes all of the dikes as originally proposed for the improvement of the reach.

Results

18. Results of tests of Plan A after two runs, shown in Plate 9, indicate a continuous channel at or below el -10 through the reach except just upstream of the head of New Madrid bar. This tendency was also indicated in the base test; however, the test of Plan A indicated a

greater amount of shoaling. The increase in the tendency for shoaling could be attributed to some extent to the added contraction provided by the additional dikes included in the plan.

Plan A-1

Description

19. Plan A-1 was the same as Plan A except for the addition of a dike 1A on the left bank at mile 888.7. This dike was 2400 ft long with crest elevations of +17 at the bank end, +17 500 ft from the stream end, and +5 at the stream end. The beginning bed condition was the same as that obtained at the end of test of Plan A, as shown in Plate 9.

Results

20. Results of test of Plan A-1 after two runs are shown in Plate 10. Shoaling of the navigation channel upstream of the head of New Madrid bar had increased. Although a channel at or below el -10 was maintained along the left side of New Madrid bar, there was an increase in the size and elevation of the sandbar near dike 2. The shoaling off the river end and downstream of the dike caused a decrease in the width of the channel along the lower portion of New Madrid bar. The channel along the right side of New Madrid bar had shoaled near its upper end, but increased in depth downstream. There was a strong indication that flow in the channel to the right of New Madrid bar had increased, with a corresponding decrease in flow in the channel to the left of the bar.

Plan A-2

Description

21. Plan A-2 was the same as Plan A-1 except for the addition of a dike on the head of New Madrid bar and an extension to dike 1A. Dike 1B on the head of New Madrid bar was approximately 1700 ft long and had a crest elevation of +15 on the upstream end, +15 for 750 ft from the upstream end, and +20 where the dike tied into New Madrid bar. Dike 1A was extended 200 ft on the stream end with the end at el 0 and joined the

original dike at el +5. The initial channel bed condition for this plan was the same as that obtained at the end of the test for Plan A-1, as shown in Plate 10.

Results

22. Results of the test of this plan, shown in Plate 11, indicate that a channel of adequate depth had developed along and upstream of the head of New Madrid bar. However, the channel at the head of the bar was of limited width and not of good alignment for navigation. There was some increase in the width of the channel along New Madrid bar, particularly along the lower portion of the bar. The channel to the right of New Madrid bar had increased in depth near its upper end, but had shoaled to less than project depth farther downstream near its lower end.

Plan A-3

Description

23. Plan A-3 was tested to determine the effectiveness of a chevron-type dike at the head of New Madrid bar designed to improve the navigation channel to the left of the bar and to control the division of flow on each side of the bar. Accordingly, this plan included a chevron-shaped dike located with its upper end 2200 ft upstream of the head of New Madrid bar with its left and right legs 1550 and 450 ft long, respectively, forming an angle of about 62.5 deg. Initially, the dike had a crest elevation of +10 at its upper end and sloped along each leg to el +5 at their downstream ends. The bed of the model before the start of this test was remolded to the conditions obtained at the end of the test of Plan A-1 and included the dikes of that plan (Plate 10). After run 1, the entire dike designated as dike 1C was raised to el +17, as shown in Plate 12, and testing continued.

Results

24. Results of the test of this plan indicate that a wide channel had developed upstream of the head of New Madrid bar and extended downstream to about mile 887.5 by the end of the second run (Plate 12). The channel along the lower portion of New Madrid bar was of adequate depth but was considerably narrower than in the upper reach. Since only one

run was made with the chevron dike at el +17, a third run was made to determine if any further development could be expected. Results of the third run, shown in Plate 13, indicate that a shoal on the left side of the channel had developed near the upper end of the chevron dike which reduced the width of the navigation channel at that point and caused some deterioration in the channel alignment. The channel downstream of the head of New Madrid bar had become wider and somewhat deeper. Elevations in the channel to the right of New Madrid bar were adequate for about 2 miles downstream.

25. In the evaluation of the results of the test of this plan, it should be considered that by the end of run 2 there was a large sand wave located about 4500 ft upstream of the upper end of the chevron dike. By the end of run 3, this wave had moved downstream, which attributed to the decrease in the width of the channel opposite the chevron dike. This development would indicate that conditions at that point would depend on the chance occurrence of a sand wave and would vary and depend to a considerable degree on flow conditions.

Plan A-4

Description

26. Plan A-4 was the same as Plan A-3 except that dike 1A (mile 888.7) was removed and the model bed was remolded to the conditions obtained at the end of the test of Plan A-1 (Plate 10). The purpose of this test was to determine if dike 1A could be eliminated without any adverse effect on channel development, as obtained with Plan A-3.

Results

27. Results shown in Plate 14 indicate that a channel of adequate depth was not obtained along the left side of the chevron dike and near the upper portion of New Madrid bar. The channel along the bar downstream of about mile 887.5 had increased in width and depth and was well aligned. There was little change in the channel along the right side of New Madrid bar.

Plan B

Description

28. Plan B was the same as Plan A except that the 1500-ft extension to dike 2 was removed. Before starting the test of this plan, the bed of the model was remolded to the condition obtained at the end of the base test (Plate 7). The purpose of this test was to determine if the extension to dike 2 was creating a backwater effect that would tend to increase shoaling near the head of New Madrid bar.

Results

29. Results shown in Plate 15 indicate considerable shoaling of the channel near the head of New Madrid bar. The amount of shoaling was somewhat greater than that obtained with Plan A (Plate 9). There was also some shoaling near the upper end of the channel to the right of New Madrid bar.

PART IV: DISCUSSION OF RESULTS AND CONCLUSIONS

Limitation of Model Results

30. The fact that this model was designed to obtain some general indications of the effects that could be expected in the reach with the proposed improvement plan and modifications should be considered in the evaluation and interpretation of the results obtained during this study. Because of the limited facilities, the model had a much higher distortion of the linear scales than was considered desirable, which had to have an effect on the division of flow and the tendency for the channel to meander within its banks. The reach was further complicated by the existence of erosion-resistant bed material in the problem area, which could not be adequately evaluated in the prototype or simulated in the model.

31. In general, the model indicated a greater tendency for shoaling than the prototype, particularly near the upper end of New Madrid bar. The full extent of this tendency could not be determined since the base test consisted of a reproduction of the high-water portion of the annual average hydrograph. Also to be considered are the average annual hydrograph used for testing of plans, which could be considerably different from what actually occurs in the river, and the fact that the model surveys were always made at the end of a high-water period.

Summary of Results and Conclusions

32. The following results and general indications were developed from the model study:

a. Developments in the reach were affected to some extent by division of flow around New Madrid bar, flow across the bar during high stages, erosion-resistant material in the bed, and tendency for the channel to meander within its banks.

b. Under most conditions, an adequate channel could be developed in the reach with the originally proposed plan (Plan A). Some maintenance dredging might be required near the head of New Madrid bar, depending on the flow condition and movement of sand waves through the reach.

c. Conditions near the head of New Madrid bar could be improved with a chevron-type dike at the head of the bar, but would require an additional spur dike along the left bank upstream of the existing dikes, as in Plan A-3.

d. None of the plans tested had any appreciable effect on conditions within the channel to the right of New Madrid bar.

e. Stabilization of the left side of New Madrid bar would be required to maintain a satisfactory alignment of the channel along that side of the bar.

