NORTON POINT DIKE STUDY,
CONEY ISLAND, NEW YORK

April 1975

MISCELLANEOUS PAPER H-75-2

NORTON POINT DIKE STUDY, CONEY ISLAND, NEW YORK

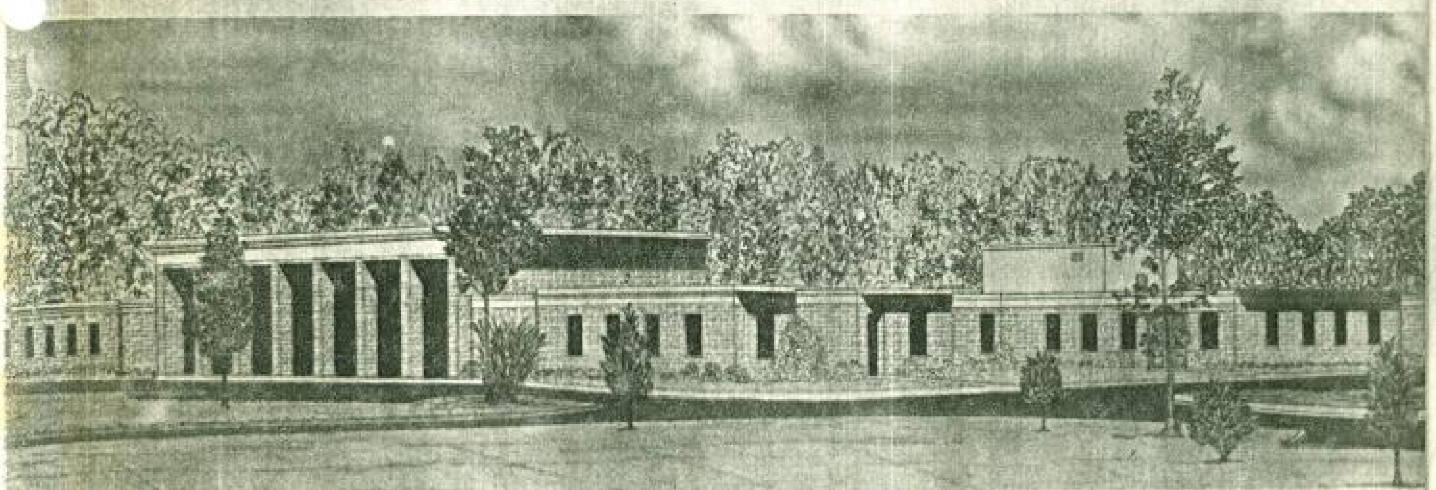
Hydraulic Model Investigation

by

Robert F. Athow, Jr., William H. Bobb, Richard A. Sager

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

April 1975
Final Report



Prepared for President, Borough of Staten Island
Staten Island, New York 10301
and
President, Borough of Brooklyn
Brooklyn, New York 11201

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER
Miscellaneous Paper H-75-2

2. GOVT ACCESSION NO.

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
NORTON POINT DIKE STUDY, CONEY ISLAND, NEW YORK
Hydraulic Model Investigation

5. TYPE OF REPORT & PERIOD COVERED
Final report

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
Robert F. Athow, Jr.
William H. Bobb
Richard A. Sager

8. CONTRACT OR GRANT NUMBER(s)

9. PERFORMING ORGANIZATION NAME AND ADDRESS
U. S. Army Engineer Waterways Experiment Station
Hydraulics Laboratory
P. O. Box 631, Vicksburg, Mississippi 39180

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS
President, Borough of Staten Island
Staten Island, NY 10301
President, Borough of Brooklyn, Brooklyn, NY 11201

12. REPORT DATE
April 1975

13. NUMBER OF PAGES
267

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

COPIED + BOUND BY PLS 4/26/82

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

Deflection dike
Hydraulic model
Coney Island Beach
Salinity
Current velocity
Dye dispersion

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

An existing comprehensive physical model that correctly reproduced tides, tidal currents, and density currents throughout the entire New York Harbor was used to determine the effects of constructing a current deflection dike at Norton Point, Coney Island, New York. The study included tests in the model to define the effects of the dike on tidal heights, current velocities, surface current patterns, salinities, and the distribution of dye from four sources

(Continued)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. ABSTRACT (Continued).

(Jamaica Bay, Oakwood Beach, Passaic Valley, and Raritan Bay) throughout the New York Harbor complex. The Norton Point current deflection dike studied was an impermeable dike, 3900 ft long, extending from the western tip of Coney Island, south-southeast into Lower New York Bay. Based on results of the model tests, it was shown that the Norton Point dike would have the following effects in the study area: (a) local current patterns would be changed and a continuous east-west current would be set up along the Coney Island beaches, (b) tidal heights and tidal phasing as well as the salinity regime would not be affected significantly, (c) sediment buildup behind the dike would be encouraged, (d) very little flushing of the waters behind the dike would occur in the period while the area is being filled by the littoral drift, and (e) concentration of pollution from the Passaic Valley Outfall showed a slight net decrease at low-water slack along Coney Island, but a significant net increase at high-water slack.

PREFACE

The studies reported herein were requested by the Borough of Richmond (subsequently renamed Borough of Staten Island), City of New York, New York, in a letter dated 6 October 1971 to the Director, U. S. Army Engineer Waterways Experiment Station (WES). The Office, Chief of Engineers (OCE), approved the study as outlined in a letter from WESHE dated 24 February 1972 to HQDA (DAEN-CWO-S), subject: Proposed Model Study of Hoffman-Swinburne Island Development, New York Harbor Model. The City of New York paid all costs in connection with the model study and for the preparation and distribution of this report.

The studies were conducted in the Hydraulics Laboratory of WES during the period August 1973 to February 1975 under the direction of Mr. H. B. Simmons, Chief of the Hydraulics Laboratory. Mr. R. A. Sager, Chief of the Estuaries Division, and Mr. W. H. Bobb, Chief of the Interior Channel Branch, directed the physical model study for which Mr. R. F. Athow, Jr., was the Project Engineer. This report was prepared by Messrs. Athow, Bobb, and Sager, with the assistance of Messrs. H. R. Smith and H. P. Townsley. Mr. F. A. Herrmann, Jr., Assistant Chief of the Hydraulics Laboratory, reviewed the report for editorial and technical content.

Model operation and data acquisition were ably rendered by Civil Engineering Technicians Burgess, Smith, Cartwright, Stewart, Herrington, Cessna, and Jefferson.

Mr. T. C. Hill, formerly of WES Hydraulics Laboratory, and Messrs. Anthony Vacarello and Martin A. Dembitz, representing the City of New York, planned and coordinated this study.

Director of WES during the performance of this study and preparation and publication of this report was COL G. H. Hilt, CE. Technical Director was Mr. F. R. Brown.

CONTENTS

NORTON POINT DIKE STUDY, CONEY ISLAND, NEW YORK

Hydraulic Model Investigation

PART I: INTRODUCTION

Background

1. The Borough of Richmond (subsequently renamed the Borough of Staten Island) was concerned with the development of two islands in Lower New York Bay known as Hoffman and Swinburne Islands (Figures 1 and 2). In addition, the Borough of Brooklyn was concerned with the resolution of the erosion of the beaches along Coney Island and the improvement of water quality along the beaches. The U. S. Army Engineer Waterways Experiment Station (WES) was requested to investigate the effects of these plans and the proposed solution to the problems on environmentally related conditions of the area. As a result, a model study in an existing model of the New York Harbor area (Plate 1) was developed and tests were initiated. In the initial stages of the model study, the need to investigate the development of the Hoffman and Swinburne Islands terminated; however, the pressing problems along Coney Island continued to exist.

2. In recent years, the quality of water along Coney Island beaches has materially deteriorated. The primary source of the domestic and industrial wastewater along the beaches apparently is the Passaic Valley Outfall in Upper New York Bay. Other potential sources are from Raritan Bay and Jamaica Bay; however, they pose a less serious problem than does the Passaic Valley Treatment Plant Outfall plus other polluted discharges into and upstream of Upper New York Bay. Under consideration to reduce the pollutant concentration along Coney Island beaches is a dike at Norton Point (Figure 2) to deflect the waters that include the wastewater from the Passaic Valley Outfall away from the beaches. The water from Upper New York Bay is carried by the ebb phase of the tidal current south through The Narrows into Lower New York Bay, and a portion

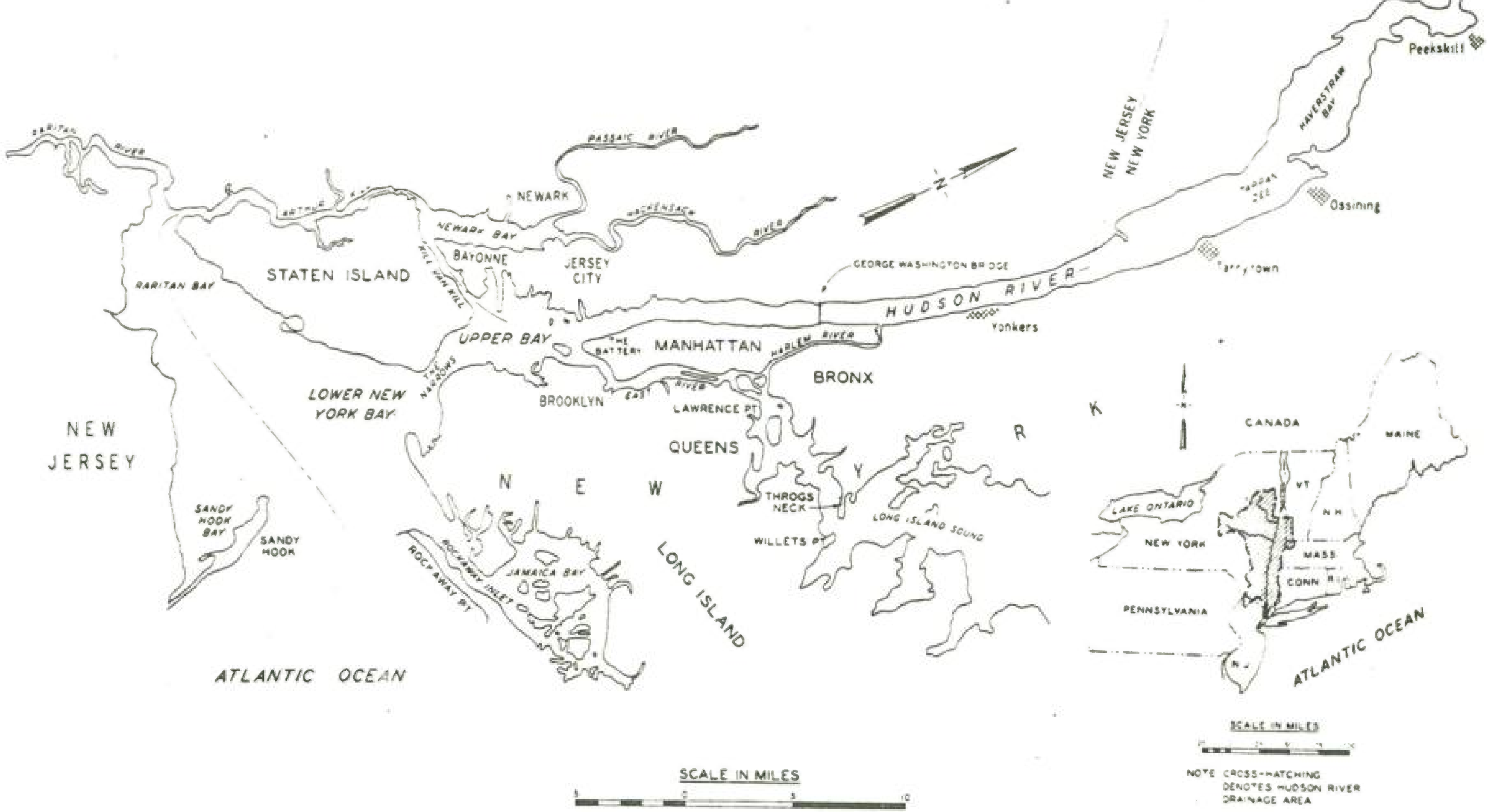


Figure 1. New York Harbor and vicinity

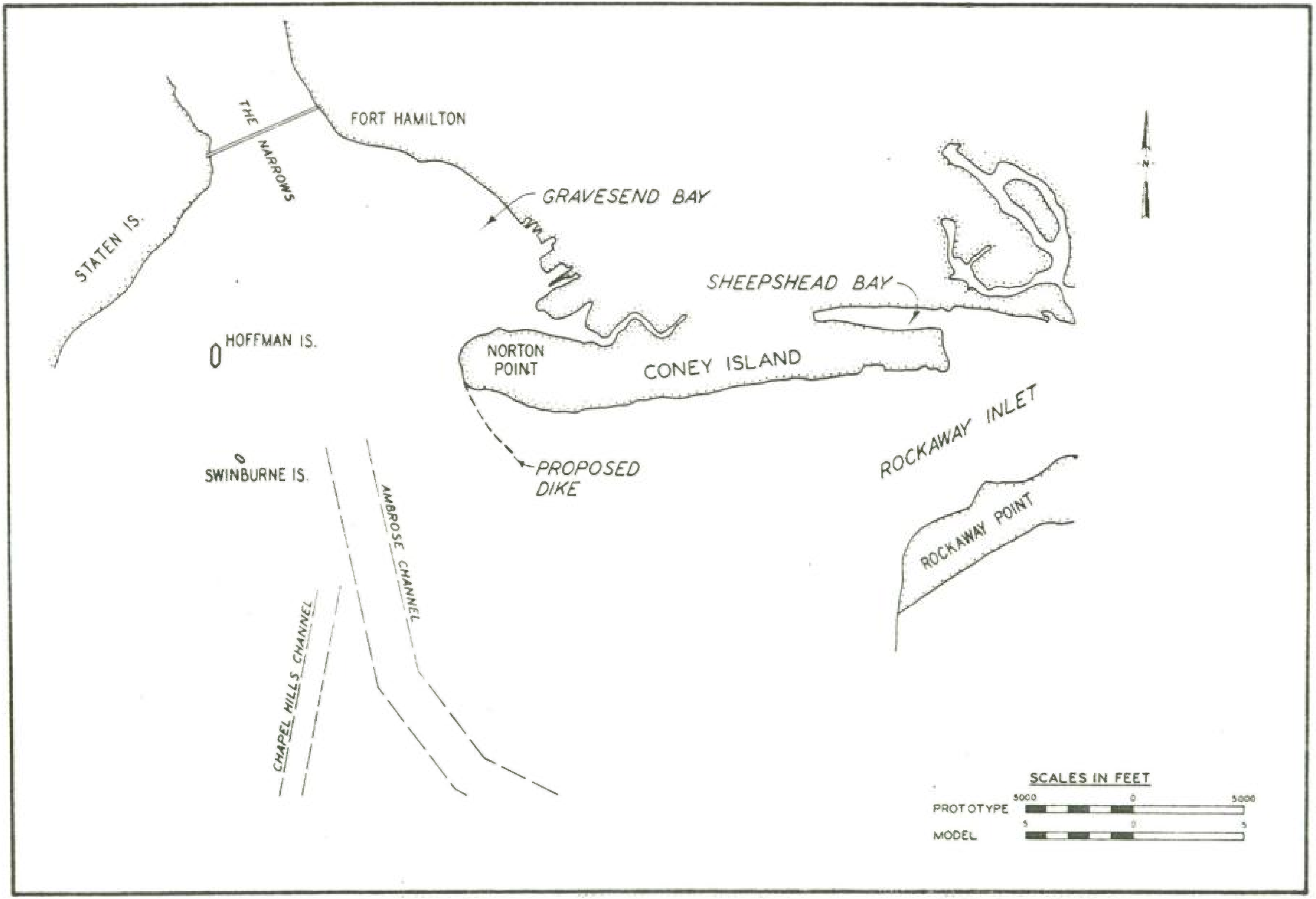


Figure 2. Location map

of this flow passes along Coney Island Beach. The purpose of the dike would be to deflect the polluted ebb currents away from the Coney Island beaches out into Lower New York Bay. The dike has a second potential benefit as an aid in reduction of erosion along the beaches. The location of the proposed dike is shown in Plate 2.

Purpose

3. The purpose of this model study was to investigate the effects of a proposed dike to be located at the Norton Point end of Coney Island on tides, currents, salinities, and mixing of effluents throughout the New York Harbor complex.

PART II: THE COMPREHENSIVE MODEL

Description

4. The New York Harbor model reproduces the tidal portions of all significant tributaries to the harbor with the exception of the Hudson River which is reproduced only as far as Hyde Park, New York. The tributaries were originally molded in the model to conform to the latest available hydrographic surveys at the time of model construction (1957). In subsequent years, updating of various portions of the model has been necessary with the result that the dates of surveys for model construction vary throughout the model. The model is of the fixed-bed type, molded entirely in concrete, and is constructed to linear scale ratios, model to prototype, of 1:1000 horizontally and 1:100 vertically. These scale ratios fix the following relations: slope 10:1; velocity 1:10; time 1:100; discharge 1:1,000,000; and volume 1:100,000,000. The salinity scale ratio required for an investigation of this type is 1:1. One prototype tidal cycle of 12 hr and 25 min is reproduced in the model in 7.45 min. A detailed discussion of the New York Harbor model and the model verification is presented in WES Technical Report No. 2-694, "Hudson River Channel, New York and New Jersey, Plans to Reduce Shoaling in Hudson River Channel and Adjacent Pier Slips; Hydraulic Model Investigation," September 1965. The model limits are shown in Plate 1.

5. The model is equipped with the necessary appurtenances to reproduce and measure all pertinent phenomena. Appurtenances used in connection with the study reported herein include primary and secondary tide generators, tide recorders, freshwater inflow measuring devices, skimming and measuring weirs, chemical titration equipment, salinity meters, current velocity meters, tide gages, and fluorometers for dye intensity determination.

Appurtenances

Tide generators

6. Tides are reproduced in typical estuarine models by controlling

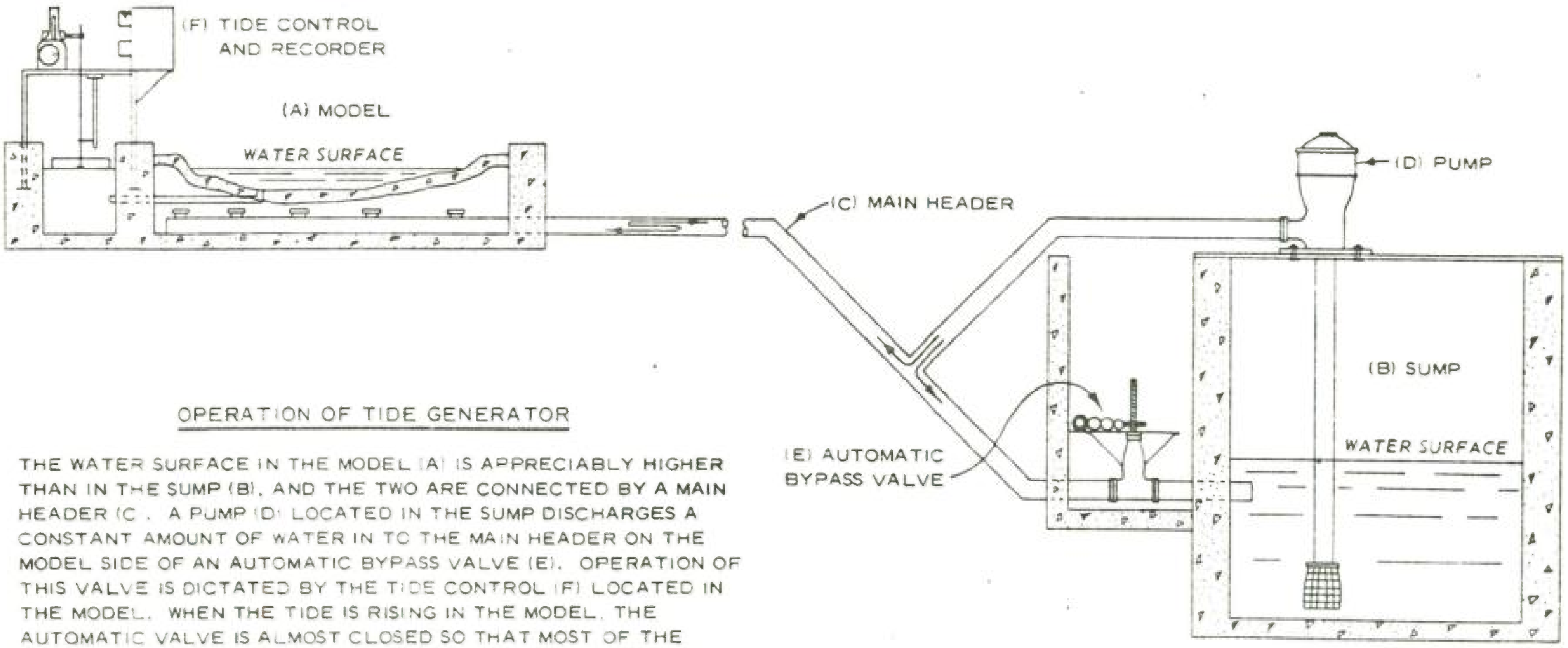
pumped inflows into the model from an ocean supply sump, coupled with programmed gravity return flows to the sump. A simplified schematic diagram of a typical tide generating system is shown in Figure 3. The New York Harbor model differs from the typical tide generating system, in that it requires three separate tide generators: (a) a primary tide generator causing the reproduction of the Atlantic Ocean tides by controlling flow to and from the ocean headbay; (b) a second primary tide generator located at the cutoff point in Long Island Sound to control flow to and from the model at that location so as to correctly reproduce tides at Willets Point; and (c) a secondary tidal apparatus necessary to correctly reproduce tidal flow in the Hudson at Hyde Park, New York. The Atlantic Ocean inflow is pumped at a constant rate and the gravity return flow is regulated with a programmed valve to cause a correct reproduction of the prototype tide, basically as described in Figure 3. The tide generating system for Long Island Sound is operated differently in that the inflow is varied with a programmed valve and the gravity outflow is constant. The Hyde Park apparatus removes the flood tidal prism of the Hudson at the model limit at the proper rate, stores the tidal flow for the proper time interval, and returns it to the system at the proper rate during the ebb tide. The Atlantic Ocean and Long Island Sound tide generators are each equipped with a tide recorder, which plots continuous records of the model reproduction and the desired prototype tide curve for comparison. The tide generators are also equipped with model clocks which indicate time in prototype hours referred to the moon's transit of the 74th meridian, and record the test duration in tidal cycles.

Inflow weirs

7. The model is equipped with Van Leer inflow weirs and constant-head tanks, which are used to correctly introduce the required freshwater inflows of the Hudson River at Hyde Park, New York, and of the Raritan River at New Brunswick, New Jersey.

Skimming weirs

8. Tidal reproduction in the model is completely automatic and is designed to operate continuously with a constant volume of water in the



OPERATION OF TIDE GENERATOR

THE WATER SURFACE IN THE MODEL (A) IS APPRECIABLY HIGHER THAN IN THE SUMP (B), AND THE TWO ARE CONNECTED BY A MAIN HEADER (C). A PUMP (D) LOCATED IN THE SUMP DISCHARGES A CONSTANT AMOUNT OF WATER IN TO THE MAIN HEADER ON THE MODEL SIDE OF AN AUTOMATIC BYPASS VALVE (E). OPERATION OF THIS VALVE IS DICTATED BY THE TIDE CONTROL (F) LOCATED IN THE MODEL. WHEN THE TIDE IS RISING IN THE MODEL, THE AUTOMATIC VALVE IS ALMOST CLOSED SO THAT MOST OF THE PUMP OUTPUT IS DIVERTED TO THE MODEL; WHEN THE TIDE IS FALLING IN THE MODEL, THE VALVE IS ALMOST OPEN SO THAT ALL OF THE PUMP OUTPUT, PLUS GRAVITY FLOW FROM THE MODEL RETURNS TO THE SUMP. THE TIDE CONTROL MAINTAINS THE PROPER VALVE OPENING AT ALL TIMES AS REQUIRED TO REPRODUCE ANY DESIRED TIDE IN THE MODEL.

Figure 3. Schematic diagram of a typical tide generating system

model/sump system. Maintaining a constant volume of water requires that water be removed and wasted from the downstream end of the model through a skimming weir at a rate equal to the total freshwater inflow of all the tributaries. The weir is called a skimming weir since it collects water from the surface where salinities are at a minimum.

Salinity meters

9. Salinity concentrations of water samples taken from the model are determined by the use of conductivity cells especially built and calibrated for this purpose or by chemical titration with silver nitrate. The cells are considered to be accurate to within ±2 percent, which amounts to about ±0.2 parts per thousand (ppt) in the lower ranges of salinity and ±0.5 ppt in the higher ranges of salinity. The salinity meter assembly is shown in Figure 4. In all cases where a high degree of accuracy is required, such as source salinities, chemical titration is used. The chemical titration equipment consists of a graduated burette for measuring silver nitrate volumes, a selected group of pipettes for measuring the volume of sample used, sample jars in which to perform the titration, a supply of silver nitrate, and potassium chromate for use as an end-point indicator in the titration process.

Current meters

10. Current velocity measurements are made in the model with miniature Price-type current meters, shown in Figure 5. The center line of the five cups on the meter is about 0.045 ft* above the bottom of the meter frame; therefore, bottom velocities in the model are measured about 5.0 ft (prototype) above the bottom. Model surface velocities are measured about 3.0 ft (prototype) below the surface. The overall width of the meter is about 0.1 ft in the model, representing a horizontal width of about 100 ft in the prototype. Therefore, the distortion of area (model to prototype) results in comparing model velocities averaged over a much larger area than those of the prototype point observations. The same is true for the vertical area since the height of the cups on

---

* A table of factors for converting U. S. customary units of measurement to metric (SI) units is presented on page 3.

the meter is equivalent to about 4.0 ft prototype. Velocities are obtained by counting the number of revolutions the meter wheel makes in a 10-sec interval which is equivalent to about 17 min in the prototype. The meters are calibrated frequently to ensure the accuracy of measurements and are capable of measuring actual velocities as low as about 0.05 fps (0.5 fps prototype).

Tide gages

11. Permanently mounted point gages are installed on the model at locations corresponding to the prototype recording tide gage locations at which verification tide data were collected, plus additional locations considered necessary for test purposes. These gages are graduated to 0.001 ft (0.1 ft prototype) and are used to measure tidal elevations throughout the model. Portable gages are used when necessary to obtain more detailed tidal data in specific reaches of the model.

Fluorometer

12. It is necessary to determine concentrations of fluorescent dyes introduced to determine dispersion patterns of the Lower Bay waters. All such measurements are made with a fluorometer (Figure 6). Five-cc samples are required, and the meters are calibrated to read values between 1 to 10,000 parts per billion (ppb). The accuracy of the fluorometer is about ±3 percent for the range of concentrations measured.

P. 12 : FIG. 4 Salinity meter
FIG. 5 Current meter

PART III: MODEL TESTS AND RESULTS

Description of Tests

Base tests

13. The first series of model tests conducted was base tests, or tests to define existing conditions. Measurements were obtained at various locations to compare with similar measurements made for the plan under investigation. The base tests and the subsequent plan tests were conducted using a repetitive mean tide with a range of 4.7 ft (prototype) at Sandy Hook (USC&GS gage) and a duration of 12.42 hr (prototype). The freshwater inflow rates used were 12,000 cfs for the Hudson River and 1770 cfs for the Raritan River. The ocean salinity was maintained at 30.0 ppt total salt throughout the tests, and the model was operated until salinity stability had been achieved prior to collecting any data. Measurements made during the base tests included tidal heights, current velocities, salinities, and dye concentrations. Additionally, surface current direction photos were taken of the study area. The results of the base test measurements are included in appropriate tables, photos, or plates along with similar results of plan tests for ease of comparison, and will not be discussed separately.

Plan tests

14. The element of the proposed plan subjected to the comprehensive testing is shown in Plate 2 and consisted of an impermeable curved dike 3900 ft in length (referred to as Plan 1). Previous feasibility studies in the same model for the City of New York of similar dikes off Coney Island had demonstrated to representatives of the Corps of Engineers and the City of New York that shorter dikes did not have the hydraulic advantages of the 3900-ft dike.

Tidal Measurements and Results

15. Tidal heights for base and plan conditions, measured at half-hour intervals at the nine locations shown in Plate 3, are shown in

P.14 : FIG 6 Turner Fluorometer

Plates 5-7. Plan 1 had no major effects on tidal phasing or elevations. Sta A, C, E, F, G, and I showed no significant change which could be attributed to Plan 1. The slight changes evidenced on the plots for these stations are within the confidence band of ±0.1 ft prototype. Sta B located within the Plan 1 area showed a slight increase in the rate of rise to high water and an increase in the rate of fall to low water for Plan 1. The elevations for high and low waters remained unchanged from the base measurements. The 0.1-ft increase in mean tide level shown for Sta D and H in Plates 6 and 7 is thought to be due to a shift of the gage zero and was probably not caused by installation of Plan 1. It is concluded that Plan 1 had no significant effects on water surface elevations throughout the model.

Current Measurements and Results

16. Current velocities were measured at half-hour intervals at the 23 locations shown in Plate 3. The water depth at mlw at Sta 23, 39, 41, 42, and 43 was less than 12 ft, so that surface measurements were made by timing the passage of a float over a given distance. The water depth at the other 18 locations exceeded 12 ft; therefore, the current meters discussed in paragraph 10 were employed. Tables 1-23 and Plates 8-30 give the results of the base and plan velocity tests. An important feature of the tabulated results is the section at the bottom of each table which gives the maximum values of flood and ebb velocity for each depth and the times at which the extreme values were measured. The last column in the bottom tabulations for each depth is titled "Ebb Predominance," which is a percentage measurement of net flow at the station location and an indicator of the direction of net flow at the point of measurement over a 12.42-hr tidal cycle. The predominance computation is made by determining the total area under the ebb and flood velocity curves over a complete tidal cycle and dividing this value into the area under the ebb velocity curve to obtain the percent of the total flow which is in the ebb direction. The ebb and flood flows at the point of measurement are in balance for an ebb predominance value of 50 percent.

Percentages greater than 50 percent indicate more flow in a downstream or ebb direction than upstream, while percentages of flow less than 50 percent indicate more flow in an upstream or flood direction at that velocity station. In the upper part of the velocity tabulations, velocities shown as negative are in the ebb direction (or eastward at Sta 6, 20, and 23).

17. Plan 1 produced some changes to current velocities in the study area. At Sta 8, 13, 15, 35, 36, 37, 38, 39, 41, 42, 43, 56, and 57, which were not in the immediate vicinity of the proposed dike, minor differences between the base and plan tests were detected. These differences at the above-mentioned stations are not systematic and were generally within the accuracy of model measurements (±0.5 fps) and are not thought to be attributable to the presence of the Plan 1 dike. They are therefore not considered to be significant.

18. Data obtained from Sta 6, 16, 18, 19, 20, 23, 25, 29, 30, and 31, all located either along Coney Island or near the Plan 1 dike, show changes to the current velocities that are considered significant and can be attributed to the presence of the Plan 1 dike. Ebb currents at the eastern end of Coney Island move westward from Rockaway Inlet, whereas they move eastward at the western end of Coney Island from The Narrows and Gravesend Bay. At Sta 6, 20, and 23, ebb currents move eastward.

19. Data obtained at Sta 6, Table 1 and Plate 8, located approximately midway along Coney Island and about 3000 ft off the beach (see Plate 3), showed essentially no change (±0.2 fps) in maximum flood velocity. Maximum ebb velocities were reduced by about 0.7 fps at the surface, middepth, and bottom. Ebb predominance decreased from 65.8 to 17.4 percent near the surface, 60.3 to 2.8 percent at middepth, and 30.8 to 0 percent near the bottom. Thus, the net transport at Sta 6 was changed from eastward to westward; i.e., transport would be toward the planned dike practically 100 percent of the time. Wave action is not reproduced in the model and could cause significant changes in net transport depending on the wave direction.

20. Data obtained at Sta 20, Table 8 and Plate 15, located

behind the dike and approximately 1800 ft east of the tip of the dike (see Plate 3), also showed a marked effect on the ebb velocities. Maximum magnitudes decreased from 1.5, 1.3, and 1.2 fps at the surface, middepth, and bottom, respectively, to 0.0 fps at all depths. Flow predominance changed from slightly westward to completely westward, indicating a significant net transport toward the dike. The area between the western end of Coney Island Beach and the proposed dike can be expected to fill rapidly.

21. Data obtained at Sta 23, Table 9 and Plate 16, located approximately 400 ft south of the seaward end of the dike (see Plate 3), exhibited increases in the magnitudes of maximum surface flood velocity from 1.9 to 2.8 fps and of the surface ebb velocity from 2.3 to 2.6 fps. These increased velocities indicate the possibility of scour near the toe of the dike. The ebb predominance decreased slightly from 62.5 to 58.2 percent, but the net transport continued to be toward the large eddy system in Lower New York Bay that is discussed further in the discussion of surface current patterns (paragraph 29).

22. Data obtained at Sta 25, Table 10 and Plate 17, south of Norton Point and immediately west of the dike (Plate 3), exhibited marked decreases in the magnitudes of the flood velocities at all depths. Maximum flood velocity decreased from 1.7 to 0.1 fps, from 1.9 to 0.1 fps, and from 2.1 to 0.3 fps at surface, middepth, and bottom, respectively. The dike almost completely diverted flood currents at Sta 25. The ebb velocities remained unchanged except for minor deviations. Ebb predominance changed from an average of 65 percent to an average of 93 percent for all depths. Net transport would thus change from moderately to strongly downstream.

23. Data obtained at Sta 29, Table 11 and Plate 18, located approximately 3200 ft west of Coney Island (Plate 3), showed little or no change to the ebb velocities at all depths. Maximum flood velocities at Sta 29 were decreased significantly. At surface depth, the decrease was 0.6 fps (1.5 to 0.9 fps), and at middepth, the decrease was 0.8 fps (1.7 to 0.9 fps). The bottom flood velocities decreased throughout the flood cycle (although the maximum flood velocity was reduced by only

0.2 fps) which resulted in an increase in ebb predominance from 45.9 to 57.5 percent. Net transport at the bottom thus changed from slightly upstream to slightly downstream. Ebb predominance at the surface and middepth increased from 75.4 to 87.8 percent and from 60.5 to 78.6 percent, respectively. Net transport at Sta 29 was thus downstream for Plan 1 conditions.

24. Data obtained at Sta 30, Table 12 and Plate 19, located in the main navigation channel from Lower Bay to Upper Bay, and approximately 5800 ft west of Coney Island (Plate 3), exhibited substantial increases in the magnitudes of flood velocities at all depths. Increases of 0.8 to 1.3 fps in maximum flood velocities were measured. The magnitude of the maximum ebb velocity at the surface increased approximately 0.5 fps, but the ebb velocities at middepth and bottom remained unchanged. Ebb predominance decreased at surface depth from 72.9 to 61.5 percent, from 43.6 to 35.9 percent at middepth, and from 28.9 to 19.3 percent at the bottom. Net transport was thus downstream at the surface and upstream at middepth and bottom.

25. Data obtained at Sta 31, Table 13 and Plate 20, located on the westerly side of the channel, 3000 ft east-southeast of Hoffman Island (Plate 3), exhibited moderate increases of about 0.5 fps in the maximum flood velocity magnitudes at all depths. The magnitude of the maximum surface and middepth ebb velocity increased by about 0.4 fps, but the maximum bottom ebb velocity magnitude decreased by 0.3 fps. Ebb predominance decreased slightly at all depths, but the net transport remained in the downstream direction.

26. At Sta 16, 18, and 19 (Tables 5-7 and Plates 12-14, respectively), located in the navigation channel about 2 miles seaward from the dike (Plate 3), maximum ebb velocities were systematically increased by about 0.5 fps. This was probably caused by the slightly westward deflection of ebb currents by the dike.

27. In summary, the current velocity data indicate that the following changes would be effected by the proposed dike:

<u>a</u>. Velocities along the western half of Coney Island Beach would be modified from a slightly western flow predominance to an essentially total western flow predominance.

_b_. Velocities immediately west of the dike would be changed by the dike to a strong ebb predominance.

_c_. The effect of the dike between Norton Point and Staten Island would be to increase the ebb predominance east of the main navigation channel, significantly increase the maximum flood velocities in the main channel, and cause a lesser increase in flood velocities west of the navigation channel.

_d_. Flood velocities in the navigation channels about 2 miles seaward from the dike would be slightly increased.

Surface Current Photos and Results

Description of photos

28. Photos 1-26 show hourly surface current patterns for the base test and Plan 1. Odd-numbered photos are for existing conditions and even-numbered photos are comparable photos with the proposed dike installed in the model. The photos are 3-sec time exposures of confetti floating on the water surface, and the streak lengths show the total travel of the confetti squares during the 3-sec exposure interval. The dots near the ends of the streaks were made by flashing a light just prior to closing the camera lens; therefore, the dots indicate direction of flow. Surface current velocities can be determined by measuring the total lengths of confetti streaks and comparing the total lengths with the velocity scale shown in each photo. Velocities obtained by this method are true surface velocities and will generally be greater than the surface velocity measurements made with current meters at comparable stations, since the surface velocities measured with the current meters are made at a depth of several feet below mean low water.

Discussion of results

29. At the initiation of ebb flow (hour 9) near the dike (Photos 19 for base and 20 for plan), the influence of the dike was confined to the area immediately around the dike. At this phase of the tidal cycle, ebb flow existed from Rockaway Inlet to Norton Point, and flood flow existed along Staten Island and through The Narrows. The ebb flow along the western face of the dike was considerably stronger than for base conditions. During the remainder of the ebb phase of the

tide (hours 10-3), the dike eliminated all flow at the western end of Coney Island (in the lee of the dike) and enlarged and intensified the counterclockwise eddy in Lower Bay. This in turn resulted in stronger westward velocities over a greater length of Coney Island Beach than existed for base conditions. With the dike, the center of the eddy progressively enlarged and moved farther south into Lower Bay from about 3000 ft offshore at hour 11 to 11,000 ft offshore at hour 3. For base conditions, the eddy moved only from about 1500 ft to about 5000 ft offshore during the same period. The southwestern edge of the eddy is essentially the zone in which ebb flow from The Narrows joins ebb flow from Rockaway Inlet. This interface is considerably farther south with the dike than for base conditions. The dike caused the waters along the western half of Coney Island Beach to be changed from an area dominated by ebb flow from The Narrows to an area dominated by ebb flow from Rockaway Inlet and the large eddy system in Lower New York Bay. At hour 1 (Photos 3 and 4), flow from The Narrows was at strength of ebb, and flow from Rockaway Inlet was past strength of ebb. By hour 2 (Photos 5 and 6), the flow from Rockaway Inlet was near slack, but strong ebb flow was still occurring from The Narrows.

30. At hour 3 (Photos 7 and 8 for base and plan, respectively), the transition between the ebb and flood phases of the tide was occurring. The interaction of flood flow from the ocean with ebb flow from The Narrows continued to sustain the large eddy in Lower Bay. For base conditions, the eddy was quite weak; with the dike, however, the eddy was still strong, but the incoming tide had forced the center of the eddy to the west approximately 3000 ft. During the remainder of the flood phase of the tide (hours 4-8, Photos 9-18), a distinct flow divergence occurred along Coney Island: westward flow moving along the western end toward The Narrows and eastward flow moving along the eastern end toward Rockaway Inlet. The position of the point of divergence fluctuated from about 9,000 to 11,000 ft west of the tip of Norton Point for the base test and from about 7,000 to 14,000 ft for Plan 1. For the base test, a large eddy developed in Gravesend Bay at hour 6 and remained there throughout the remainder of the flood flow.

With the dike installed, the eddy developed about 4000 ft west of Norton Point and moved progressively north into Gravesend Bay. At the end of the flood phase, the position of the eddy was about 2000 ft west of that for the base test. This was probably a direct result of the sharp flow separation which occurred on the west side of the dike from hours 5-8. A much smaller and weaker eddy persisted throughout much of the flood phase of the tide between the dike and the flow separation. The dike also deflected the main concentration of flood currents between Coney Island and Staten Island from about 1000 to 2000 ft west of Norton Point about 4000 ft westward to the navigation channel. Flow immediately east of the dike was essentially slack throughout the flood period.

31. In summary, analysis of the surface current direction photos indicates that:

a. The dike would result in local changes in current patterns throughout the tidal cycle.

b. During ebb flow the dike would deflect flow from The Narrows away from Coney Island.

c. During the period of strong ebb flow, the dike would cause an existing eddy in Lower Bay to increase considerably in size. The enlarged eddy should retain an increased portion of material entering the area in the surface stratum from The Narrows.

d. During the period of strong flood flow, the dike would cause an area of eddies to develop west of the dike, modification to the eddy in Gravesend Bay, and a shift of the flow moving toward The Narrows to the navigation channel between the end of Coney Island and Staten Island.

e. Although pollutants from The Narrows will ultimately reach Coney Island Beach after construction of the proposed dike, they would be delayed due to the time period they are trapped in the large intensified eddy in Lower Bay.

f. Flow along the western half of Coney Island Beach would be modified by the dike to essentially an east-to-west flow throughout the tidal cycle.

g. The slack-water area behind the dike would be susceptible to a gradual increase in pollutant levels until littoral drift fills the area, which should occur in a relatively short time.

Salinity Tests and Results

Description of tests

32. Salinity measurements at the times of high- and low-water slacks were made every second tidal cycle for the first 10 tidal cycles of testing and then every fifth cycle until a total of 50 tidal cycles had occurred. The salinity data were obtained by measuring the salinity concentration of the same sample obtained for the dye tests of the Raritan and Passaic Valley sources. Salinity sampling was not initiated until salinity stability had been achieved. Surface and bottom samples (or only middepth samples at the shallow stations) were obtained at 50 station locations shown in Plate 4 (all except Sta 48). The averages of the 13 salinity observations made at each station at high- and low-water slacks are shown in Table 24.

Discussion of results

33. The test procedure established to determine the effect of the dike on salinities was intended to provide results where the influence of the dike could be determined directly from an analysis of the data. The intent was to maintain control of all test conditions so that the addition of the dike was the only change between the base and Plan 1 tests. Data from Sta 1 and 2 (Table 24) located in the headbay of the model (Plate 4) show that high-water slack salinities were 0.5 ppt higher for the plan test at both the surface and bottom at both stations. The low-water slack salinities varied from 0.3 ppt higher at the surface at Sta 2 to 0.7 ppt higher at the surface at Sta 1, with an average of 0.5 ppt higher for the plan test. In order to compare the results of the base and plan tests, salinities for the plan test were reduced by 0.5 ppt to provide a common source or ocean salinity. The salinity differences between the base test and the adjusted plan results are shown in Table 25.

34. The result of the adjusted difference in salinity for base and plan tests (Table 25) shows that, of the 170 average salinities, 93 are within the variation expected due to the accuracy of the measuring system (±0.5 ppt). The other 77 locations showed differences

greater than 0.5 ppt (46 higher and 31 lower) due to the plan. Thirty-five of the locations showed differences 1.0 ppt or greater (19 higher and 16 lower) due to the plan. These differences can be the result of several causes, of which three are the most probable. First, the method used to sample the data can introduce some variation in test results. Although care was taken to assure that samples were obtained at the same depth each time a sample was obtained, some variations did occur with a resulting spread in the data. In general, these differences were small due to the fairly small variation in salinity with depth throughout the test area, except in the immediate area of the four points where pollution sources were simulated (Plate 4).

35. The most significant reason for the differences in salinity observed between the base and dike tests is the dynamic nature of the New York Harbor system, in particular the area below The Narrows and Raritan River. Both Raritan Bay and Lower New York Bay are subject to the development of changing eddies and turbulent conditions throughout a tidal cycle. These conditions are quite sensitive, and exact duplication was not possible in the model nor could they be expected to duplicate exactly during successive tidal cycles in the prototype. As a result, the salinity distribution from successive tidal cycles was subject to change. Inspection of the data for the area above The Narrows does show less of a difference between the base and plan data (Sta 55 through 61). In general, these areas are also complex dynamically; however, the development of eddies is more repetitive due to the confinement of the flow. Thirdly, the dike could also be the cause of the changes in salinities in Raritan Bay and Lower New York Bay. It does not seem reasonable, however, that this structure would result in significant salinity changes in areas remote from Norton Point.

36. Inspection of the data at high-water slack in the general area of the dike indicates a 1.0-ppt or greater reduction in salinity in the lee of the dike (Sta 22), along the east end of Coney Island (Sta 5), and immediately west of the dike (Sta 24). Between the end of the dike and Coney Island (Sta 21), a reduction of 0.7 ppt was observed with the dike. A difference of less than 0.5 ppt was measured at Sta 6

located in Lower New York Bay midway along Coney Island. The differences for these stations at low-water slack were all within ±0.7 ppt with the dike.

37. The most significant change in salinity appears to be at Sta 7 (Plate 2). Sta 7 is located in a shoal area where the depth is about 10 ft mlw and also in the area of the eddy that is enlarged by the dike (see paragraph 29). Salinity reductions of 2.5 and 2.3 ppt were observed for high-water slack and low-water slack, respectively. The dike thus appears to cause a significant reduction of the salinity in the area of the large eddy south of Coney Island.

38. In the remaining areas of the New York Harbor complex, no conclusive proof exists that the dike caused significant salinity changes. A trend for salinities to increase in Jamaica Bay, in Sandy Hook Bay, and in Raritan Bay was observed. Although it is conceivable that significant increases in salinity along the eastern end of Staten Island and in the eastern end of Arthur Kill could have resulted from deflection of flow into Raritan Bay by the dike, it is not reasonable to conclude that the plan caused the large salinity changes (generally 2-3 ppt, but as great as 7.9 ppt at the surface of Sta 52, which was quite close to the Raritan Bay dye injection point) observed at Sta 49, 50, 52, and 53. If the dike had been the cause of these large changes, intermediate locations (e.g., Sta 41-45) also should have shown significant changes. The same can be said of the changes observed in Jamaica Bay and Sandy Hook Bay. These changes therefore cannot be definitely attributed to the dike and are more probably due to experimental differences.

39. In summary, the data do indicate that the dike would cause a reduction in salinity in Lower New York Bay approximately 10,000 ft south of Coney Island of approximately 2.5 ppt and reductions of 1.0 to 1.5 ppt at high-water slack along Coney Island. No other salinity changes can be definitely attributed to the dike.

Dye Dispersion Tests and Results

Description of tests

40. A series of dye dispersion tests was conducted for the base

and plan conditions to determine the effects of the proposed dike on dispersion characteristics in Lower New York Bay and adjacent areas. In each test, the density of the dye solution was maintained at that of fresh water in order to best simulate the outfall effluents. Two fluorescent dyes (Uranine and Pontacyl Brilliant Pink) with wavelengths at opposite ends of the visible spectrum were prepared with initial concentrations of 100,000 ppb and were released at four different points of the model (A, B, C, and D in Plate 4). Test 1, Run 1, consisted of dye releases from Jamaica Bay and Oakwood Beach and freshwater (i.e., no dye) releases from Passaic Valley and Raritan Bay. Test 1, Run 2, consisted of dye releases from Passaic Valley and Raritan Bay and freshwater releases from Jamaica Bay and Oakwood Beach. The Oakwood Beach release was included in the test program for the Hoffman and Swinburne Island studies. The data were obtained during this study, but are not included or discussed in this report; however, the data are retained in permanent files at WES. The prototype release rates, the equivalent model release rates, and the total volume of dye mixture or fresh water released during each test are shown in the following tabulation:

Release Point	Prototype Release Rate mgd	Equivalent Model Release Rate cc/min	Actual Model Release Rate cc/min	Total Volume Released* liters
A-Jamaica Bay Combined Outfall	355.5	935.0	93.5	34.7
B-Oakwood Beach Outfall	40.0	105.2	105.2	39.0
C-Raritan Bay Outfall	72.0	189.4	189.4	70.3
D-Passaic Valley Outfall	700.0	1841.0	184.1	68.3

* The initial concentration of the dye in the solution was 100,000 ppb. The actual model release rates were revised to maintain model values within the measuring capabilities of the fluorometers.

41. The dye was released as a continuous injection from each release point for a total elapsed time of 50 tidal cycles, equivalent to approximately 25 days in the prototype. Half the stations were sampled during the odd-numbered cycles during the first 10 tidal cycles and

every fifth cycle for the remainder of the test; i.e., 1, 3, 5, 7, 9, 14, 19, etc. The remaining half were sampled during the even-numbered cycles during the first 10 tidal cycles and every fifth cycle for the remainder of the test; i.e., 2, 4, 6, 8, 10, 15, 20, etc. The locations of the dye sampling stations are shown in Plate 4 (samples were obtained at all stations except Sta 60). Samples were taken at surface and bottom where the station location exceeded 12 ft in depth and at middepth only if the water depth was less than 12 ft. Sampling times were coincident with the occurrence of local high- and low-water slacks at each station. The samples were analyzed for dye concentration, and plots presenting dye concentration in ppb as a function of time in tidal cycles for the various release points, stations, depths, and slack times are presented in Plates 31-167. Plates 31-80 show measurements made of dye released at Point A in the mouth of Jamaica Bay and referred to as the Combined Jamaica Release. Plates 81-130 show measurements made of dye released from the Passaic Valley Outfall at Point D, while Plates 131-176 show measurements made of dye released at Point C at the Middlesex County Outfall in Raritan Bay. Sta 35, 37, 38, and 41 were not sampled during the Raritan Bay dye test.

42. The following facts should be considered when analyzing the results of dye dispersion tests conducted in the New York Harbor model. The Upper and Lower New York Bays and surrounding areas have very complex and dynamic flow conditions. There are many large and time-varying eddy formations in Lower Bay which circulate clouds of dye throughout the system. If a sample is not repeatedly obtained precisely as local current slack occurs at a station, or if the location at which the sample is obtained is offset by a small distance, either vertically or horizontally from the previous sampling point, there can be considerable differences between the dye concentrations, which are really sampling errors. The initial dye concentration for all releases was 100,000 ppb, whereas the maximum value measured at most stations was less than 100 ppb, indicating rapid and large-scale dilutions compared to initial concentrations. There were no stations with concentrations higher than 2000 ppb for any tests. The fluorescent dyes used were conservative

and did not decay during the actual model tests. Therefore, all data contained in this report are for conservative materials and should be understood as such. Appropriate time-decay factors must be applied before applying the model results to conditions involving real pollutants.

43. Although 50 dye sampling locations were used in the model, stations of particular interest in this study were those located in the vicinity of Coney Island. Table 26 shows the trend of change in dye concentration due to the dike at the stations of primary interest for this study. Care should be exercised in reviewing the data for the dye released from Raritan Bay. Dye from the Raritan Bay release arrived later than 20 tidal cycles after release and had not achieved stability at any of the stations along Coney Island prior to the termination of each test; thus, concentrations were on the order of 10 to 30 ppb but still increasing at these stations when the test was terminated.

Jamaica Bay combined dye release test

44. The results of the test with dye released in Jamaica Bay at Point A (actually in Rockaway Inlet as shown in Plate 4) are presented in Plates 31-80. All dye released during the flooding phase of the tide immediately moved into Jamaica Bay and remained within the bay at concentrations on the order of 150 to 250 ppb at low-water slack and 300 to 350 ppb at high-water slack throughout the test, as indicated by the results of measurements at Sta 3 shown in Plate 33. Dye released at Point A during the ebbing phase of the tide was carried out Rockaway Inlet and into the large eddy system in Lower New York Bay and subsequently dispersed throughout the problem area. Concentrations rarely exceeded 10 to 20 ppb at locations other than Sta 4, 5, 6, 21, and 22 (Plates 34, 35, 36, 46, and 47, respectively).

45. Dye was observed at Sta 5 located about 3 miles east of Norton Point and 3500 ft off Coney Island (see Plate 2 for location and Plate 35 for data) during the initial sampling period, two tidal cycles after initiation of dye release in Jamaica Bay. The data showed that the dike caused a 50 percent reduction in dye concentration (from about 40 ppb to 20 ppb at cycle 50) at local high-water slack and a minimal increase (less than 5 percent) at local low-water slack. This station

is apparently within an excursion length of Release Point A.

46. At Sta 6 (Plate 36), located about 2 miles east of Norton Point and about 3000 ft offshore in the buoyed navigation channel adjacent to Coney Island, dye was initially observed at high-water slack at tidal cycle 3 and at low-water slack at tidal cycle 5 for both base and plan conditions. After the level of dye concentration stabilized, the data indicate the dike caused about a 70 percent reduction in dye concentration at surface depth (from about 55 ppb to about 16 ppb) at local high-water slack and about a 25 percent reduction at the bottom. At low-water slack, surface concentration was increased by about 45 percent, and bottom concentration was reduced by about 50 percent.

47. The data from Sta 21 (Plate 46), located approximately 3000 ft east of Norton Point and about 1000 ft east of the dike in the buoyed navigation channel, showed the dike resulted in about a 25 percent decrease in the concentration of dye from Jamaica Bay at both surface (45 ppb to 33 ppb) and bottom (25 ppb to 20 ppb) depths at local high-water slack. The low-water slack concentration at bottom depth was decreased about 60 percent (from 25 ppb to 10 ppb). Because the surface low-water slack observations for Plan 1 were somewhat erratic, it is difficult to define the change caused by the dike. At cycle 30, the concentration was increased by about 40 percent, but at cycle 50 the increase was about 130 percent. Dye was initially observed at high-water slack during the third tidal cycle and at low-water slack during the fifth tidal cycle.

48. Sta 22 is located about 700 ft offshore (south) of Norton Point and about 600 ft east of the dike (Plate 2). Measurements at this location (Plate 47) showed an increase of about 35 percent (22 ppb to 30 ppb) in dye concentration at local high-water slack and a reduction of about 25 percent (34 ppb to 21 ppb) at local low-water slack. Dye was initially observed at high-water slack at tidal cycle 3 and at tidal cycle 5 at low-water slack for both base and plan conditions.

49. Immediately west of the dike at Sta 24 (see Plate 2 for location and Plate 48 for data), a trend for dye to arrive later at both surface and bottom depths at high-water slack was observed with the dike

installed. Dye was first observed at the surface at tidal cycle 3 without the dike and at tidal cycle 7 with the dike. At the bottom, it was observed at cycle 3 without the dike and at cycle 5 with the dike. A trend also existed for surface dye levels to be reduced by about 45 percent at high-water slack with the dike. At low-water slack, surface and bottom concentrations were increased by about 50 percent, but the difference was only about 4 ppb at cycle 50.

50. The data from Sta 7 (Plate 37) located south of Coney Island approximately 8000 ft into Lower Bay (Plate 2) did not show any definite influence of the dike on test results. Inspection of the data from the remaining stations monitored during the test does not show any major influence of the dike. Although the dye concentrations in Gravesend Bay and along the Staten Island shore were quite small for this dye source, the dike did increase concentrations by a few ppb in the area from The Narrows to Sta 43. Table 26 gives a qualitative indication of the changes in dye concentration at stations in the problem area caused by the dike.

51. In summary, the results of the test with dye released in Jamaica Bay show a general reduction in high-water slack dye concentrations along Coney Island Beach from Rockaway Inlet to the proposed Norton Point Dike. However, near the head of the pocket between the dike and the beach (Sta 22), high-water slack concentrations were increased. At low-water slack, dye concentrations along the beach were unchanged at Sta 4, 5, and 7, were decreased in the pocket at Sta 22, and were increased at the surface and decreased at the bottom at Sta 6 and 21. Dye entering Jamaica Bay during the flood portion of the injection cycle is trapped in the bay and slowly disperses out through Rockaway Inlet during subsequent tidal cycles. This process is essentially unchanged by the dike, as evidenced by the lack of change in low-water slack concentrations at Sta 3, 4, and 5. The changes in concentrations along Coney Island Beach farther from Rockaway Inlet (Sta 6, 21, 22, and 24) resulted from the deflection of ebb currents by the dike away from the beach and into Lower New York Bay. The large volume in Lower New York Bay was sufficient to absorb this influx of additional

dye without increasing the concentration at Sta 7.

Passaic Valley Outfall release test

52. The results of the test with dye released at Point D at the Passaic Valley Treatment Plant Outfall in Upper New York Bay are presented in Plates 81-130. Sta 58 (Plate 128) was located immediately adjacent to (slightly downstream of) the point of dye release (see Plate 4 for location), and dye was observed there immediately after the initiation of the test. Because of the proximity to the release point, low-water slack concentrations at Sta 58 were rather erratic; however, the surface low-water slack concentration appears to have been increased by about 50 percent for Plan 1. Since the high-water slack concentrations were unchanged at this location, it does not seem likely that the observed low-water slack changes were caused by the dike. The data from Sta 56 (Plate 126) and 57 (Plate 127) show the progression of the dye through Kill Van Kull into Newark Bay (Sta 55, Plate 125) and into Arthur Kill (Sta 54, Plate 124). No evidence of the influence of the dike upstream of The Narrows is apparent.

53. Inspection of the data obtained at Sta 35, 36, and 37 (Plates 105, 106, and 107) located in The Narrows, at Sta 32 and 33 (Plates 102 and 103) located in Gravesend Bay, at Sta 34 (Plate 104) located in the main navigation channel, and at Sta 38-42 (Plates 108-112) located in the general vicinity of Hoffman and Swinburne Islands shows that the dye rapidly entered Lower Bay. No evidence is apparent of any consistent effects of the dike on measurements at the above locations. The dye solution, prepared with fresh water, quickly dispersed throughout Upper Bay, and the major portion was subsequently flushed into Lower Bay in the predominantly ebb surface stratum.

54. At Sta 42-47 (Plates 112-116) located in the northern portion of Lower Bay, some evidence that the dike caused an earlier arrival of dye of higher concentration can be observed from the data during the first 5-10 cycles; however, the trend essentially disappeared as stability is reached.

55. The results of data in Sandy Hook Bay are shown in Plates 90, 91, and 92 (Sta 10, 11, and 12). The results of the data obtained

farthest into the bay (Sta 10) show that dye arrived earlier with the dike. At high-water slack, the dye arrived with the dike shortly after tidal cycle 14 and for the base test shortly before tidal cycle 19. At low-water slack, the results of the test with the dike show dye arriving shortly after tidal cycle 19, and for the base test dye arrived shortly before tidal cycle 24. At the end of the test, the test data with the dike show an increase in concentration of about 60 percent. The results of data obtained at Sta 11 at high- and low-water slacks show about 45 percent increases in surface dye concentrations and 20-25 percent increases at bottom depth with the dike installed. Furthermore, the dye arrived at the bottom at Sta 11 between tidal cycles 10 and 15 for the test with the dike, as compared to an arrival time without the dike of close to 20 tidal cycles. At high-water slack, the dike caused the dye to arrive slightly earlier at the bottom but several tidal cycles later at the surface. At Sta 12, peak dye concentrations were essentially unchanged, but the arrival time for low-water slack occurred several cycles earlier. At the end of Sandy Hook (Sta 9, Plate 89), surface low-water slack peak concentrations were increased by about 100 percent and low-water slack concentration was increased by about 20 percent. There were no significant changes in arrival times.

56. The data from Sta 14, 17, and 28 (Plates 93, 95, and 101) located in the Chapel Hills Navigation Channel do not indicate any influence from the dike, except that the peak surface concentration at high-water slack at Sta 28 was increased by about 35 percent.

57. The data at the junction of Lower Bay and the ocean (Sta 8, Plate 88) show a marked increase in high-water slack surface dye concentration (also of 100 percent at cycle 50) with the dike installed in the model. Sta 8 is located very close to the model boundary as shown by Plate 4. Inspection of the data obtained from Sta 1 and 2 (Plates 81 and 82), monitored to show changes in source salinity in the Atlantic Ocean headbay, does not show this same trend and, in fact, the data are in close agreement between the base and dike test results. The data at Sta 8 may thus be erroneous.

58. The data from Sta 16 (Plate 94) located in the Ambrose

Navigation Channel approximately 3 miles south of Norton Point show that, at high-water slack, dye arrived at the bottom prior to the third tidal cycle with the dike. Without the dike, dye was not observed until tidal cycle 7. The data obtained at tidal cycle 50 show an increase in dye concentration at the bottom depth of about 250 percent (28 to 100 ppb) due to the dike. The high-water slack data obtained at the surface depth do not show any influence of the dike on the results. The data for low-water slack show that without the dike dye arrived at the surface prior to tidal cycle 3. When the dike was tested, dye was initially observed at tidal cycle 5. At the end of the test, the dike resulted in about a 50 percent reduction of the surface dye concentration (from about 100 ppb to 50 ppb). No significant change occurred at low-water slack at the bottom.

59. The data from Sta 7 (Plate 87) show that at high-water slack dye arrives prior to tidal cycle 3 with the dike installed and at about tidal cycle 5 without the dike. At high-water slack, plan test values were about double base test values throughout the tests, about 30 ppb for base as compared to 60 ppb at the end of the dike test. The low-water slack arrival times and concentrations with and without the Norton Point Dike are identical. Since Sta 7 was located in the large eddy during ebb flow, it is surprising that low-water slack concentrations were unchanged by the dike.

60. Sta 5, 6, 21, and 22 (Plates 85, 86, 96, and 97) are located along Coney Island (see Plate 2 for locations). The dike delayed the high-water slack arrival time at Sta 5 and 6 by about two cycles, but advanced the low-water slack arrival time at Sta 6 and 21 by about two cycles. At high-water slack, dye concentrations at cycle 50 were increased by the dike by about 55 percent at Sta 5, 45 percent at Sta 6 (surface), 50 percent at Sta 21 (bottom), and 60 percent at Sta 22. At low-water slack, the dike reduced concentrations by about 60 percent at Sta 5 and 20 percent at Sta 21 (surface). Again, it is surprising that there was no change in low-water slack concentrations at Sta 6, which was located in the ebb-flow eddy. Although water quality conditions along Coney Island Beach will be improved at low-water slack by the dike

(delayed arrival time and lower concentrations), conditions will be worsened at high-water slack (advanced arrival time and increased concentrations).

61. In the course of conducting the test program, visual observations were made during model operation for conditions both with and without the dike installed. It was determined visually that, as the dye from the Passaic Valley Outfall moved downstream into Lower Bay during ebb flow, the dike deflected the flow away from Coney Island into Lower Bay where the dye was more easily trapped in the enlarged eddy system. The dye subsequently moved with the eddy currents along Coney Island during the flood tide interval. The dike also trapped the dye at the extreme western end of Coney Island. The visual observations indicated that the dike caused a delay in arrival time immediately adjacent to the beach (perhaps as much as 200 ft offshore) at both high-water slack and low-water slack. Wave action in the prototype would probably alter this condition in the field.

62. In summary, the results of the Passaic Valley Outfall tests with the dike showed that:

a. Changes do occur to some extent at all stations measured in Lower Bay; however, although the percentage changes are large, the magnitudes of the dye concentrations are small and considered insignificant.

b. Minor increases in dye concentrations would occur in Sandy Hook Bay at both high-water slack and low-water slack and arrival times would be advanced.

c. At low-water slack, rather small reductions in dye concentrations would result along Coney Island Beach and arrival times would be delayed by about two tidal cycles.

d. At high-water slack, significant increases in dye concentrations would occur along Coney Island Beach, and arrival times would be advanced by about two tidal cycles.

e. Final analysis of the net change to conditions can only be completed after application of the decay rates of the pollutants to the dye concentrations measured; however, the trend is for the dike to delay the arrival of the dye at low-water slack and to cause the dye to arrive earlier at high-water slack along the beaches of Coney Island with a small decrease of dye concentration at low-water slack and significant increase at high-water slack resulting in an overall increase in conservative dye concentration levels after a few tidal cycles.

Raritan Bay dye release test

63. Currents in the vicinity of the Middlesex County Outfall in Raritan Bay are minimal, and mean freshwater flow from the Raritan River is comparatively small. Therefore, it would be expected that dye released at the Middlesex County Outfall would remain in the vicinity of the outfall for considerably longer periods of time than dye released in a high-velocity regime. This is exactly what happened in the model. Dye released at the Middlesex County Outfall was slowly dispersed throughout the system as can be determined by a detailed sequential study of the data included in Plates 131-176. However, such an effort does not appear to be necessary to the determination of the effects of the proposed Norton Point Dike on dispersion of dye released at the Middlesex County Outfall.

64. A minimum of 20 tidal cycles was required for dye to reach the Coney Island area. Although maximum concentrations along Coney Island (Sta 5, 6, 21, and 22) were increased by substantial percentages (about 30-170 percent), by that time, dilution had reduced maximum concentrations, which are on the order of 1000 ppb near the release point, to from 10 to 30 ppb. Concentrations in this area were still increasing at the end of the test, and it is likely that they would have continued to increase somewhat with time. Since the concentrations in the problem area were so small and the arrival time was equivalent to 10 or more prototype days, it was not considered necessary to analyze the Raritan Bay release data in detail.

PART IV: CONCLUSIONS

65. Based on results of tests conducted in the New York Harbor model and presented in this report, the following conclusions concerning the effects of installation of the proposed Norton Point Dike have been reached:

a. The dike would have no effect on tidal heights or tidal phasing.

b. The effects of the dike on current velocities and patterns would be to:

   (1) Modify the flow along the western half of Coney Island from a slightly western flow predominance to an essentially total western flow predominance.

   (2) Deflect ebb flow coming from The Narrows away from Coney Island.

   (3) Change the flow immediately west of the dike to a strong ebb predominance.

   (4) Increase the ebb predominance east of the main navigation channel.

   (5) Significantly increase the maximum flood velocity in the main navigation channel between Norton Point and Staten Island, with progressively lesser increases seaward.

   (6) Cause an increase in flood velocities west of the navigation channel between Norton Point and Staten Island.

   (7) Cause an eddy existing in Lower New York Bay during strong ebb flow to increase considerably in size.

   (8) Cause an eddy to develop west of the dike during flood flow.

   (9) Modify an eddy existing during flood flow in Gravesend Bay.

   (10) Cause slack water to exist behind the dike.

c. The dike would cause a reduction in salinity in Lower New York Bay approximately 10,000 ft south of Coney Island of approximately 2.5 ppt and reductions of 1.0 to 1.5 ppt at high-water slack along Coney Island. No other salinity changes can be definitely attributed to the dike.

d. The effects of the dike on dye concentrations from dye released in Jamaica Bay would be to:

(1) Cause a general reduction in high-water slack concentrations along Coney Island Beach from Rockaway Inlet to the dike; however, near the head of the pocket between the dike and the beach, high-water slack concentrations would be increased.

(2) Cause an increase at the surface and decrease at the bottom in low-water slack concentrations along the western two-thirds of Coney Island Beach (Sta 6 and 21). Near the head of the pocket between the dike and the beach, low-water slack concentrations were decreased. Dye concentrations at low-water slack were unchanged along the eastern one-third of Coney Island Beach and in Rockaway Inlet.

(3) Cause no other significant changes in dye concentration.

e. The effects of the dike on dye concentration from dye released at the Passaic Valley Outfall would be to:

(1) Cause minor increases in dye concentrations in Sandy Hook Bay and advance the arrival times at both high-water slack and low-water slack.

(2) Cause rather small reductions in dye concentrations along Coney Island Beach and delay arrival times by about two tidal cycles at low-water slack.

(3) Cause significant increases in dye concentrations and advances in arrival times by about two tidal cycles at high-water slack along Coney Island Beach.

(4) Cause changes at other locations; however, these changes are considered insignificant.

f. The effects of the dike on dye concentrations from dye released in Raritan Bay at the Middlesex County Treatment Plant Outfall are not considered significant. The arrival times were a minimum of about 10 to 12 days and dye concentrations from 10 to 30 ppb were observed around the Coney Island area after a period equivalent to about 25 days.

g. The installation of the dike would encourage sediment buildup behind the dike and would not allow the further dispersion of any pollutant which had been moved into the area behind the dike. This would be a temporary condition which would cease when the area behind the dike became completely filled with sediment.

h. Final analysis of the effect of the dike on changes in pollutant levels can only be completed after application of the decay rates of the pollutants to the dye concentrations measured; however, for the Passaic Valley

Outfall the results indicate an overall increase in pollutant levels after a few tidal cycles would occur in the vicinity of Coney Island Beach. The dike would delay the arrival of the dye at low-water slack and would cause the dye to arrive earlier at high-water slack. A small decrease of dye concentrations at low-water slack and significant increases at high-water slack would occur.

BIBLIOGRAPHY

Boyd, M. B. et al., "Enlargement of the Chesapeake and Delaware Canal; Hydraulic and Mathematical Model Investigation," Technical Report H-73-16, Oct 1973, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

Simmons, H. B. and Bobb, W. H., "Hudson River Channel, New York and New Jersey, Plans to Reduce Shoaling in Hudson River Channels and Adjacent Pier Slips; Hydraulic Model Investigation," Technical Report No. 2-694, Sep 1965, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

__________, "Pollution Studies for Interstate Sanitation Commission, New York Harbor Model; Hydraulic Model Investigation," Miscellaneous Paper No. 2-558, Feb 1963, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss.

TABLE 1

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 6

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-0.9	0.2	-0.9	0.2	-0.3	0.2
0.5	-1.1	0.2	-0.9	0.2	-0.3	0.2
1.0	-1.2	0.3	-1.1	0.2	-0.3	0.2
1.5	-1.1	0.4	-0.9	0.2	0.1	0.2
2.0	-0.9	0.5	-0.4	0.4	0.1	0.2
2.5	0.1	0.7	0.1	0.5	0.1	0.2
3.0	0.2	1.0	0.1	0.7	0.5	0.4
3.5	0.1	1.2	0.1	1.1	0.8	0.7
4.0	0.5	1.2	0.4	0.9	0.7	0.5
4.5	0.5	0.8	0.6	0.9	0.7	0.4
5.0	0.8	0.8	0.9	0.2	0.9	0.2
5.5	1.0	1.0	0.9	0.9	0.3	0.6
6.0	0.9	1.1	0.5	1.0	0.1	0.6
6.5	0.7	0.8	0.4	0.7	0.1	0.3
7.0	0.5	0.4	0.3	0.6	0.3	0.3
7.5	0.1	0.2	0.1	0.4	0.1	0.
8.0	-0.3	-0.1	0.1	0.2	0.1	0.2
8.5	-0.1	-0.3	0.1	0.2	0.1	0.2
9.0	-0.2	-0.3	0.1	0.2	0.1	0.2
9.5	-0.3	-0.3	-0.3	0.2	0.1	0.2
10.0	-0.5	-0.1	-0.3	0.2	0.1	0.2
10.5	-0.7	-0.1	-0.4	-0.3	0.1	0.2
11.0	-0.9	-0.5	-0.6	0.2	-0.3	0.2
11.5	-1.1	-0.5	-0.9	0.2	-0.5	0.2
12.0	-1.1	0.2	-0.9	0.2	-0.7	0.2

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.0	1.0	-1.2	65.8
1	3.5	1.2	11.0	-0.5	17.4

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	0.9	1.0	-1.1	60.3
1	3.5	1.1	10.5	-0.3	2.8

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	0.9	12.0	-0.7	30.8
1	3.5	0.7	7.5	0.	0.0

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 2

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 8

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.8	-2.5	-1.9	-2.3	-1.5	-1.4
0.5	-2.0	-2.4	-2.0	-2.0	-1.6	-1.4
1.0	-2.0	-2.5	-1.9	-1.8	-1.4	-1.0
1.5	-1.5	-2.1	-1.2	-1.4	-1.0	-0.6
2.0	-1.0	-1.4	-0.8	-0.8	-0.8	-0.1
2.5	0.1	-0.6	0.1	-0.3	0.1	0.1
3.0	0.6	0.2	0.8	0.2	0.9	0.7
3.5	1.2	0.6	1.1	0.9	1.2	1.4
4.0	1.5	1.1	1.5	1.4	1.4	1.7
4.5	1.5	1.4	1.6	1.4	1.4	1.4
5.0	1.3	1.4	1.6	1.4	1.3	1.3
5.5	1.1	1.4	1.5	1.6	1.2	1.2
6.0	1.0	1.4	1.3	1.6	1.2	1.2
6.5	1.0	1.0	1.2	1.4	1.0	1.2
7.0	1.0	0.9	1.1	1.4	0.9	1.1
7.5	0.6	0.6	0.9	1.0	0.4	0.8
8.0	0.4	0.4	0.8	0.7	0.4	0.6
8.5	-0.5	0.1	0.2	0.2	-0.6	-0.3
9.0	-0.4	-0.5	-0.8	-0.5	-0.8	-0.5
9.5	-1.1	-1.0	-1.1	-0.9	-1.2	-0.8
10.0	-1.2	-1.3	-1.3	-1.4	-1.5	-1.0
10.5	-2.0	-1.6	-1.8	-1.9	-1.8	-1.4
11.0	-2.0	-2.2	-1.8	-1.9	-1.6	-1.5
11.5	-1.7	-2.3	-2.0	-2.3	-1.4	-1.9
12.0	-1.4	-2.5	-1.7	-2.3	-1.6	-1.9

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	4.0	1.5	0.5	-2.0	61.7
1	5.5	1.4	0.	-2.5	68.7

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	4.5	1.6	0.5	-2.0	55.9
1	5.5	1.6	0.	-2.3	59.0

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	4.0	1.4	10.5	-1.8	58.3
1	4.0	1.7	11.5	-1.9	51.9

NOTE: Time is expressed in hours after moon's transit of 74th meridian. Velocities are expressed in feet per second prototype.

TABLE 3

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 13

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-0.5	-0.8	-0.9	-0.6	0.1	0.1
0.5	-0.3	-0.8	-0.6	-0.6	0.1	0.1
1.0	0.1	-0.5	-0.7	-0.4	0.1	0.1
1.5	0.1	-0.3	-0.4	-0.3	0.1	0.1
2.0	0.1	0.1	0.1	0.1	0.1	0.1
2.5	0.2	0.1	0.1	0.1	0.3	0.4
3.0	0.4	0.3	0.5	0.1	0.5	0.4
3.5	1.0	0.7	0.9	0.8	0.7	0.4
4.0	0.8	0.6	1.0	1.0	0.8	0.6
4.5	1.0	0.7	1.6	1.1	1.0	0.8
5.0	1.2	1.3	1.6	1.4	1.1	0.8
5.5	1.5	1.2	1.6	1.5	1.2	0.6
6.0	0.5	1.0	0.8	0.8	0.5	0.4
6.5	0.1	0.3	0.1	0.3	0.1	0.8
7.0	0.2	0.1	0.2	0.1	0.2	0.4
7.5	0.1	0.3	0.2	0.4	0.2	0.1
8.0	0.1	0.4	0.1	0.5	0.3	0.2
8.5	-0.5	0.4	0.1	0.1	0.1	0.1
9.0	-0.5	0.3	0.1	0.1	-0.3	0.1
9.5	-0.7	-0.3	-0.5	0.1	-0.5	0.1
10.0	-0.9	-0.5	-0.7	-0.4	-0.3	-0.4
10.5	-0.9	-0.8	-0.5	-0.6	-0.4	-0.4
11.0	-0.9	-0.8	-0.8	-0.8	-0.5	-0.3
11.5	-0.8	-0.9	-0.9	-0.6	-0.5	-0.3
12.0	-0.7	-0.9	-0.9	-0.8	-0.1	0.1

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.5	10.0	-0.9	47.3
1	5.0	1.3	12.0	-0.9	46.1

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	4.5	1.6	0.	-0.9	43.7
1	5.5	1.5	11.0	-0.8	38.3

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.2	11.0	-0.5	25.5
1	4.5	0.8	10.0	-0.4	17.1

NOTE: Time is expressed in hours after moon's transit of 74th meridian. Velocities are expressed in feet per second prototype.

TABLE 4

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 15

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.2	-1.3	-0.7	-1.0	0.1	-0.3
0.5	-1.1	-1.2	-0.9	-1.0	-0.3	-0.3
1.0	-0.9	-1.0	-0.8	-0.7	-0.4	-0.4
1.5	-0.6	-0.7	-0.5	-0.6	-0.3	-0.3
2.0	-0.5	-0.5	-0.5	-0.5	-0.1	0.1
2.5	-0.4	0.1	-0.1	-0.1	0.1	0.2
3.0	0.3	0.3	0.3	0.5	0.2	0.6
3.5	0.4	0.9	0.8	0.5	0.9	0.5
4.0	0.5	1.0	0.3	0.9	0.9	0.8
4.5	0.4	0.5	0.3	0.6	0.9	0.8
5.0	0.6	0.5	0.5	0.6	0.8	1.0
5.5	0.8	0.8	0.5	0.7	0.4	0.6
6.0	0.7	0.8	0.8	0.7	0.5	1.2
6.5	0.8	0.6	0.9	1.6	0.5	0.7
7.0	0.9	0.7	1.0	1.3	0.5	1.0
7.5	1.0	0.6	0.9	0.7	0.7	0.6
8.0	1.1	0.1	1.0	0.5	0.5	0.5
8.5	0.8	0.1	0.5	0.4	0.2	0.3
9.0	0.4	0.1	0.4	0.2	0.1	0.1
9.5	0.2	0.1	0.3	0.1	0.1	0.1
10.0	0.1	-0.1	0.1	0.1	0.1	-0.1
10.5	-0.2	-0.5	0.1	-0.1	0.1	-0.3
11.0	-0.4	-0.9	-0.2	-0.5	0.1	-0.4
11.5	-0.8	-1.2	-0.3	-0.8	0.1	-0.4
12.0	-1.0	-1.3	-0.4	-1.0	0.1	-0.3

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	8.0	1.1	0.	-1.2	43.6
1	4.0	1.0	0.	-1.3	53.9

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	7.0	1.0	0.5	-0.9	33.2
1	6.5	1.6	0.	-1.0	39.5

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	3.5	0.9	1.0	-0.4	11.8
1	6.0	1.2	1.0	-0.4	21.9

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 5

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 16

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.8	-2.4	-1.3	-1.7	-1.0	-1.3
0.5	-1.9	-2.5	-1.2	-1.9	-1.0	-1.6
1.0	-1.9	-2.2	-1.5	-1.7	-1.3	-1.5
1.5	-1.6	-2.3	-1.4	-1.5	-1.0	-1.2
2.0	-1.4	-1.9	-1.3	-1.5	-0.9	-0.5
2.5	-1.2	-1.4	-0.8	-0.8	-0.6	0.1
3.0	-0.6	-0.8	-0.4	-0.1	-0.1	0.5
3.5	0.3	-0.1	0.4	0.4	1.3	1.1
4.0	1.0	0.4	1.1	1.1	1.5	1.5
4.5	1.2	0.7	1.6	1.5	1.5	1.7
5.0	1.5	1.3	1.8	1.8	1.5	1.6
5.5	1.5	1.4	1.8	1.9	1.7	1.6
6.0	1.6	1.6	1.8	1.6	1.5	1.6
6.5	1.7	1.7	1.6	1.5	1.3	1.4
7.0	1.2	1.5	1.1	1.3	1.2	1.4
7.5	1.0	1.2	0.9	1.0	0.9	0.8
8.0	0.7	0.7	0.8	0.9	1.0	0.5
8.5	0.2	0.3	0.5	0.3	0.6	0.3
9.0	-0.1	0.1	-0.1	-0.3	0.1	0.1
9.5	-0.4	-0.3	-0.3	-0.3	-0.3	-0.1
10.0	-0.8	-0.6	-0.3	-0.3	-0.3	-0.3
10.5	-1.0	-1.2	-0.7	-0.8	-0.4	-0.6
11.0	-1.3	-1.4	-1.0	-1.1	-0.8	-1.1
11.5	-1.4	-1.5	-1.1	-1.4	-1.0	-1.4
12.0	-1.6	-2.3	-1.2	-1.8	-0.7	-1.4

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	1.7	0.5	-1.9	58.4
1	6.5	1.7	0.5	-2.5	65.2

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	1.8	1.0	-1.5	48.5
1	5.5	1.9	0.5	-1.9	53.1

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.7	1.0	-1.3	39.6
1	4.5	1.7	0.5	-1.6	42.7

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 6

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 18

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.6	-2.1	-1.3	-2.0	-0.5	-1.3
0.5	-1.9	-2.4	-1.5	-2.1	-0.7	-1.4
1.0	-2.1	-2.8	-1.7	-1.9	-0.9	-1.1
1.5	-2.2	-2.8	-1.7	-1.7	-0.9	-1.0
2.0	-2.2	-2.7	-1.6	-1.7	-0.7	-1.1
2.5	-1.6	-2.2	-1.3	-1.5	-0.3	-0.6
3.0	-1.1	-1.5	-0.8	-0.9	0.1	0.1
3.5	-0.4	-1.1	-0.4	-0.5	0.5	0.5
4.0	-0.3	-0.5	0.1	-0.3	0.7	0.8
4.5	0.1	0.1	0.1	-0.4	1.0	1.1
5.0	0.1	0.1	0.4	0.3	1.2	1.7
5.5	0.1	0.4	0.3	0.8	1.4	1.6
6.0	0.1	0.7	0.1	0.7	1.3	1.5
6.5	0.1	0.5	0.6	1.0	1.1	1.6
7.0	0.1	0.7	0.9	1.1	1.1	1.7
7.5	0.3	0.6	0.8	1.0	0.9	1.5
8.0	0.4	0.8	0.9	1.0	0.9	0.7
8.5	0.8	0.5	0.4	0.8	0.8	0.5
9.0	0.1	0.2	0.1	0.6	0.1	0.5
9.5	0.1	-0.4	-0.1	0.1	0.1	0.3
10.0	0.1	-0.5	0.1	-0.2	0.1	0.1
10.5	-0.7	-0.7	0.1	-0.5	-0.1	-0.3
11.0	-0.7	-1.2	-0.3	-0.9	-0.3	-0.4
11.5	-1.0	-1.7	-0.7	-1.1	-0.3	-0.7
12.0	-1.3	-1.9	-1.1	-1.8	-0.3	-0.6

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	8.0	0.4	1.5	-2.2	88.5
1	8.0	0.8	1.0	-2.8	83.6

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	7.0	0.9	1.0	-1.7	70.6
1	7.0	1.1	0.5	-2.1	69.6

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	5.5	1.4	1.0	-0.9	31.5
1	5.0	1.7	0.5	-1.4	36.9

NOTE: Time is expressed in hours after moon's transit of 74th meridian. Velocities are expressed in feet per second prototype.

TABLE 7

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 19

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.0	-1.4	-2.2	-0.9	-1.6	-0.3	-0.7
0.5	-1.9	-3.0	-1.1	-1.7	-0.3	-0.7
1.0	-2.1	-3.4	-1.1	-1.7	-0.3	-0.9
1.5	-2.1	-3.3	-1.3	-1.7	-0.3	-0.5
2.0	-2.0	-2.8	-1.1	-1.3	0.1	-0.1
2.5	-1.7	-2.3	-0.9	-0.8	0.1	0.2
3.0	-1.2	-1.7	-0.7	-0.1	0.1	0.3
3.5	-0.6	-1.2	0.1	0.2	0.1	0.5
4.0	0.1	-0.5	0.3	0.5	0.1	1.0
4.5	0.3	-0.3	0.8	0.8	0.9	1.3
5.0	0.7	0.8	0.9	1.3	1.3	1.5
5.5	0.6	1.1	1.1	1.4	1.7	1.3
6.0	0.6	0.8	1.1	1.1	1.5	1.3
6.5	0.9	1.0	1.1	1.1	1.3	1.2
7.0	0.8	1.1	0.9	1.1	1.1	1.4
7.5	0.7	0.9	0.9	1.2	1.1	1.1
8.0	0.1	0.8	0.9	1.2	0.8	1.1
8.5	0.1	0.6	0.1	0.8	0.6	0.8
9.0	-0.1	0.1	-0.3	0.4	0.1	0.5
9.5	0.1	-0.3	-0.3	0.1	0.1	0.1
10.0	-0.1	-0.3	-0.1	0.1	0.1	0.1
10.5	-0.5	-0.5	-0.3	-0.2	0.1	-0.1
11.0	-0.9	-1.2	-0.3	-0.5	0.1	-0.1
11.5	-1.1	-1.7	-0.4	-0.8	0.1	-0.3
12.0	-1.1	-2.2	-0.8	-1.2	0.1	-0.8

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	0.9	1.0	-2.1	76.2
1	5.5	1.1	1.0	-3.4	78.7

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.1	1.5	-1.3	53.6
1	5.5	1.4	0.5	-1.7	49.9

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.7	0.	-0.3	9.0
1	5.0	1.5	1.0	-0.9	23.2

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 8

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 20

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.4	0.1	-1.1	0.1	-0.6	0.1
0.5	-1.5	0.1	-1.2	0.1	-0.6	0.1
1.0	-1.4	0.1	-0.4	0.1	-0.8	0.1
1.5	-0.9	0.1	-0.5	0.1	-0.4	0.1
2.0	-1.0	0.1	-0.1	0.1	-1.0	0.1
2.5	-0.4	0.2	-0.2	0.2	-0.7	0.1
3.0	0.2	0.9	0.4	0.3	-1.1	0.2
3.5	0.8	1.3	1.0	0.7	1.0	0.3
4.0	1.6	1.5	1.5	1.3	1.8	0.5
4.5	1.8	1.4	1.7	1.0	1.8	0.4
5.0	1.8	1.2	2.0	0.8	1.7	0.4
5.5	1.9	1.0	1.9	0.6	1.7	0.2
6.0	1.5	0.8	1.6	0.5	1.4	0.1
6.5	1.6	0.6	1.7	0.4	1.6	0.1
7.0	1.6	0.5	1.4	0.5	1.2	0.1
7.5	1.3	0.3	1.2	0.4	1.1	0.1
8.0	0.6	0.1	0.6	0.2	0.8	0.2
8.5	0.3	0.1	0.4	0.1	0.4	0.1
9.0	-0.3	0.1	-0.1	0.1	0.1	0.1
9.5	-0.3	0.1	-0.3	0.1	-0.3	0.1
10.0	-1.1	0.1	-0.7	0.1	-0.6	0.1
10.5	-1.4	0.1	-1.0	0.1	-0.9	0.1
11.0	-1.4	0.1	-1.3	0.1	-1.2	0.1
11.5	-1.4	0.1	-1.2	0.1	-0.7	0.1
12.0	-1.4	0.1	-0.9	0.1	-0.4	0.1

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.9	0.5	-1.5	47.1
1	4.0	1.5	0.	0.1	0.

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	2.0	11.0	-1.3	35.8
1	4.0	1.3	0.	0.1	0.

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	4.0	1.8	11.0	-1.2	38.1
1	4.0	0.5	0.	0.1	0.

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 9

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 23

TIME IN HOURS	SURFACE BASE	SURFACE PLAN
0.	-2.1	-2.5
0.5	-2.1	-2.0
1.0	-2.3	-2.4
1.5	-2.2	-1.8
2.0	-1.6	-1.0
2.5	-1.1	-1.1
3.0	-0.8	1.4
3.5	0.	2.0
4.0	1.3	2.4
4.5	1.6	2.8
5.0	1.8	2.4
5.5	1.9	2.0
6.0	1.8	2.0
6.5	1.3	1.9
7.0	0.9	1.4
7.5	1.1	0.7
8.0	0.8	0.
8.5	0.	-0.8
9.0	-0.7	-1.3
9.5	-1.1	-1.9
10.0	-1.1	-2.3
10.5	-1.1	-2.4
11.0	-1.4	-2.5
11.5	-1.7	-2.6
12.0	-2.0	-2.4

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.9	1.0	-2.3	62.5
1	4.5	2.8	11.5	-2.6	58.2

Note: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 10

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 25

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-2.0	-2.8	-2.1	-2.4	-2.0	-1.9
0.5	-2.4	-2.8	-2.4	-2.4	-1.9	-1.7
1.0	-2.6	-2.6	-2.3	-2.2	-2.1	-1.7
1.5	-2.4	-2.6	-2.2	-1.7	-1.7	-1.6
2.0	-2.0	-2.4	-1.6	-1.5	-1.8	-1.6
2.5	-1.4	-1.5	-1.2	-0.9	-1.4	-0.9
3.0	-0.9	-0.7	-0.6	0.1	-1.4	-0.6
3.5	-0.6	0.1	0.1	0.1	-0.7	0.1
4.0	0.1	0.1	0.6	0.1	0.1	0.3
4.5	0.7	0.1	1.4	0.1	0.7	0.3
5.0	[illegible].4	0.1	1.9	0.1	1.4	0.3
5.5	1.5	0.1	1.8	0.1	2.1	0.1
6.0	0.8	0.1	1.8	0.1	1.7	0.1
6.5	1.7	0.1	1.7	0.1	1.9	0.1
7.0	1.7	0.1	1.6	0.1	1.5	0.1
7.5	1.0	0.1	1.0	-0.3	1.4	0.1
8.0	0.9	0.1	0.7	-0.3	0.9	0.1
8.5	0.7	-0.3	0.1	-0.5	0.4	0.1
9.0	0.1	-0.9	0.1	-0.5	0.1	0.1
9.5	-0.7	-1.2	-0.3	-0.5	-0.1	0.1
10.0	-1.3	-1.5	-0.9	-0.6	-0.3	-0.7
10.5	-1.7	-2.2	-2.3	-1.3	-0.7	-1.5
11.0	-2.7	-2.3	-2.6	-1.6	-2.5	-1.7
11.5	-2.3	-2.5	-2.2	-2.0	-2.4	-2.4
12.0	-2.0	-2.8	-1.9	-2.4	-2.2	-2.3

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	1.7	11.0	-2.7	69.8
1	3.5	0.1	0.	-2.8	95.8

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	1.9	11.0	-2.6	63.2
1	3.0	0.1	0.	-2.4	94.8

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	2.1	11.0	-2.5	62.7
1	4.0	0.3	11.5	-2.4	89.2

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 11

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 29

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-3.0	-2.4	-2.3	-2.4	-1.6	-1.6
0.5	-3.1	-3.1	-2.4	-2.2	-1.6	-1.4
1.0	-3.1	-3.1	-2.1	-2.0	-1.5	-1.6
1.5	-3.1	-3.1	-1.7	-1.6	-2.0	-1.5
2.0	-3.1	-2.9	-1.6	-1.4	-0.9	-1.3
2.5	-2.9	-2.4	-1.0	-1.3	-0.8	-0.8
3.0	-1.1	-1.6	-0.4	-0.9	0.1	0.1
3.5	-0.6	-1.0	0.1	-0.3	0.1	0.1
4.0	-0.1	-0.1	0.1	0.1	0.7	0.4
4.5	0.1	0.1	0.3	0.4	1.5	1.3
5.0	0.4	0.1	1.0	0.9	1.6	1.4
5.5	1.1	0.9	1.6	0.8	1.4	0.3
6.0	1.3	0.9	1.6	0.7	1.5	0.6
6.5	1.3	0.6	1.7	0.4	1.3	0.7
7.0	1.5	0.5	1.6	0.3	1.4	1.0
7.5	1.4	0.4	1.4	0.5	1.4	0.9
8.0	1.4	0.4	1.1	0.1	1.5	0.9
8.5	0.8	0.1	0.7	0.3	0.9	0.9
9.0	0.2	-0.5	0.3	0.2	0.3	0.7
9.5	-0.9	-0.9	0.1	0.1	0.2	0.2
10.0	-1.0	-1.1	-0.7	-0.7	0.1	0.1
10.5	-1.4	-1.4	-1.3	-0.9	-0.6	-0.5
11.0	-1.6	-1.6	-1.5	-1.3	-1.1	-0.9
11.5	-2.3	-2.1	-1.7	-1.7	-1.3	-1.8
12.0	-2.2	-2.3	-1.6	-1.8	-1.0	-1.8

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	7.0	1.5	0.5	-3.1	75.4
1	5.5	0.9	0.5	-3.1	87.8

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	1.7	0.5	-2.4	60.5
1	5.0	0.9	0.	-2.4	78.6

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	1.6	1.5	-2.0	45.9
1	5.0	1.4	11.5	-1.8	57.5

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 12

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 30

TIME	SURFACE		MIDDEPTH		BOTTOM	
IN HOURS	BASE	PLAN	BASE	PLAN	BASE	PLAN
0.	-1.5	-2.2	-1.3	-1.6	-1.1	-1.3
0.5	-2.4	-2.4	-1.6	-1.6	-1.3	-1.3
1.0	-2.0	-3.1	-1.7	-1.6	-1.3	-0.9
1.5	-2.4	-3.0	-1.5	-1.5	-0.9	-0.7
2.0	-2.1	-2.6	-1.0	-1.3	-0.5	0.1
2.5	-2.1	-2.1	-0.8	-0.1	-0.1	0.3
3.0	-1.6	-1.6	-0.3	0.1	0.3	0.9
3.5	-1.2	-1.2	0.1	0.9	1.3	1.6
4.0	-0.8	-0.7	0.4	1.4	1.4	1.6
4.5	0.1	0.1	1.1	1.5	1.6	1.6
5.0	0.1	0.9	1.3	2.4	1.4	1.6
5.5	0.6	2.5	1.6	3.1	1.5	2.3
6.0	1.0	2.4	1.6	2.4	1.6	2.4
6.5	1.0	2.0	1.8	1.9	1.4	1.6
7.0	1.3	2.0	1.6	2.4	1.5	1.6
7.5	1.4	1.9	1.6	2.1	1.2	1.6
8.0	1.2	1.5	1.3	1.6	1.2	1.1
8.5	0.9	1.2	1.1	1.3	1.0	0.9
9.0	0.6	0.9	0.8	0.9	0.7	0.8
9.5	0.1	0.1	0.1	0.1	0.2	0.1
10.0	-0.9	-0.9	0.1	0.1	0.1	0.1
10.5	-0.9	-0.9	-0.3	-0.9	0.1	0.1
11.0	-1.0	-1.3	-0.8	-0.9	-0.3	0.1
11.5	-1.7	-1.4	-1.0	-1.6	-0.7	-0.1
12.0	-1.6	-2.0	-1.2	-1.5	-0.9	-1.0

SURFACE

PLAN	MAXIMUM FLOOD		MAXIMUM EBB		EBB PRE-
	TIME HOURS	VELOCITY DATA	TIME HOURS	VELOCITY DATA	DOMINANCE
BASE	7.5	1.4	0.5	-2.4	72.9
1	5.5	2.5	1.0	-3.1	61.5

MIDDEPTH

PLAN	MAXIMUM FLOOD		MAXIMUM EBB		EBB PRE-
	TIME HOURS	VELOCITY DATA	TIME HOURS	VELOCITY DATA	DOMINANCE
BASE	6.5	1.8	1.0	-1.7	43.6
1	5.5	3.1	0.	-1.6	35.9

BOTTOM

PLAN	MAXIMUM FLOOD		MAXIMUM EBB		EBB PRE-
	TIME HOURS	VELOCITY DATA	TIME HOURS	VELOCITY DATA	DOMINANCE
BASE	4.5	1.6	0.5	-1.3	28.9
1	6.0	2.4	0.	-1.3	19.3

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 13

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 31

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.0	-2.2	-2.9	-1.4	-2.4	-1.4	-0.1
0.5	-2.4	-3.1	-2.0	-2.7	-2.0	-2.0
1.0	-2.8	-3.1	-2.3	-2.8	-2.3	-2.0
1.5	-2.8	-3.0	-2.3	-2.6	-2.0	-2.0
2.0	-2.4	-2.5	-1.6	-2.4	-1.9	-1.5
2.5	-1.9	-2.2	-1.7	-1.6	-1.4	-1.2
3.0	-1.4	-0.9	-1.4	-1.3	-1.2	-0.7
3.5	-0.8	-0.8	-0.7	-0.7	-0.5	0.1
4.0	-0.3	0.1	-0.1	0.1	-0.1	0.3
4.5	0.4	0.3	0.7	1.0	1.1	1.5
5.0	0.8	1.3	1.1	1.6	1.8	1.8
5.5	1.0	1.6	1.4	1.6	1.5	1.6
6.0	1.0	1.6	1.2	1.6	1.4	1.6
6.5	1.0	1.8	1.1	1.6	1.3	1.6
7.0	1.2	2.0	1.4	1.8	1.2	1.8
7.5	1.0	2.0	1.4	1.6	1.3	1.6
8.0	1.4	1.6	1.2	1.5	0.9	1.1
8.5	1.0	1.1	1.0	1.4	1.0	0.9
9.0	0.6	0.8	0.7	0.9	0.7	0.3
9.5	0.1	0.1	-0.1	0.1	0.2	0.1
10.0	-0.3	-0.7	-0.1	-0.6	0.1	-0.4
10.5	-1.1	-0.9	-0.1	-0.9	-0.1	-0.6
11.0	-1.5	-1.3	-1.0	-1.1	-0.6	-1.2
11.5	-1.9	-1.6	-1.4	-1.6	-1.2	-1.4
12.0	-1.7	-2.4	-1.4	-2.1	-1.1	-1.7

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	8.0	1.4	1.0	-2.8	71.1
1	7.0	2.0	0.5	-3.1	63.2

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.4	1.0	-2.3	60.6
1	7.0	1.8	1.0	-2.8	59.7

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	1.5	1.0	-2.3	56.5
1	5.0	1.8	0.5	-2.0	51.5

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 14

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 35.