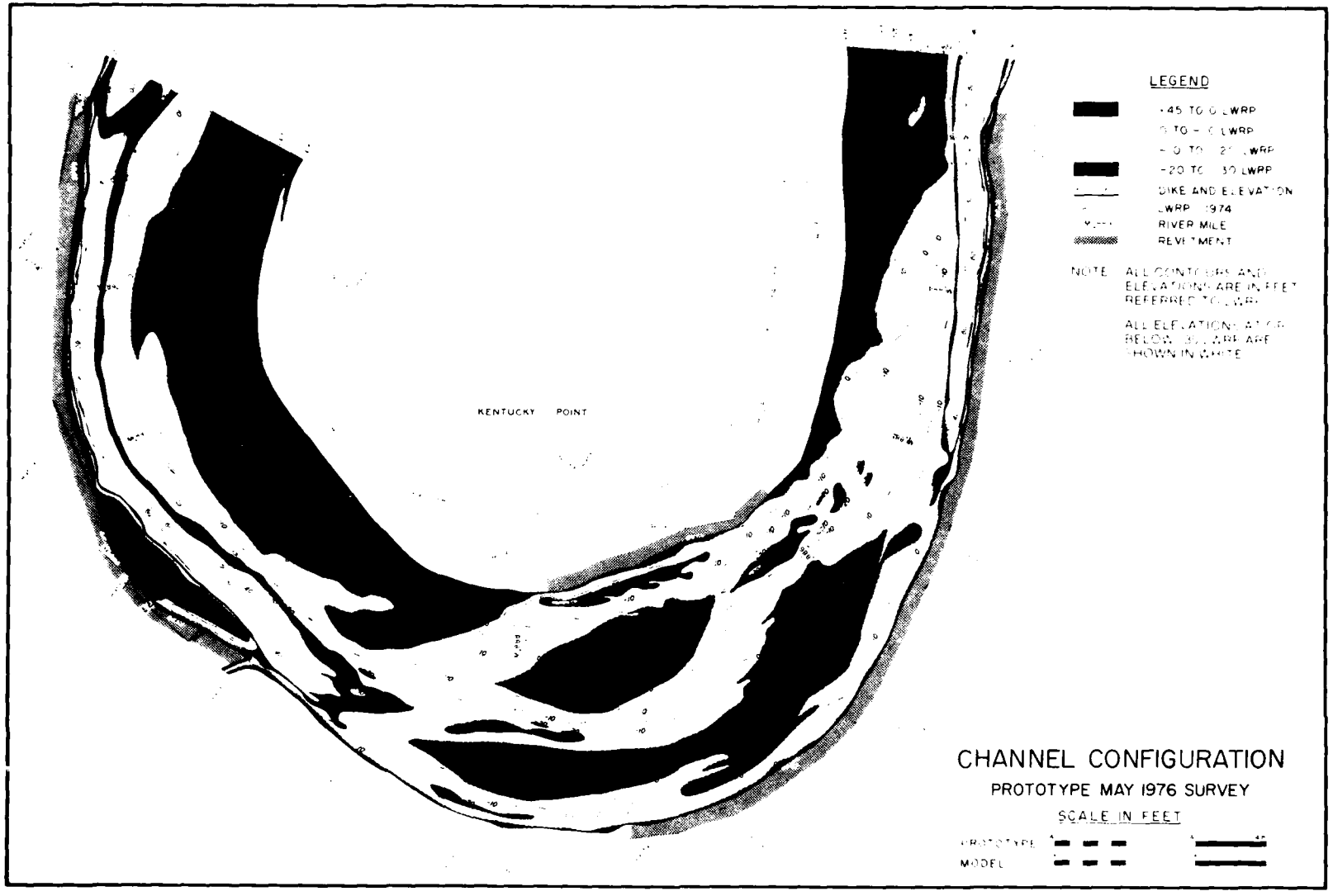
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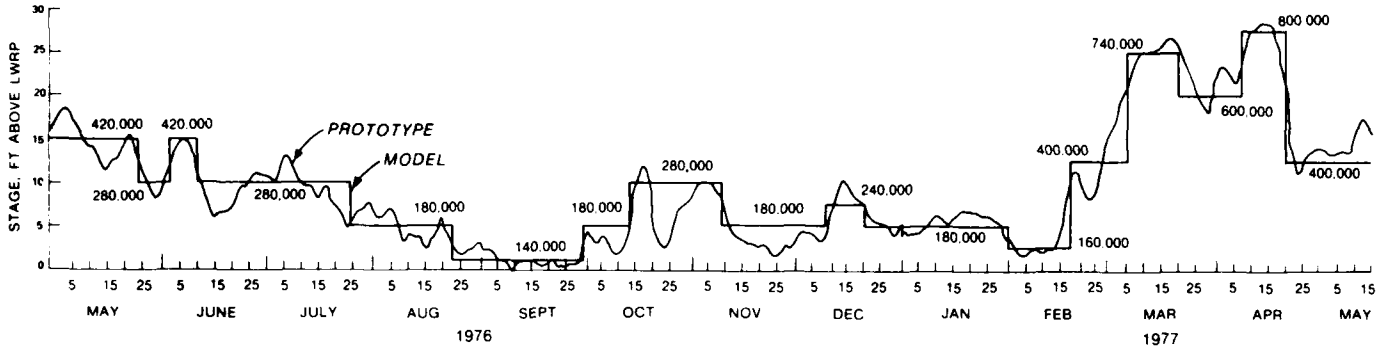
PLATE 1

PLATE 2



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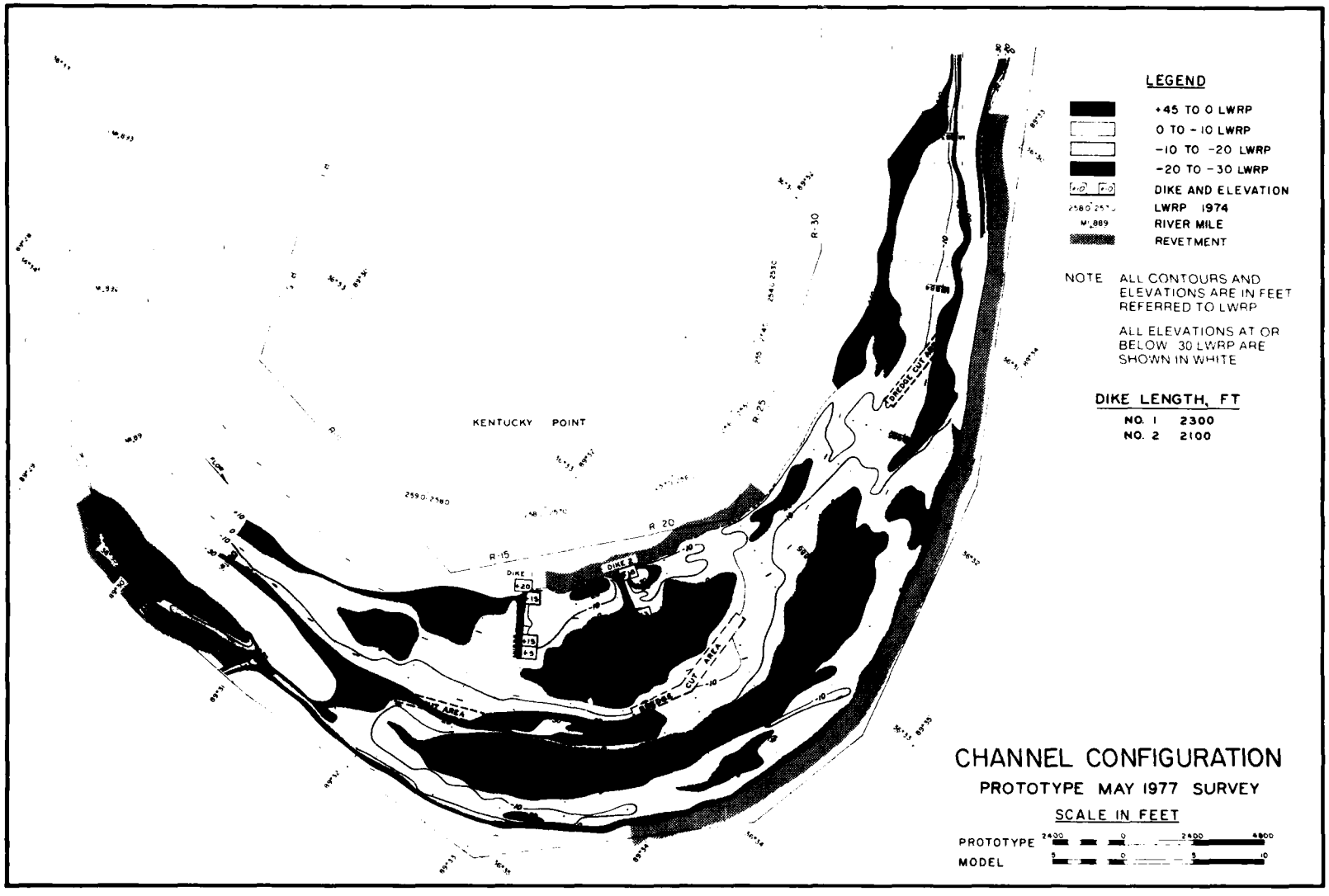
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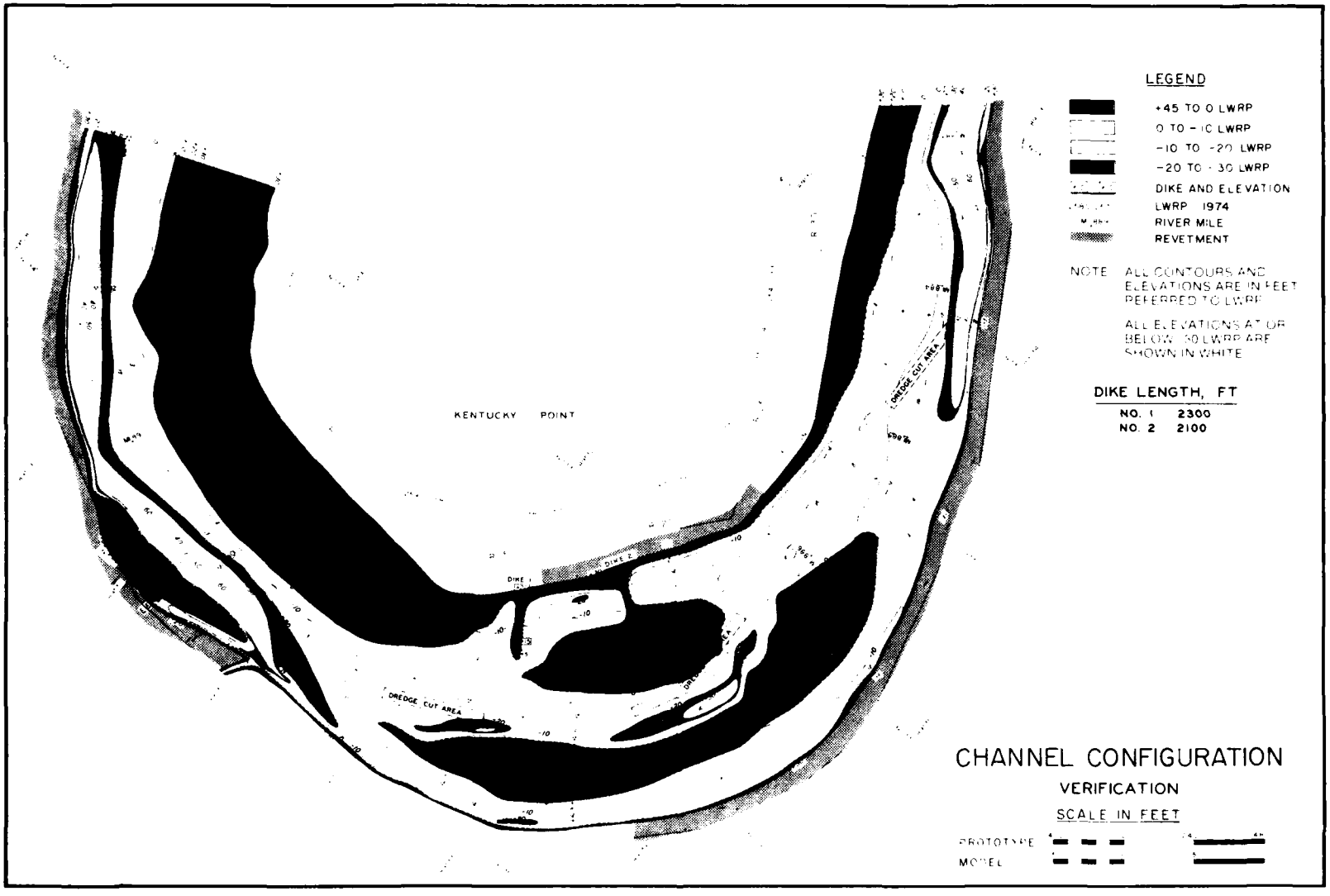
PLATE 3

PLATE 4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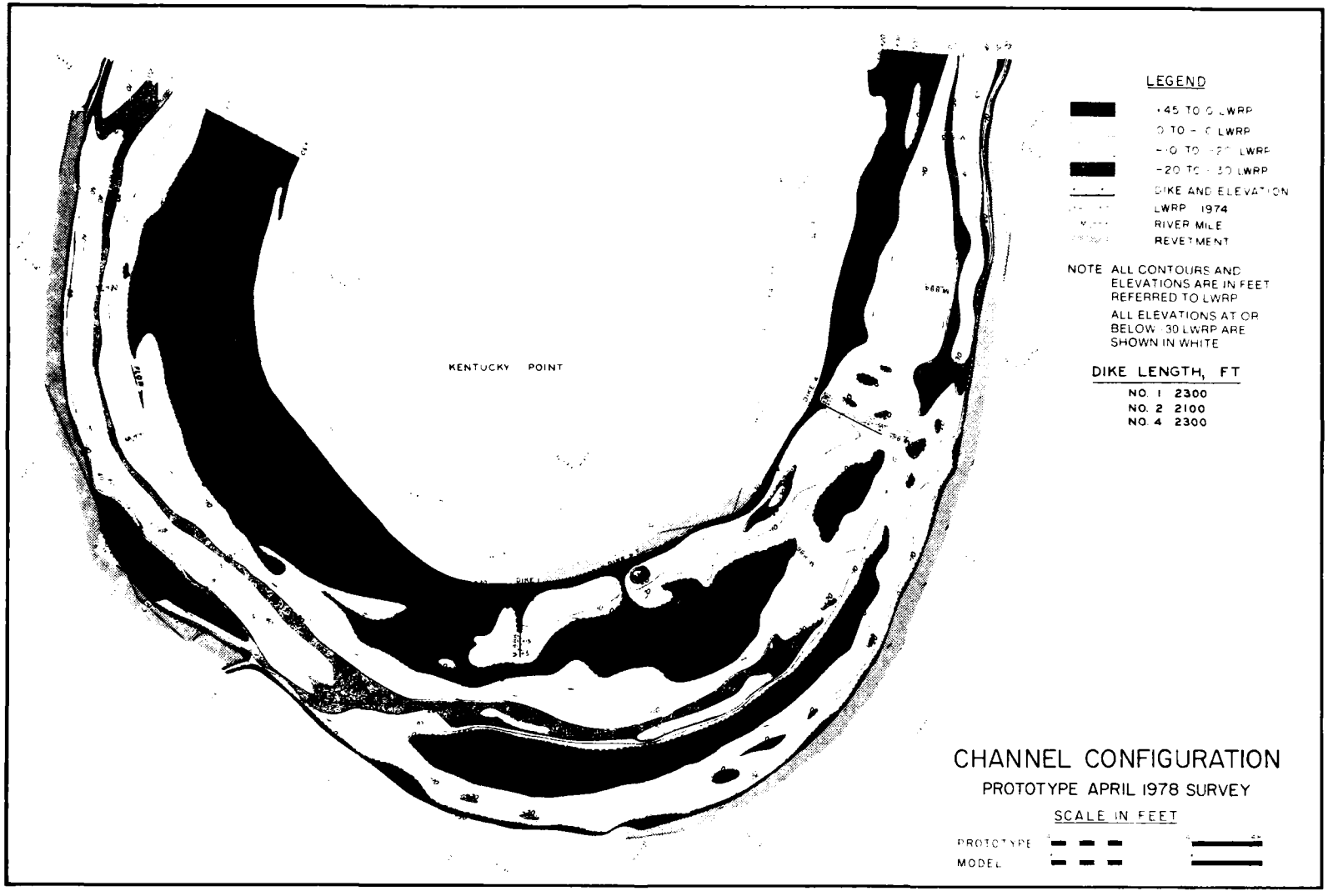
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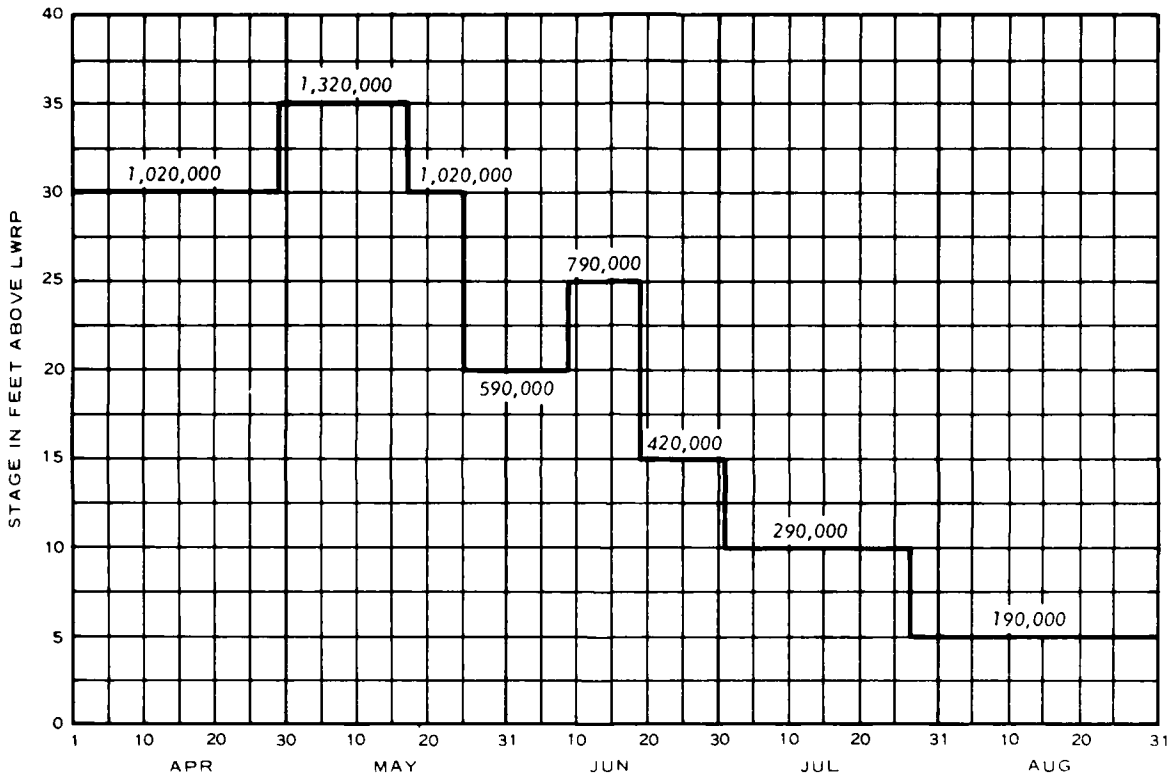
NO. 4 2300
CHANNEL CONFIGURATION
PROTOTYPE APRIL 1978 SURVEY
SCALE IN FEET
PROTOTYPE
MODEL