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-2.3	-2.0	-1.6	-1.7	-1.2	-1.3
0.5	-2.5	-2.1	-2.1	-1.8	-1.3	-1.5
1.0	-2.6	-1.9	-2.2	-1.7	-1.4	-1.5
1.5	-2.3	-1.7	-1.0	-0.9	-0.9	-0.5
2.0	-1.6	-1.4	-0.8	-0.8	-0.8	-0.3
2.5	-1.0	-0.8	-0.6	-0.4	-0.4	-0.1
3.0	-0.7	-0.5	-0.3	0.1	0.1	-0.1
3.5	-0.3	-0.1	0.1	0.1	0.1	-0.4
4.0	0.1	0.1	0.1	0.5	0.3	0.2
4.5	0.3	0.5	0.7	1.0	1.1	0.5
5.0	0.8	1.0	1.3	1.0	1.6	1.3
5.5	1.4	1.4	1.6	1.3	1.6	1.7
6.0	1.6	1.4	1.6	1.5	1.6	1.7
6.5	1.6	1.7	1.6	1.7	1.7	2.0
7.0	1.6	2.1	1.6	2.3	1.7	1.8
7.5	1.6	2.2	1.6	2.1	1.7	2.2
8.0	1.6	2.1	1.6	1.7	1.6	1.8
8.5	1.3	0.8	1.4	1.1	1.2	1.1
9.0	0.7	0.7	0.8	0.7	0.8	0.7
9.5	0.1	0.5	0.3	0.1	0.4	0.1
10.0	0.1	-0.3	0.1	0.1	0.1	0.1
10.5	-0.3	-0.6	-0.6	-0.5	-0.5	-0.4
11.0	-0.7	-1.1	-1.2	-0.9	-0.9	-0.5
11.5	-1.6	-1.7	-1.3	-1.4	-1.0	-0.7
12.0	-2.3	-1.8	-1.6	-1.3	-1.0	-1.1

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	7.5	1.6	1.0	-2.6	58.7
1	7.5	2.2	0.5	-2.1	51.7

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.0	1.6	1.0	-2.2	47.9
1	7.0	2.3	0.5	-1.8	41.6

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	1.7	1.0	-1.4	37.4
1	7.5	2.2	0.5	-1.5	35.0

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 15

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 36

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.9	-2.7	-1.6	-2.1	-1.0	-2.1
0.5	-1.9	-2.9	-1.6	-2.2	-1.2	-2.1
1.0	-2.4	-2.6	-1.6	-2.3	-1.3	-2.2
1.5	-2.5	-2.3	-2.0	-1.9	-1.5	-2.1
2.0	-2.0	-2.0	-1.6	-1.7	-1.6	-1.7
2.5	-1.6	-1.6	-1.6	-1.3	-0.8	-1.2
3.0	-1.3	-1.0	-1.0	-0.9	-0.4	-0.5
3.5	-0.5	-0.5	-0.6	-0.2	0.1	0.9
4.0	0.1	-0.3	0.1	-0.3	0.4	1.3
4.5	0.4	0.3	0.4	0.8	0.8	1.2
5.0	0.8	0.8	1.2	1.4	1.6	1.5
5.5	1.1	1.5	1.3	1.6	1.6	1.5
6.0	1.5	1.3	1.6	1.7	1.6	1.3
6.5	1.6	1.5	1.6	1.8	1.6	1.3
7.0	1.6	1.7	1.6	1.9	1.6	1.5
7.5	1.6	2.0	1.7	1.7	1.6	1.9
8.0	1.4	1.8	1.6	1.7	1.6	2.0
8.5	1.0	1.6	1.2	1.5	1.2	1.7
9.0	0.4	1.2	0.8	1.0	0.7	1.1
9.5	0.1	0.7	0.4	0.7	0.4	0.7
10.0	0.1	0.4	0.1	-0.1	0.1	-0.3
10.5	-0.5	-0.8	-0.3	-0.3	-0.3	-0.1
11.0	-1.2	-1.0	-0.8	-1.1	-0.6	-0.8
11.5	-1.6	-1.7	-1.2	-1.7	-0.8	-1.7
12.0	-1.6	-2.3	-1.6	-2.0	-0.8	-1.8

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	1.6	1.5	-2.5	62.0
1	7.5	2.0	0.5	-2.9	59.4

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	7.5	1.7	1.5	-2.0	52.9
1	7.0	1.9	1.0	-2.3	53.2

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	1.6	2.0	-1.6	40.5
1	8.0	2.0	1.0	-2.2	47.6

NOTE: Time is expressed in hours after moon's transit of 74th meridian. Velocities are expressed in feet per second prototype.

TABLE 16

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 37

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-2.2	-2.9	-2.0	-1.7	-1.4	-2.1
0.5	-2.6	-2.8	-2.6	-1.9	-1.9	-2.1
1.0	-2.6	-2.9	-2.6	-2.0	-2.2	-2.2
1.5	-2.6	-2.9	-2.4	-2.0	-1.9	-2.1
2.0	-2.1	-2.3	-2.0	-1.6	-1.5	-1.7
2.5	-1.9	-1.6	-1.3	-1.1	-1.1	-1.2
3.0	-1.0	-1.1	-1.2	-0.8	-0.9	-0.8
3.5	-0.6	-0.7	-0.6	-0.4	-0.6	0.1
4.0	0.1	-0.3	0.1	0.1	0.1	0.1
4.5	0.3	0.3	0.9	0.4	1.1	1.0
5.0	0.9	1.0	1.2	1.0	1.3	1.8
5.5	1.9	1.4	1.5	1.1	1.5	1.3
6.0	1.7	1.5	2.0	1.4	1.9	1.0
6.5	1.9	1.5	1.9	1.7	2.0	0.7
7.0	1.9	1.6	1.9	1.8	1.6	1.3
7.5	1.9	1.6	1.9	1.5	1.5	0.7
8.0	1.8	1.5	1.7	1.4	1.4	0.9
8.5	1.2	0.7	1.3	1.0	1.2	0.9
9.0	0.6	0.2	0.5	0.3	0.6	0.5
9.5	0.1	0.1	0.1	0.1	0.5	0.4
10.0	-0.7	-0.3	-0.4	-0.4	-0.4	0.1
10.5	-1.2	-1.3	-0.5	-0.7	-0.7	-0.3
11.0	-1.3	-1.7	-1.2	-1.2	-1.1	-1.0
11.5	-1.4	-2.1	-1.5	-1.7	-1.4	-1.4
12.0	-1.9	-2.4	-1.8	-1.9	-1.2	-2.1

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	5.5	1.9	0.5	-2.6	60.6
1	7.0	1.6	0.	-2.9	68.8

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	6.0	2.0	0.5	-2.6	57.1
1	7.0	1.8	1.0	-2.0	59.1

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	6.5	2.0	1.0	-2.2	52.2
1	5.0	1.8	1.0	-2.2	60.9

NOTE: Time is expressed in hours after moon's transit of 74th meridian. Velocities are expressed in feet per second prototype.

TABLE 17

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 38

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.3	-2.5	-1.5	-2.0	-1.4	-1.4
0.5	-1.9	-2.5	-1.7	-1.9	-1.7	-1.5
1.0	-1.9	-2.4	-1.8	-2.3	-1.8	-1.5
1.5	-1.5	-2.3	-1.8	-2.0	-1.8	-1.5
2.0	-1.3	-2.0	-1.2	-1.6	-1.3	-1.3
2.5	-1.2	-1.4	-1.2	-1.0	-0.8	-1.0
3.0	-0.8	-0.8	-0.6	-0.7	-0.5	-0.3
3.5	-0.3	-0.6	-0.3	-0.3	-0.3	0.1
4.0	0.1	0.1	0.1	0.1	0.1	0.9
4.5	0.4	0.1	1.2	0.6	0.9	1.4
5.0	0.9	0.6	1.2	1.5	1.2	1.6
5.5	1.9	1.0	1.7	2.3	1.2	1.7
6.0	1.3	1.3	1.6	1.8	1.4	1.6
6.5	0.9	1.4	1.3	1.9	1.3	1.6
7.0	1.5	1.7	1.9	1.8	1.2	1.5
7.5	1.4	1.8	1.5	1.9	1.3	1.1
8.0	1.5	2.0	1.3	1.6	1.2	0.9
8.5	1.3	1.4	1.1	1.6	0.9	0.8
9.0	0.7	1.2	0.5	0.8	0.4	0.5
9.5	0.3	0.3	0.3	0.4	0.3	0.3
10.0	0.1	0.1	0.1	0.1	0.1	0.1
10.5	-1.2	-0.6	-0.8	-0.8	-0.8	-0.9
11.0	-1.5	-1.6	-1.3	-1.0	-1.2	-0.8
11.5	-1.5	-2.0	-1.2	-1.6	-1.2	-1.1
12.0	-1.5	-2.4	-1.3	-1.9	-1.0	-1.3

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	5.5	1.9	0.5	-1.9	56.0
1	8.0	2.0	0.	-2.5	61.5

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	7.0	1.9	1.0	-1.8	51.3
1	5.5	2.3	1.0	-2.3	50.5

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PREDOMINANCE
BASE	6.0	1.4	1.0	-1.8	54.4
1	5.5	1.7	1.5	-1.5	46.2

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 18

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 39

TIME IN HOURS	SURFACE BASE	SURFACE PLAN
0.	-1.3	-2.1
0.5	-1.6	-1.8
1.0	-1.6	-1.7
1.5	-1.7	-1.6
2.0	-1.0	-1.3
2.5	-0.8	-1.0
3.0	-0.2	-0.5
3.5	0.	0.
4.0	0.	0.7
4.5	0.6	1.2
5.0	0.9	1.3
5.5	1.0	1.3
6.0	1.1	1.2
6.5	1.0	1.2
7.0	0.9	1.5
7.5	1.1	1.4
8.0	1.1	1.3
8.5	1.0	1.0
9.0	0.8	0.7
9.5	0.5	0.
10.0	0.	-0.5
10.5	-0.6	-0.7
11.0	-1.0	-1.3
11.5	-1.1	-1.3
12.0	-1.3	-1.7

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.0	1.1	1.5	-1.7	54.5
1	7.0	1.5	0.	-2.1	53.9

Note: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 19

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 41

TIME IN HOURS	SURFACE BASE	SURFACE PLAN
0.	-0.9	-1.3
0.5	-0.6	-0.8
1.0	-0.1	-0.4
1.5	0.	-0.1
2.0	0.	0.
2.5	0.	0.2
3.0	0.2	0.3
3.5	0.2	0.5
4.0	0.3	0.6
4.5	0.7	0.7
5.0	0.7	0.8
5.5	0.9	1.1
6.0	0.9	1.1
6.5	1.0	1.1
7.0	1.0	1.2
7.5	1.1	1.4
8.0	1.0	1.2
8.5	1.0	1.1
9.0	0.7	0.8
9.5	0.5	0.5
10.0	0.	0.
10.5	-0.5	-0.2
11.0	-0.7	-0.8
11.5	-0.9	-1.0
12.0	-0.6	-1.3

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	7.5	1.1	11.5	-0.9	28.8
1	7.5	1.4	12.0	-1.3	31.1

Note: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 20

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 42

TIME IN HOURS	SURFACE BASE	SURFACE PLAN
0.	-0.7	-0.7
0.5	-0.6	-0.6
1.0	-0.6	-0.6
1.5	-0.7	-0.5
2.0	-0.5	-0.4
2.5	0.	0.
3.0	0.3	0.3
3.5	0.5	0.6
4.0	0.6	0.8
4.5	0.8	1.0
5.0	0.7	0.8
5.5	0.7	0.7
6.0	0.7	0.6
6.5	0.8	0.6
7.0	0.6	0.6
7.5	0.4	0.4
8.0	0.3	0.4
8.5	0.	0.4
9.0	0.	0.
9.5	-0.3	-0.4
10.0	-0.5	-0.6
10.5	-0.7	-0.6
11.0	-0.7	-0.6
11.5	-0.8	-0.7
12.0	-0.7	-0.7

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	6.5	0.8	11.5	-0.8	51.3
1	4.5	1.0	0.	-0.7	45.2

Note: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 21

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 43

TIME IN HOURS	SURFACE BASE	SURFACE PLAN
0.	-0.2	-0.6
0.5	-0.5	-0.7
1.0	-0.8	-0.6
1.5	-0.8	-0.6
2.0	-0.9	-0.5
2.5	-0.7	0.
3.0	-0.7	0.
3.5	0.	0.2
4.0	0.	0.2
4.5	0.5	0.6
5.0	0.6	0.6
5.5	0.5	0.6
6.0	0.5	0.6
6.5	0.5	0.6
7.0	0.7	0.8
7.5	0.8	0.8
8.0	0.8	0.9
8.5	0.8	0.7
9.0	0.6	0.5
9.5	0.4	0.5
10.0	0.	0.4
10.5	0.	0.4
11.0	0.	0.
11.5	-0.2	-0.4
12.0	-0.2	-0.6

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	7.5	0.8	2.0	-0.9	42.2
1	8.0	0.9	0.5	-0.7	31.0

Note: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 22

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 56

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-1.9	-2.0	-2.1	-1.9	-1.4	-1.6
0.5	-1.8	-1.8	-1.6	-1.9	-1.2	-1.6
1.0	-1.4	-1.6	-1.3	-1.6	-1.2	-1.5
1.5	-1.5	-1.2	-1.5	-1.2	-1.2	-0.9
2.0	-1.3	-1.0	-1.2	-0.8	-1.2	-0.7
2.5	-0.8	0.2	-0.9	-0.3	-0.9	-0.1
3.0	-0.1	0.3	0.1	0.2	0.1	0.2
3.5	1.1	1.6	1.0	1.5	0.5	1.3
4.0	2.4	1.9	2.3	2.0	2.0	1.5
4.5	2.5	2.0	2.9	2.2	2.7	2.1
5.0	2.7	2.2	2.7	2.4	2.9	2.0
5.5	2.7	2.2	2.6	2.4	3.0	2.1
6.0	2.5	2.2	2.7	2.4	2.8	1.9
6.5	2.2	1.6	2.4	1.8	2.3	1.7
7.0	1.6	1.1	1.6	1.3	1.8	1.1
7.5	1.2	0.8	1.1	0.9	1.2	0.9
8.0	0.5	0.7	0.7	0.6	0.8	0.4
8.5	0.1	0.2	0.1	0.2	0.1	0.2
9.0	0.1	0.2	0.1	0.2	0.1	-0.1
9.5	-1.1	-1.1	-1.2	-0.9	-1.0	-0.9
10.0	-1.6	-1.4	-1.9	-1.6	-1.6	-1.3
10.5	-1.8	-1.6	-2.0	-1.9	-1.8	-1.5
11.0	-1.8	-1.8	-2.1	-2.2	-1.7	-1.8
11.5	-1.8	-1.8	-2.1	-2.1	-1.8	-2.0
12.0	-1.8	-2.0	-2.0	-2.0	-1.9	-1.6

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	2.7	0.	-1.9	48.7
1	5.0	2.2	0.	-2.0	49.8

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	4.5	2.9	0.	-2.1	49.5
1	5.0	2.4	11.0	-2.2	50.4

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	3.0	12.0	-1.9	45.5
1	4.5	2.1	11.5	-2.0	49.6

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 23

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON CURRENT VELOCITIES
STATION 57

TIME IN HOURS	SURFACE BASE	SURFACE PLAN	MIDDEPTH BASE	MIDDEPTH PLAN	BOTTOM BASE	BOTTOM PLAN
0.	-2.4	-2.9	-2.4	-2.9	-2.5	-2.4
0.5	-1.8	-2.7	-1.8	-2.6	-1.9	-2.4
1.0	-1.8	-2.4	-1.8	-2.1	-1.8	-2.2
1.5	-1.8	-1.6	-1.8	-1.5	-1.8	-1.6
2.0	-1.9	-1.3	-1.7	-0.9	-1.8	-1.1
2.5	-1.2	-0.3	-1.2	-0.3	-1.2	-0.1
3.0	0.1	0.3	0.1	0.3	-0.4	0.4
3.5	0.9	1.6	0.7	1.6	0.6	1.4
4.0	2.0	2.1	2.2	2.1	2.0	1.9
4.5	2.9	2.5	2.9	2.0	2.7	2.3
5.0	3.1	2.4	3.0	2.6	2.8	2.4
5.5	3.0	2.6	3.0	2.8	2.8	2.5
6.0	3.0	2.3	3.0	2.4	2.8	2.2
6.5	2.6	1.6	2.6	2.0	2.4	1.9
7.0	1.9	1.5	1.9	1.3	2.0	1.6
7.5	1.2	0.7	1.1	0.9	1.4	1.0
8.0	0.6	0.4	0.6	0.7	0.8	0.6
8.5	0.1	0.2	0.1	0.2	0.1	0.2
9.0	-0.8	-0.9	-0.4	-0.3	0.1	0.2
9.5	-1.5	-1.6	-1.4	-1.2	-1.1	-1.1
10.0	-2.5	-2.4	-2.5	-1.8	-2.1	-1.7
10.5	-2.8	-2.6	-2.8	-2.6	-2.6	-2.4
11.0	-2.8	-2.7	-2.7	-3.1	-2.6	-2.8
11.5	-2.7	-2.7	-2.5	-2.9	-2.7	-2.9
12.0	-2.6	-2.6	-2.8	-2.9	-2.7	-2.8

SURFACE

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	3.1	10.5	-2.8	54.9
1	5.5	2.6	0.	-2.9	58.9

MIDDEPTH

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.5	3.0	10.5	-2.8	54.6
1	5.5	2.8	11.0	-3.1	56.9

BOTTOM

PLAN	MAXIMUM FLOOD TIME HOURS	MAXIMUM FLOOD VELOCITY DATA	MAXIMUM EBB TIME HOURS	MAXIMUM EBB VELOCITY DATA	EBB PRE-DOMINANCE
BASE	5.0	2.8	11.5	-2.7	54.8
1	5.5	2.5	11.5	-2.9	55.8

NOTE: Time is expressed in hours after moon's transit of 74th meridian.
Velocities are expressed in feet per second prototype.

TABLE 24

NEW YORK HARBOR MODEL
AVERAGE SALINITIES* WITHOUT AND WITH NORTON POINT DIKE

	HIGH-WATER SLACK						LOW-WATER SLACK					
	SURFACE		MIDDEPTH		BOTTOM		SURFACE		MIDDEPTH		BOTTOM	
Station	Base	Plan	Base	Plan	Base	Plan	Base	Plan	Base	Plan	Base	Plan
1	28.8	29.3	--	--	28.9	29.4	28.6	29.3	--	--	29.0	29.6
2	28.9	29.4	--	--	29.0	29.5	29.1	29.4	--	--	29.1	29.5
3	26.3	27.8	--	--	26.5	27.8	26.8	28.1	--	--	26.9	28.1
4	27.7	27.4	--	--	27.9	28.4	26.5	27.8	--	--	27.0	27.9
5	--	--	27.7	26.6	--	--	--	--	27.8	27.7	--	--
6	27.3	27.3	--	--	27.7	28.4	26.0	26.9	--	--	27.5	28.3
7	--	--	27.9	25.9	--	-	--	--	28.0	26.2	--	--
8	28.8	28.9	--	--	28.6	29.3	26.4	26.2	--	--	28.4	28.7
9	28.6	29.3	--	--	28.8	29.6	25.5	27.0	--	--	27.2	28.5
10	25.3	26.6	--	--	25.4	26.8	25.7	26.7	--	--	25.7	26.9
11	23.9	26.3	--	--	26.9	27.8	25.0	26.3	--	--	26.7	27.9
12	25.3	25.9	--	--	26.4	28.1	24.1	25.8	--	--	26.7	27.9
14	27.9	28.7	--	--	28.3	28.8	25.3	25.8	--	--	28.5	28.5
16	27.5	27.4	--	--	28.1	28.8	25.8	25.9	--	--	27.8	28.1
17	26.1	26.5	--	--	26.2	28.8	25.1	25.6	--	--	28.0	28.4
21	27.1	26.9	--	--	27.7	27.5	25.7	26.9	--	--	27.6	28.0
22	--	--	27.4	26.6	--	--	--	--	27.0	27.5	--	--
24	27.1	25.9	--	--	27.7	25.9	24.8	26.0	--	--	24.9	26.1
26	26.9	27.0	--	--	27.4	28.3	24.9	25.8	--	--	25.6	26.4
27	26.9	27.3	--	--	27.8	29.0	24.9	24.3	--	--	27.3	28.3
28	25.7	26.4	--	--	27.8	28.8	25.0	25.8	--	--	26.1	27.3
32	--	--	24.9	25.1	--	--	--	--	25.5	25.8	--	--
33	25.6	25.5	--	--	26.4	26.5	25.1	25.8	--	--	25.8	27.4
34	25.8	25.9	--	--	27.6	27.8	24.5	24.8	--	--	27.0	26.9
35	25.3	26.0	--	--	26.6	26.5	24.5	24.5	--	--	24.9	25.4
36	25.1	25.4	--	--	26.7	26.9	24.0	24.3	--	--	24.4	24.9
37	23.4	23.7	--	--	26.5	26.3	24.2	24.3	--	--	24.4	25.0
38	--	-	25.3	24.6	--	--	--	--	26.3	24.9	--	--
39	--	--	25.3	25.0	--	--	--	--	25.9	25.3	--	--
40	22.3	23.9	--	--	25.5	26.4	25.0	25.7	--	--	25.5	25.9
41	--	--	25.0	25.6	--	--	--	--	22.2	25.7	--	--
42	25.2	25.6	--	--	27.2	28.0	24.1	25.2	--	--	26.1	27.1
43	--	--	24.4	25.3	--	--	--	--	25.4	26.0	--	--
44	25.6	26.7	--	--	27.3	28.2	22.1	24.6	--	--	26.6	27.7
45	--	--	25.5	25.4	--	--	--	--	26.5	26.0	--	--
46	--	--	24.9	23.5	--	--	--	--	25.8	24.7	--	--
47	--	--	25.3	25.1	--	--	--	--	26.6	26.4	--	--
49	22.4	25.5	--	--	26.9	25.9	22.4	24.1	--	--	26.7	25.2
50	22.1	25.5	--	--	26.6	28.0	24.2	26.2	--	--	27.1	27.9
51	--	--	24.6	24.2	--	--	--	--	25.3	25.2	--	--
52	18.2	26.6	--	--	25.9	27.4	20.5	22.6	--	--	25.8	24.2
53	23.6	25.3	--	--	25.2	26.4	24.3	25.4	--	--	24.4	25.4
54	24.2	25.2	--	--	24.3	25.4	24.3	25.1	--	--	24.3	25.1
55	24.3	24.9	--	--	24.3	25.0	25.0	25.6	--	--	24.9	25.9
56	24.1	24.5	--	--	24.0	24.5	24.4	24.9	--	--	24.3	24.8
57	24.2	24.6	--	--	24.6	25.4	24.2	24.5	--	--	24.3	24.8
58	24.4	24.9	--	--	25.4	26.2	22.7	23.8	--	--	24.4	24.7
59	23.2	23.8	--	--	24.4	25.1	19.6	20.3	--	--	25.4	25.7
60	23.8	24.0	--	--	24.1	24.1	28.7	28.8	--	--	29.0	29.2
61	18.4	19.5	--	--	23.7	23.8	13.7	14.1	--	--	20.9	19.4

*Salinity values are in ppt and are averages of 13 measurements made at regular intervals throughout each test.

TABLE 25

NEW YORK HARBOR MODEL
EFFECTS OF NORTON POINT DIKE ON SALINITIES
Salinity Changes*
(ppt)

STATION	HIGH-WATER SLACK SURFACE	HIGH-WATER SLACK MIDDEPTH	HIGH-WATER SLACK BOTTOM	LOW-WATER SLACK SURFACE	LOW-WATER SLACK MIDDEPTH	LOW-WATER SLACK BOTTOM
1	0	-	0	+0.2	-	+0.1
2	0	-	0	-0.2	-	-0.1
3	+1.0	-	+0.8	+0.8	-	+0.7
4	-0.8	-	0	+0.8	-	+0.4
5	-	-1.6	-	-	-0.6	-
6	-0.5	-	+0.2	+0.4	-	+0.3
7	-	-2.5	-	-	-2.3	-
8	-0.4	-	+0.2	-0.7	-	-0.2
9	+0.2	-	+0.3	+1.0	-	+0.8
10	+0.8	-	+0.9	+0.5	-	+0.7
11	+1.9	-	+0.4	+0.8	-	+0.7
12	+0.1	-	+1.2	+1.2	-	+0.7
14	+0.3	-	0	0	-	-0.5
16	-0.6	-	+0.2	-0.4	-	-0.2
17	-0.1	-	+2.1	0	-	-0.1
21	-0.7	-	-0.7	+0.7	-	-0.1
22	-	-1.3	-	-	0	-
24	-1.7	-	-2.3	+0.7	-	+0.7
26	-0.4	-	+0.4	+0.4	-	+0.3
27	-0.1	-	+0.7	-1.1	-	+0.5
28	+0.2	-	+0.5	+0.3	-	+0.7
32	-	-0.3	-	-	-0.2	-
33	-0.6	-	-0.4	+0.2	-	+1.1
34	-0.4	-	-0.3	-0.2	-	-0.6
35	+0.2	-	-0.6	-0.5	-	0
36	-0.2	-	-0.3	-0.2	-	0
37	-0.2	-	-0.7	-0.4	-	+0.1
38	-	-1.2	-	-	-1.9	-
39	-	-0.8	-	-	-1.1	-
40	+1.1	-	+0.4	+0.2	-	-0.1
41	-	+0.1	-	-	+3.0	-
42	-0.1	-	+0.3	+0.6	-	+0.5
43	-	+0.4	-	-	+0.1	-
44	+0.6	-	+0.4	+2.0	-	+0.6
45	-	-0.6	-	-	+1.0	-
46	-	-1.9	-	-	-1.6	-
47	-	-0.7	-	-	-0.7	-
49	+2.6	-	-1.5	+1.2	-	-2.0
50	+2.9	-	+0.9	+1.5	-	+0.3
51	-	-0.9	-	-	-0.6	-
52	+7.9	-	+1.0	+1.6	-	-2.1
53	+1.2	-	+0.7	+0.6	-	+0.5
54	+0.5	-	+0.6	+0.3	-	+0.3
55	+0.1	-	+0.2	+0.1	-	+0.5
56	-0.1	-	0	0	-	0
57	-0.1	-	+0.3	-0.2	-	0
58	0	-	+0.3	+0.6	-	-0.2
59	+0.1	-	+0.2	+0.2	-	-0.2
60	-0.3	-	-0.5	-0.4	-	-0.3
61	+0.6	-	-0.4	-0.1	-	-2.0

* These changes are the differences between base test salinities and adjusted plan test salinities (see paragraph 33 of text).

TABLE 26

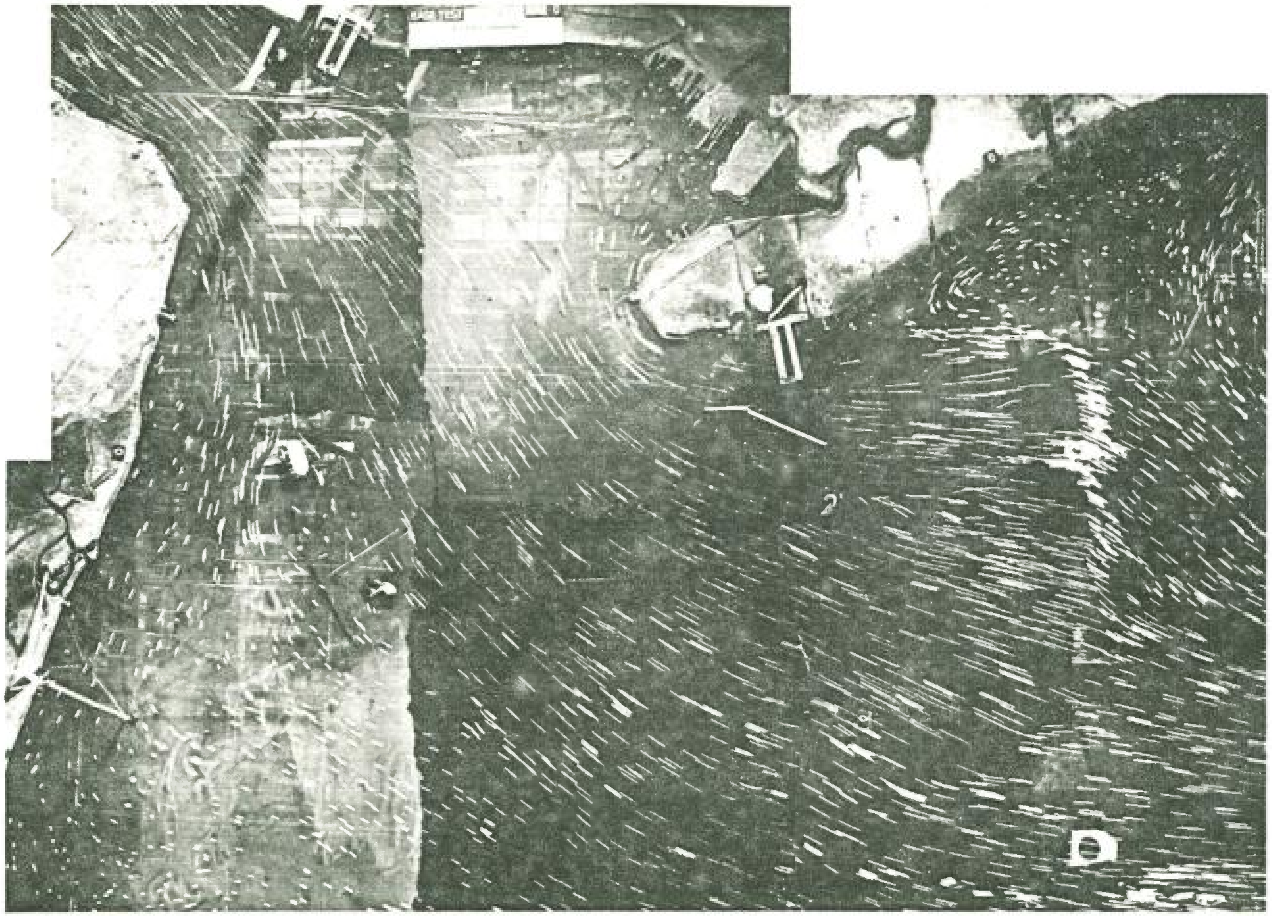
DIRECTION OF CHANGE IN DYE CONCENTRATION DUE TO DIKE
(After 50 Cycles)

Station	Dye From Jamaica Bay HW	Dye From Jamaica Bay LW	Dye From Passaic Valley HW	Dye From Passaic Valley LW	Dye From Raritan Bay* HW	Dye From Raritan Bay* LW
4	-	NC	+	-	+	+
5	-	NC	+	-	+	NC
6	-	(+S, -B)	+	-	+	+
7	NC	NC	+	-	+	+
21	-	(+S, -B)	+	NC	+	+
22	+	-	+	-	+	NC
24	(-S, NC B)	+	+	+	+	+
26	NC	+	-	+	+	+
27	NC	+	+	-	-	+
28	+	+	-	+	+	+
32	+	NC	+	+	+	+
33	(-S, NC B)	+	-	-	-	+
34	(+S, NC B)	+	-	+	+	NC
35	+	+	-	NC	+	+

\+ indicates increase in dye concentration
\- indicates decrease (i.e., improvement) in dye concentration
NC indicates no change in dye concentration
S indicates surface
B indicates bottom

*NOTE: Stable dye concentrations from this source were not achieved at any of the stations along Coney Island.

PHOTO 1



MODEL TEST DATA

TIDE .... MEAN
HUDSON RIVER FRESHWATER DISCHARGE ..... 12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE ..... 1,770 CFS
OCEAN SALINITY .... 30,000 PPM

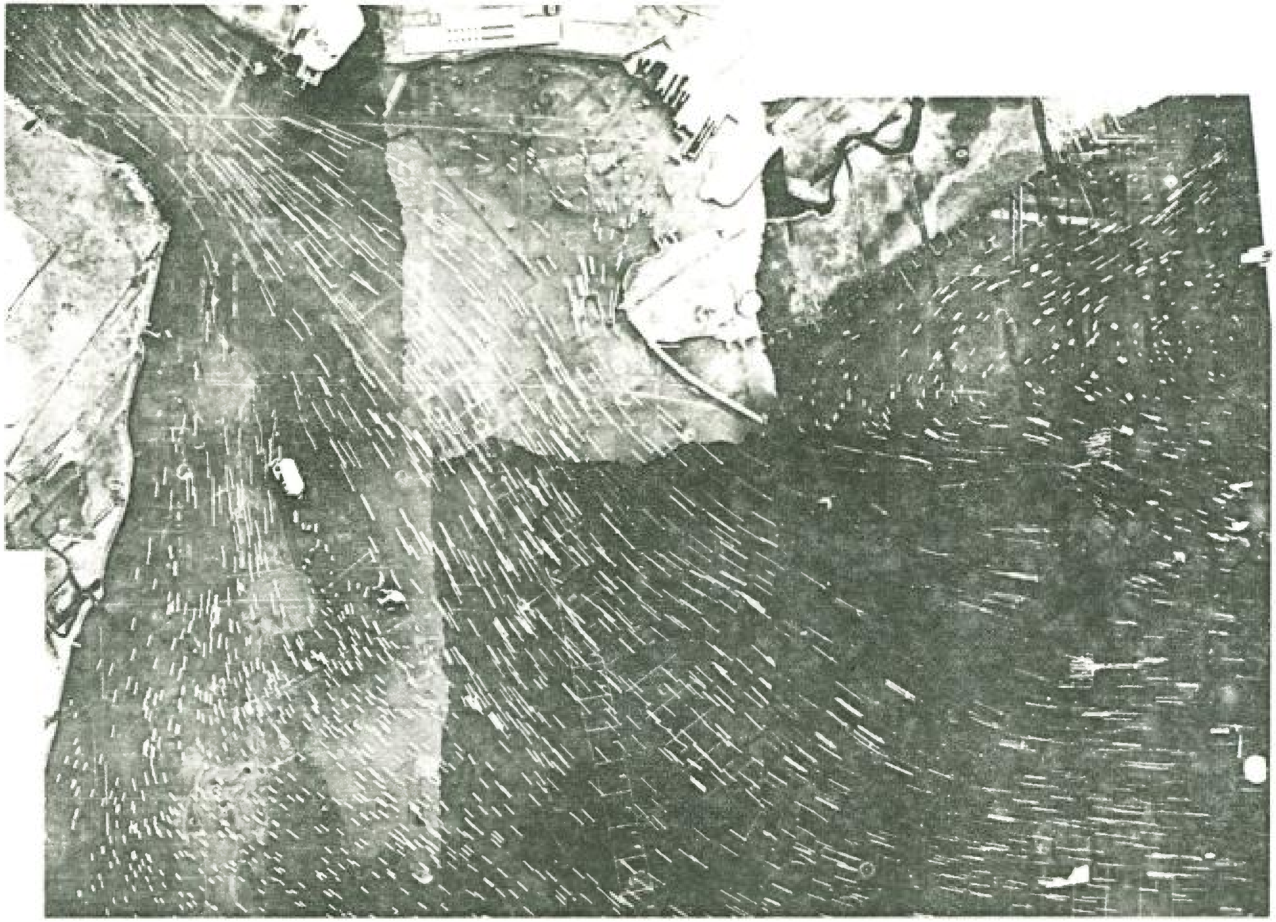
VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 0



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE
0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

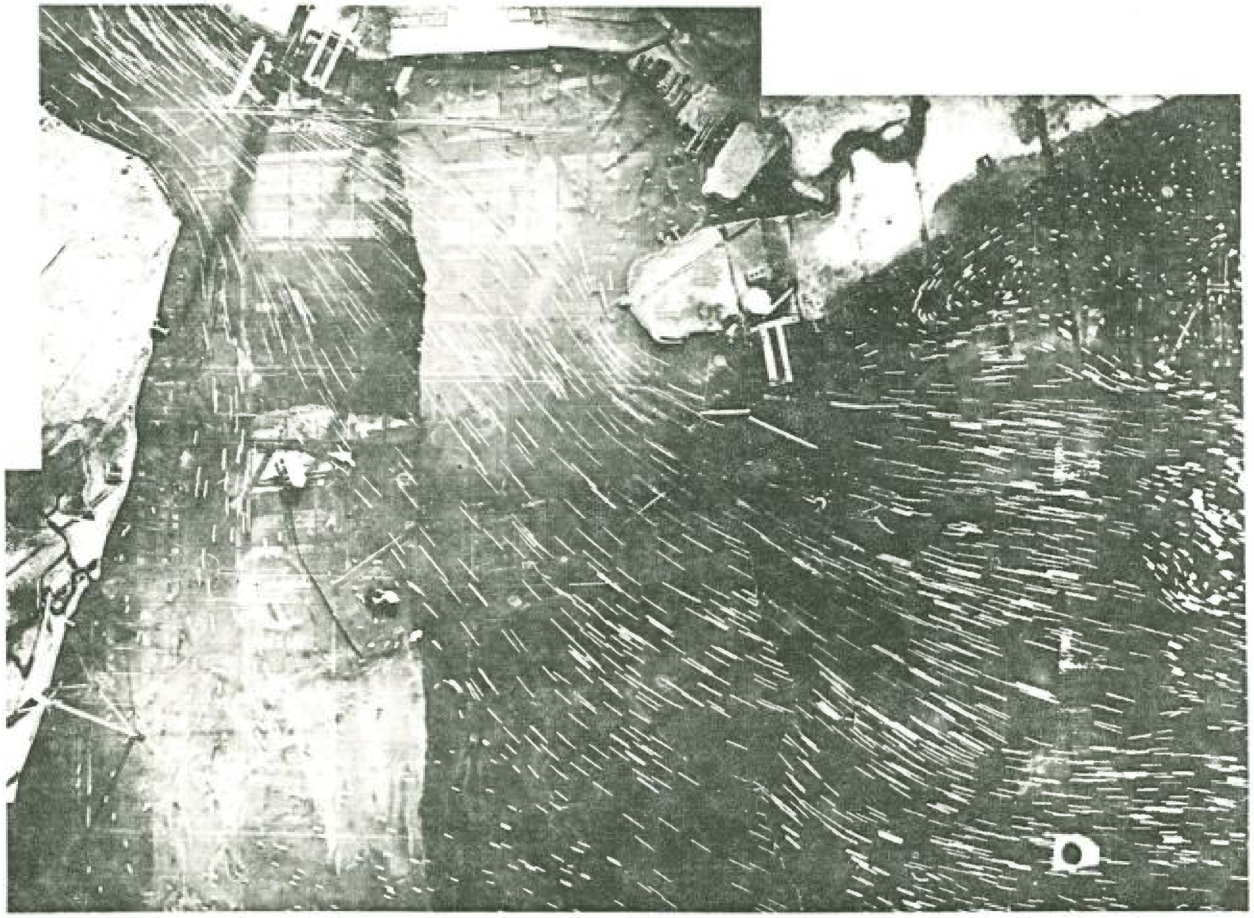
SURFACE CURRENT DIRECTIONS

PLAN 1

HOUR 0

PHOTO 2

PHOTO 3



MODEL TEST DATA

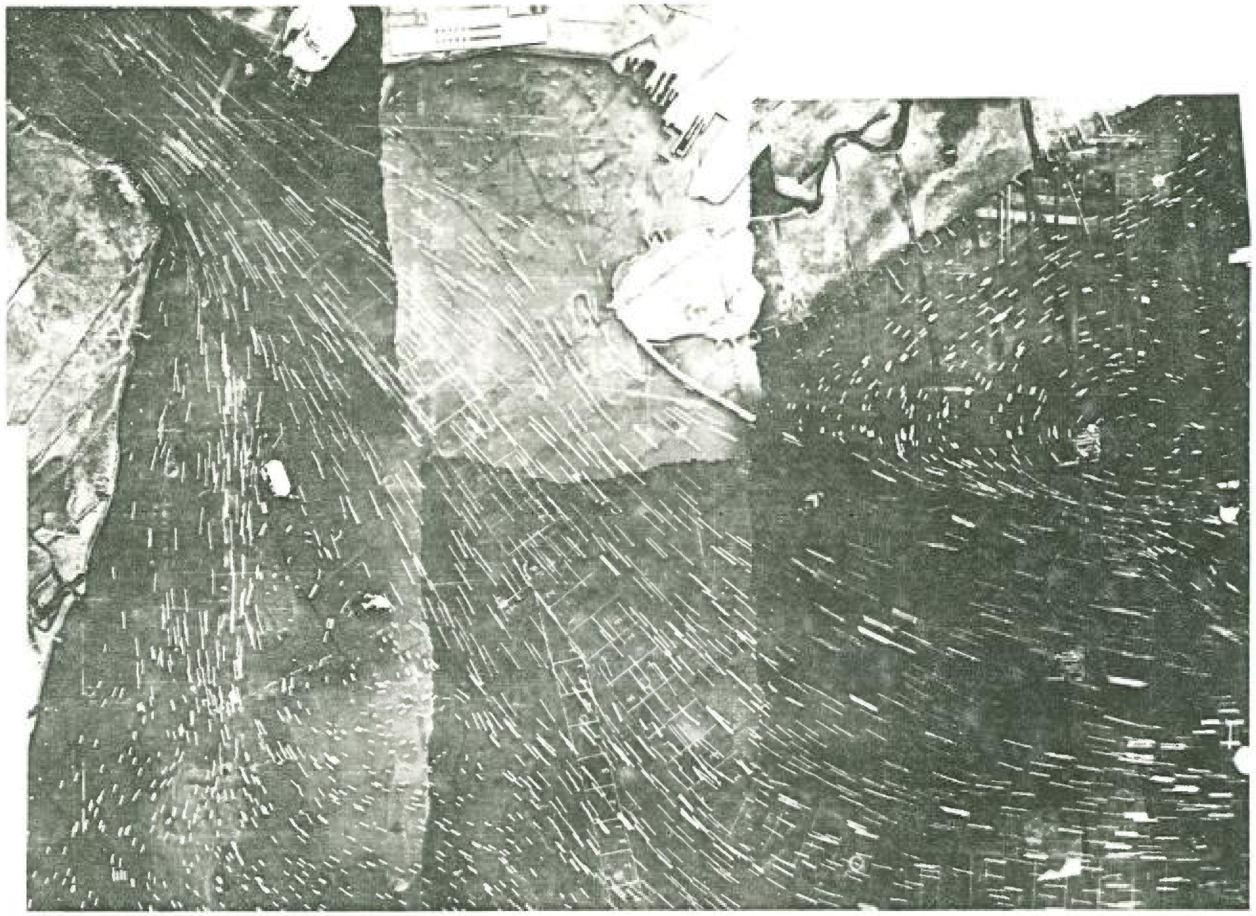
TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 1



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

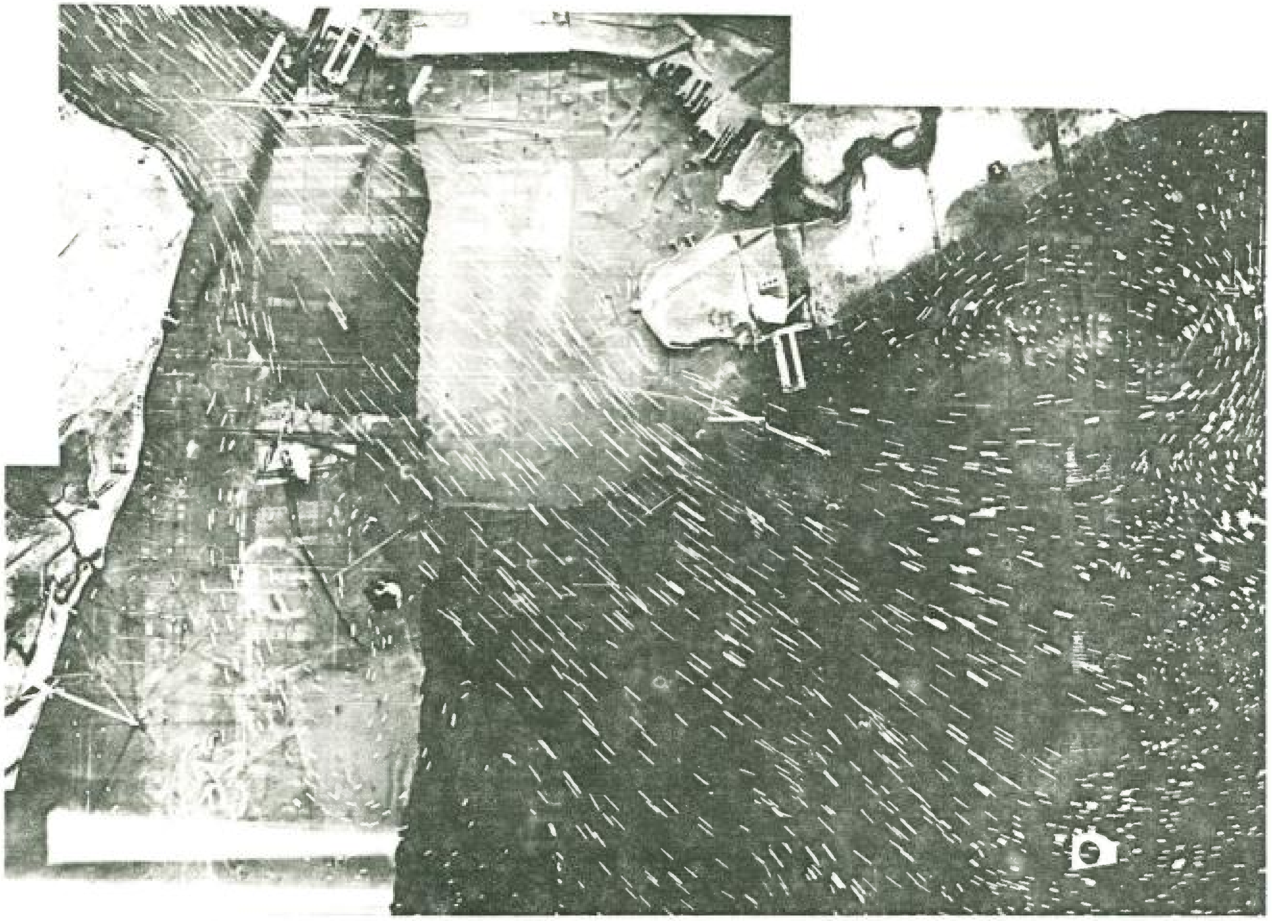
SURFACE CURRENT DIRECTIONS

PLAN 1

HOUR 1

PHOTO 4

PHOTO 5



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

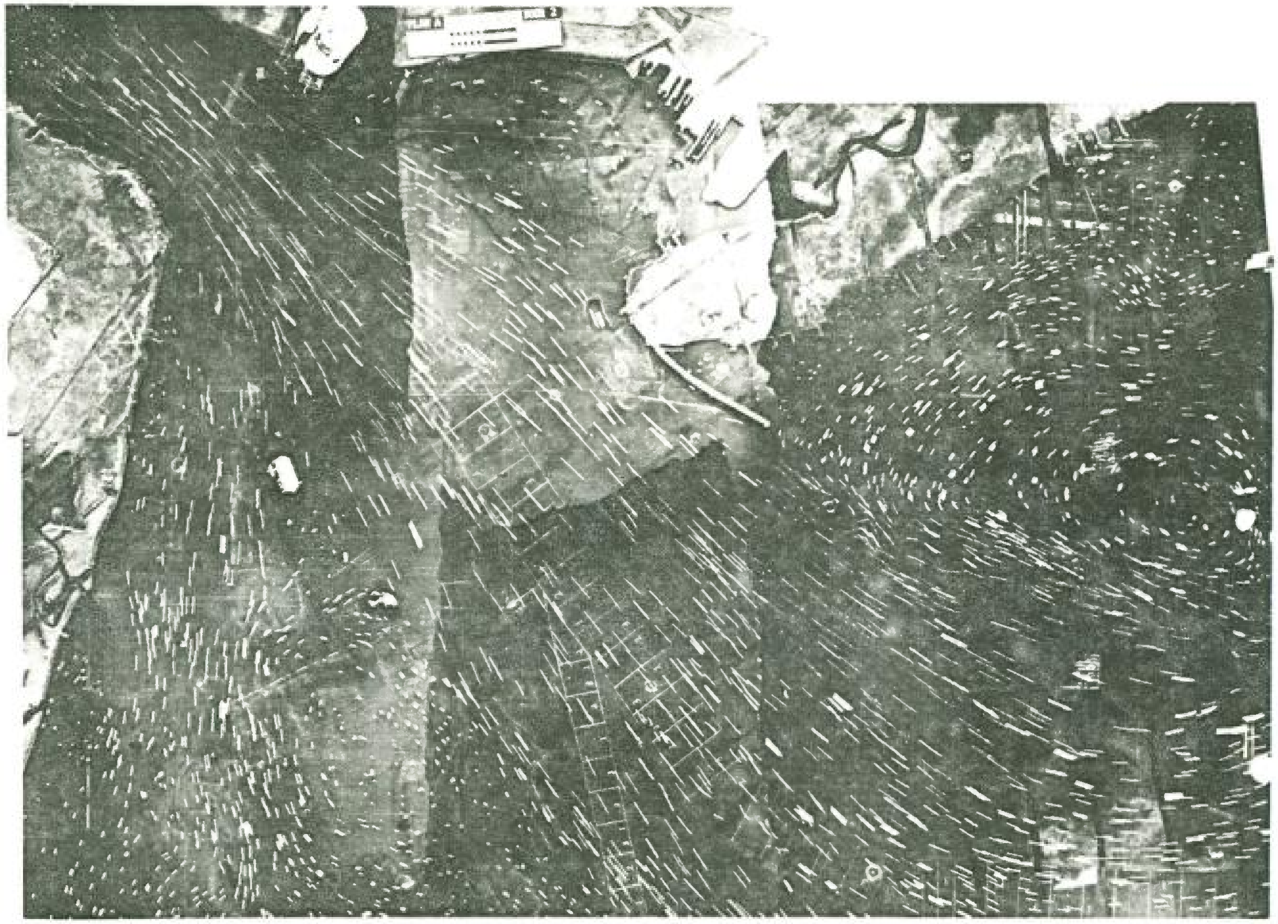
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 2



MODEL TEST DATA

TIDE .... MEAN
HUDSON RIVER FRESHWATER DISCHARGE ... 12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE ... 1,770 CFS
OCEAN SALINITY .... 30,000 PPM

VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

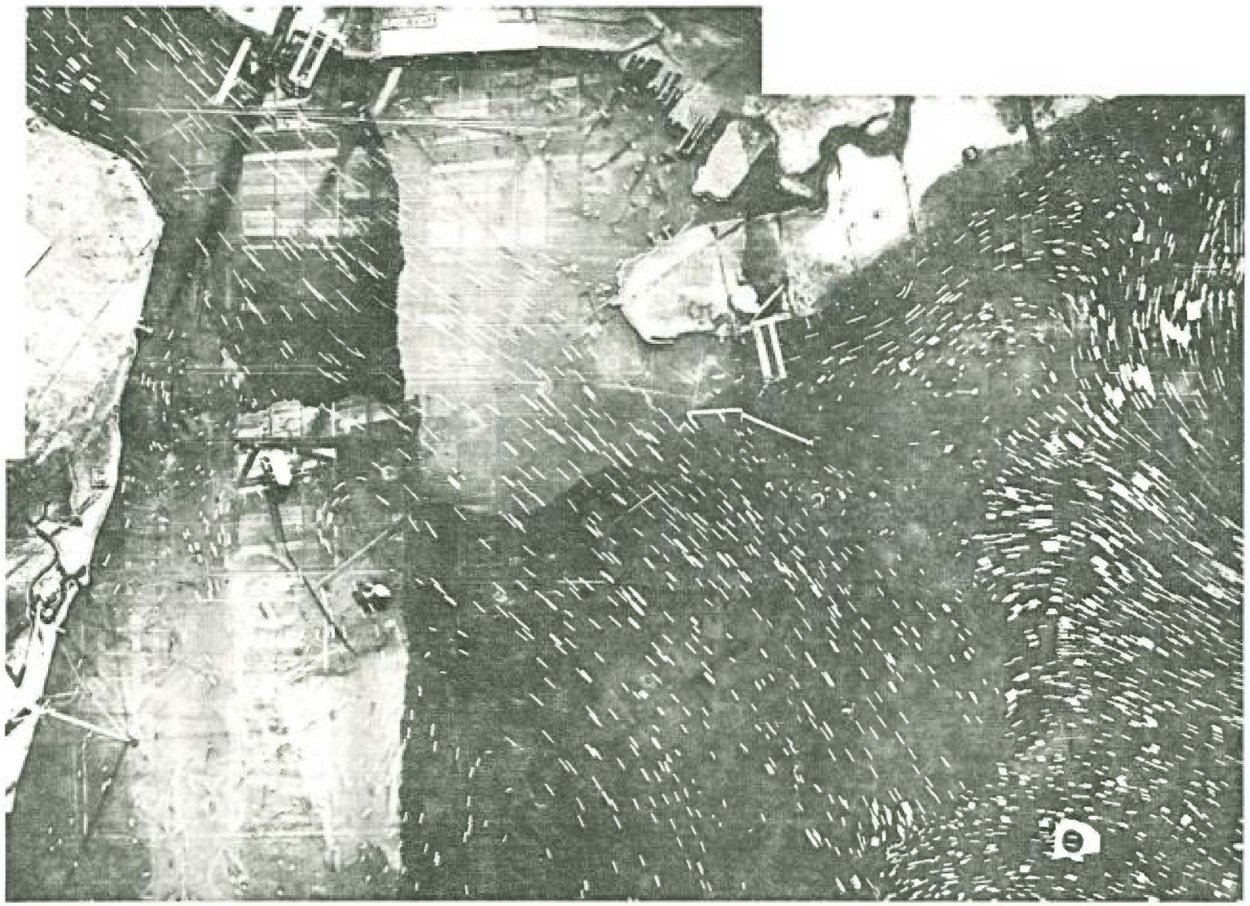
SURFACE CURRENT DIRECTIONS

PLAN I

HOUR 2

PHOTO 6

PHOTO 7



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

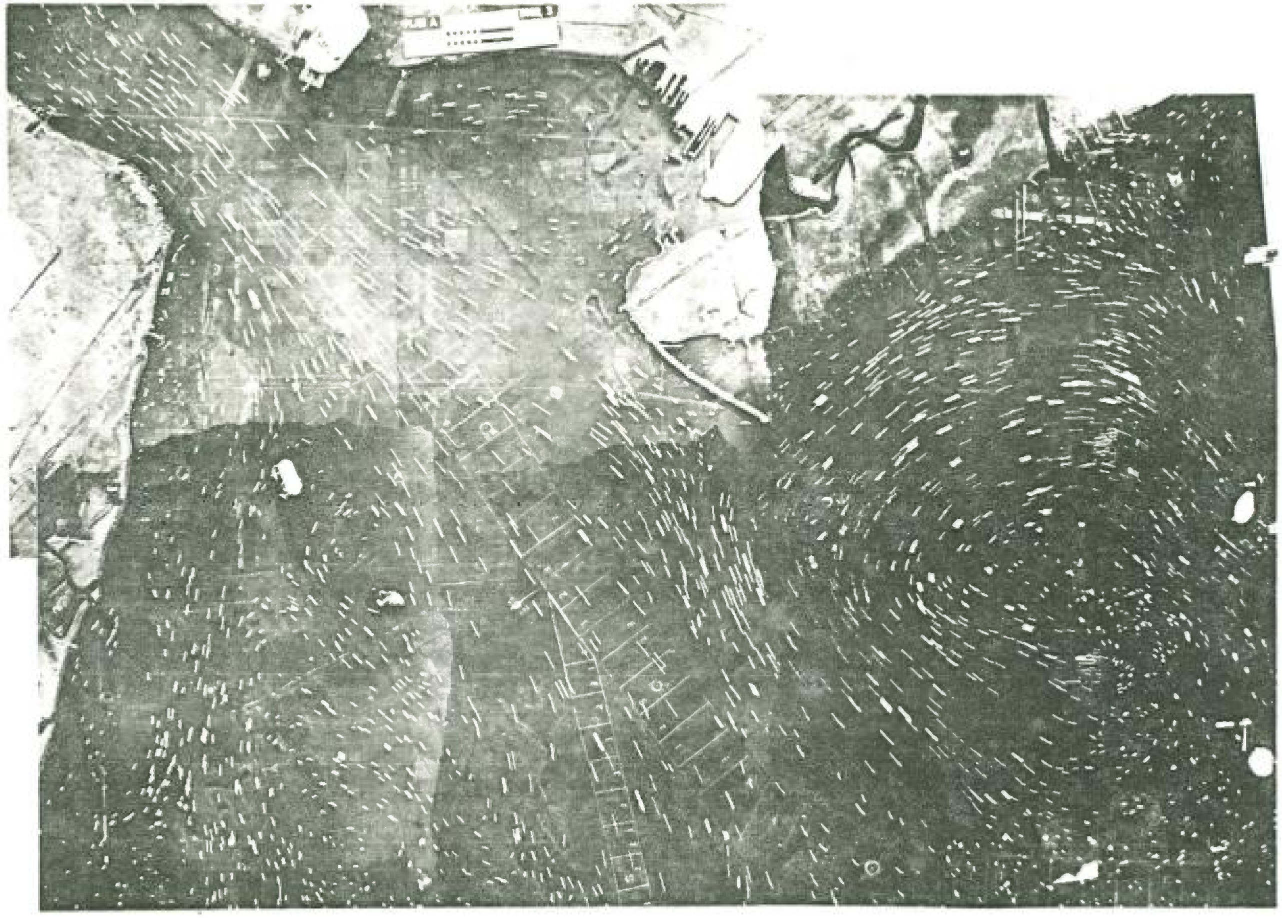
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 3



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

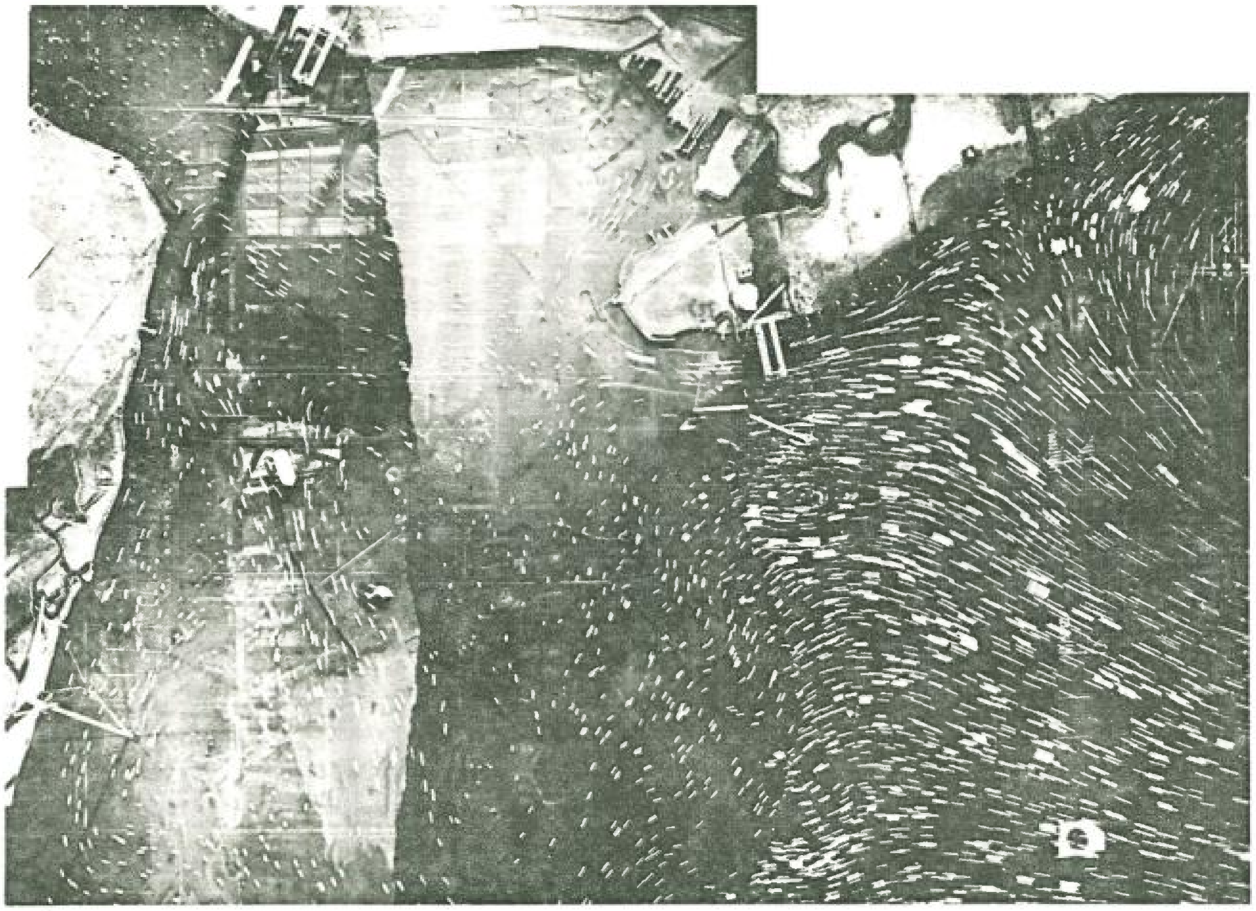
SURFACE CURRENT DIRECTIONS

PLAN I

HOUR 3

PHOTO 8

PHOTO 9



MODEL TEST DATA

TIDE .... MEAN
HUDSON RIVER FRESHWATER DISCHARGE ... 12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE ... 1,770 CFS
OCEAN SALINITY .... 30,000 PPM

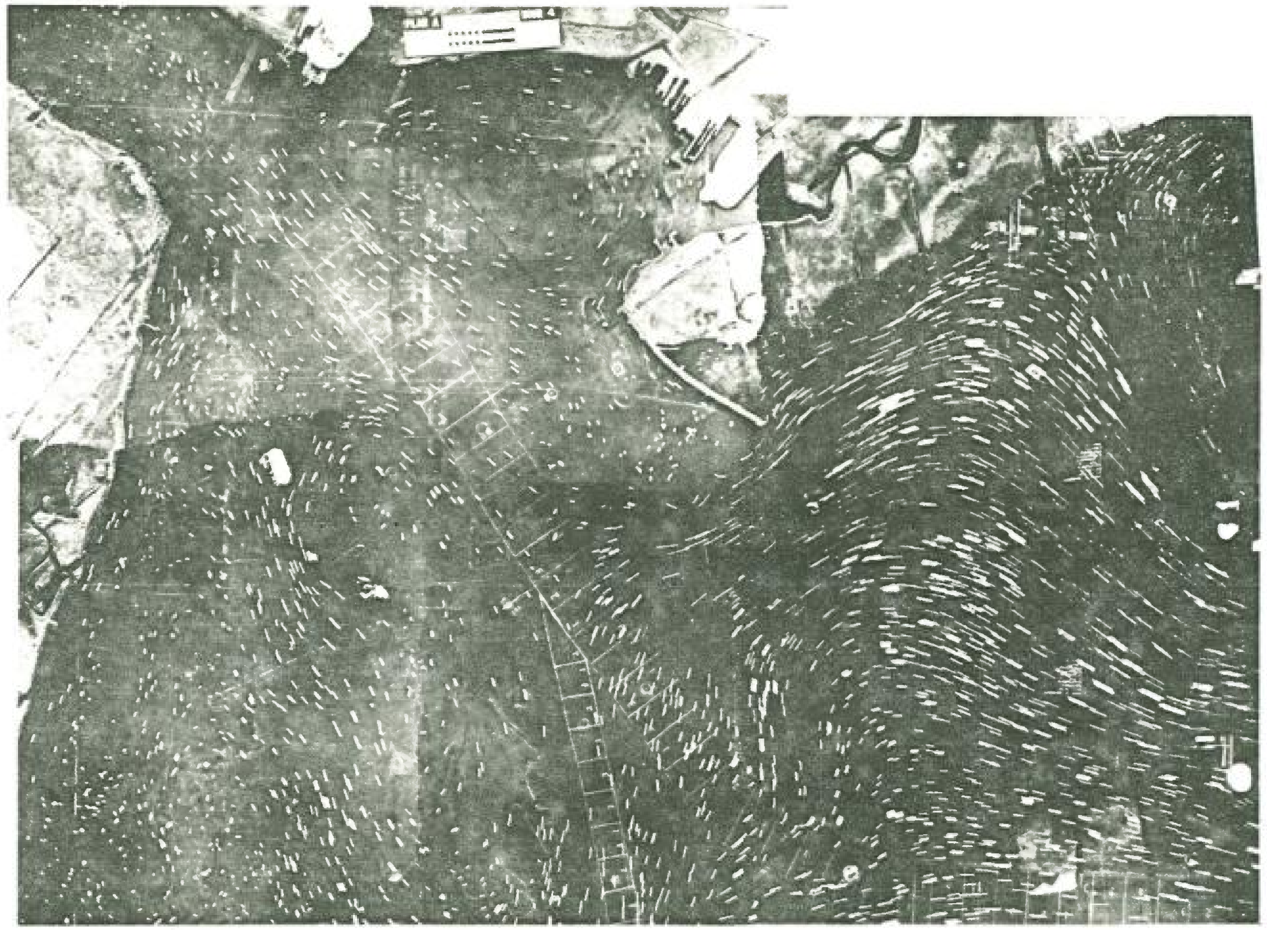
VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 4



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

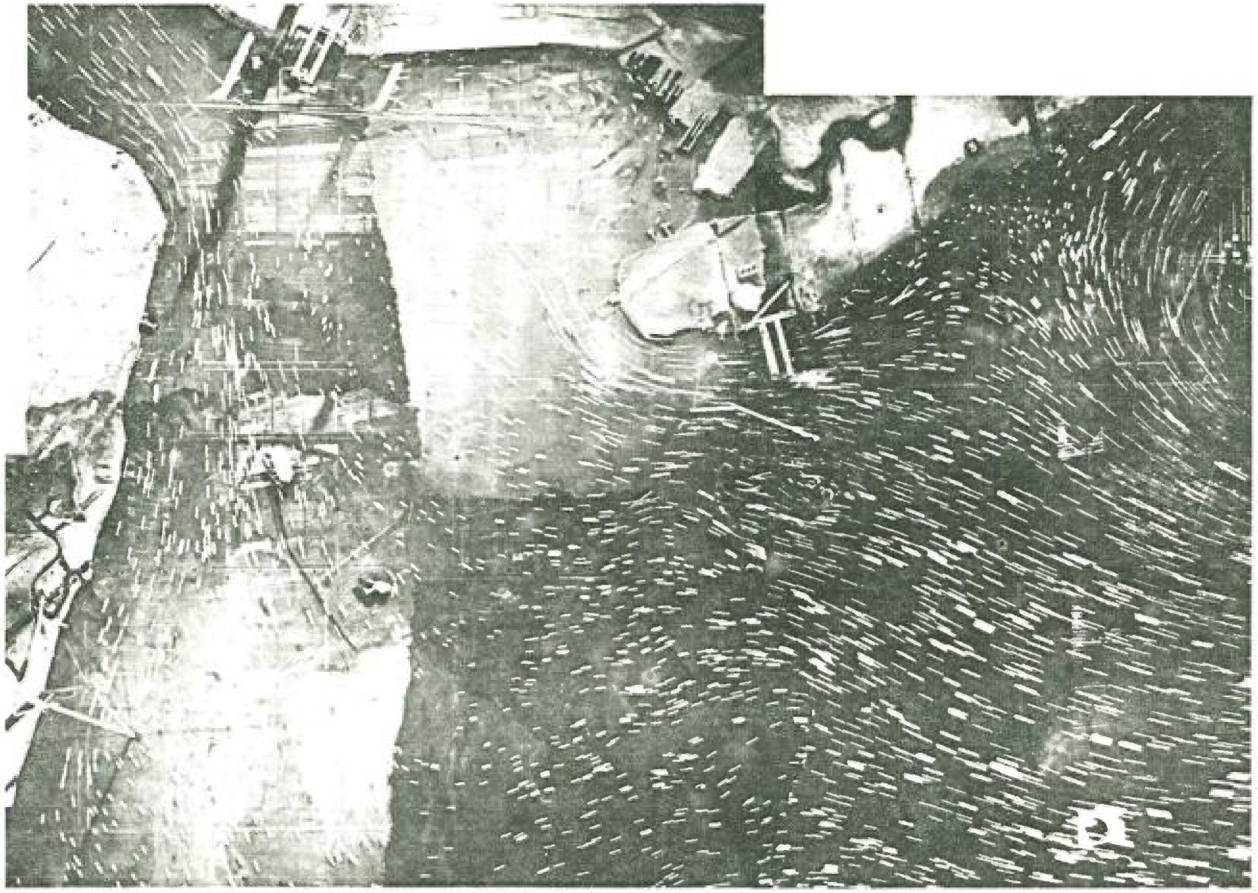
SURFACE CURRENT DIRECTIONS

PLAN I

HOUR 4

PHOTO 10

PHOTO 11



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

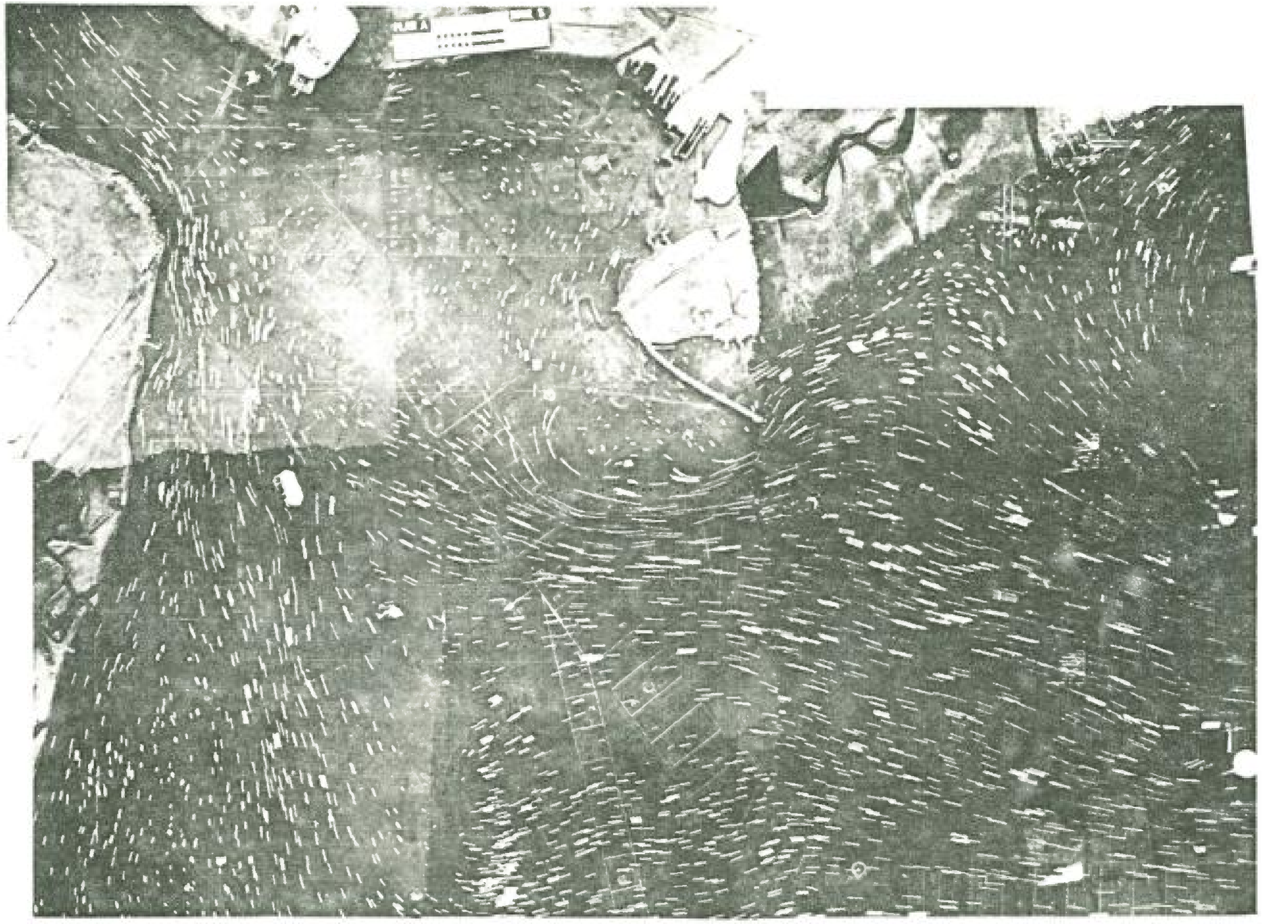
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 5



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

FPS PROTOTYPE

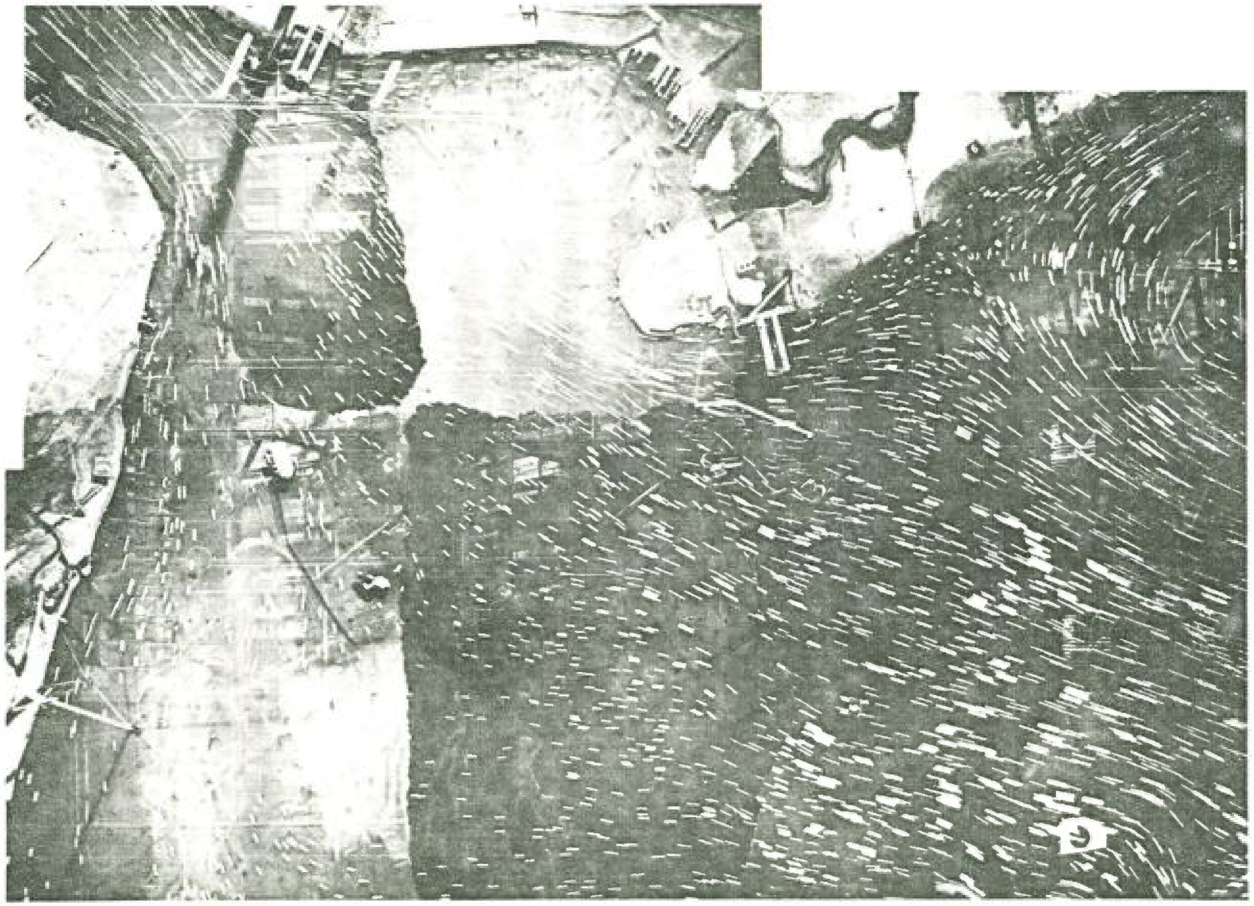
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

PLAN I

HOUR 5

PHOTO 12



MODEL TEST DATA

TIDE .... MEAN
HUDSON RIVER FRESHWATER DISCHARGE ... 12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE ... 1,770 CFS
OCEAN SALINITY .... 30,000 PPM

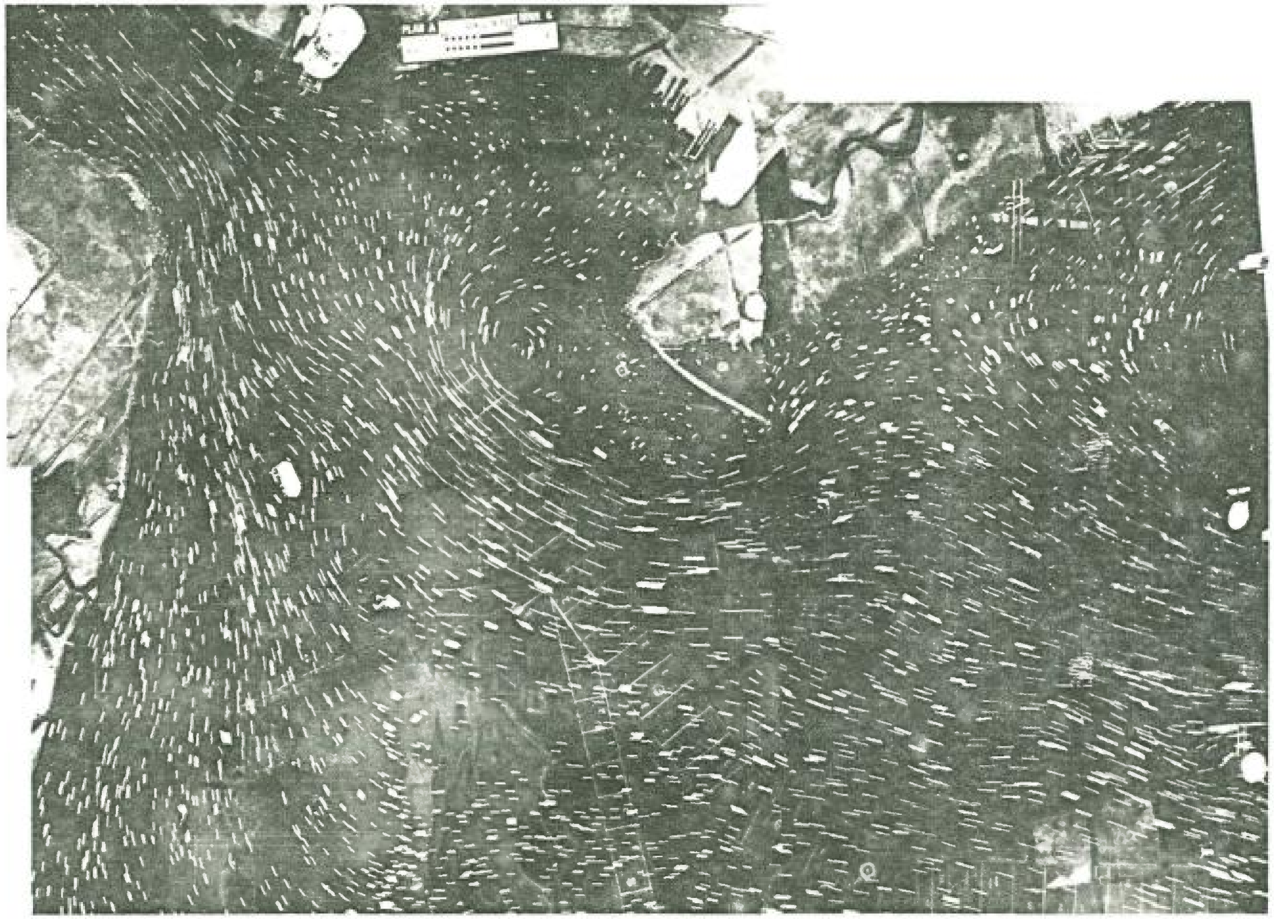
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 6

PHOTO 13



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

FPS PROTOTYPE

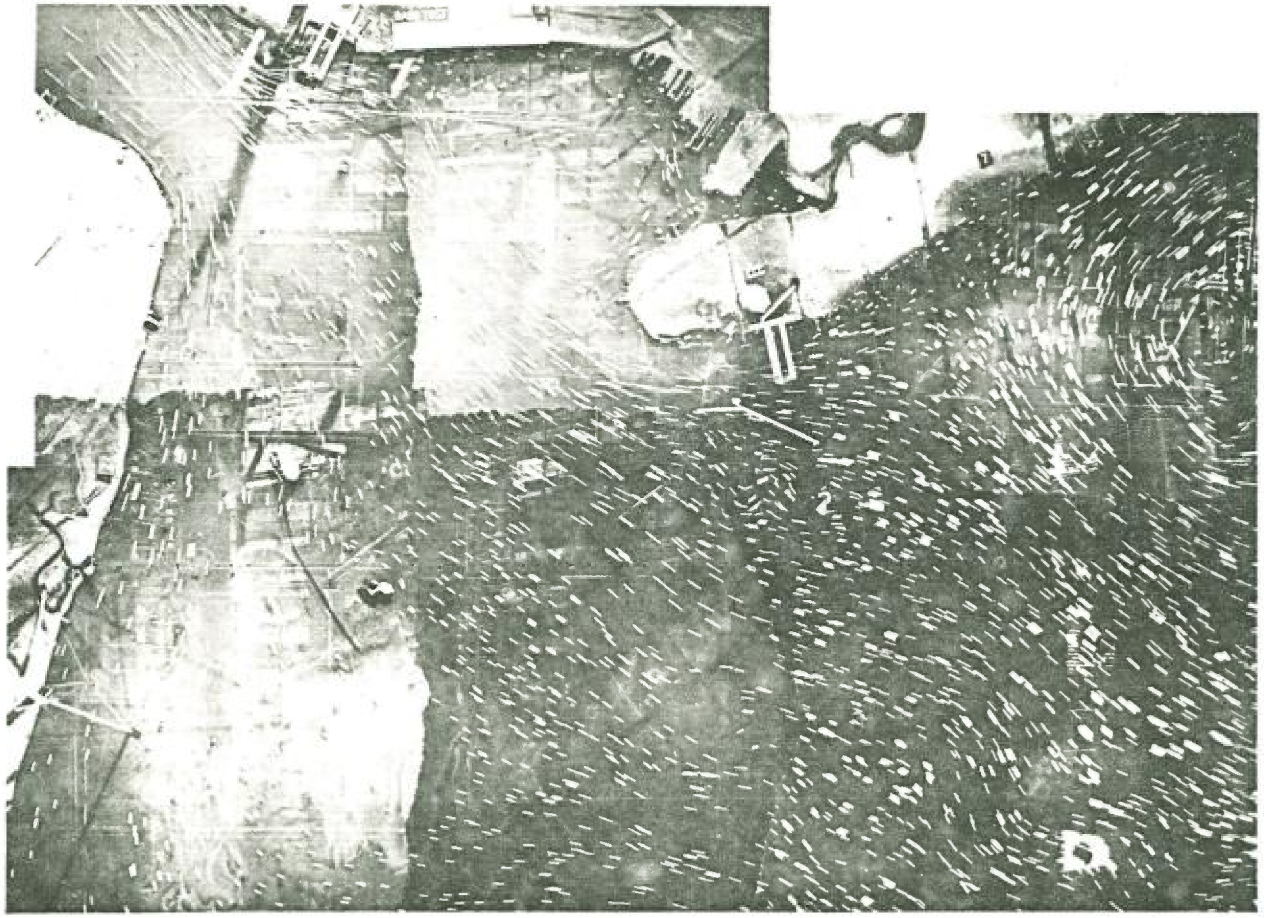
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

PLAN 1

HOUR 6

PHOTO 14



NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

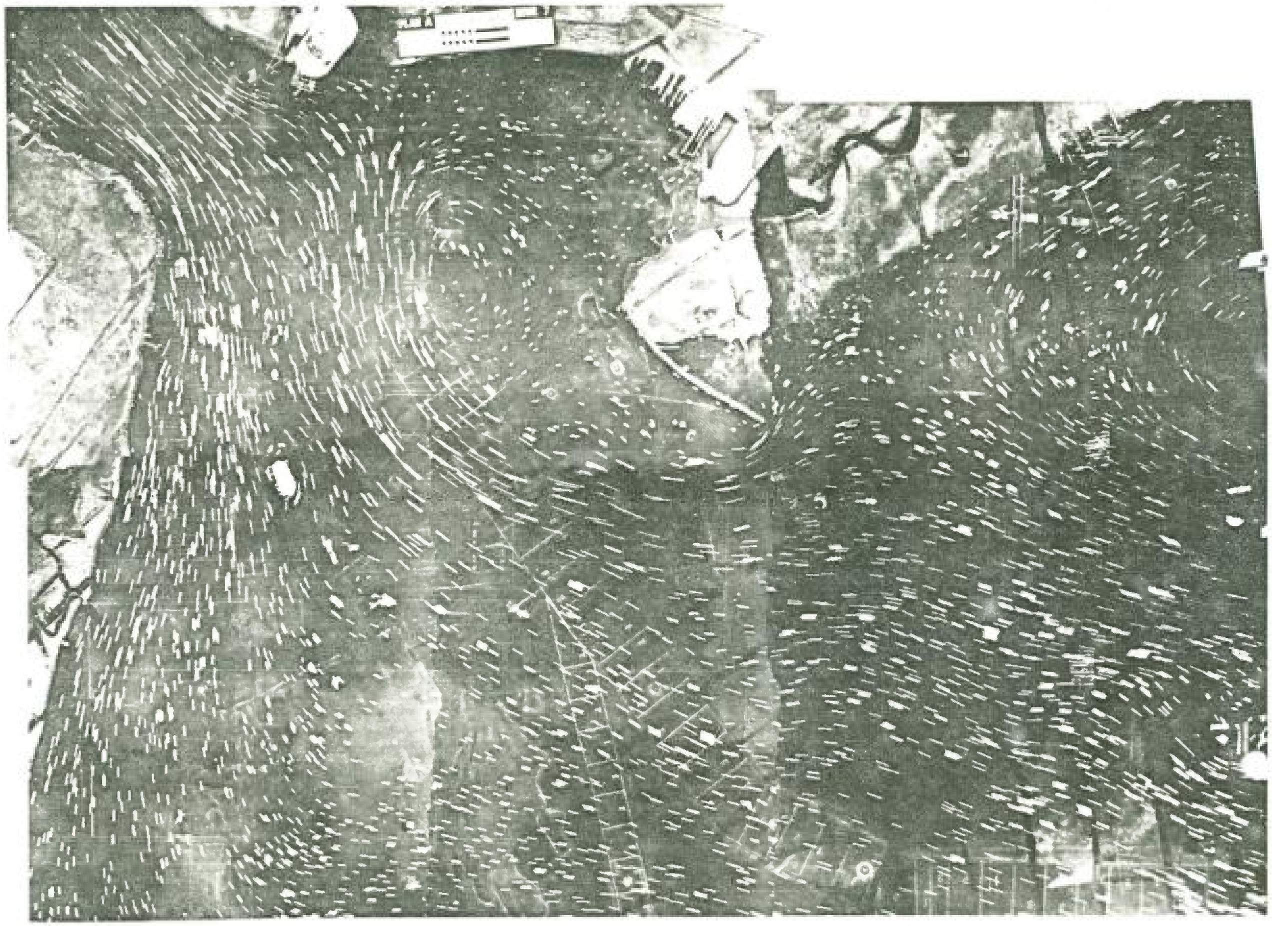
HOUR 7

MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

PHOTO 15



MODEL TEST DATA

TIDE .... MEAN
HUDSON RIVER FRESHWATER DISCHARGE .... 12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE .... 1,770 CFS
OCEAN SALINITY .... 30,000 PPM

VELOCITY SCALE

FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

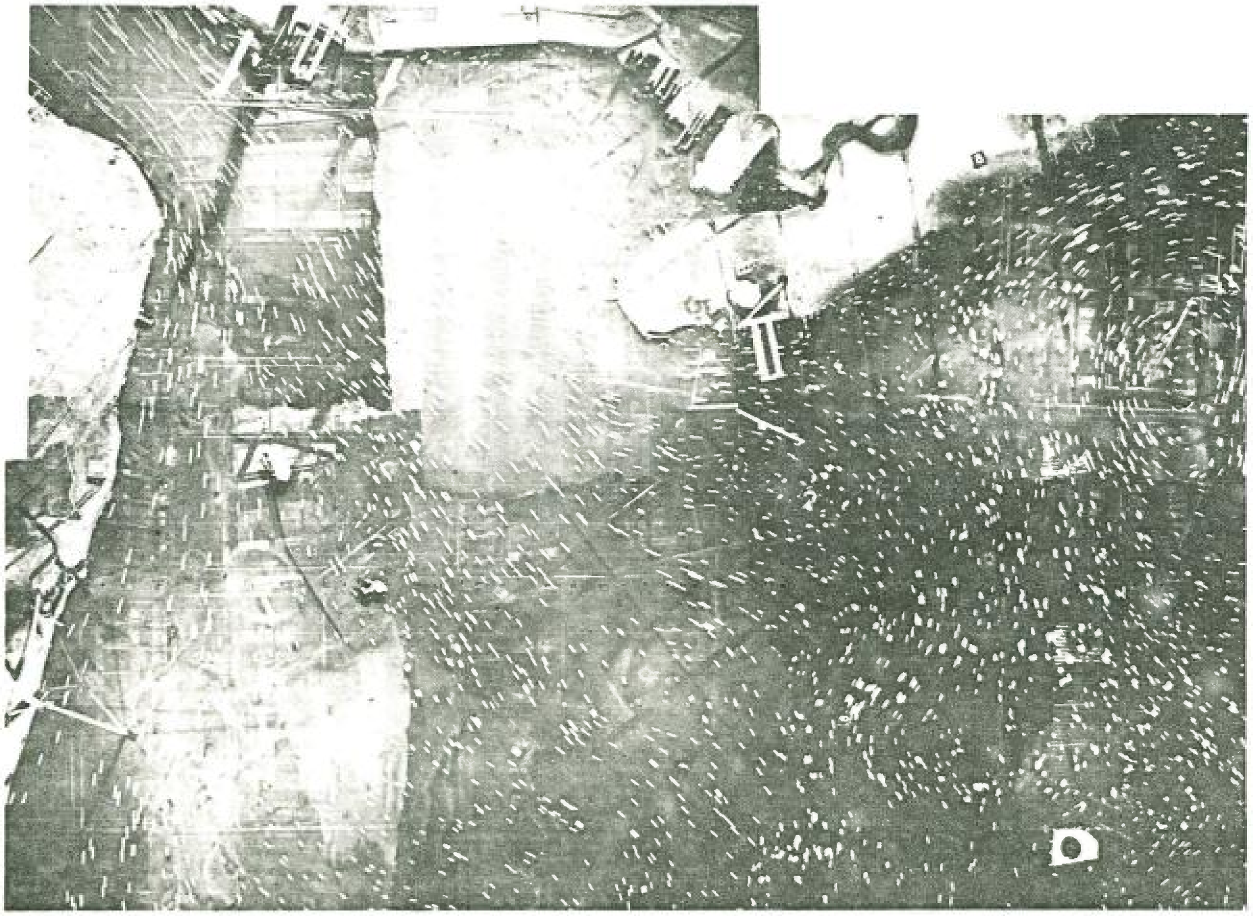
SURFACE CURRENT DIRECTIONS

PLAN I

HOUR 7

PHOTO 16

PHOTO 17



MODEL TEST DATA

TIDE .... MEAN
HUDSON RIVER FRESHWATER DISCHARGE ... 12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE ... 1,770 CFS
OCEAN SALINITY .... 30,000 PPM

VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS
BASE CONDITIONS
HOUR 8

MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

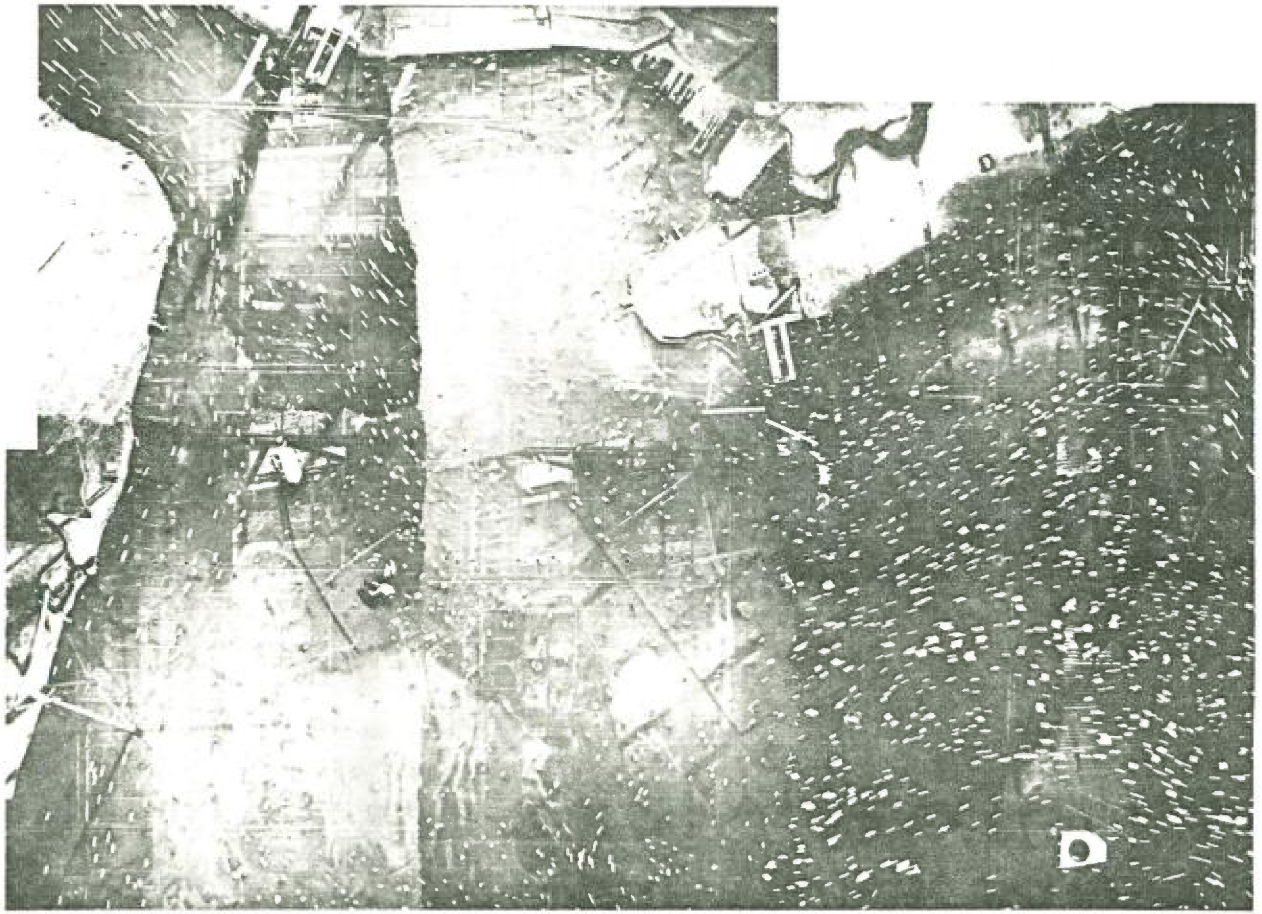
VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS
PLAN I
HOUR 8

PHOTO 18

PHOTO 19



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

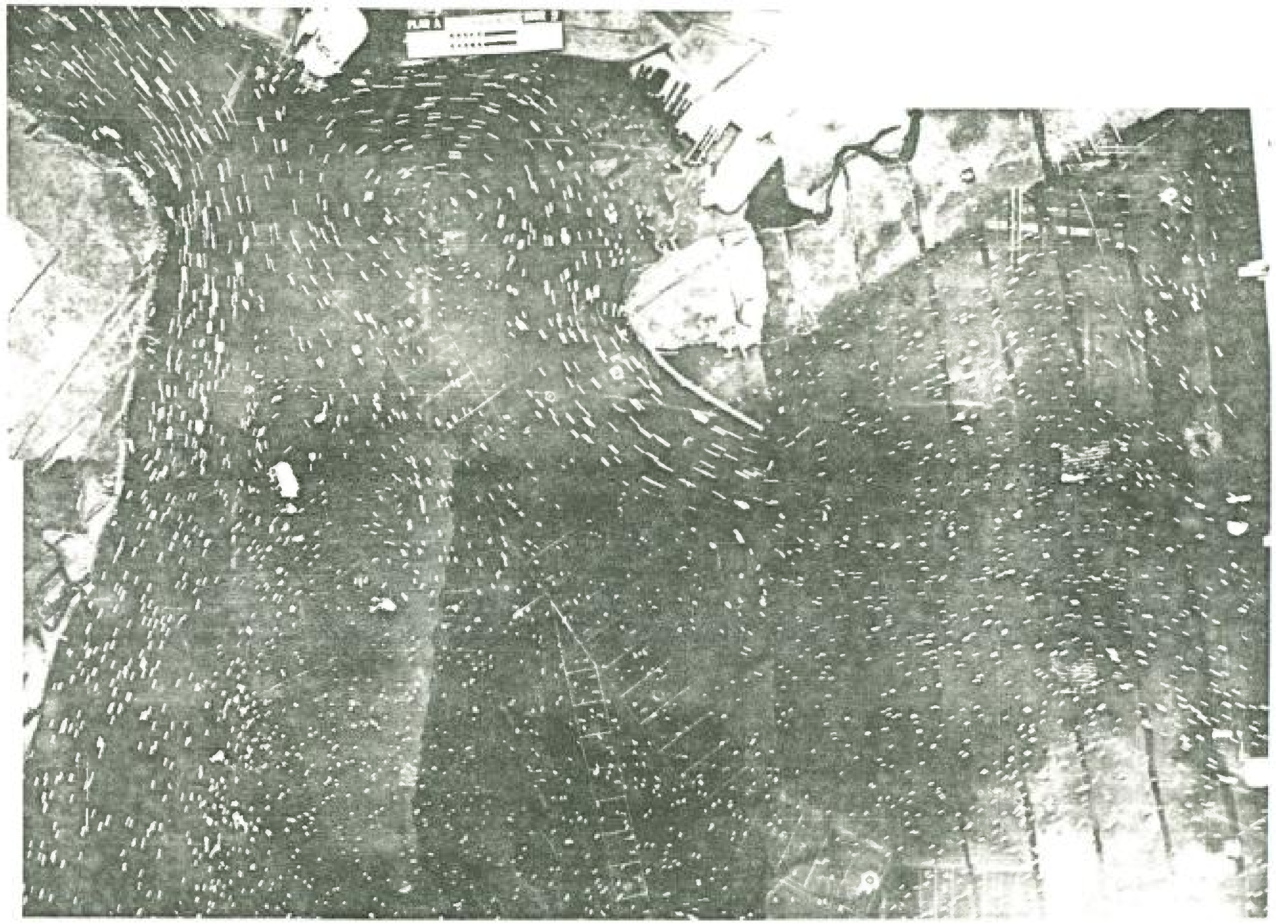
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 9