PLATE 5

PLATE 6



NOTE: VALUES SHOWN ON HYDROGRAPH ARE PROTOTYPE DISCHARGE IN CFS

BASE TEST HYDROGRAPH

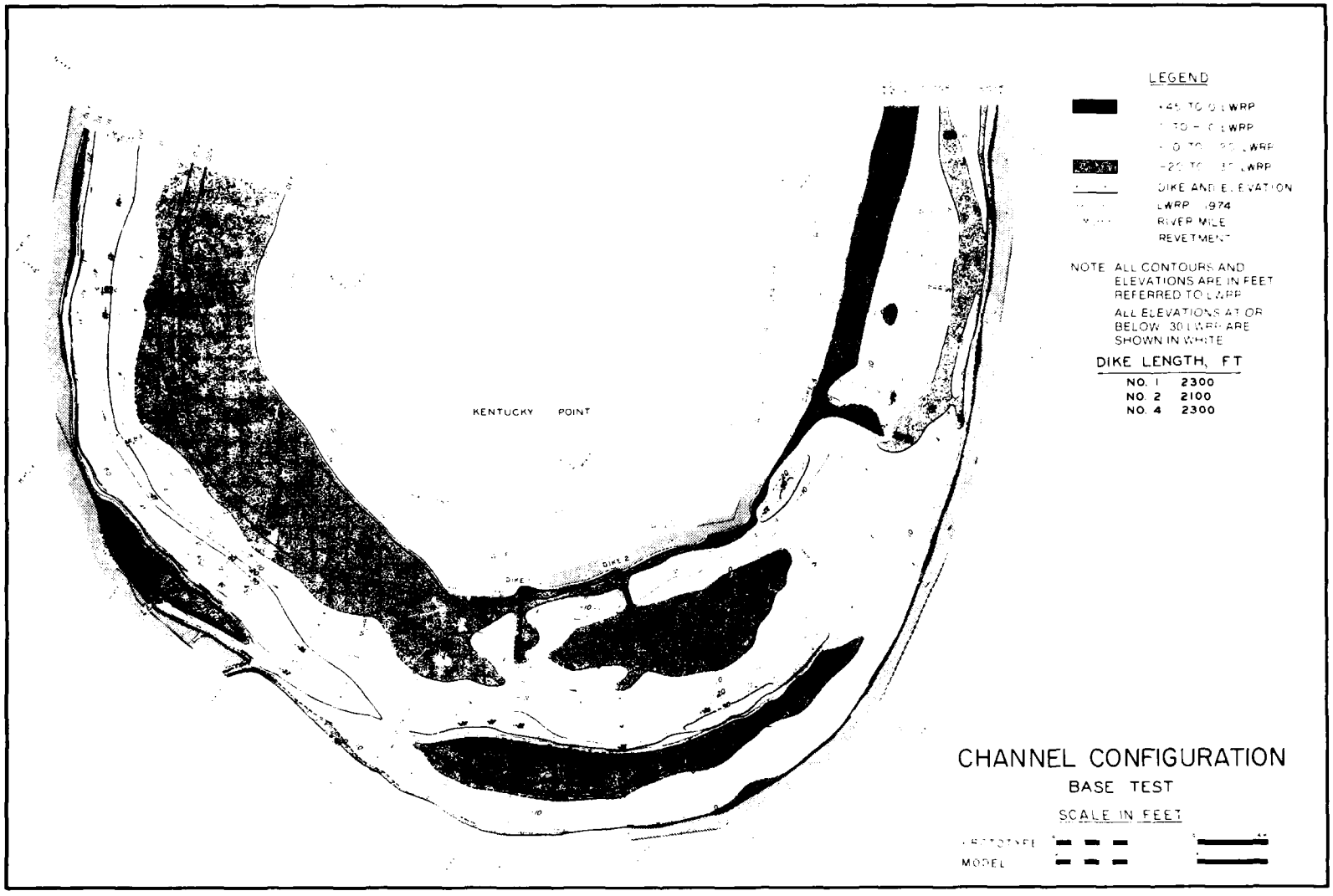
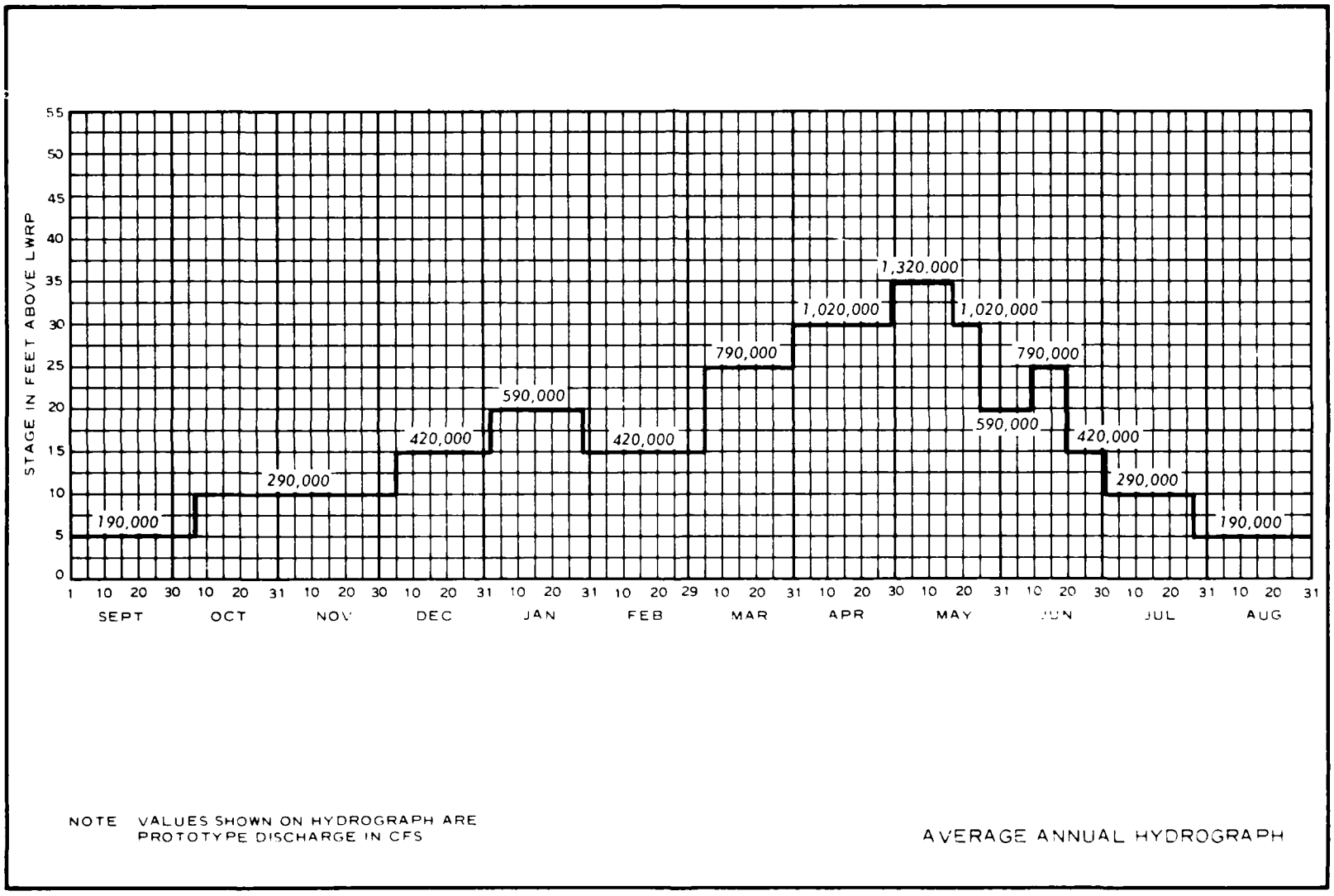