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

FPS PROTOTYPE

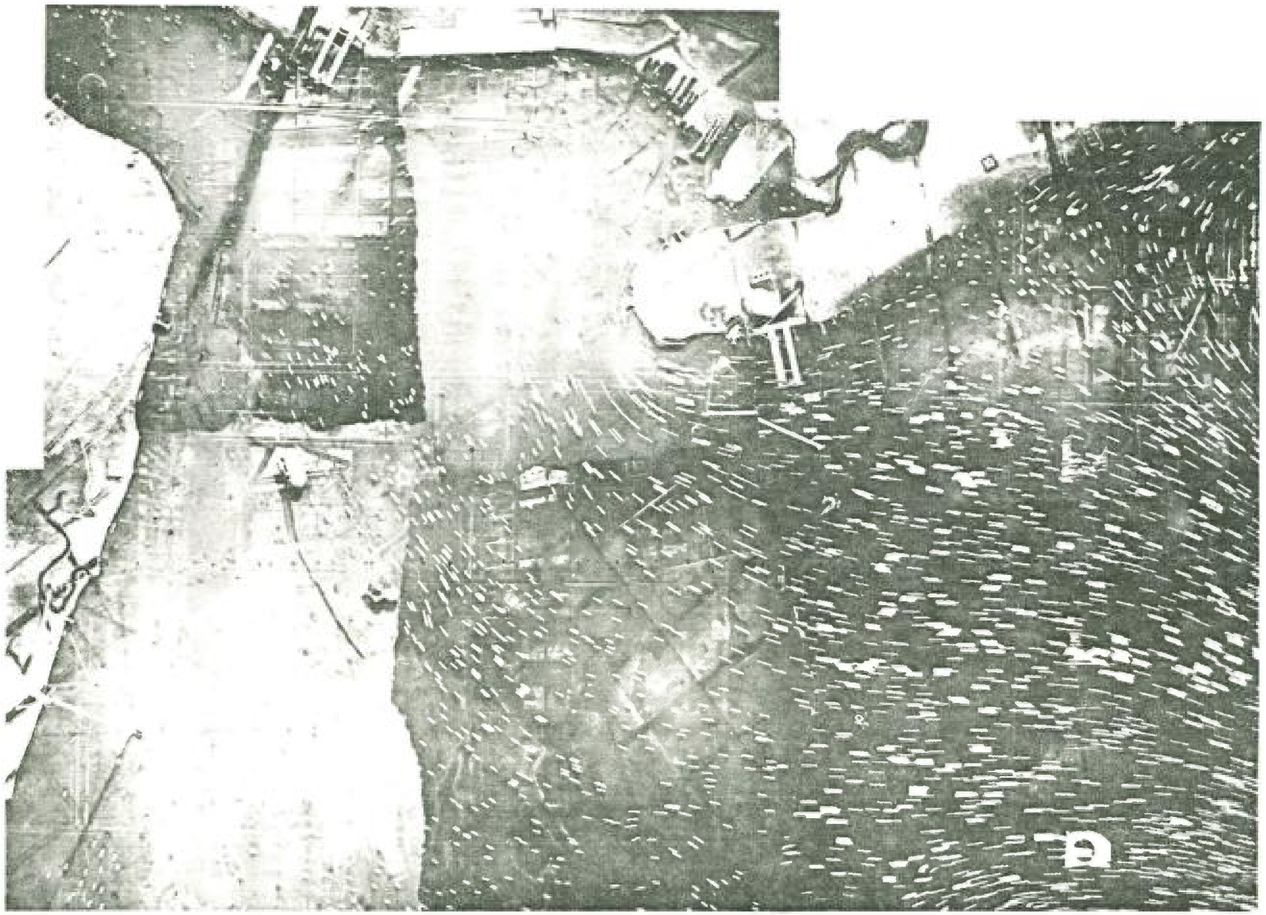
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

PLAN I

HOUR 9

PHOTO 20



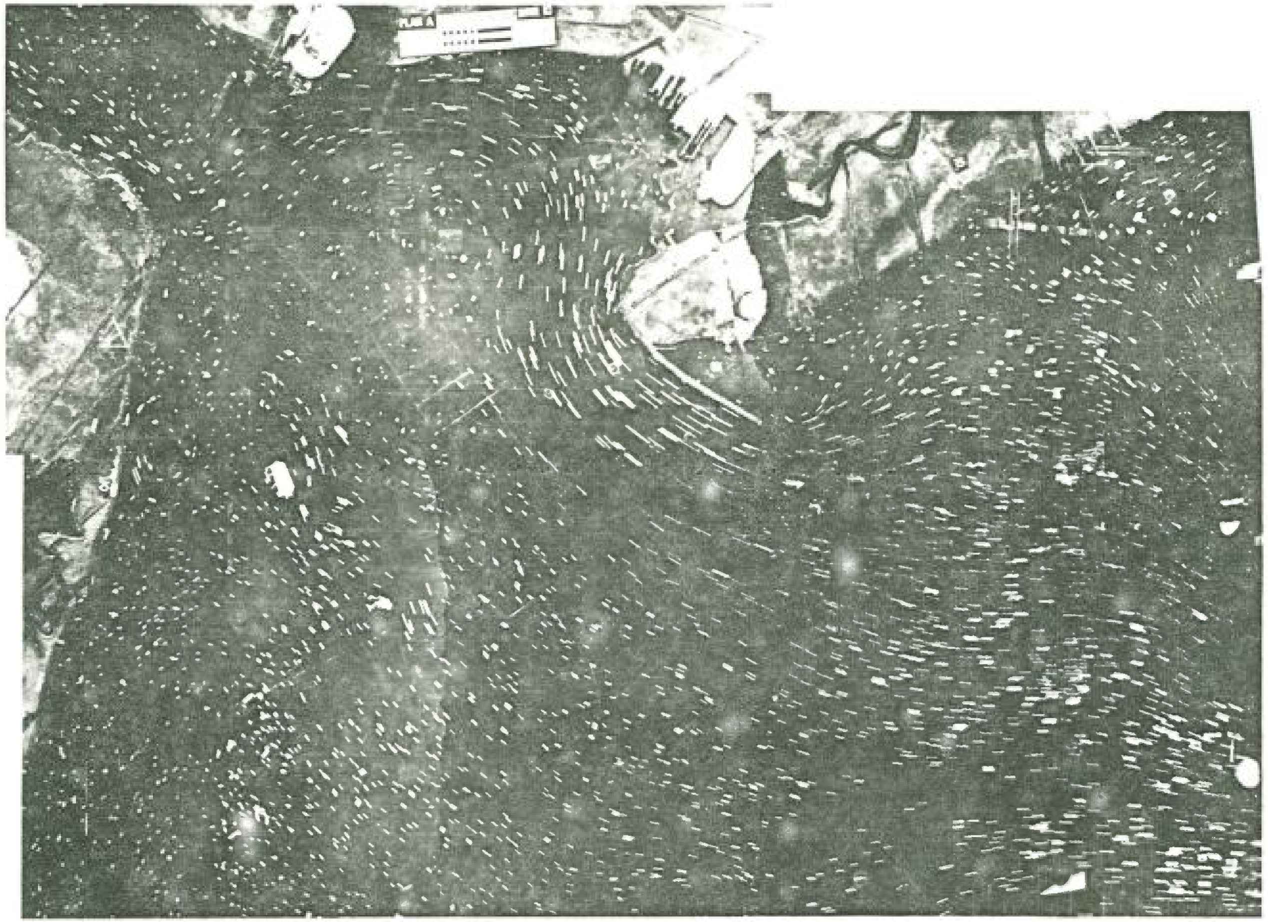
MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE
5 0 5 10
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS
BASE CONDITIONS
HOUR 10



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

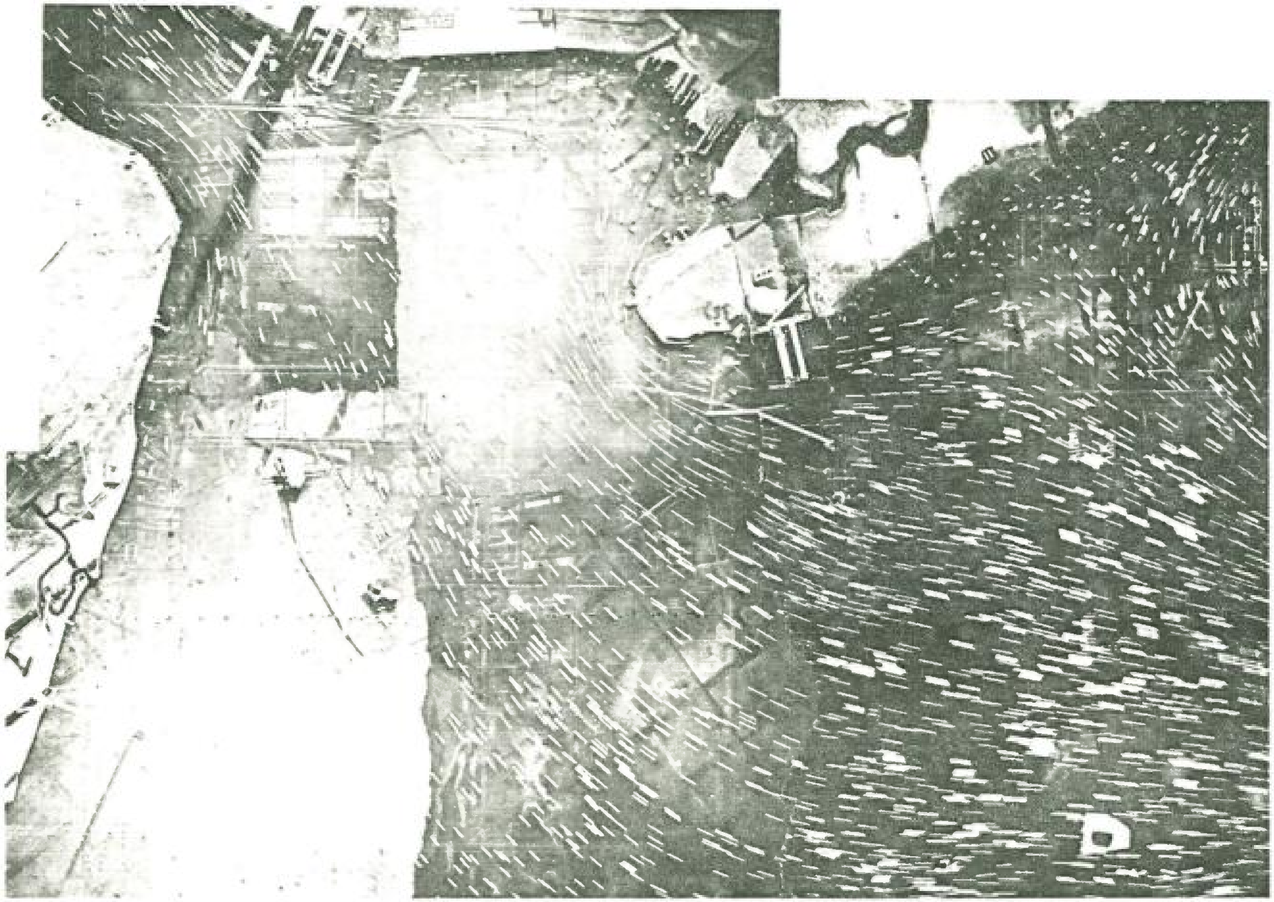
SURFACE CURRENT DIRECTIONS

PLAN 1

HOUR 10

PHOTO 22

PHOTO 23



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

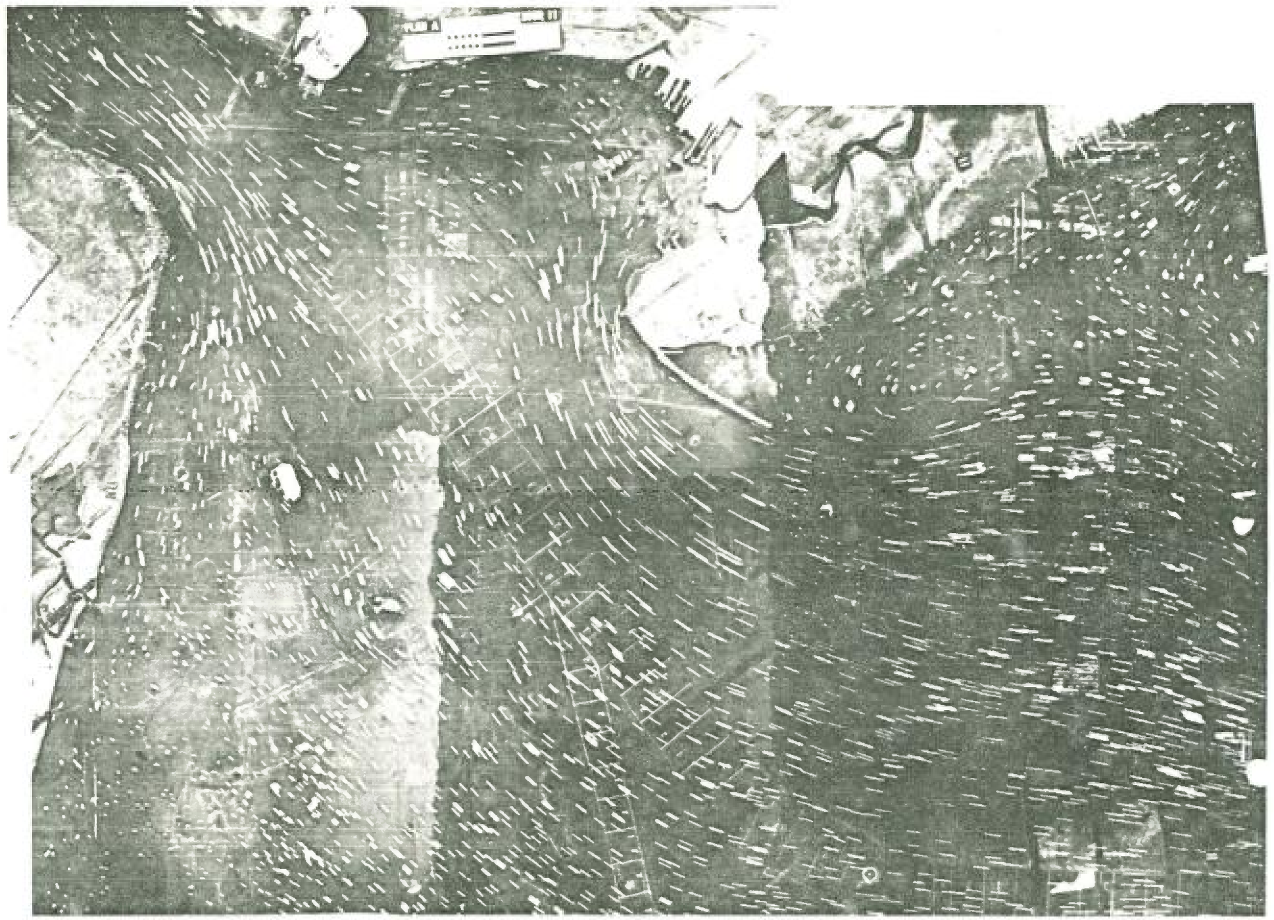
FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 11



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

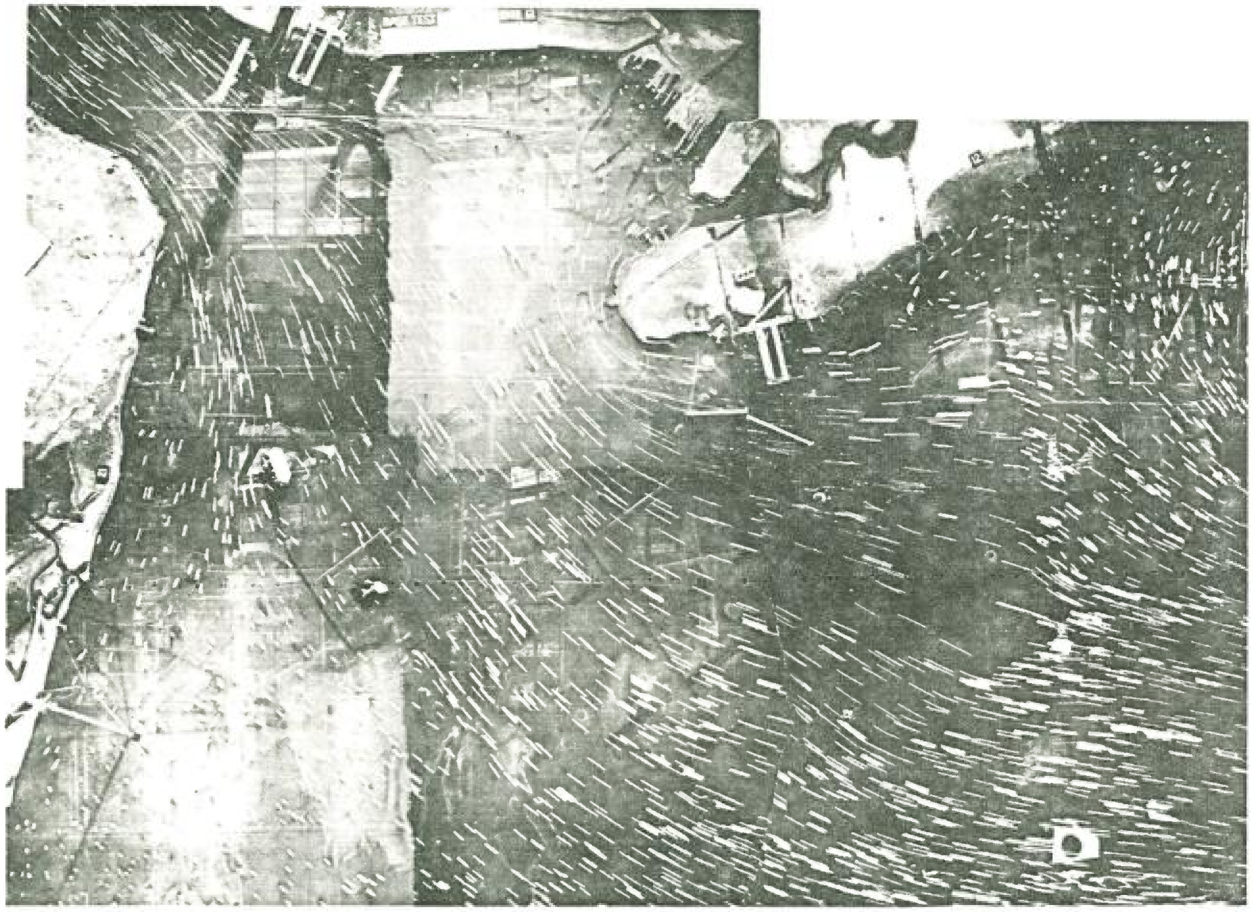
SURFACE CURRENT DIRECTIONS

PLAN I

HOUR 11

PHOTO 24

PHOTO 25



MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM

VELOCITY SCALE

5 0 5 10

FPS PROTOTYPE

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

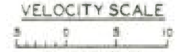
SURFACE CURRENT DIRECTIONS

BASE CONDITIONS

HOUR 12

MODEL TEST DATA

TIDE	MEAN
HUDSON RIVER FRESHWATER DISCHARGE	12,000 CFS (MEDIAN)
RARITAN RIVER FRESHWATER DISCHARGE	1,770 CFS
OCEAN SALINITY	30,000 PPM



NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

SURFACE CURRENT DIRECTIONS

PLAN 1

HOUR 12

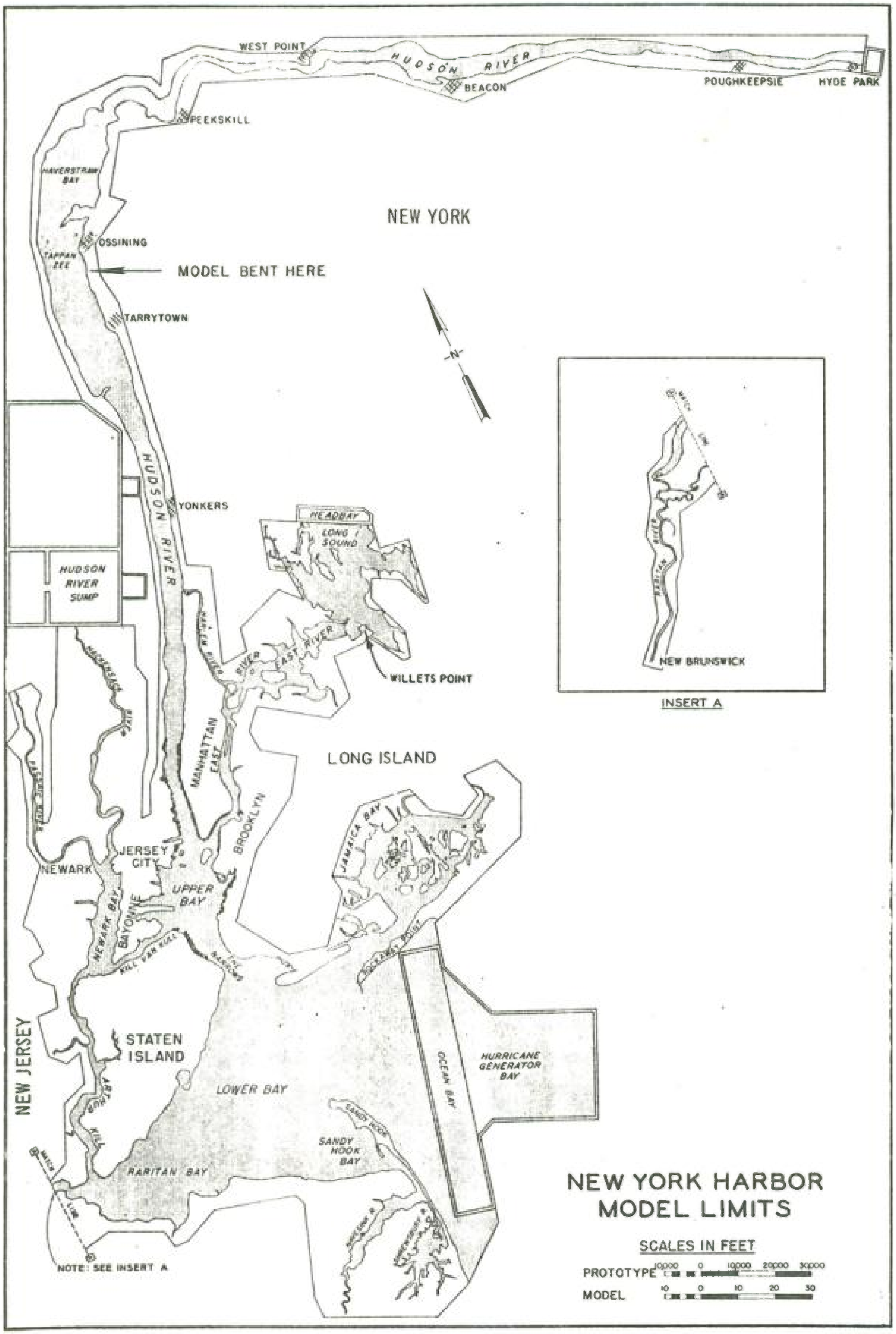
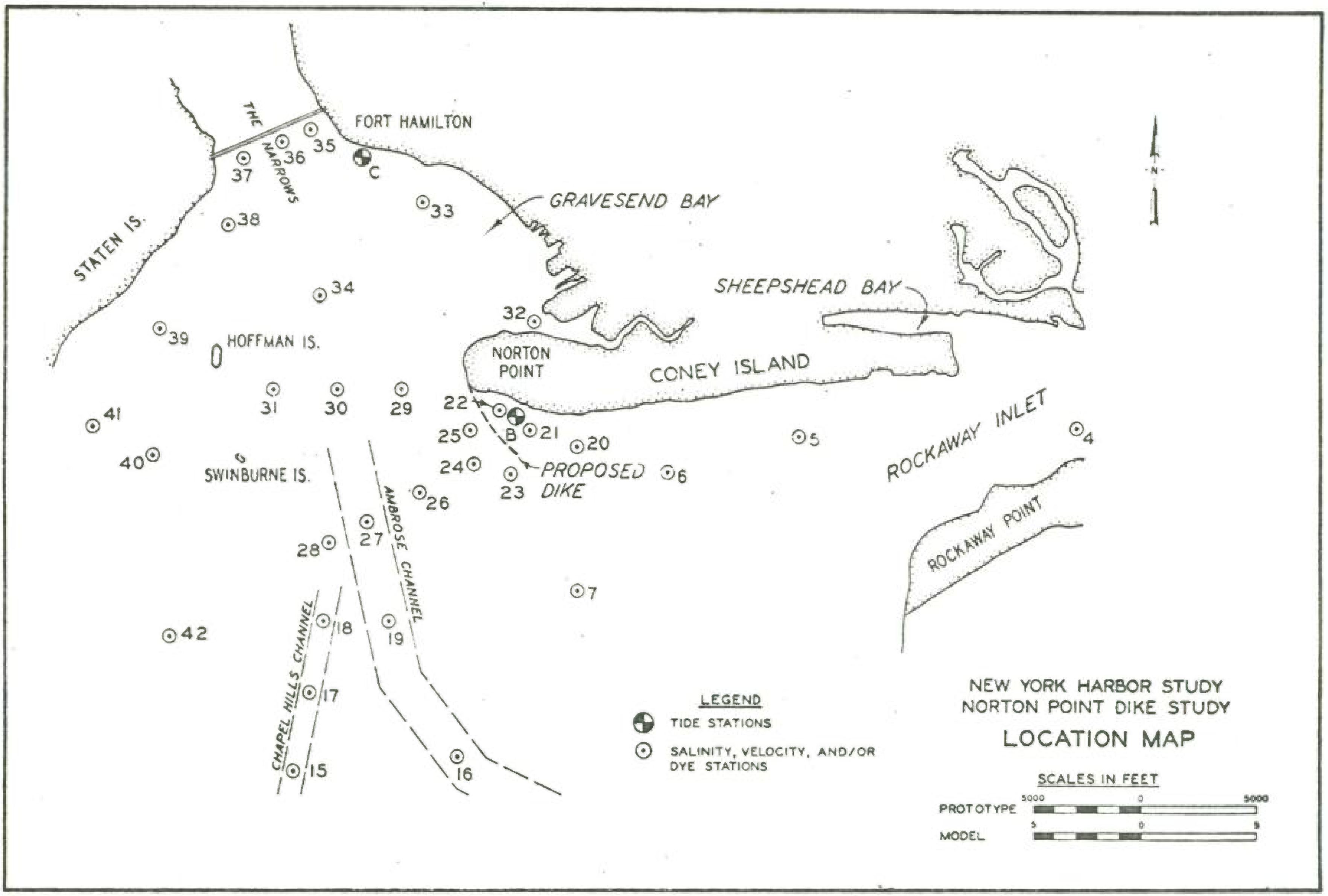
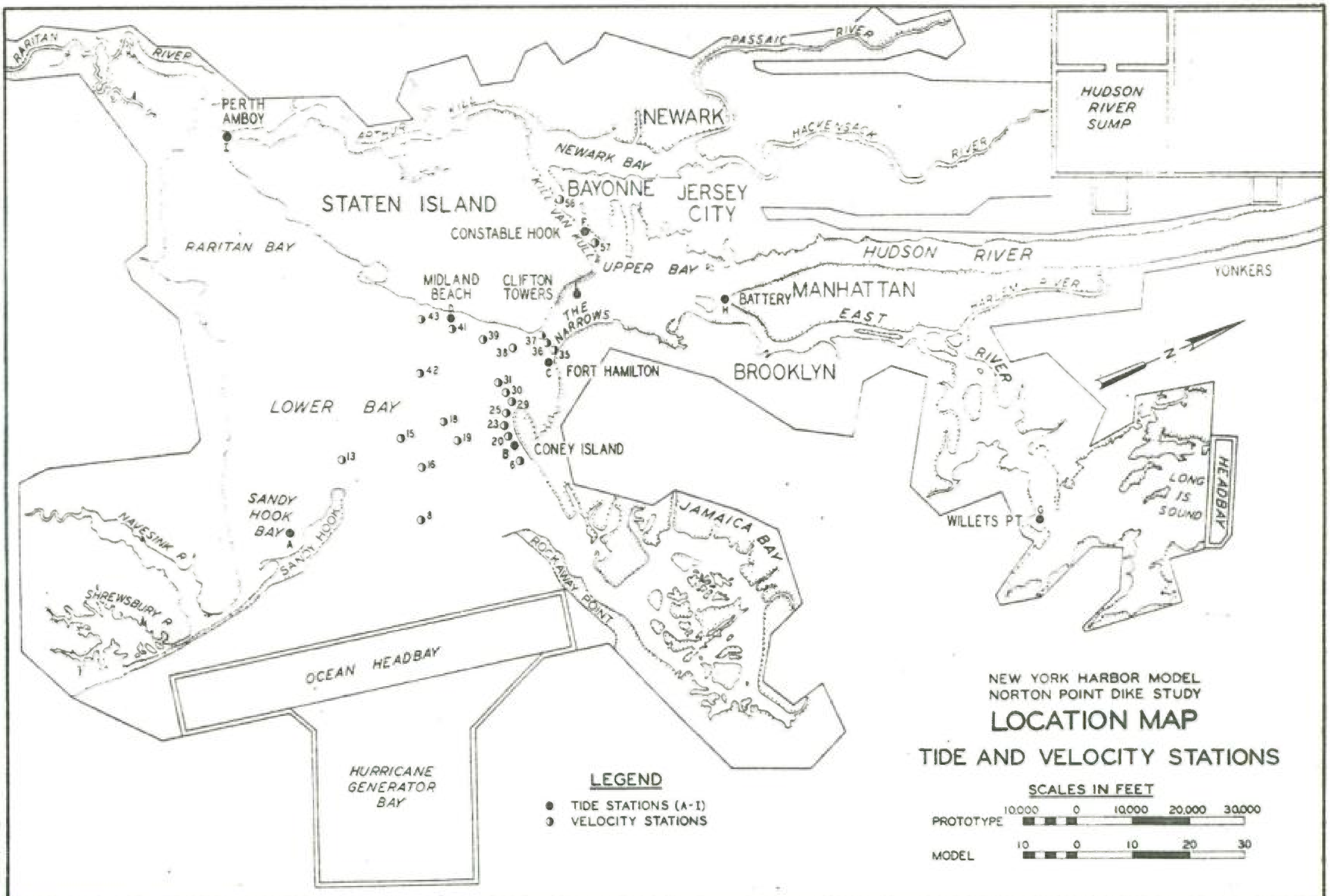

NEW YORK HARBOR
MODEL LIMITS
SCALES IN FEET
PROTOTYPE 10000 0 10000 20000 30000
MODEL 10 0 10 20 30
WEST POINT
HUDSON RIVER
BEACON
POUGHKEEPSIE
HYDE PARK
PEEKSKILL
HAVERSTRAW BAY
NEW YORK
OSSINING
TAPPAN ZEE
MODEL BENT HERE
TARRYTOWN
N
YONKERS
HUDSON RIVER SUMP
HEADBAY
LONG I SOUND
HARLEM RIVER
EAST RIVER
WILLETS POINT
NEW BRUNSWICK
INSERT A
MANHATTAN
EAST
LONG ISLAND
BROOKLYN
JAMAICA BAY
JERSEY CITY
NEWARK
NEWARK BAY
BAYONNE
UPPER BAY
KILL VAN KULL
ROCKAWAY POINT
NEW JERSEY
STATEN ISLAND
OCEAN BAY
HURRICANE GENERATOR BAY
LOWER BAY
SANDY HOOK
SANDY HOOK BAY
RARITAN BAY
ARTHUR KILL
NOTE: SEE INSERT A

PLATE 2



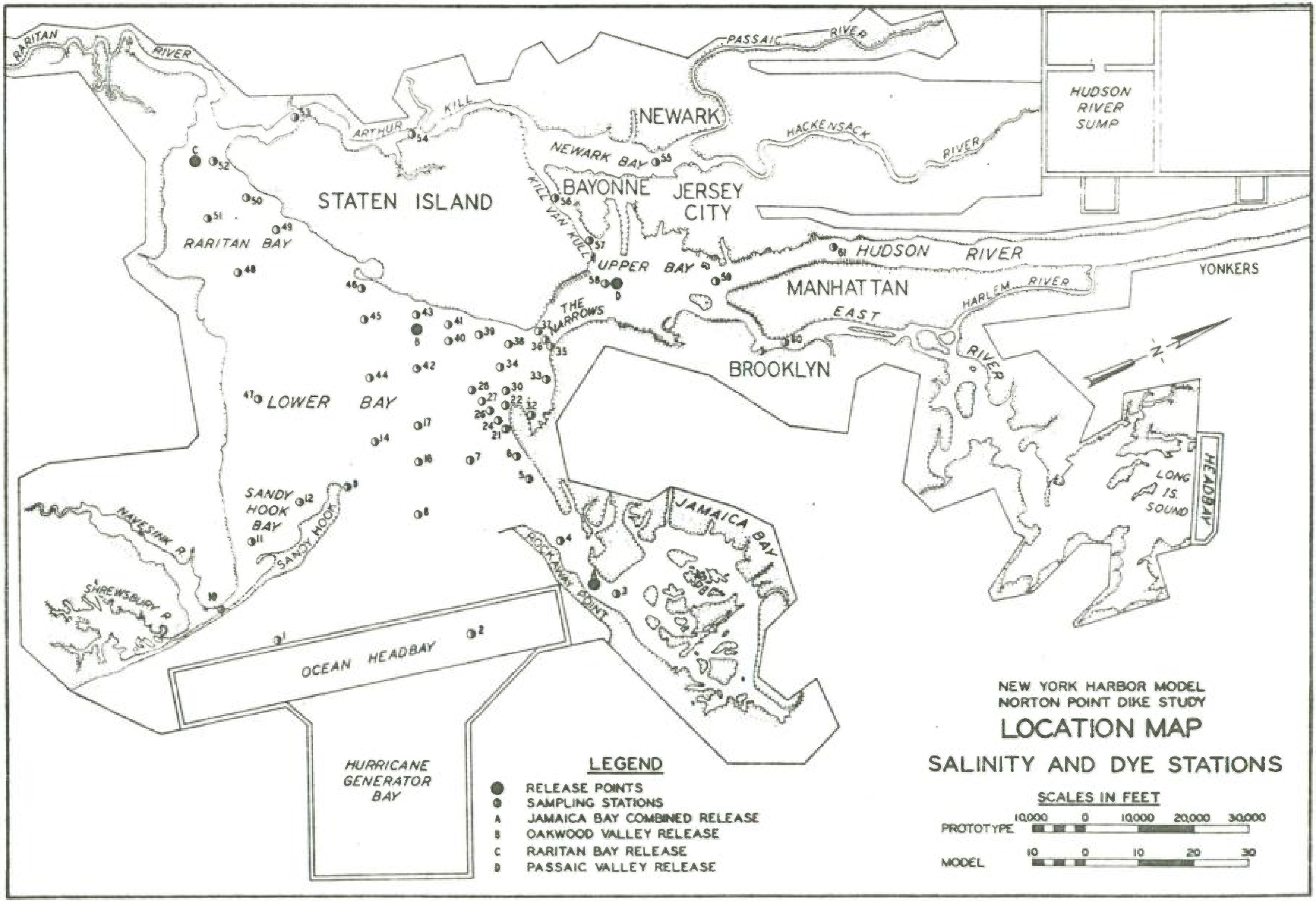
THE NARROWS
FORT HAMILTON
STATEN IS.
GRAVESEND BAY
SHEEPSHEAD BAY
HOFFMAN IS.
SWINBURNE IS.
NORTON POINT
CONEY ISLAND
ROCKAWAY INLET
ROCKAWAY POINT
PROPOSED DIKE
AMBROSE CHANNEL
CHAPEL HILLS CHANNEL
N
C
B
4
5
6
7
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
LEGEND
TIDE STATIONS
SALINITY, VELOCITY, AND/OR DYE STATIONS
NEW YORK HARBOR STUDY
NORTON POINT DIKE STUDY
LOCATION MAP
SCALES IN FEET
PROTOTYPE
5000
0
5000
MODEL
5
0
5



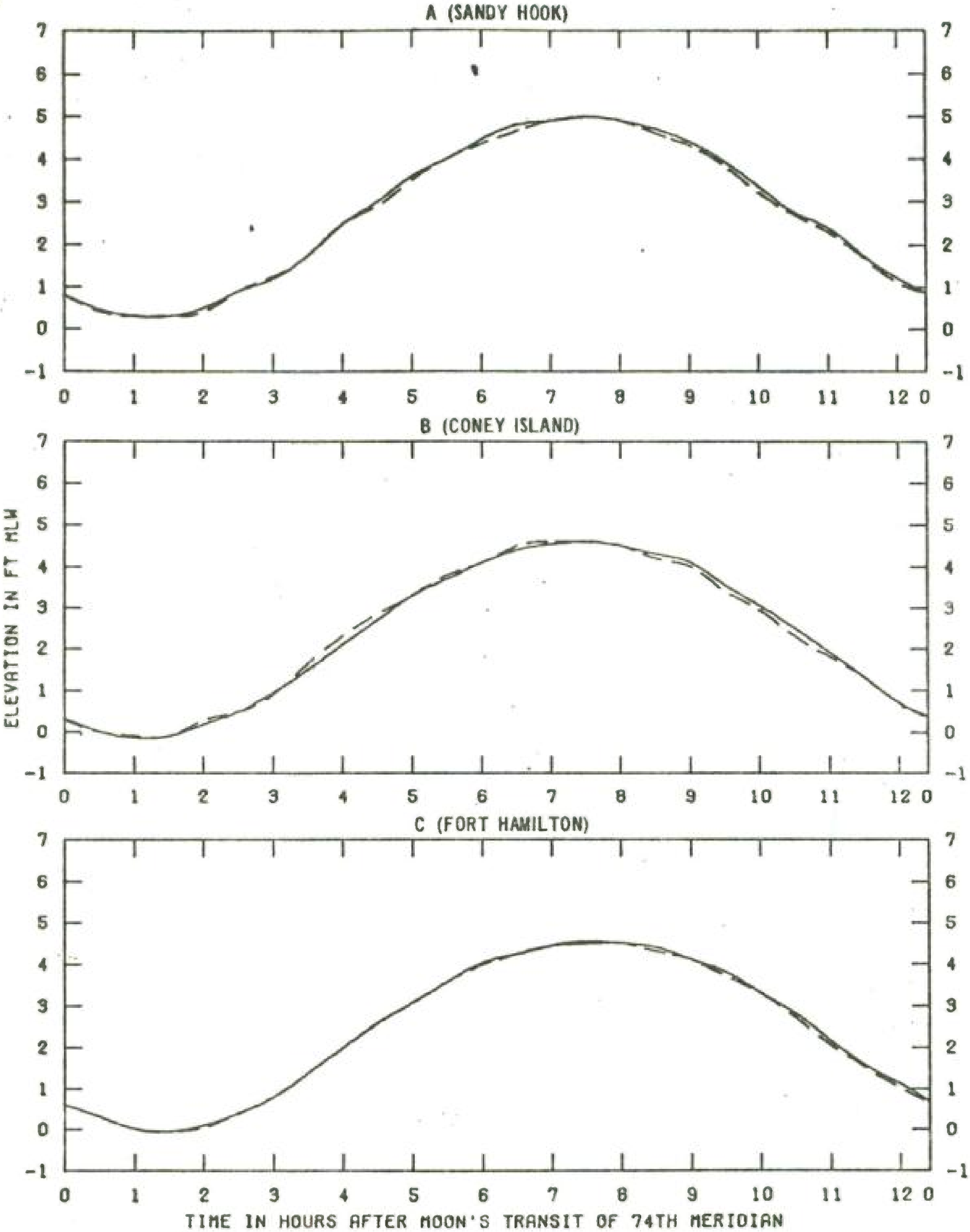
RARITAN RIVER
PASSAIC RIVER
PERTH AMBOY
I
ARTHUR KILL
NEWARK
NEWARK BAY
HACKENSACK RIVER
HUDSON RIVER SUMP
BAYONNE
JERSEY CITY
STATEN ISLAND
KILL VAN KULL
56
F
57
CONSTABLE HOOK
RARITAN BAY
UPPER BAY
HUDSON RIVER
YONKERS
MIDLAND BEACH
D
CLIFTON TOWERS
THE NARROWS
BATTERY
H
MANHATTAN
HARLEM RIVER
EAST RIVER
43
41
39
38
37
36
35
C
FORT HAMILTON
BROOKLYN
42
31
30
29
25
23
20
B
6
LOWER BAY
18
15
19
13
16
CONEY ISLAND
SANDY HOOK BAY
A
SANDY HOOK
8
NAVESINK R.
SHREWSBURY R.
ROCKAWAY POINT
JAMAICA BAY
WILLETS PT.
G
LONG IS. SOUND
HEADBAY
OCEAN HEADBAY
HURRICANE GENERATOR BAY
LEGEND
TIDE STATIONS (A-I)
VELOCITY STATIONS
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY
LOCATION MAP
TIDE AND VELOCITY STATIONS
SCALES IN FEET
PROTOTYPE 10,000 0 10,000 20,000 30,000
MODEL 10 0 10 20 30

PLATE 3

PLATE 4



RARITAN RIVER
PASSAIC RIVER
ARTHUR KILL
NEWARK
HACKENSACK RIVER
HUDSON RIVER SUMP
NEWARK BAY
KILL VAN KULL
BAYONNE
JERSEY CITY
STATEN ISLAND
RARITAN BAY
UPPER BAY
HUDSON RIVER
YONKERS
MANHATTAN
HARLEM RIVER
THE NARROWS
EAST RIVER
BROOKLYN
LOWER BAY
SANDY HOOK BAY
SANDY HOOK
NAVESINK R.
SHREWSBURY R.
JAMAICA BAY
ROCKAWAY POINT
LONG IS. SOUND
HEADBAY
OCEAN HEADBAY
HURRICANE GENERATOR BAY
N
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY
LOCATION MAP
SALINITY AND DYE STATIONS
LEGEND
RELEASE POINTS
SAMPLING STATIONS
A JAMAICA BAY COMBINED RELEASE
B OAKWOOD VALLEY RELEASE
C RARITAN BAY RELEASE
D PASSAIC VALLEY RELEASE
SCALES IN FEET
PROTOTYPE 10,000 0 10,000 20,000 30,000
MODEL 10 0 10 20 30



TEST CONDITIONS

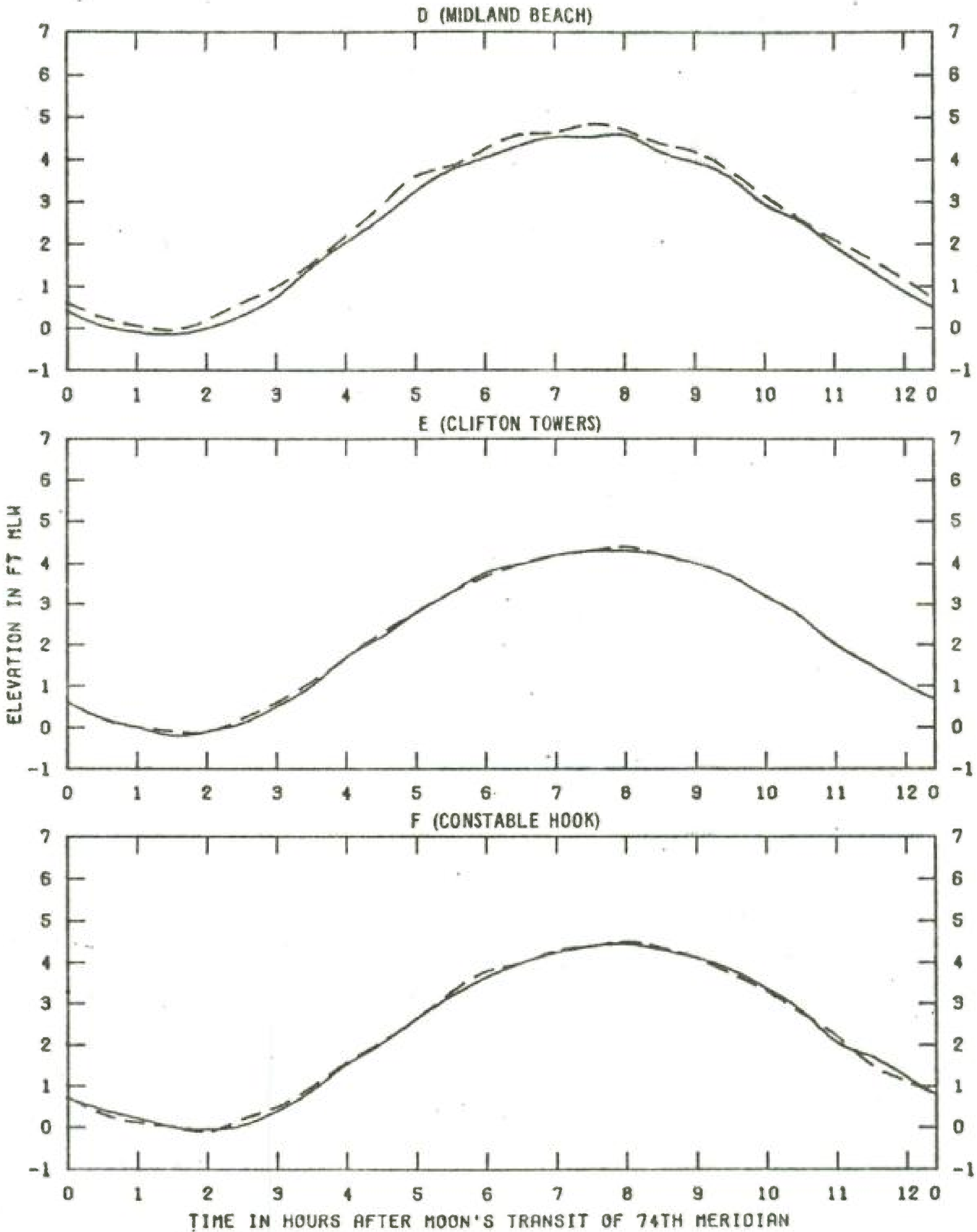
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

LEGEND
BASE ————
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON TIDAL HEIGHTS
STATIONS
A , B , AND C

PLATE 5



TEST CONDITIONS

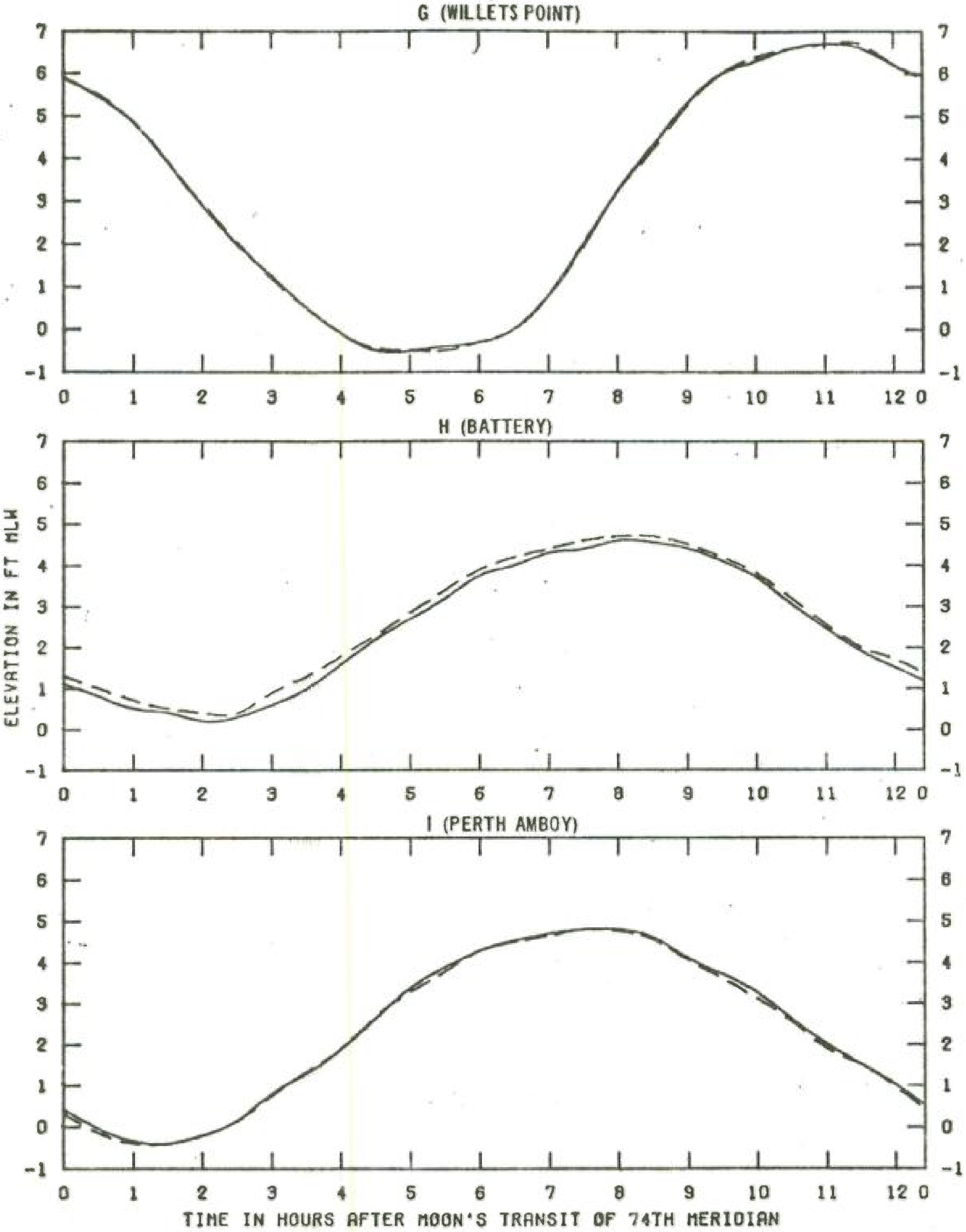
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON TIDAL HEIGHTS

STATIONS
D , E , AND F

PLATE 6



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

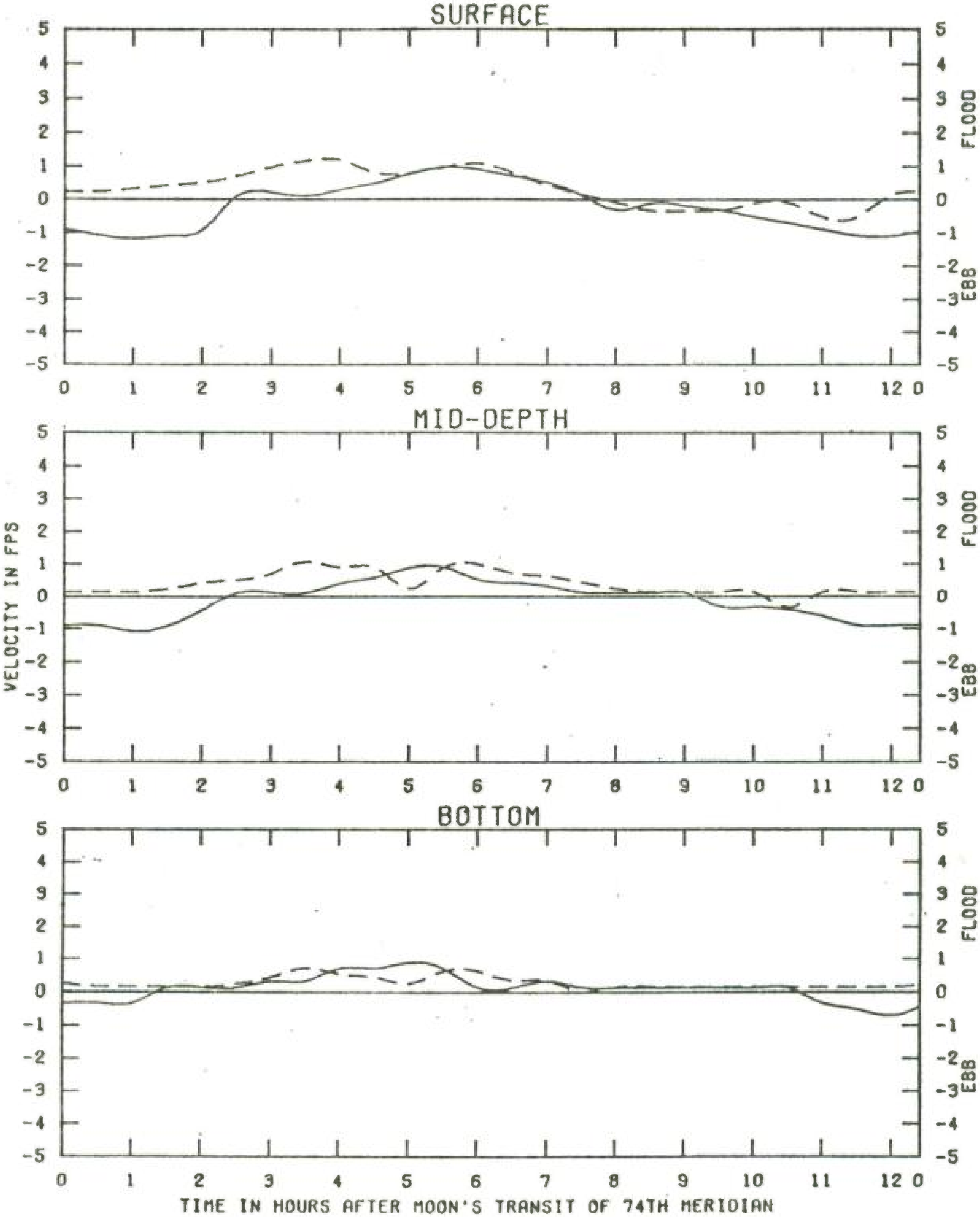
LEGEND
BASE ———
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON TIDAL HEIGHTS

STATIONS
G , H , AND I

PLATE 7



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

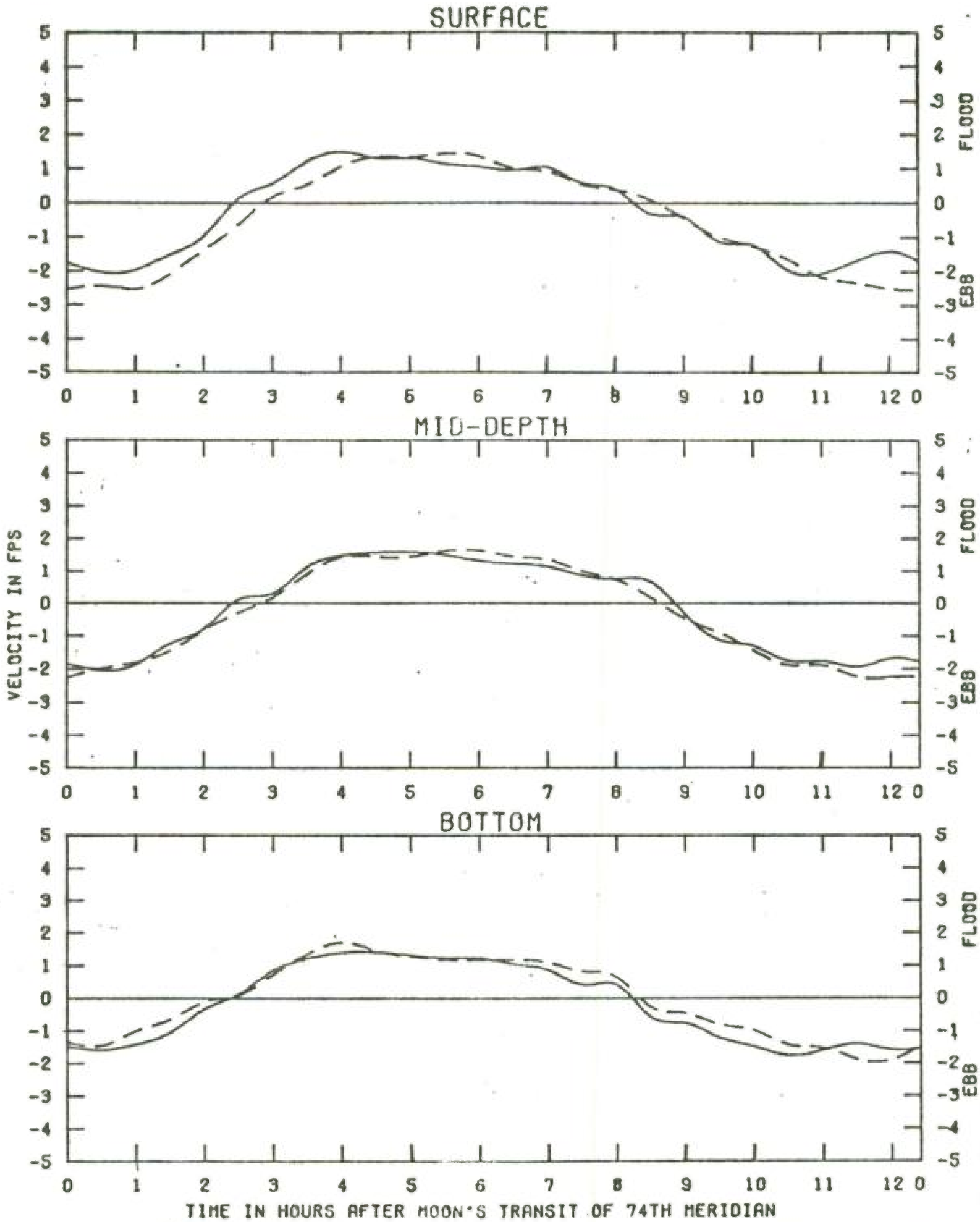
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
06

LEGEND
BASE ———
PLAN 1 — — —

PLATE 8



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

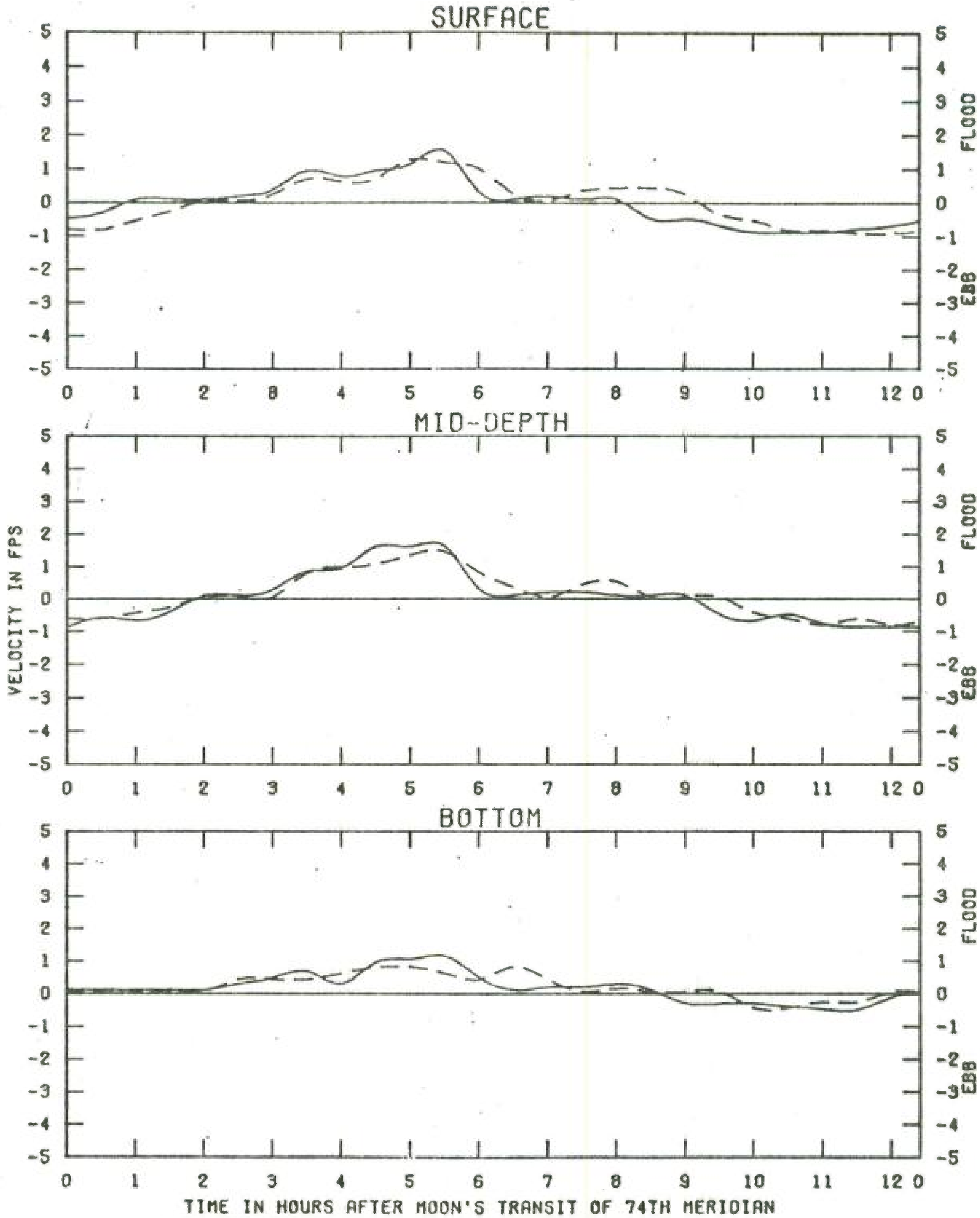
LEGEND
BASE ———
PLAN 1 – – –

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
08

PLATE 9



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

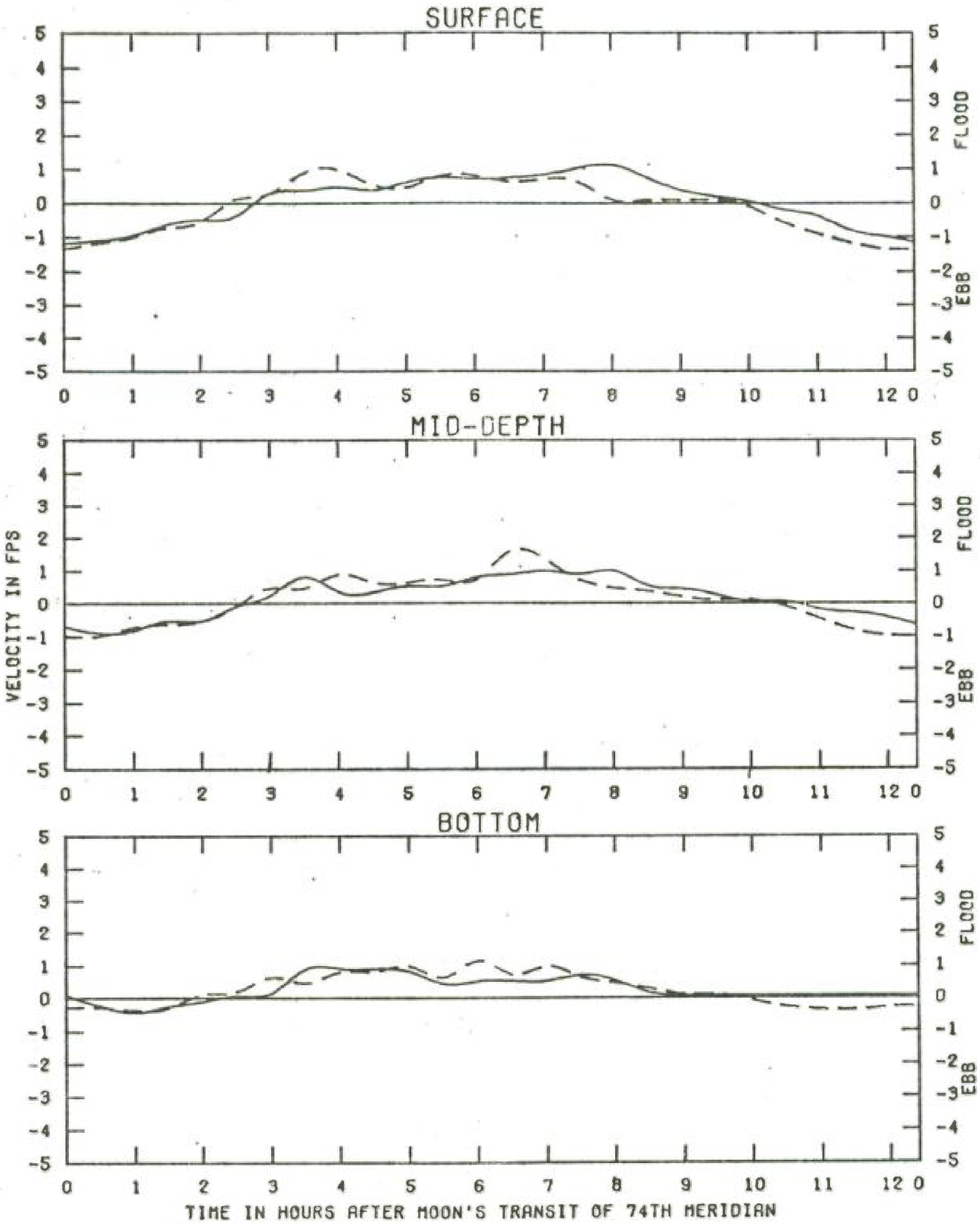
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
13

LEGEND
BASE ———
PLAN 1 – – –

PLATE 10



TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

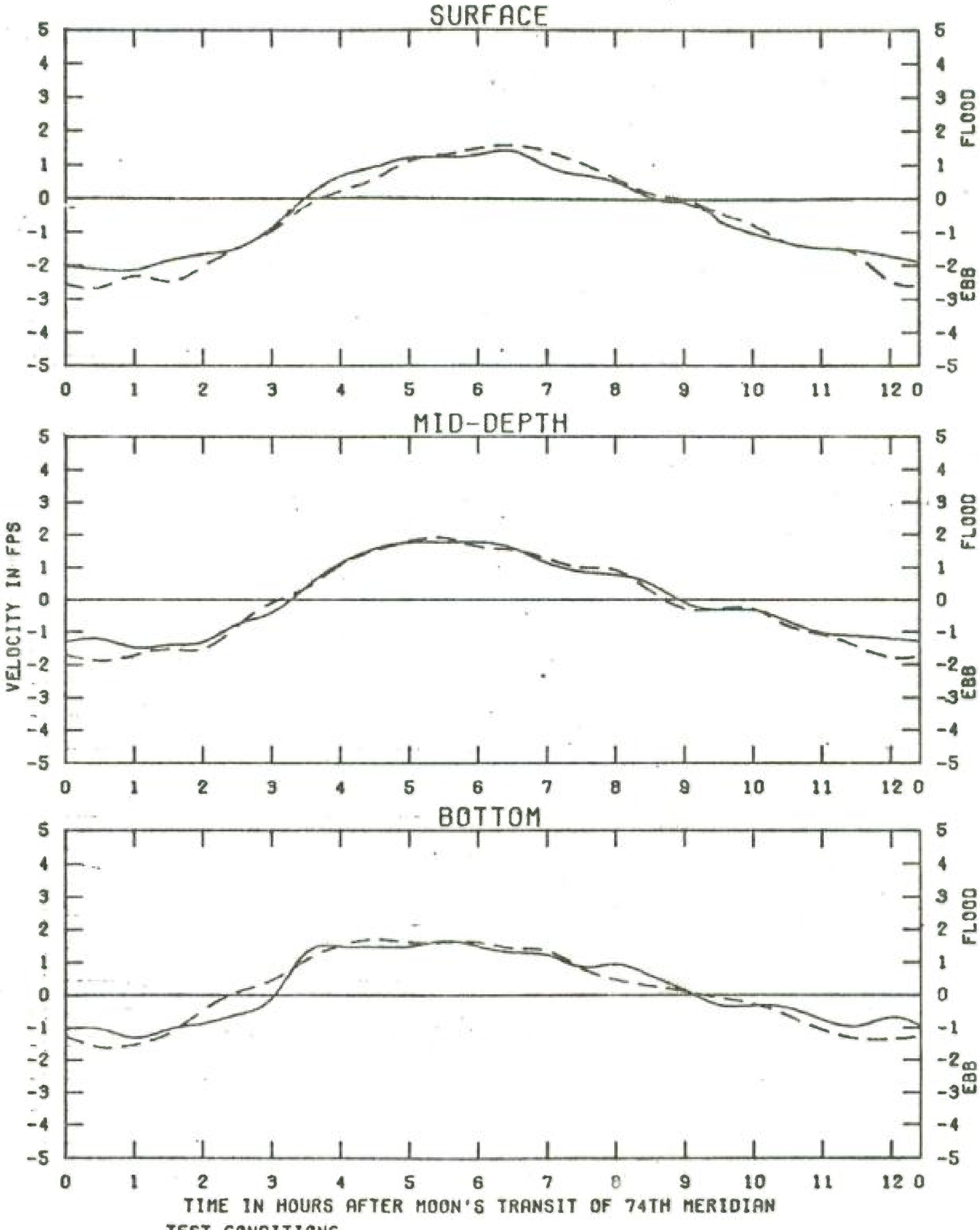
LEGEND
BASE ————
PLAN 1 – – –

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
15

PLATE 11



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

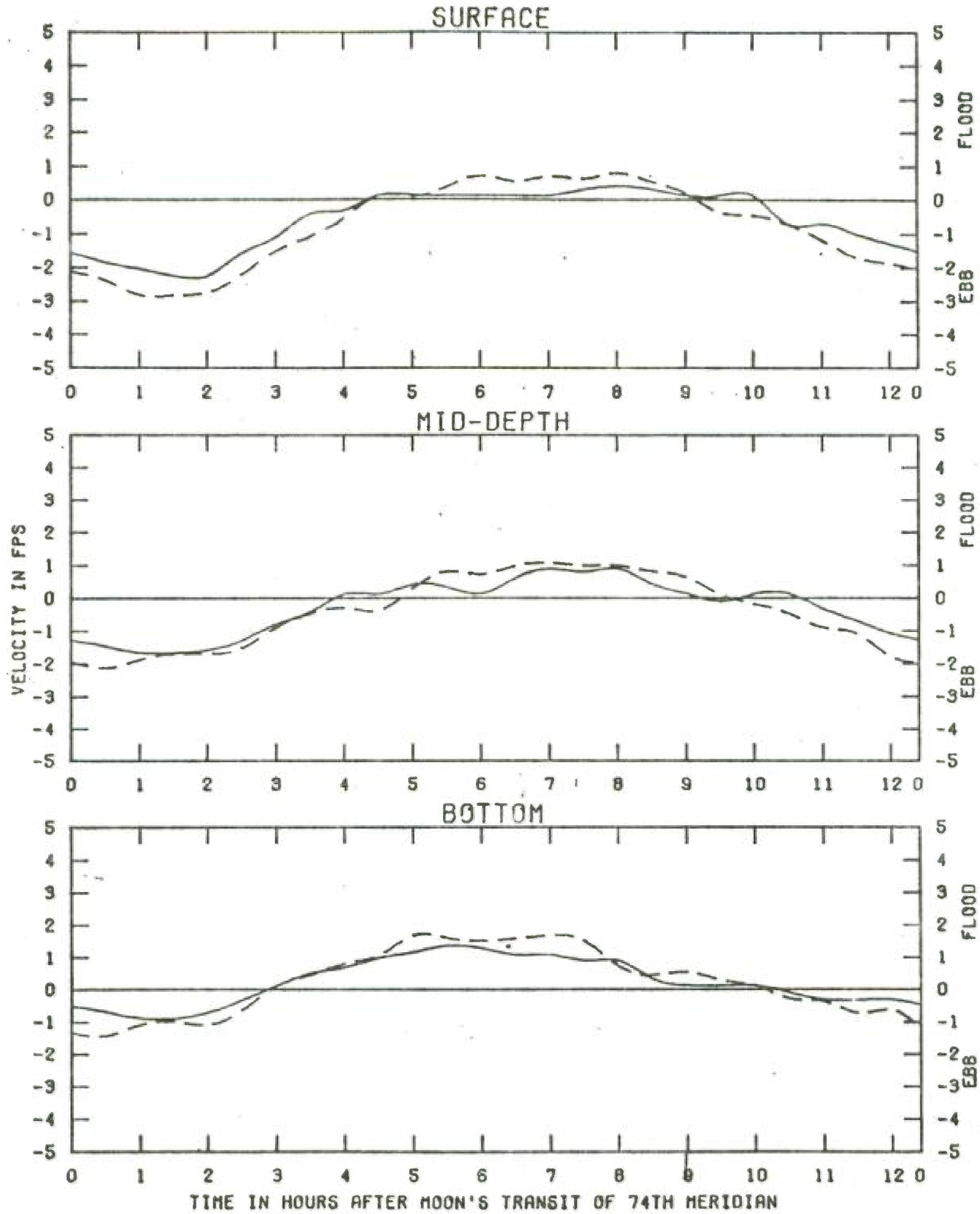
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
16

LEGEND
BASE ———
PLAN 1 — — —

PLATE 12



TEST CONDITIONS

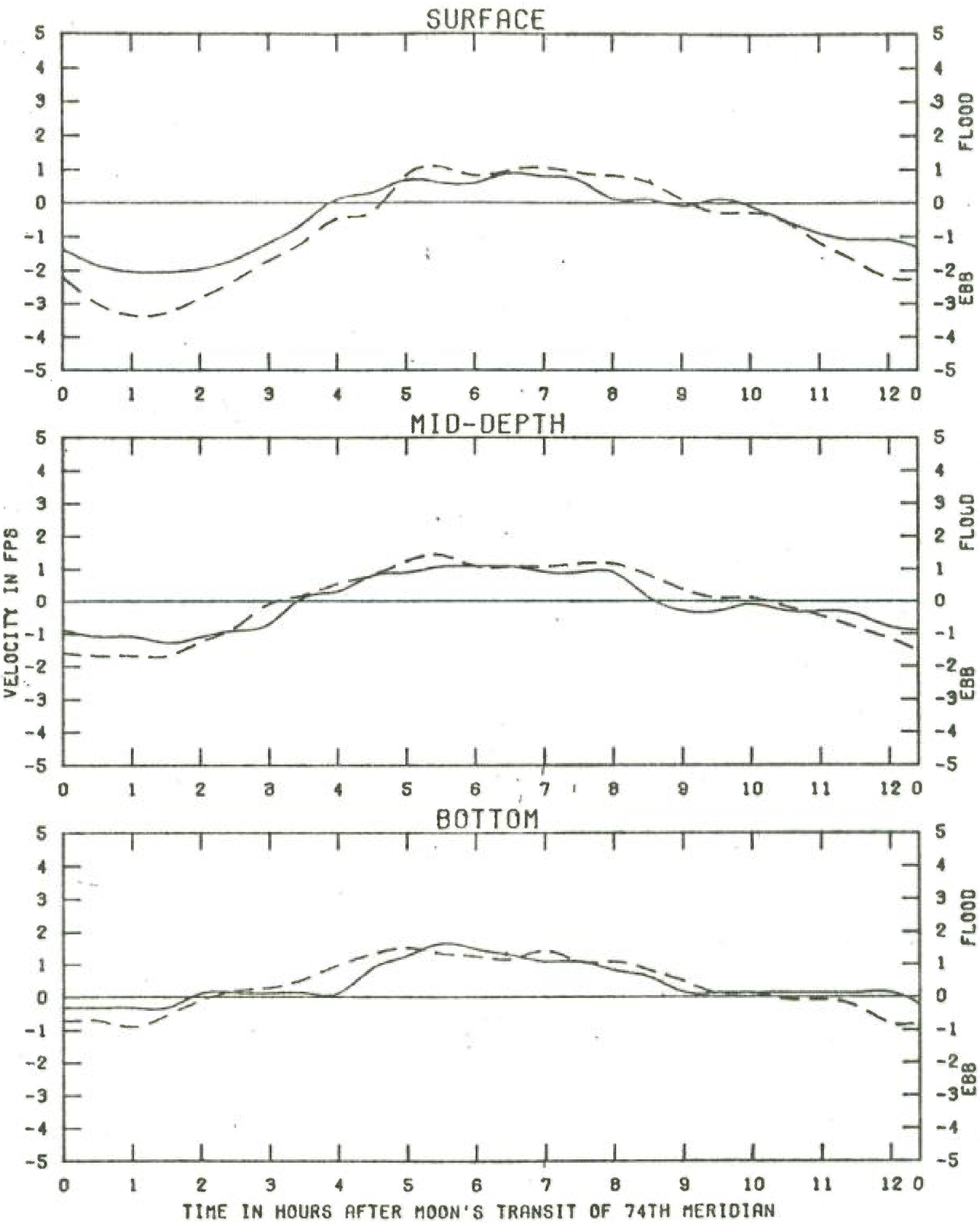
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

LEGEND
BASE ———
PLAN 1 – – –

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
18



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS

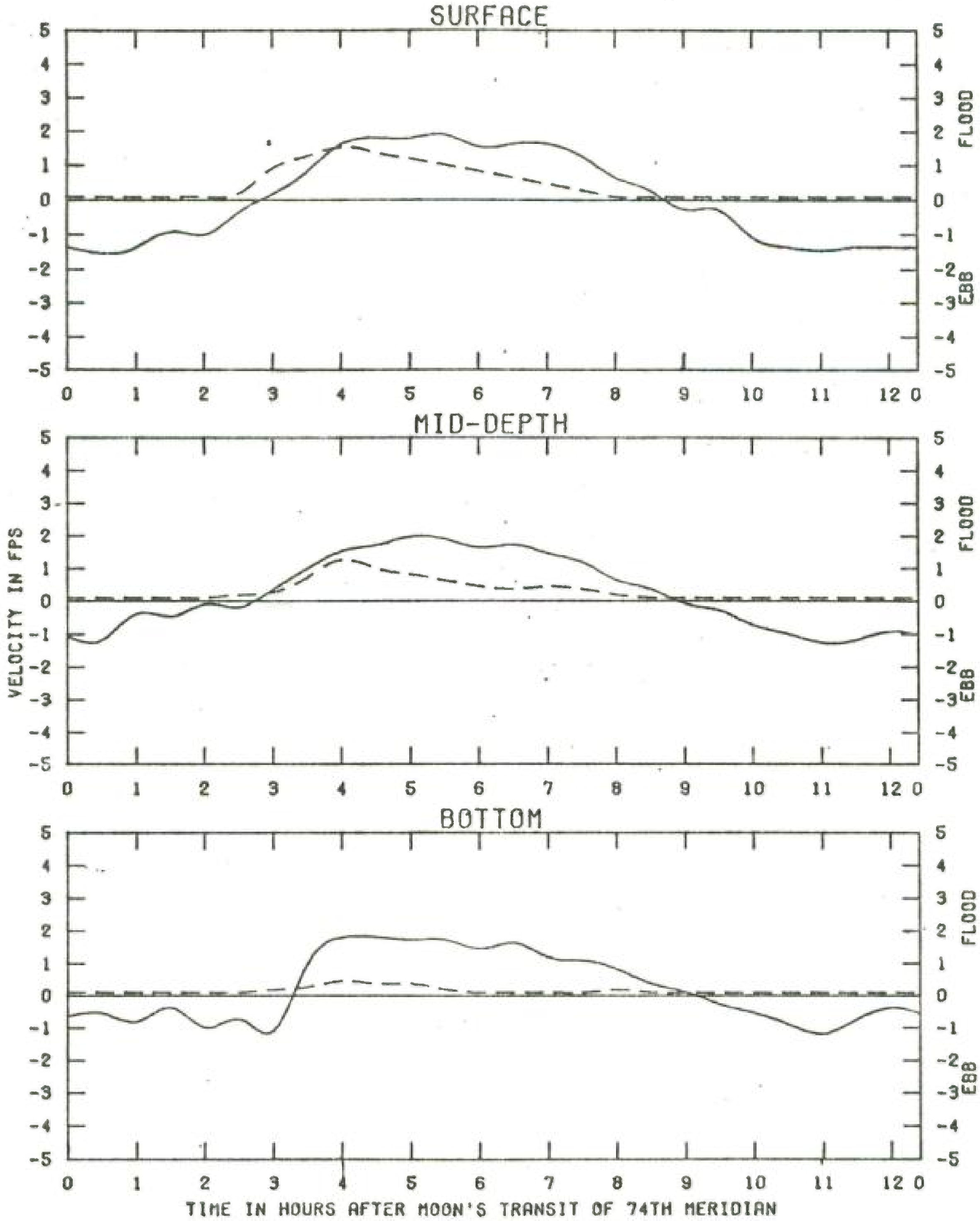
LEGEND
BASE ————
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
19

PLATE 14



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

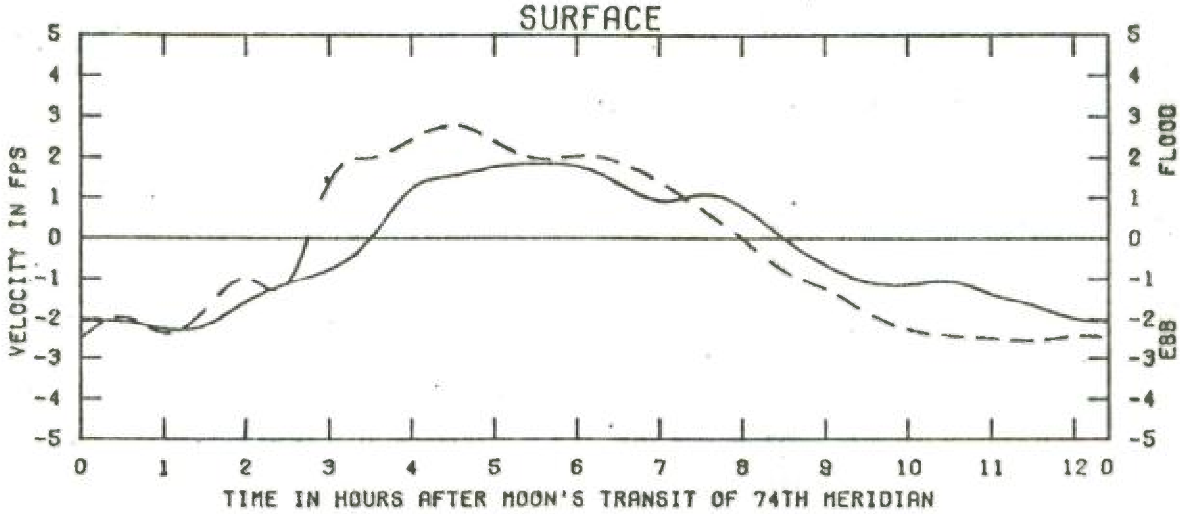
LEGEND
BASE ———
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
20

PLATE 15



TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

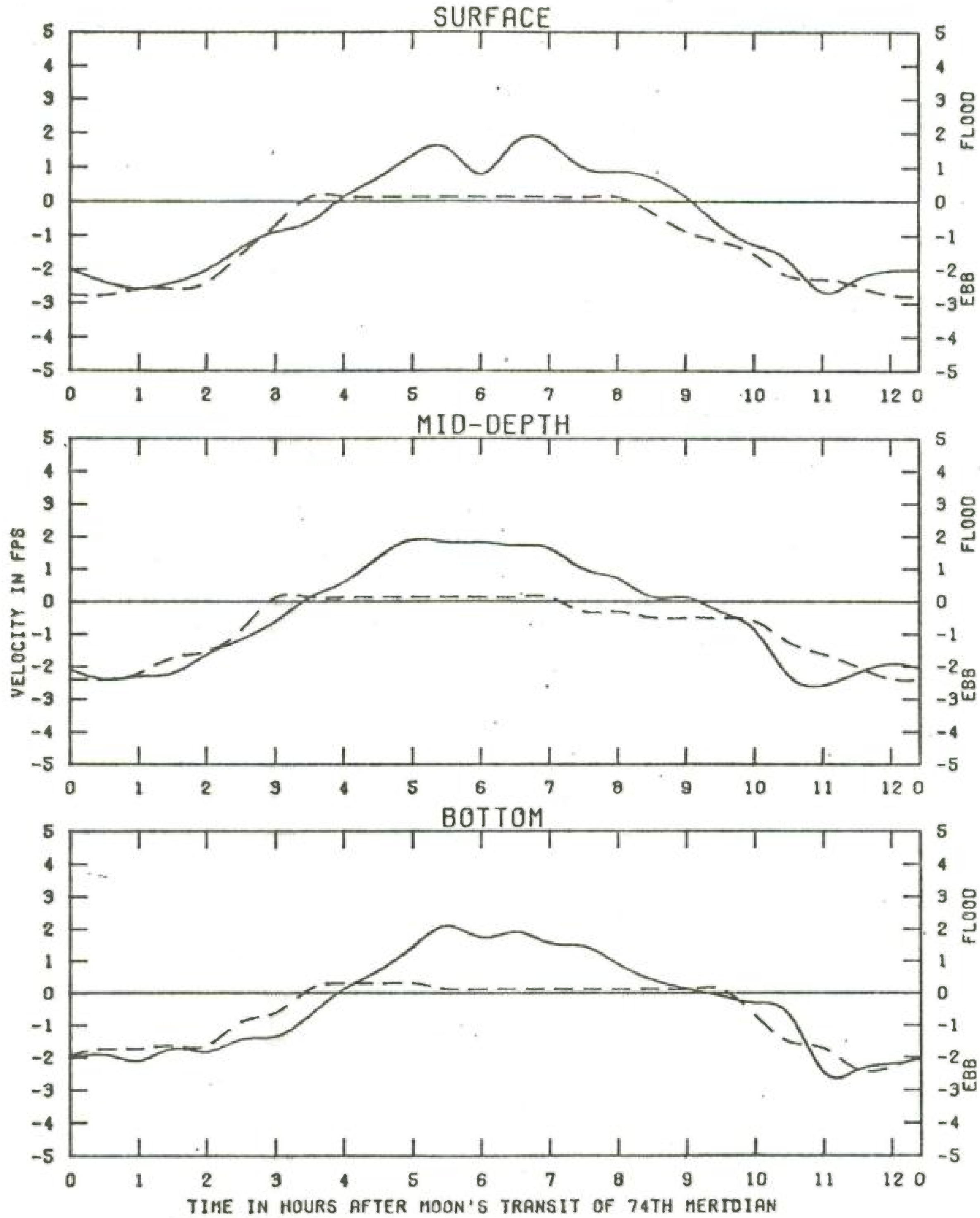
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
23

LEGEND
BASE ———
PLAN 1 — — —

PLATE 16



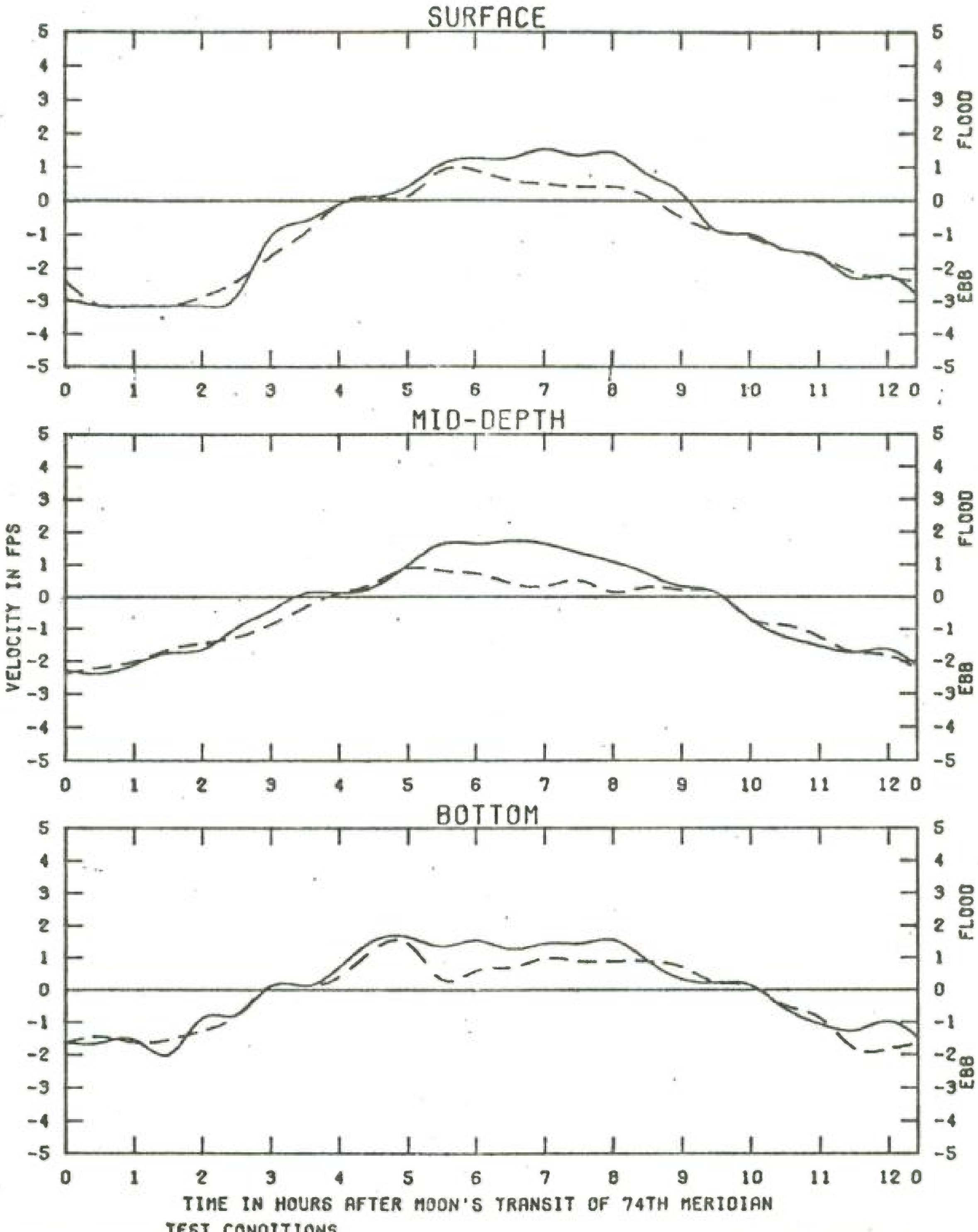
TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON VELOCITIES

STATION 25



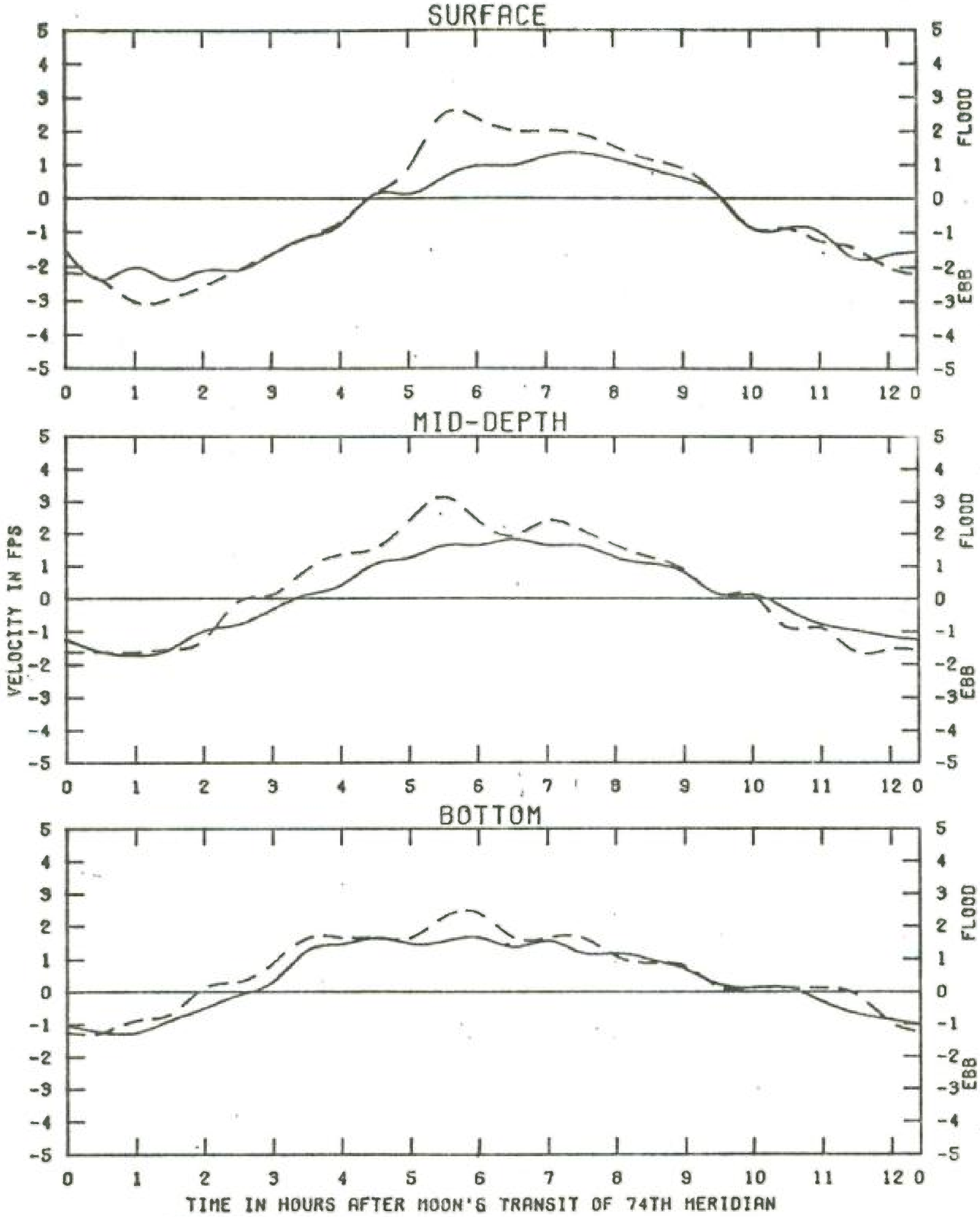
TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

LEGEND
BASE ————
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
29



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

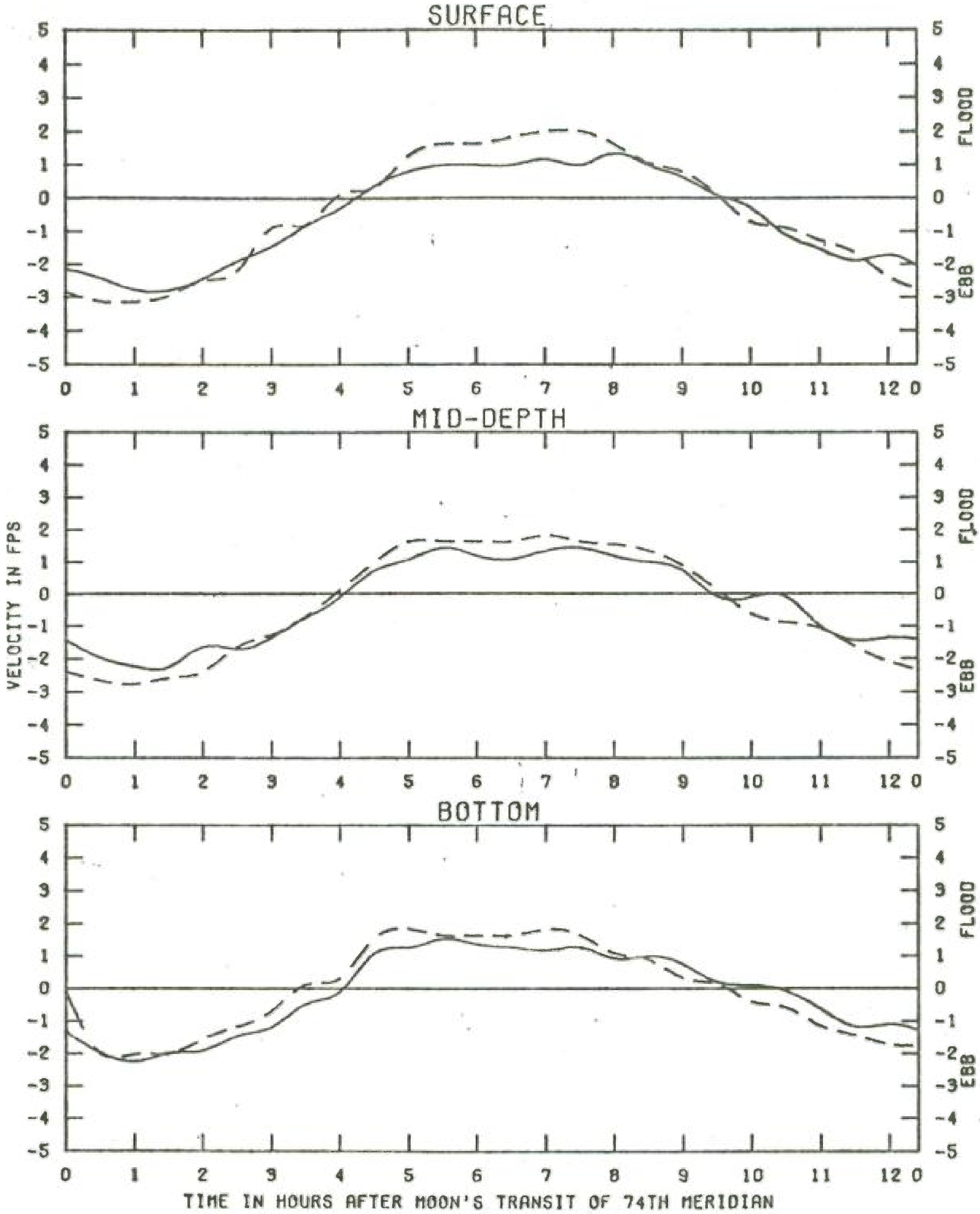
LEGEND
BASE ———
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
30

PLATE 19



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

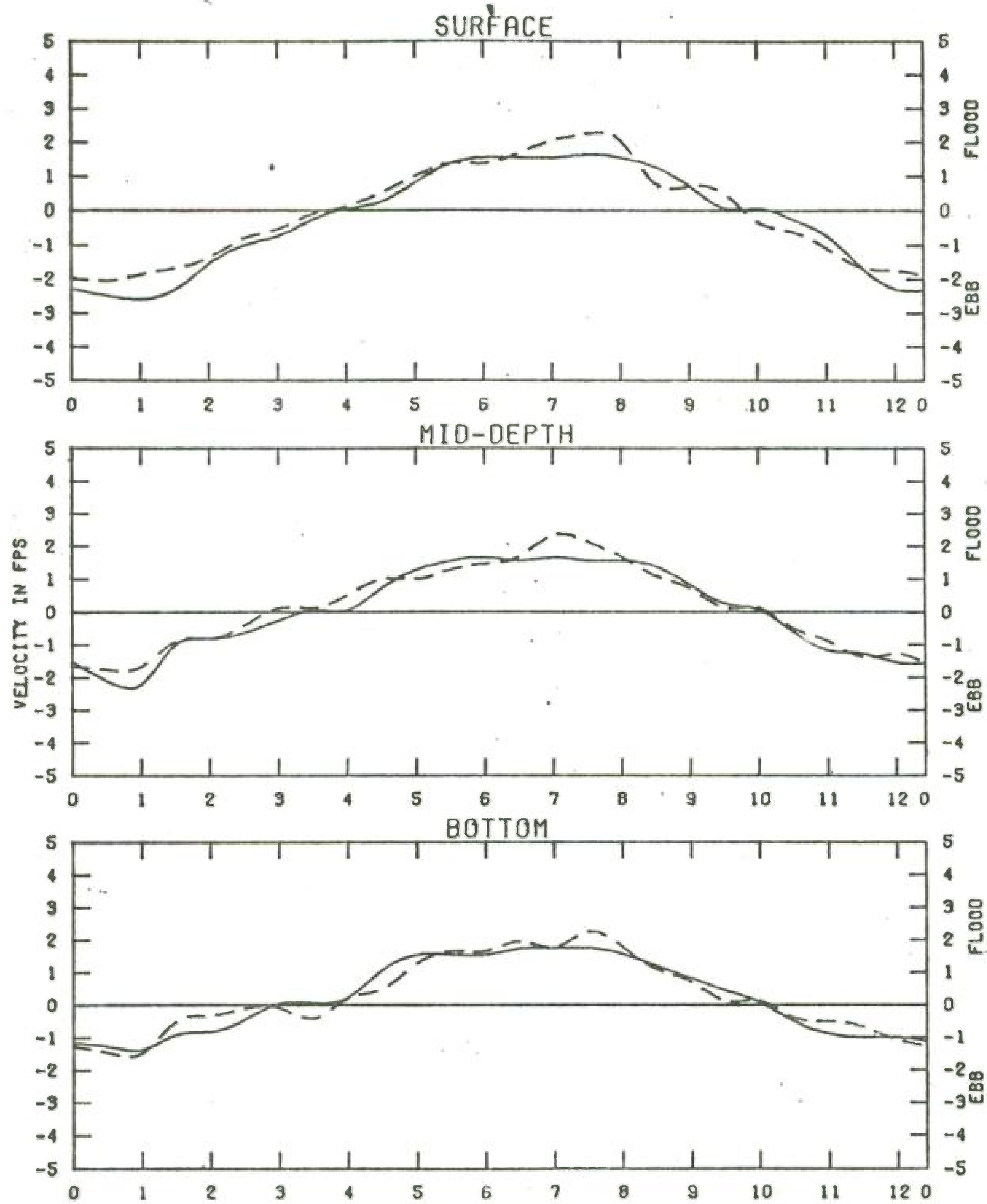
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
31

LEGEND
BASE ————
PLAN 1 — — — —

PLATE 20



TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

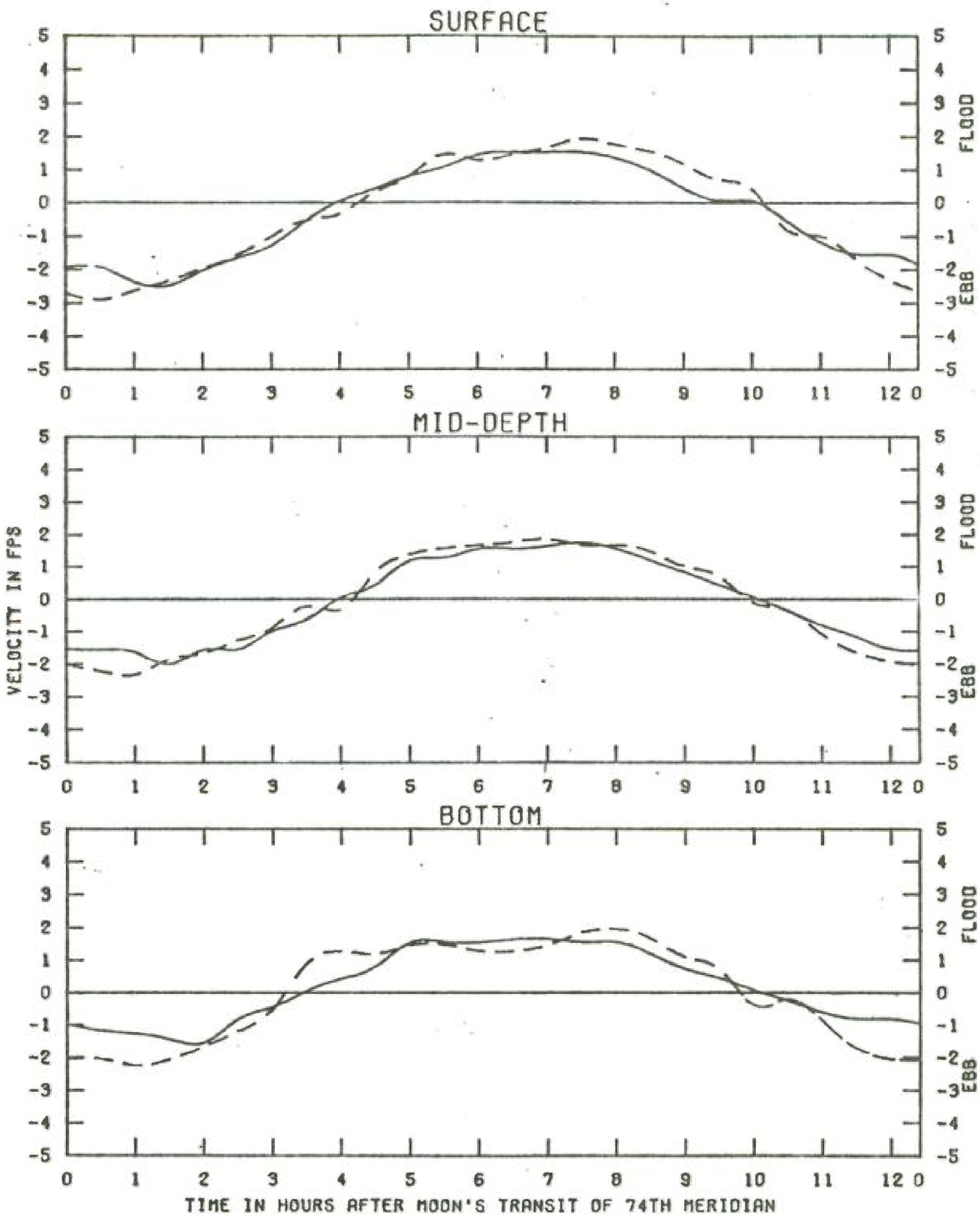
LEGEND
BASE ————
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
35

PLATE 21



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

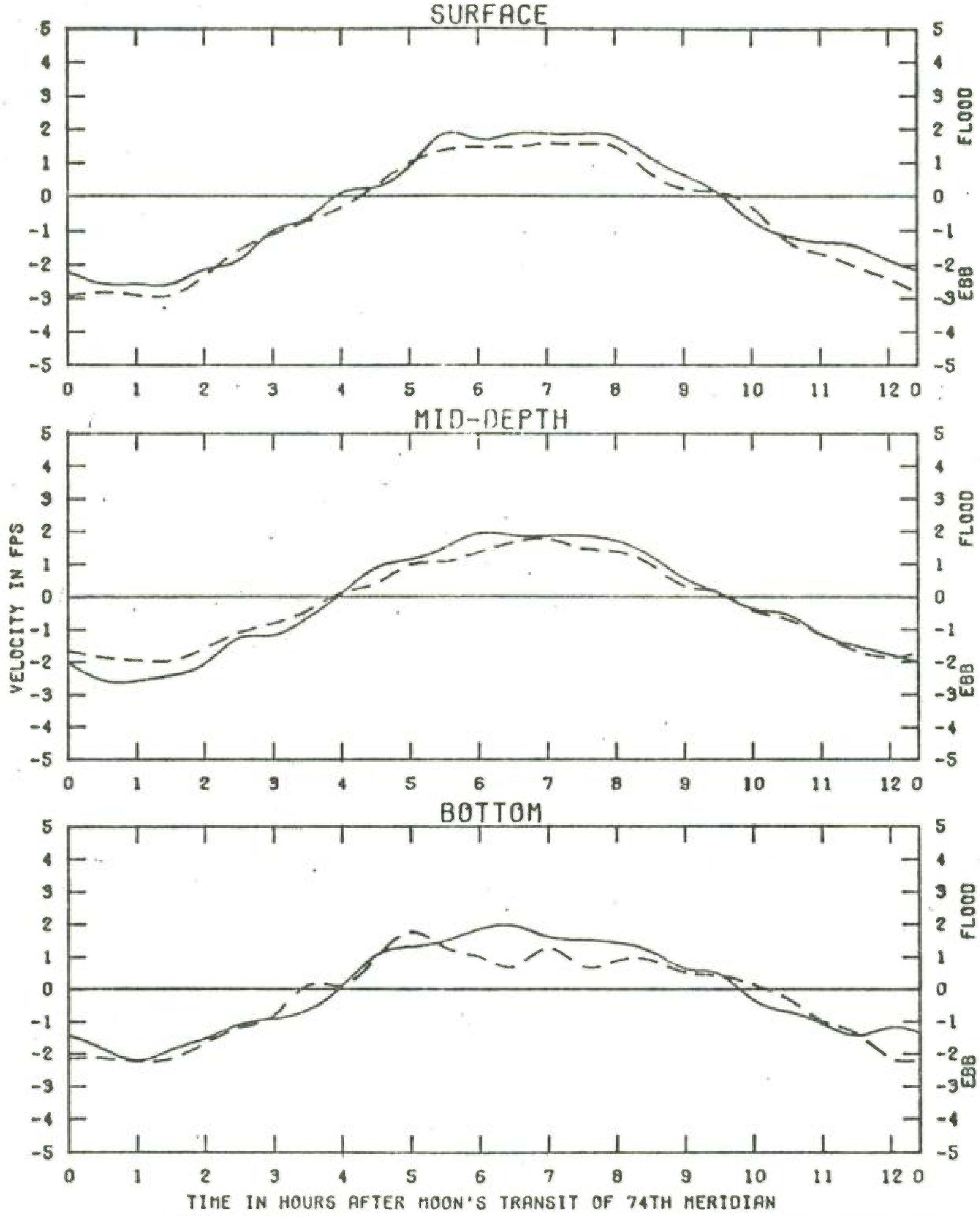
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
36

LEGEND
BASE ————
PLAN 1 — — — —

PLATE 22



TEST CONDITIONS

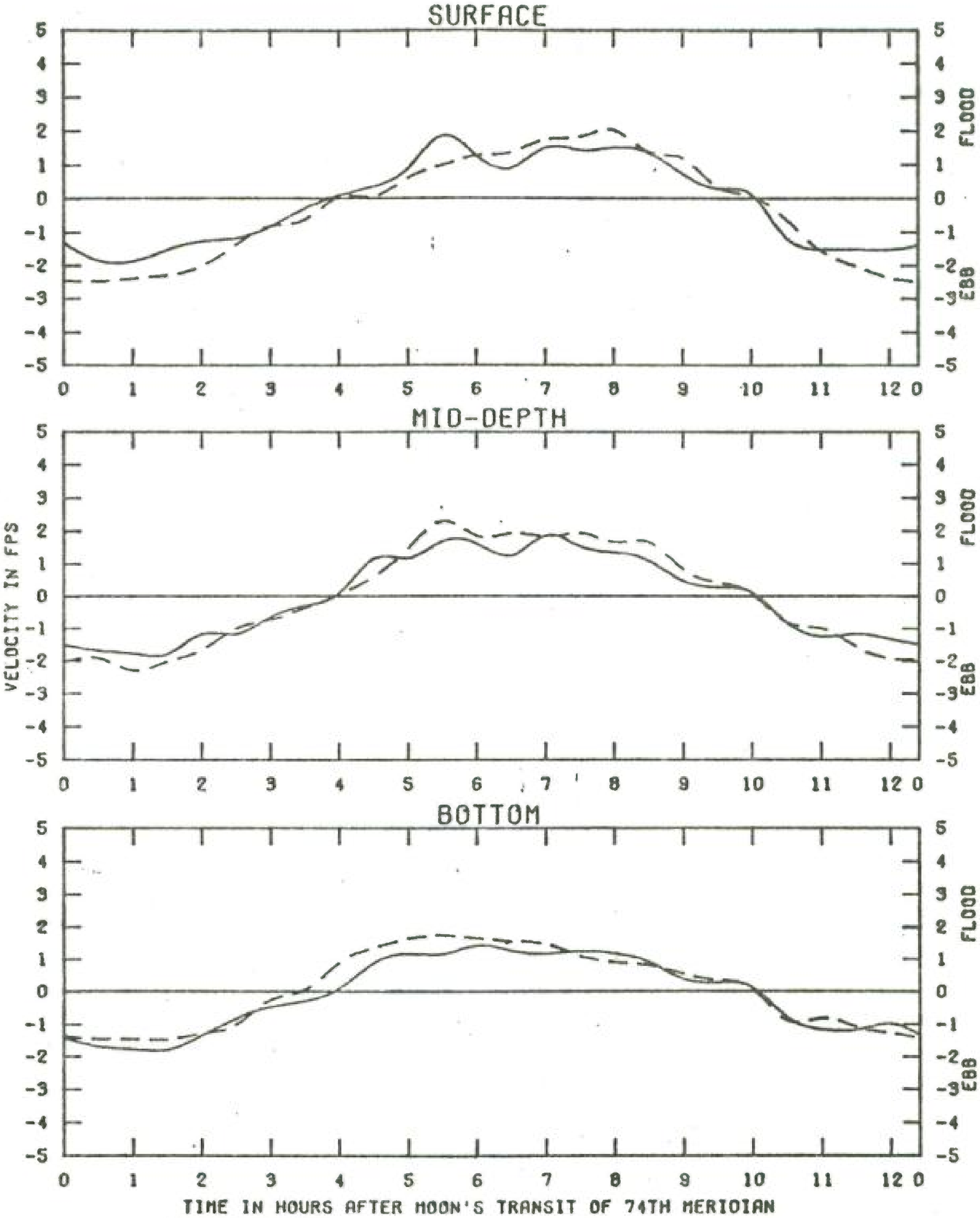
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

LEGEND
BASE ————
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON VELOCITIES

STATION 37



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

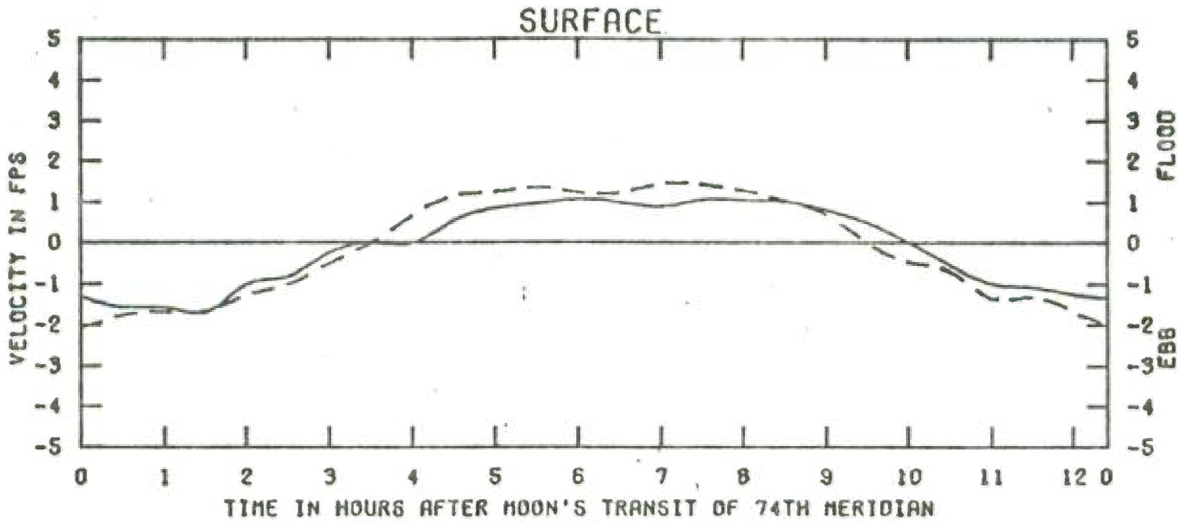
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
38

LEGEND
BASE ———
PLAN 1 — — —

PLATE 24



TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

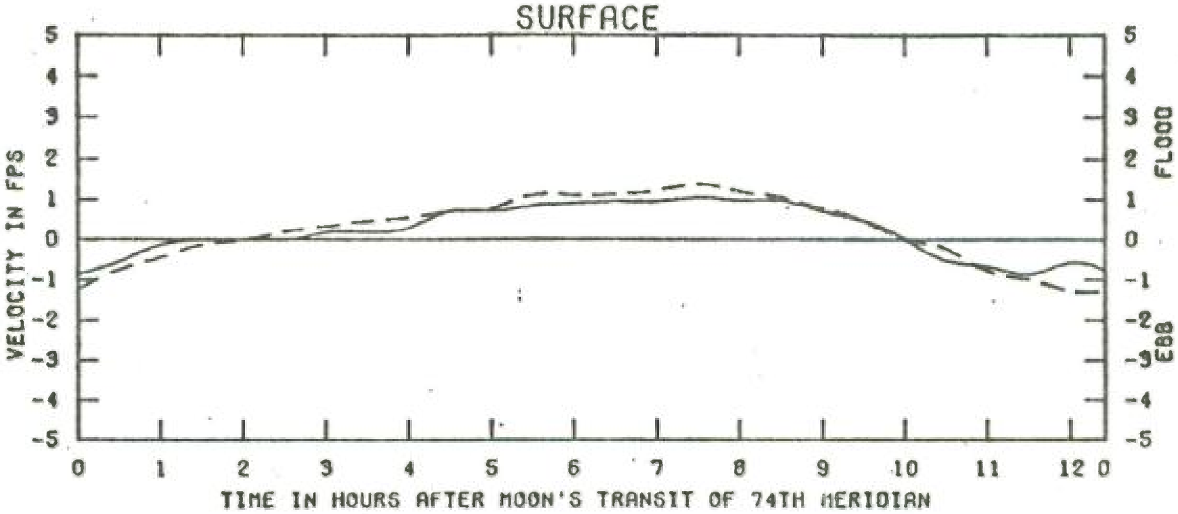
LEGEND
BASE ———
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
39

PLATE 25



TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

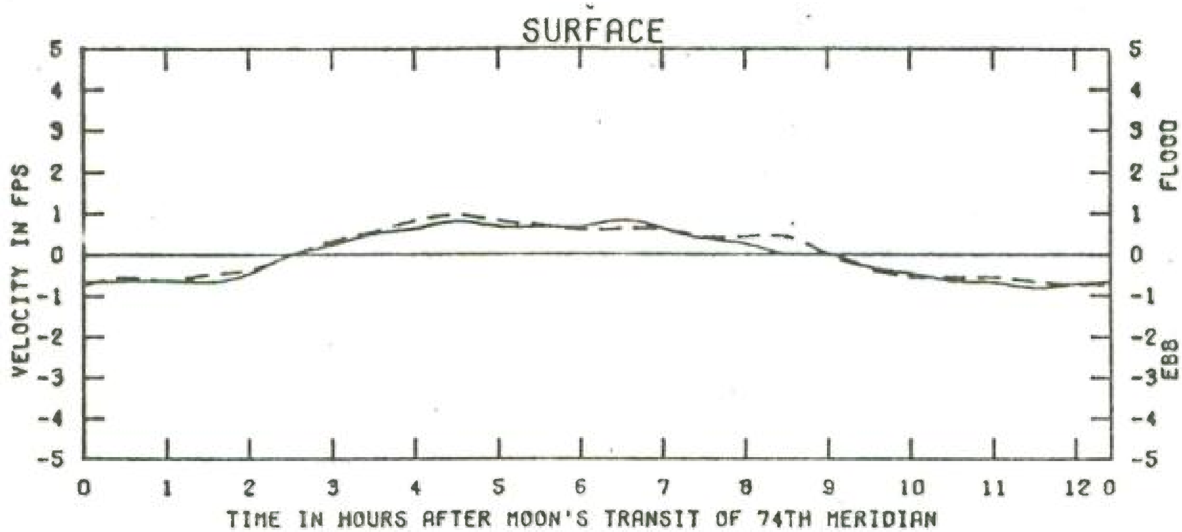
LEGEND
BASE ————
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
41

PLATE 26



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

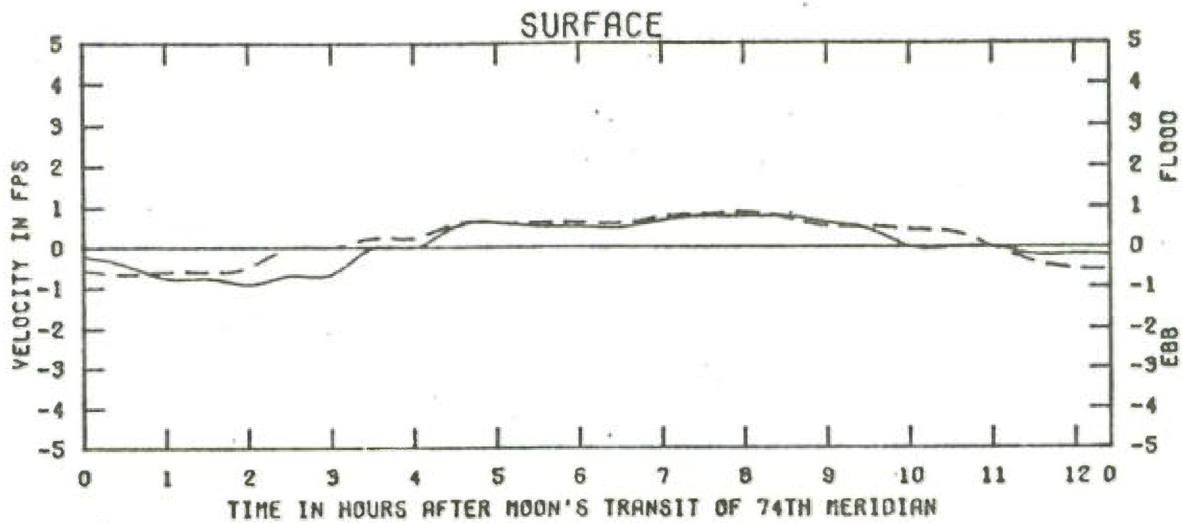
LEGEND
BASE ———
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
42

PLATE 27



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

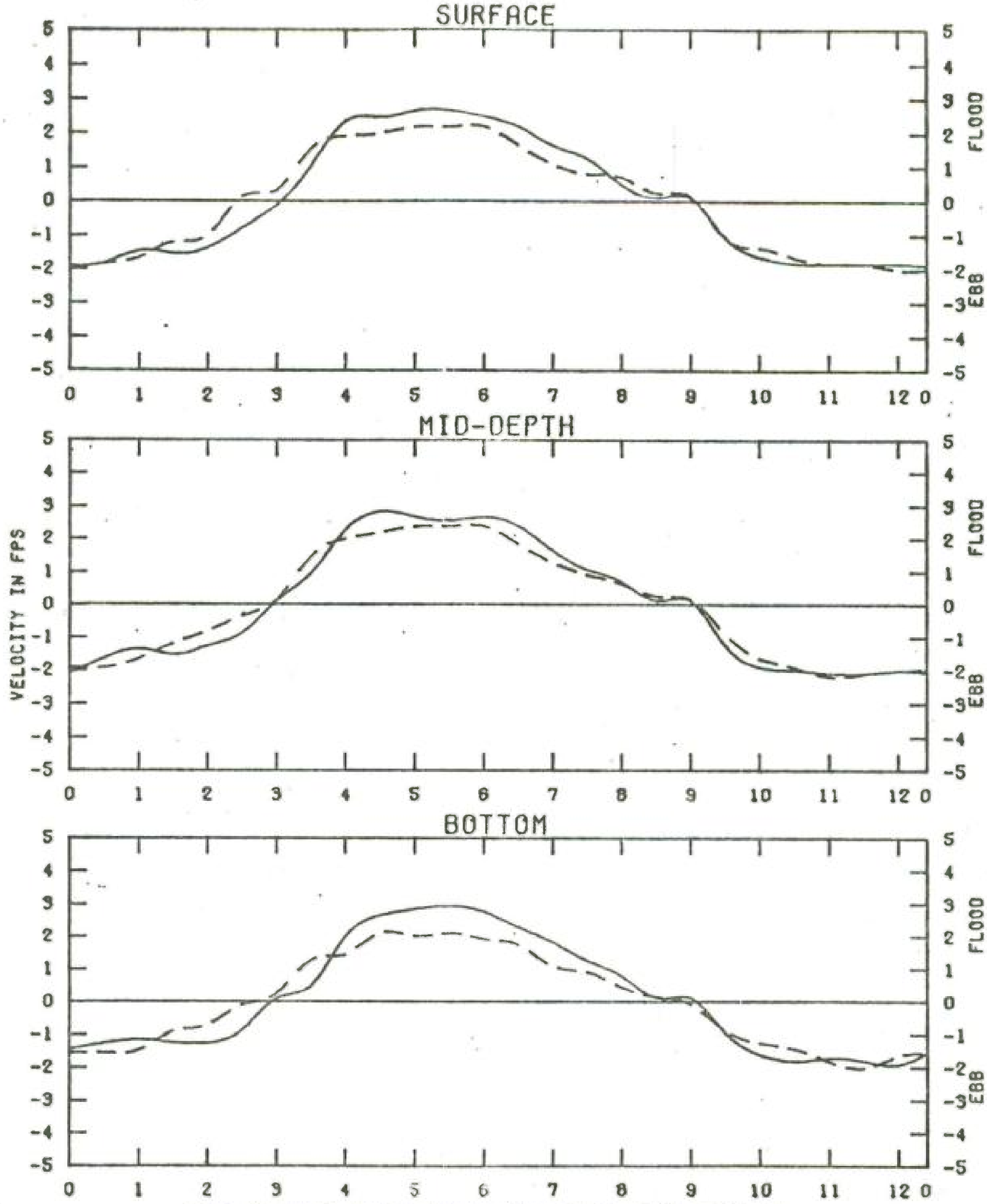
LEGEND
BASE ———
PLAN 1 — — —

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
43

PLATE 28



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS

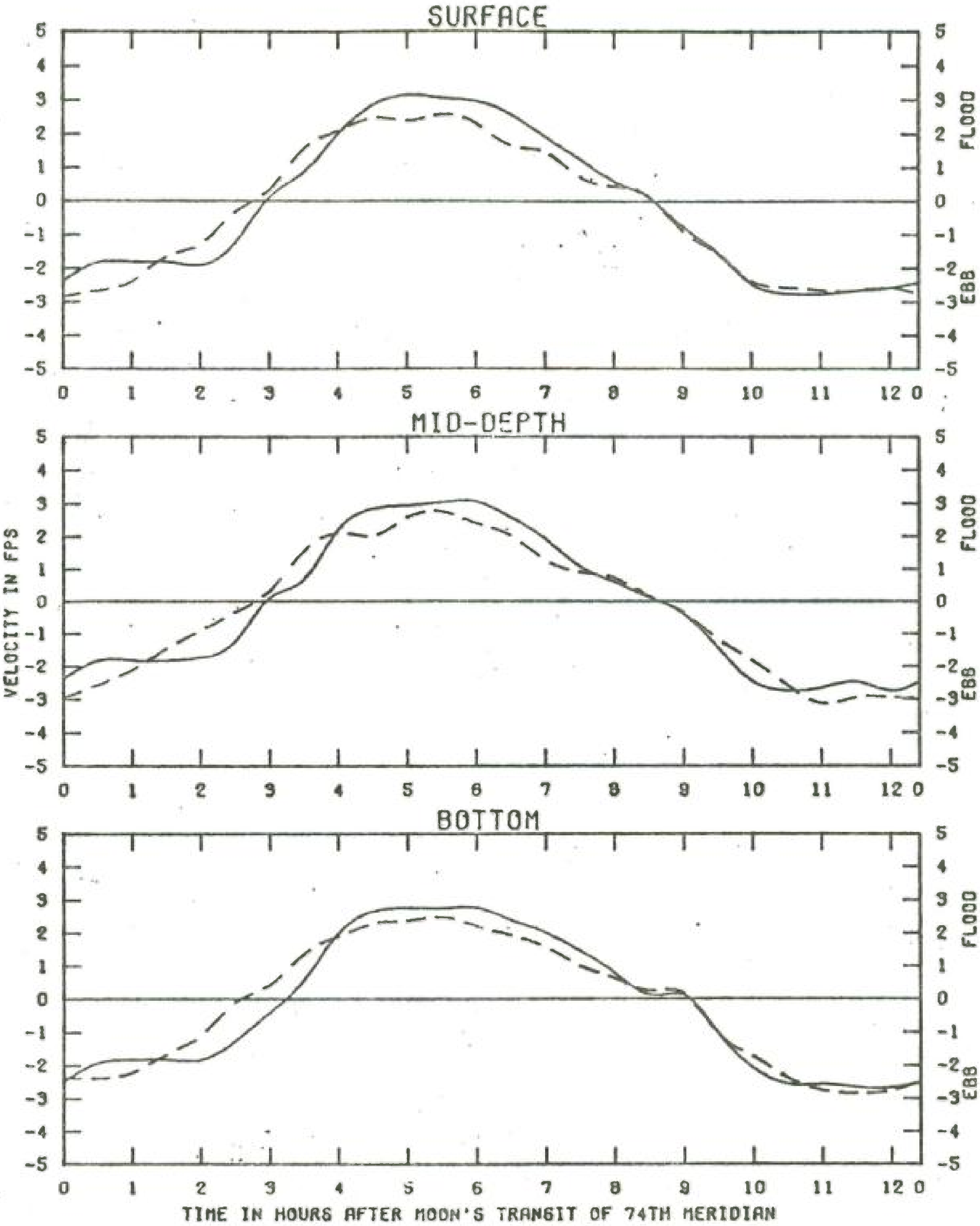
LEGEND
BASE ————
PLAN 1 – – – –

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
58

PLATE 29



TEST CONDITIONS

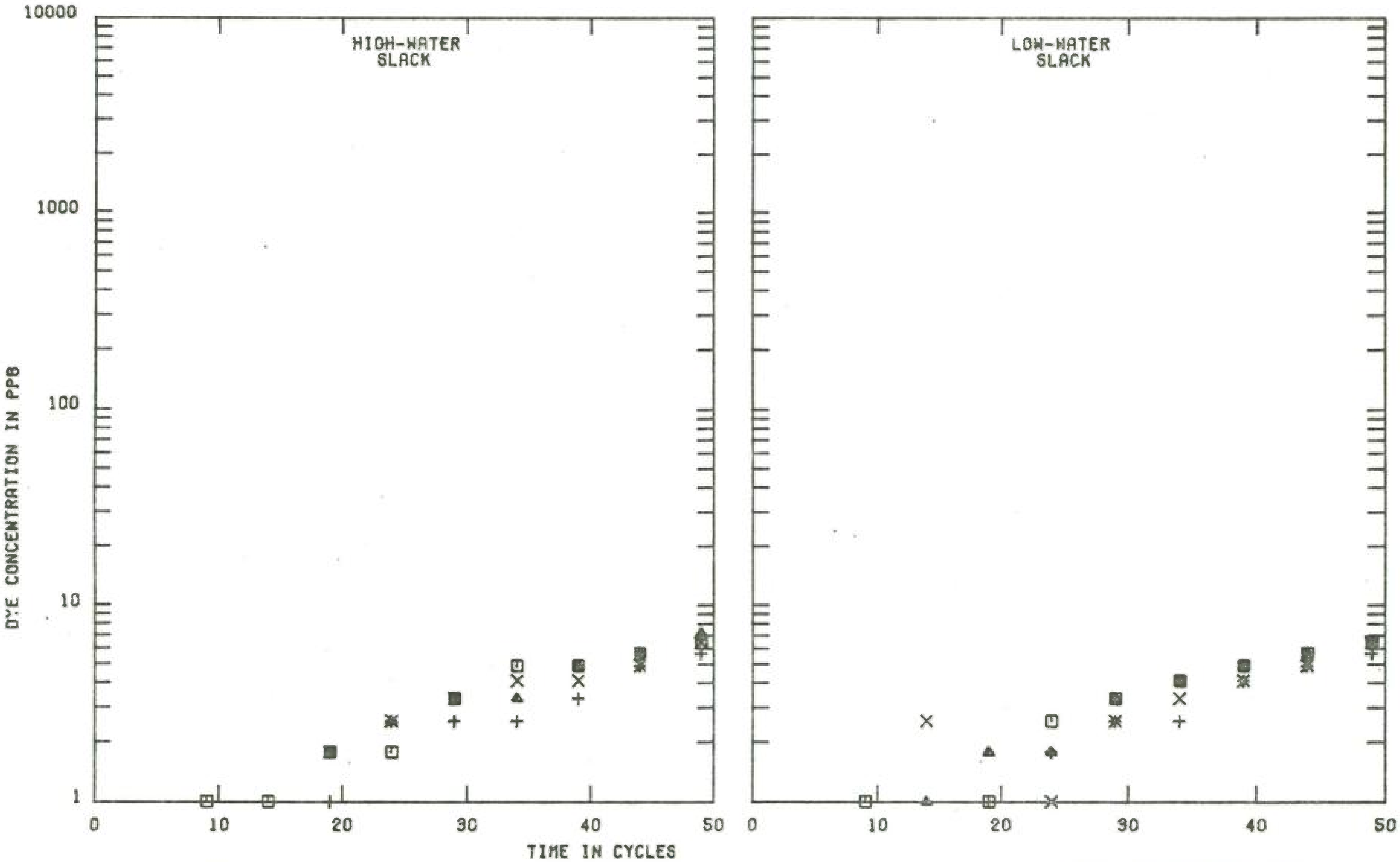
TIDAL RANGE AT SANDY HOOK	4.7	FT
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF
PLAN 1
ON VELOCITIES

STATION
57

LEGEND
BASE ————
PLAN 1 – – –



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

- ⊡ ——— SURFACE — BASE
- ▲ — — — BOTTOM — BASE
- + —-—-— SURFACE — PLAN 1
- × —--— BOTTOM — PLAN 1

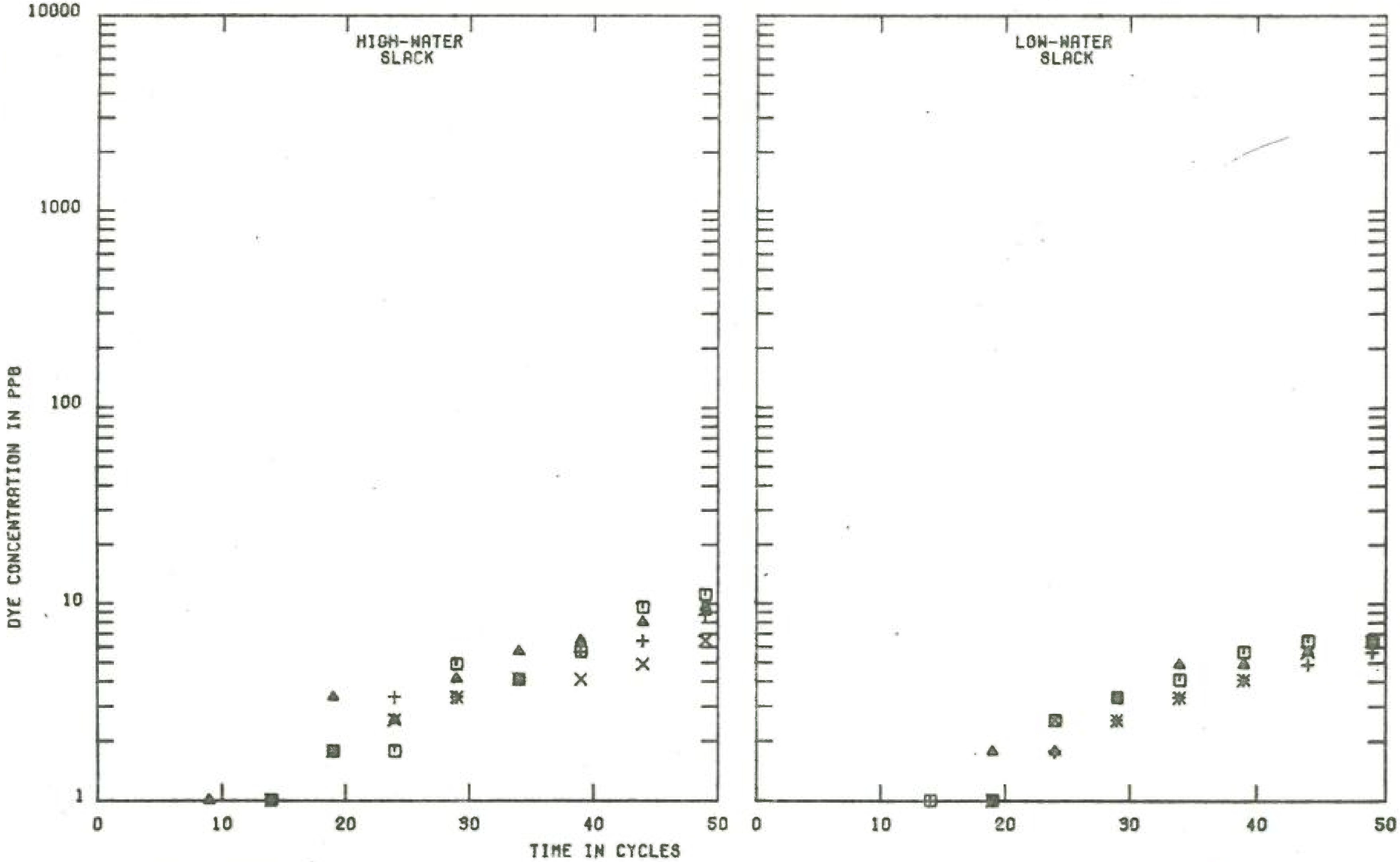
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 1

PLATE 31



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

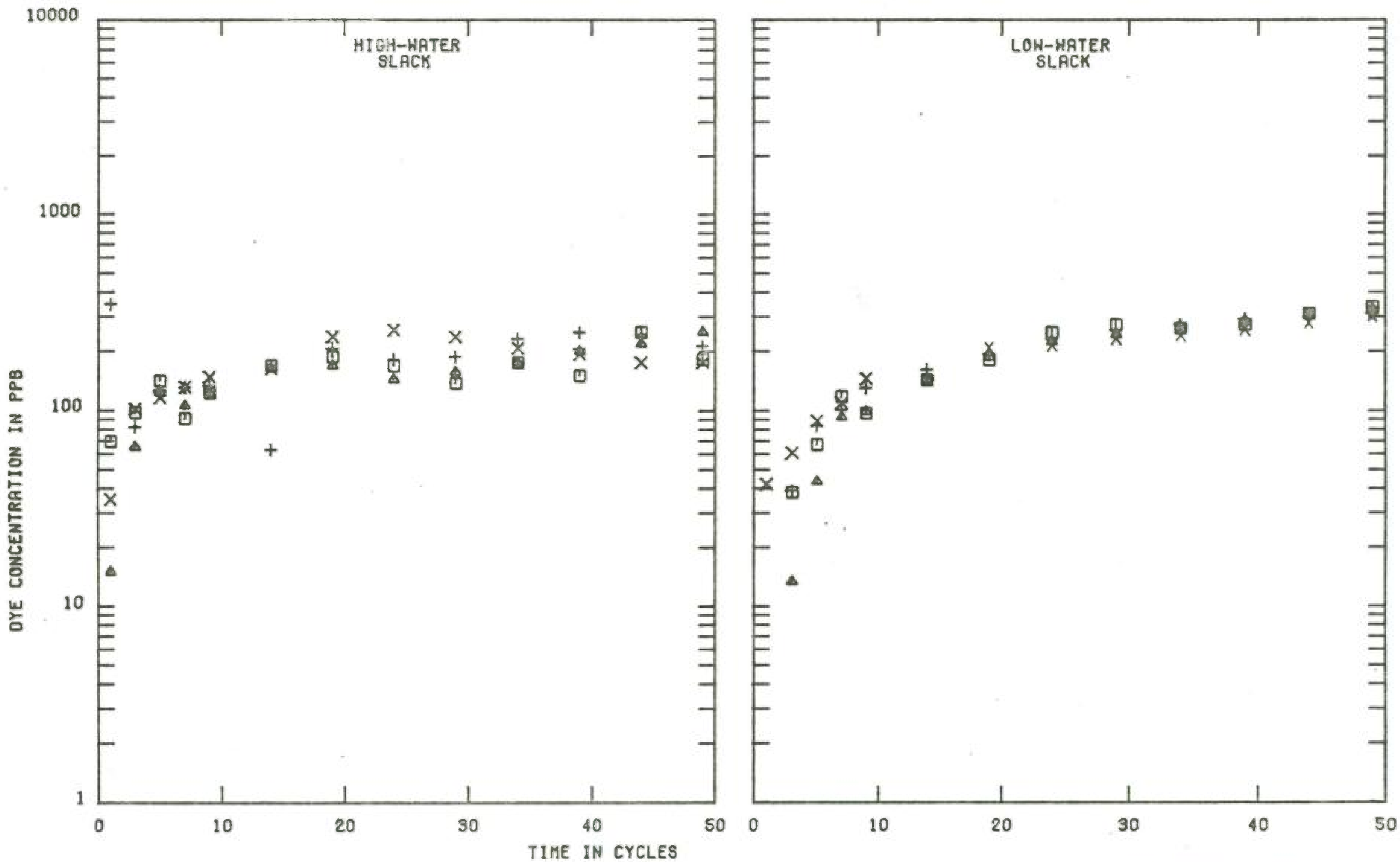
⊡ ——— SURFACE, ▲ — — — BOTTOM: BASE
+ —-—- SURFACE, × —-—- BOTTOM: PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 2



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

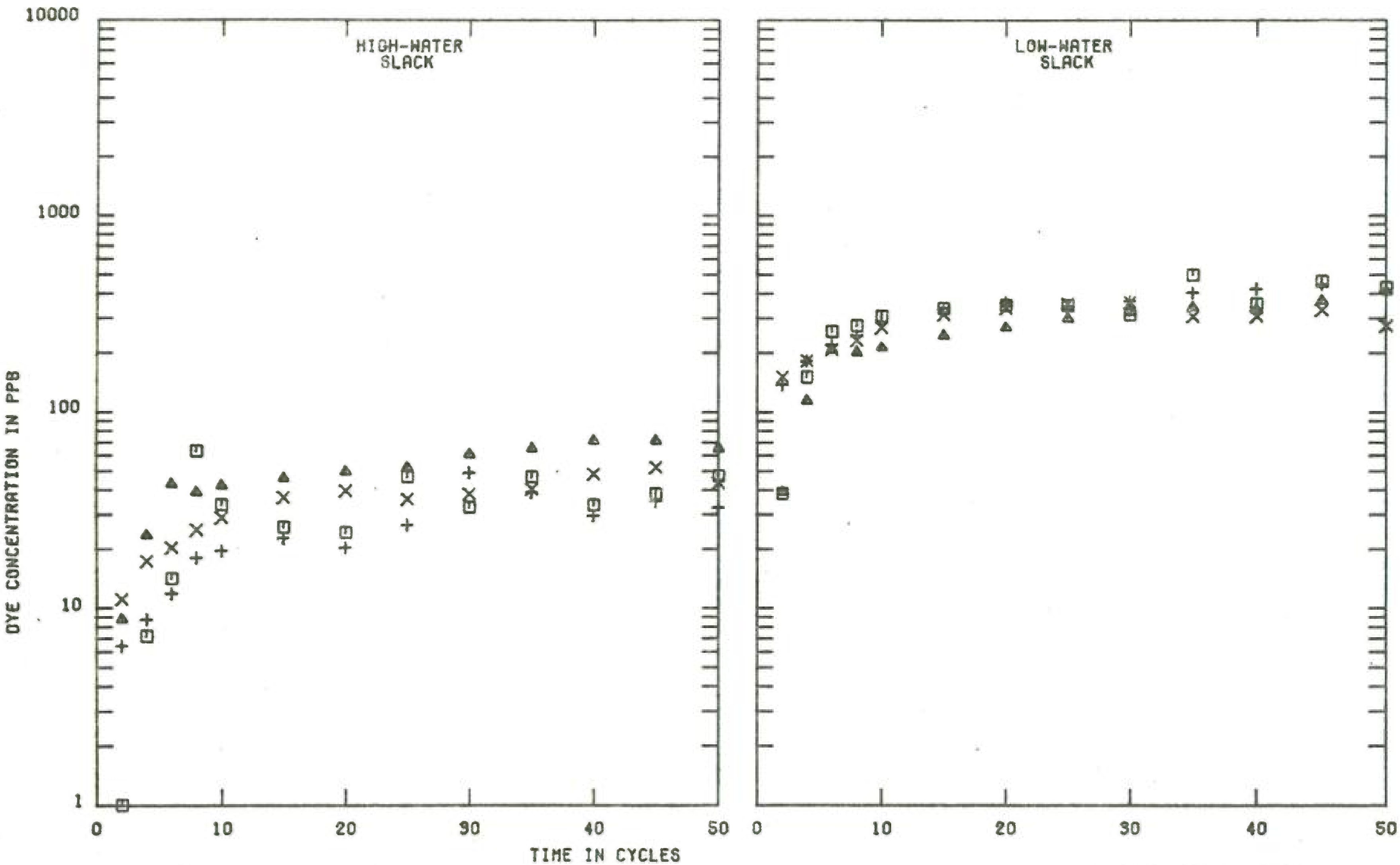
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 3

PLATE 33



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

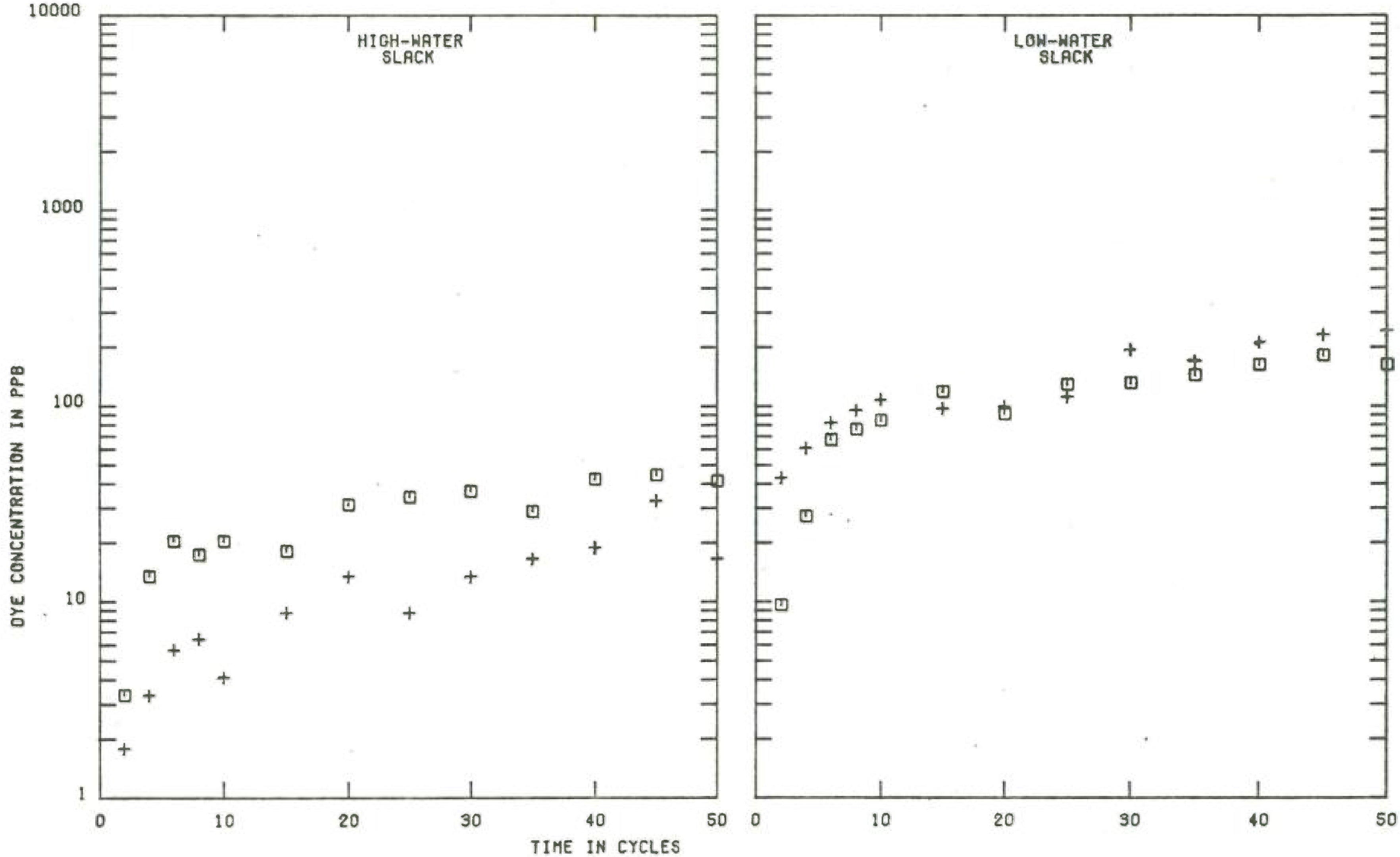
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
X —--—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 4



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

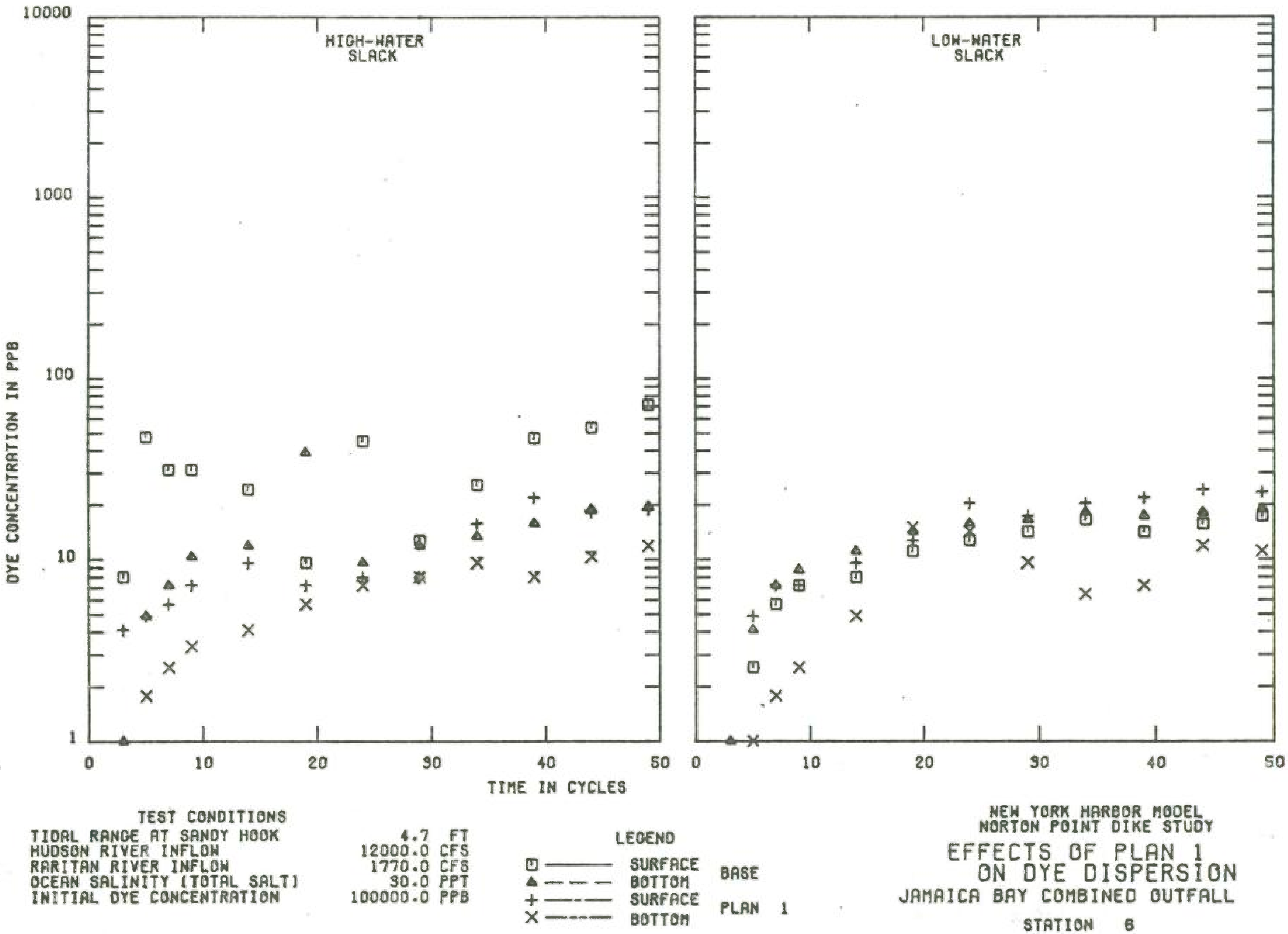
⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 5 MID-DEPTH



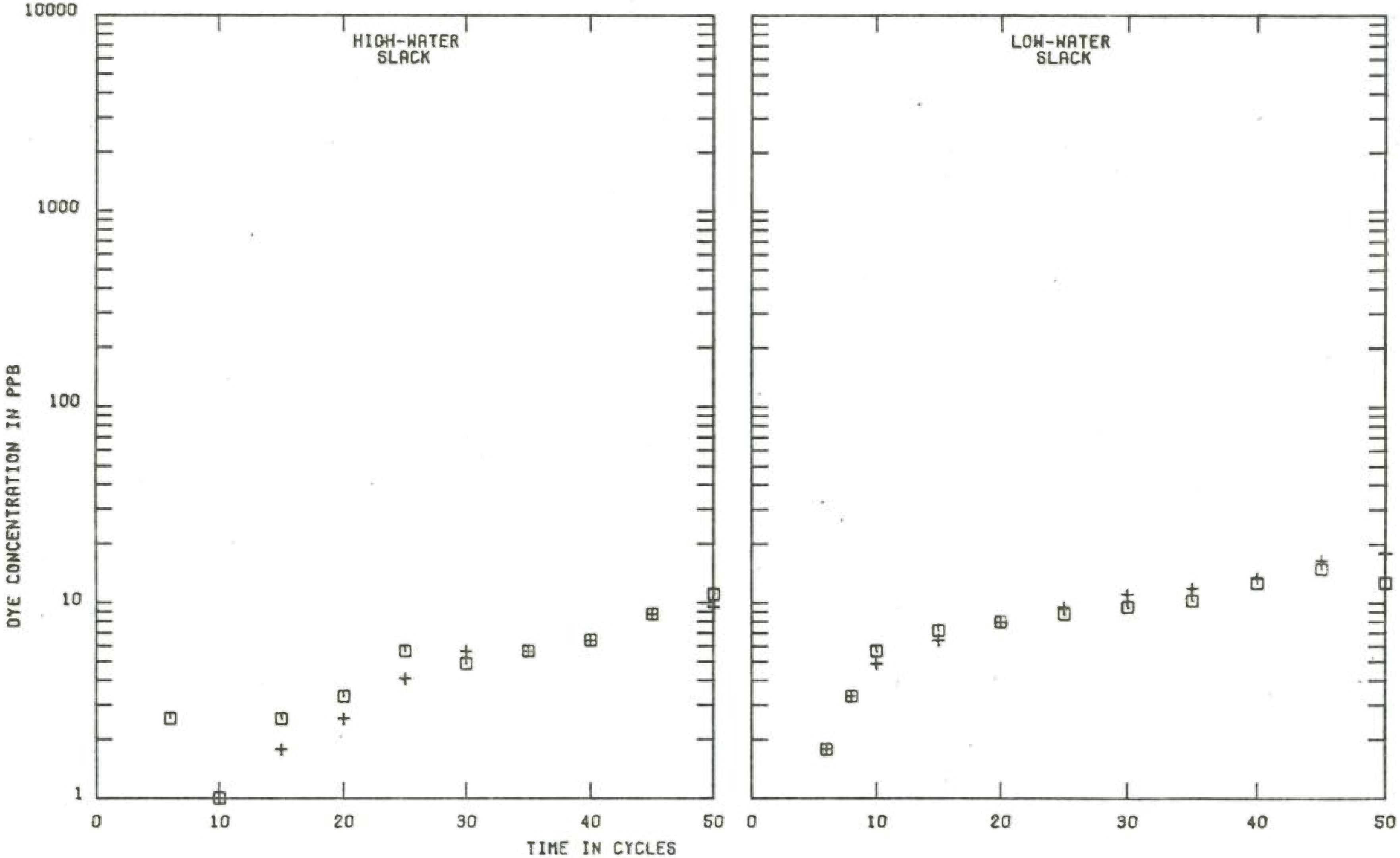
TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 6



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

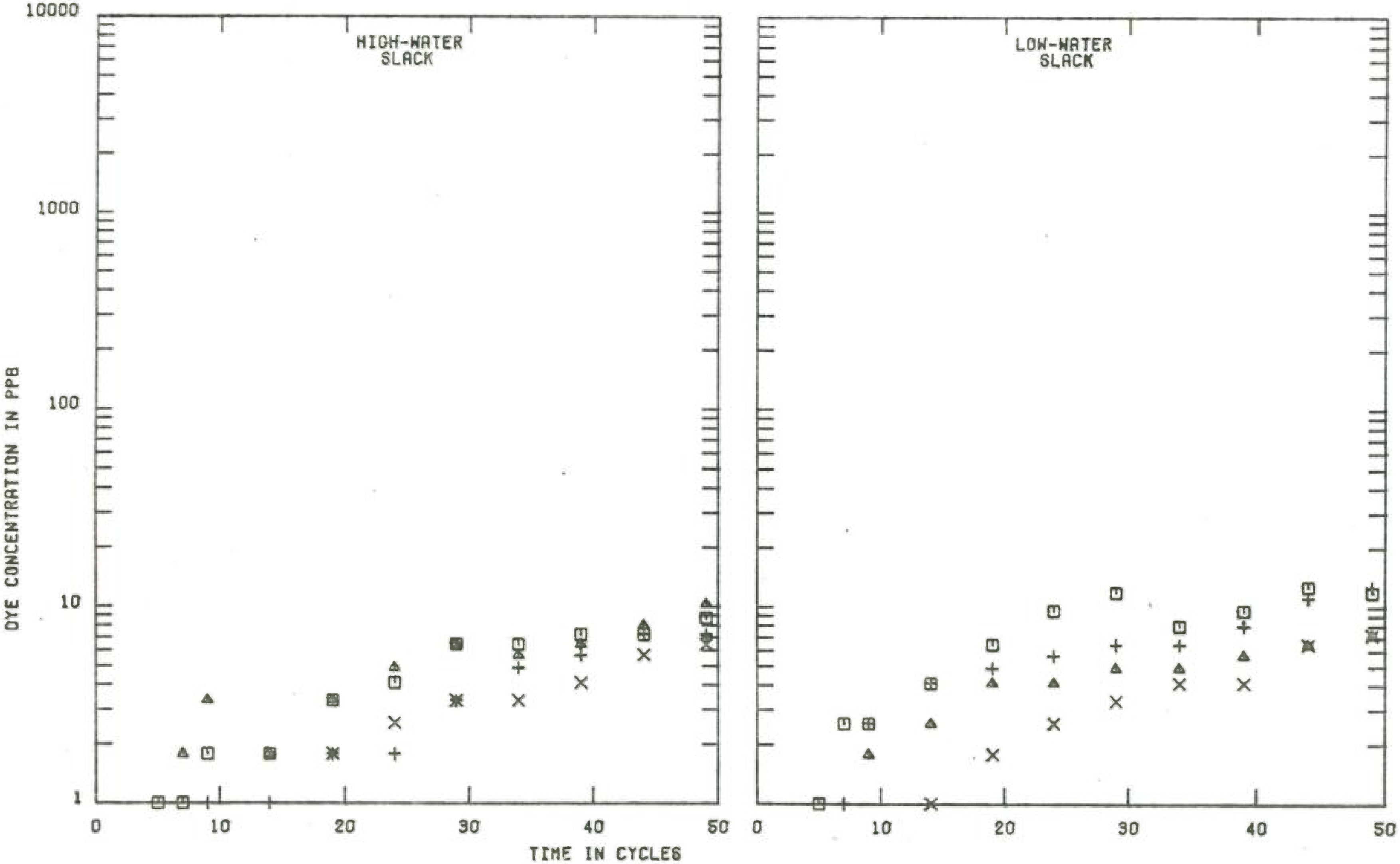
□ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 7 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

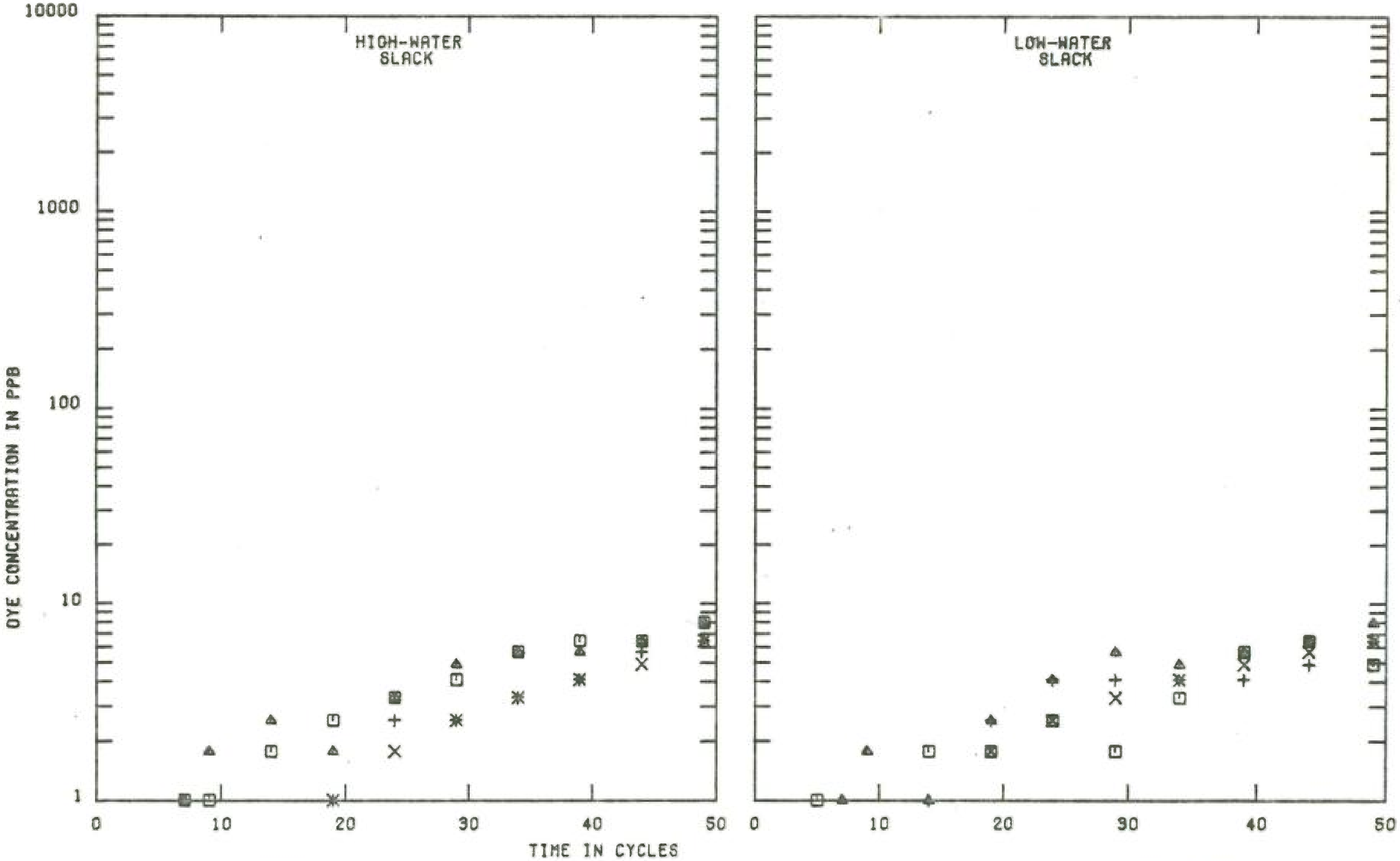
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 8



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ——— SURFACE BASE
△ — — — BOTTOM BASE
+ —·—·— SURFACE PLAN 1
× —··— BOTTOM PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

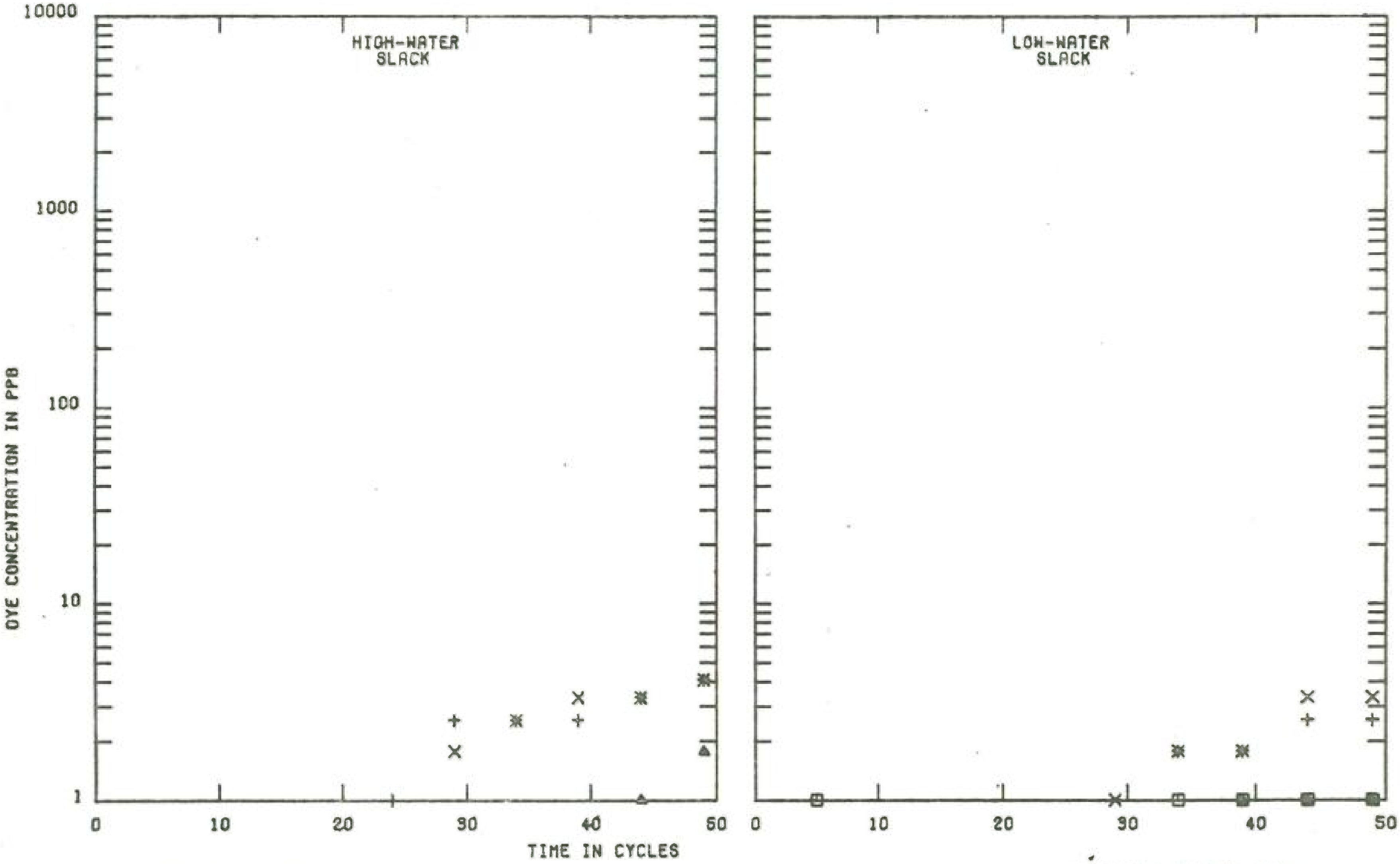
EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 9

PLATE 39

PLATE 40



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

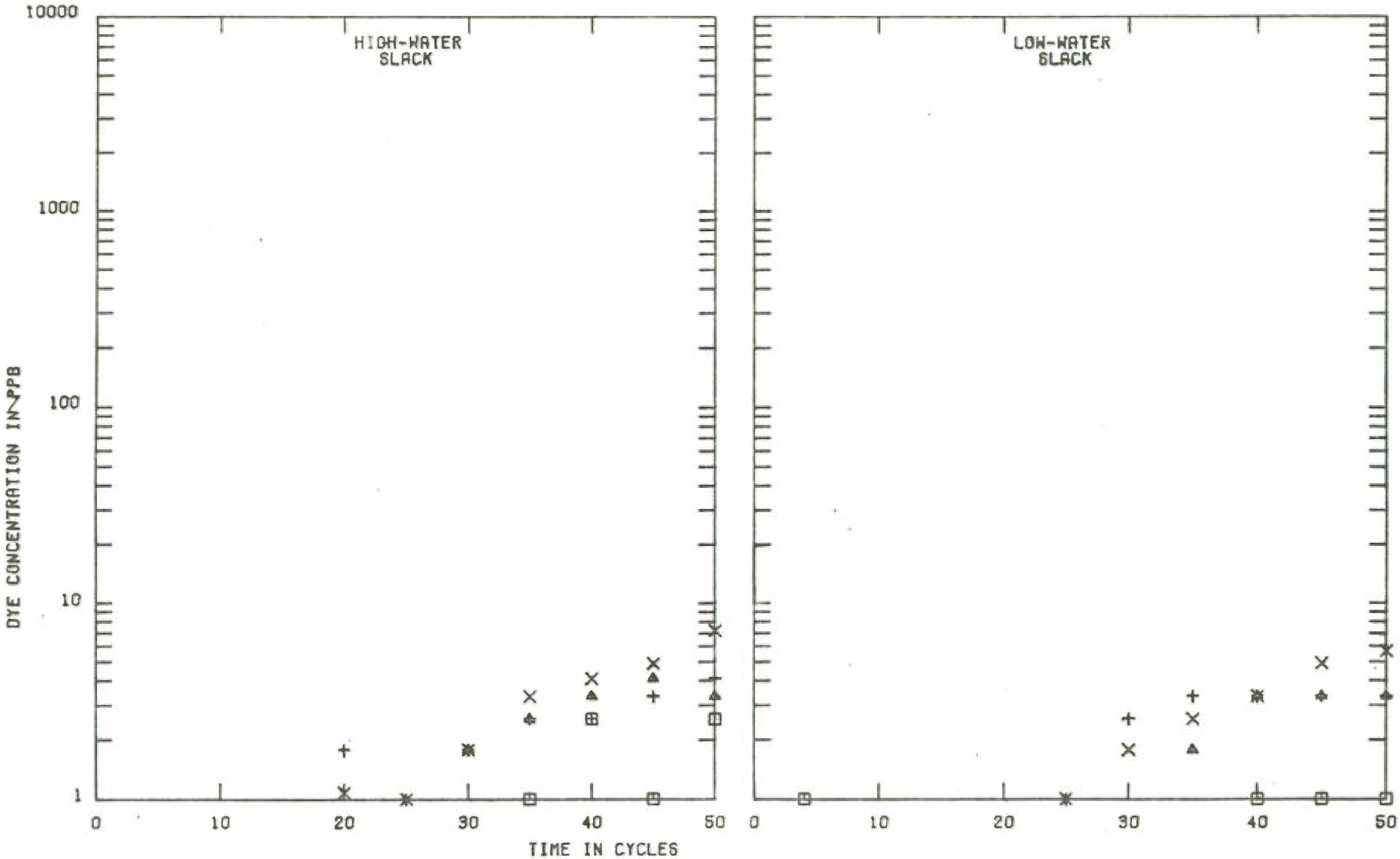
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 10



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

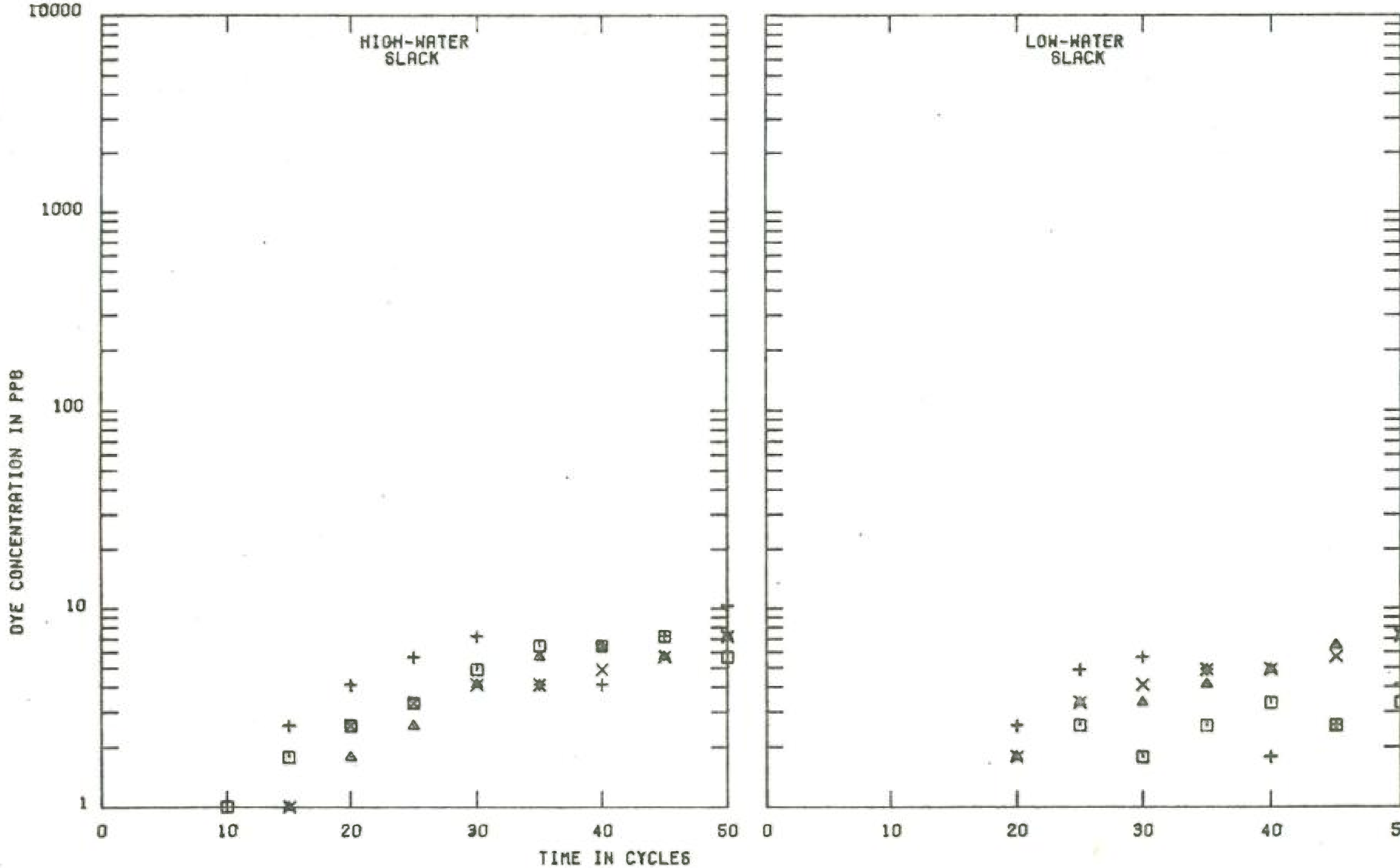
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 11

PLATE 42



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

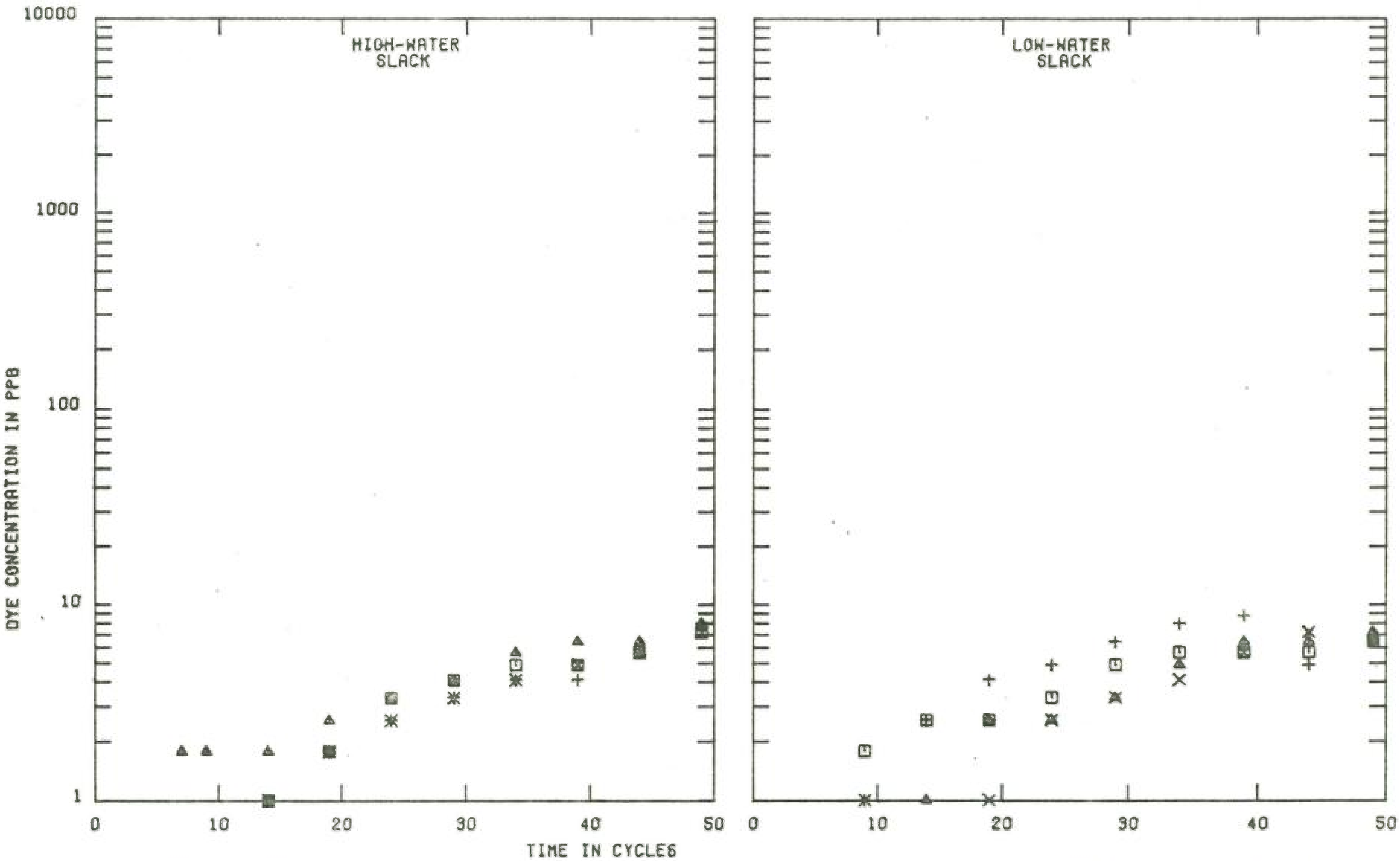
□ ——— SURFACE } BASE
▲ — — — BOTTOM } BASE
+ —·—·— SURFACE } PLAN 1
× —··— BOTTOM } PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 12



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

- ⊡ ——— SURFACE — BASE
- ▲ — — — BOTTOM — BASE
- + —·—·— SURFACE — PLAN 1
- × —··—·· BOTTOM — PLAN 1

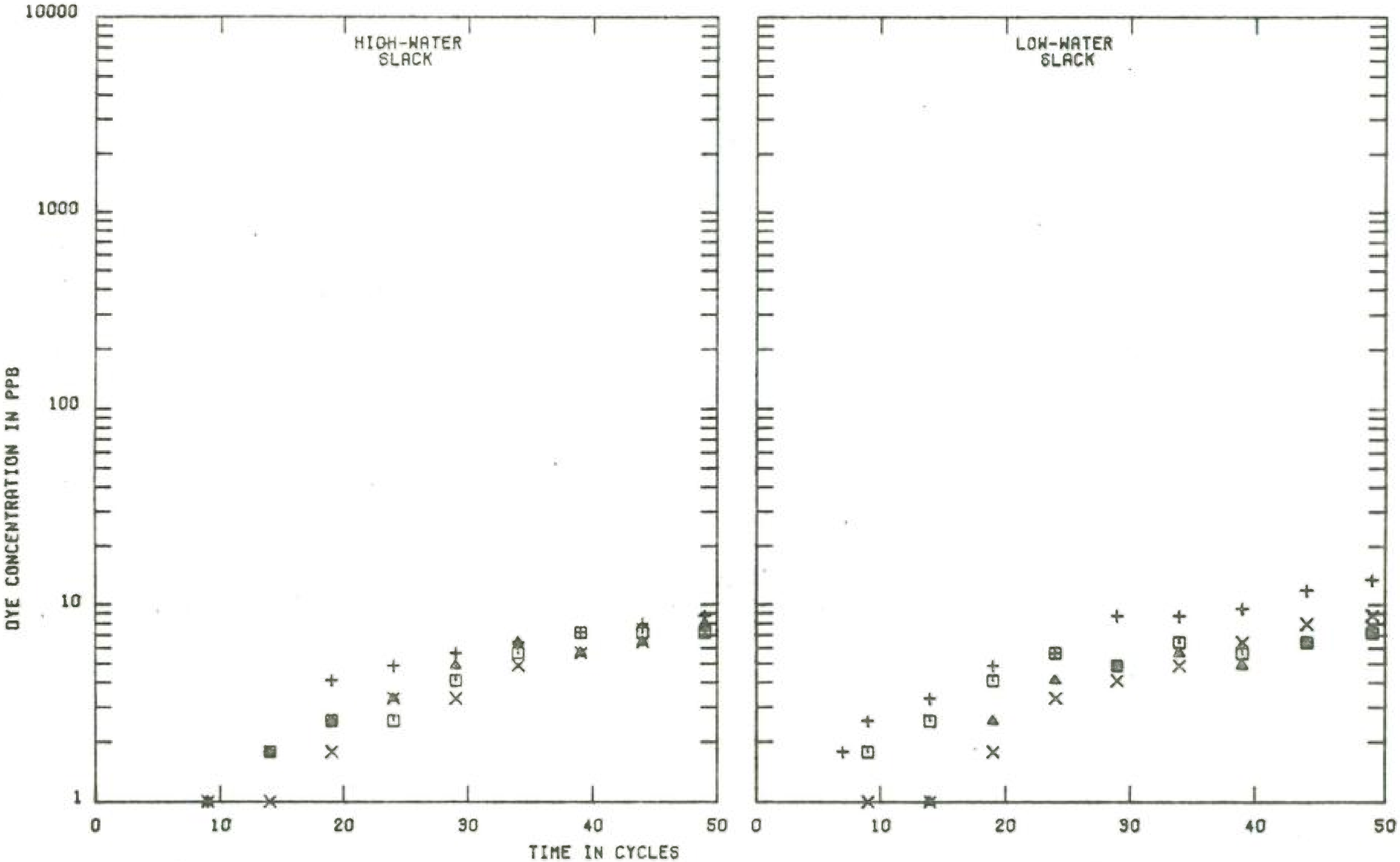
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 14

PLATE 43



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

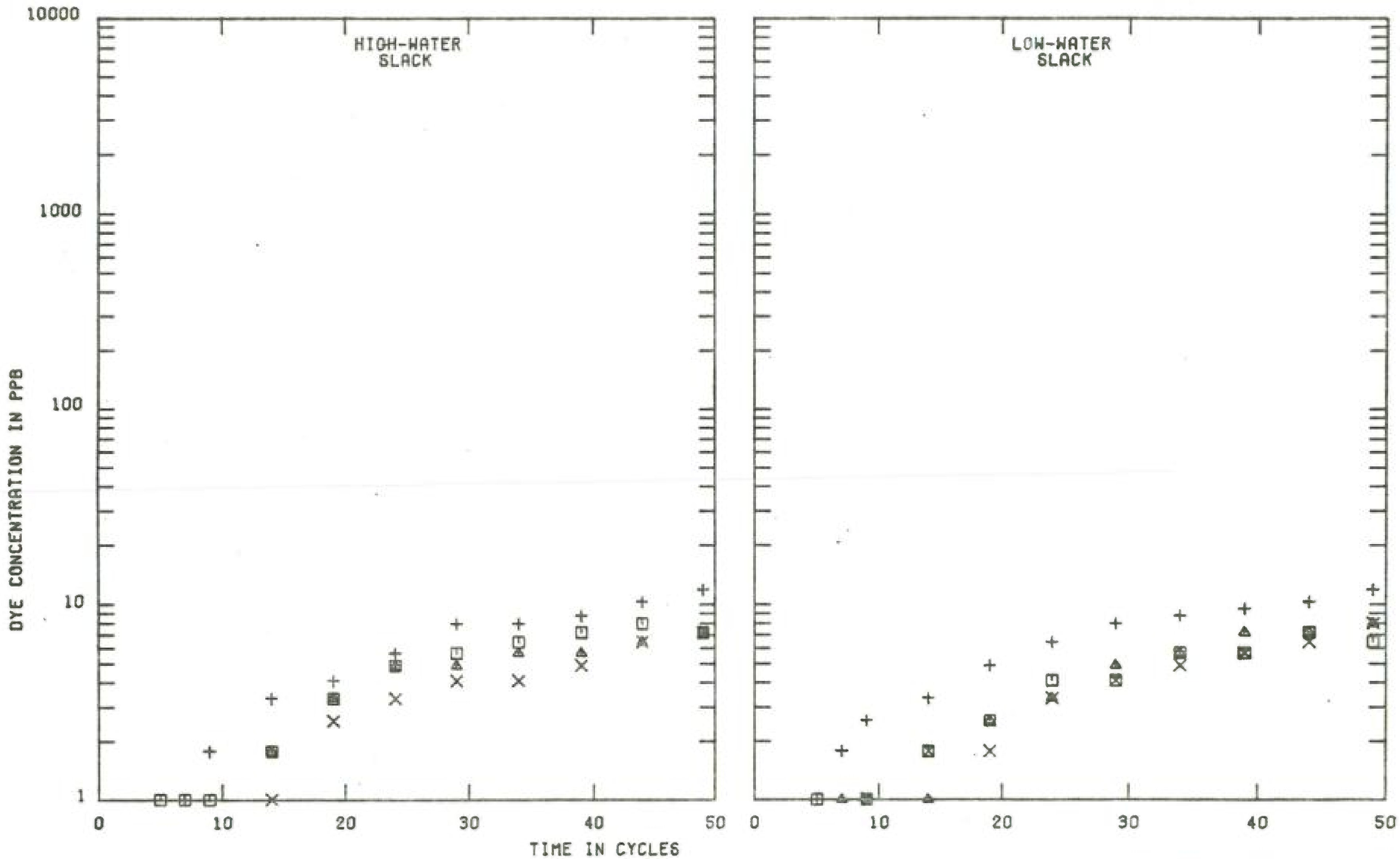
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 16



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

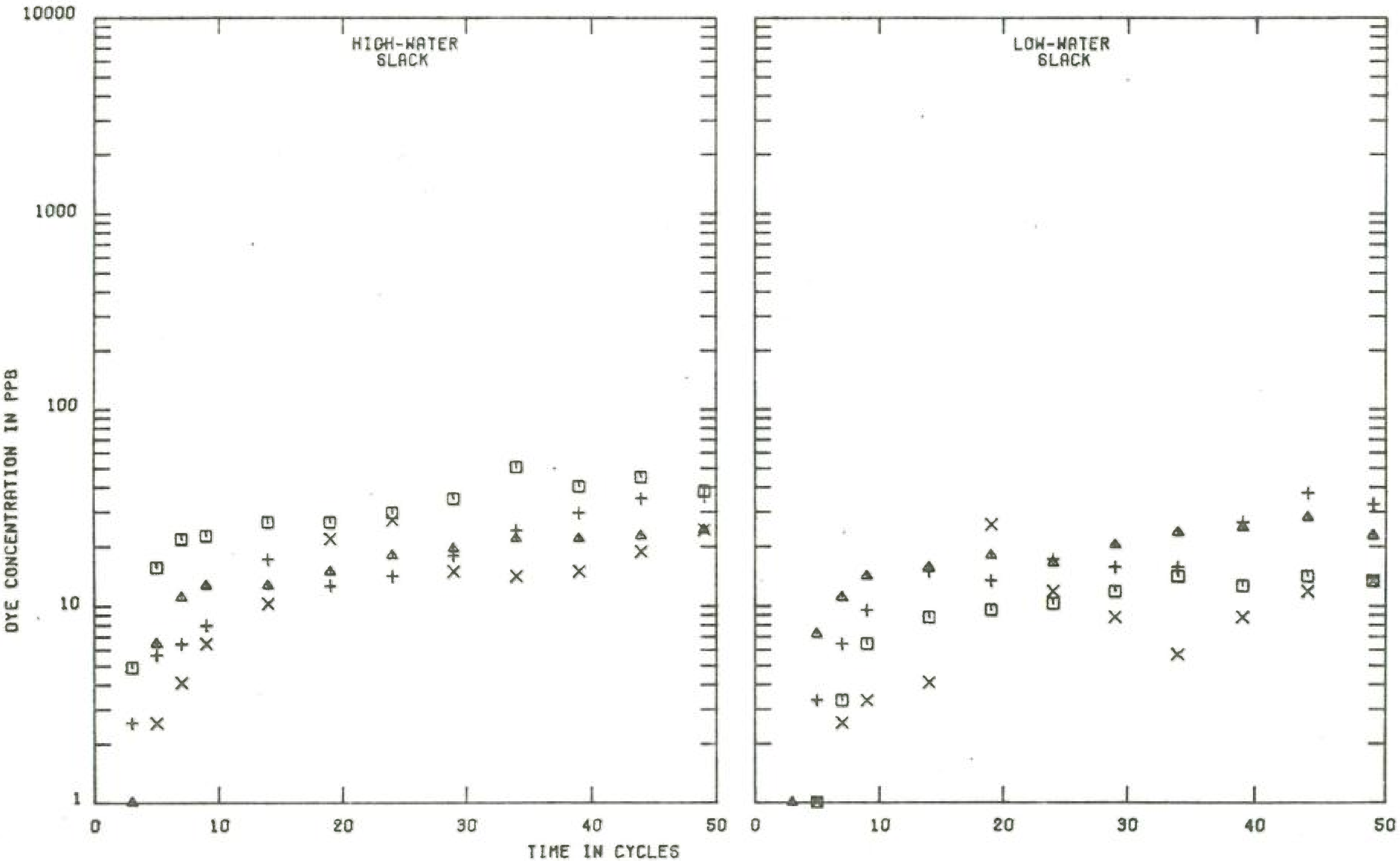
Symbol	Location	Condition
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 17

PLATE 45



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

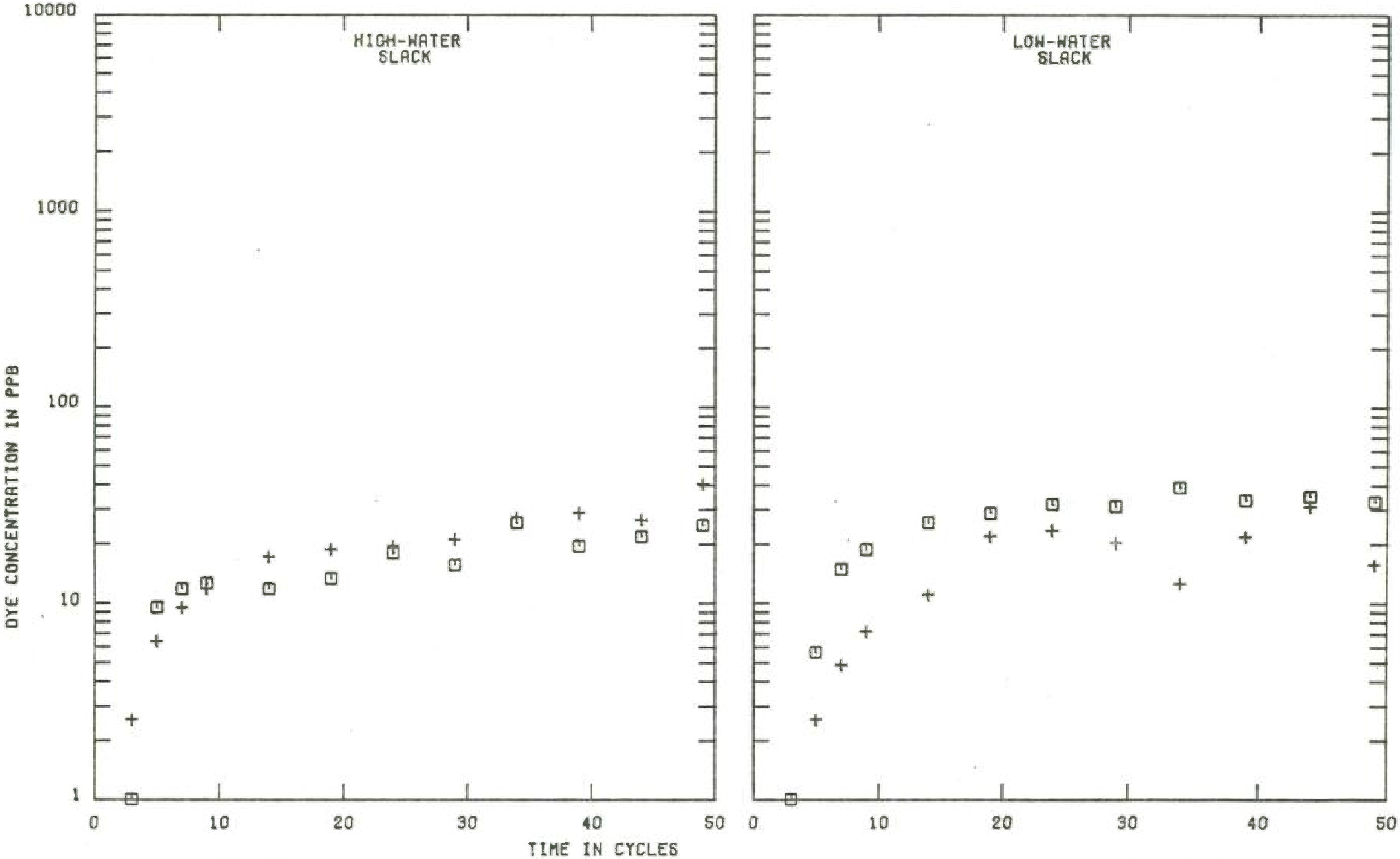
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 21



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ——— BASE

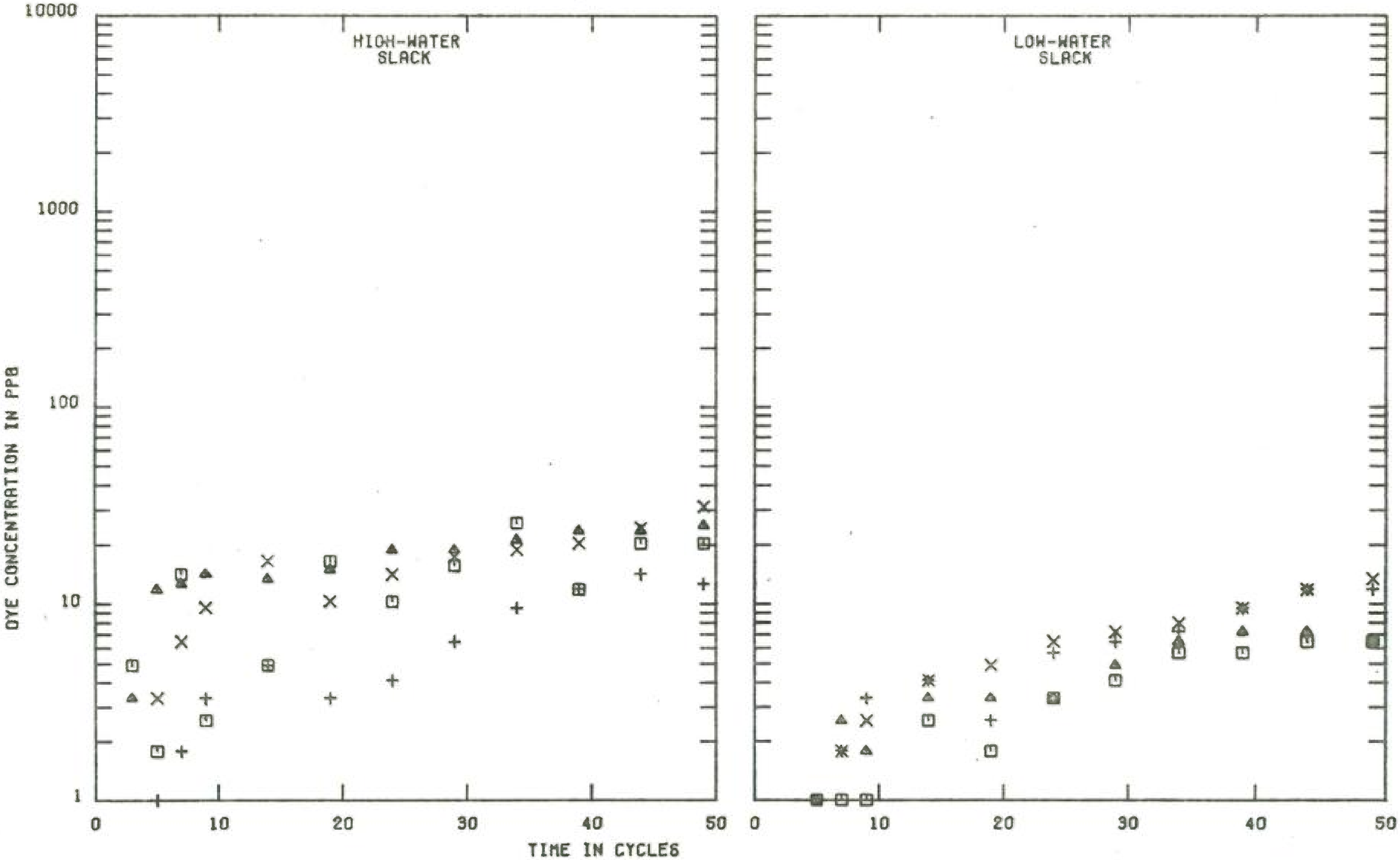
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 22 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