KENTUCKY POINT
DIKE 1
DIKE 2
LEGEND
+4.5 TO 0 LWRP
0 TO -2.5 LWRP
-2.5 TO -3.5 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -3.0 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1 2300
NO. 2 2100
NO. 4 2300
CHANNEL CONFIGURATION
BASE TEST
SCALE IN FEET
PROTOTYPE
MODEL

PLATE 7

PLATE 8



NOTE VALUES SHOWN ON HYDROGRAPH ARE PROTOTYPE DISCHARGE IN CFS

AVERAGE ANNUAL HYDROGRAPH

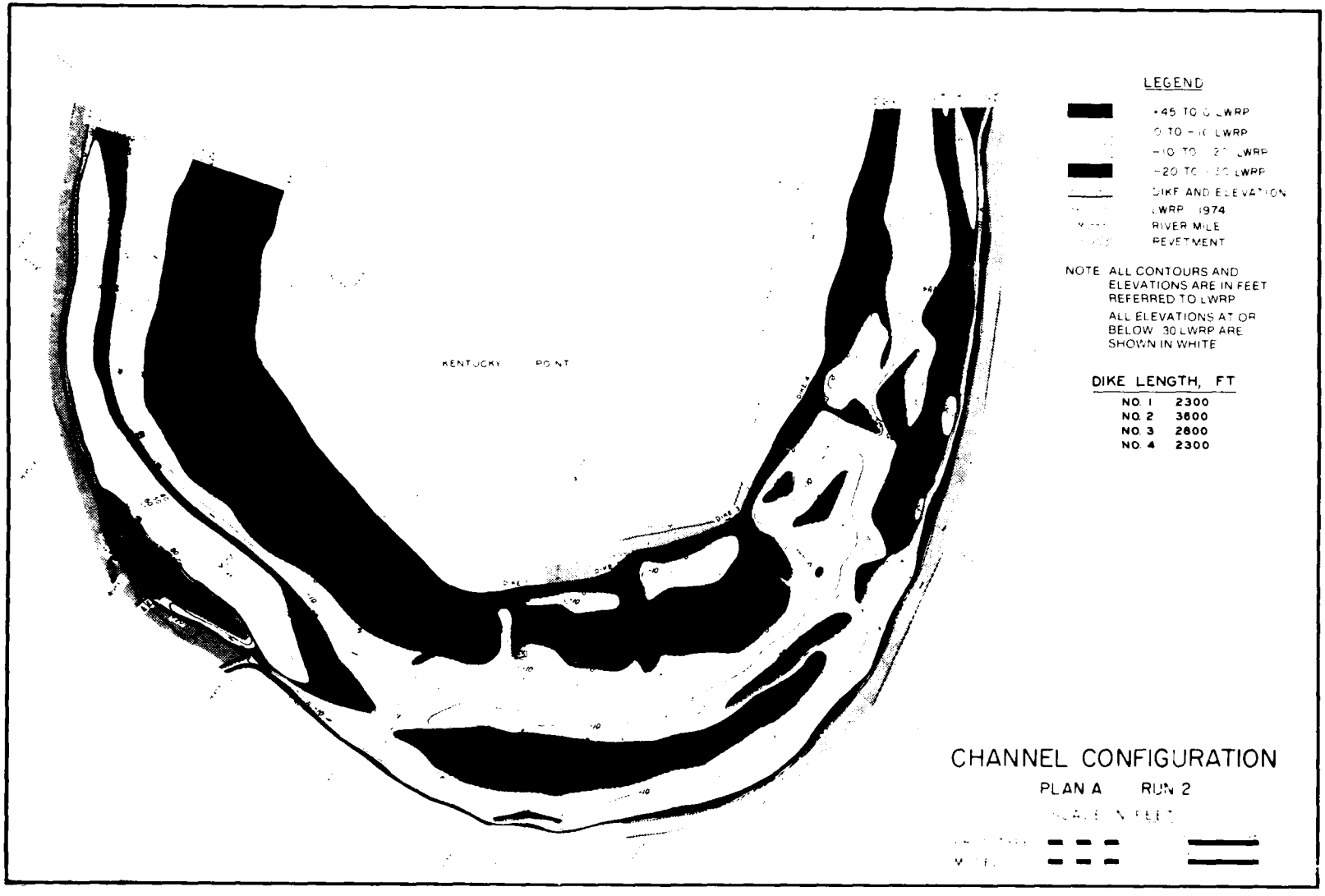
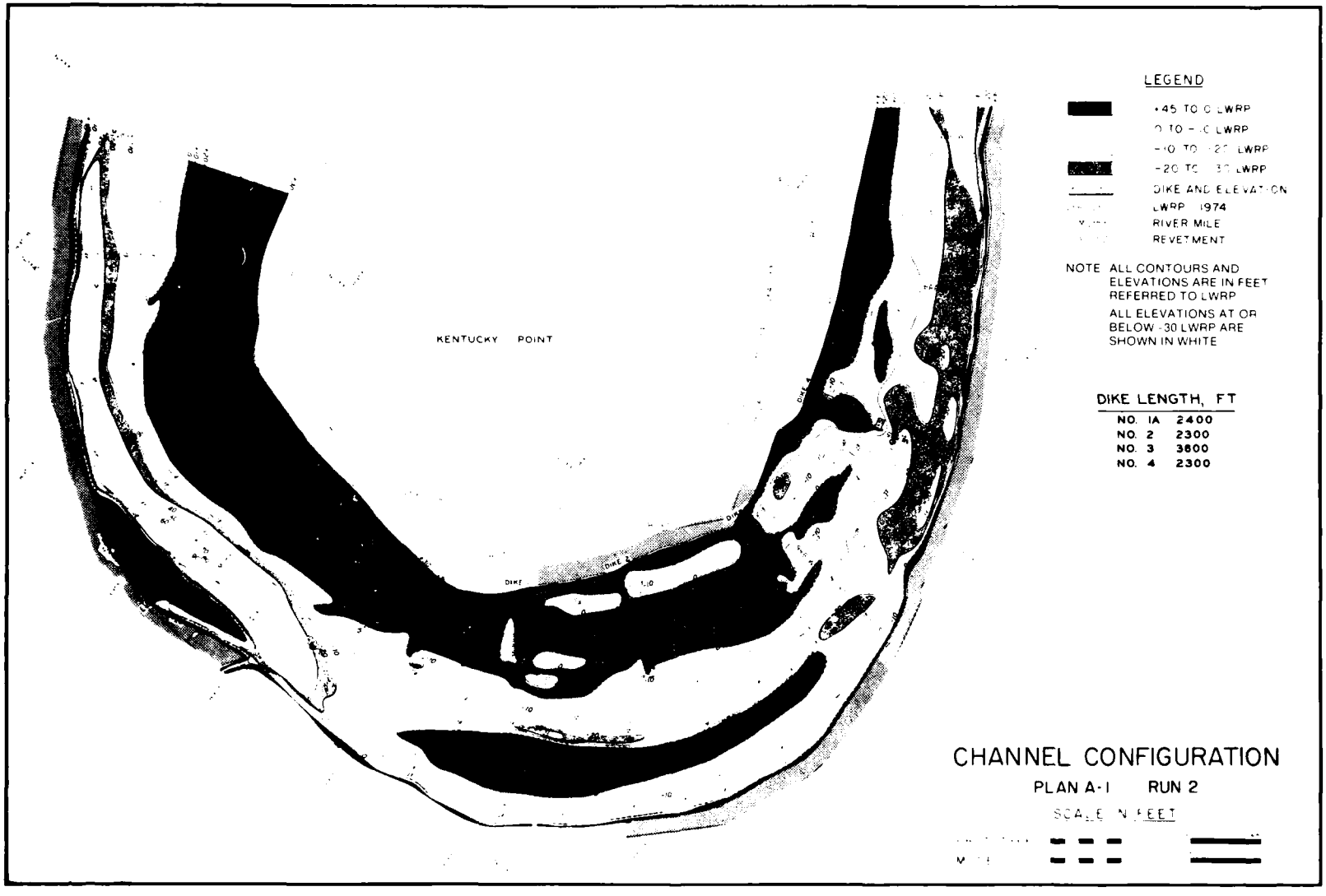