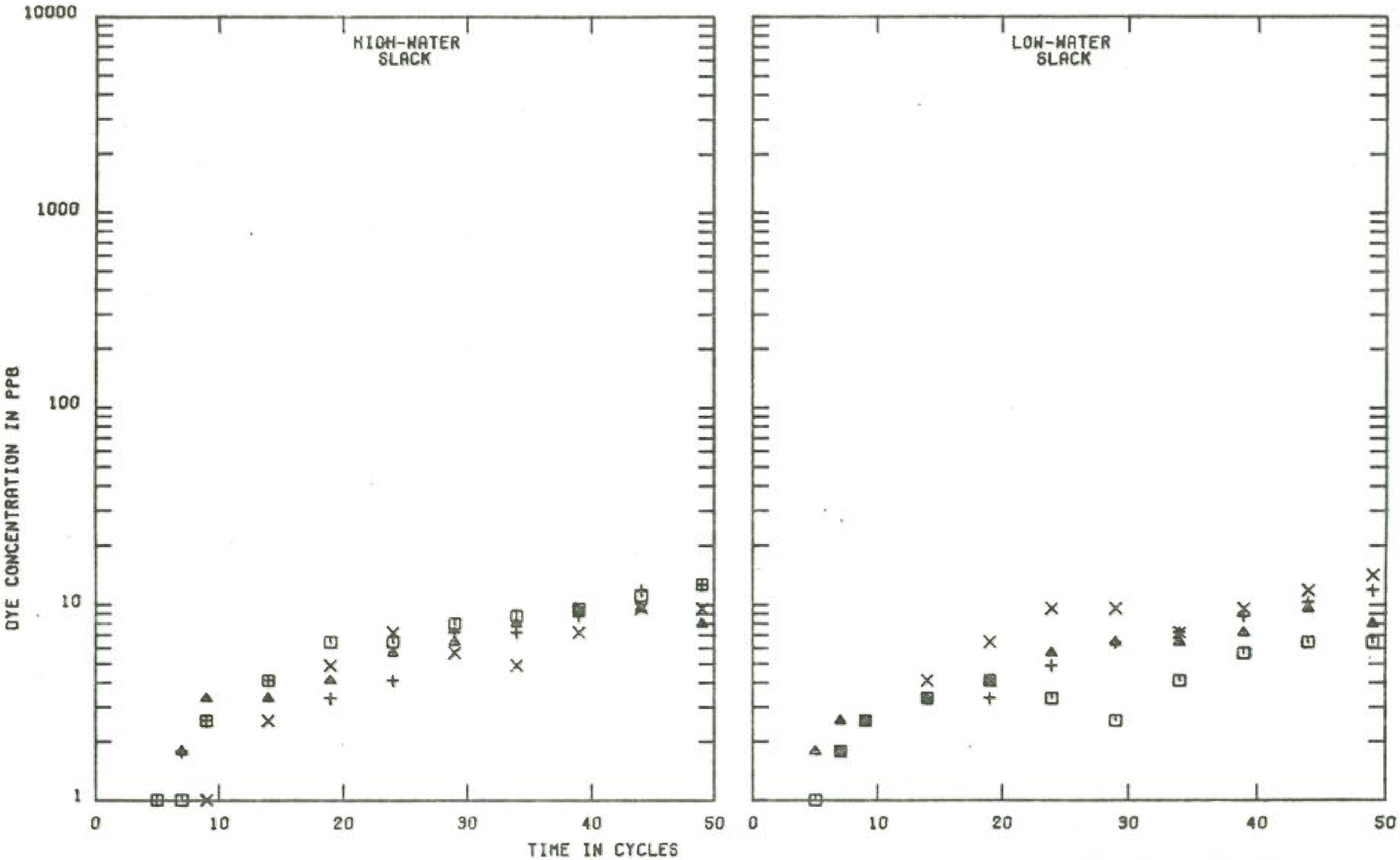
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—	SURFACE	PLAN 1
X —◆—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 24



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

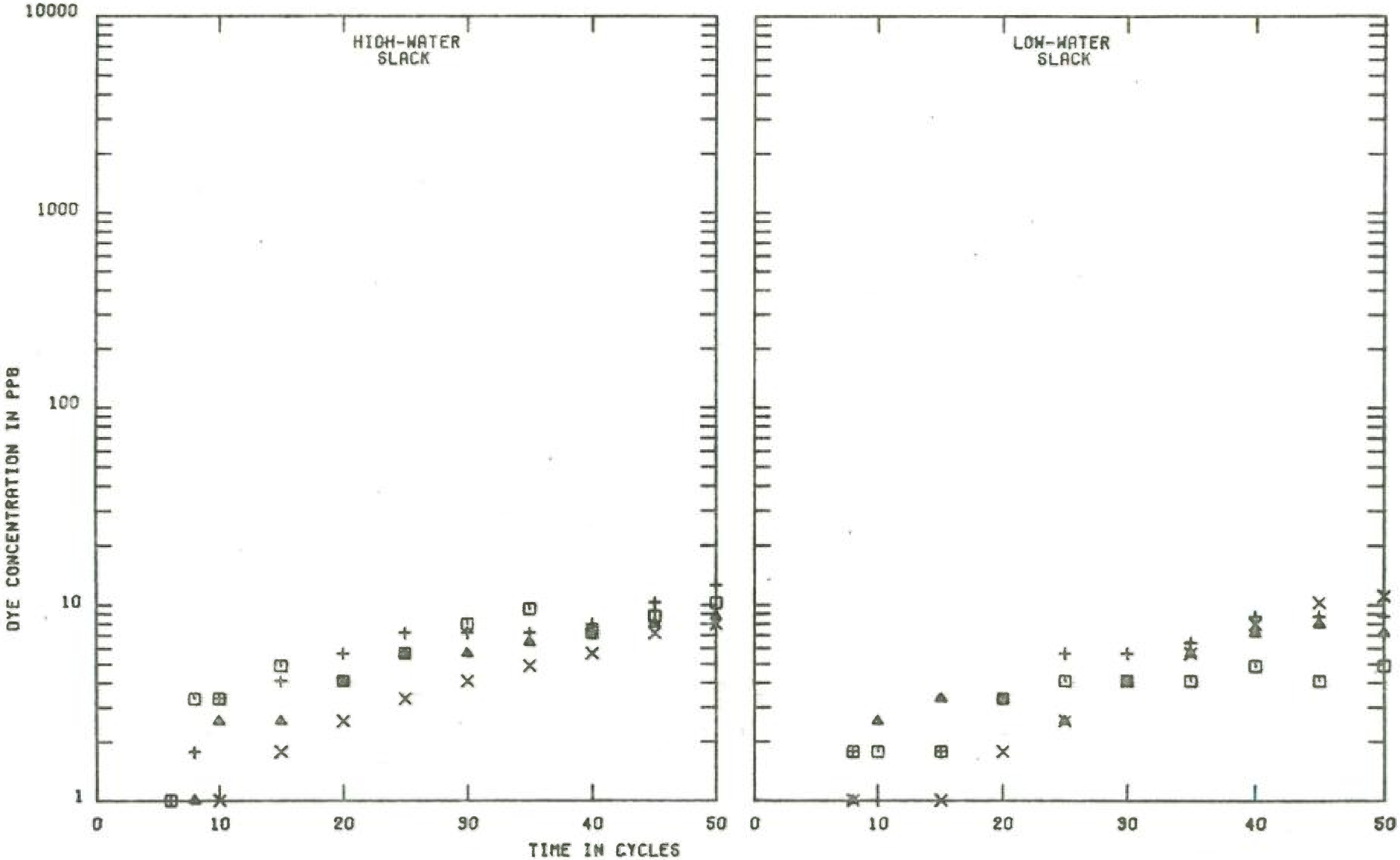
□ ——— SURFACE } BASE
▲ — — — BOTTOM } BASE
+ —·—·— SURFACE } PLAN 1
× —··—·· BOTTOM } PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 26

PLATE 49



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

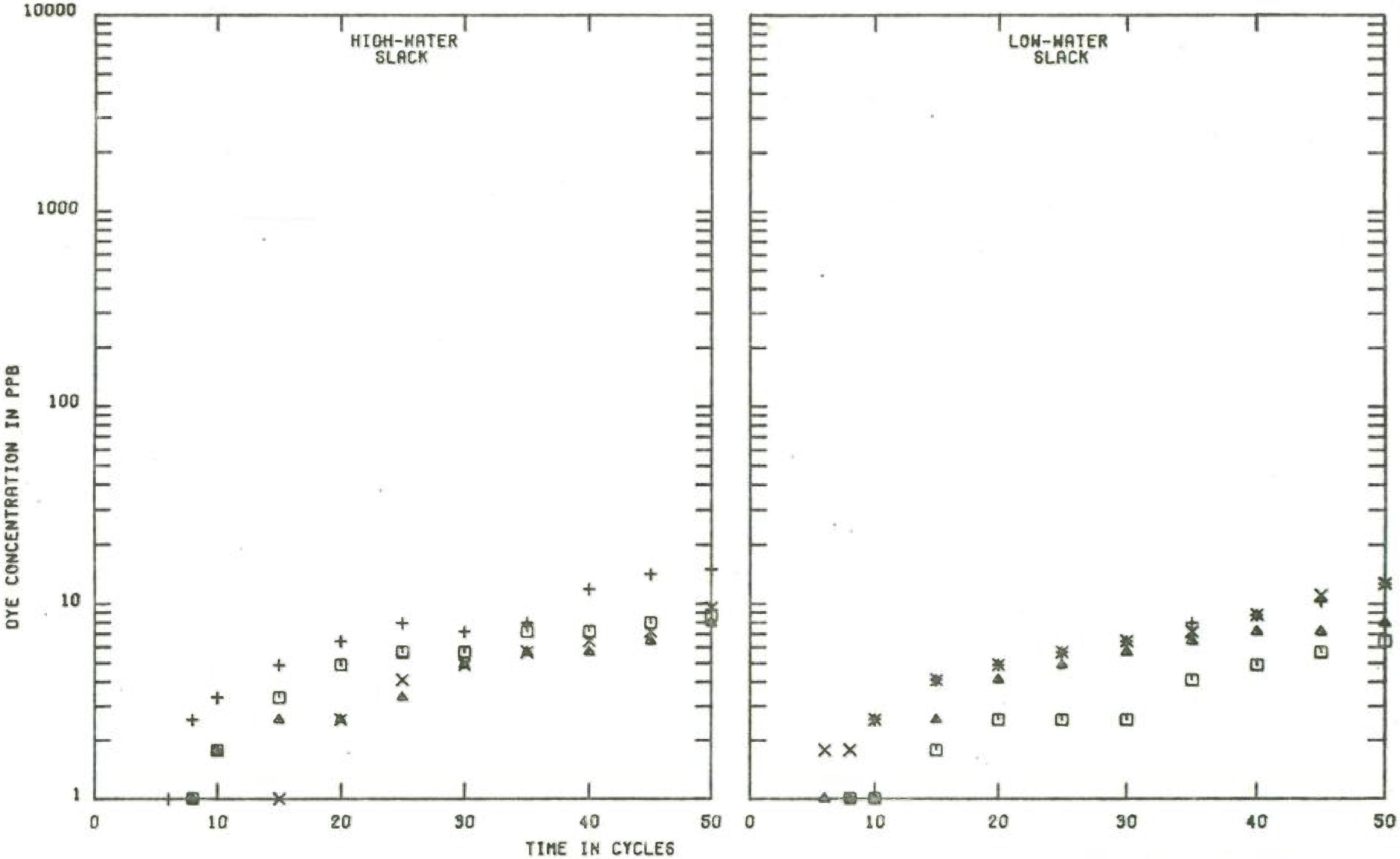
LEGEND

- □ ——— SURFACE, BASE
- ▲ — — — BOTTOM, BASE
- + —·—·— SURFACE, PLAN 1
- X —··—··— BOTTOM, PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 27



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
× —--—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

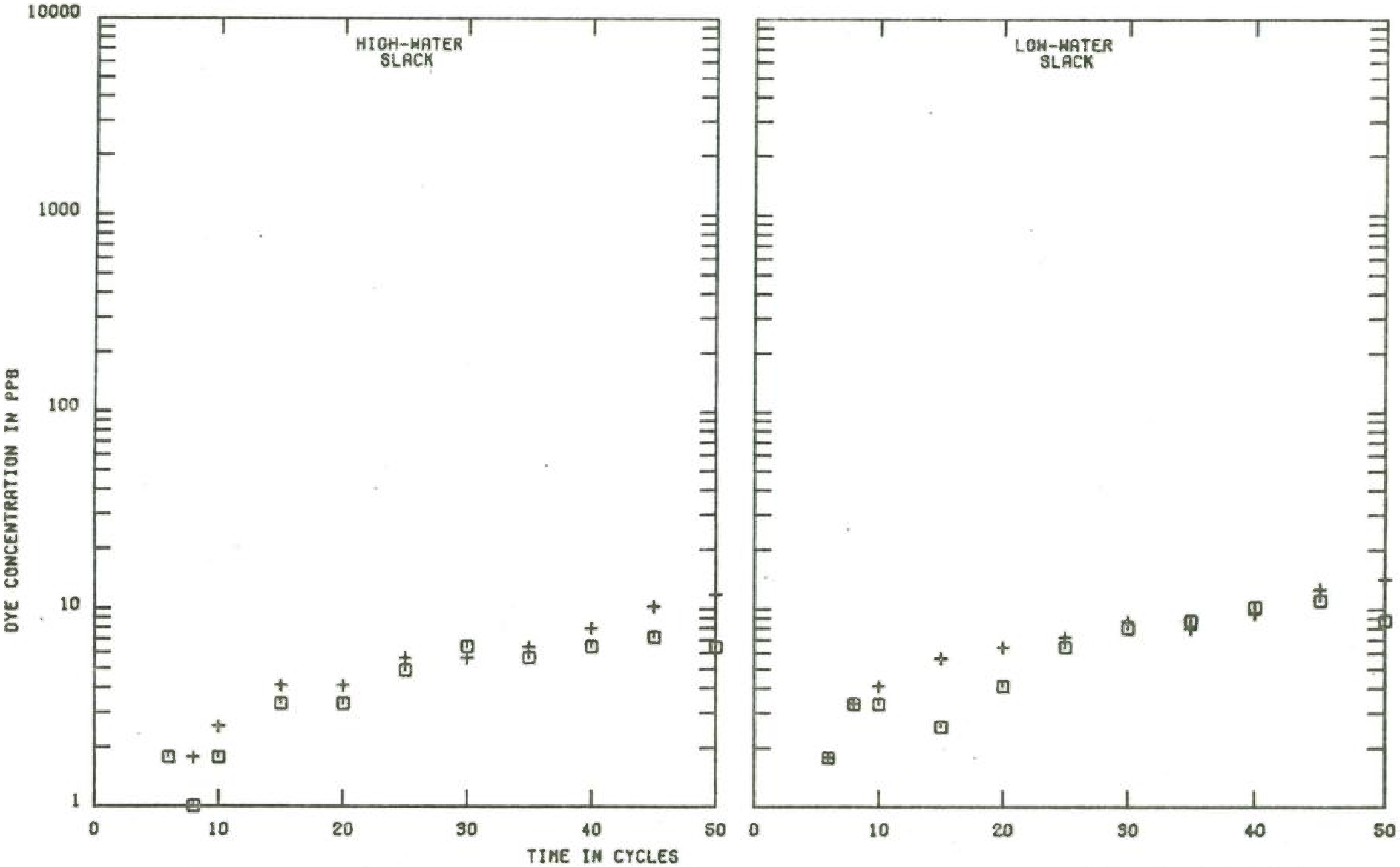
EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 28

PLATE 51

PLATE 52



TEST CONDITIONS

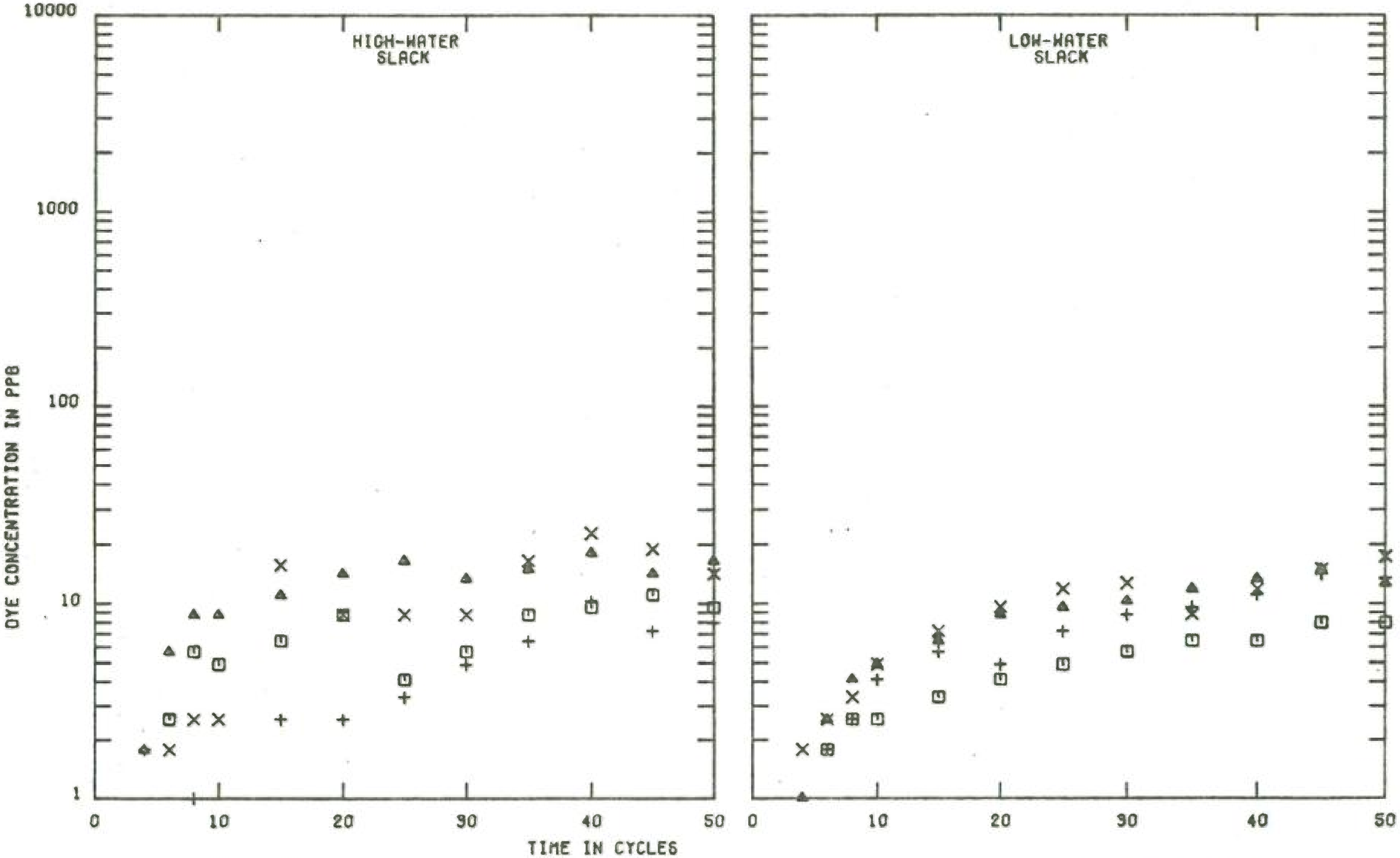
TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 32 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

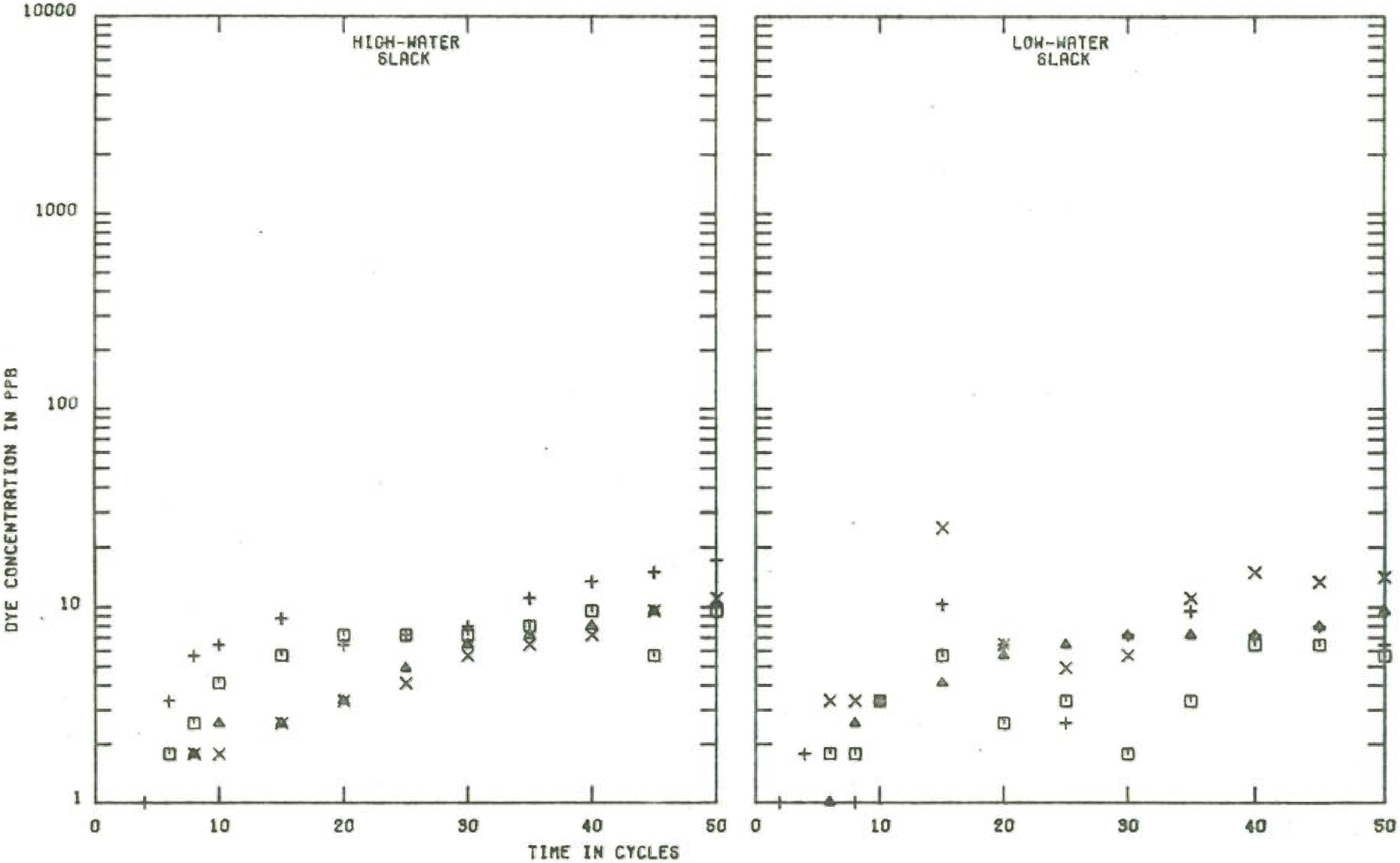
EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 33

PLATE 53

PLATE 54



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

Symbol	Layer	Test
□ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 34

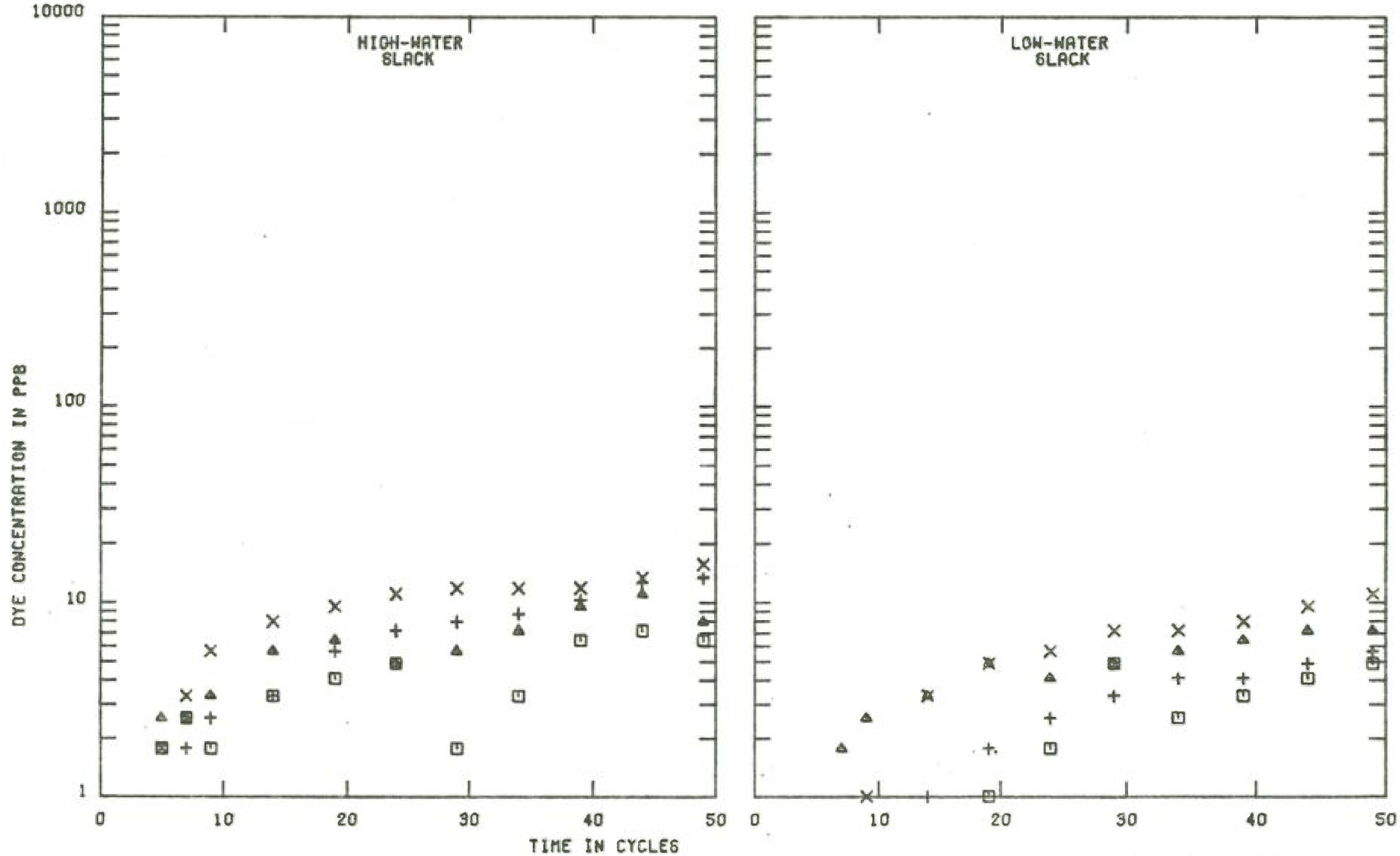


PLATE 55

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	

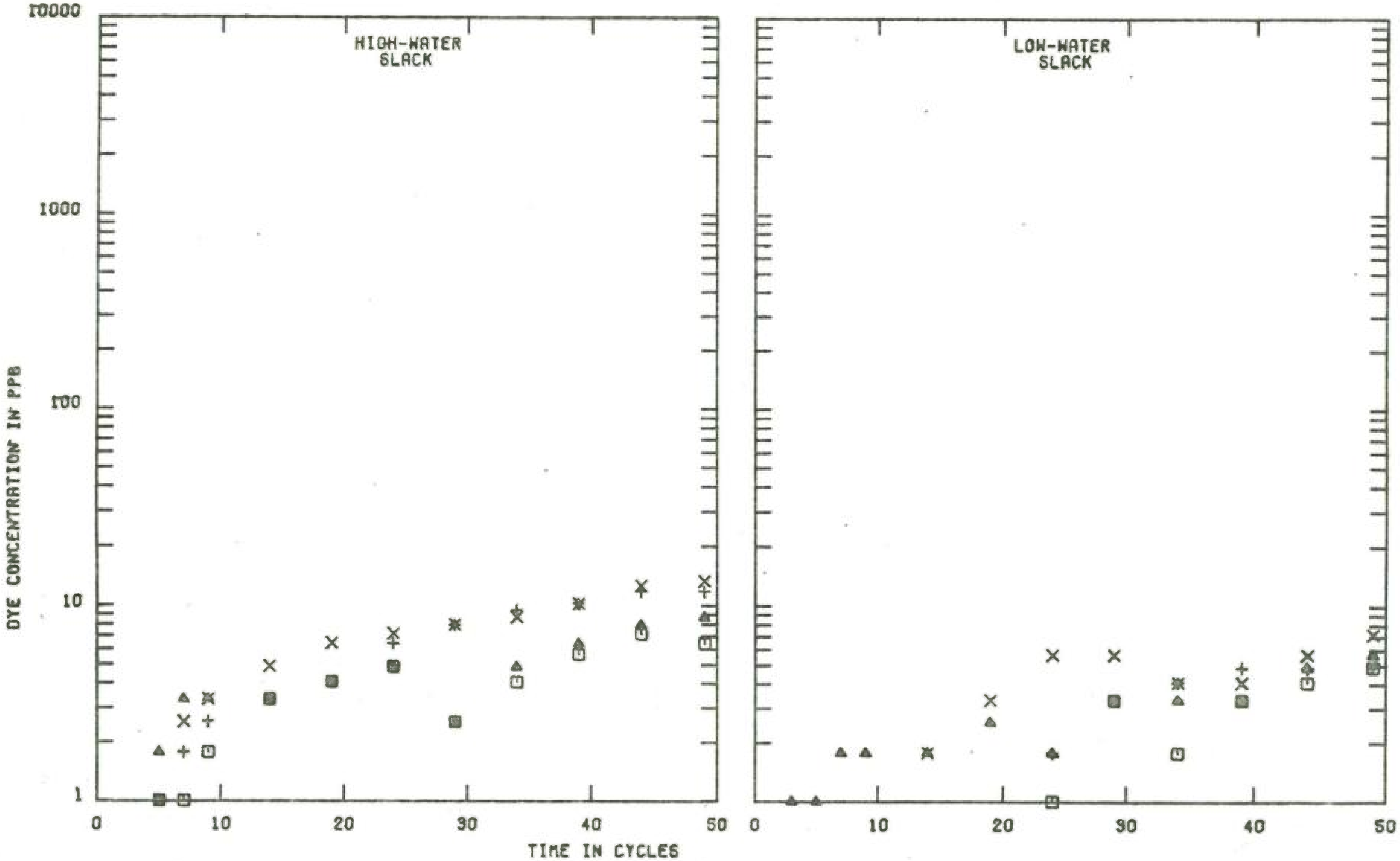
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 35

PLATE 56



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

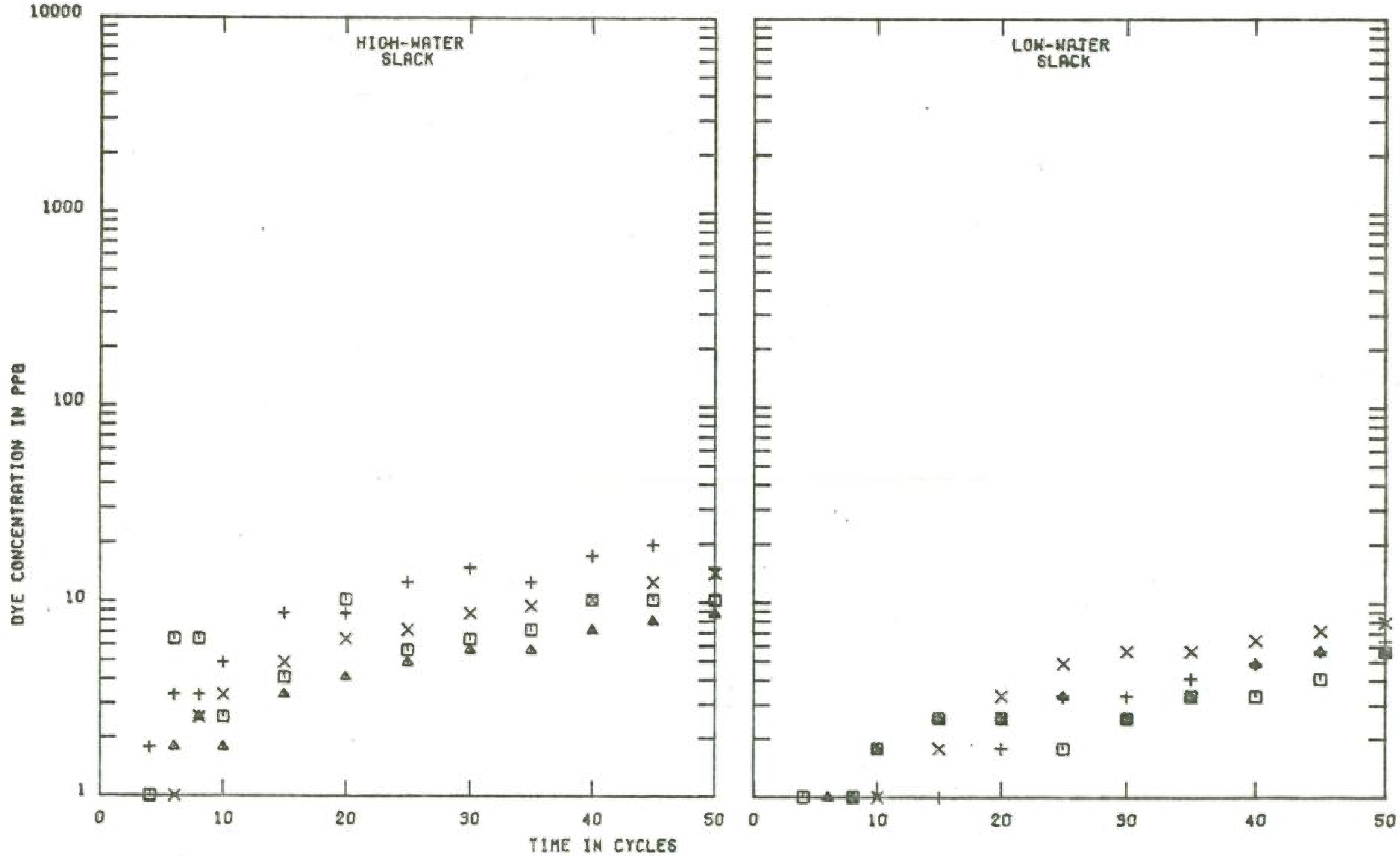
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 36



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

□ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

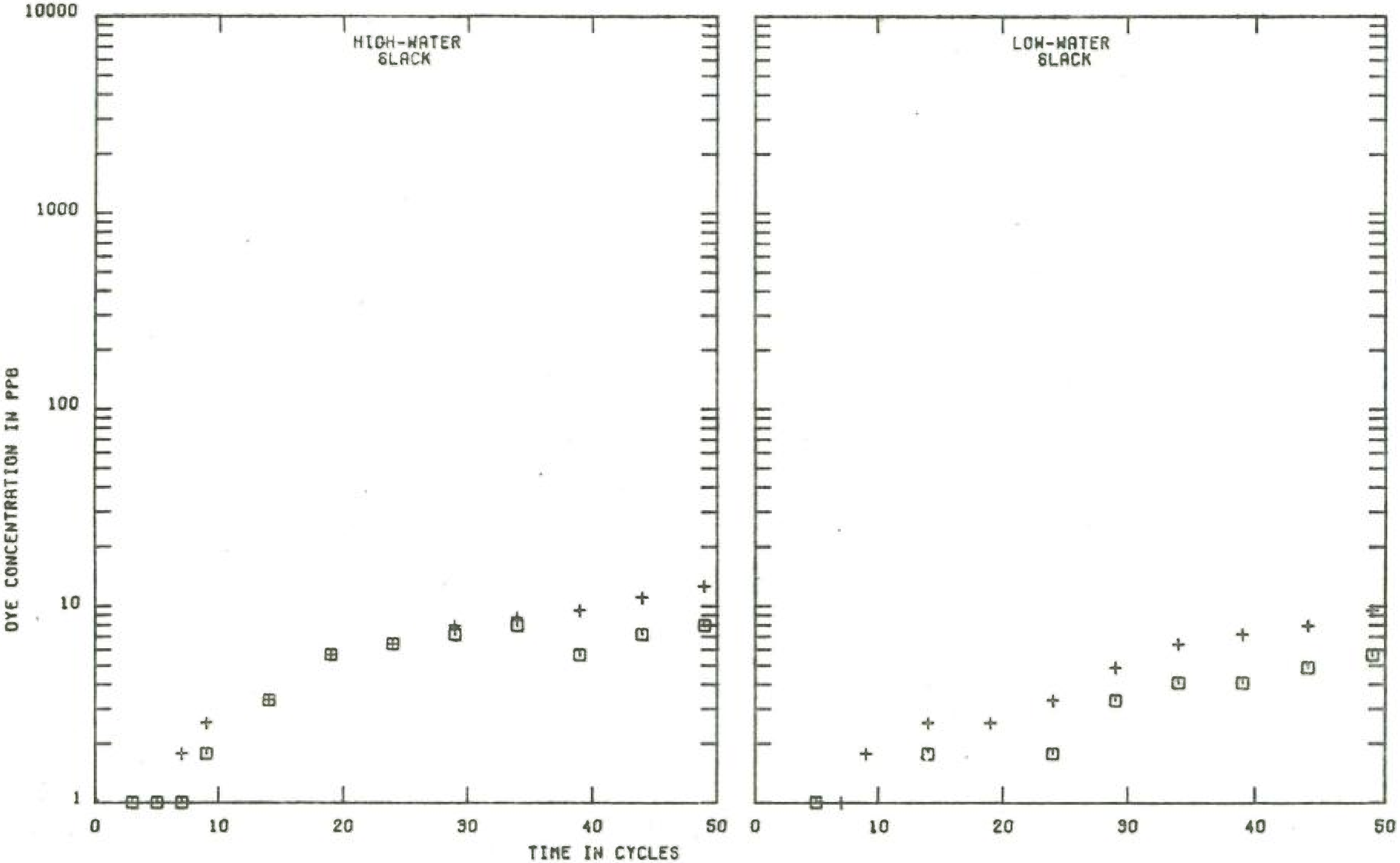
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 37

PLATE 58



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

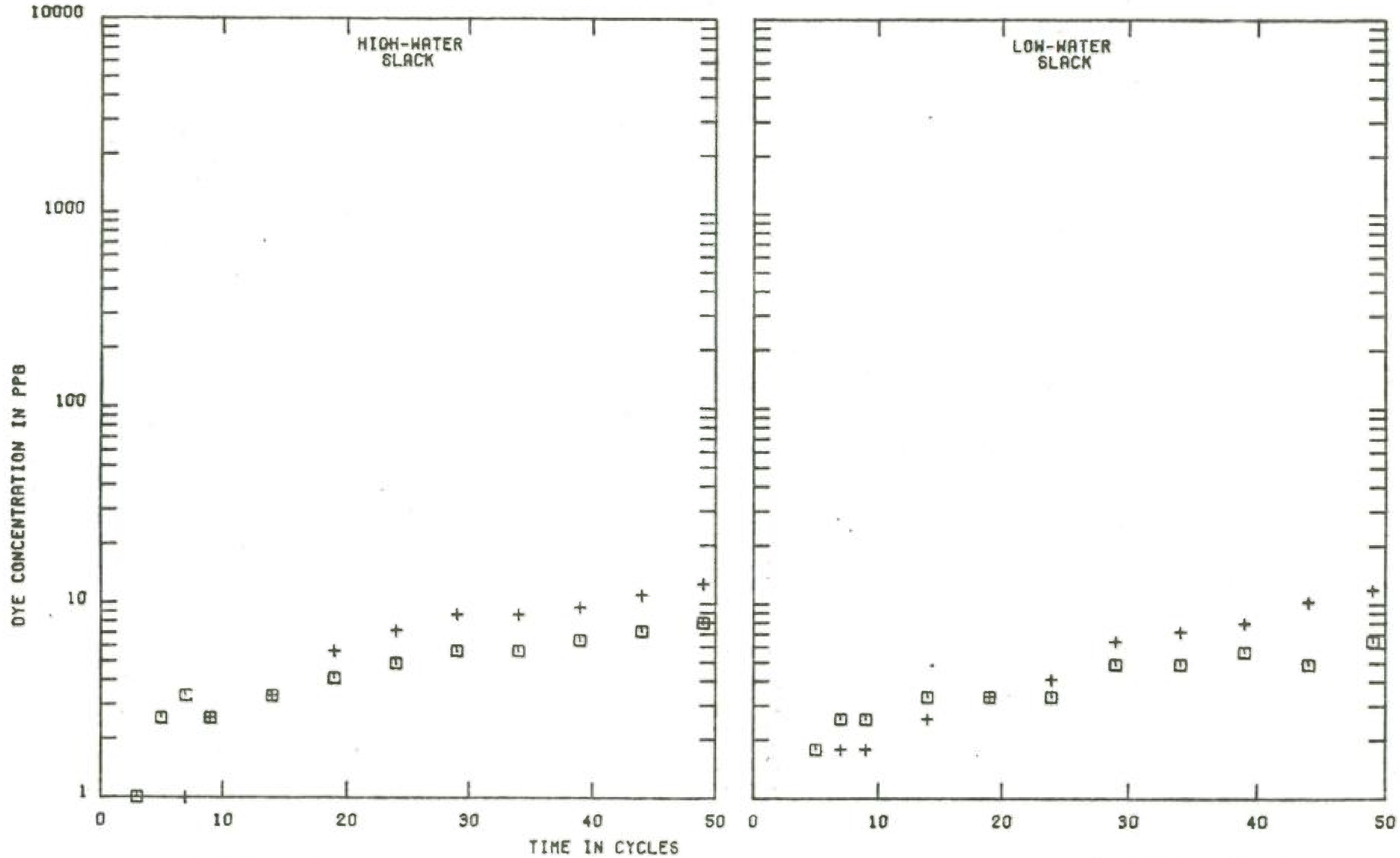
⊡ ——— BASE

\+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 38 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ——— BASE

+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

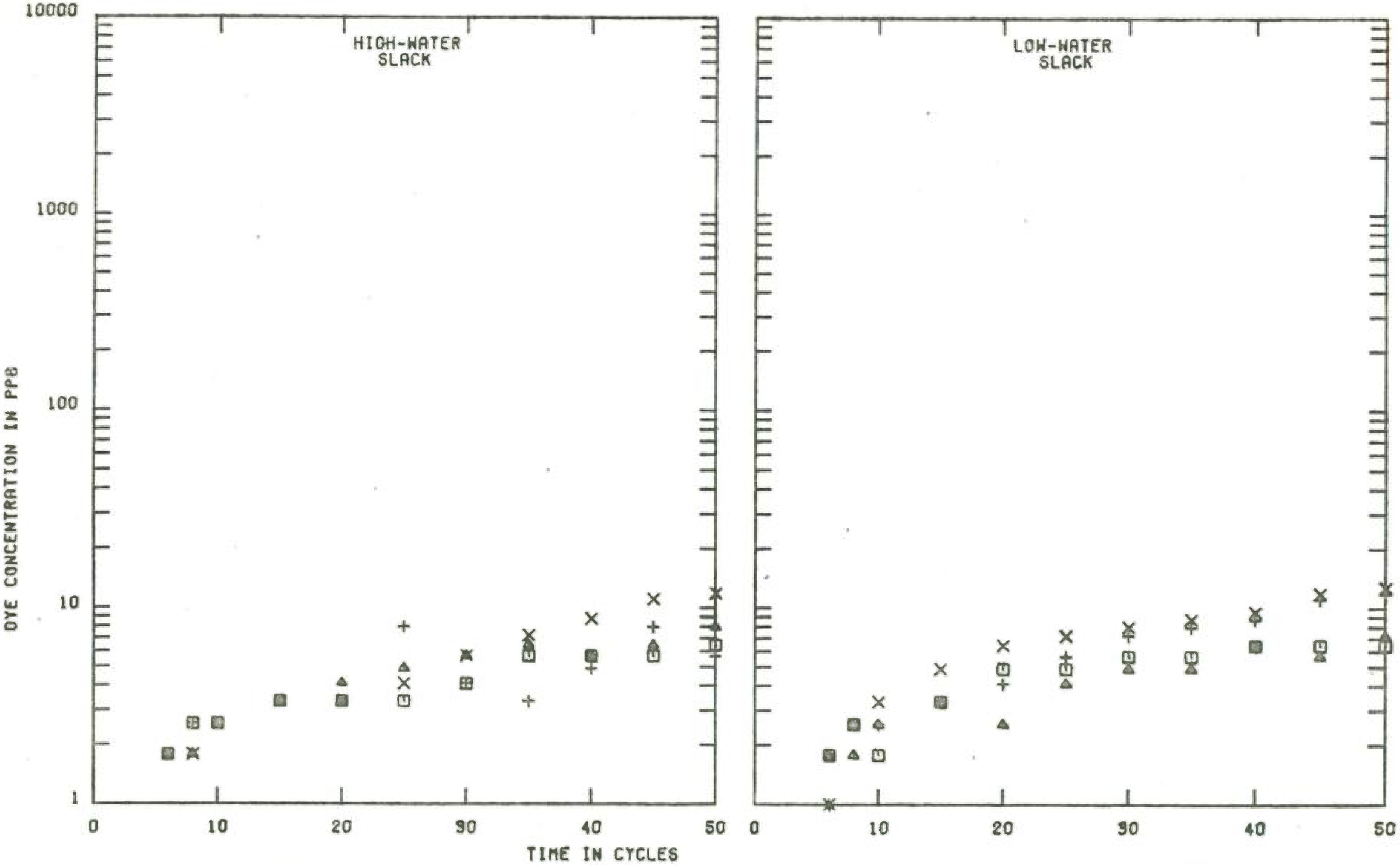
EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 39 MID-DEPTH

PLATE 59

PLATE 60



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

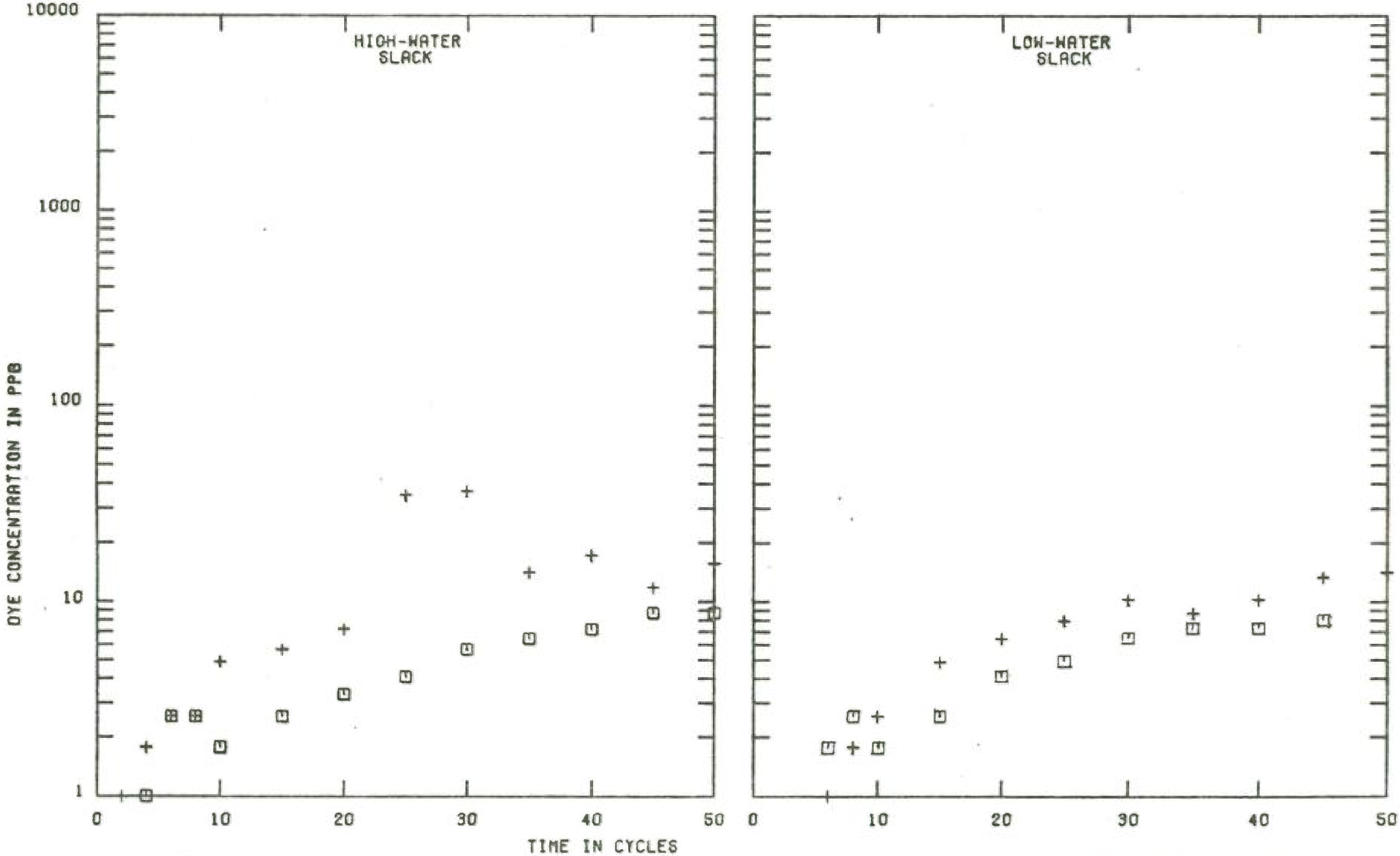
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 40



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

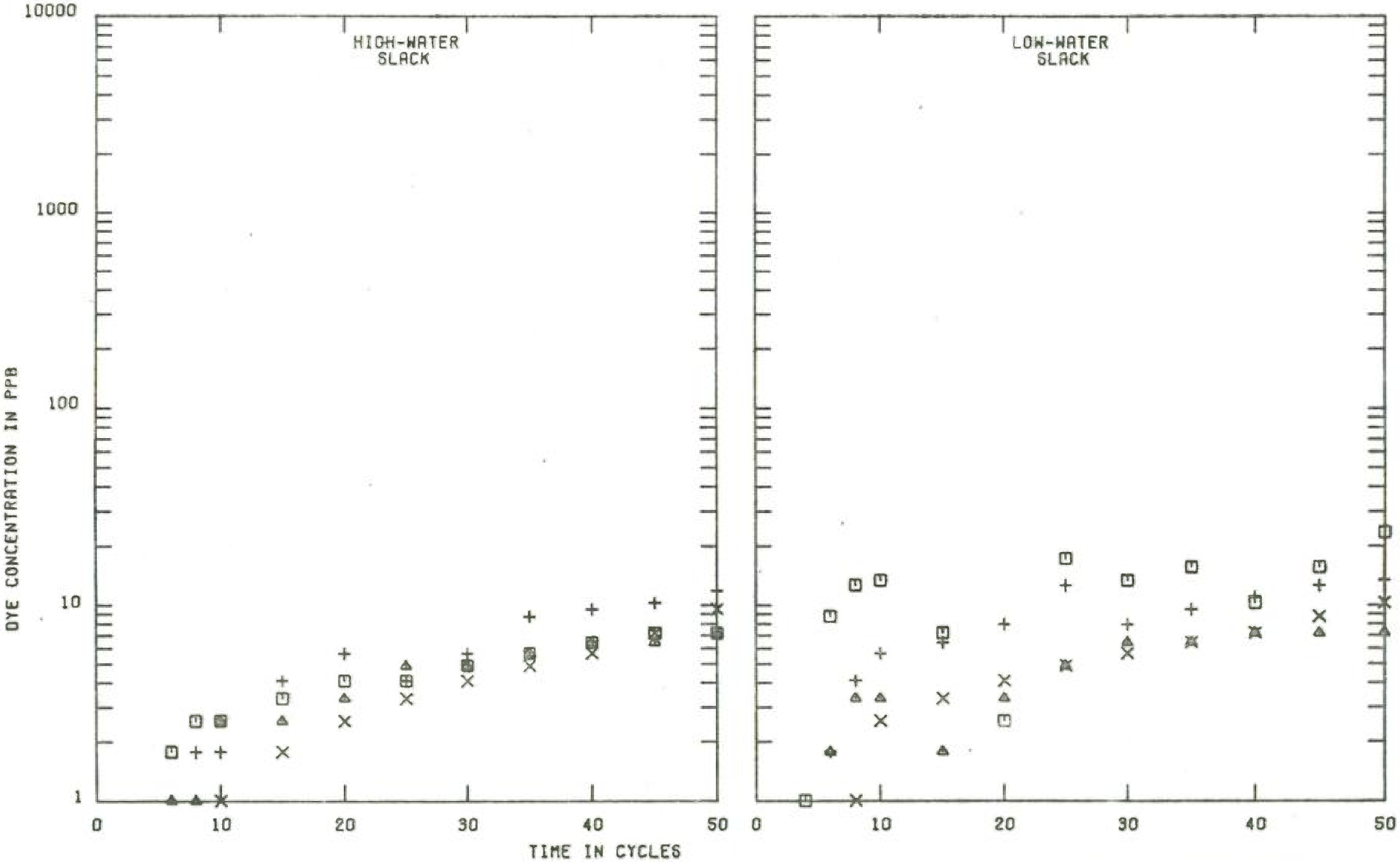
LEGEND

⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 41 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

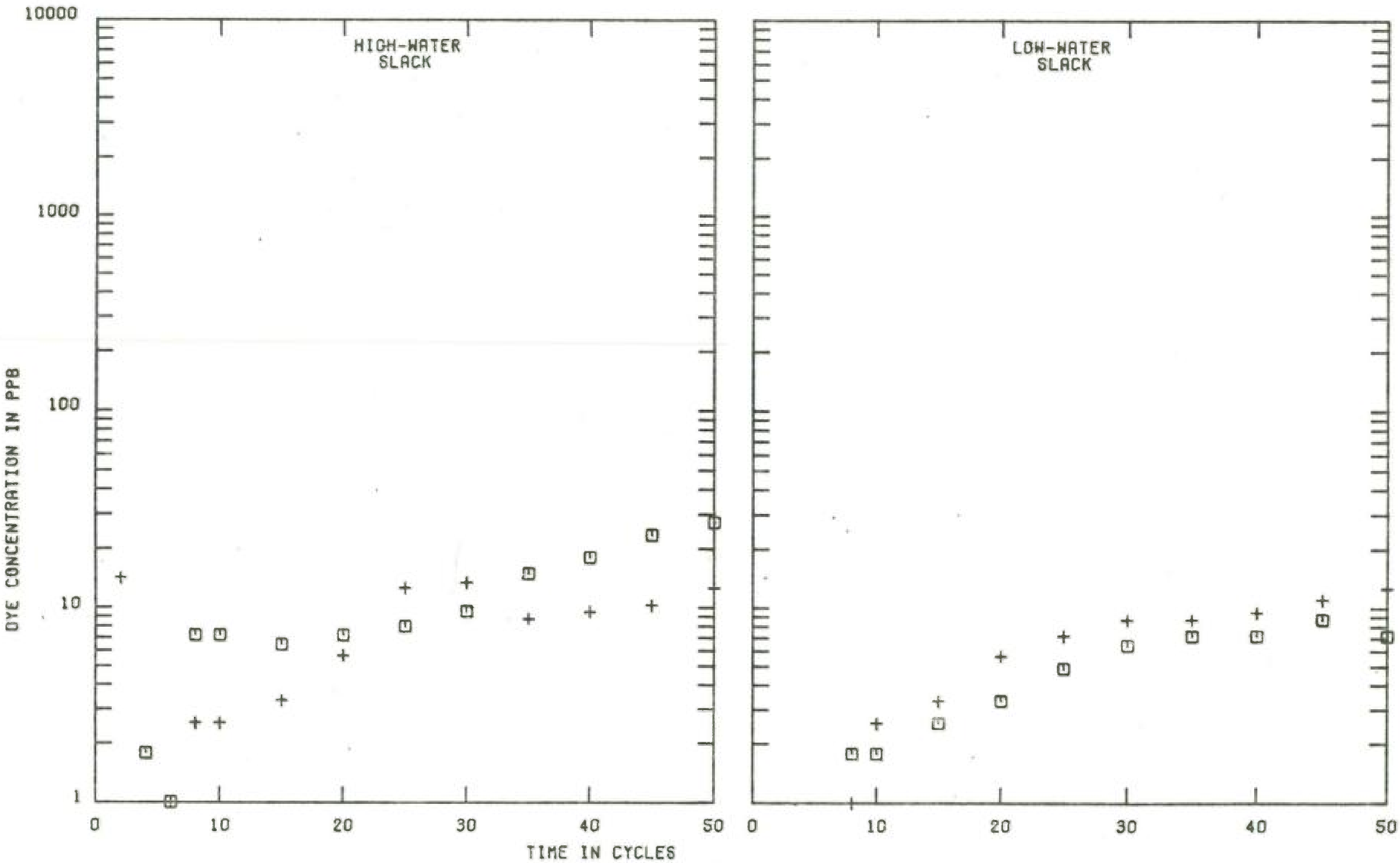
□ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 42



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ——— BASE
\+ — — — PLAN 1

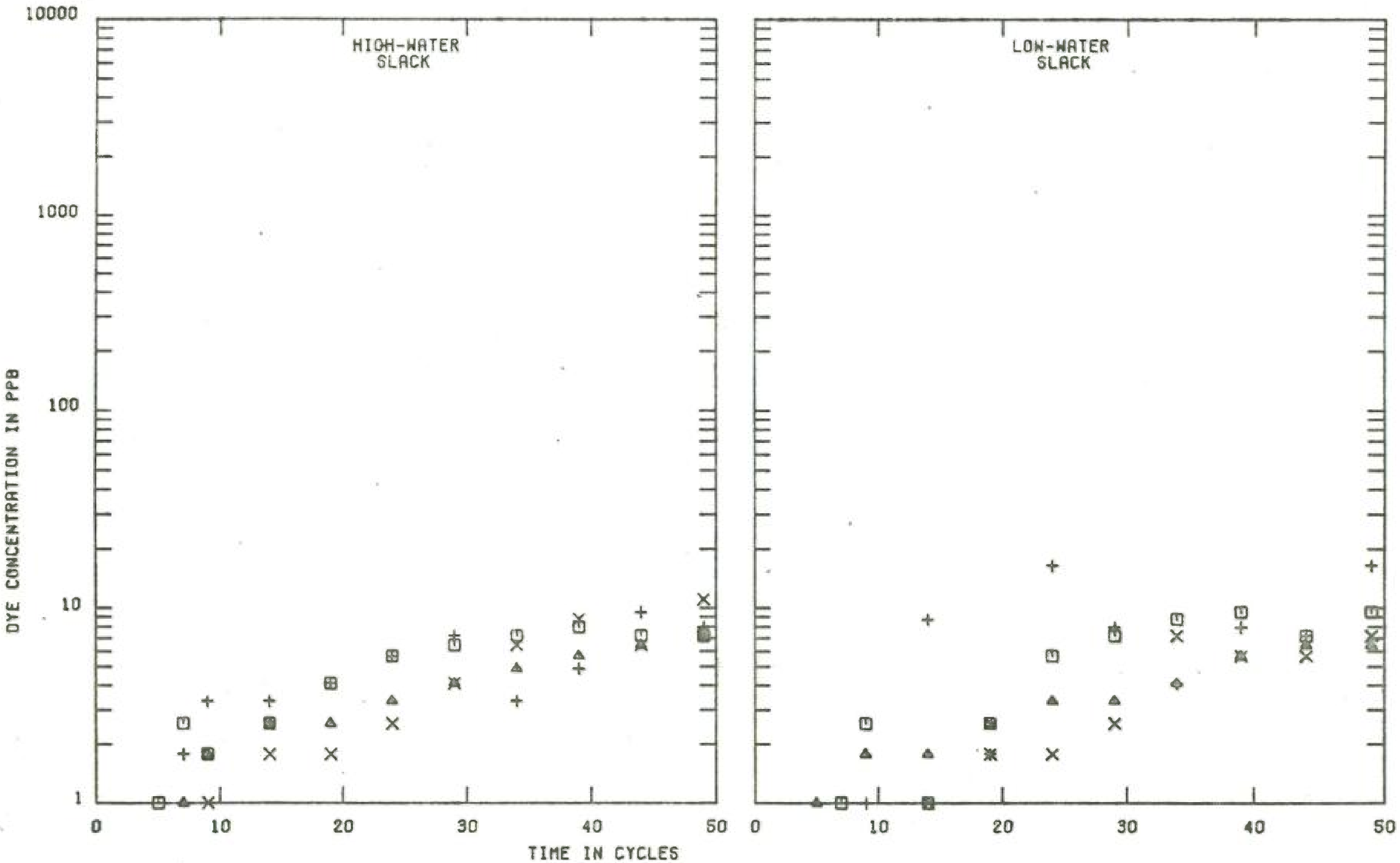
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 43 MID-DEPTH

PLATE 64



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

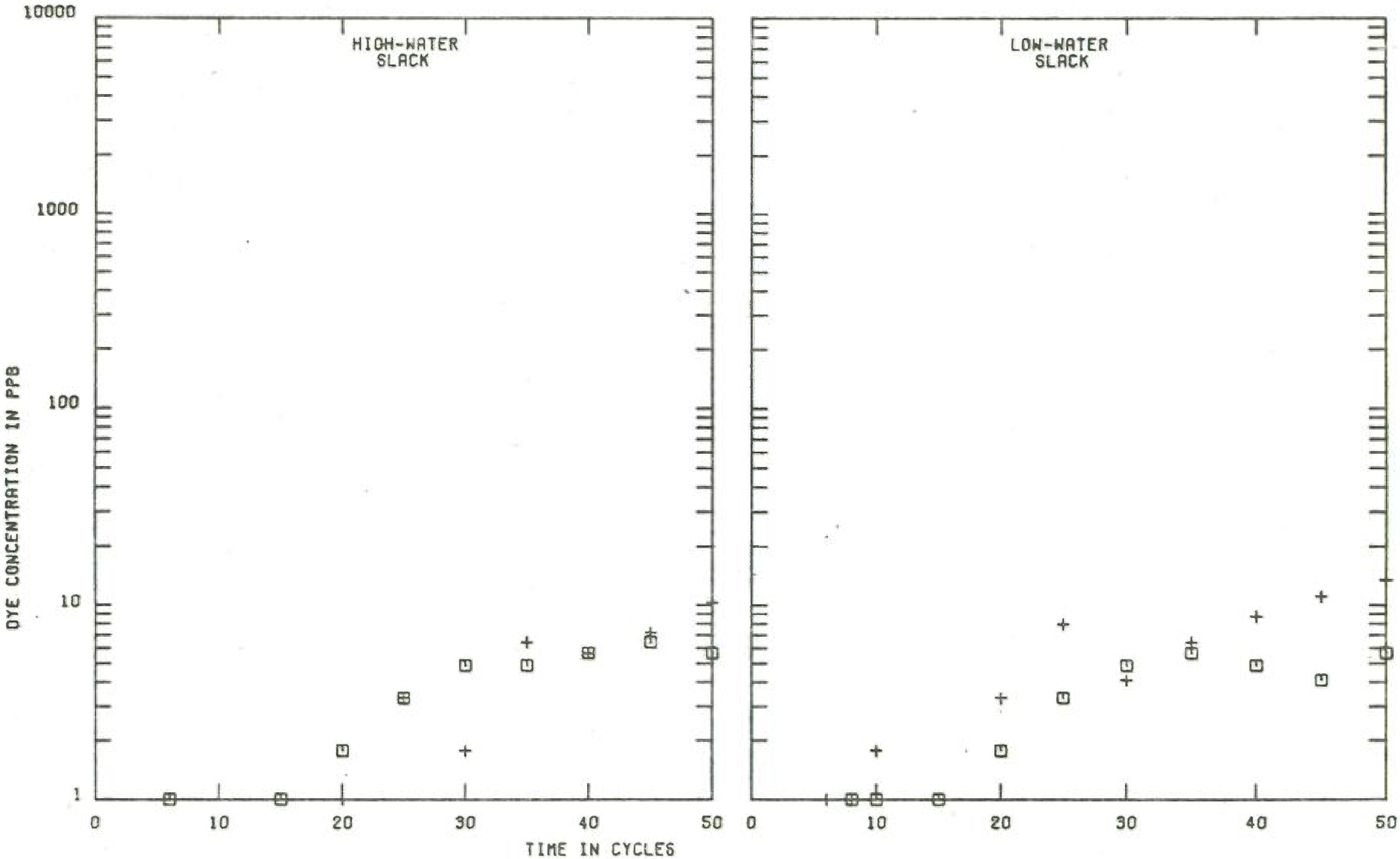
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 44



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

□ ——— BASE
+ — — — PLAN 1

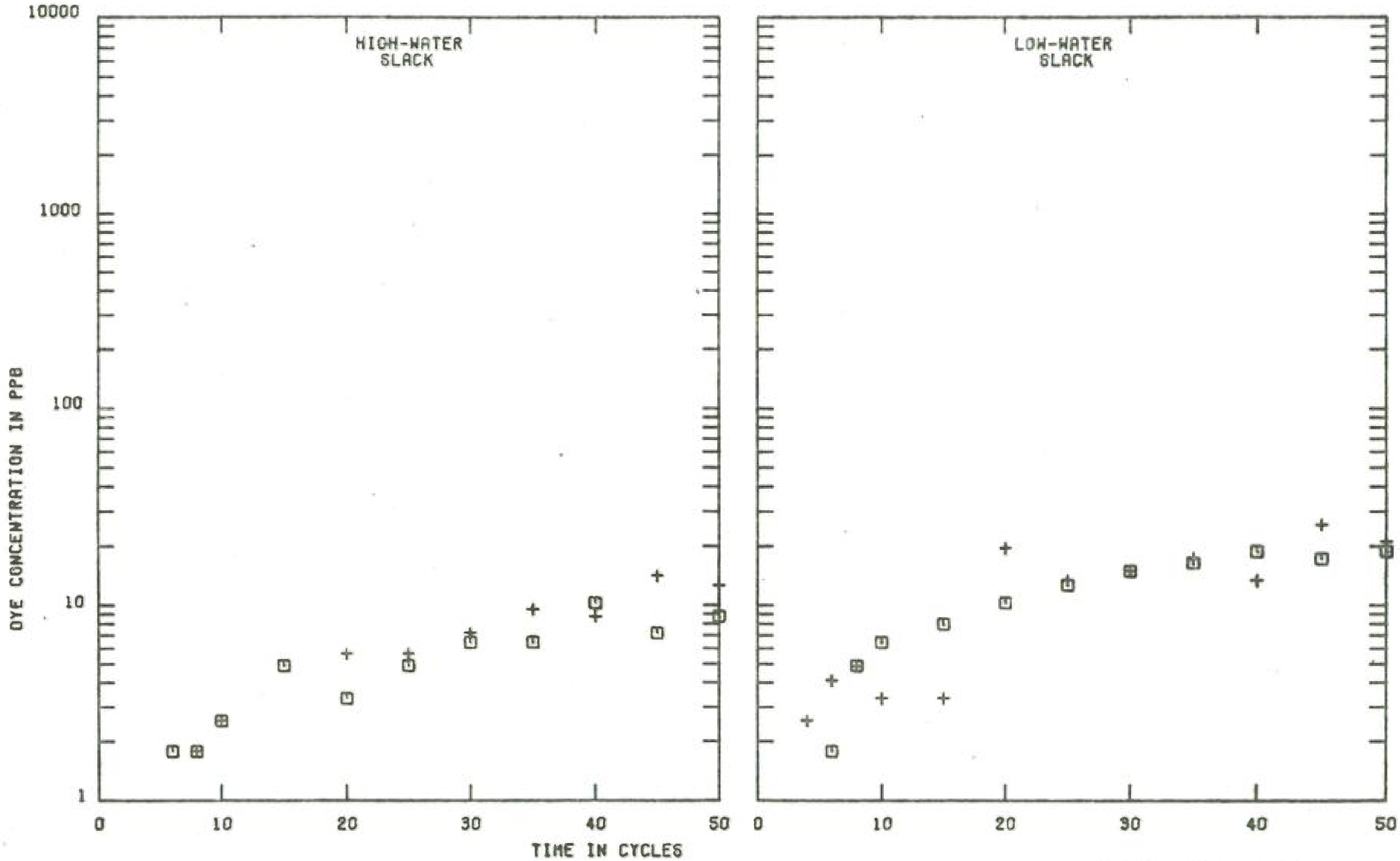
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 45 MID-DEPTH

PLATE 66



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

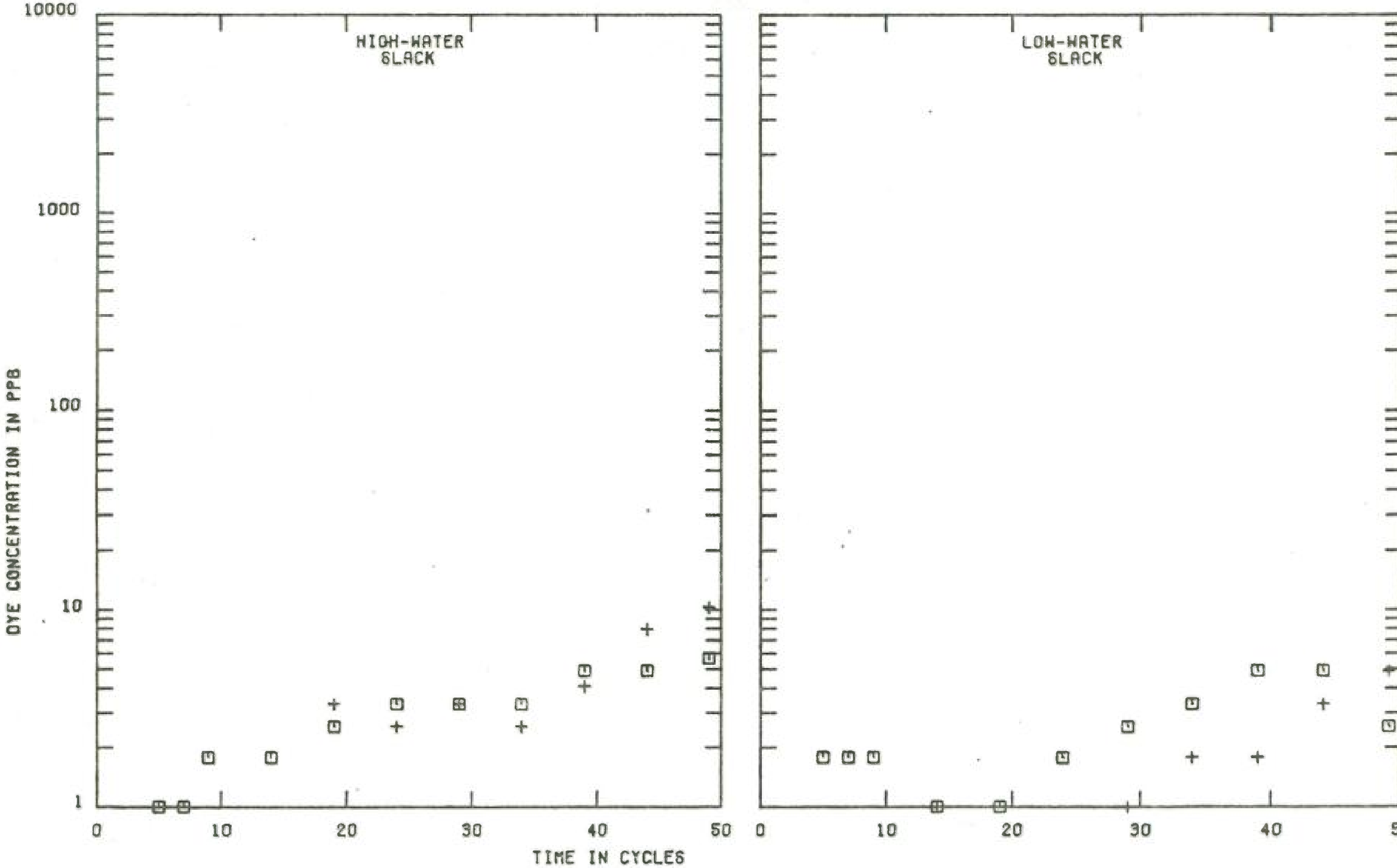
⊡ ——— BASE
+ – – – PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 46 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

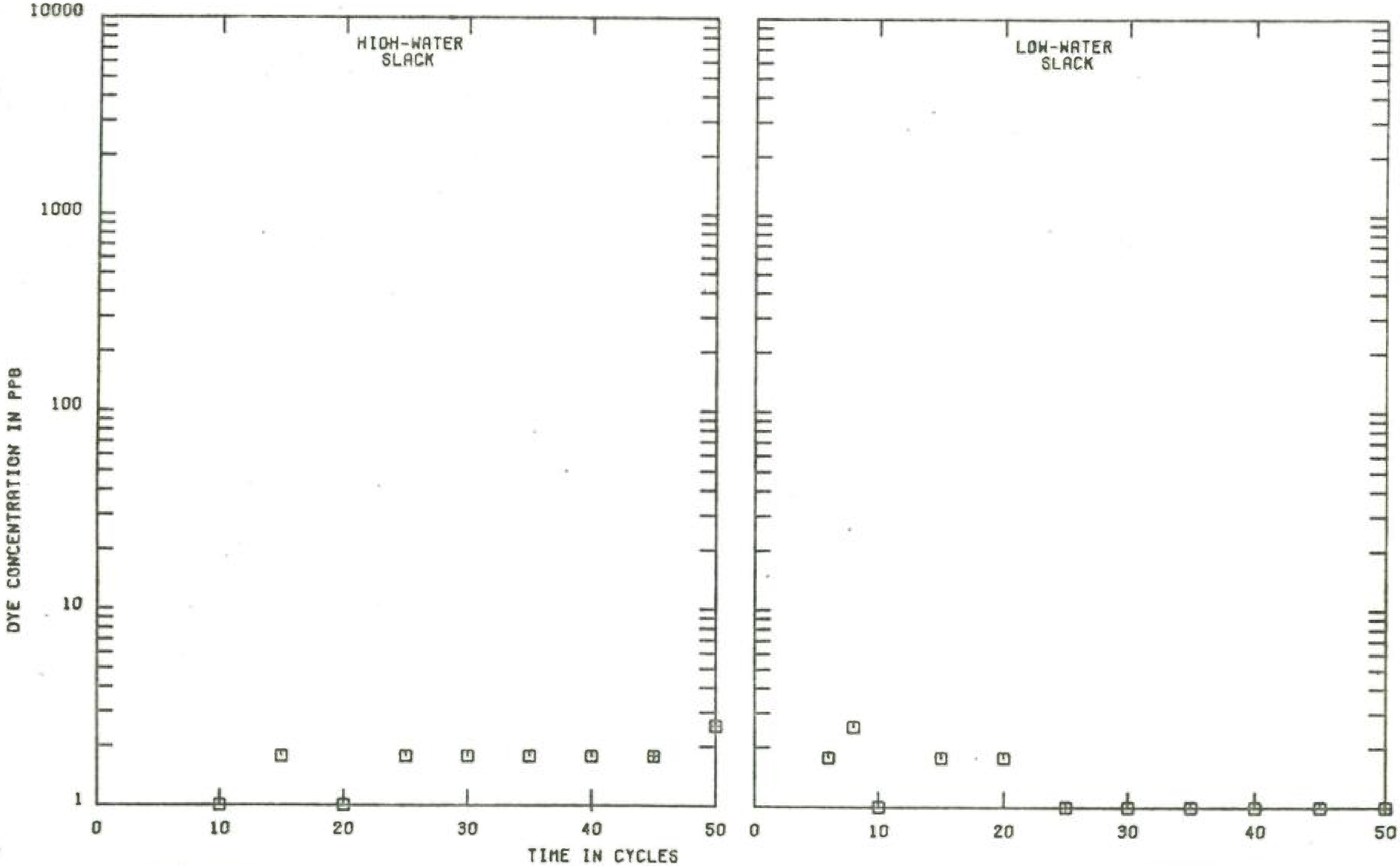
⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 47 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

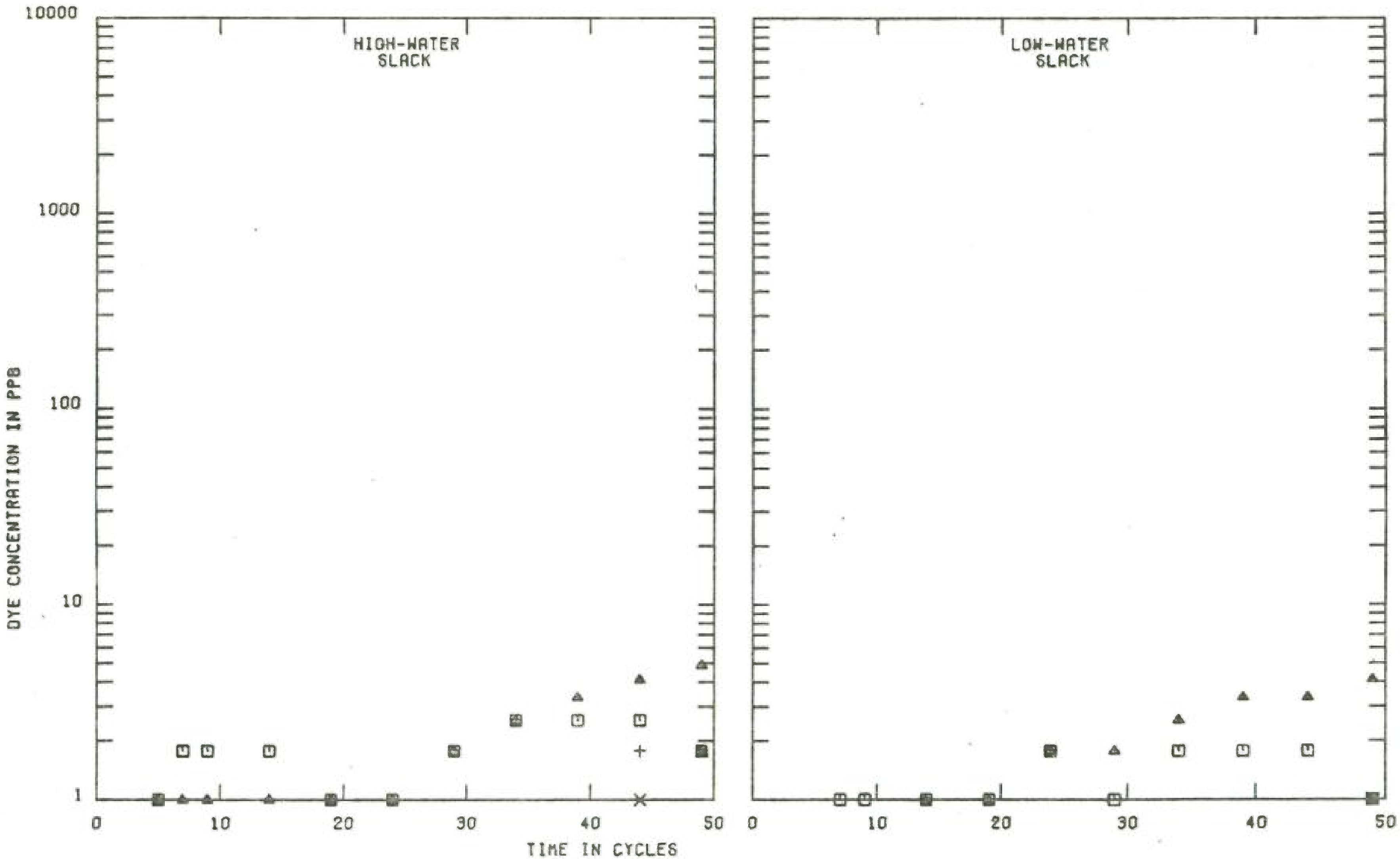
□ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 48 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

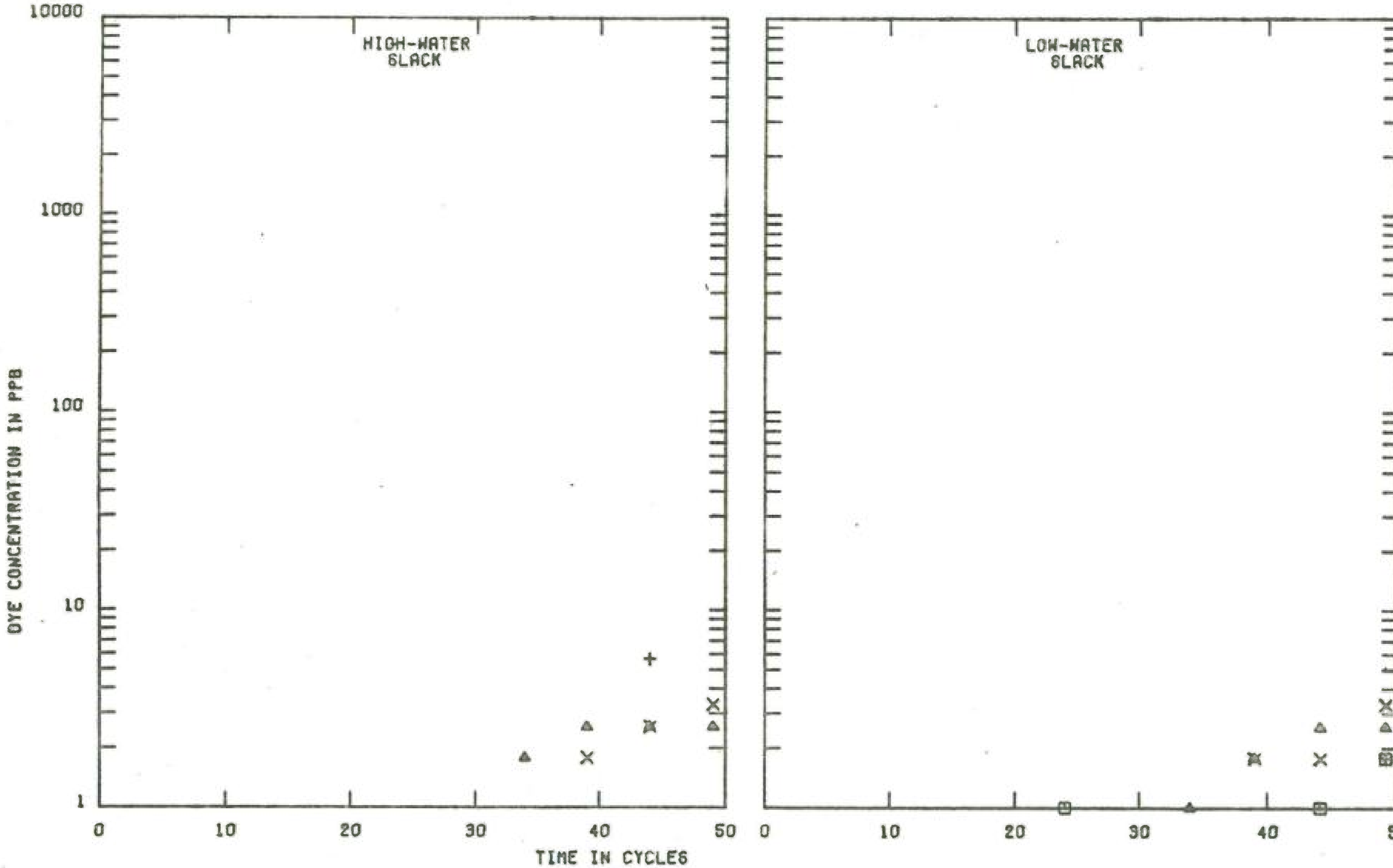
□ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 49



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

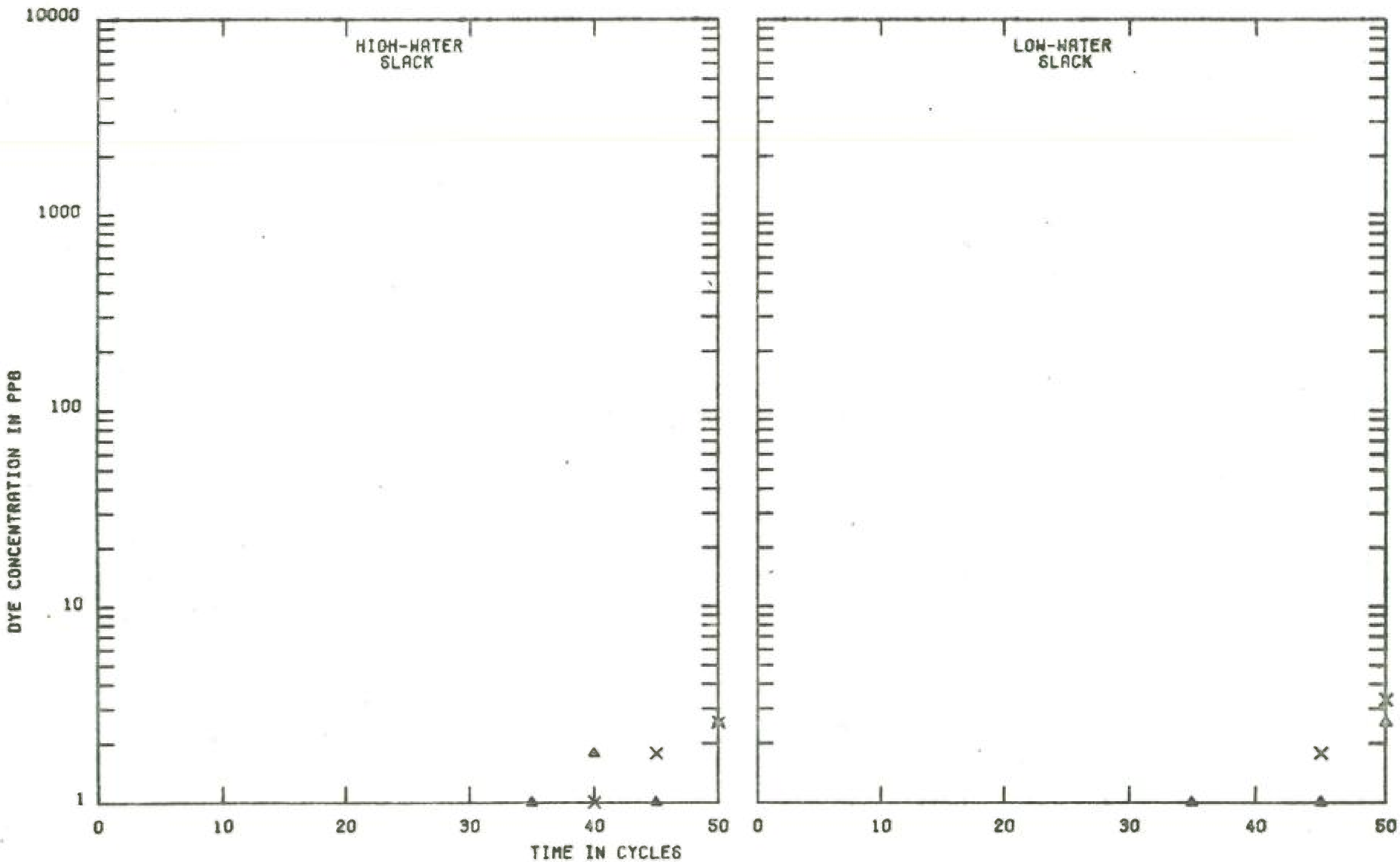
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 50



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

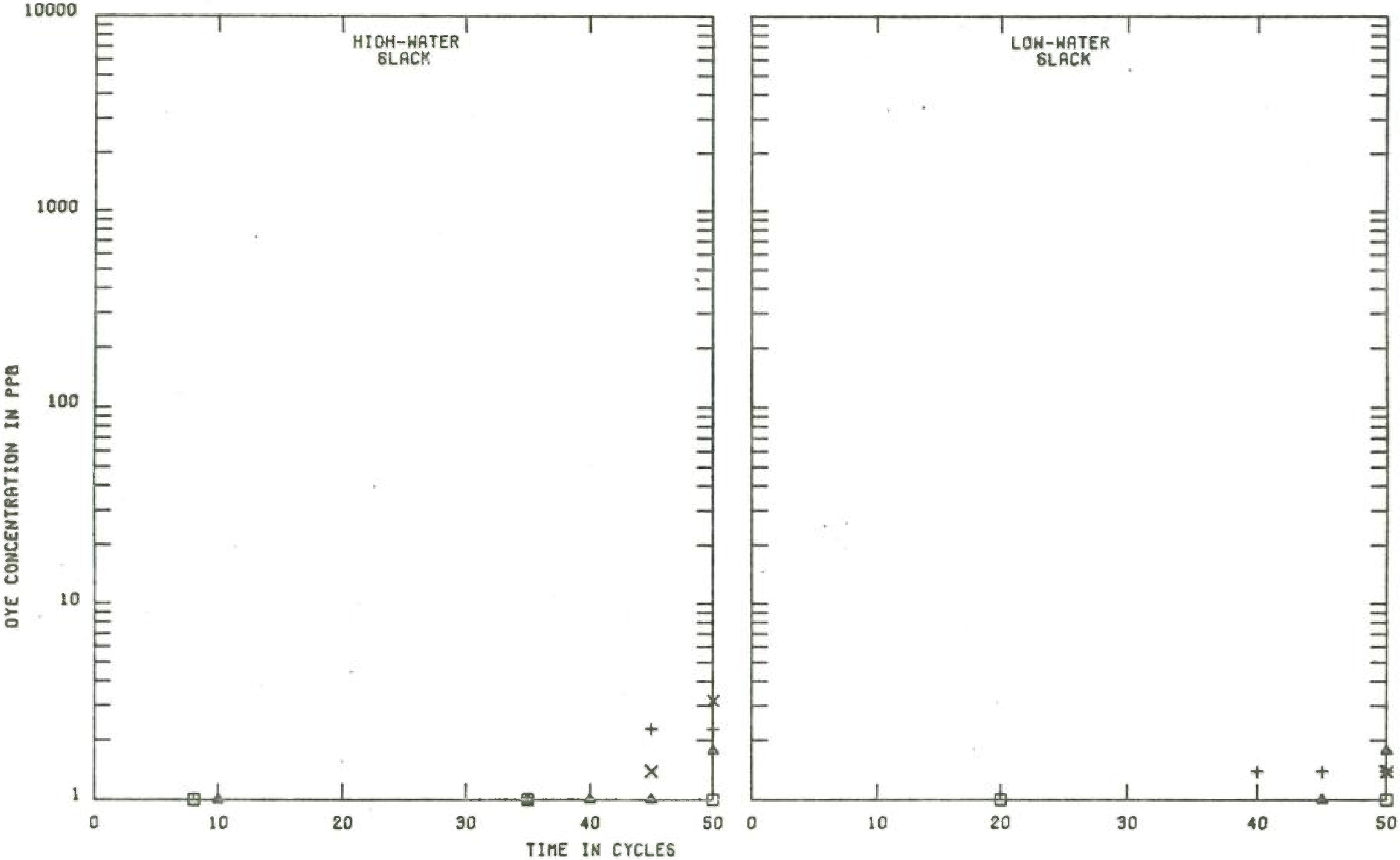
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 52



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

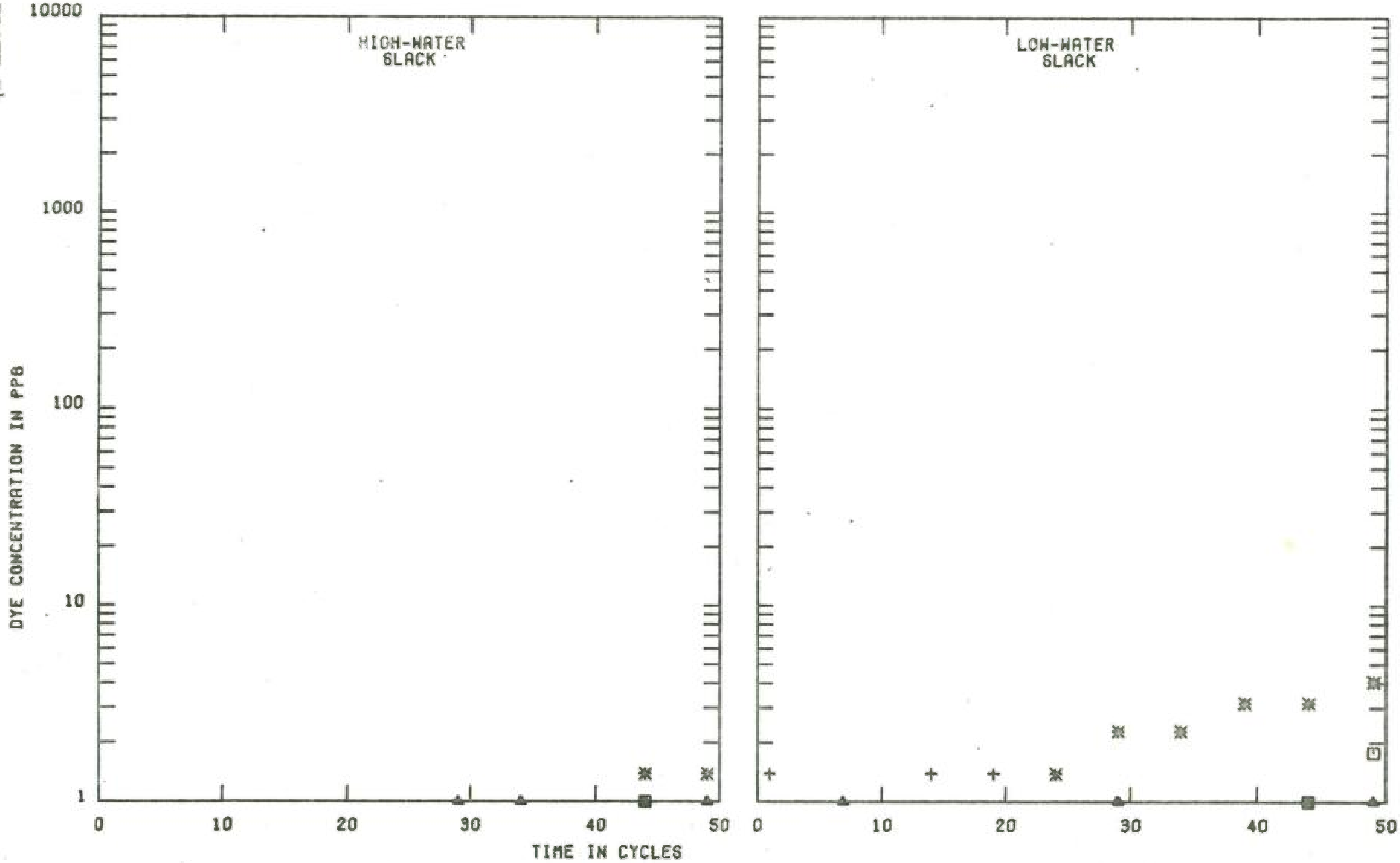
- □ ——— SURFACE, ▲ — — — BOTTOM: BASE
- + —·— SURFACE, × —··— BOTTOM: PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 53

PLATE 73



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

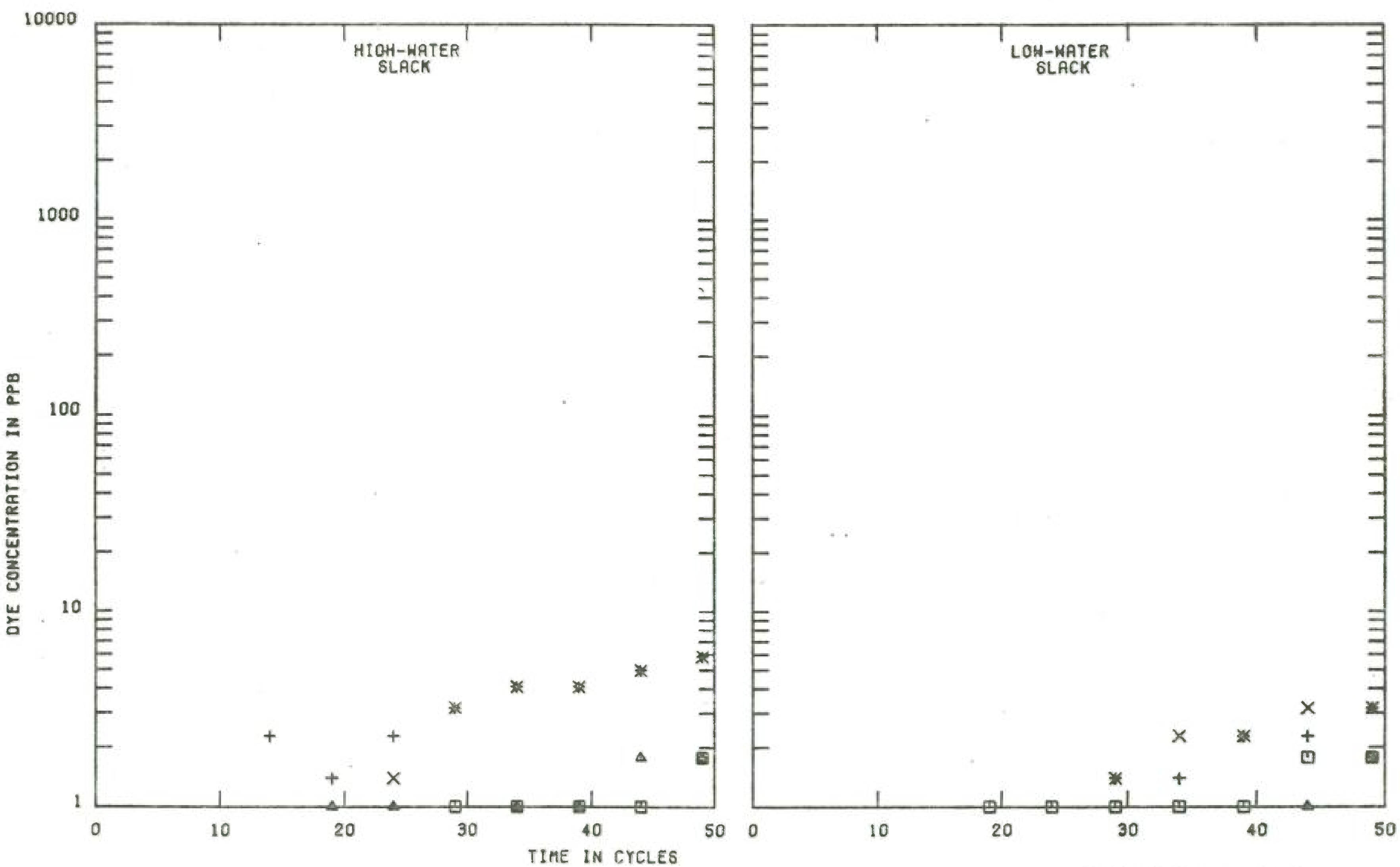
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 54



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ——— SURFACE, ▲ — — — BOTTOM: BASE

+ —·—·— SURFACE, × —··—·· BOTTOM: PLAN 1

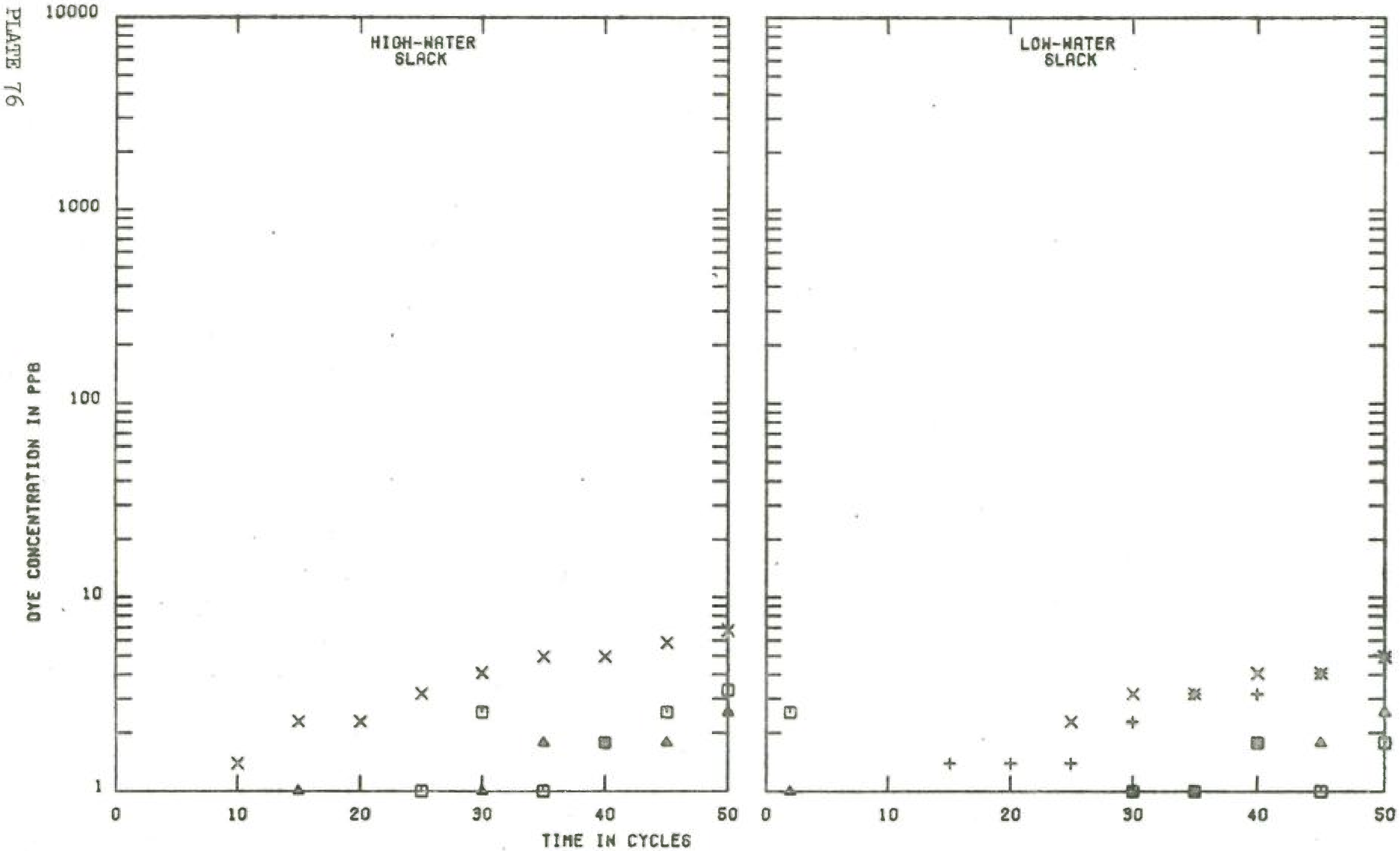
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 55

PLATE 76



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

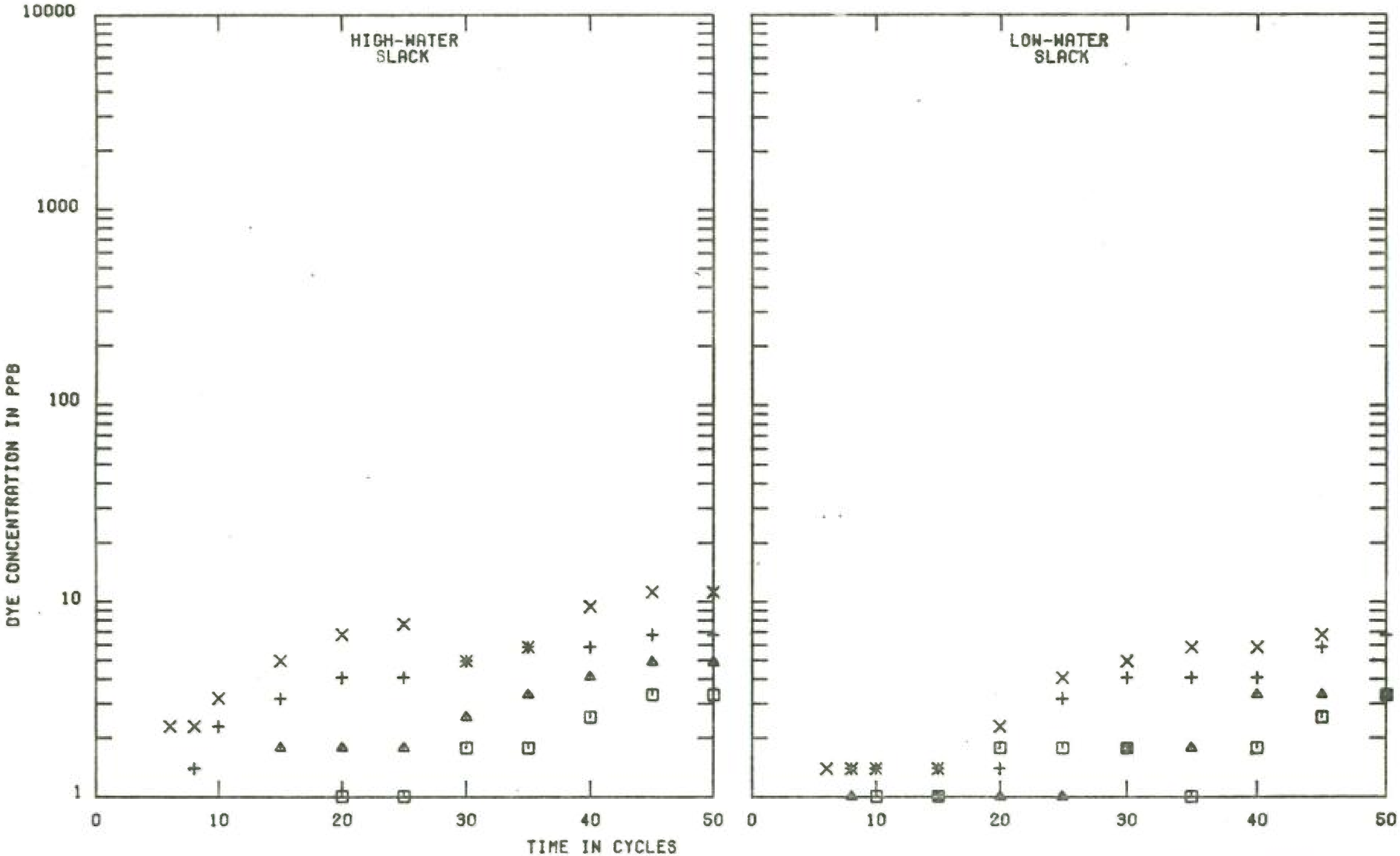
Symbol	Line	Level	Condition
□	———	SURFACE	BASE
▲	— — —	BOTTOM	BASE
+	—·—·—	SURFACE	PLAN 1
×	—·-·—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 56



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

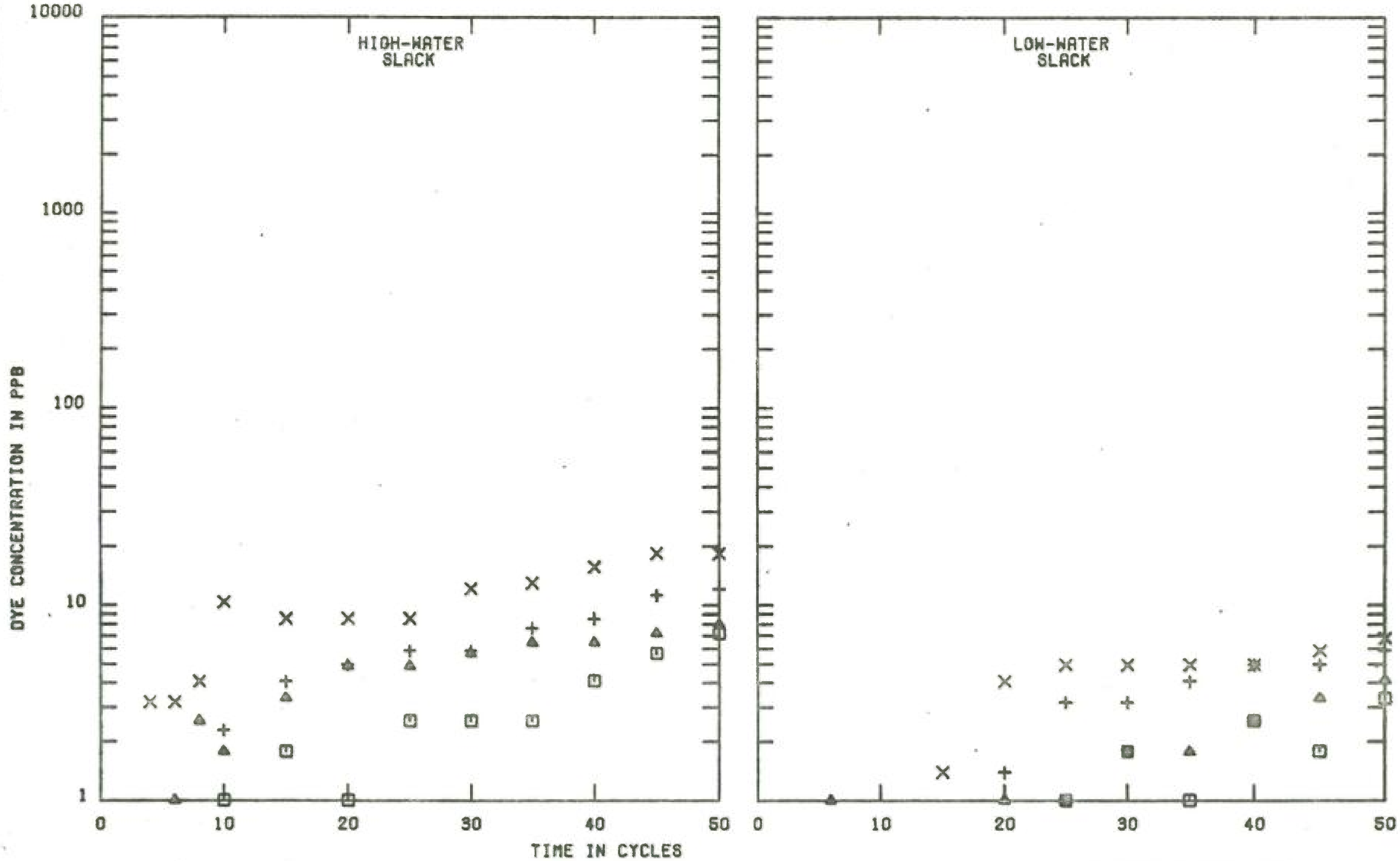
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
X —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 57



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

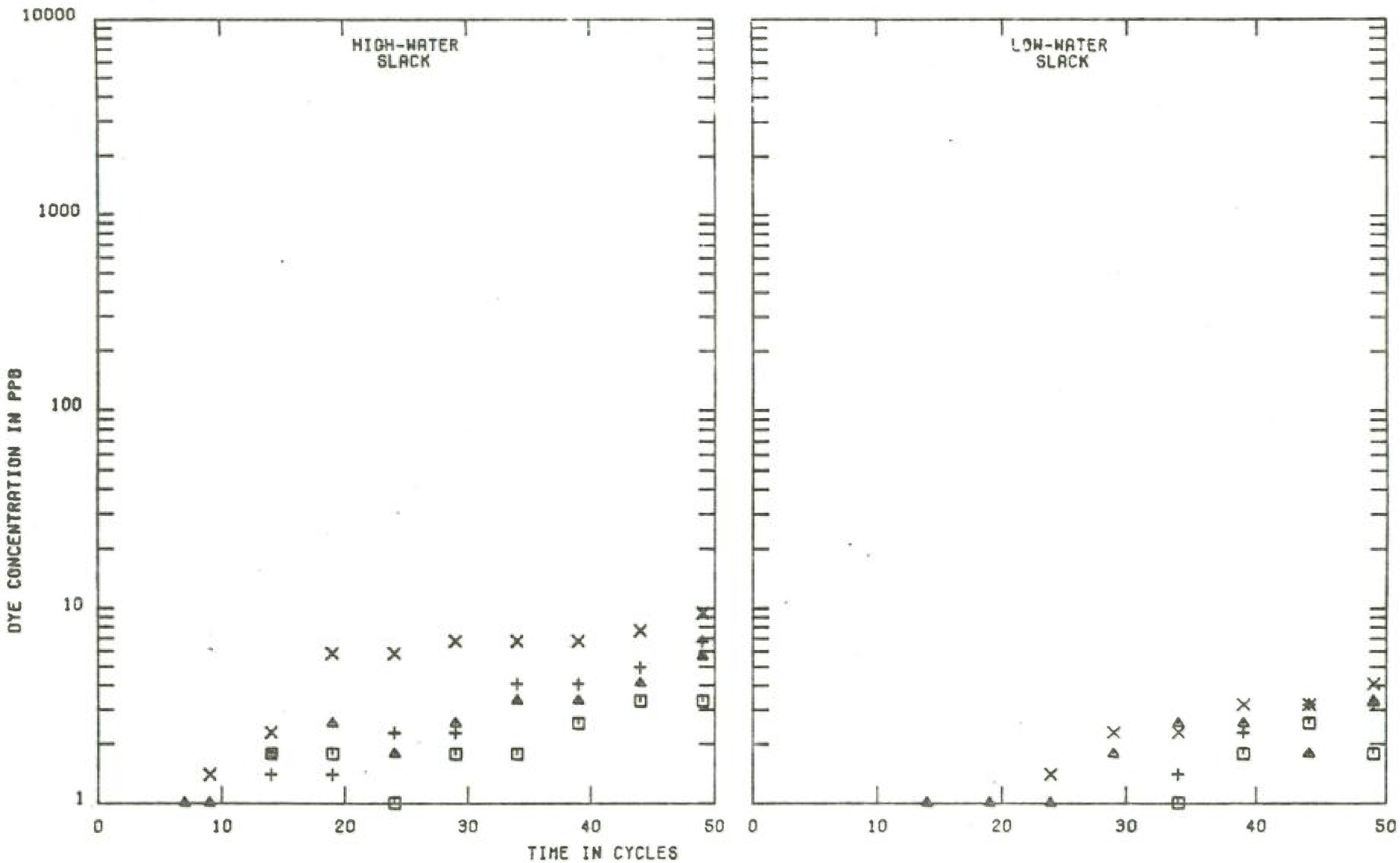
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
× —--—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 58



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

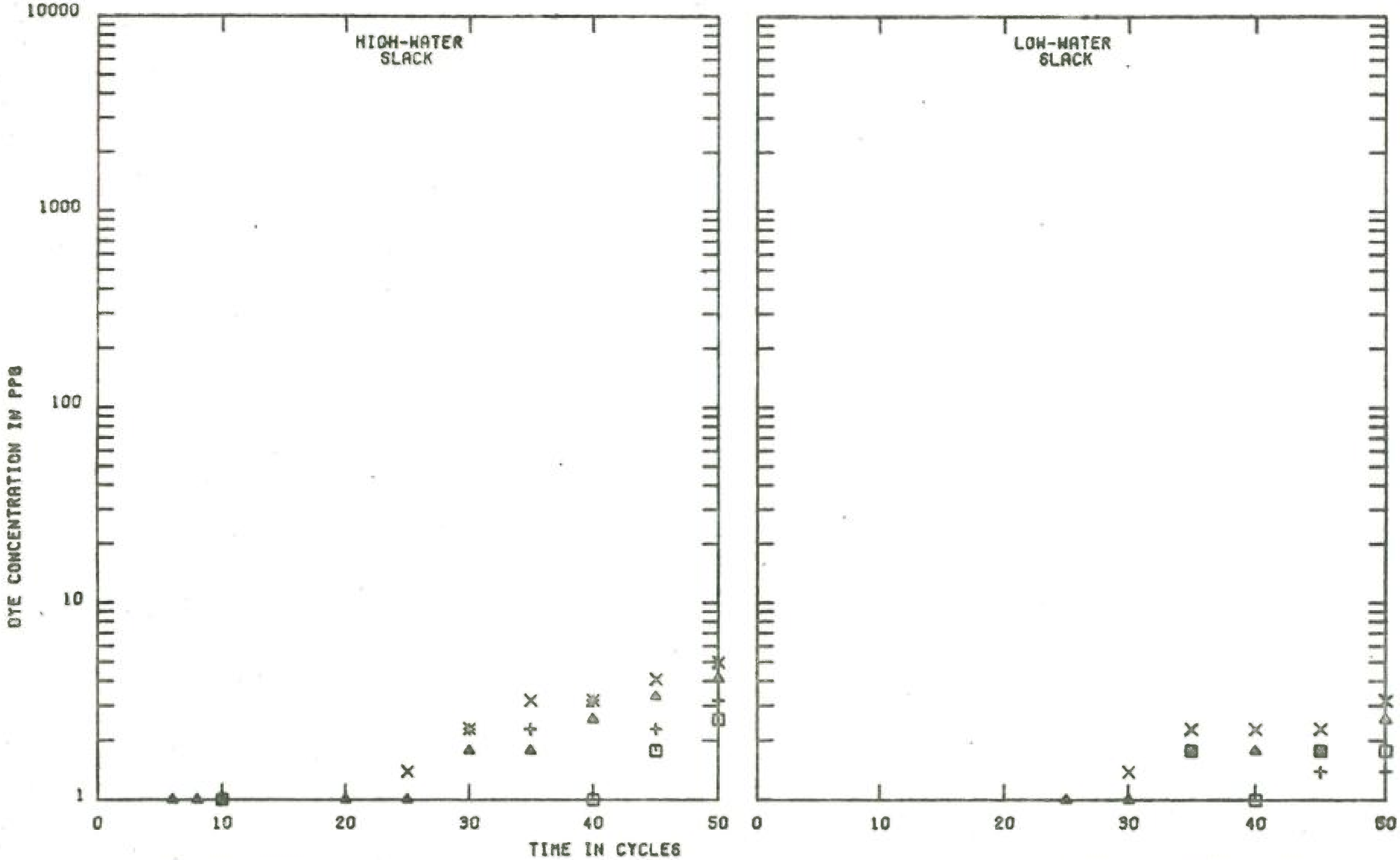
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

JAMAICA BAY COMBINED OUTFALL

STATION 59



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

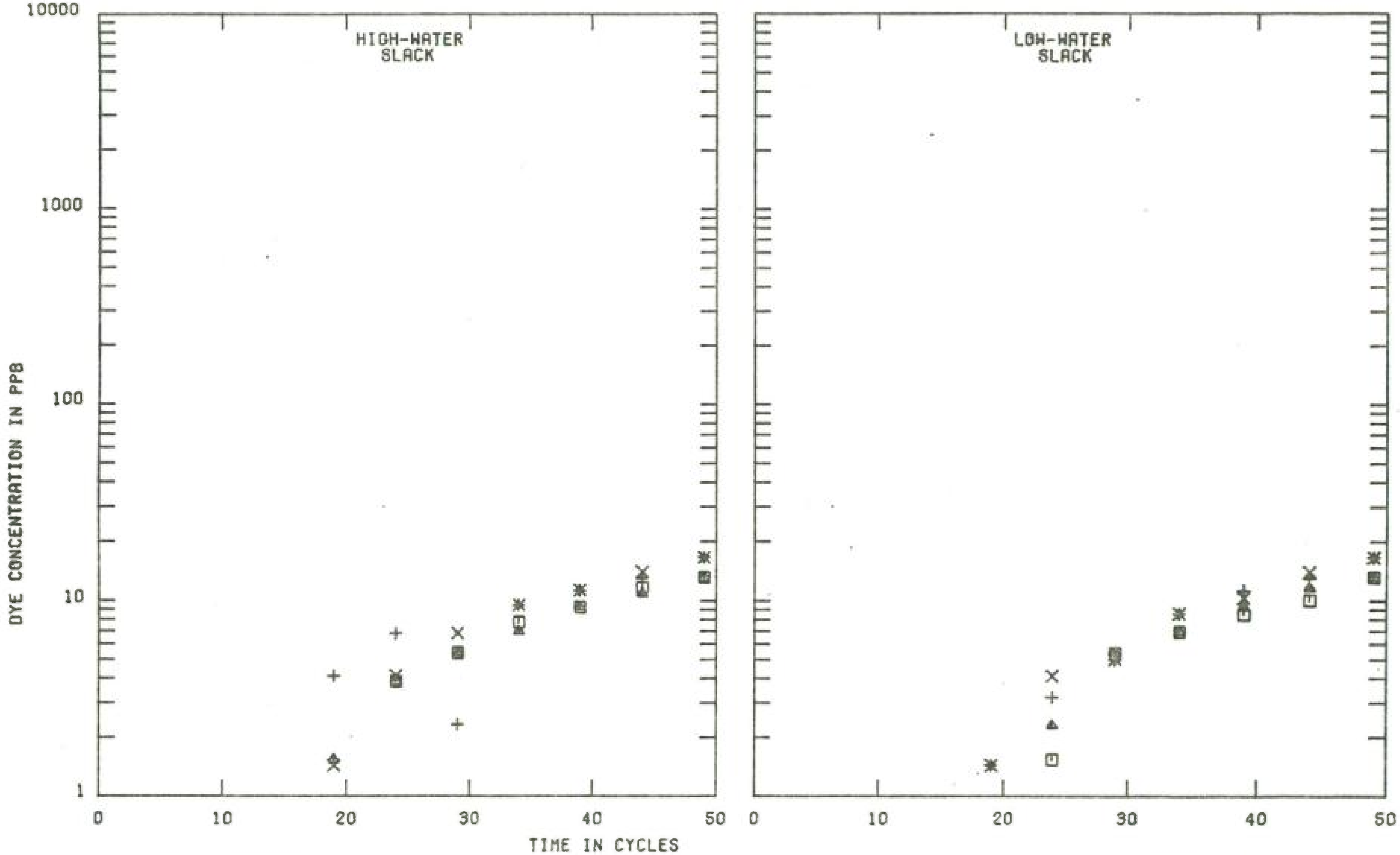
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
JAMAICA BAY COMBINED OUTFALL

STATION 81



TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

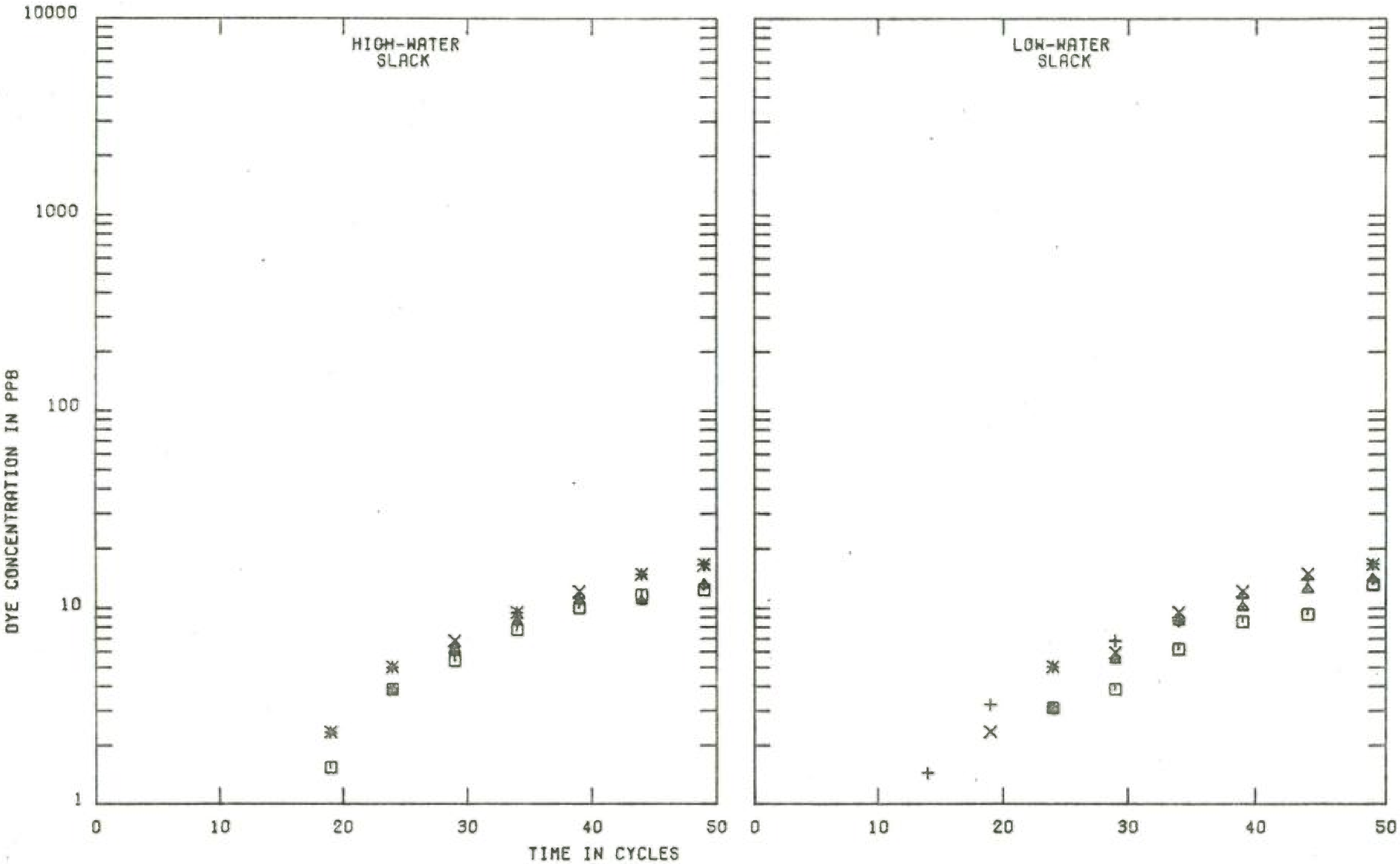
Symbol	Location	Condition
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 1

PLATE 81



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

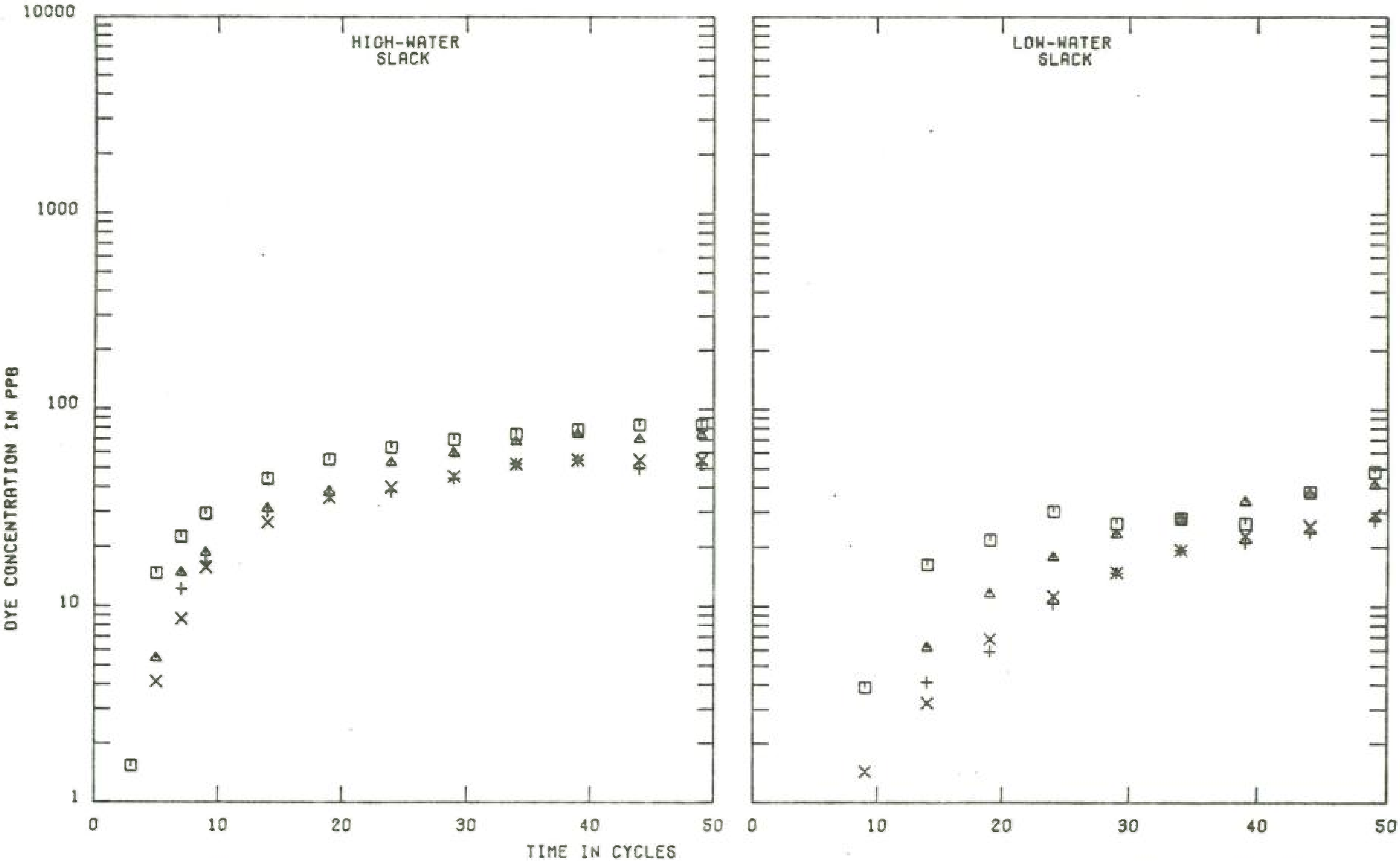
LEGEND

⊡ ————	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× ------	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 2



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

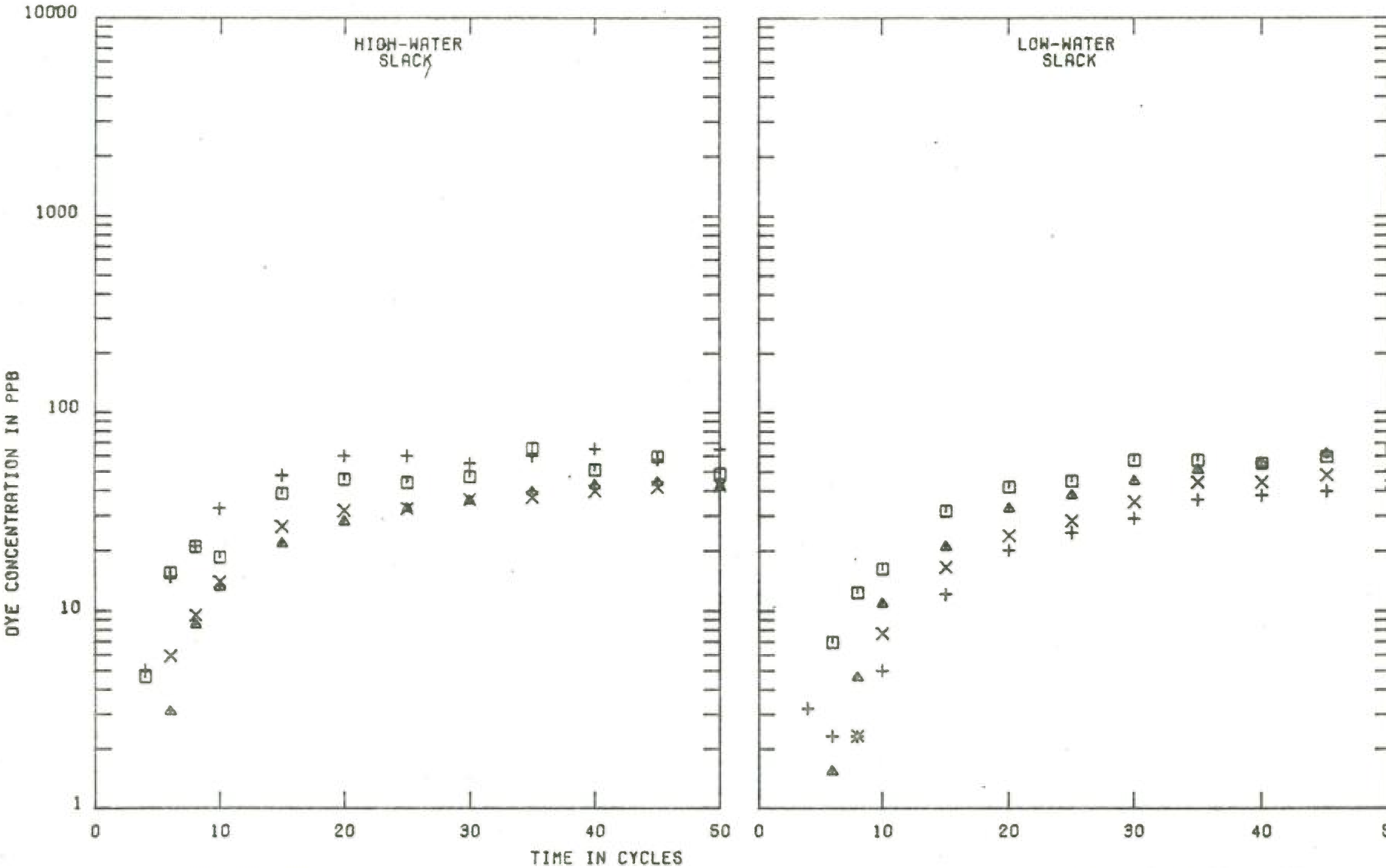
LEGEND

□ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× - - - - -	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 3



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

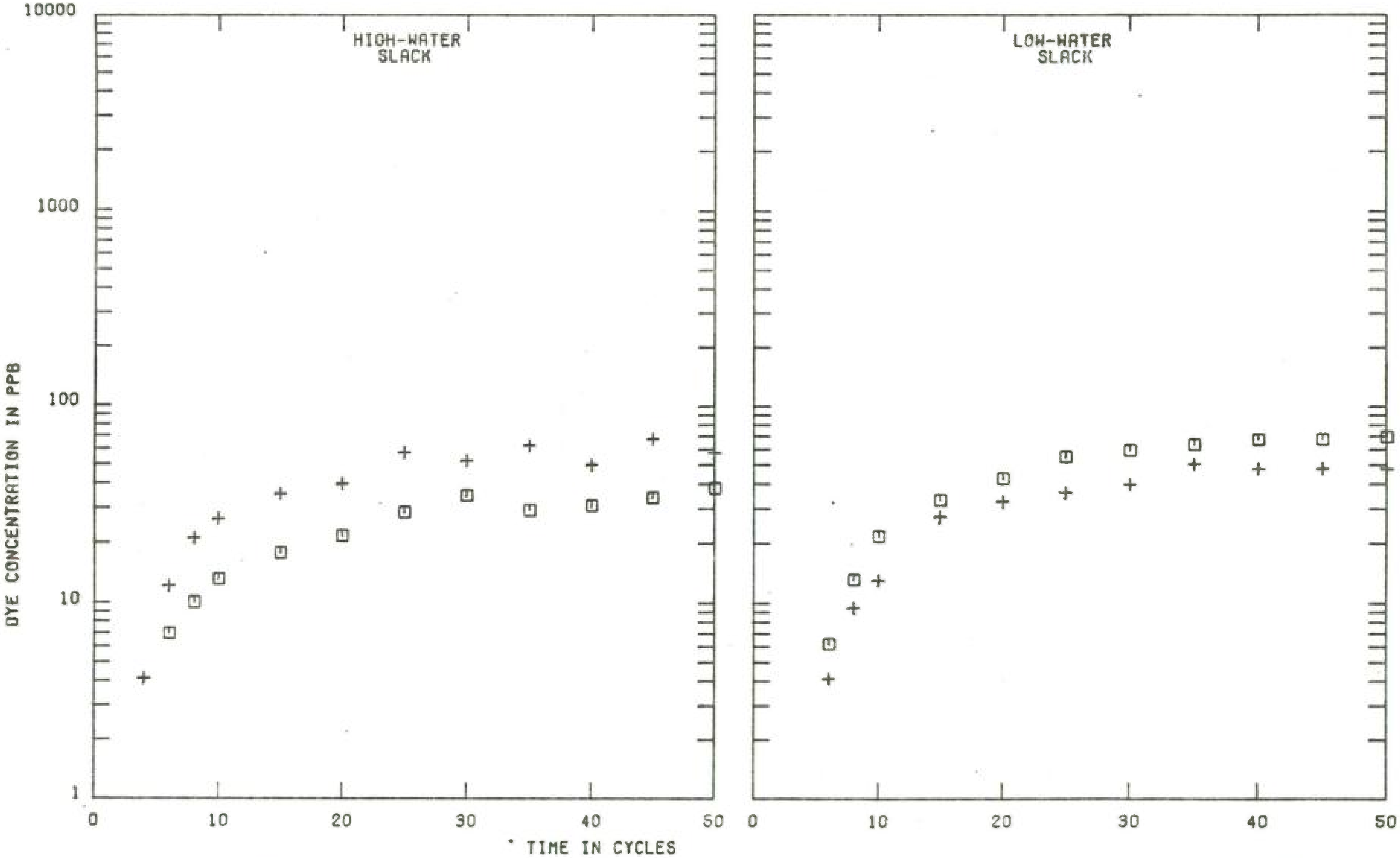
LEGEND

⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
× —--—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 4



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

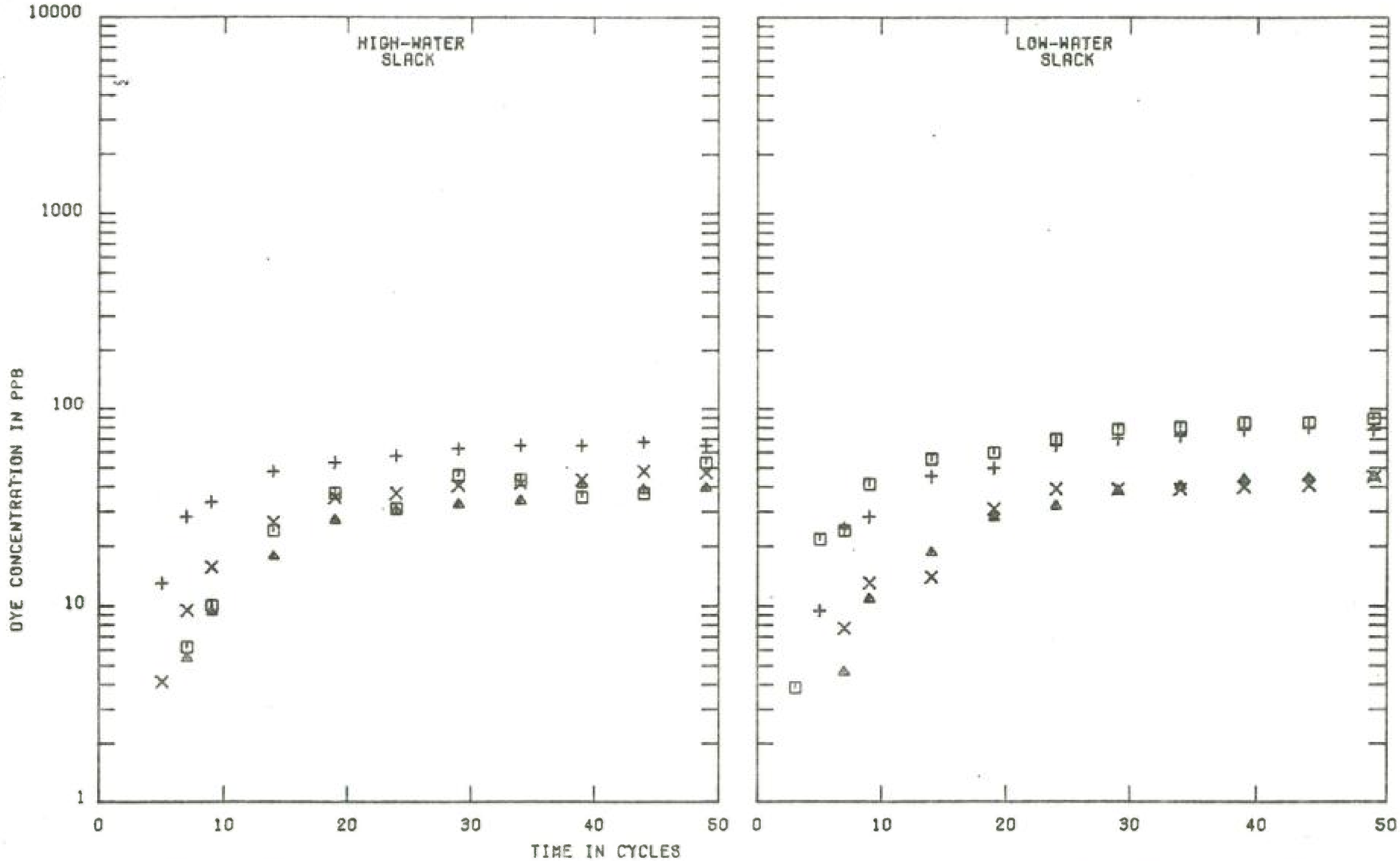
□ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 5 MID-DEPTH

PLATE 85



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

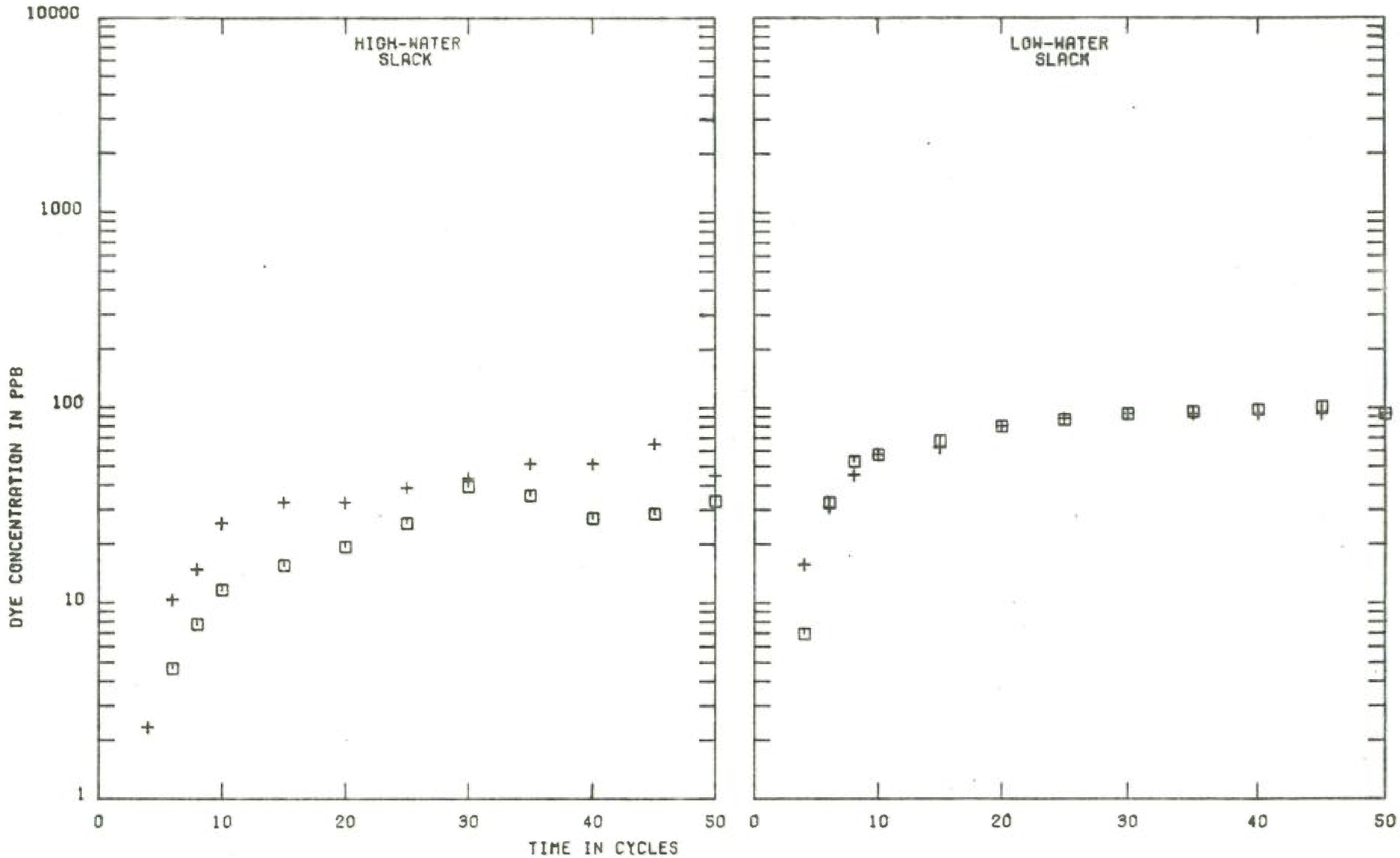
Symbol	Line		
⊡	————	SURFACE	BASE
▲	— — —	BOTTOM	BASE
+	—·—·—	SURFACE	PLAN 1
×	—··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 8



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1778.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

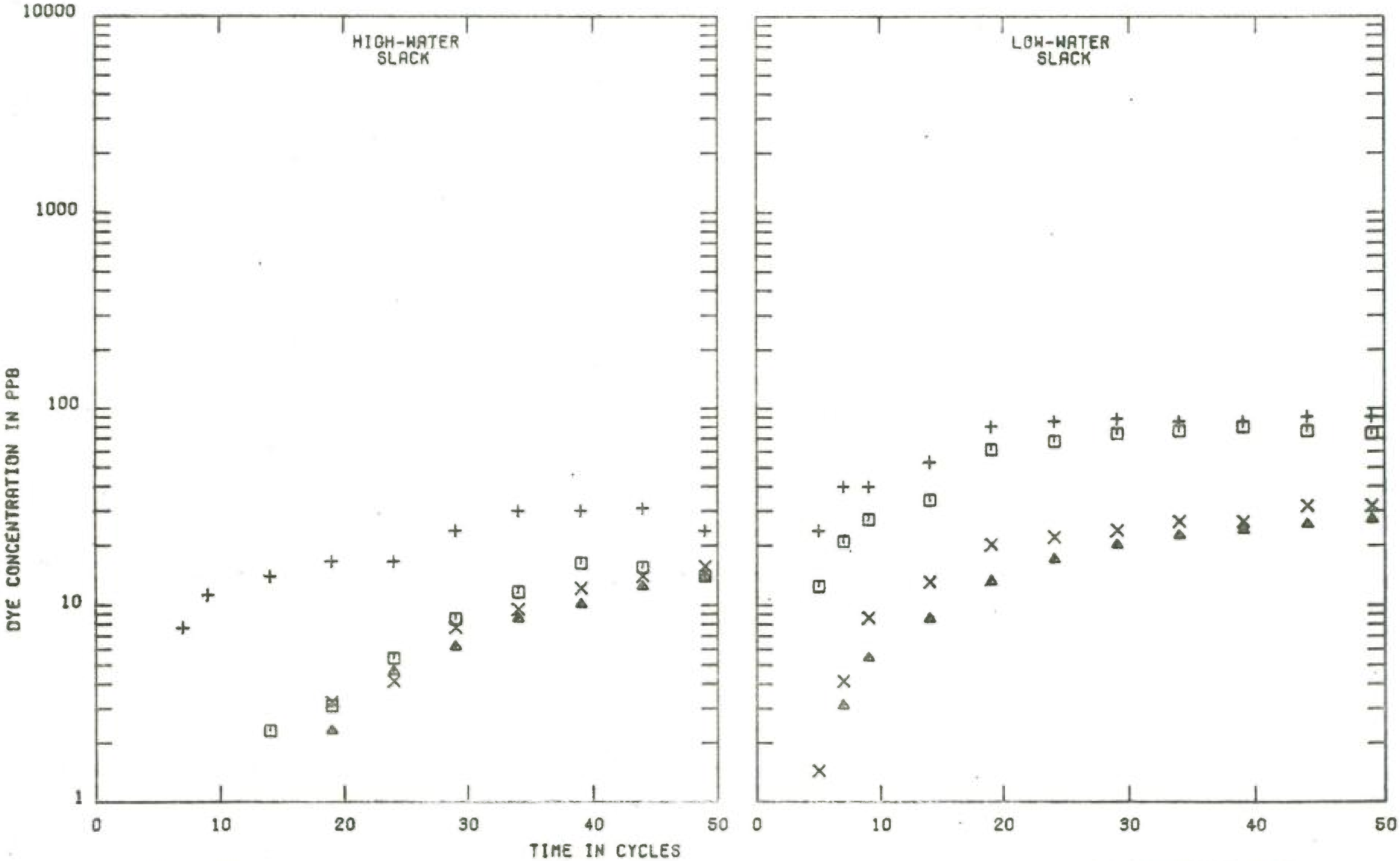
□ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 7 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

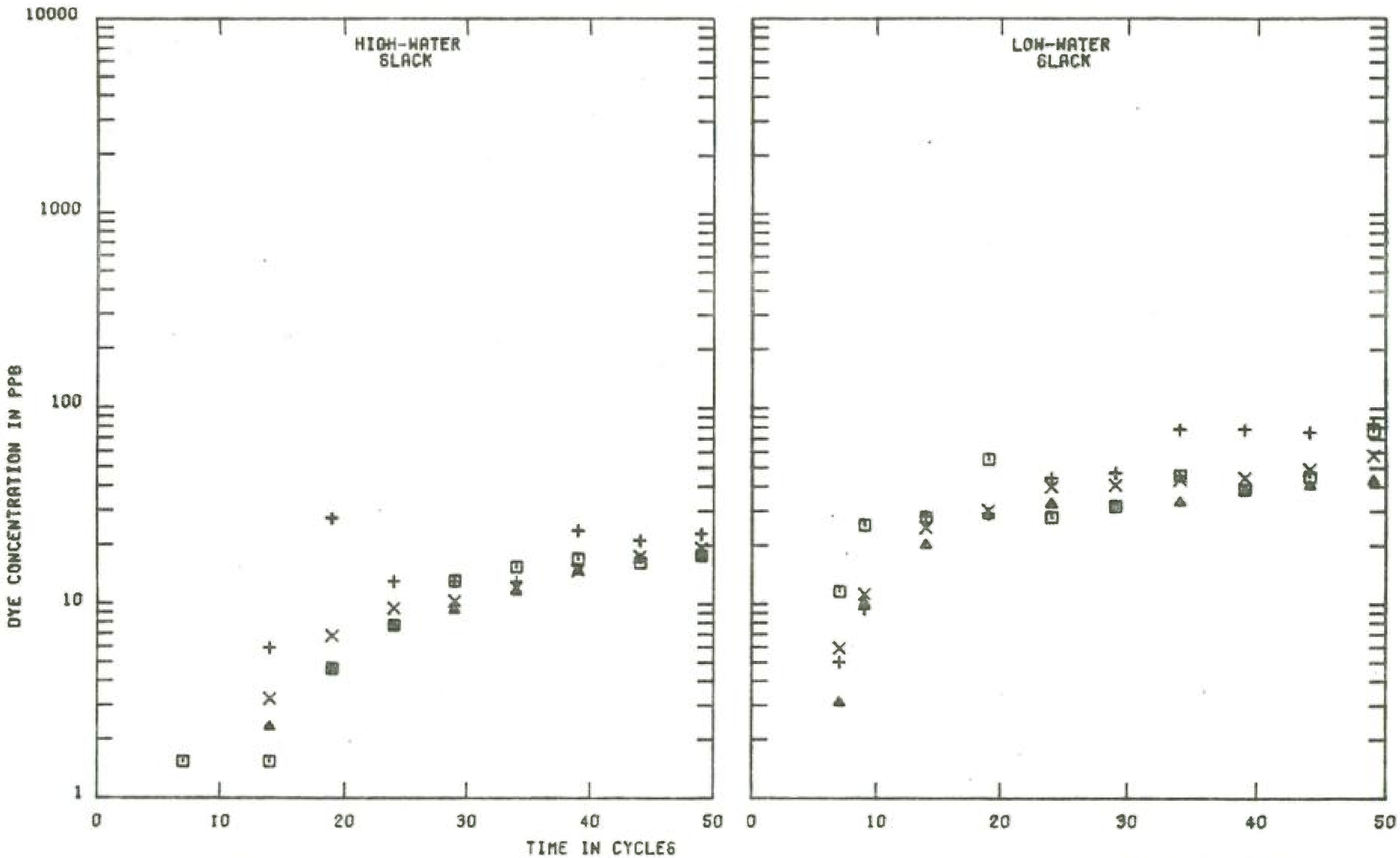
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 8



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

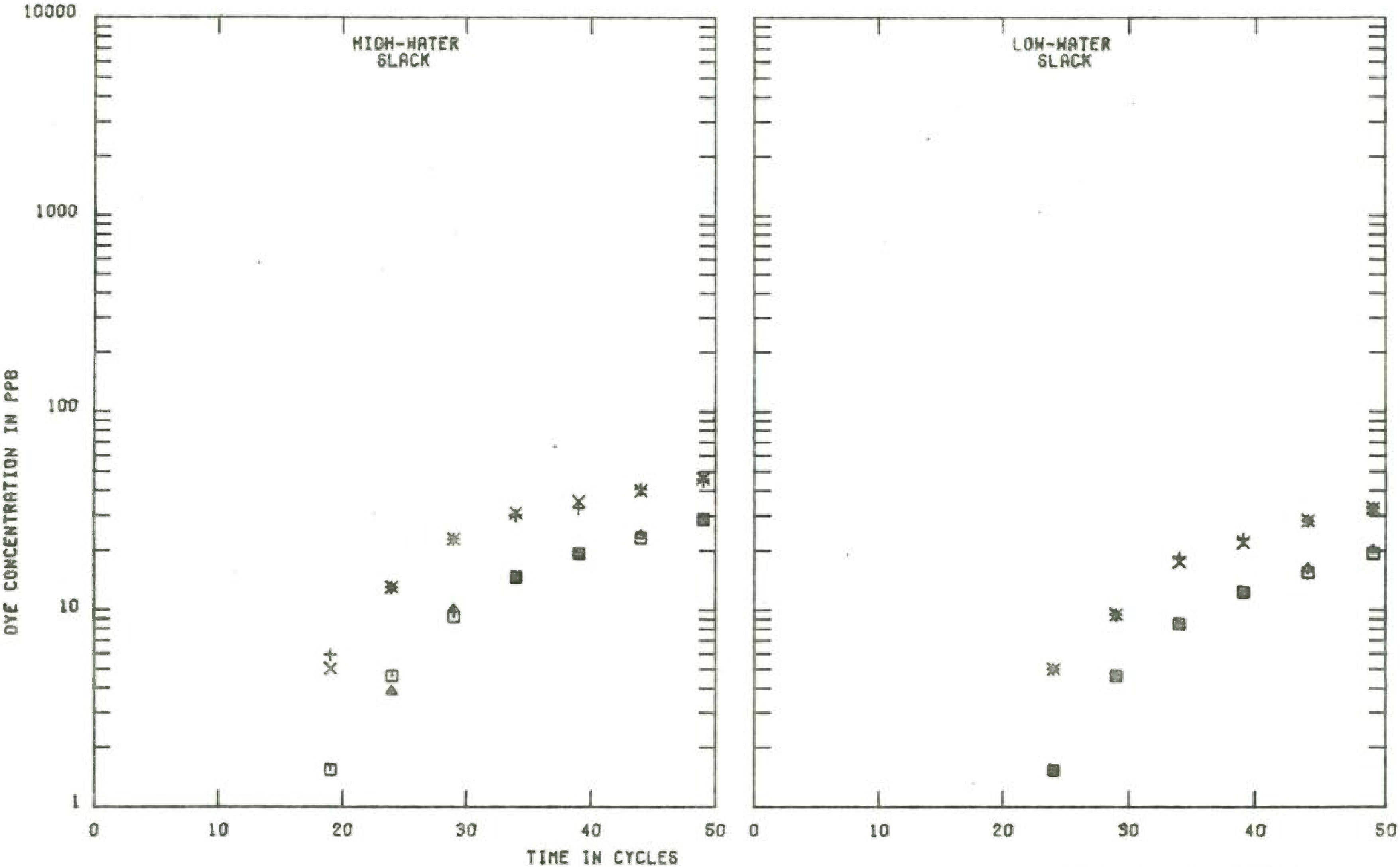
□ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
X —··—··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 8



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

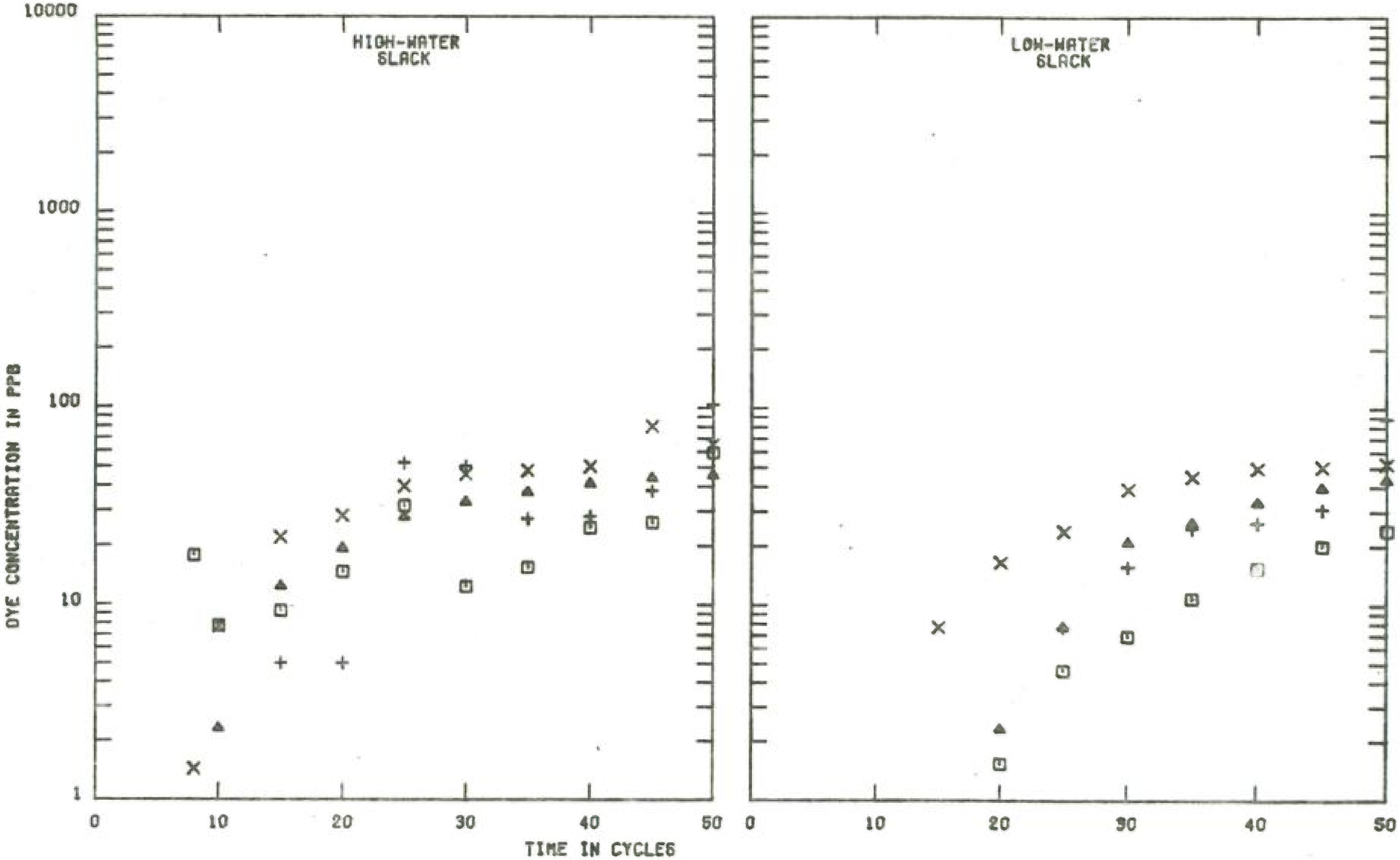
LEGEND

- □ ——— SURFACE — BASE
- △ — — — BOTTOM — BASE
- + —·—·— SURFACE — PLAN 1
- × —··—··— BOTTOM — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 10



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

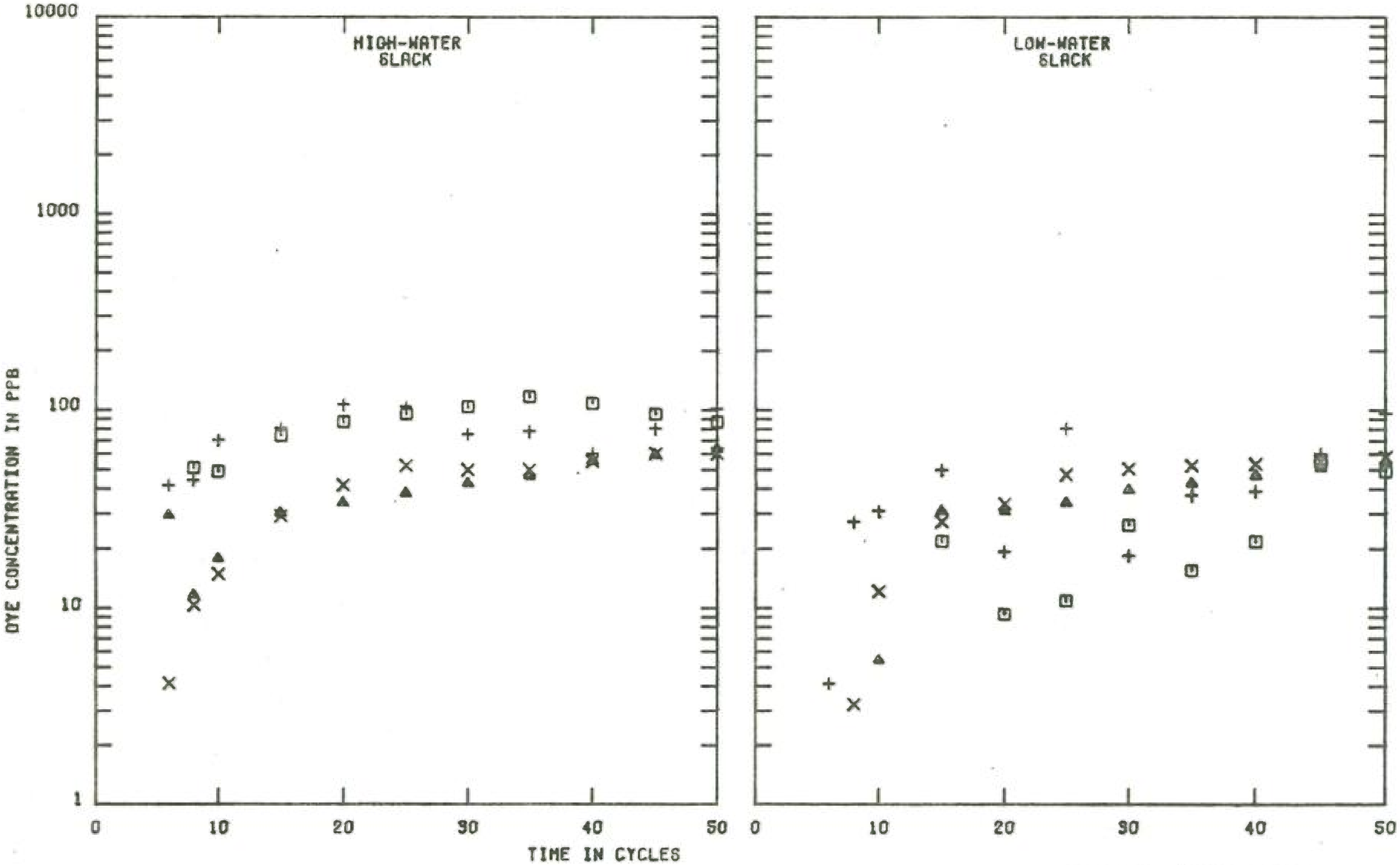
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —···—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 11



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

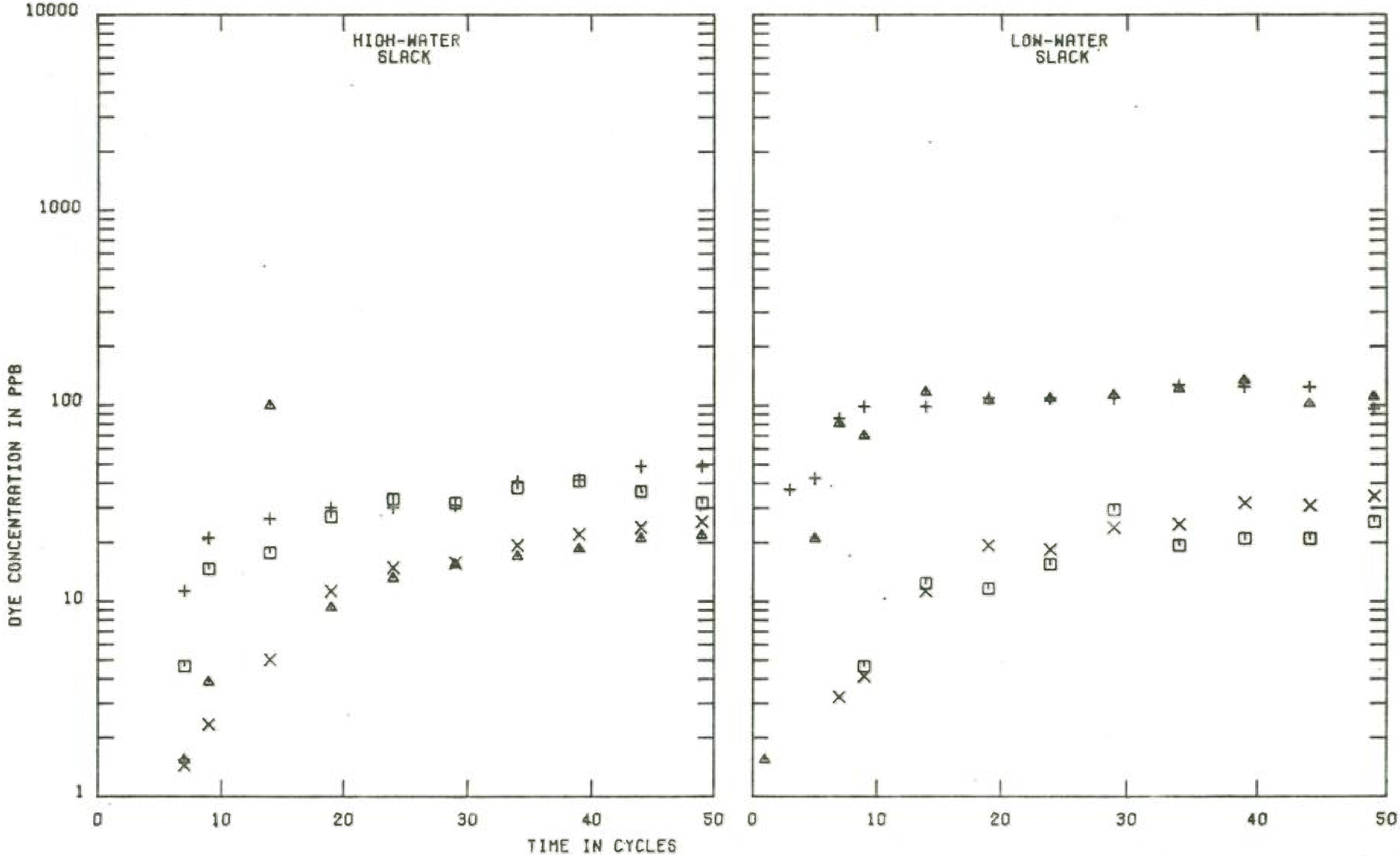
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
X —---—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 12



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ——— SURFACE BASE
△ — — — BOTTOM BASE
+ —·— SURFACE PLAN 1
× —··— BOTTOM PLAN 1

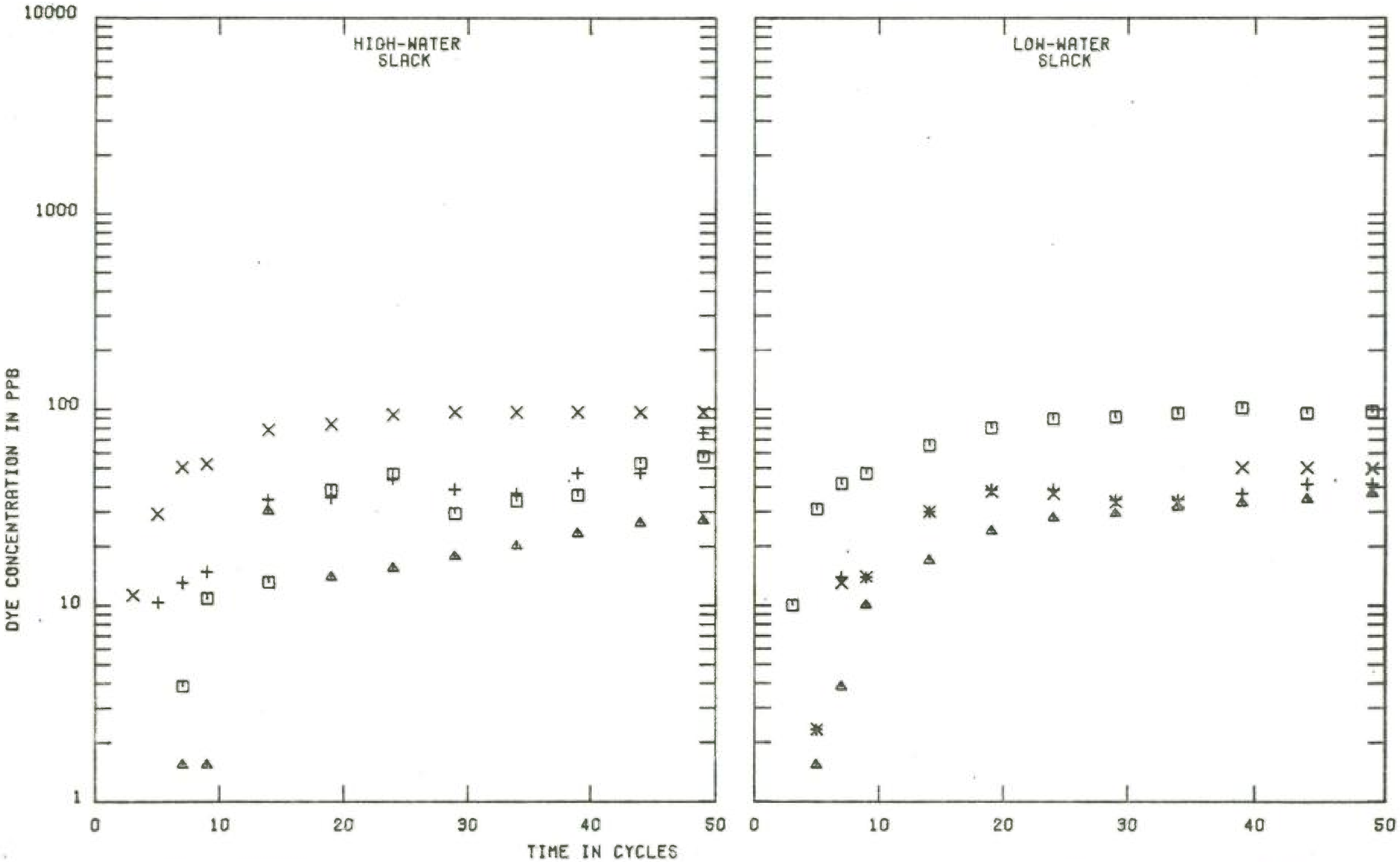
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 14

PLATE 93



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

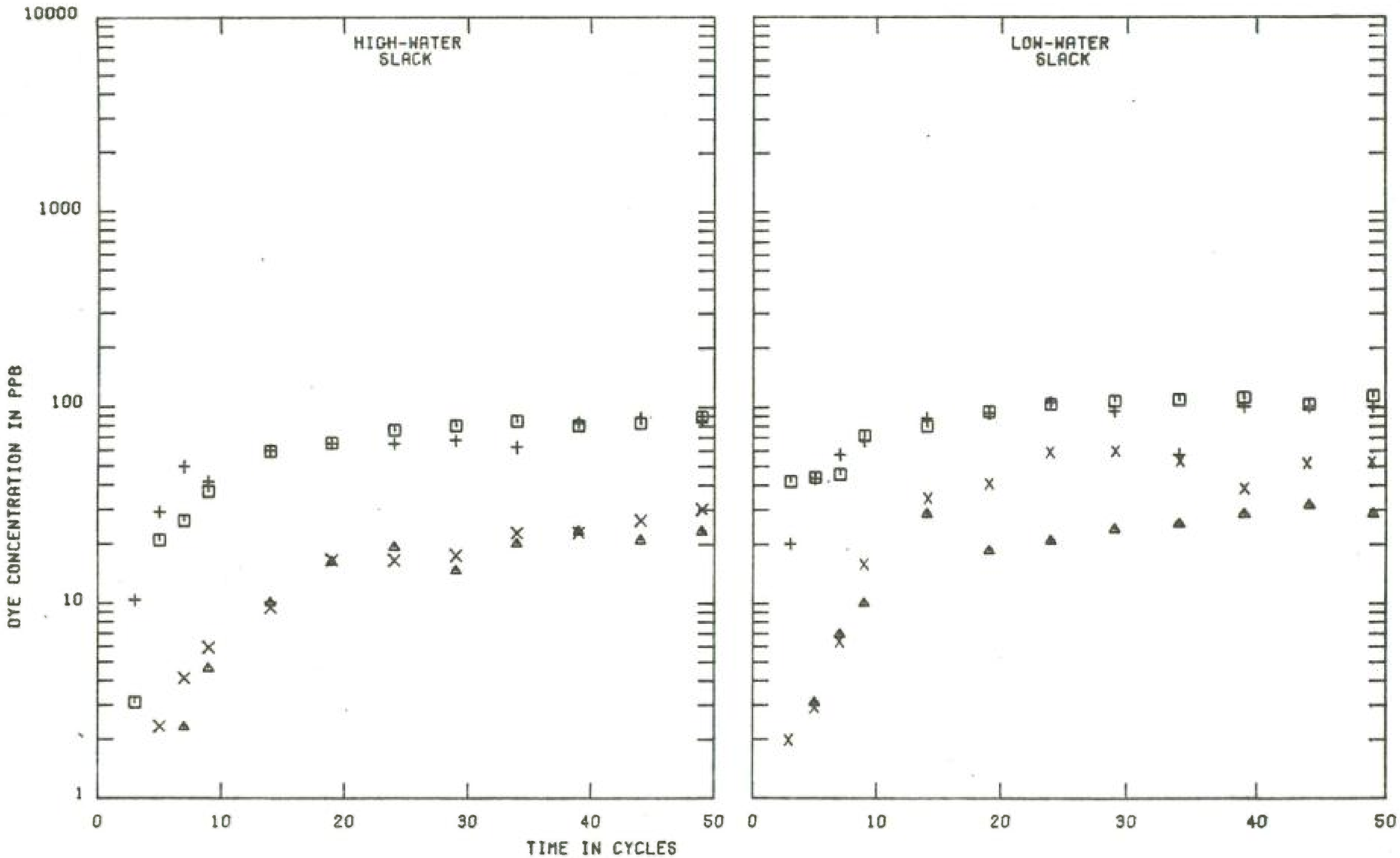
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 16



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

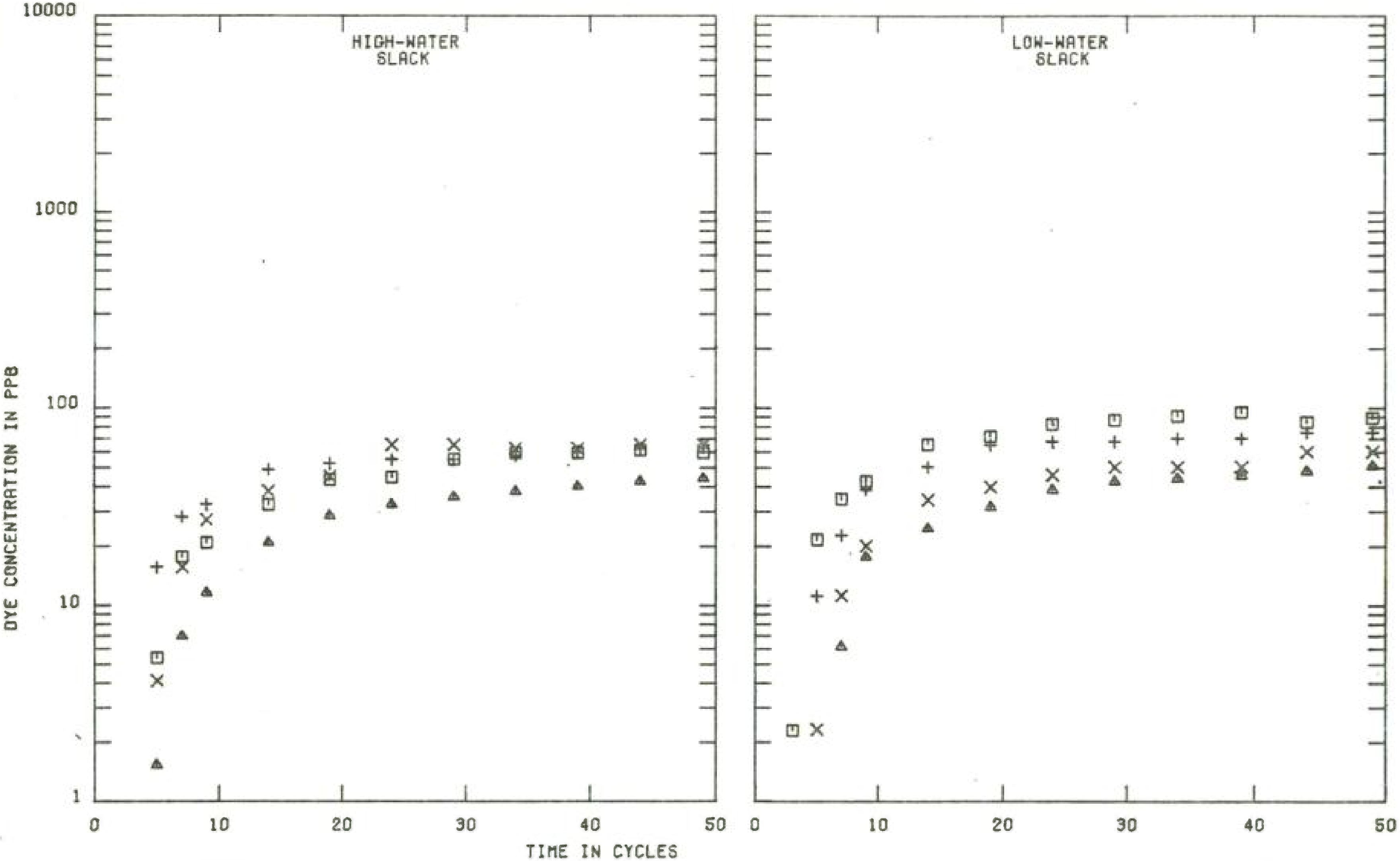
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 17



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

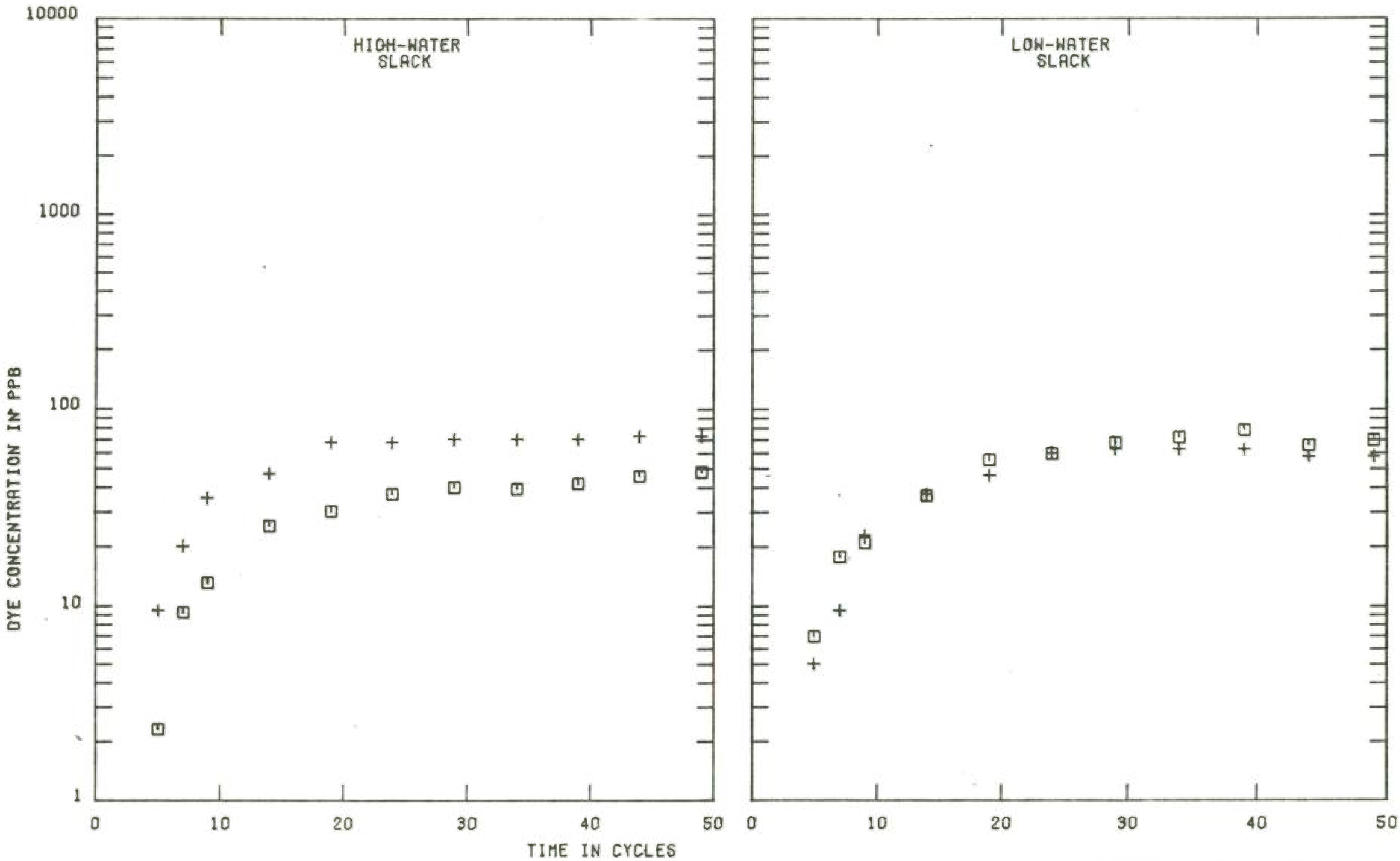
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 21



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

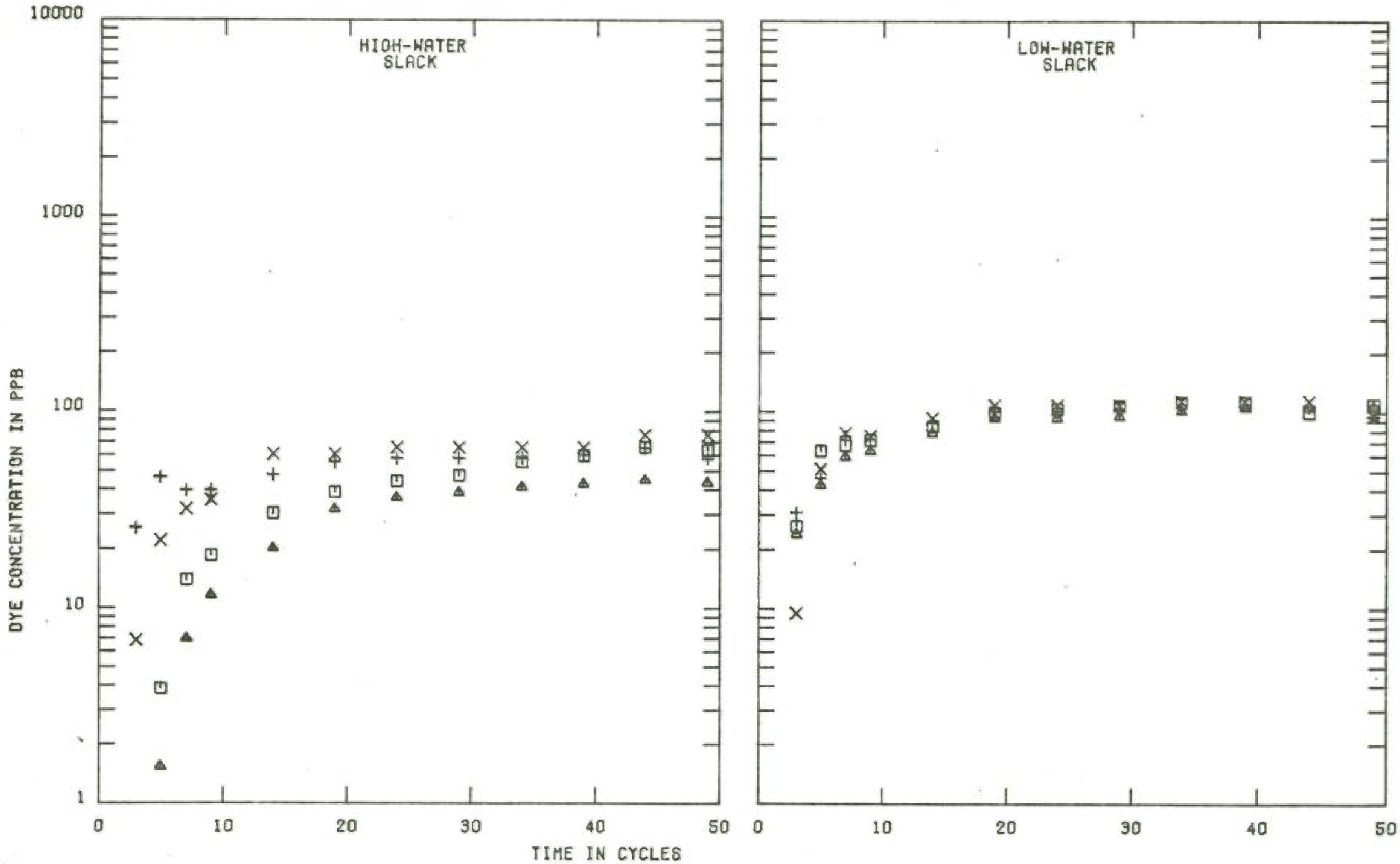
⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 22 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

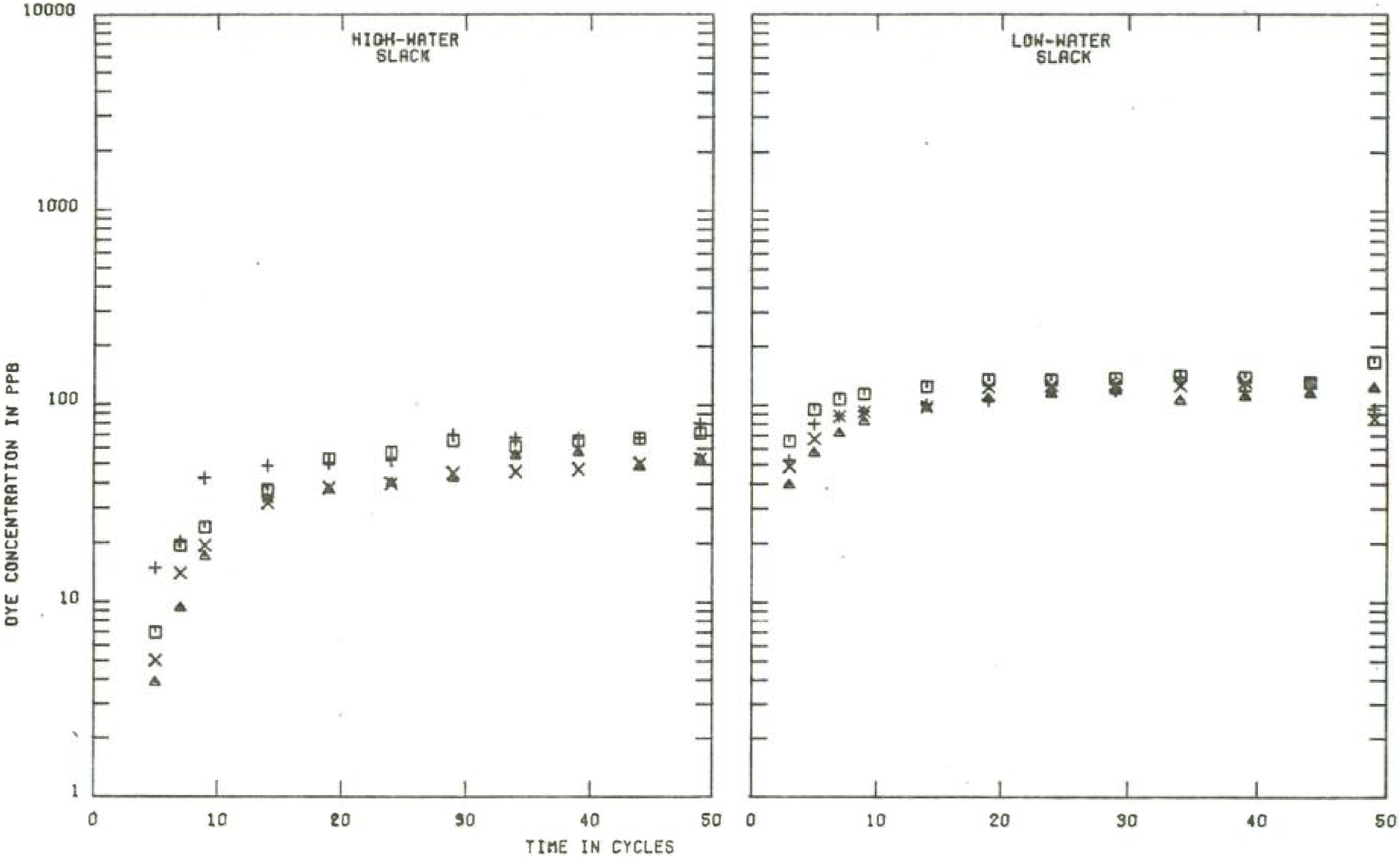
LEGEND

Symbol	Level	Condition
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 24



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

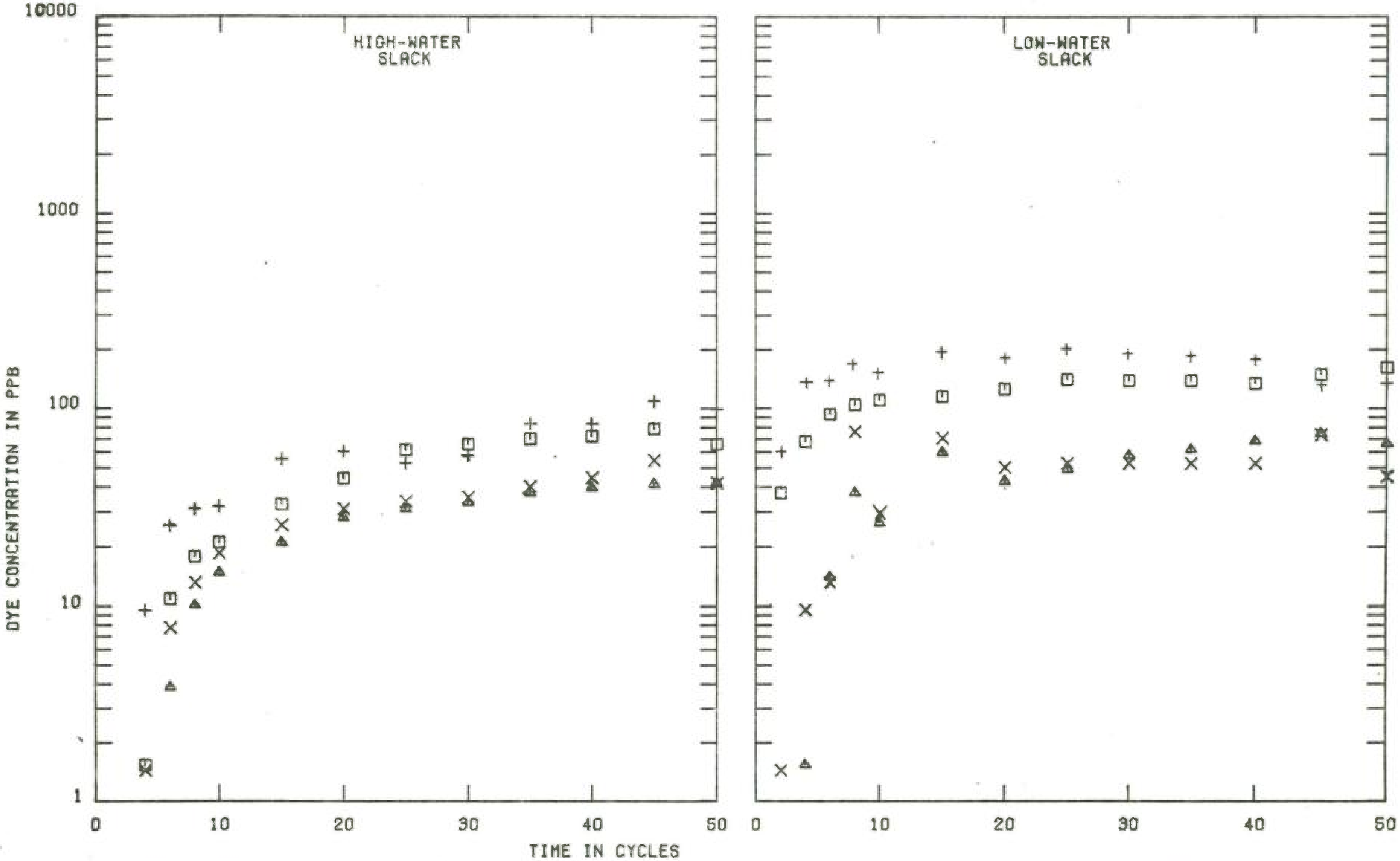
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
X —---	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 26



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

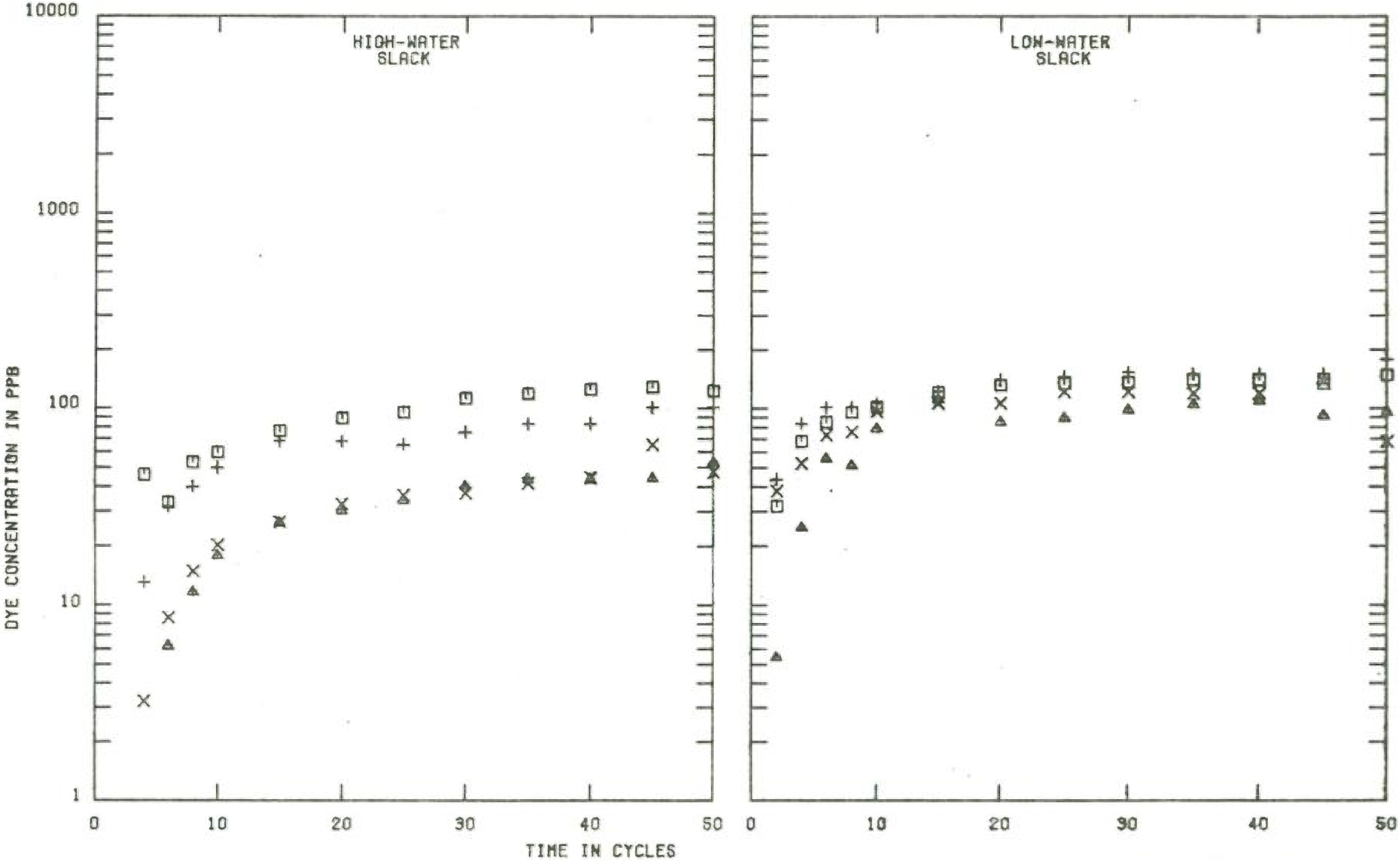
□ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·	SURFACE	PLAN 1
X —-—-	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 27