KENTUCKY POINT
LEGEND
+45 TO 0 LWRP
0 TO -10 LWRP
-10 TO -20 LWRP
-20 TO -30 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -30 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1 2300
NO. 2 3600
NO. 3 2800
NO. 4 2300
CHANNEL CONFIGURATION
PLAN A RUN 2

PLATE 9

PLATE 10


KENTUCKY POINT
DIKE
DIKE
DIKE
LEGEND
+45 TO 0 LWRP
0 TO -10 LWRP
-10 TO -20 LWRP
-20 TO -30 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -30 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1A 2400
NO. 2 2300
NO. 3 3600
NO. 4 2300
CHANNEL CONFIGURATION
PLAN A-1 RUN 2
SCALE IN FEET

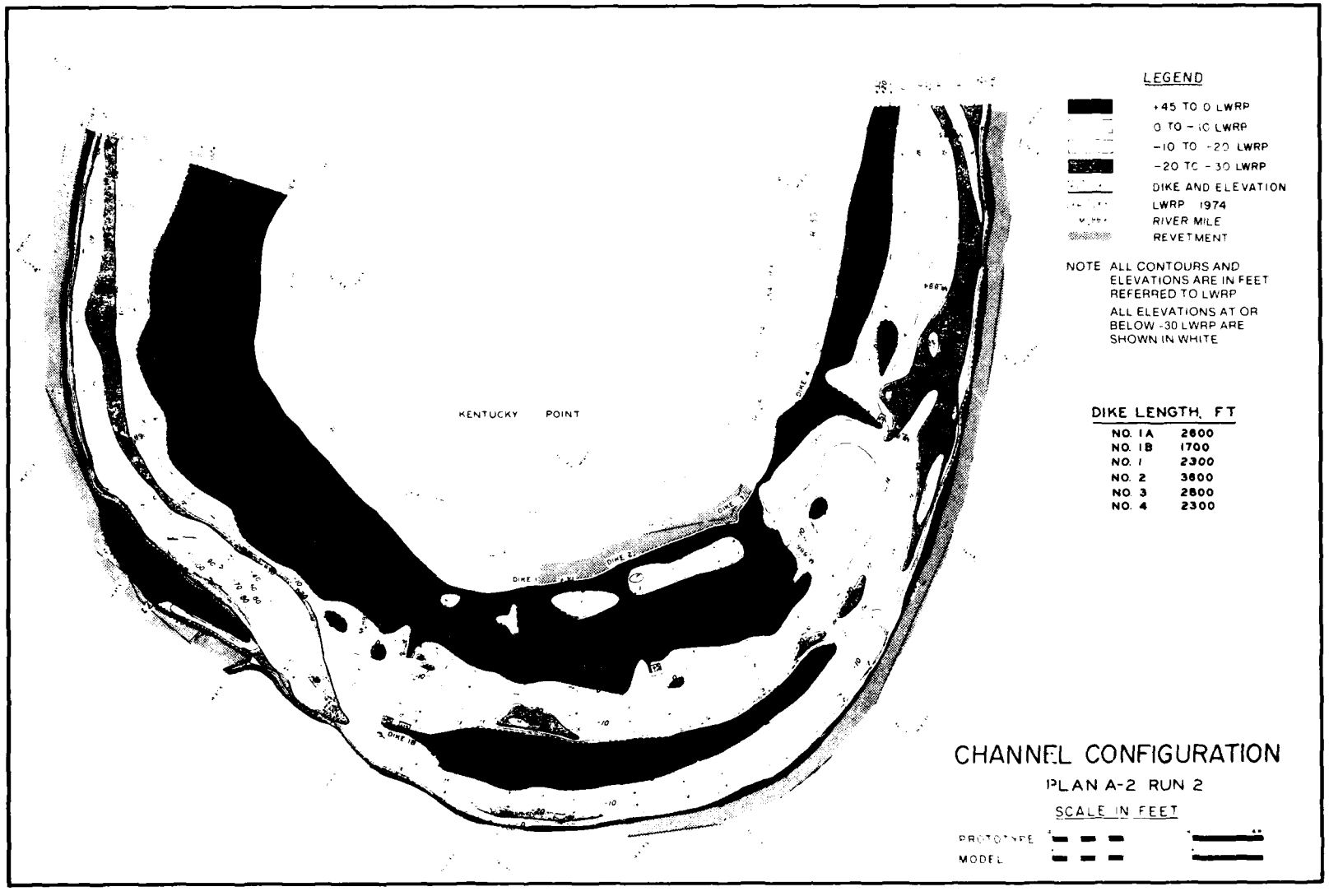
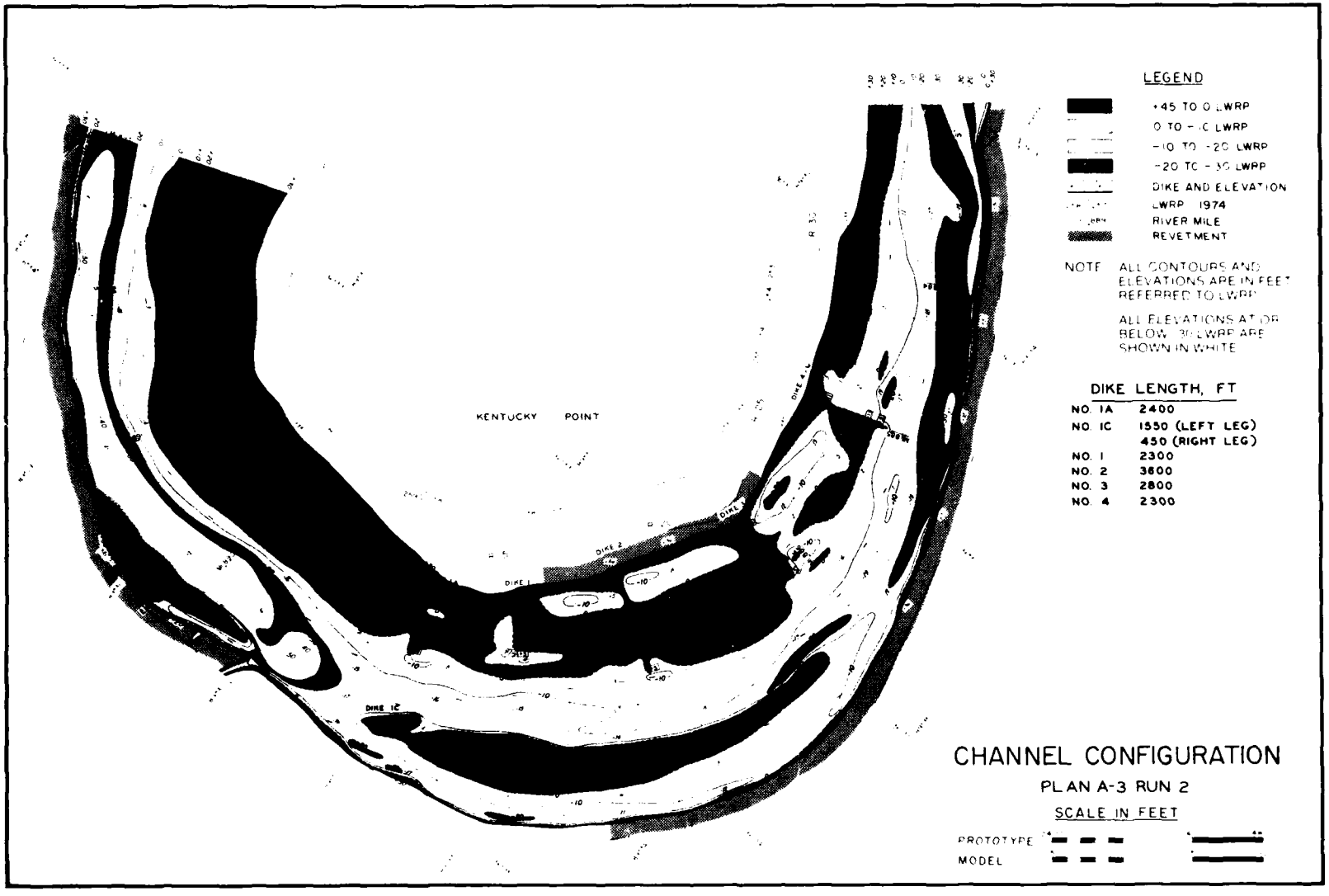