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

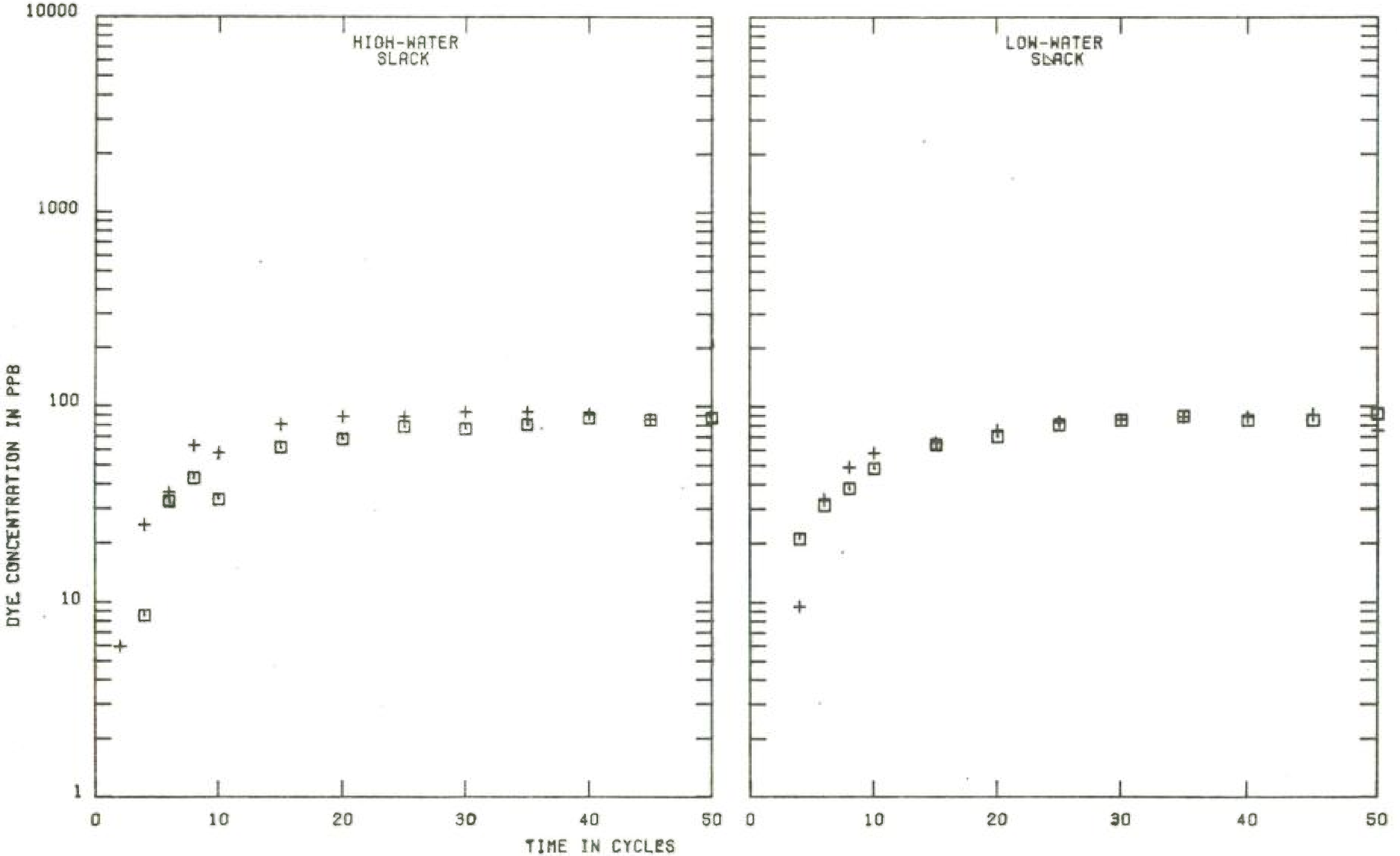
LEGEND

□ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 28



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 32 MID-DEPTH

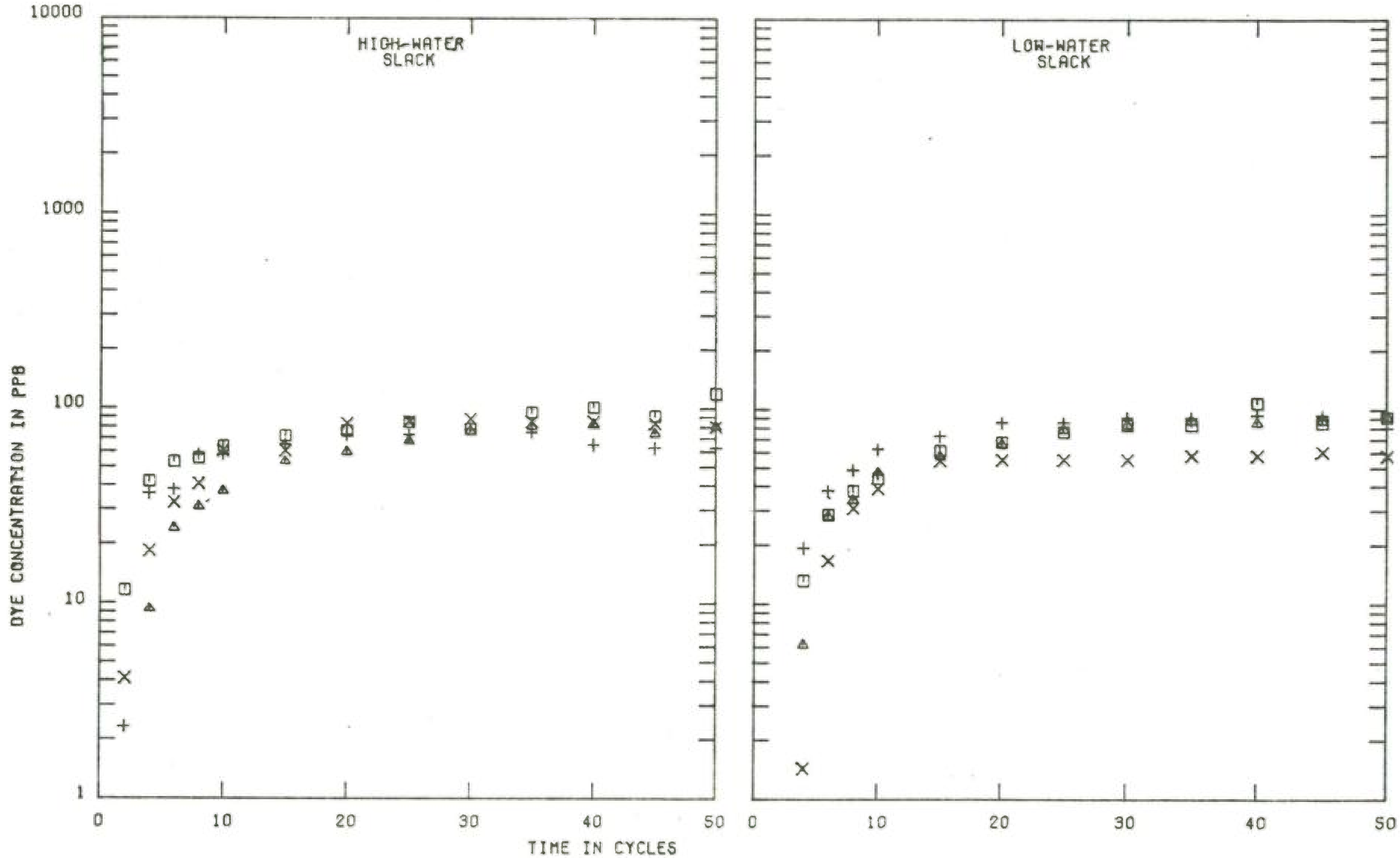


PLATE 103

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

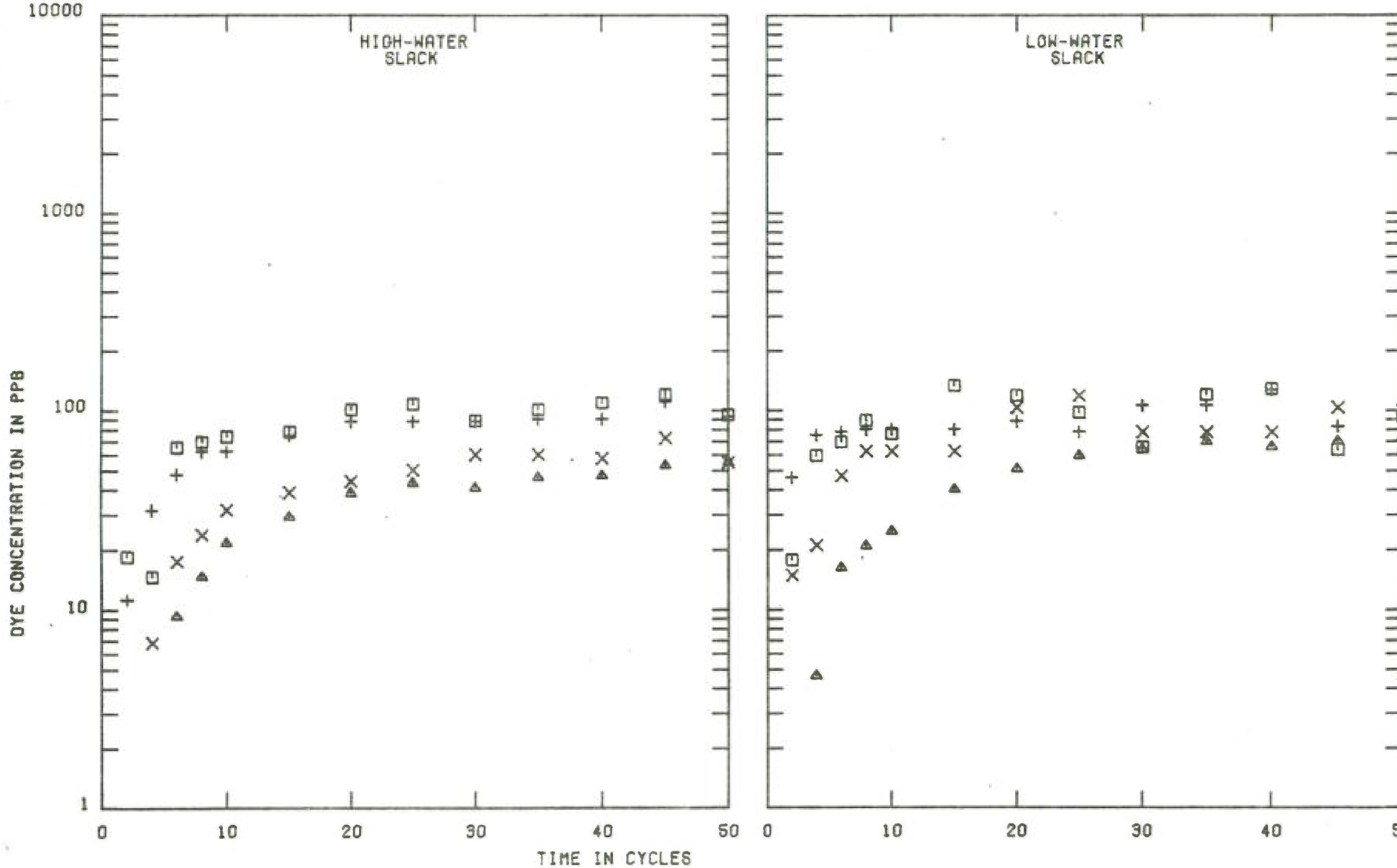
LEGEND

Symbol	Location	Condition
⊡ ————	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ ———	SURFACE	PLAN 1
× ----	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 33



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 34

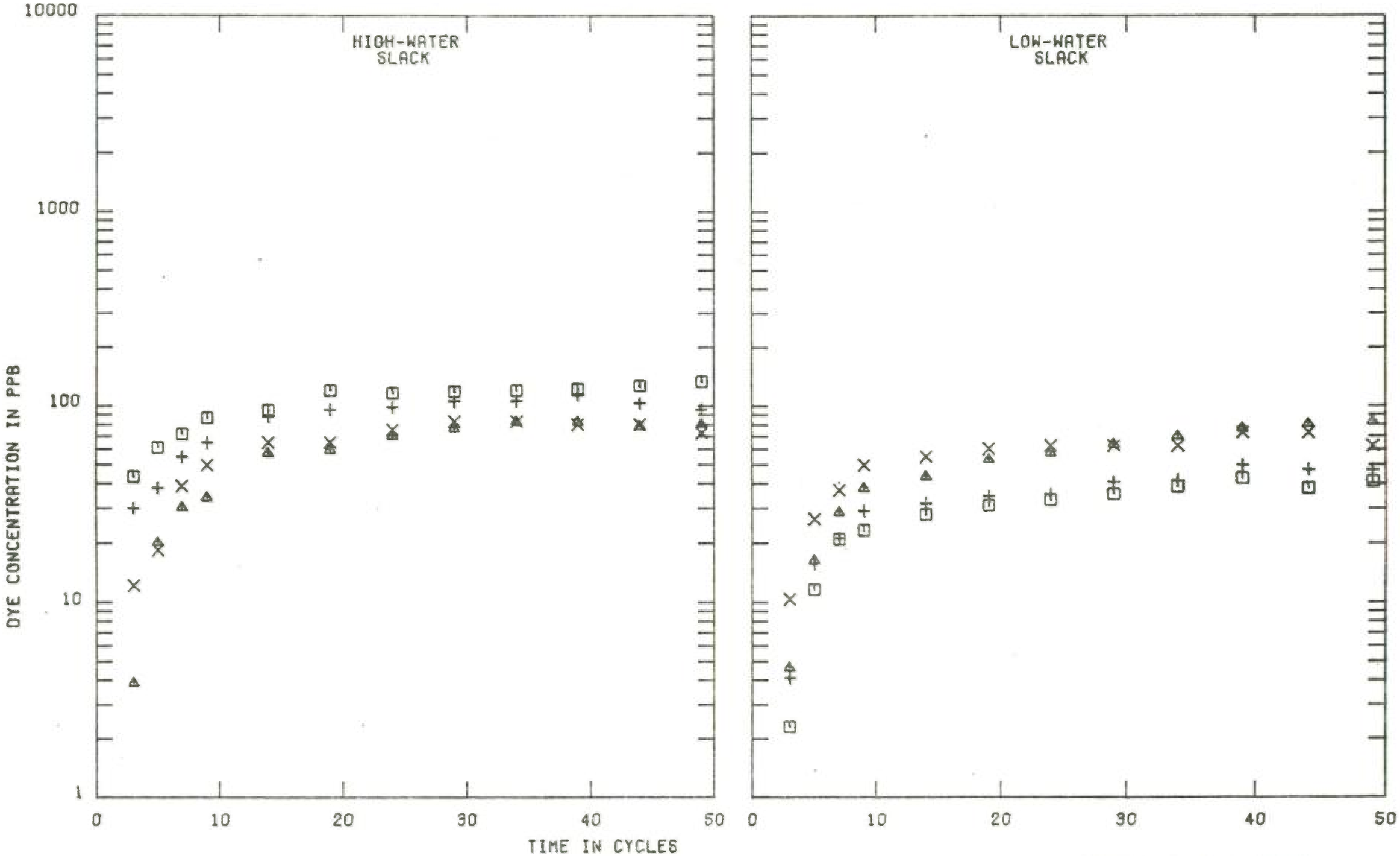


PLATE 105

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

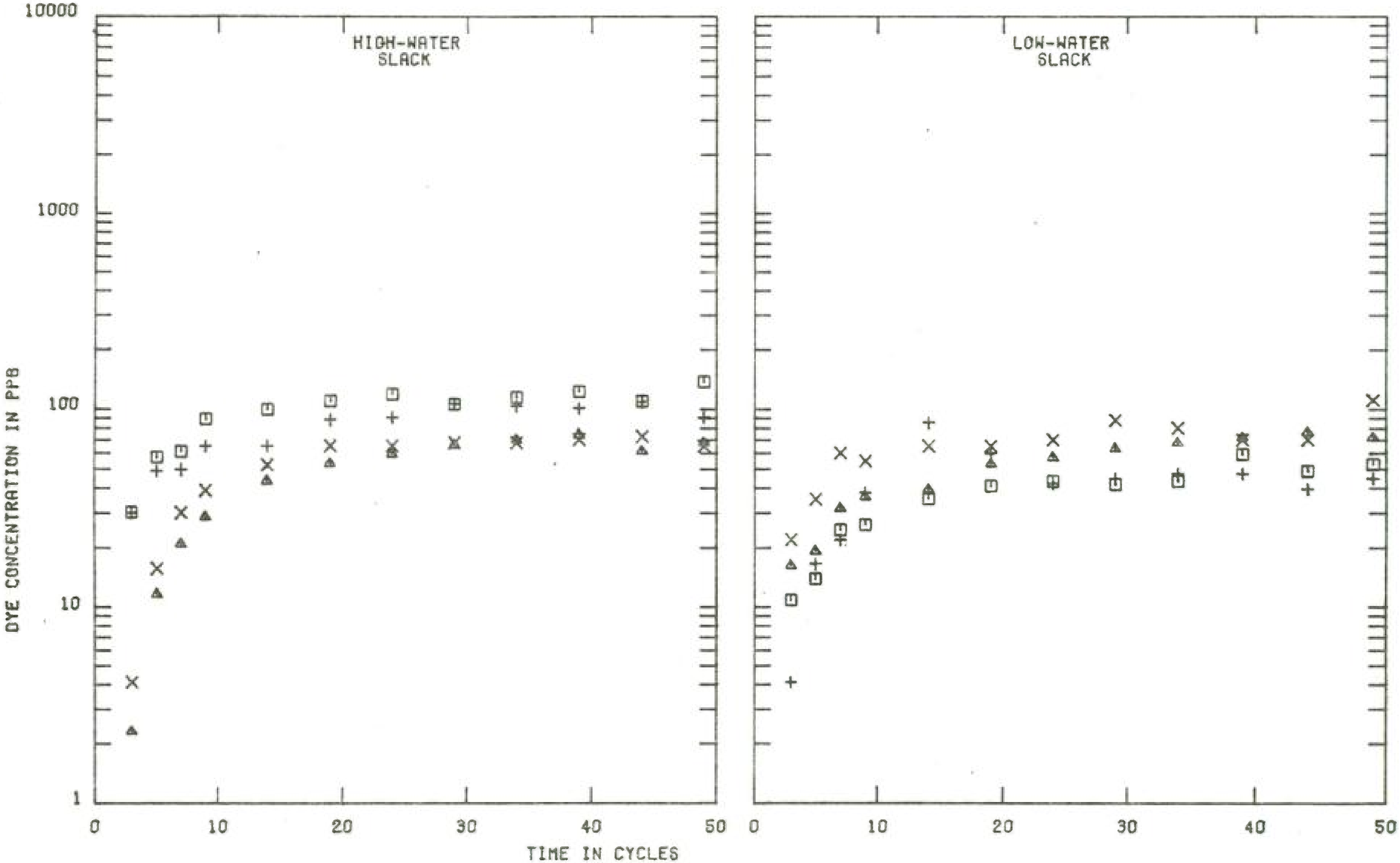
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 35



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

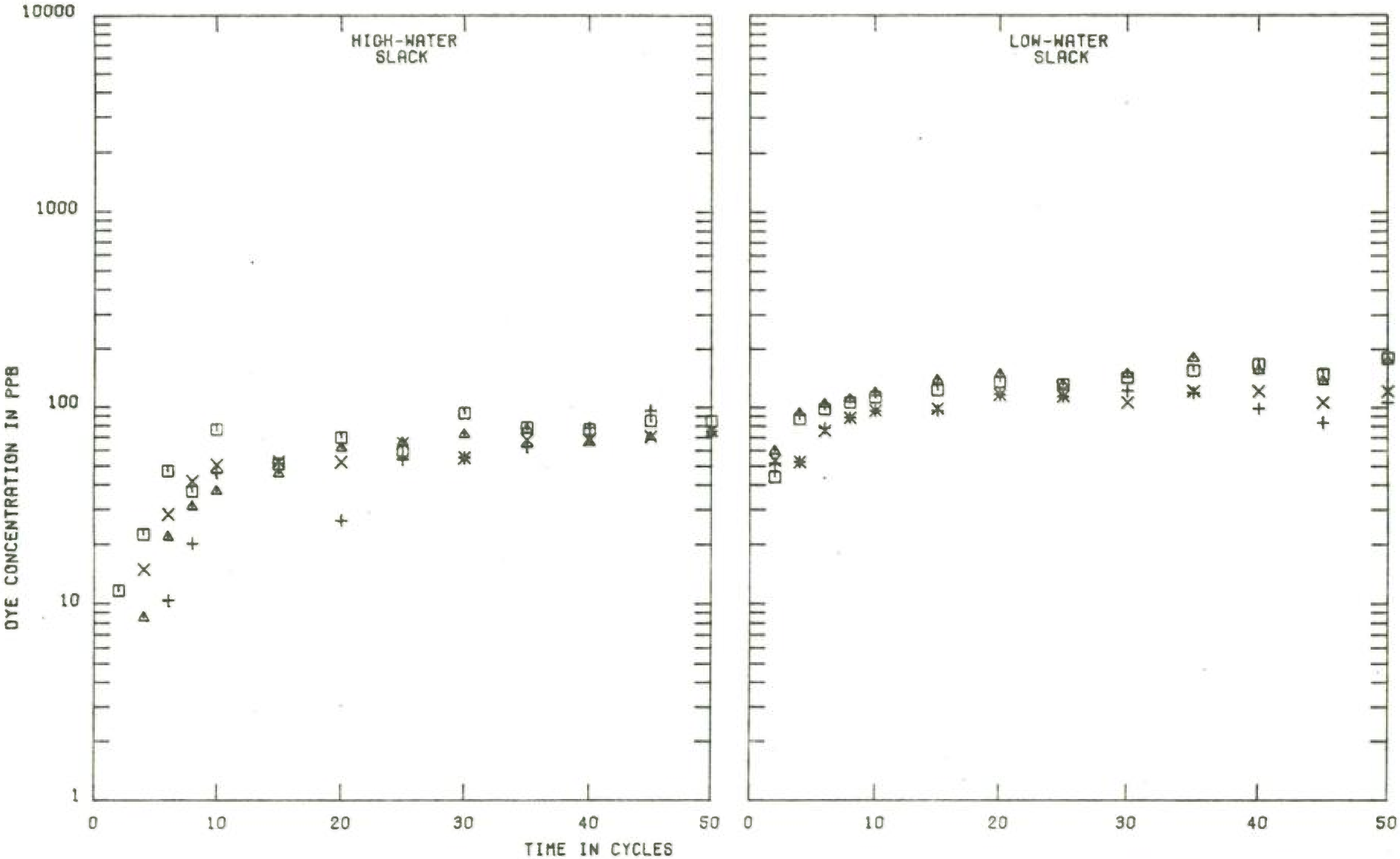
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 36



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

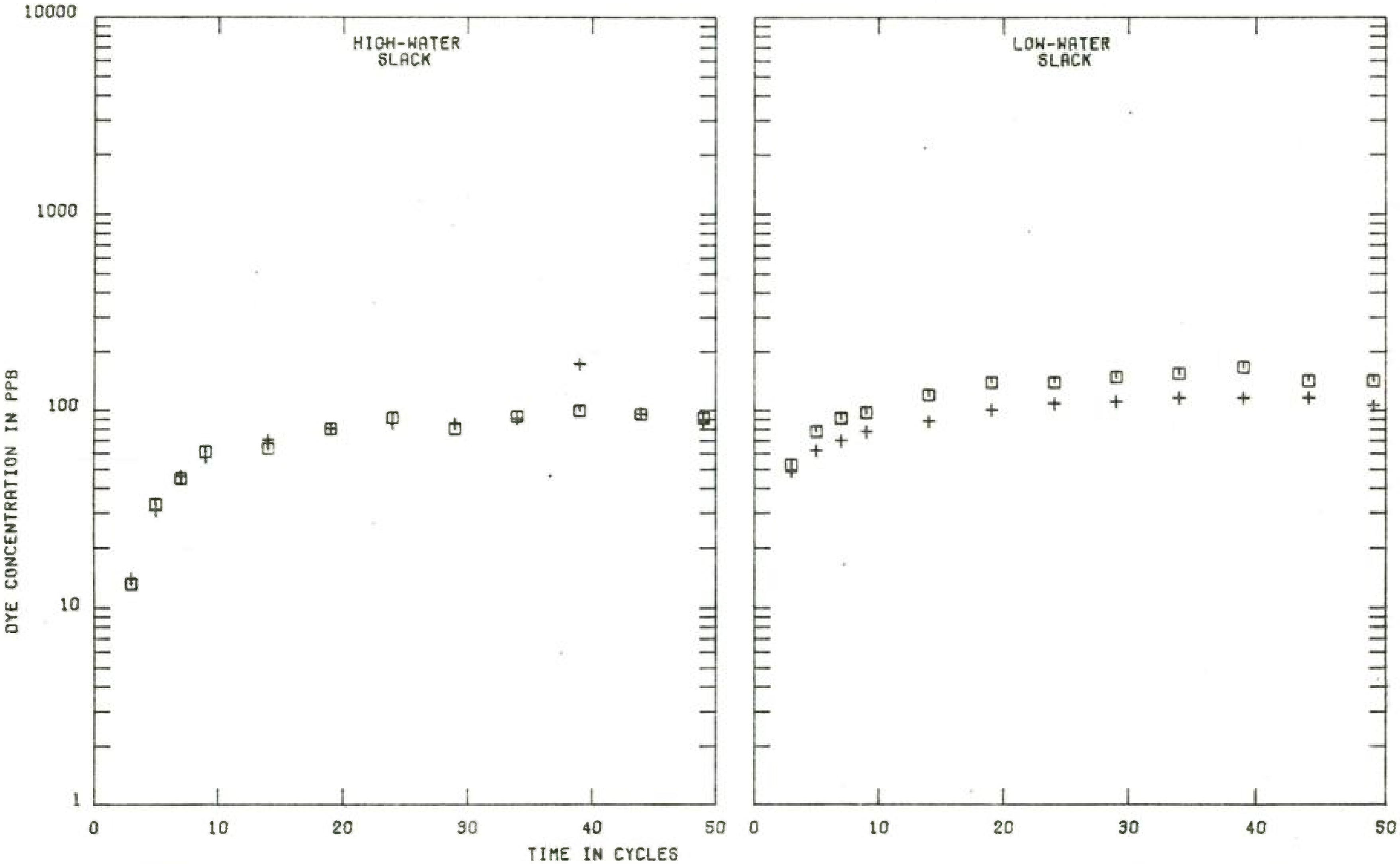
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 37



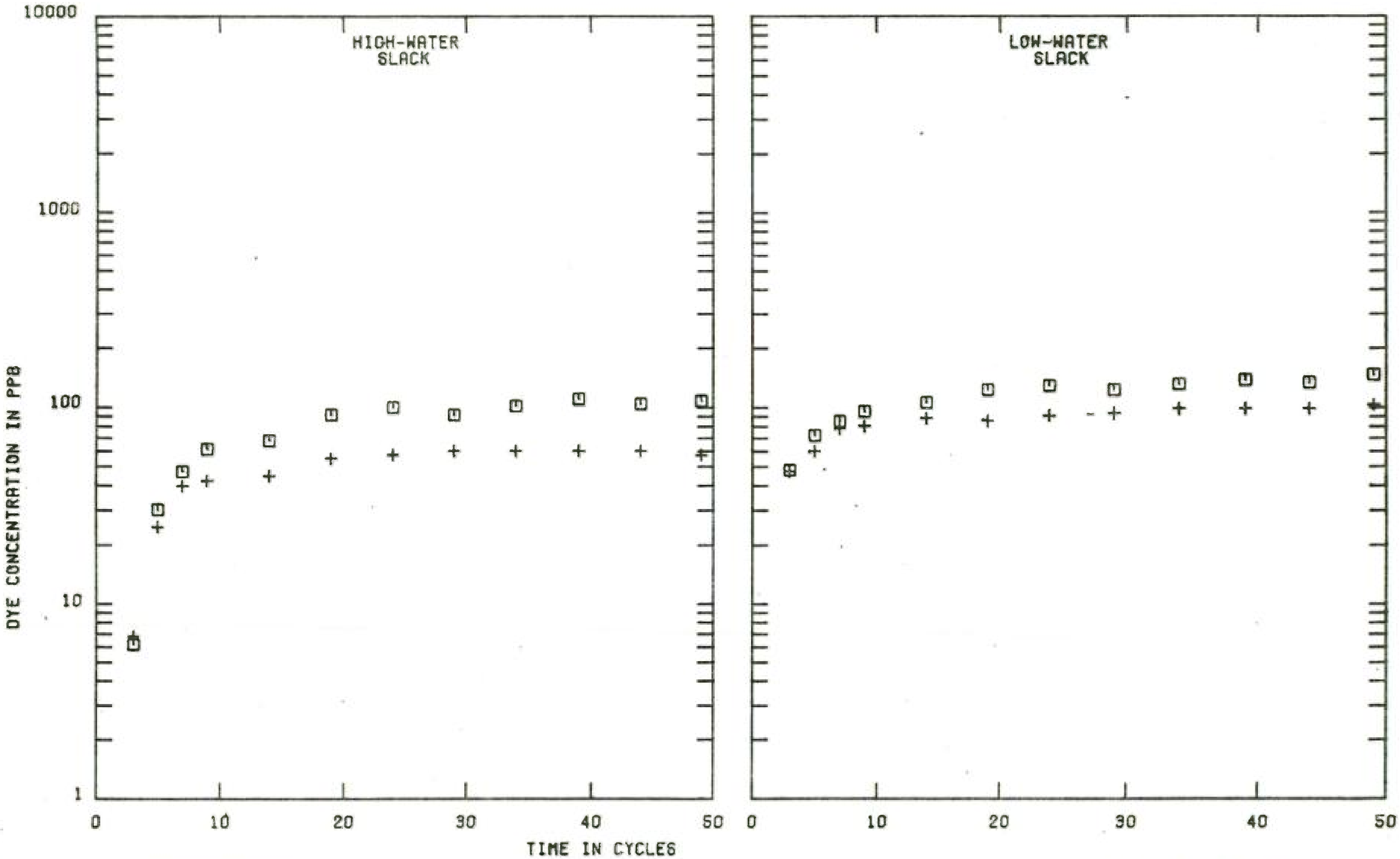
TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 38 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

□ ——— BASE

+ — — — PLAN 1

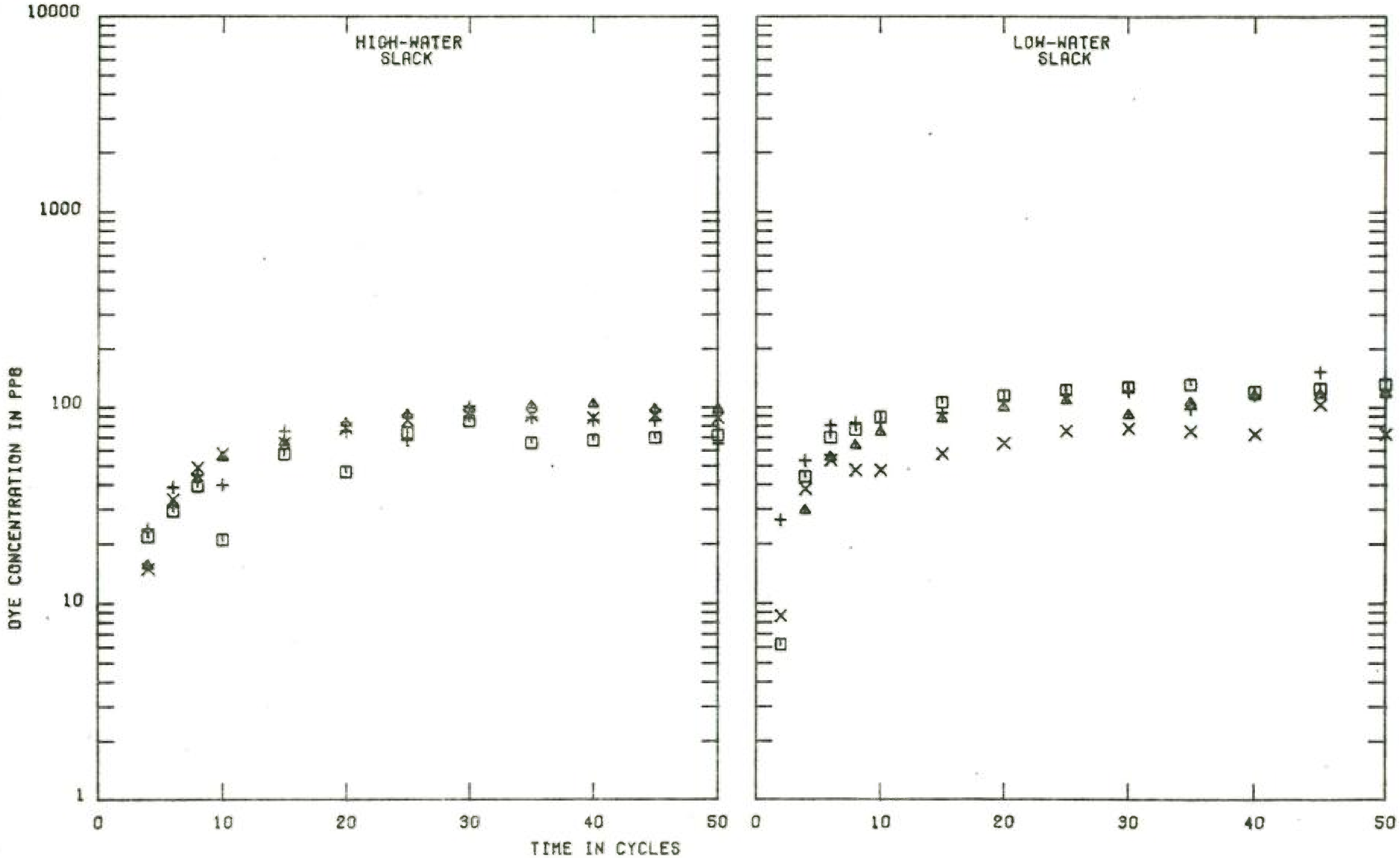
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 39 MID-DEPTH

PLATE 110



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

Symbol	Line	Position	Condition
⊡	———	SURFACE	BASE
▲	— — —	BOTTOM	BASE
+	—·—·—	SURFACE	PLAN 1
×	—··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 40

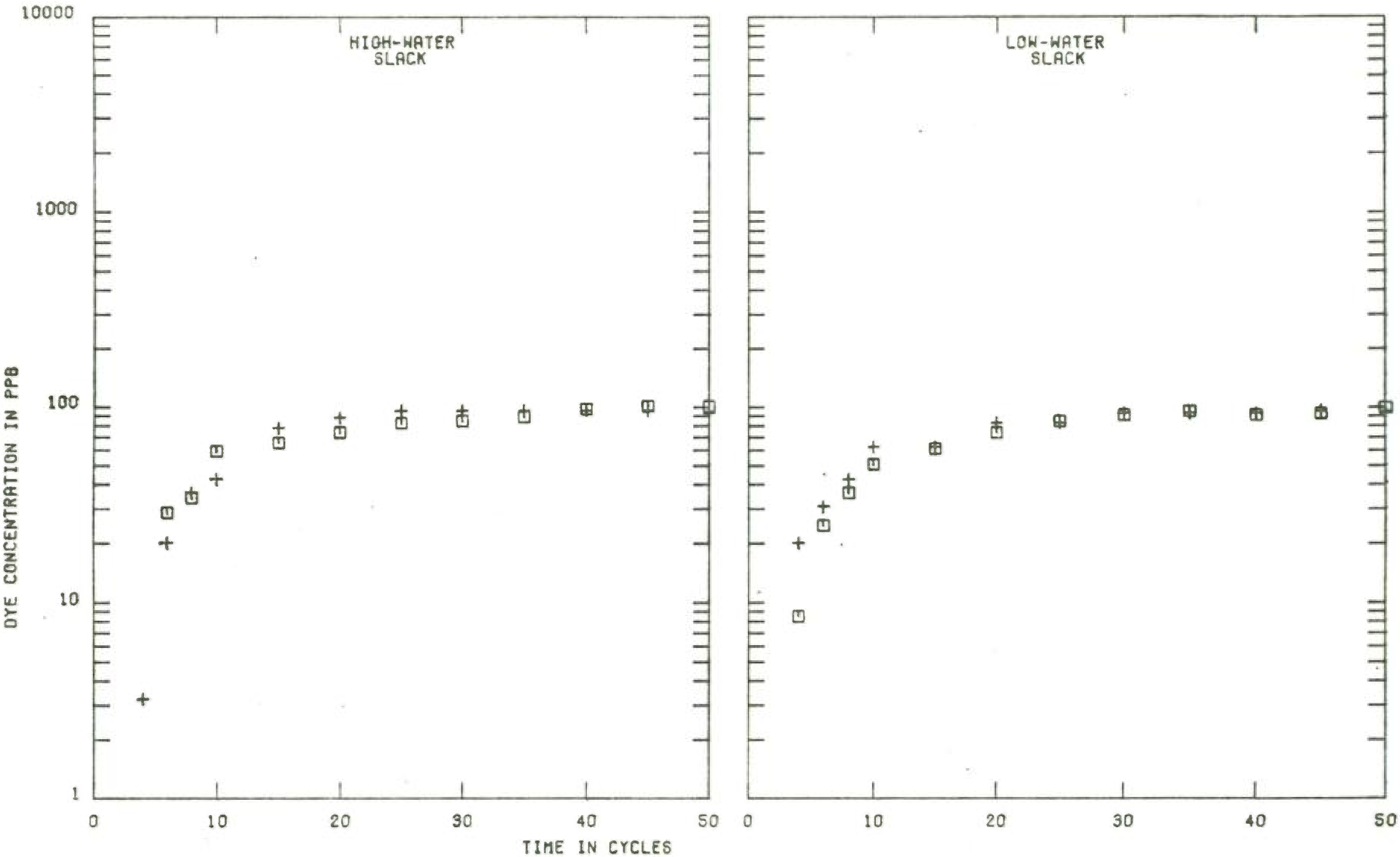


PLATE 111

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

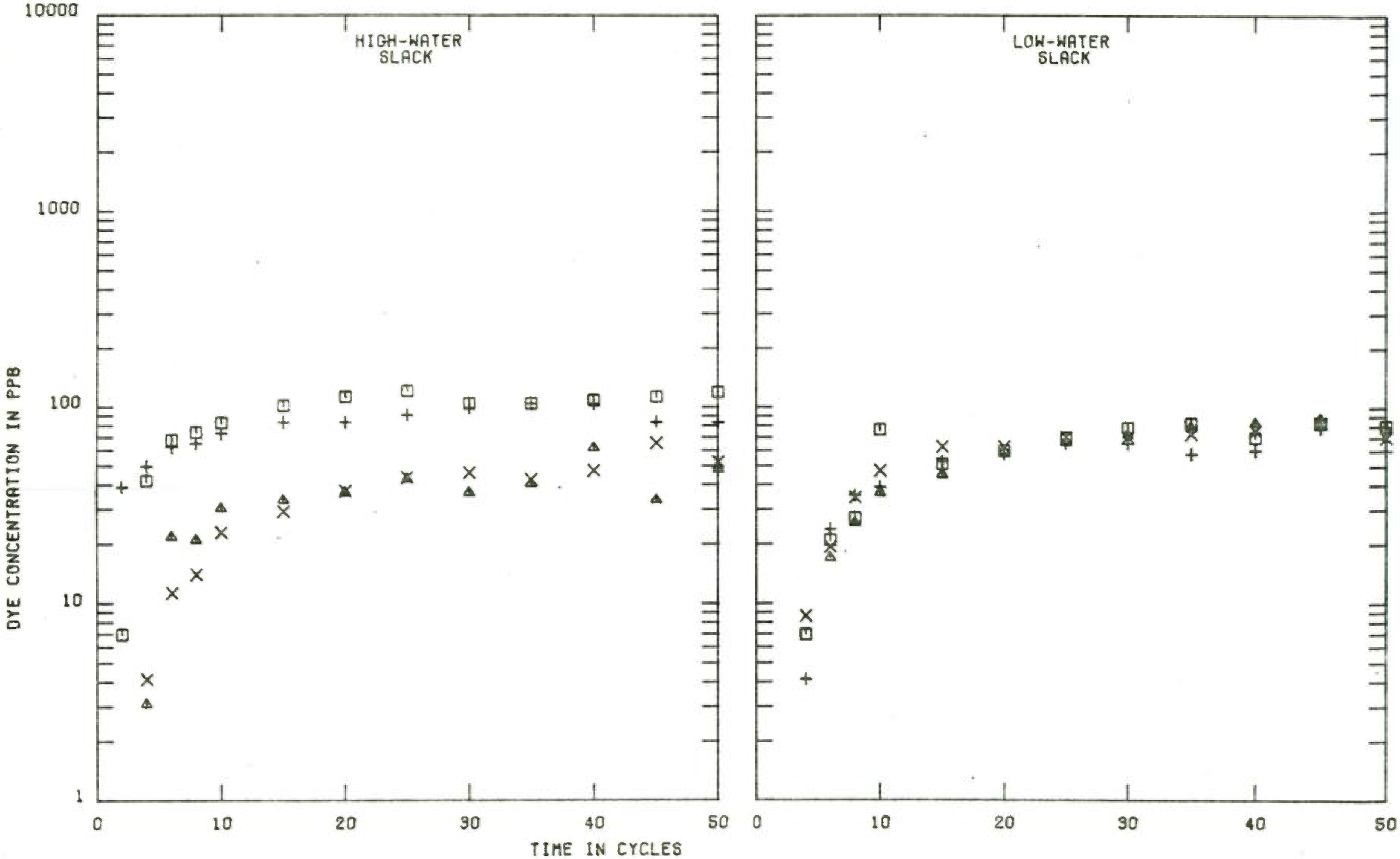
LEGEND

□ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 41 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

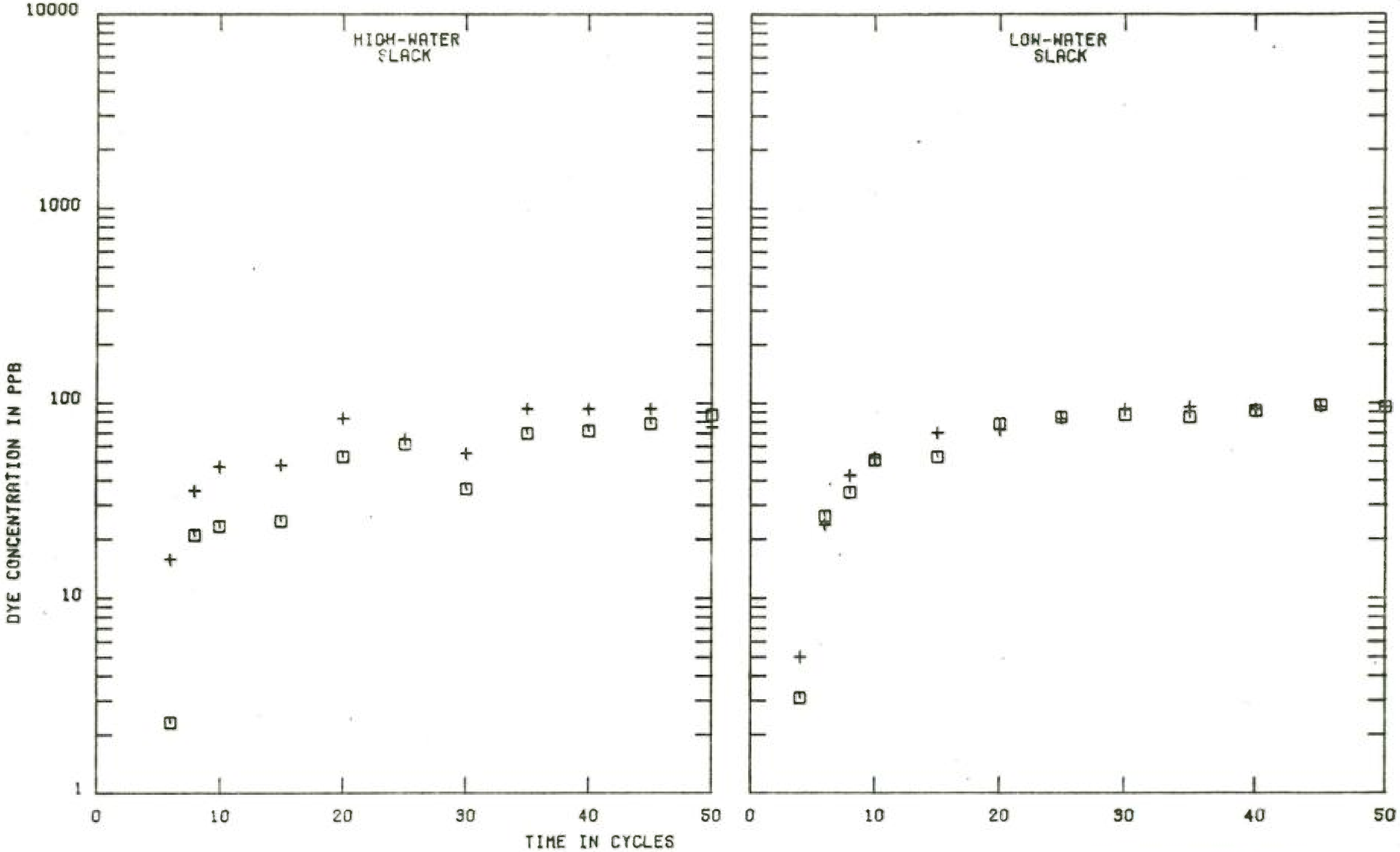
LEGEND

⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —-—	SURFACE	PLAN 1
X —--—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 42



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ——— BASE

\+ — — — PLAN 1

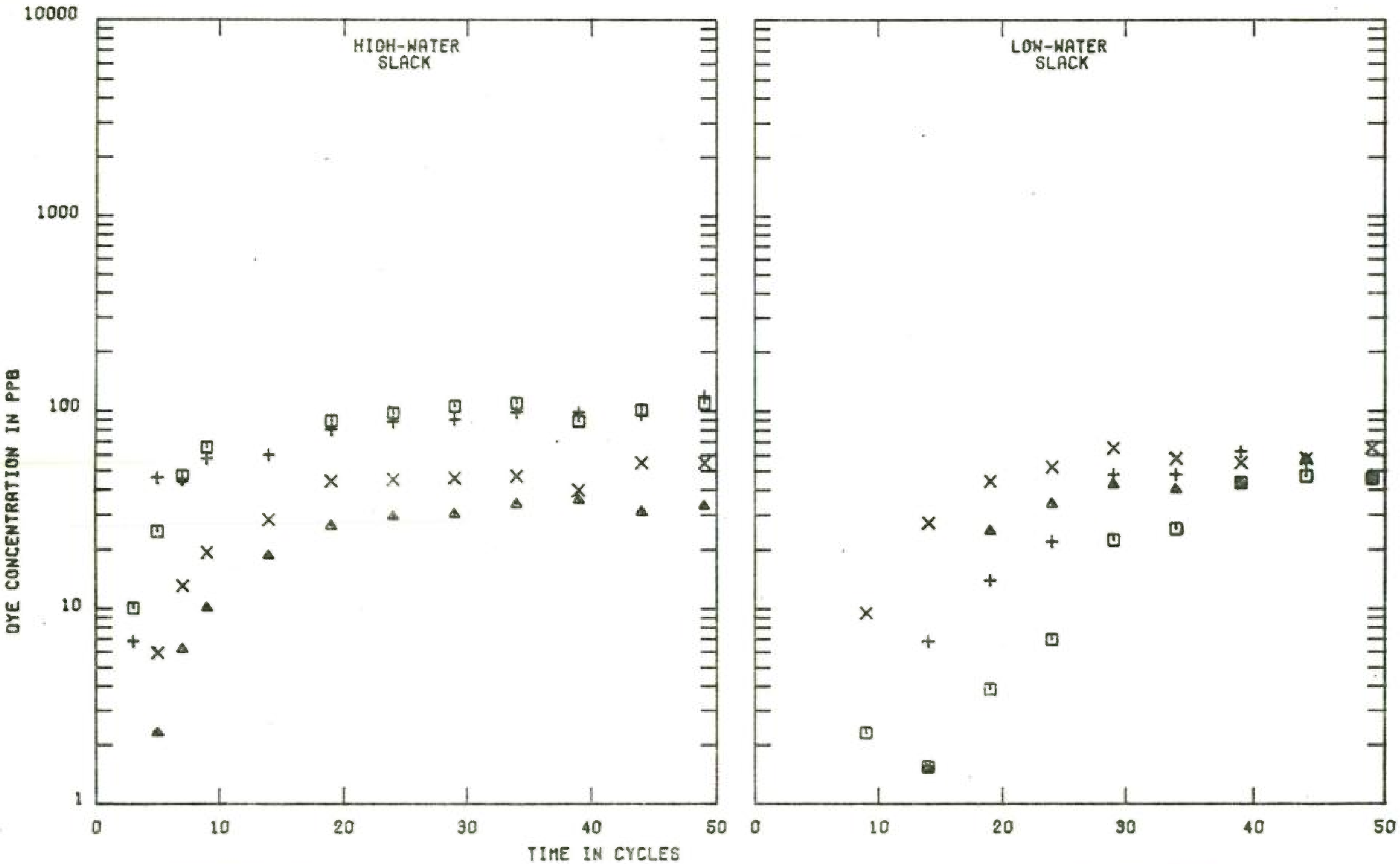
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 43 MID-DEPTH

PLATE 114



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

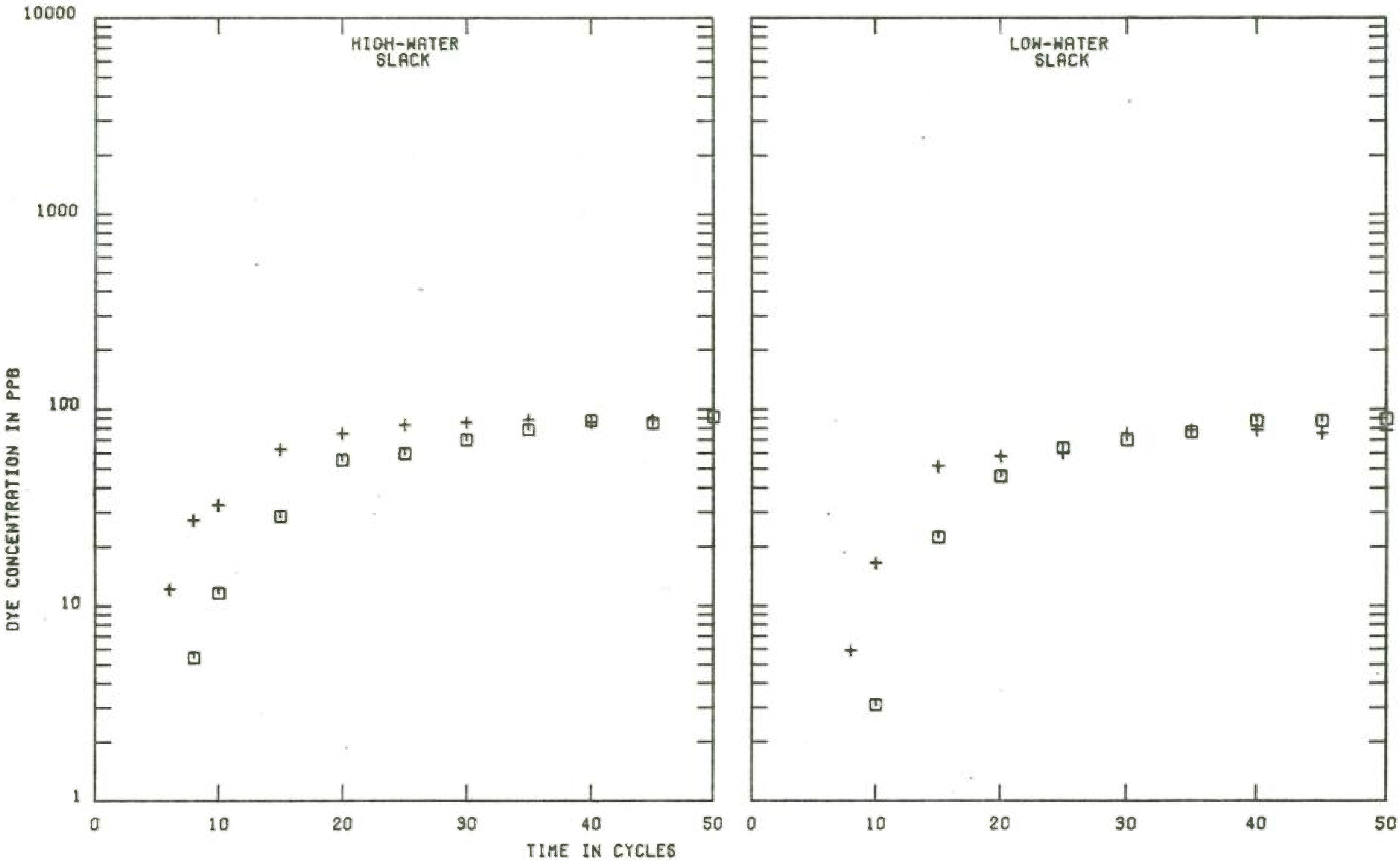
LEGEND

⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —-—-—	SURFACE	PLAN 1
× —-----	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 44



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

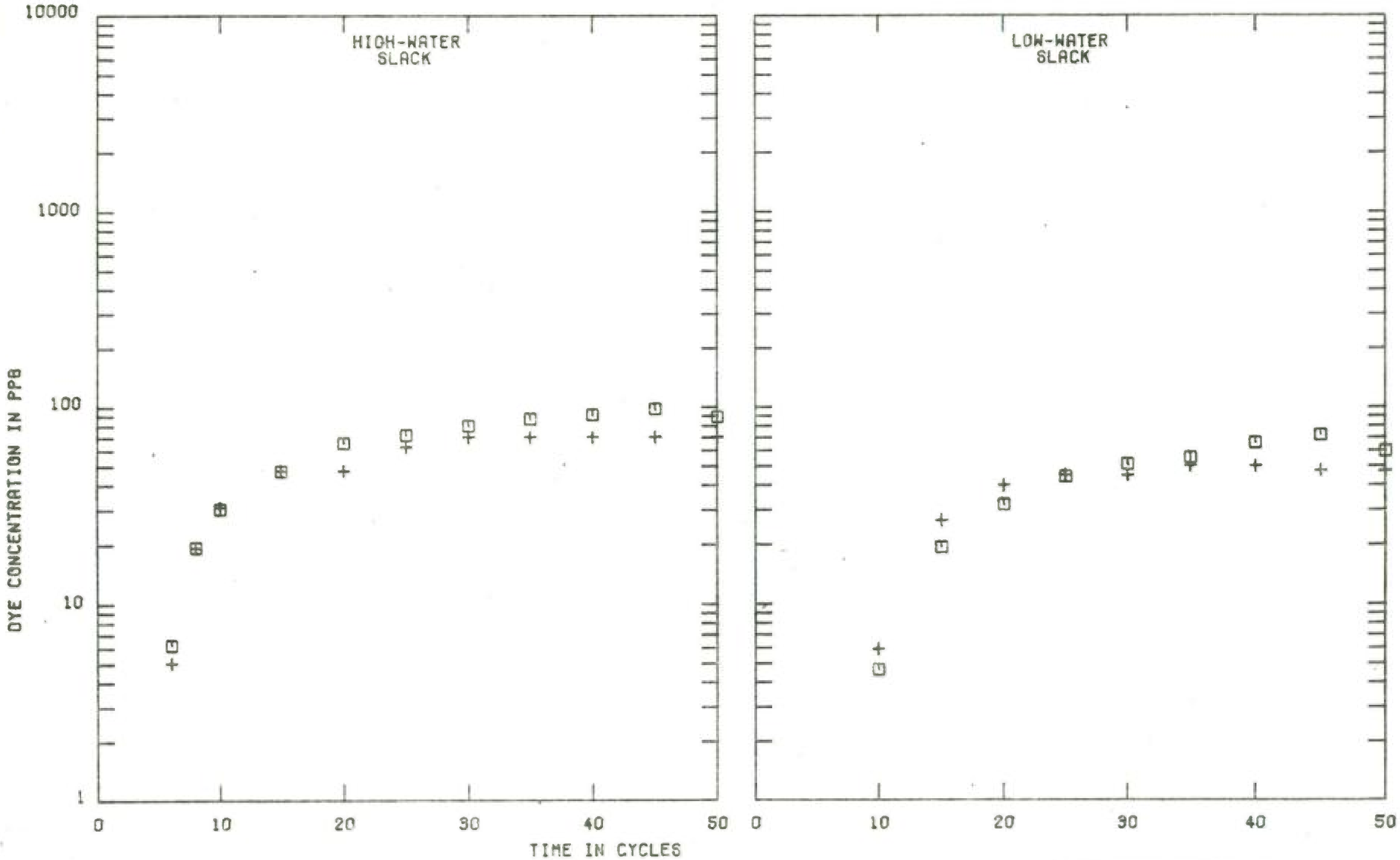
EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 45 MID-DEPTH

PLATE 115

PLATE 116



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

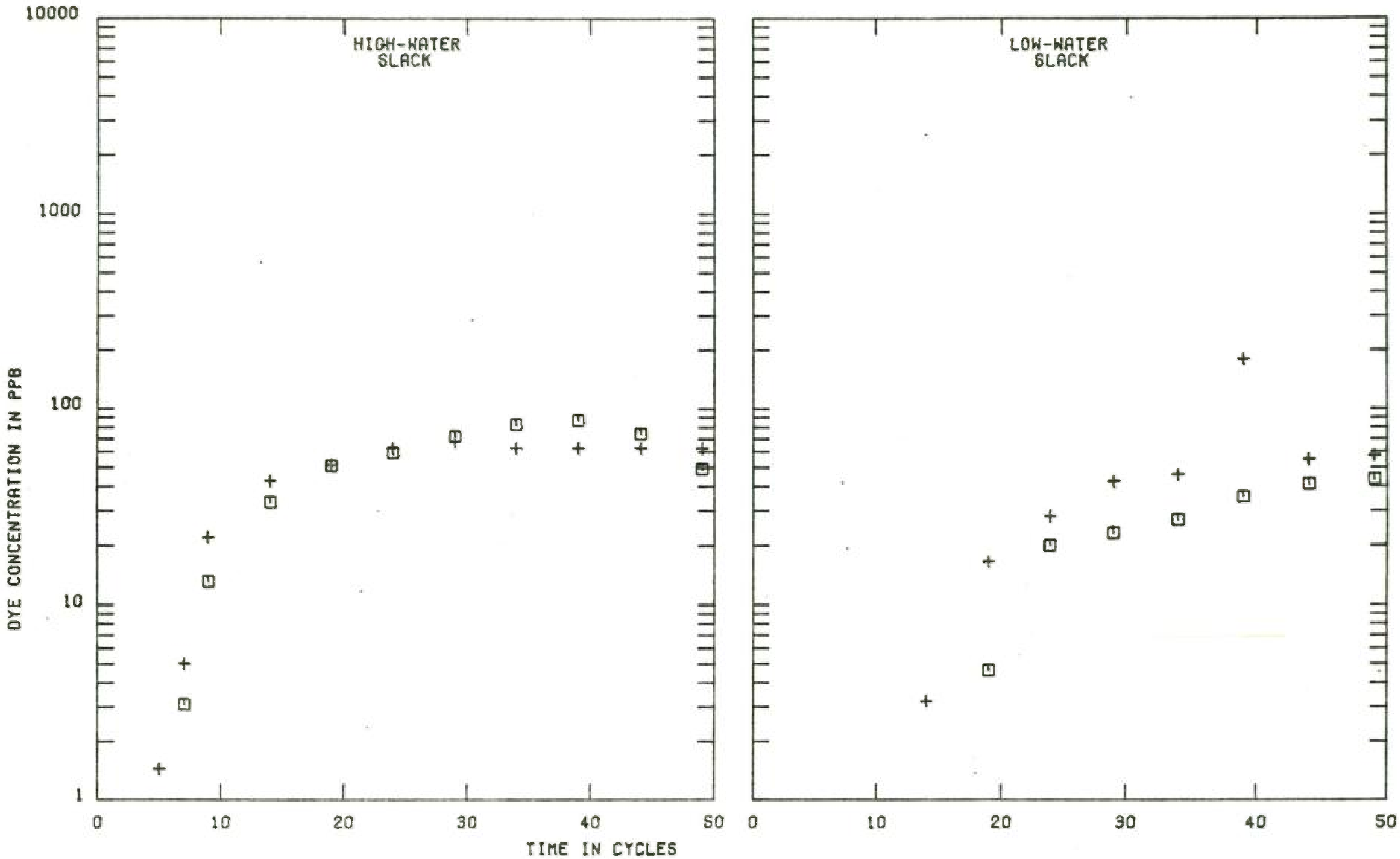
LEGEND

⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 46 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ——— BASE
\+ — — — PLAN 1

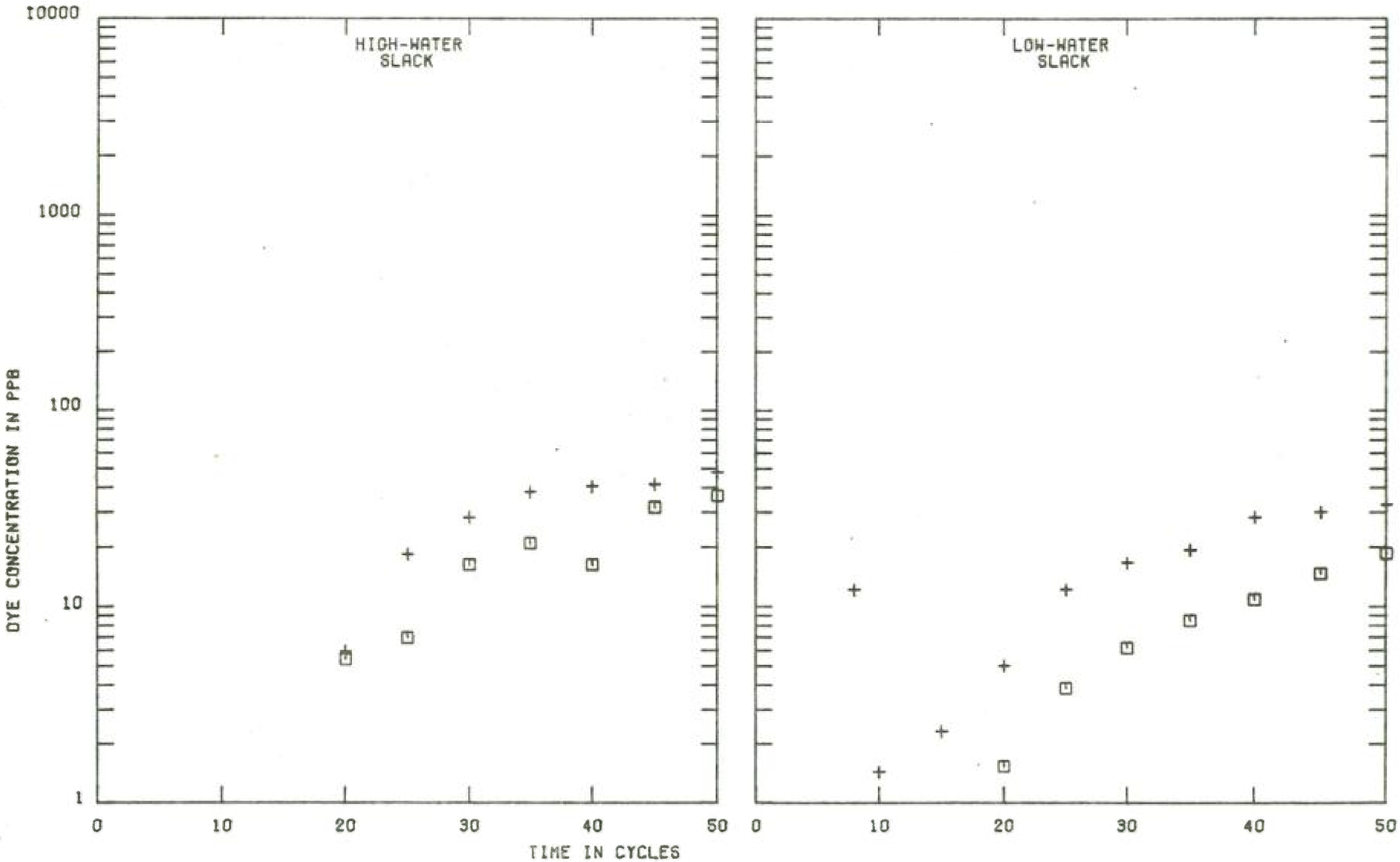
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 47 MID-DEPTH

PLATE 118



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

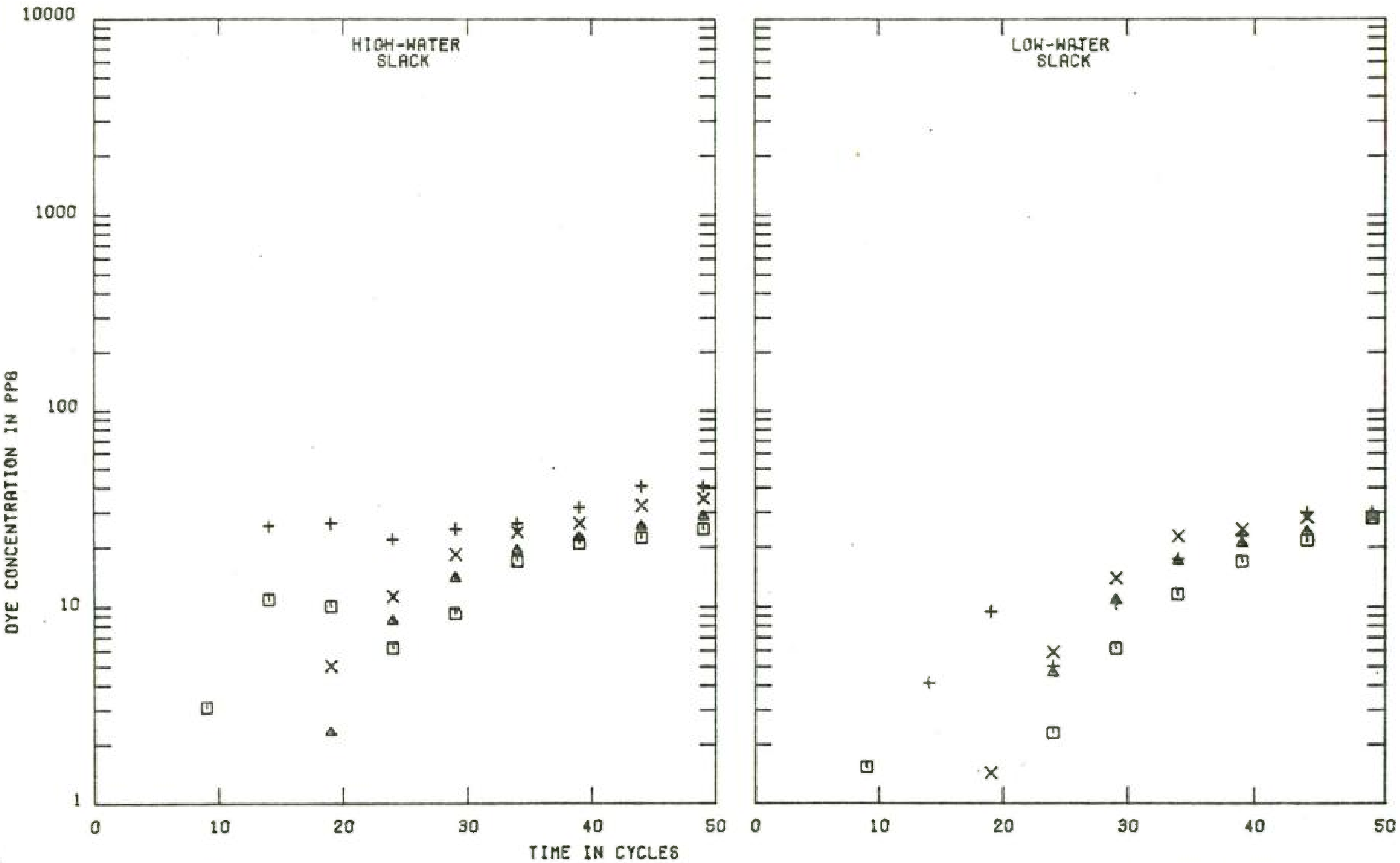
LEGEND
⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 48 MID-DEPTH

PLATE 120



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

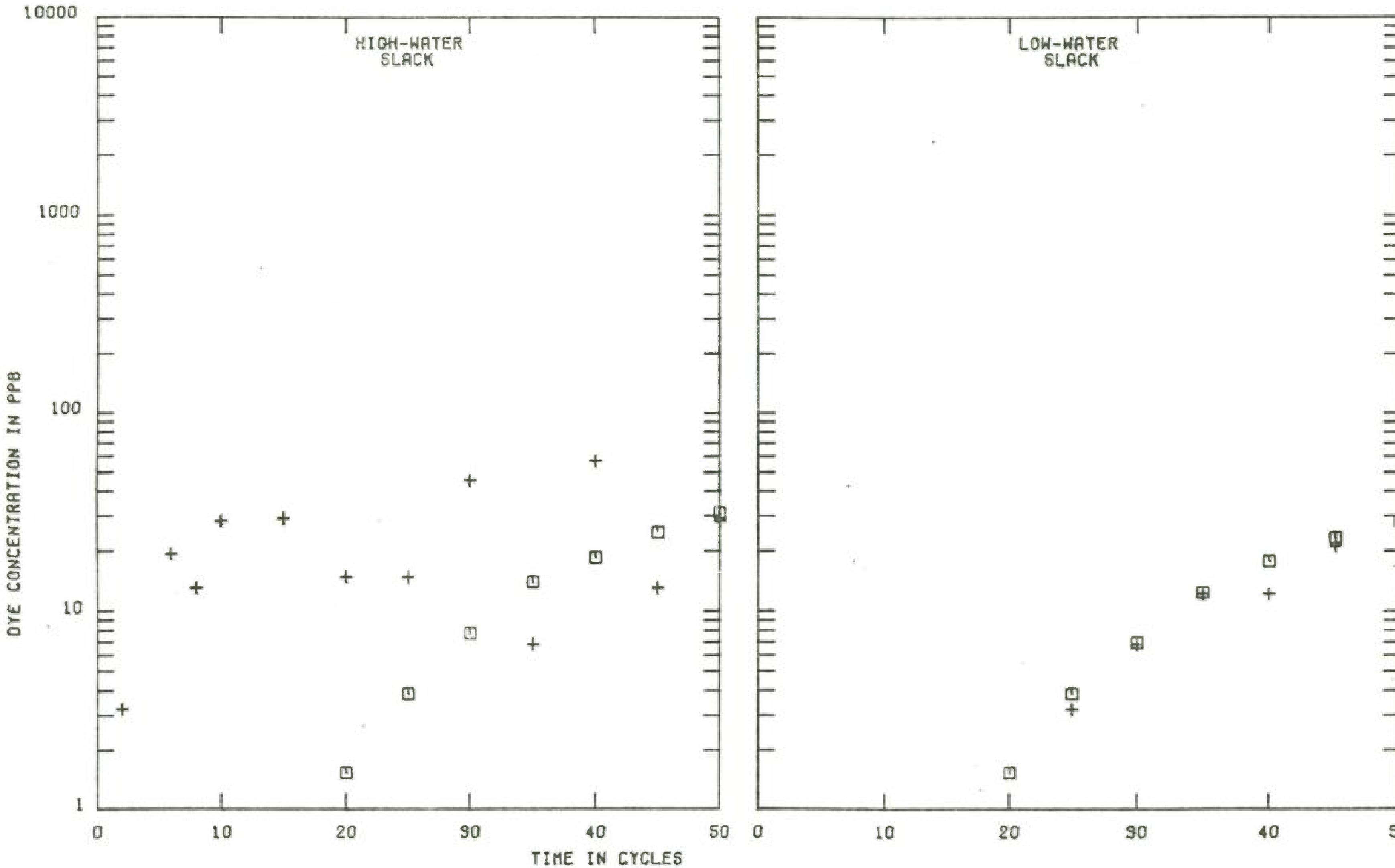
□ ——— SURFACE BASE
△ — — — BOTTOM BASE
+ —-—- SURFACE PLAN 1
X —--— BOTTOM PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 50



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ——— BASE
\+ — — — PLAN 1

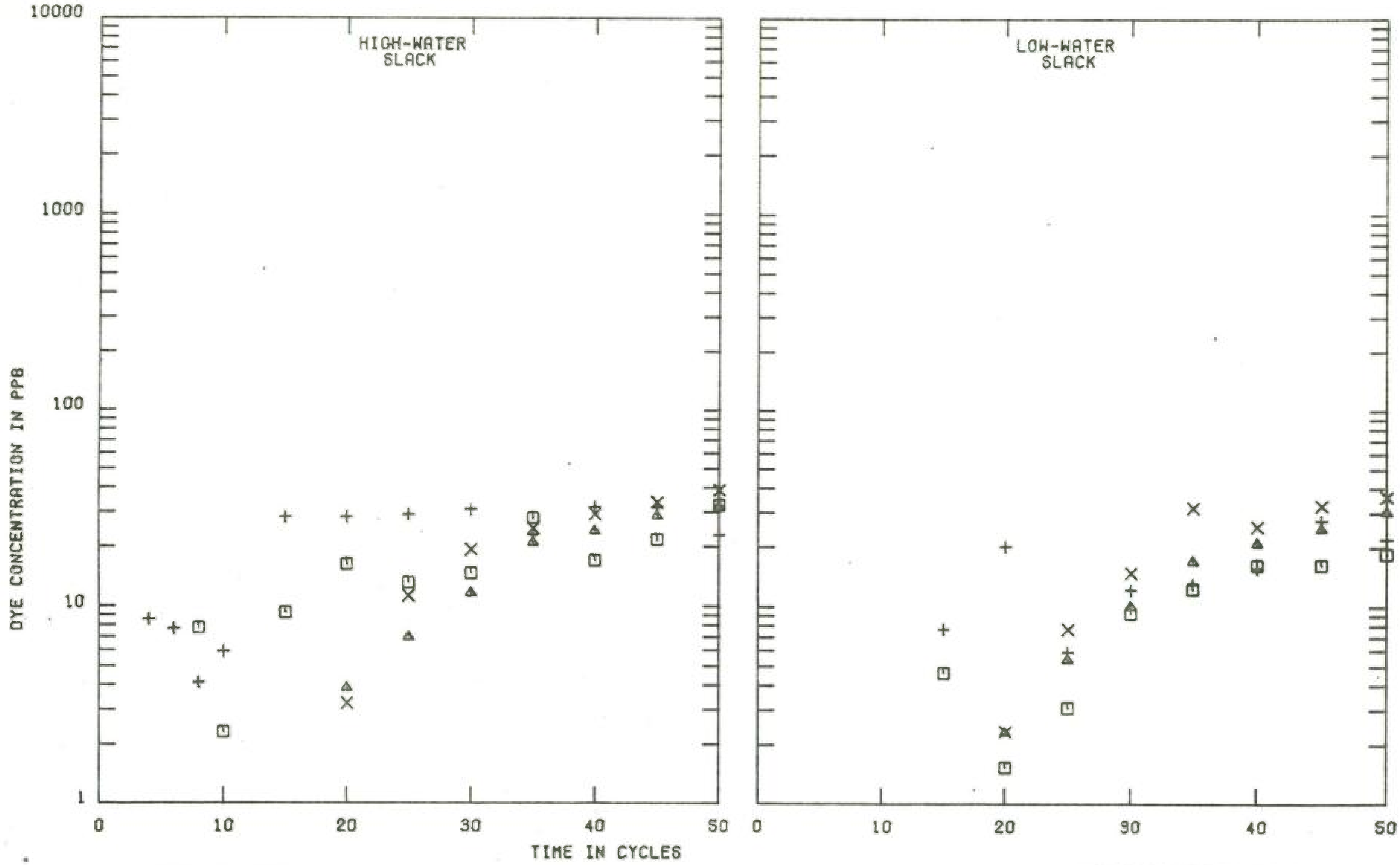
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 51 MID-DEPTH

PLATE 121



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

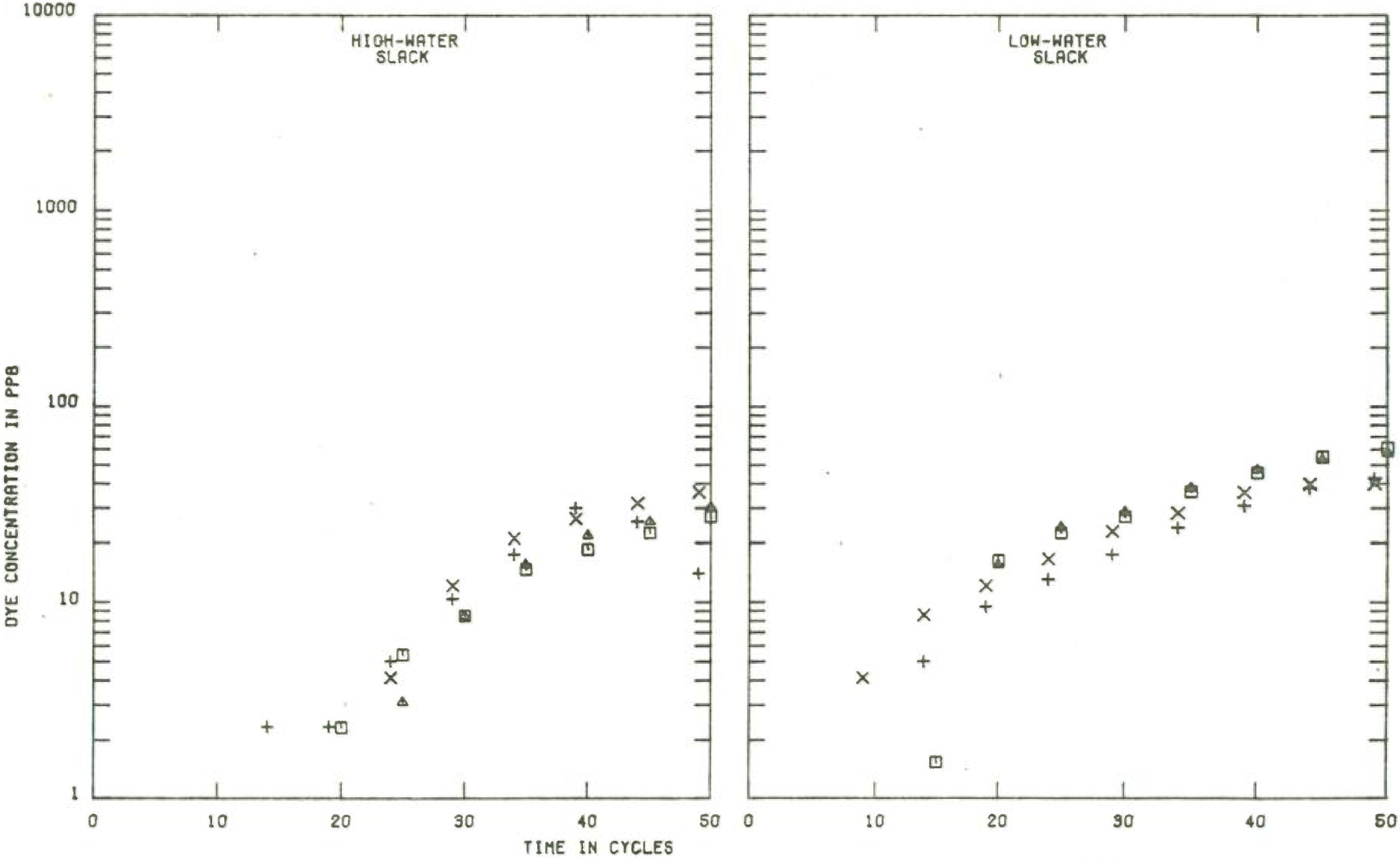
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
× —--—-	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 52



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

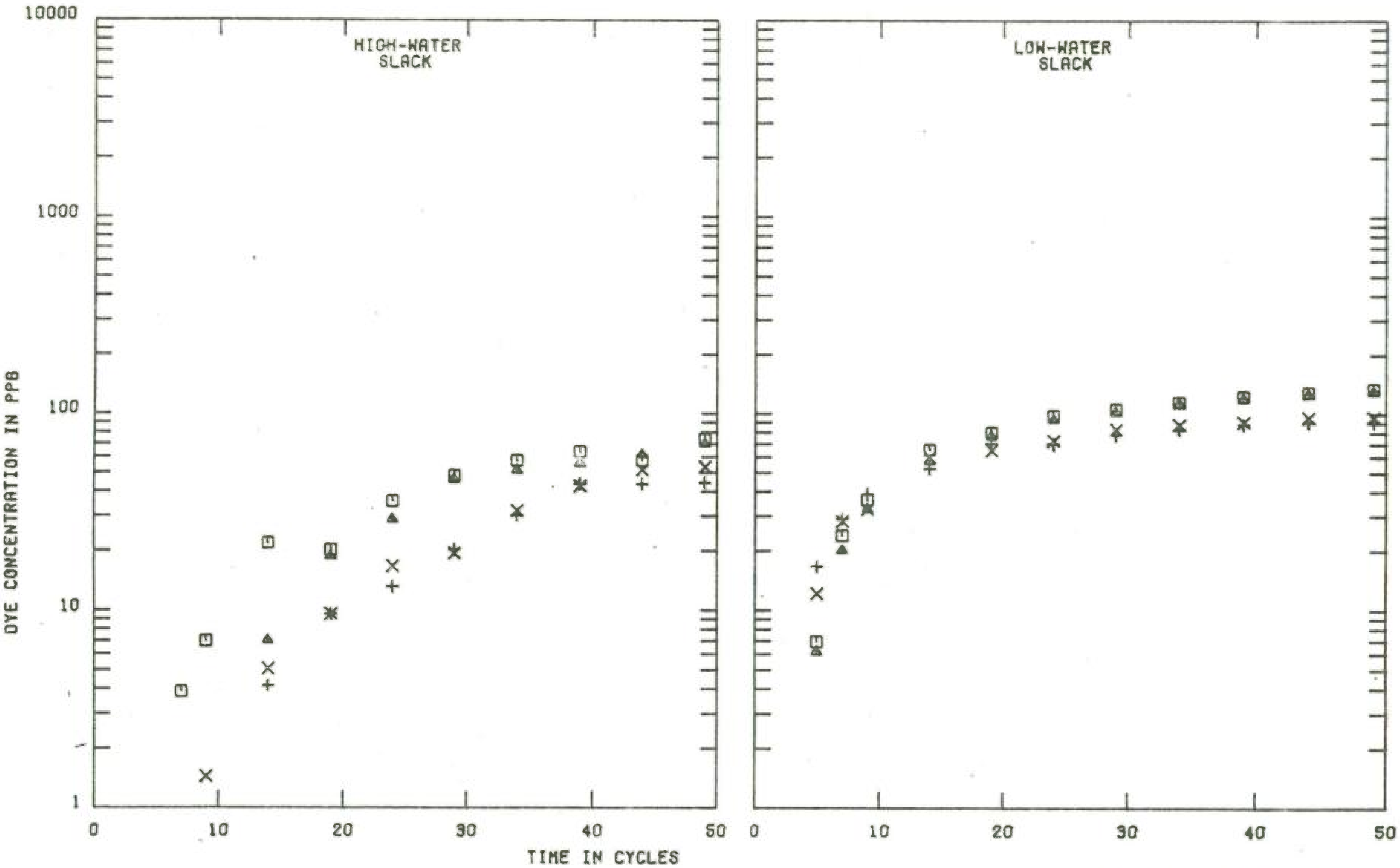
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 53

PLATE 124



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

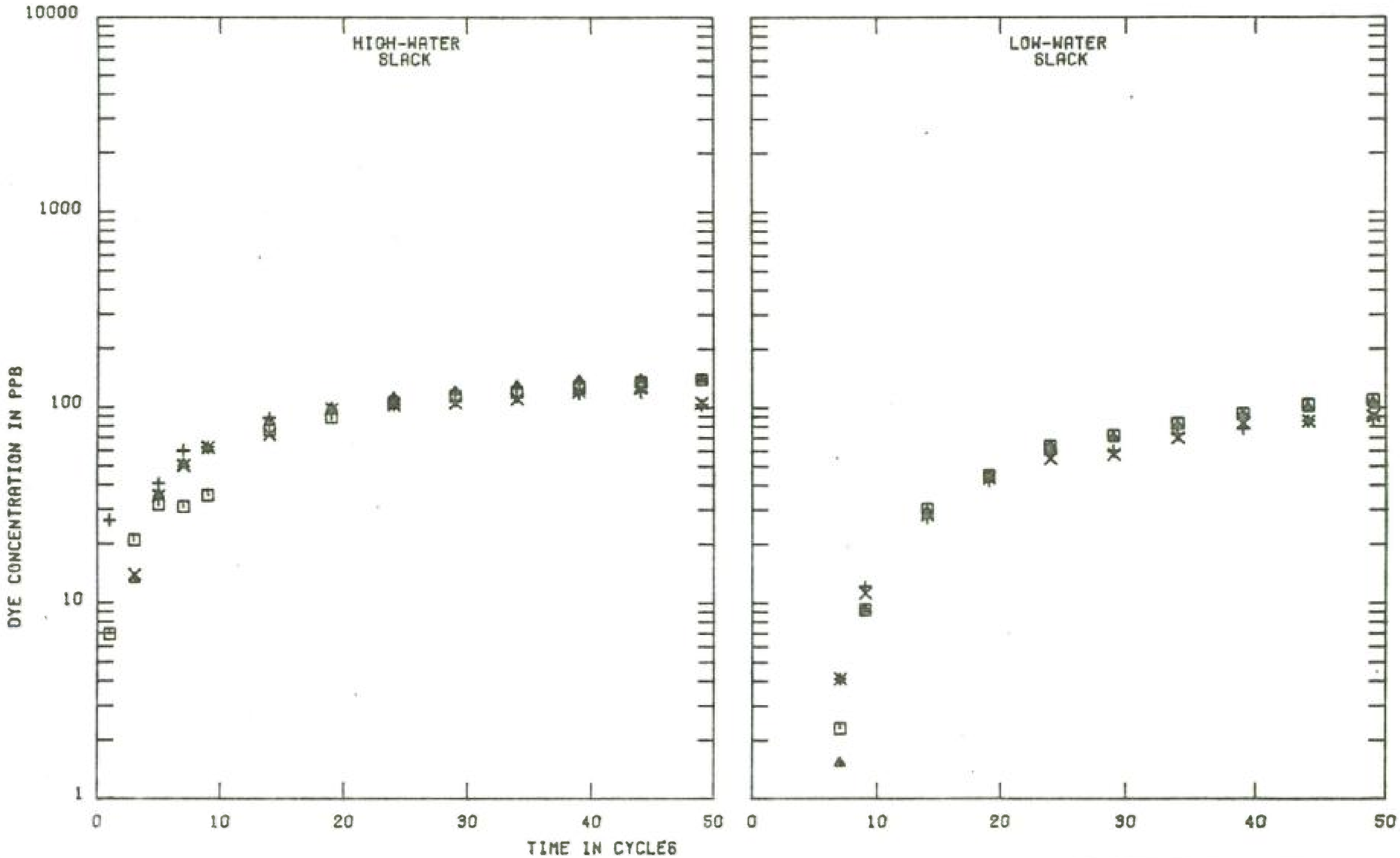
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 54



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

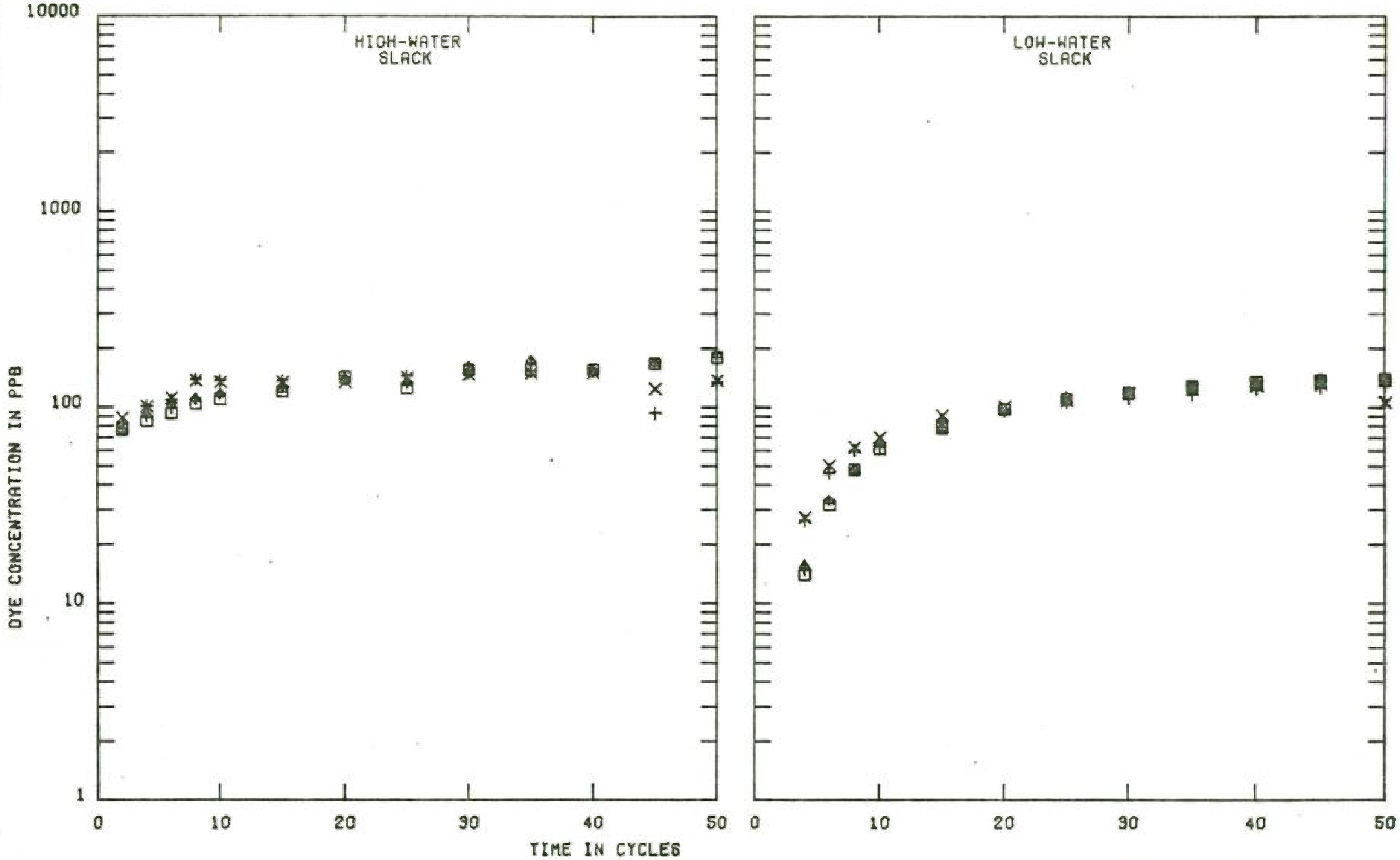
□ ——— SURFACE, ▲ — — — BOTTOM: BASE
+ —·—·— SURFACE, × —··—··— BOTTOM: PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 55



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

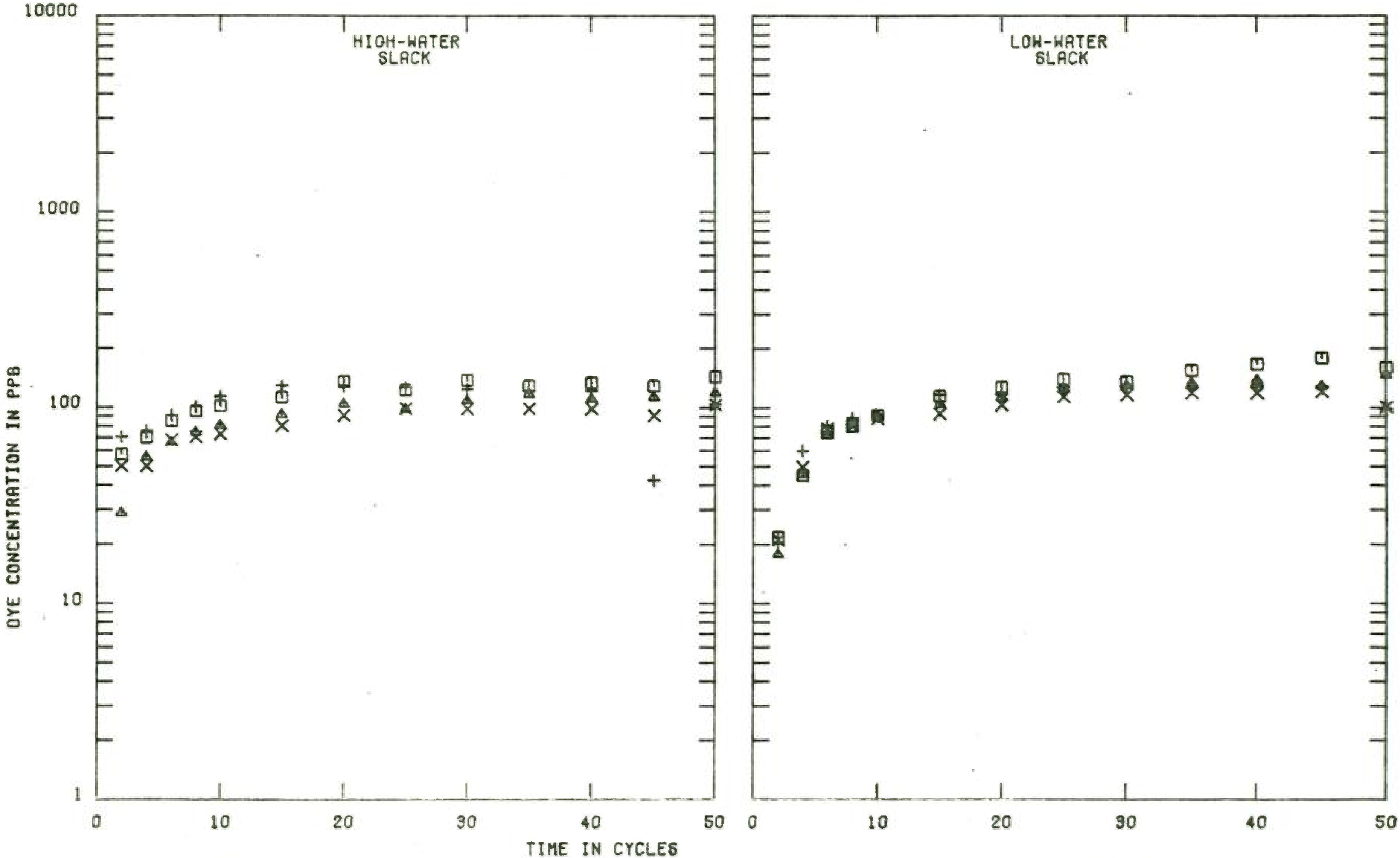
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 56



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

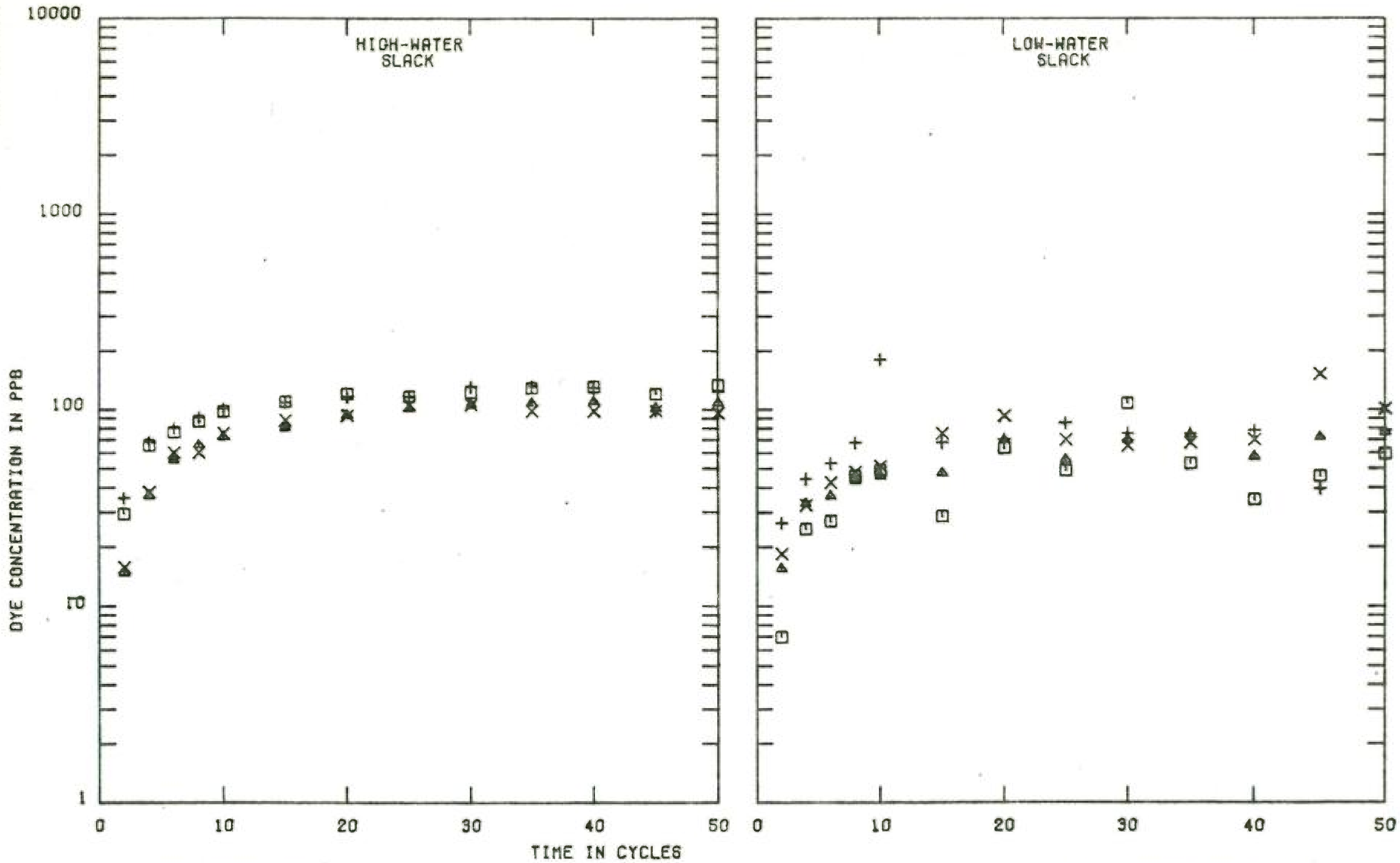
LEGEND

⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
X —··—··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 57