KENTUCKY POINT
DIKE 1A
DIKE 1B
DIKE 1
DIKE 2
DIKE 3
DIKE 4
-10
-20
LEGEND
+45 TO 0 LWRP
0 TO -10 LWRP
-10 TO -20 LWRP
-20 TO -30 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -30 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1A 2600
NO. 1B 1700
NO. 1 2300
NO. 2 3800
NO. 3 2800
NO. 4 2300
CHANNEL CONFIGURATION
PLAN A-2 RUN 2
SCALE IN FEET
PROTOTYPE
MODEL

PLATE 11

PLATE 12


KENTUCKY POINT
DIKE 1A
DIKE 1
DIKE 2
DIKE 1C
LEGEND
+45 TO 0 LWRP
0 TO -10 LWRP
-10 TO -20 LWRP
-20 TO -30 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -30 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1A 2400
NO. 1C 1550 (LEFT LEG)
450 (RIGHT LEG)
NO. 1 2300
NO. 2 3600
NO. 3 2800
NO. 4 2300
CHANNEL CONFIGURATION
PLAN A-3 RUN 2
SCALE IN FEET
PROTOTYPE
MODEL

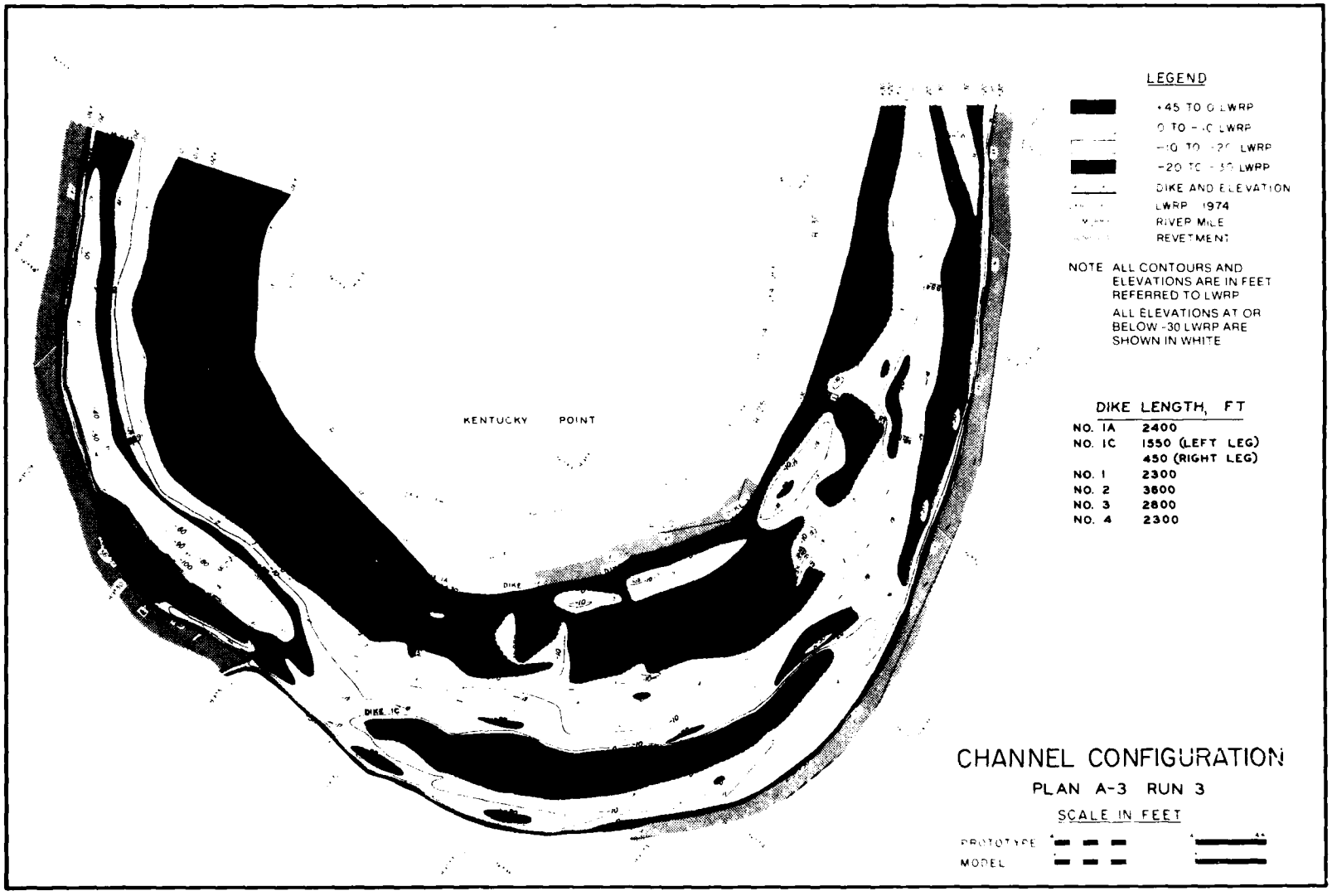
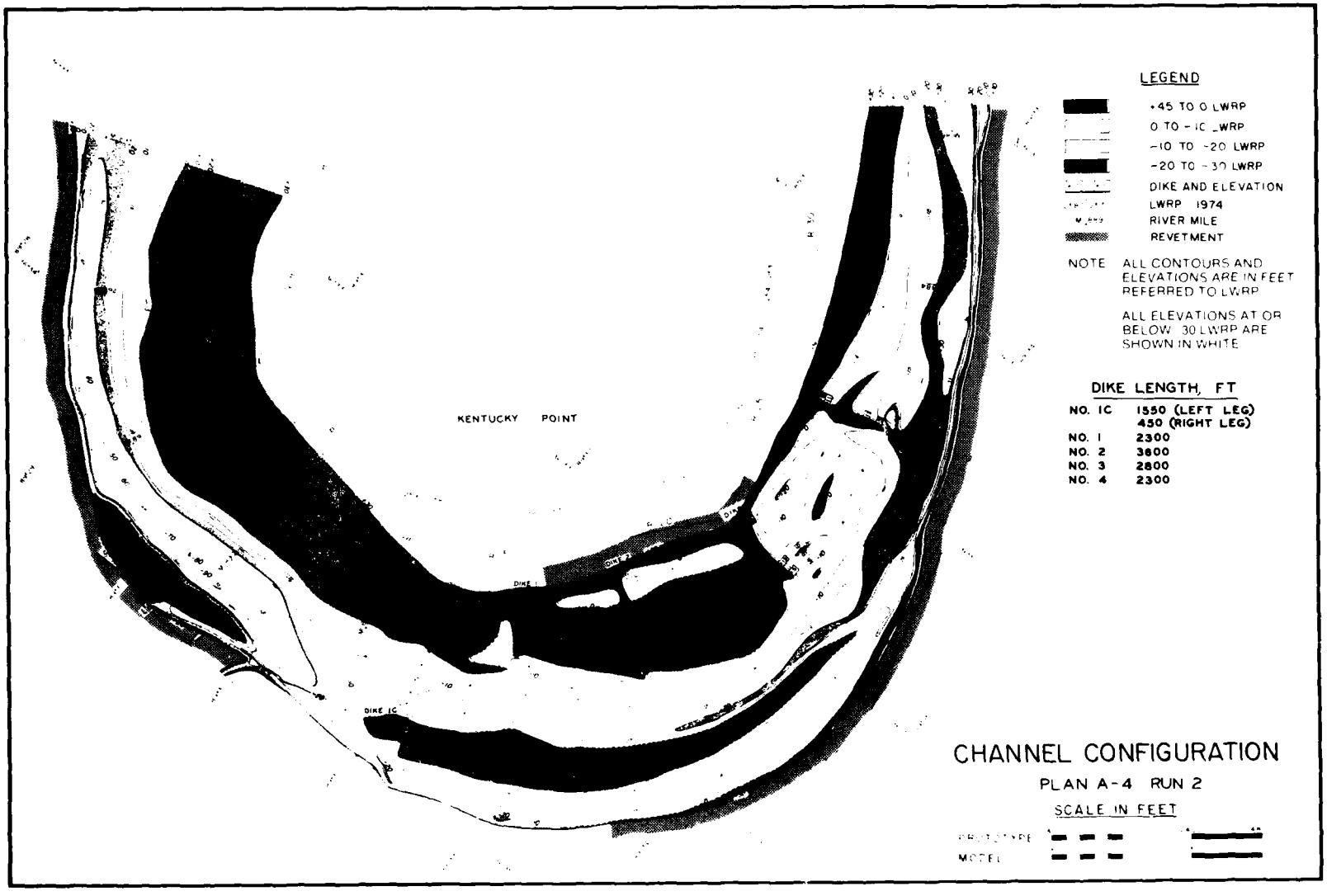

KENTUCKY POINT
DIKE
DIKE 1C
LEGEND
+45 TO 0 LWRP
0 TO -10 LWRP
-10 TO -20 LWRP
-20 TO -30 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -30 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1A 2400
NO. 1C 1550 (LEFT LEG)
450 (RIGHT LEG)
NO. 1 2300
NO. 2 3600
NO. 3 2800
NO. 4 2300
CHANNEL CONFIGURATION
PLAN A-3 RUN 3
SCALE IN FEET
PROTOTYPE
MODEL

PLATE 13

PLATE 14


KENTUCKY POINT
DIKE 1
DIKE 2
DIKE 3
DIKE 1C
LEGEND
+45 TO 0 LWRP
0 TO -10 LWRP
-10 TO -20 LWRP
-20 TO -30 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -30 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1C 1550 (LEFT LEG) 450 (RIGHT LEG)
NO. 1 2300
NO. 2 3600
NO. 3 2800
NO. 4 2300
CHANNEL CONFIGURATION
PLAN A-4 RUN 2
SCALE IN FEET
PROTOTYPE
MODEL

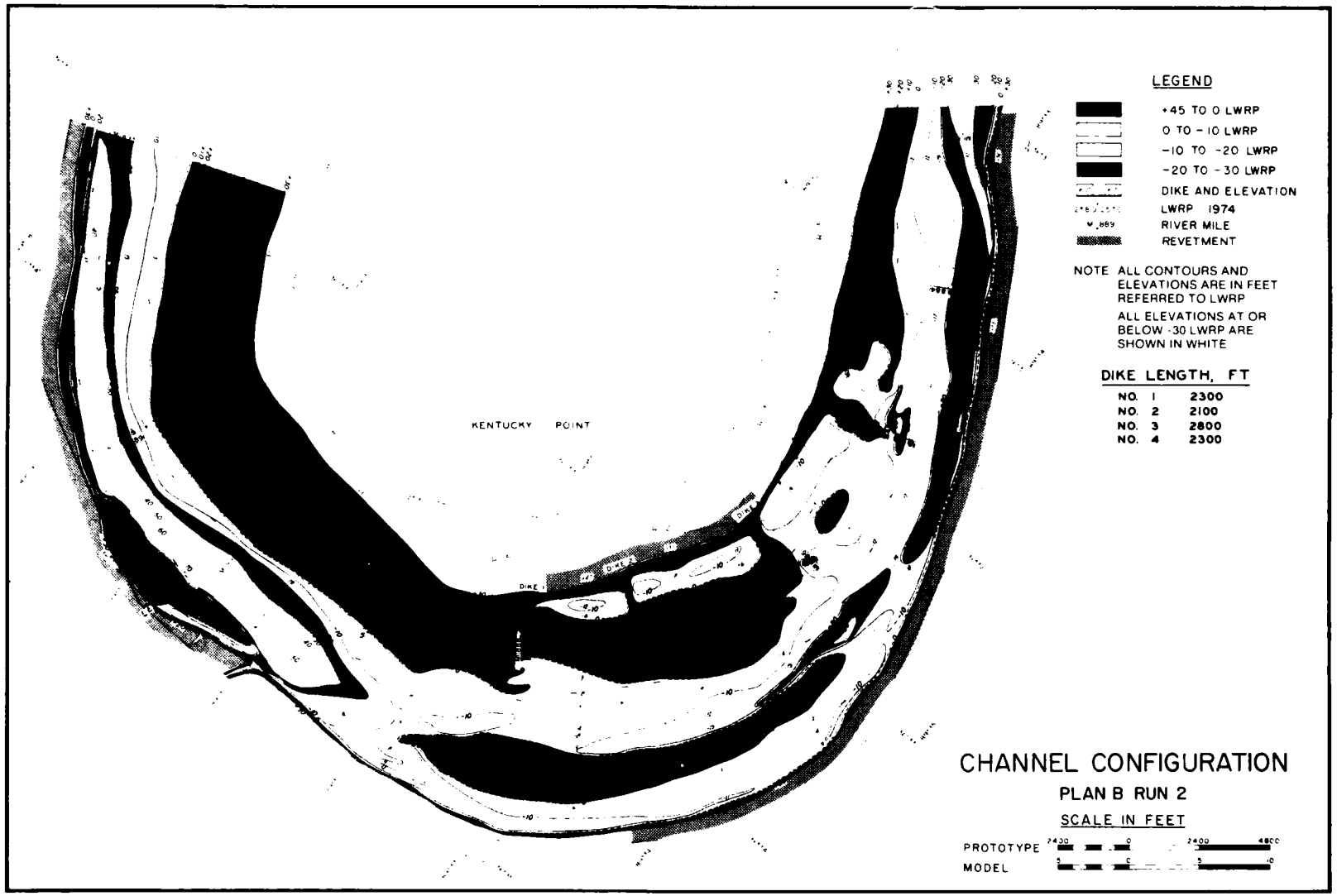

KENTUCKY POINT
DIKE 1
DIKE 2
DIKE 3
DIKE 4
LEGEND
+45 TO 0 LWRP
0 TO -10 LWRP
-10 TO -20 LWRP
-20 TO -30 LWRP
DIKE AND ELEVATION
LWRP 1974
RIVER MILE
REVETMENT
NOTE ALL CONTOURS AND ELEVATIONS ARE IN FEET REFERRED TO LWRP
ALL ELEVATIONS AT OR BELOW -30 LWRP ARE SHOWN IN WHITE
DIKE LENGTH, FT
NO. 1 2300
NO. 2 2100
NO. 3 2800
NO. 4 2300
CHANNEL CONFIGURATION
PLAN B RUN 2
SCALE IN FEET
PROTOTYPE
MODEL

PLATE 15

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.

Pokrefke, Thomas J., Jr.
Investigation of proposed dike systems on the Mississippi River : Report 2 : New Madrid bar reach : Hydraulic model investigation / by Thomas J. Pokrefke, Jr., John J. Franco (Hydraulics Laboratory, U.S. Army Engineer Waterways Experiment Station). -- Vicksburg, Miss. : The Station ; Springfield, Va. : available from NTIS, [1981].
15 p., 15 pages of plates : ill. ; 27 cm. -- Miscellaneous paper / U.S. Army Engineer Waterways Experiment Station ; H-70-1, Report 2)
Cover title.
"May 1981."
"Sponsored by Mississippi River Commission and U.S. Army Engineer Division, Lower Mississippi Valley."

1. Channels (Hydraulic engineering). 2. Dikes (Engineering). 3. Hydraulic models. 4. Mississippi River. I. Franco, John J. II. United States.

Pokrefke, Thomas J.
Investigation of proposed dike systems : ... 1981.
(Card 2)

Mississippi River Commission. III. United States. Army. Corps of Engineers. Lower Mississippi Valley Division. IV. U.S. Army Engineer Waterways Experiment Station. Hydraulics Laboratory. V. Title VI. Series: Miscellaneous paper (U.S. Army Engineer Waterways Experiment Station) ; H-70-1, Report 2.
TA7.W34m no.H-70-1 Report 2