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

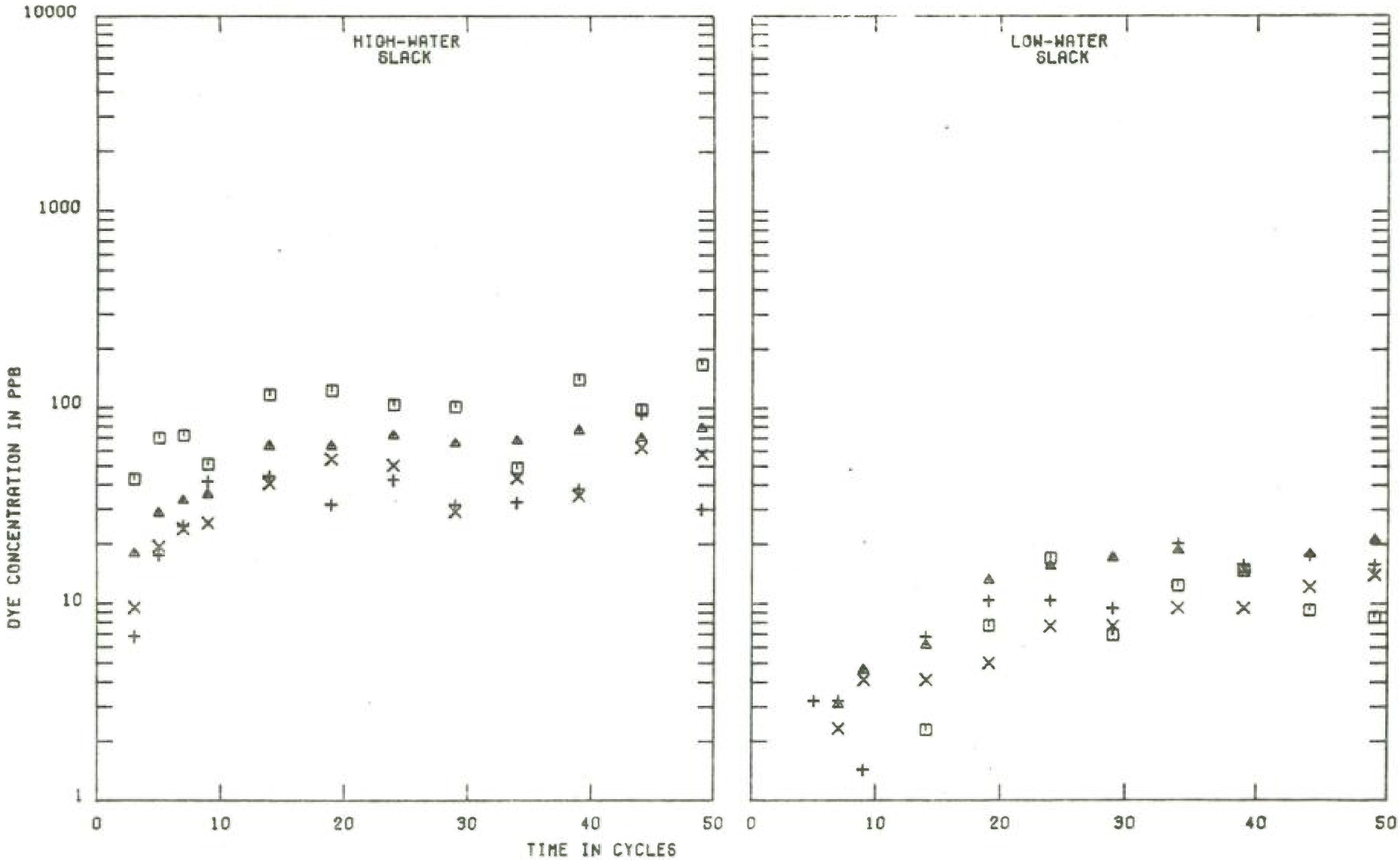
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
× —--—-	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 58



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

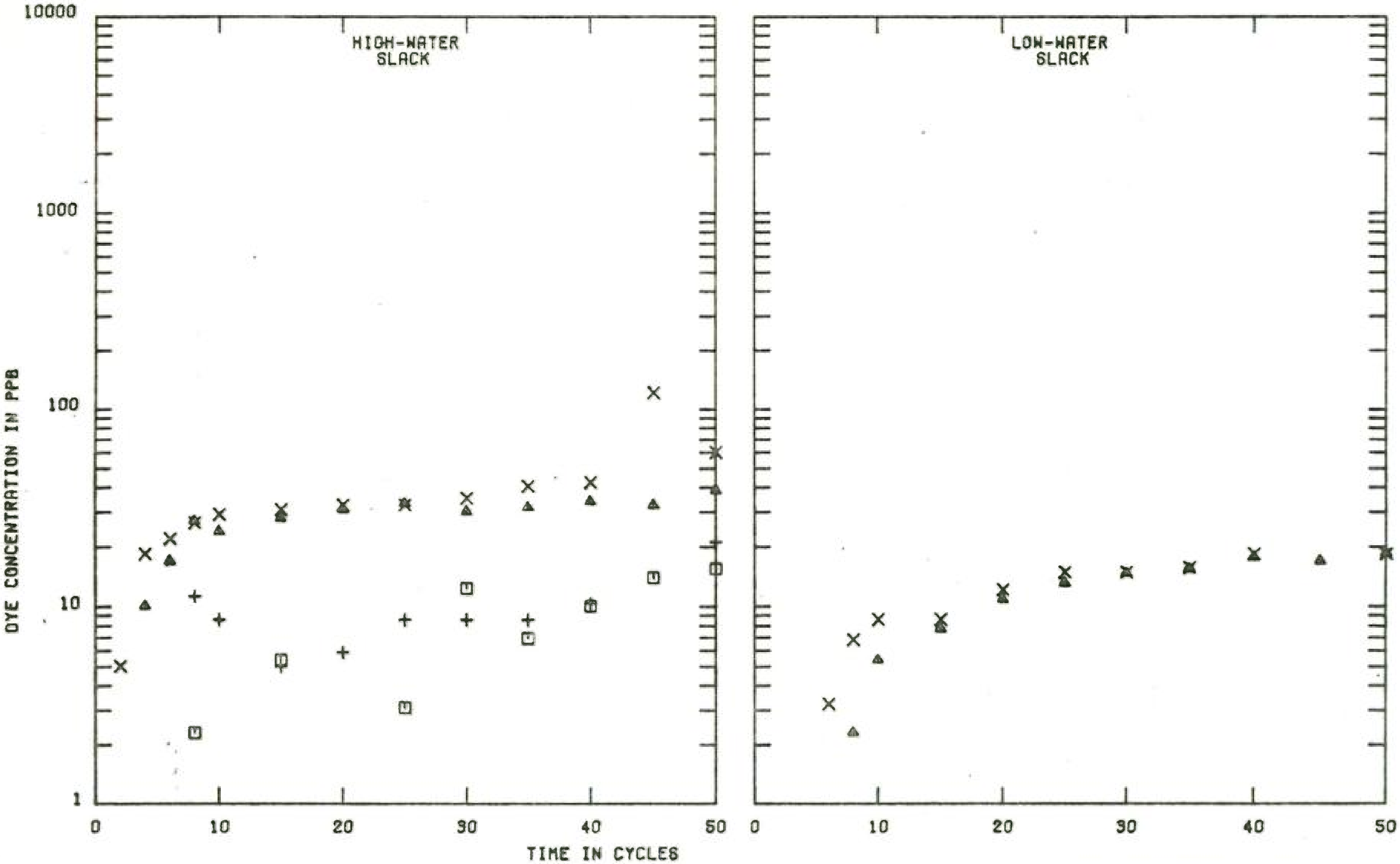
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
PASSAIC VALLEY OUTFALL RELEASE

STATION 59



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

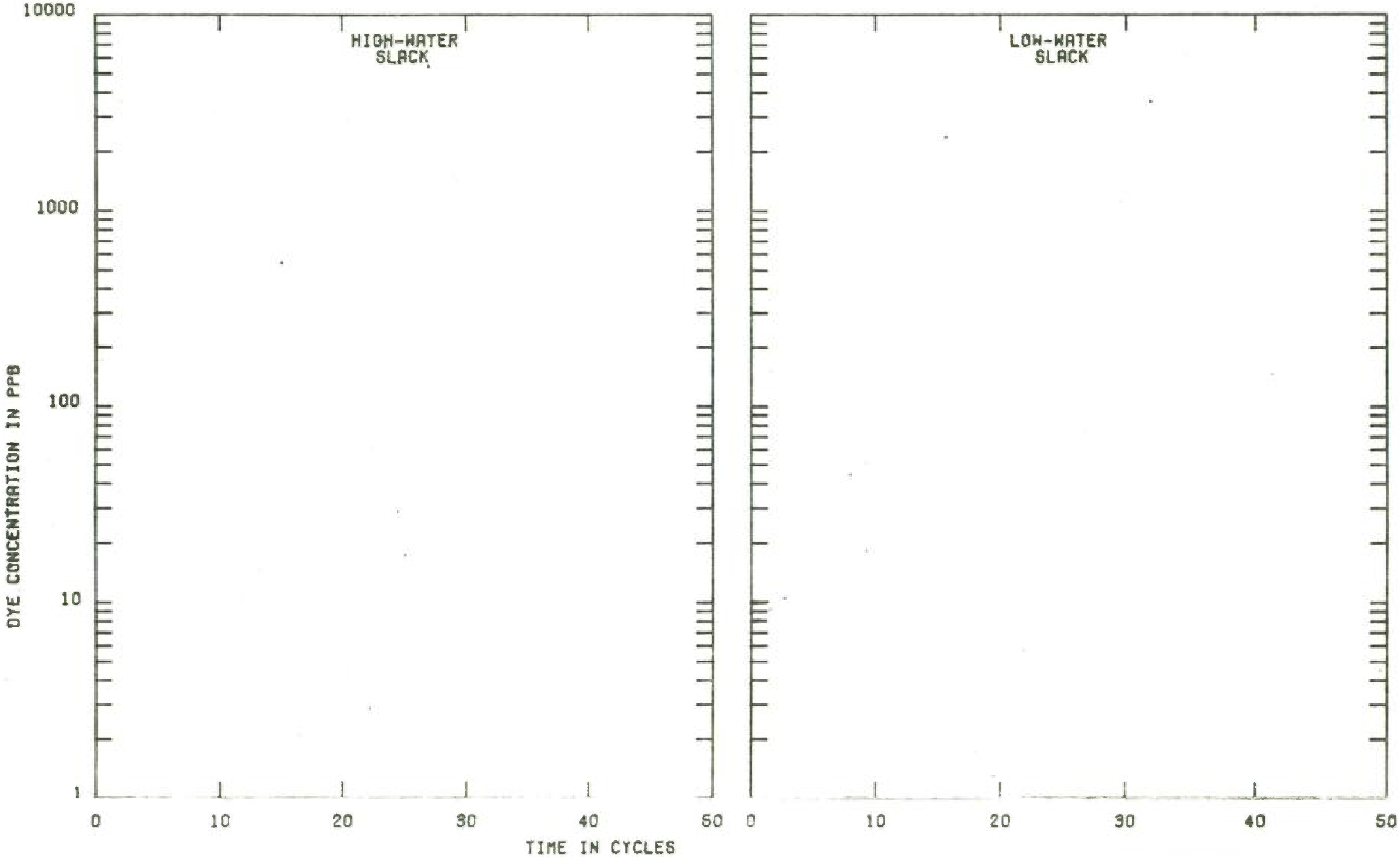
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —-—-—	SURFACE	PLAN 1
× —--—--	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

PASSAIC VALLEY OUTFALL RELEASE

STATION 61



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ ——-——	SURFACE	PLAN 1
× —--——	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 1

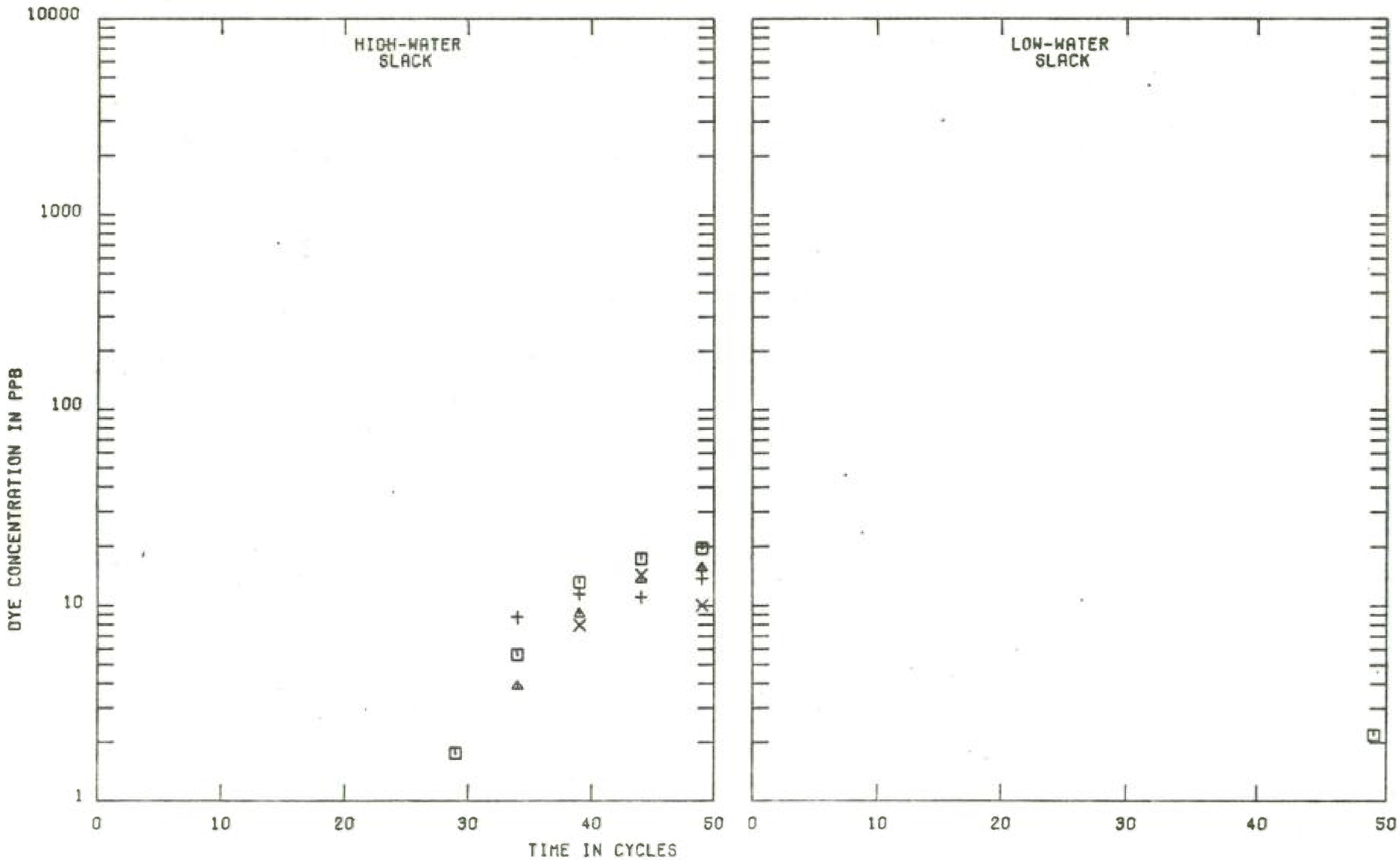


PLATE 133

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

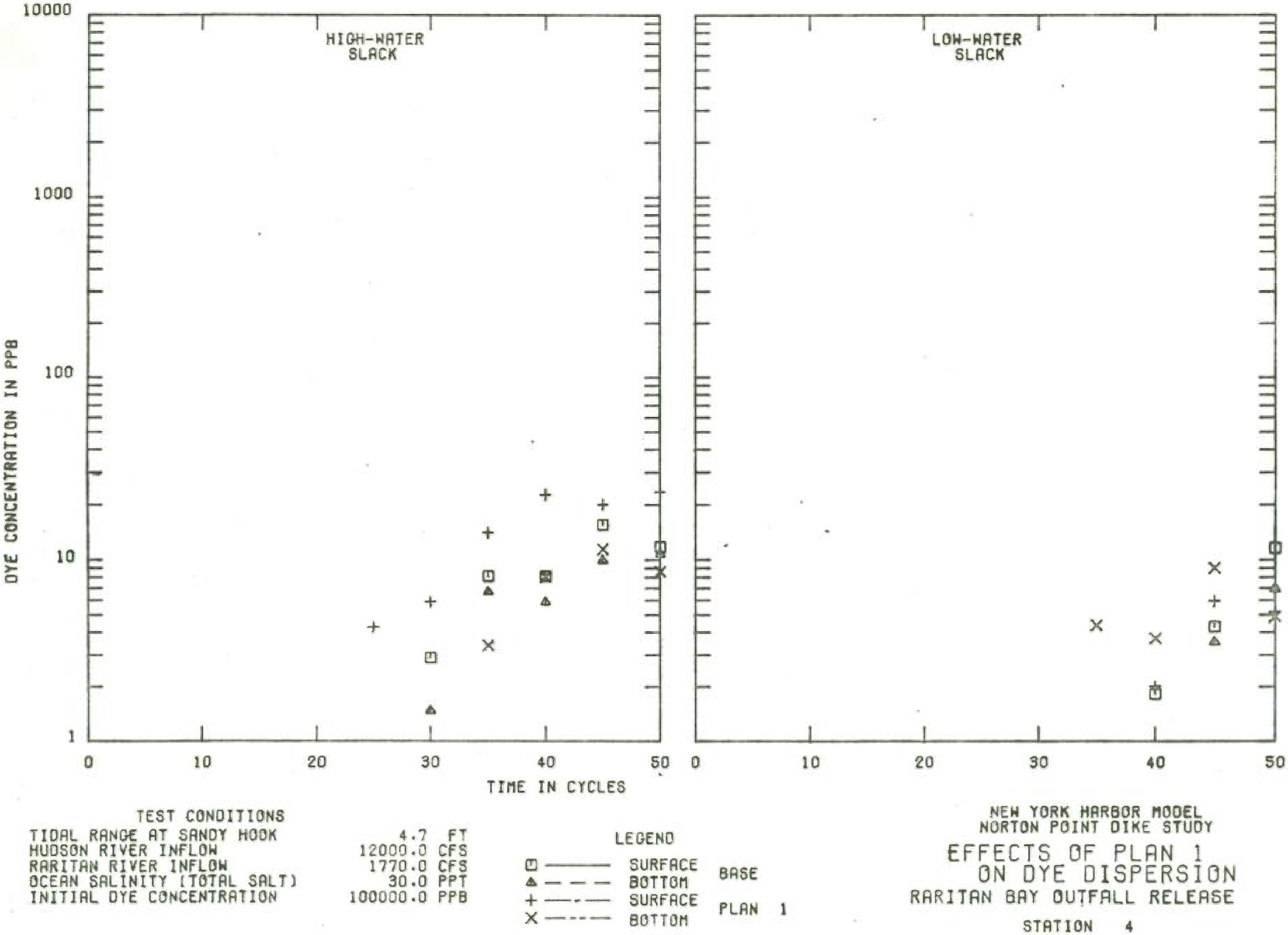
LEGEND

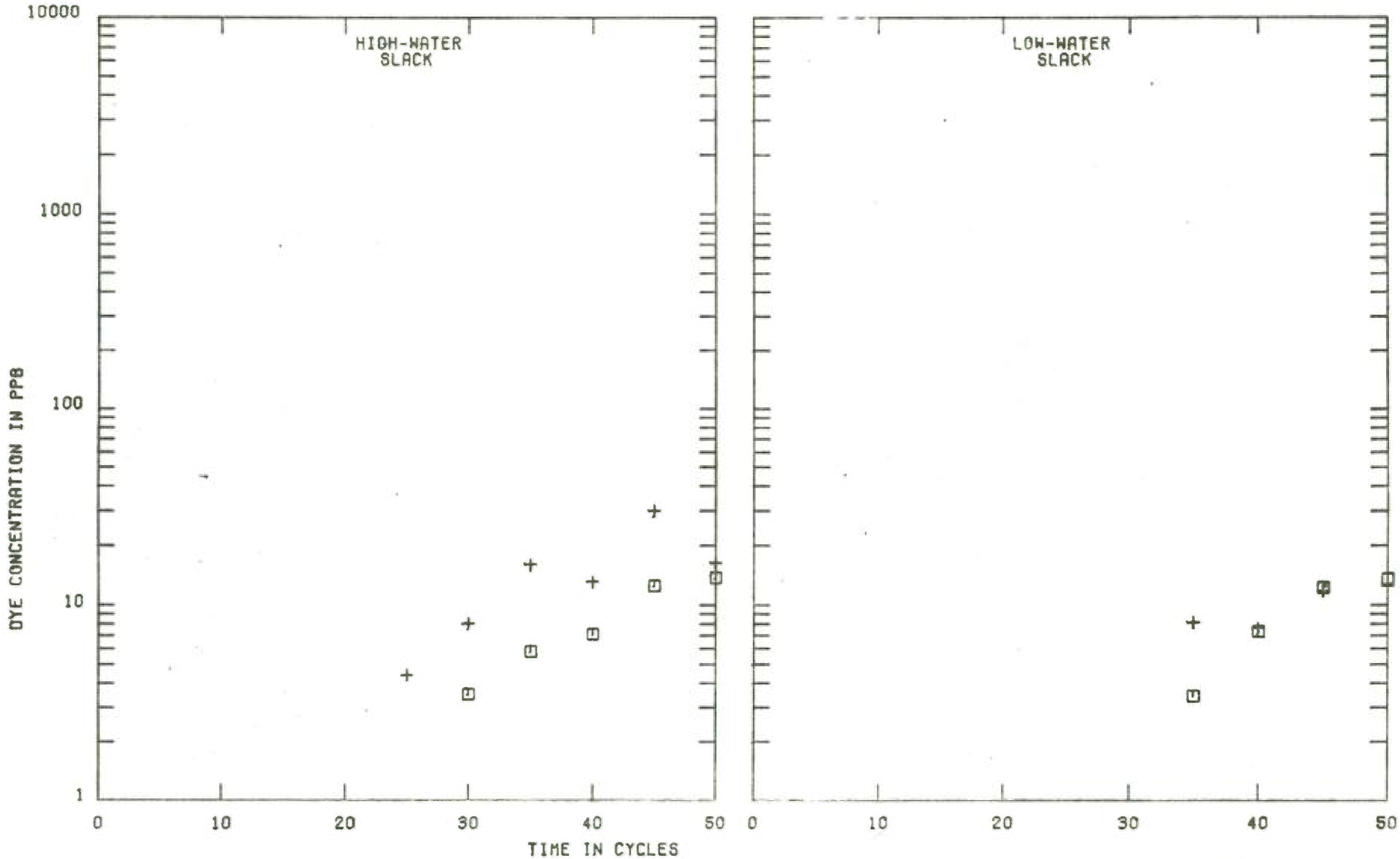
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 3


HIGH-WATER SLACK
LOW-WATER SLACK
DYE CONCENTRATION IN PPB
TIME IN CYCLES
TEST CONDITIONS
TIDAL RANGE AT SANDY HOOK 4.7 FT
HUDSON RIVER INFLOW 12000.0 CFS
RARITAN RIVER INFLOW 1770.0 CFS
OCEAN SALINITY (TOTAL SALT) 30.0 PPT
INITIAL DYE CONCENTRATION 100000.0 PPB
LEGEND
SURFACE
BOTTOM
BASE
SURFACE
BOTTOM
PLAN 1
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY
EFFECTS OF PLAN 1 ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE
STATION 4



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

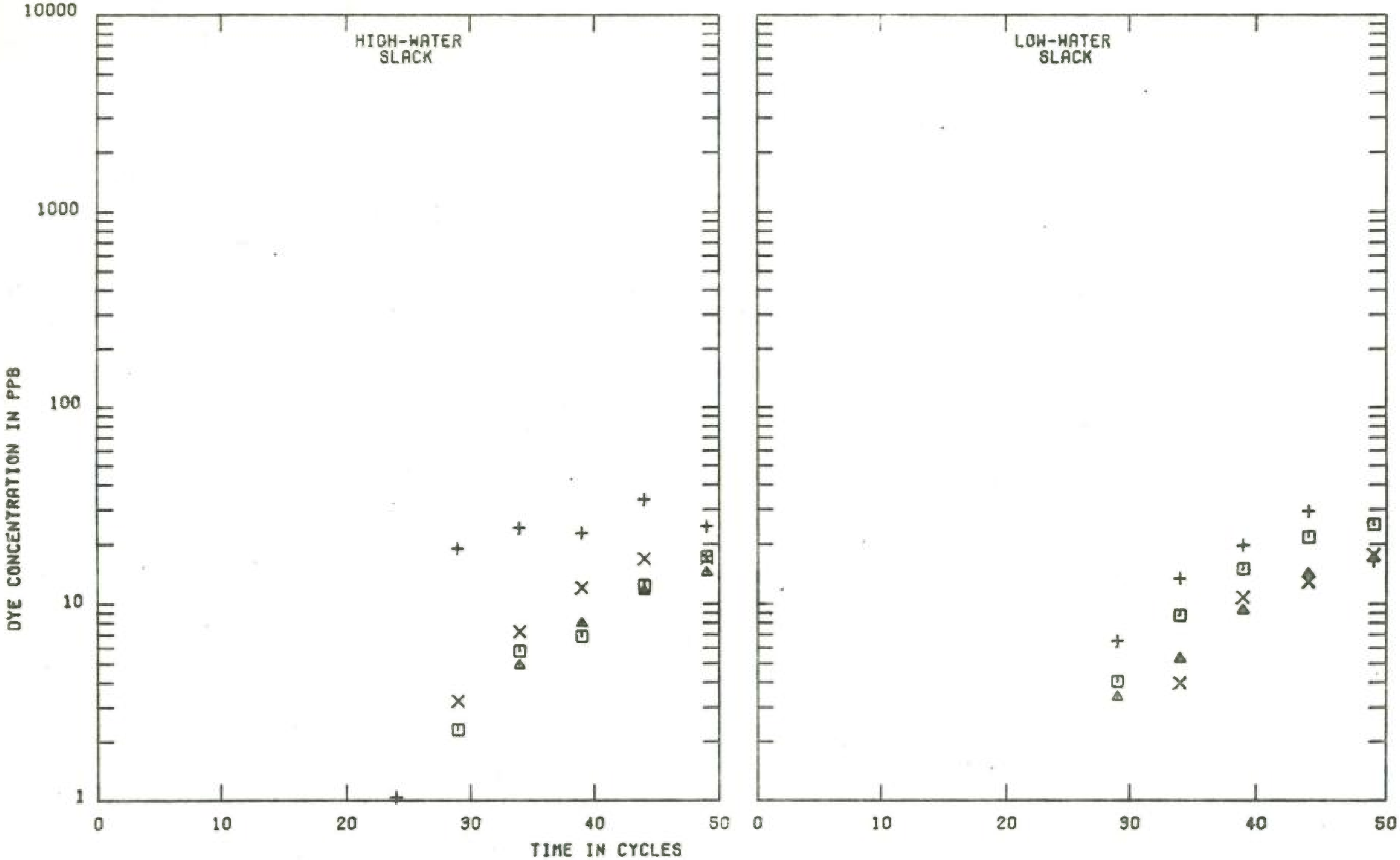
□ ——— BASE
\+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 5 MID-DEPTH

PLATE 136



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

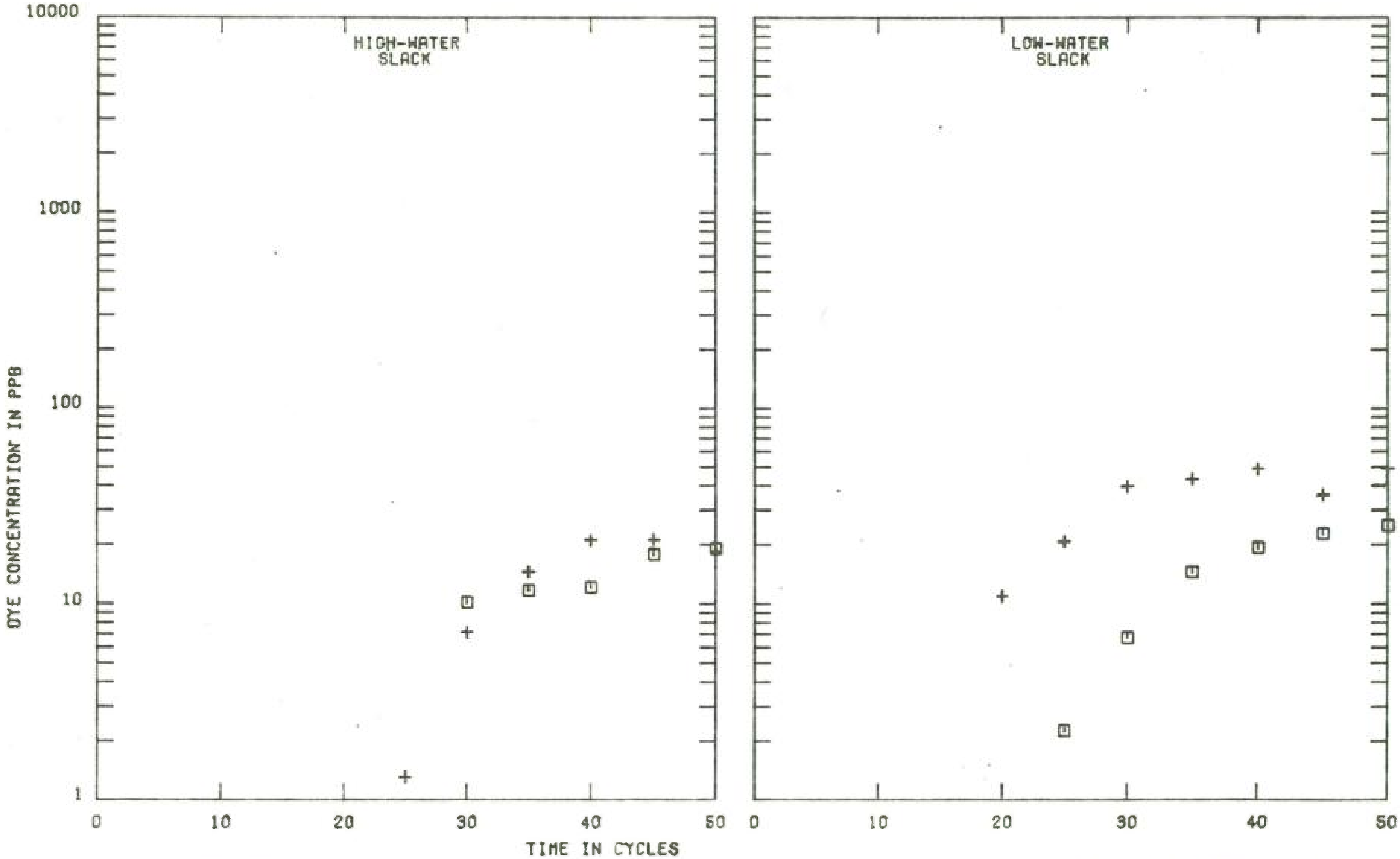
LEGEND

Symbol	Layer	Condition
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —·—·—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 8



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

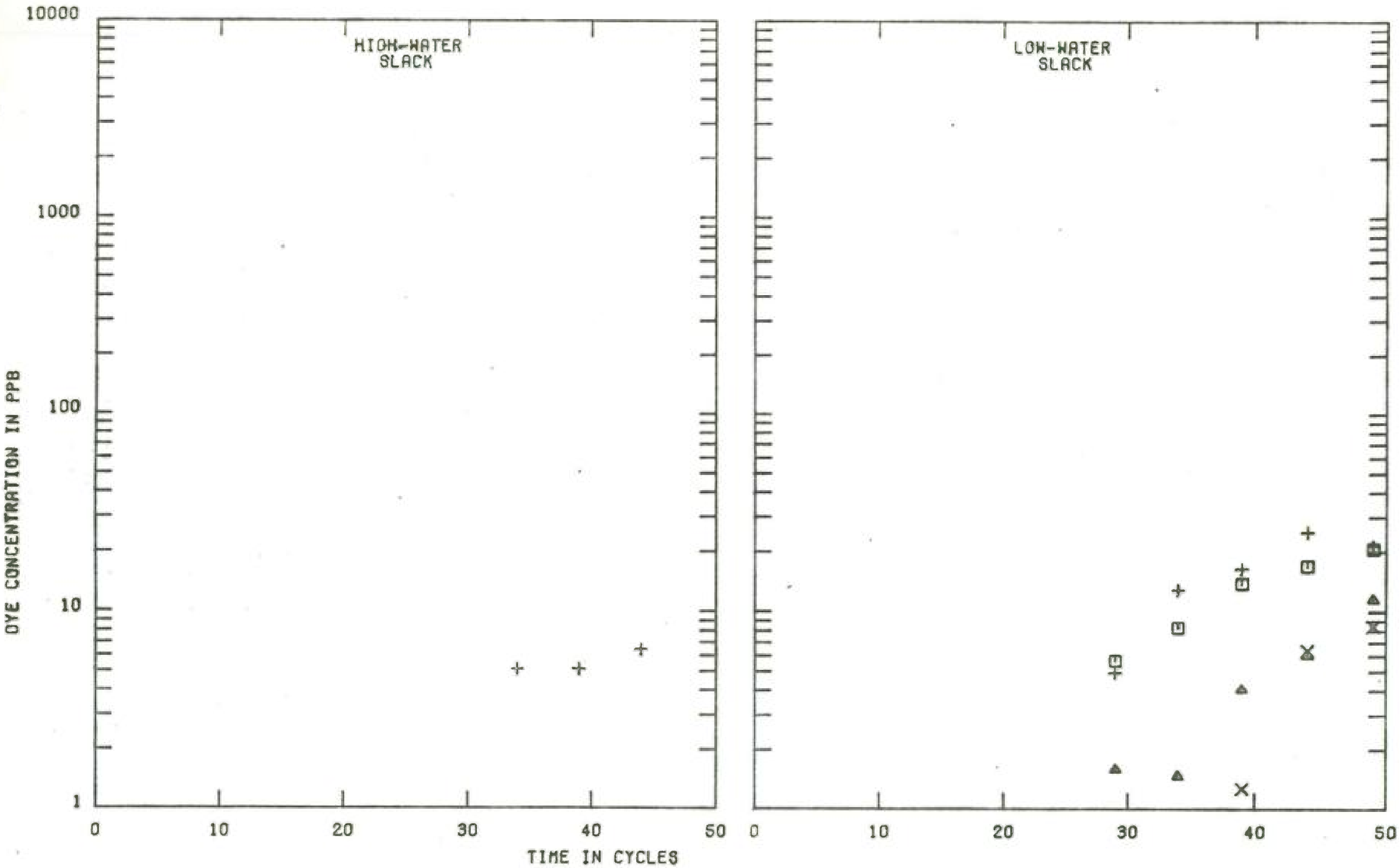
⊡ ———— BASE

+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 7 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

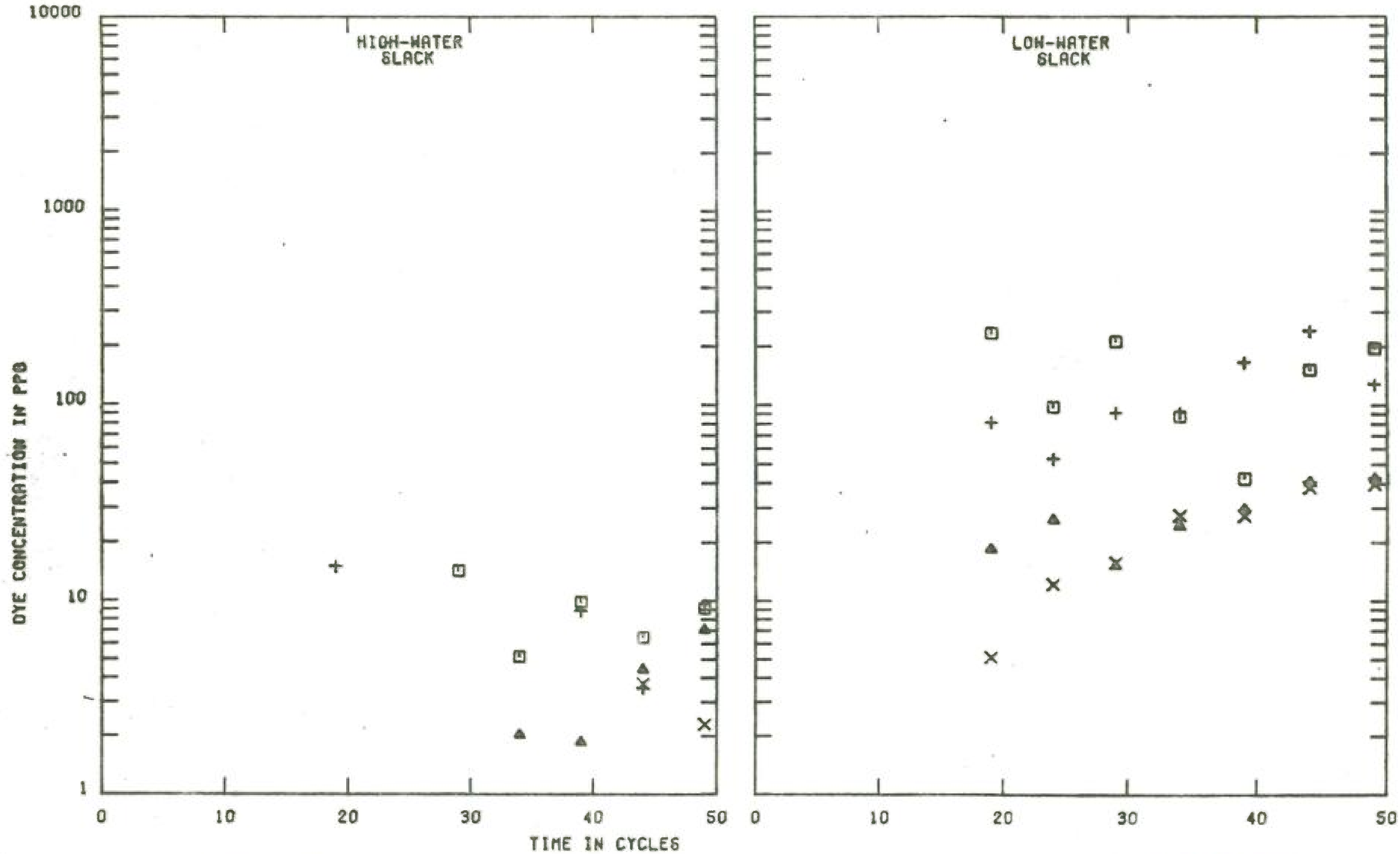
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —---	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 8



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	

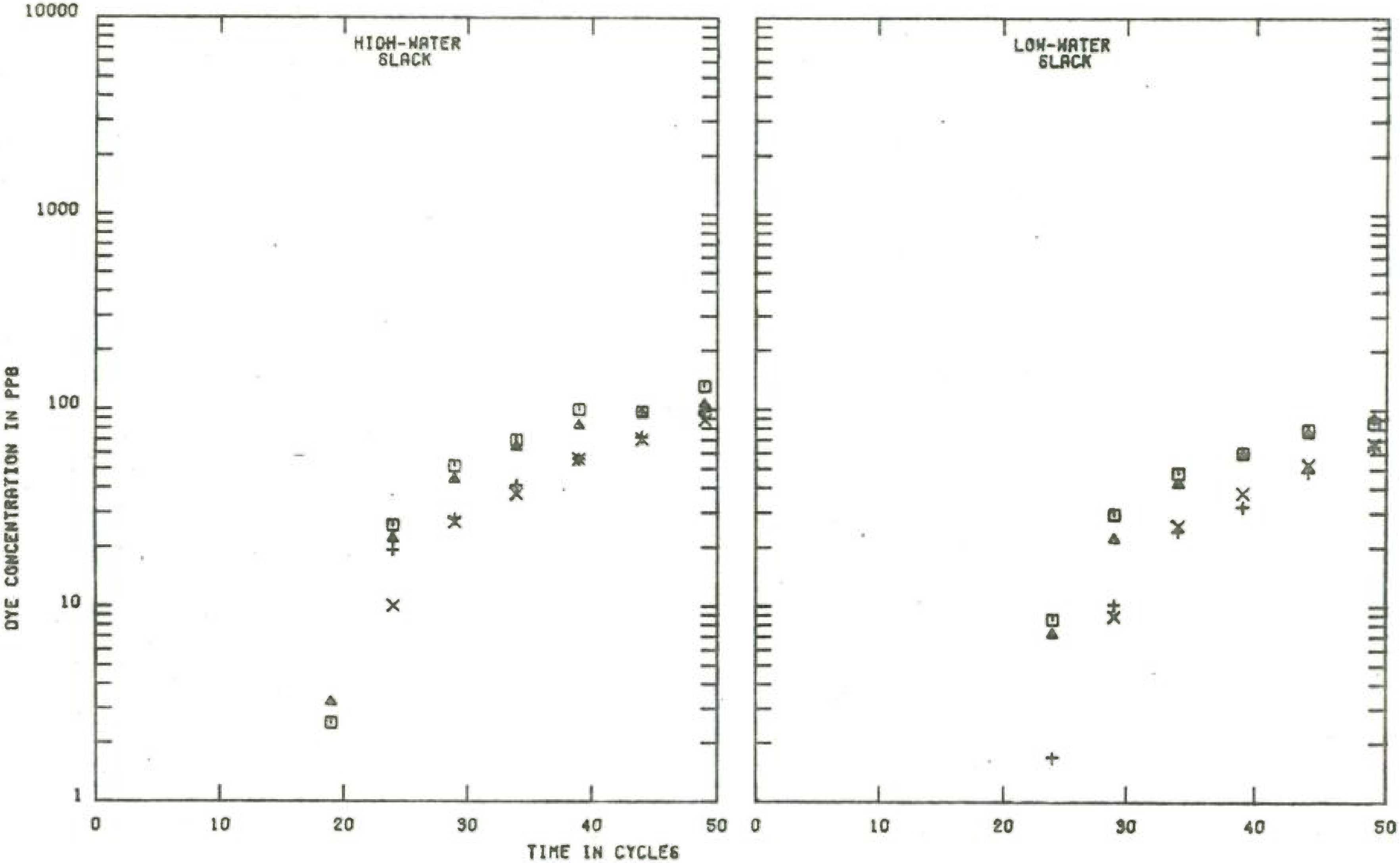
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 9

PLATE 140



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ————	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 10

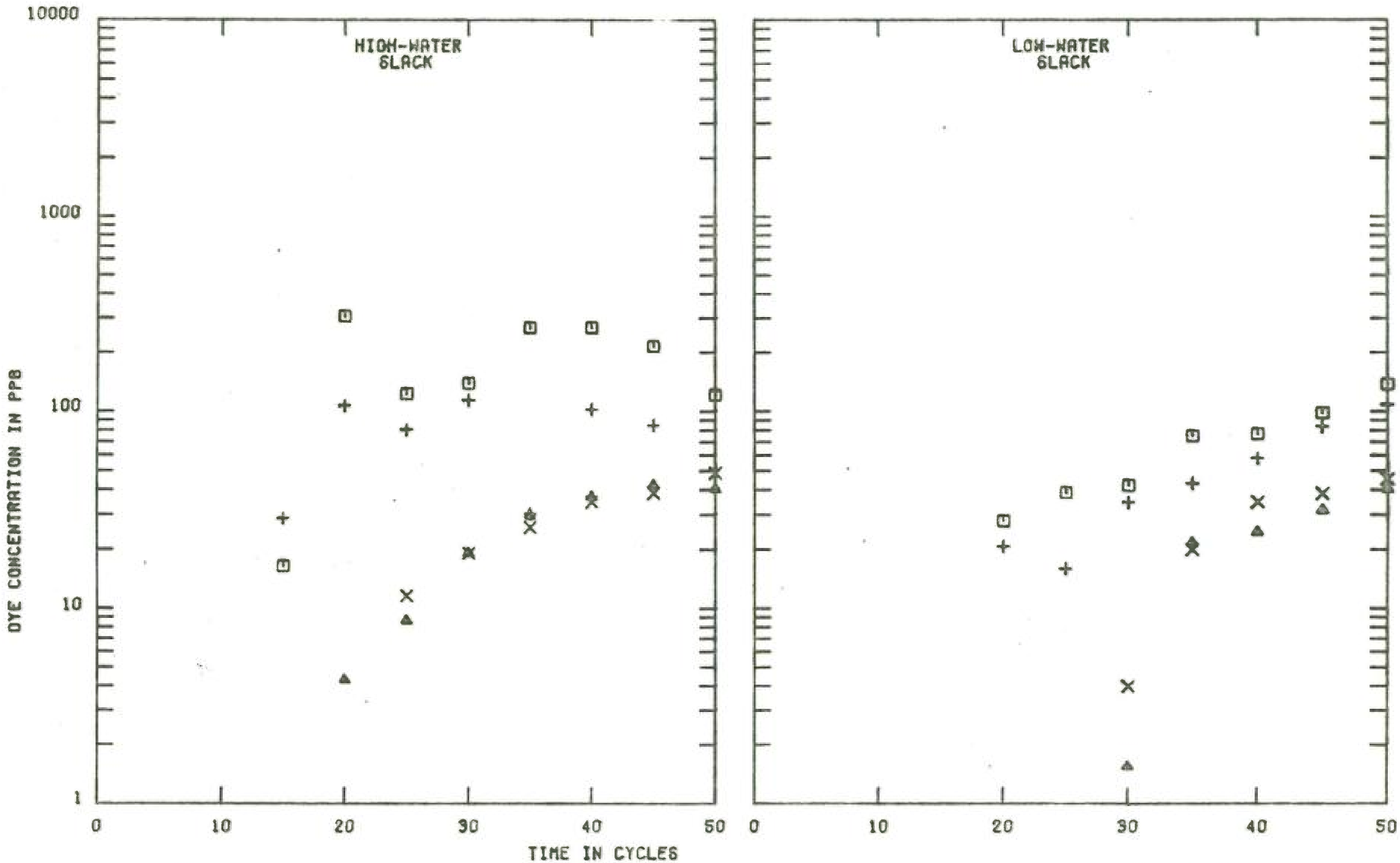


PLATE 141

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

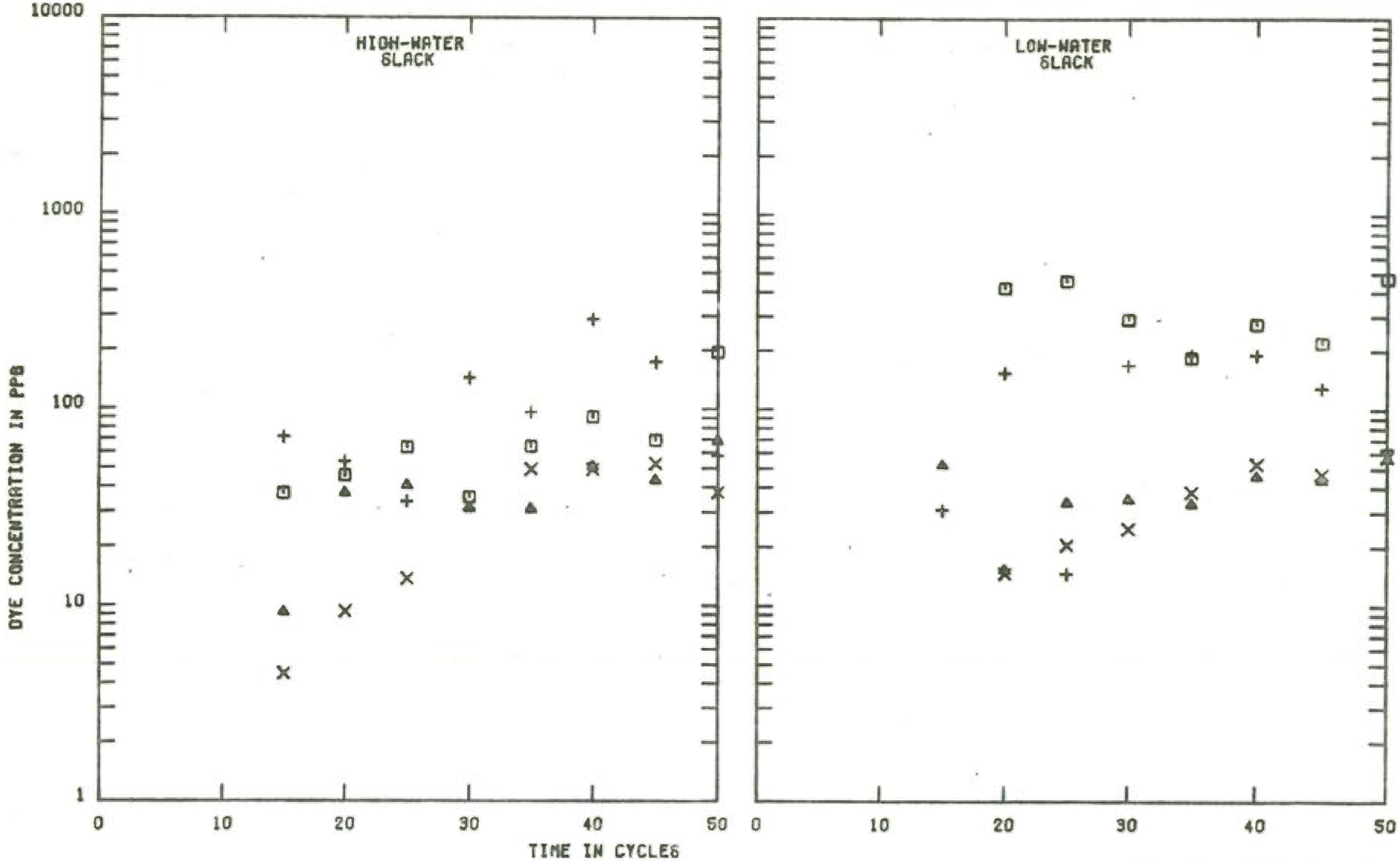
LEGEND

⊡ ——— SURFACE	BASE	
▲ — — — BOTTOM		
+ —-—- SURFACE	PLAN 1	
× —--—- BOTTOM		

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 11



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

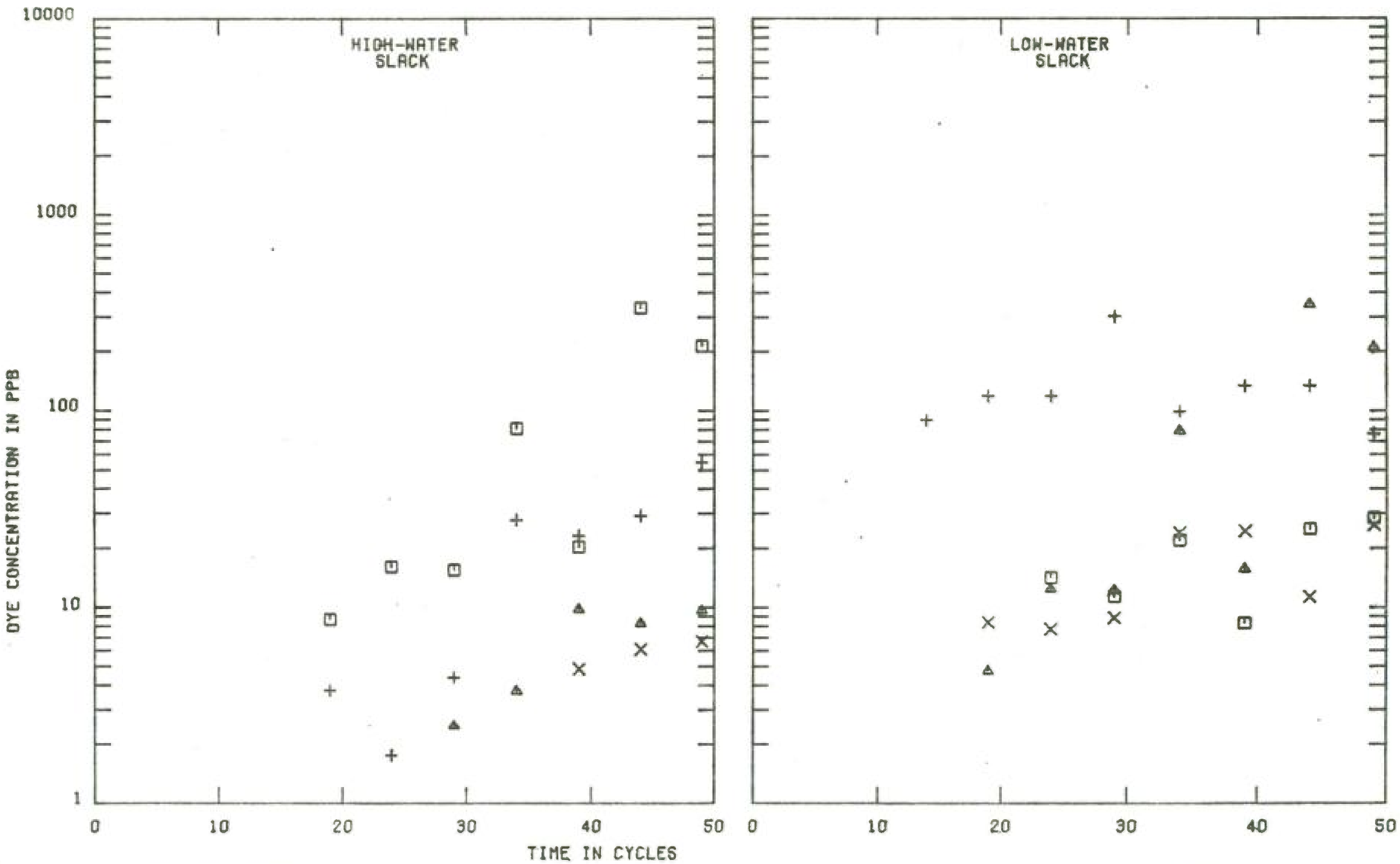
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 12



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

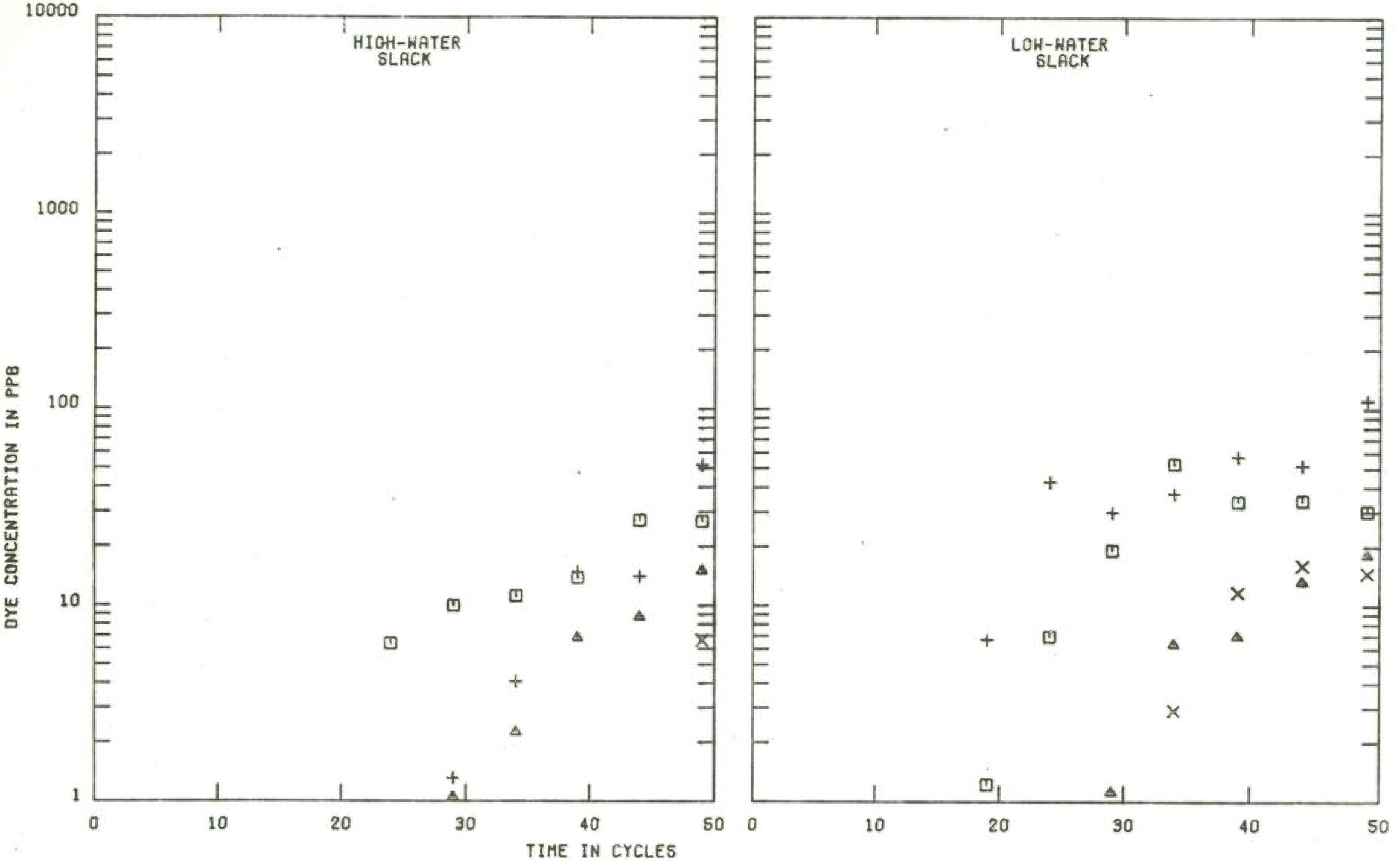
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 14



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

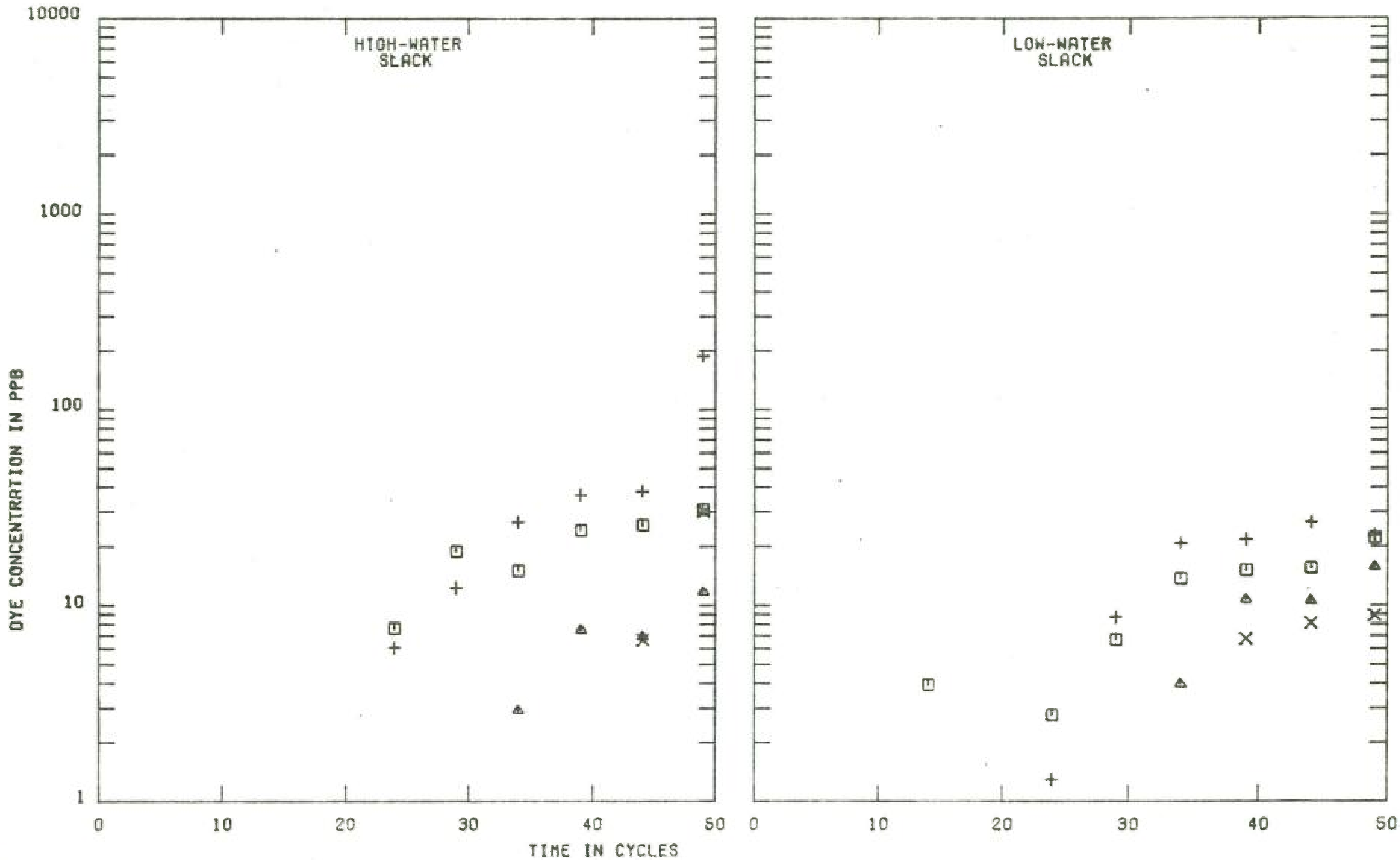
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 16



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

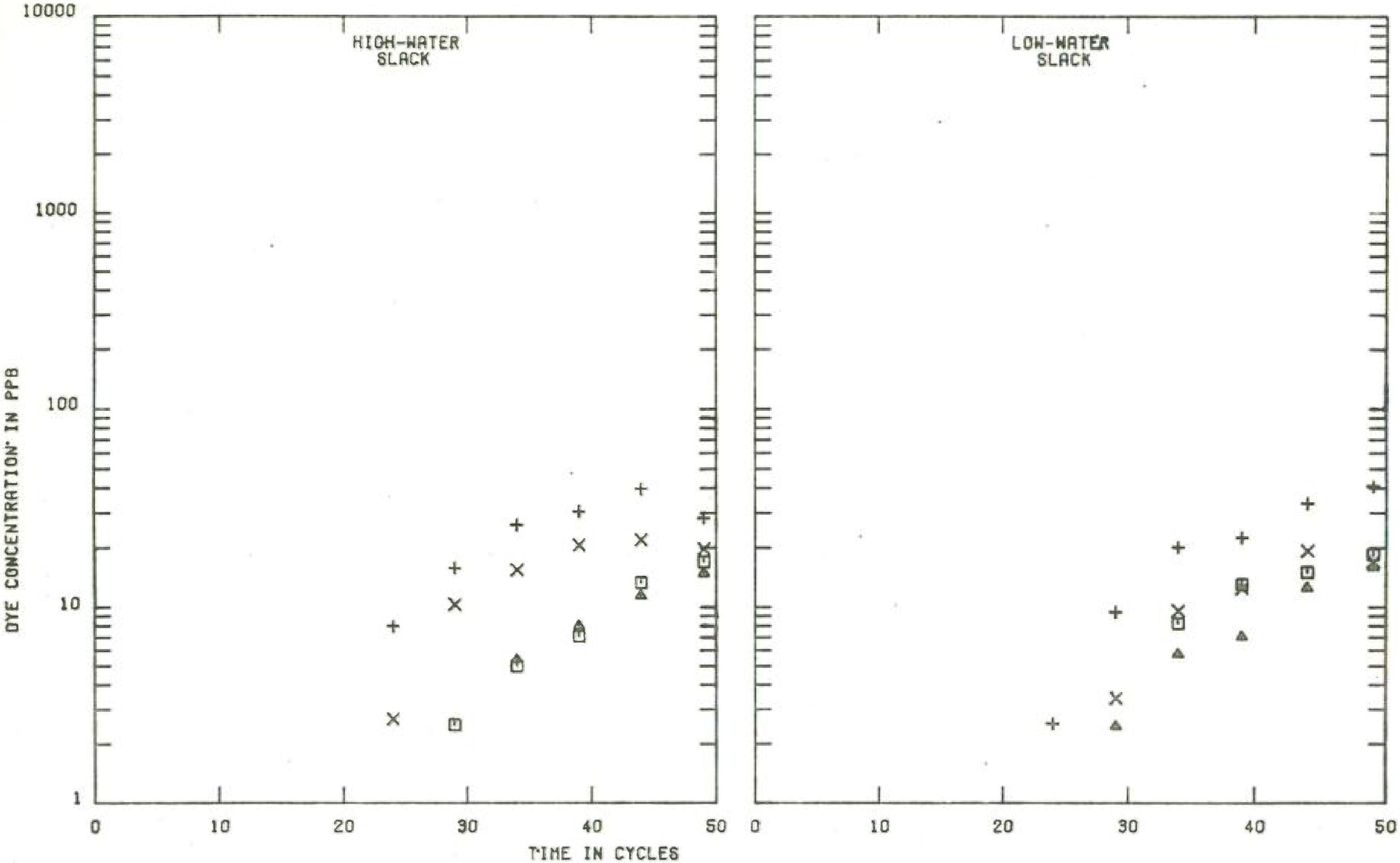
□ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 17

PLATE 146



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

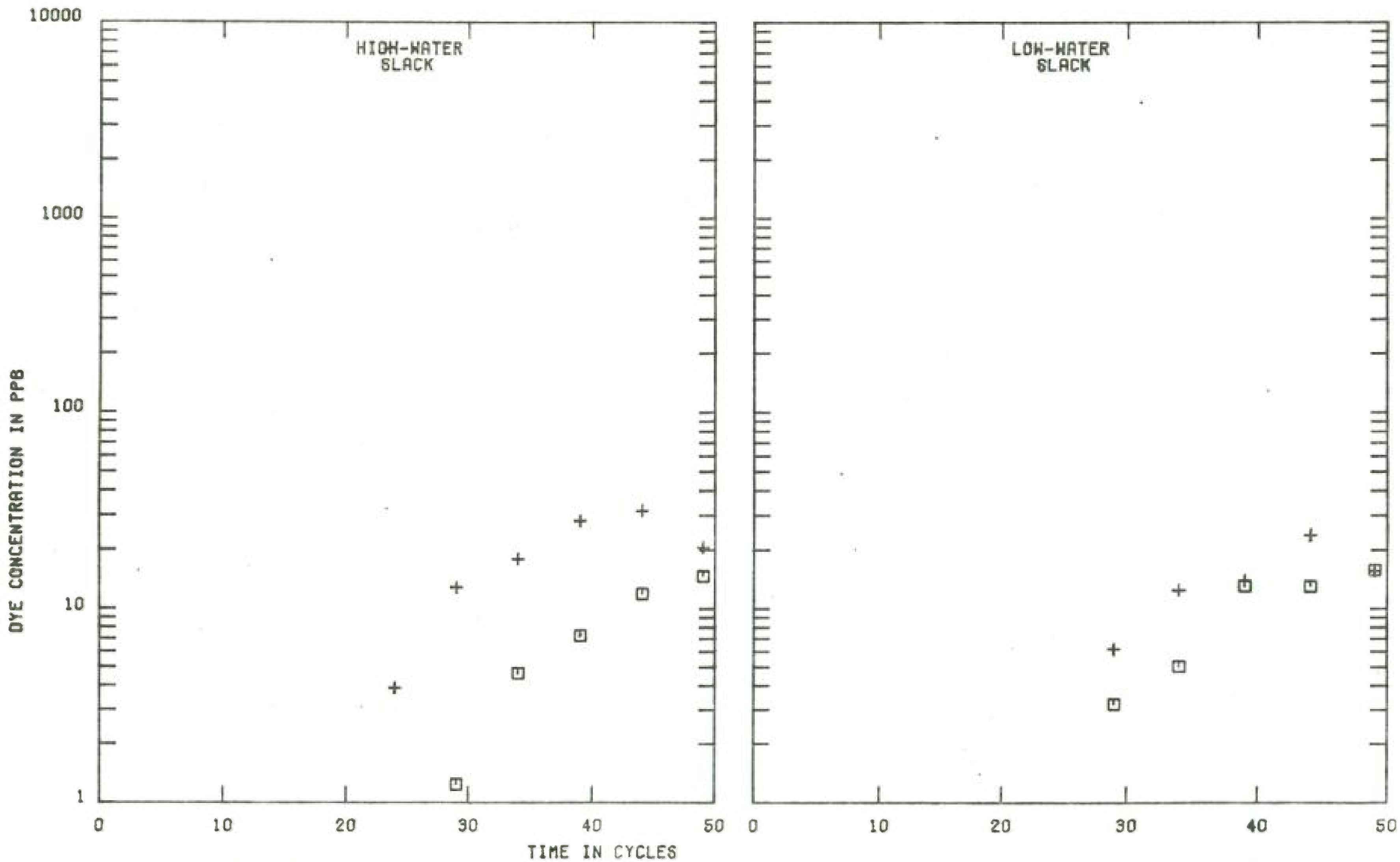
LEGEND

⊡ ——— SURFACE — BASE
▲ — — — BOTTOM — BASE
+ —·—·— SURFACE — PLAN 1
× —·-·— BOTTOM — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 21



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

⊡ ——— BASE
+ — — — PLAN 1

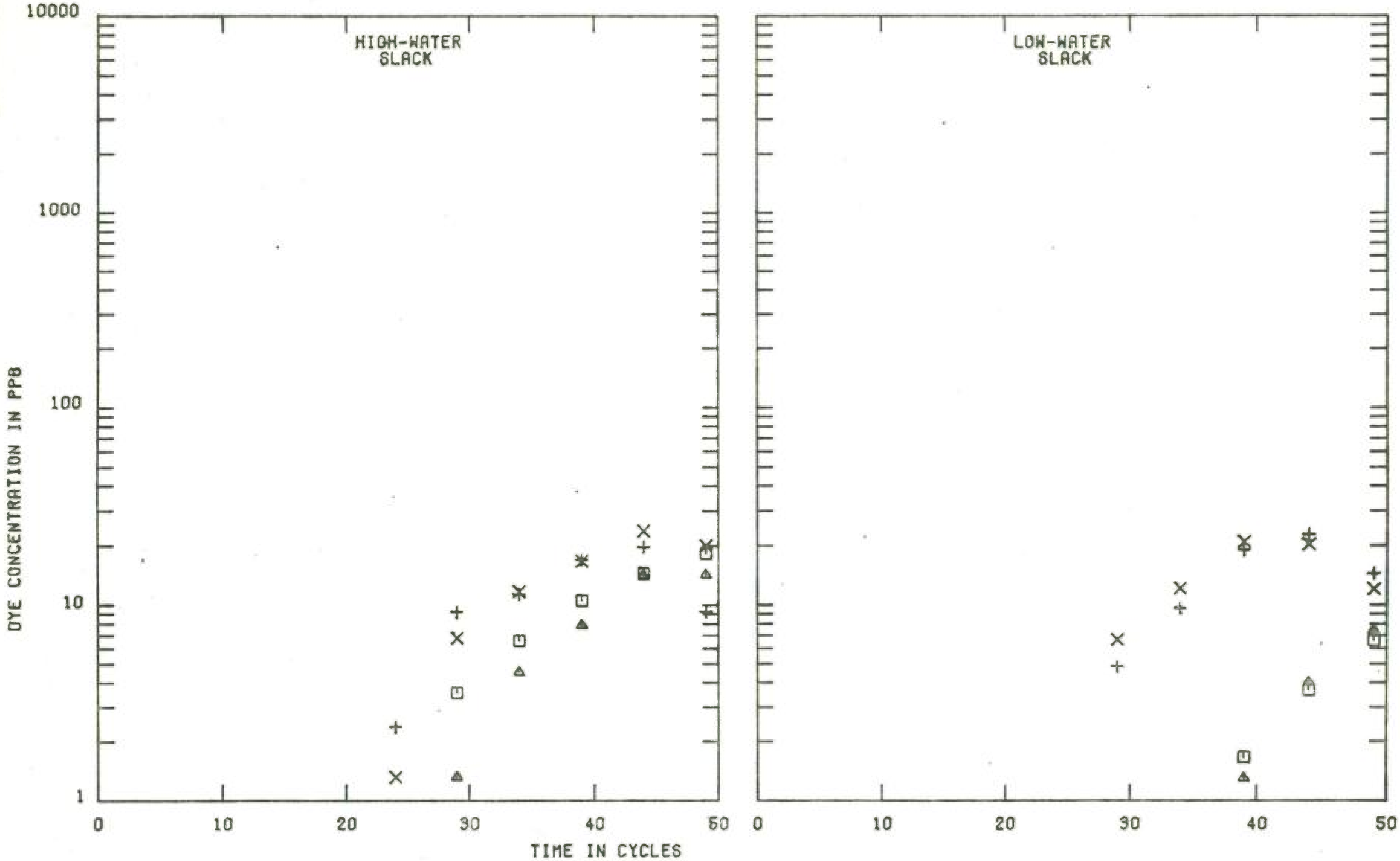
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 22 MID-DEPTH

PLATE 148



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

- ⊡ ——— SURFACE — BASE
- △ — — — BOTTOM — BASE
- + —·—·— SURFACE — PLAN 1
- × —·-·— BOTTOM — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 24

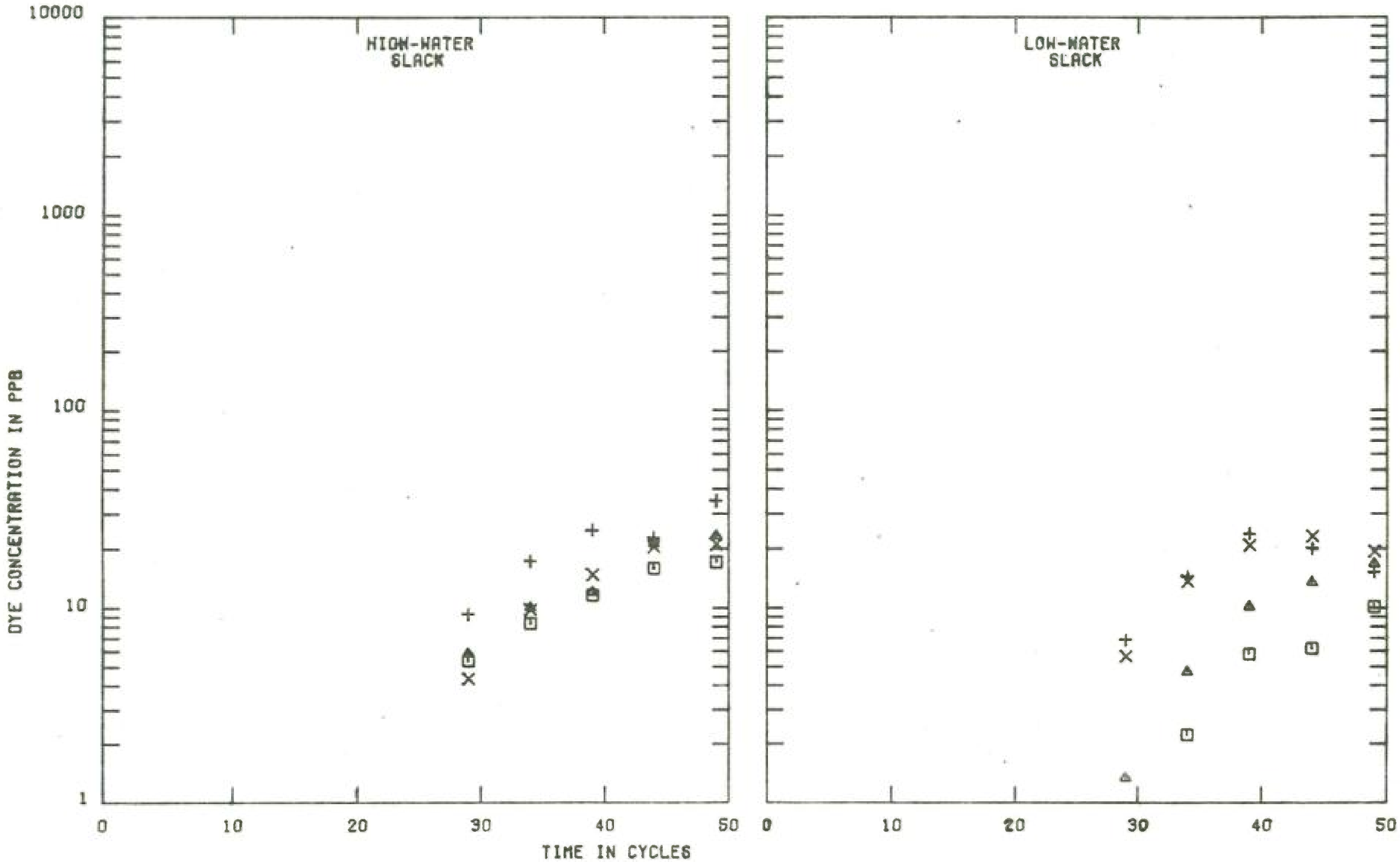


PLATE 149

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

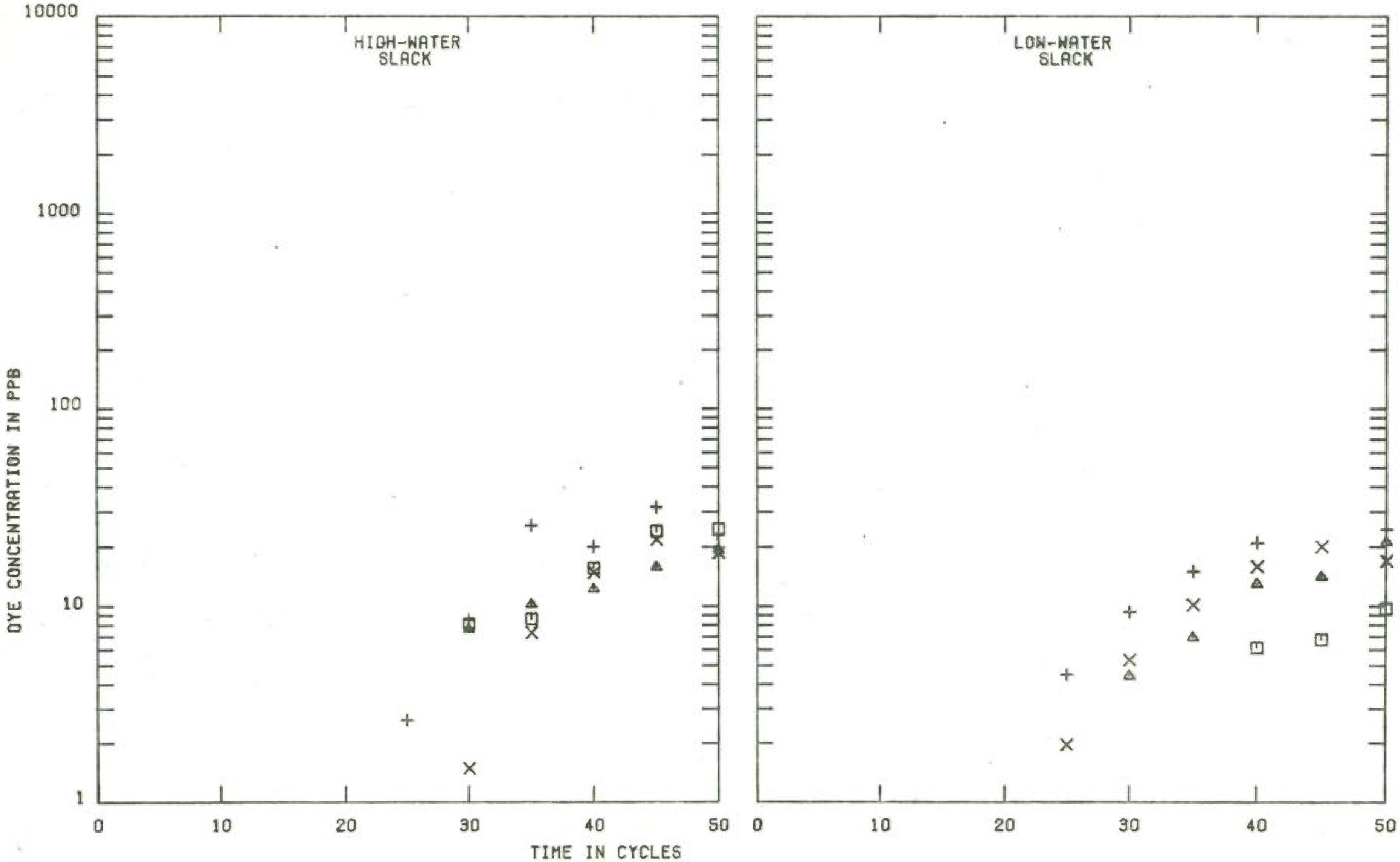
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 26



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

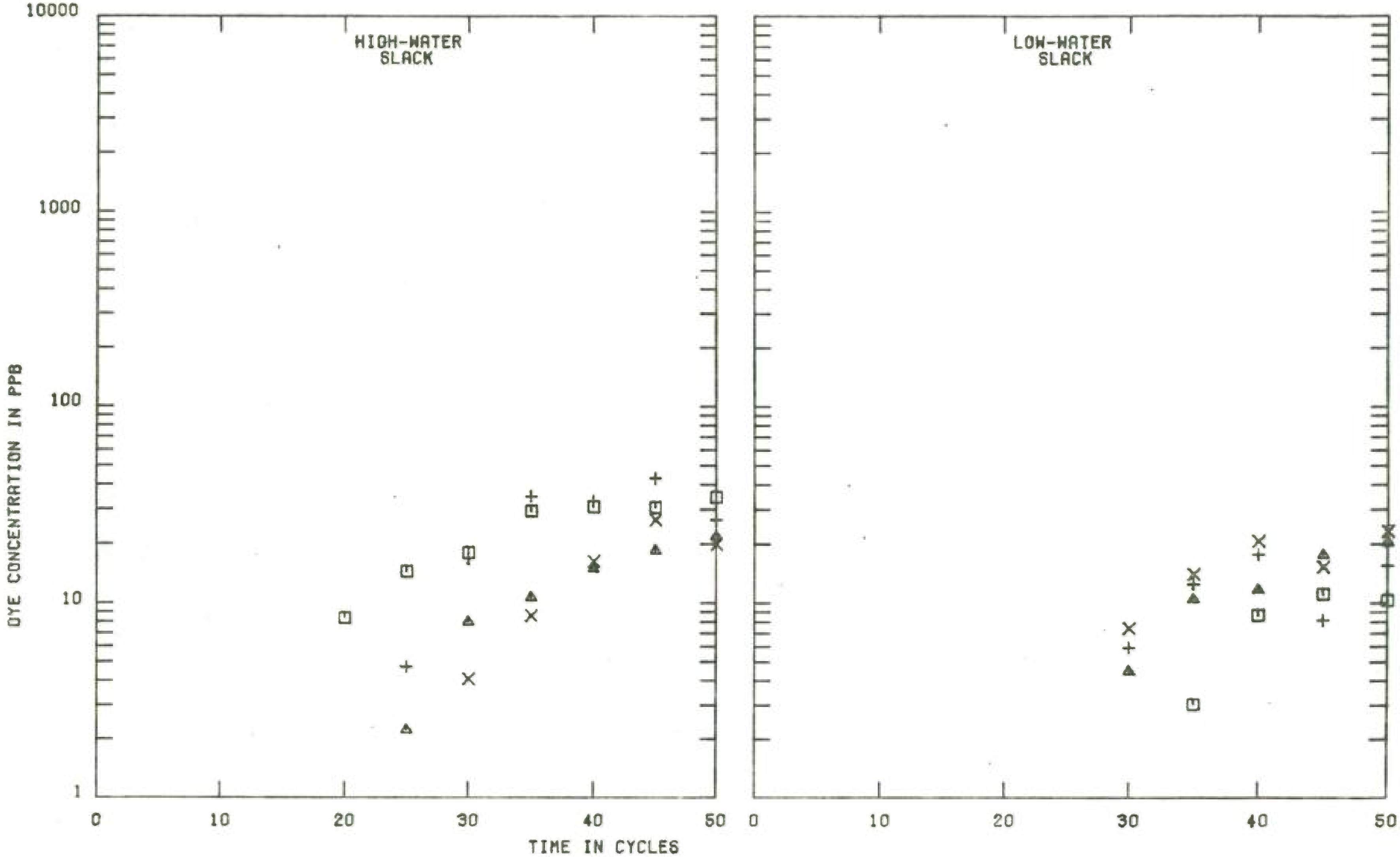
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 27



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

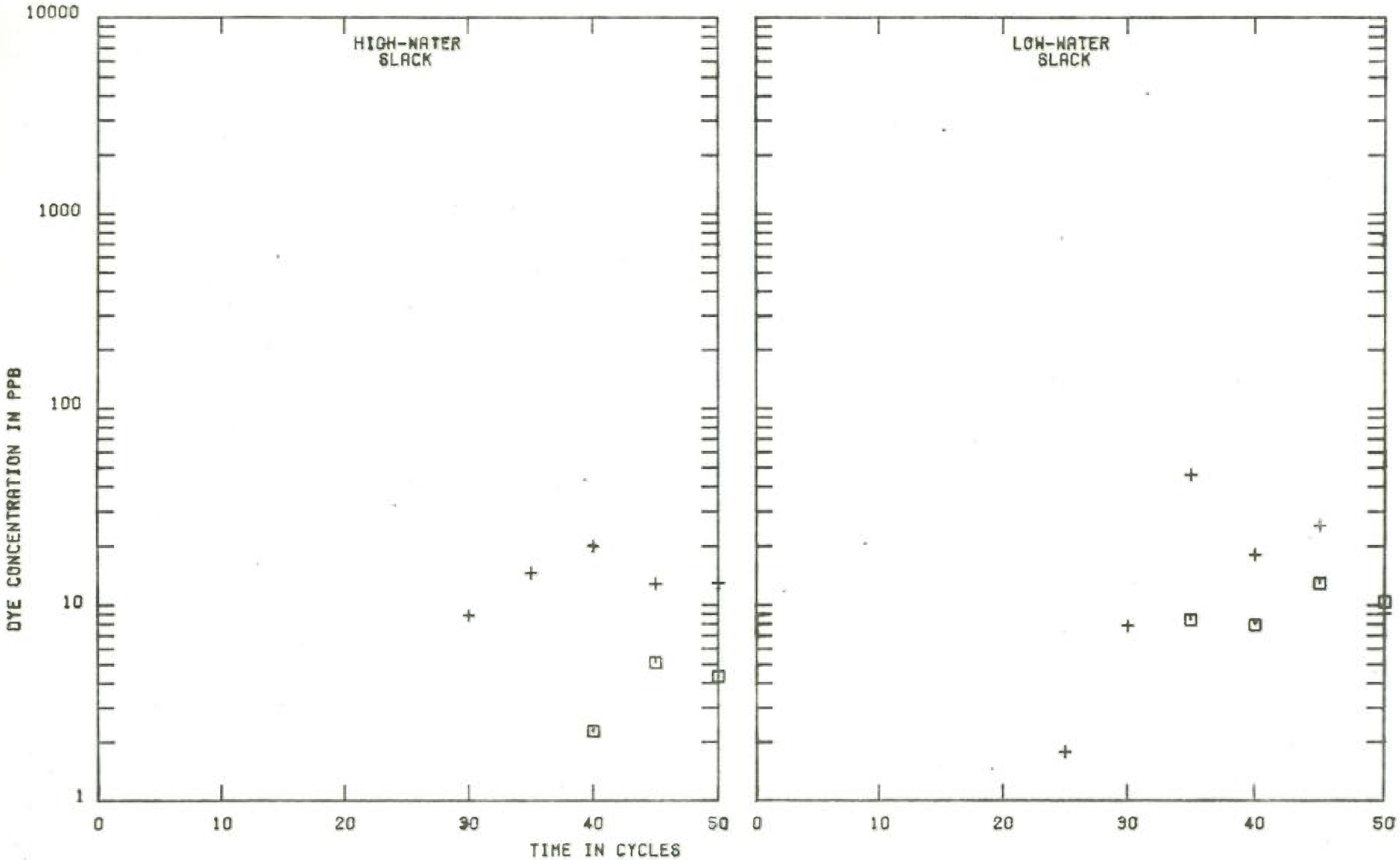
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
X —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 28

PLATE 152



TEST CONDITIONS	
TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

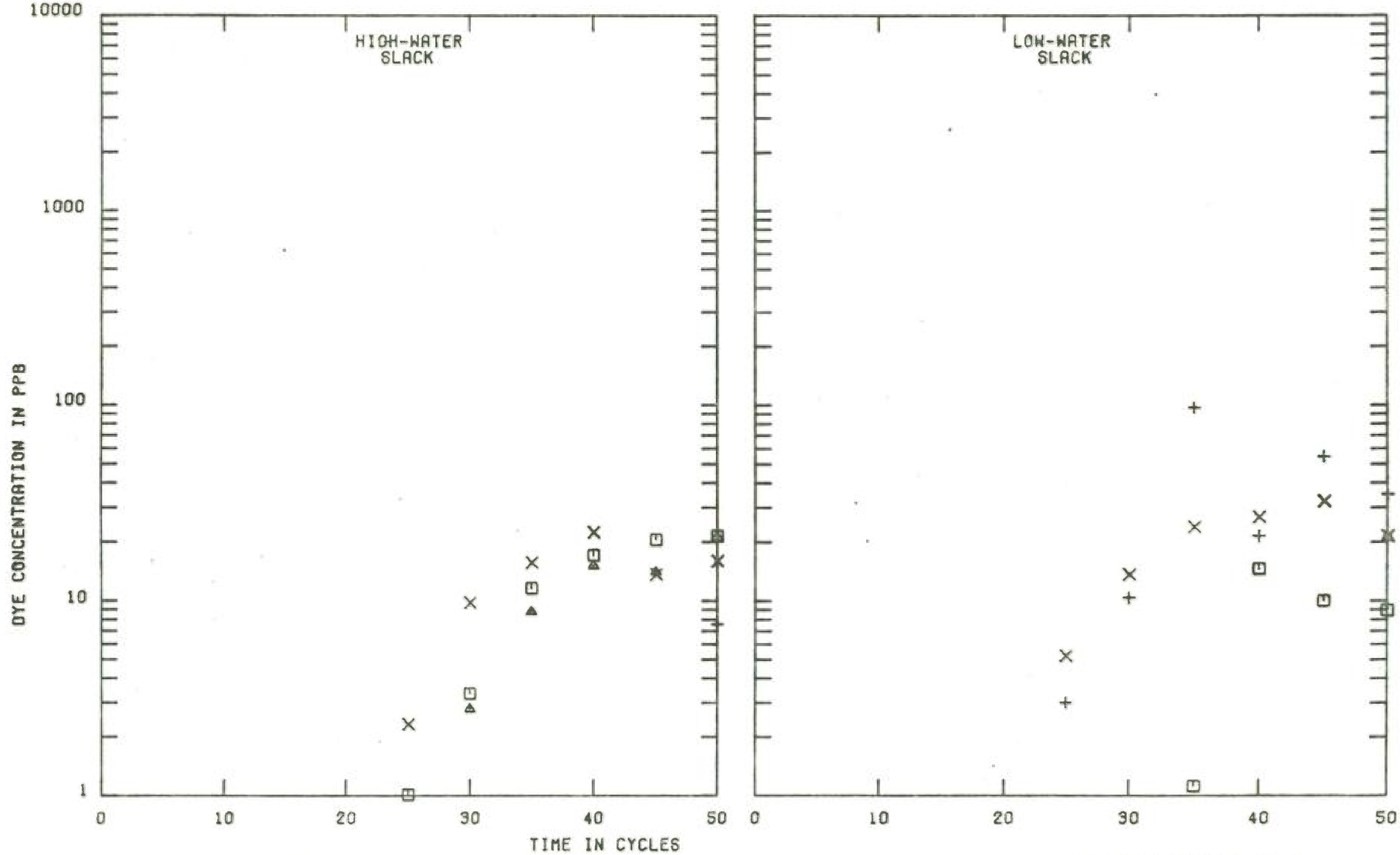
LEGEND
⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 32 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

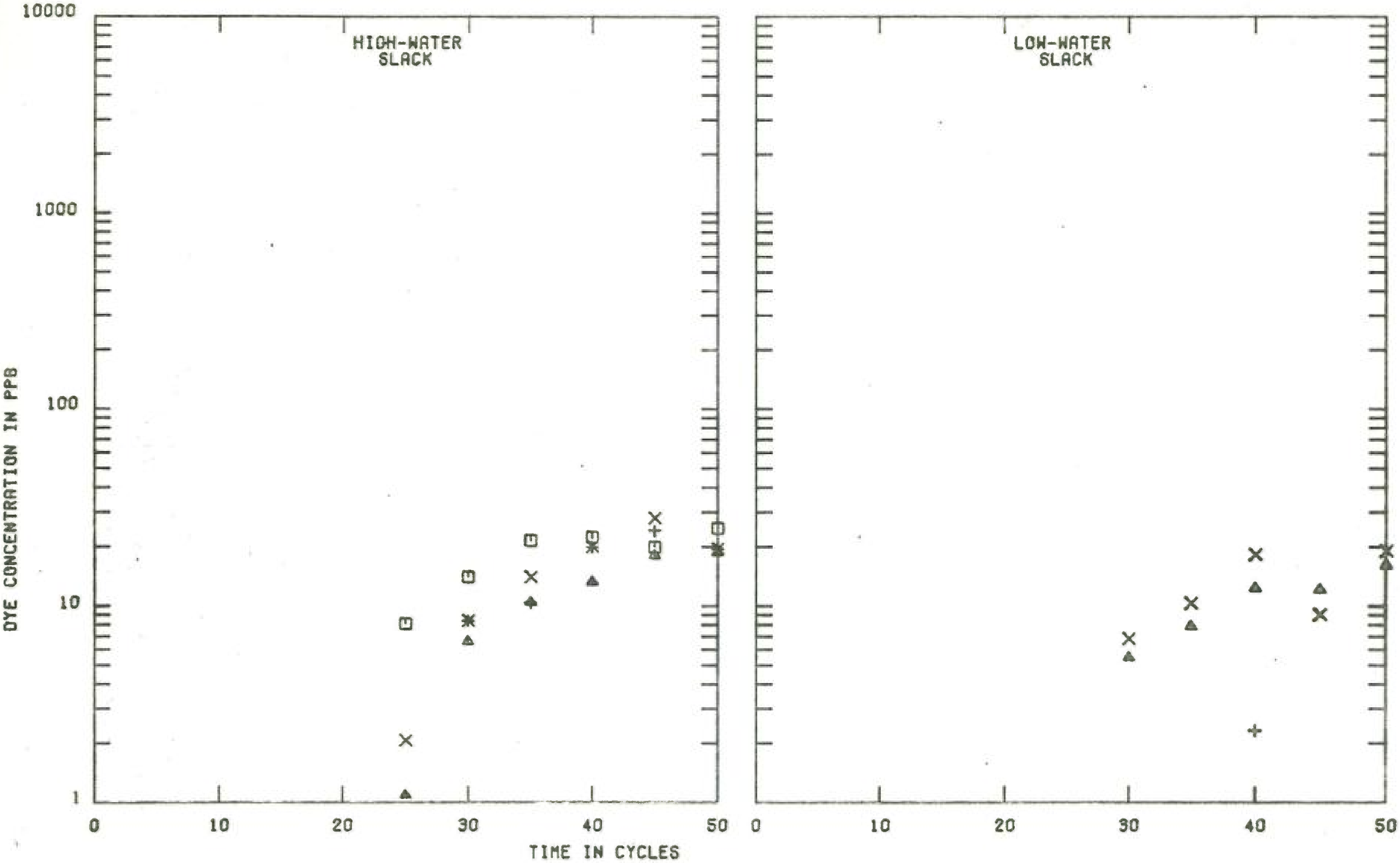
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
× —--—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 33

PLATE 153



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

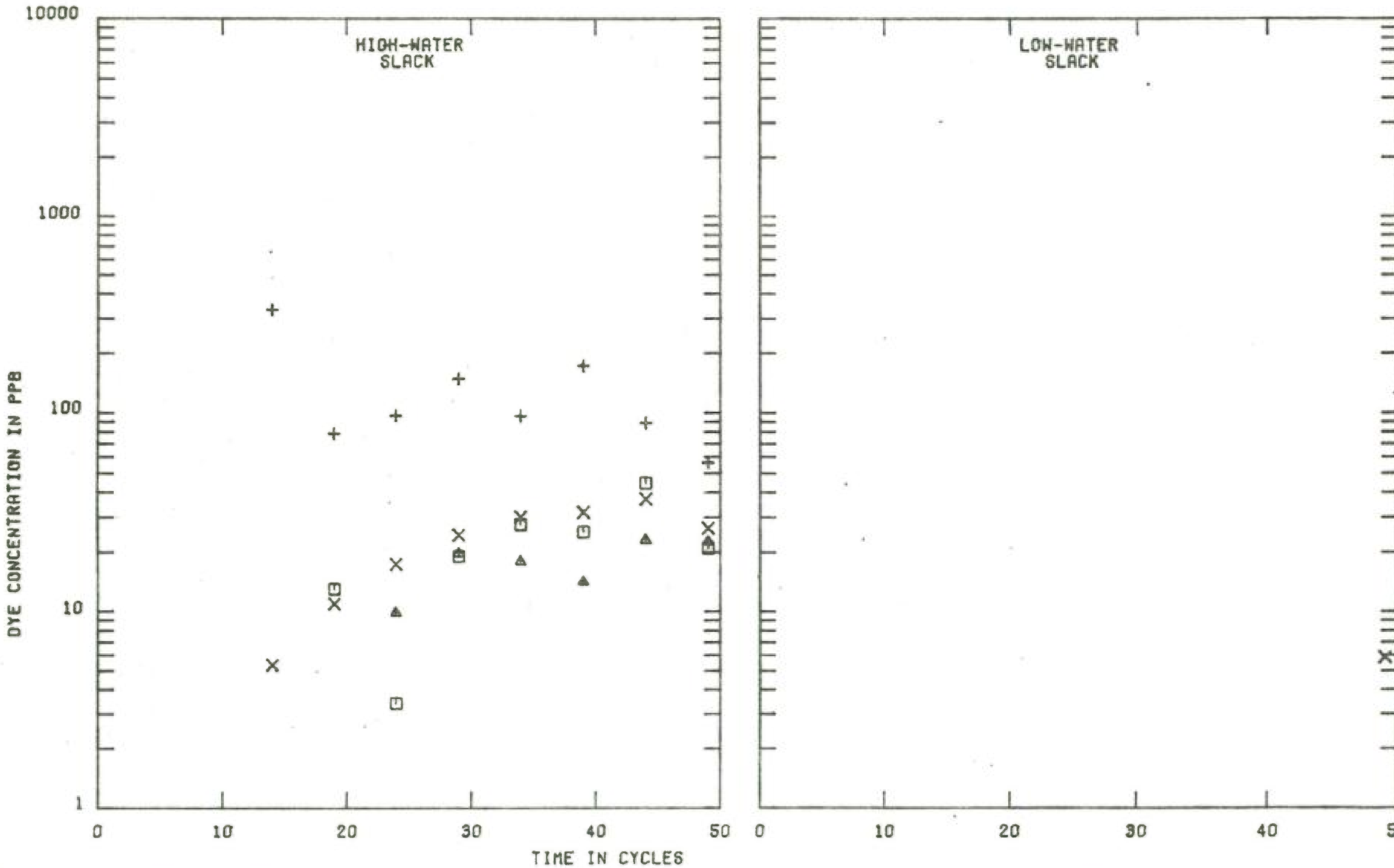
LEGEND

⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 34



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

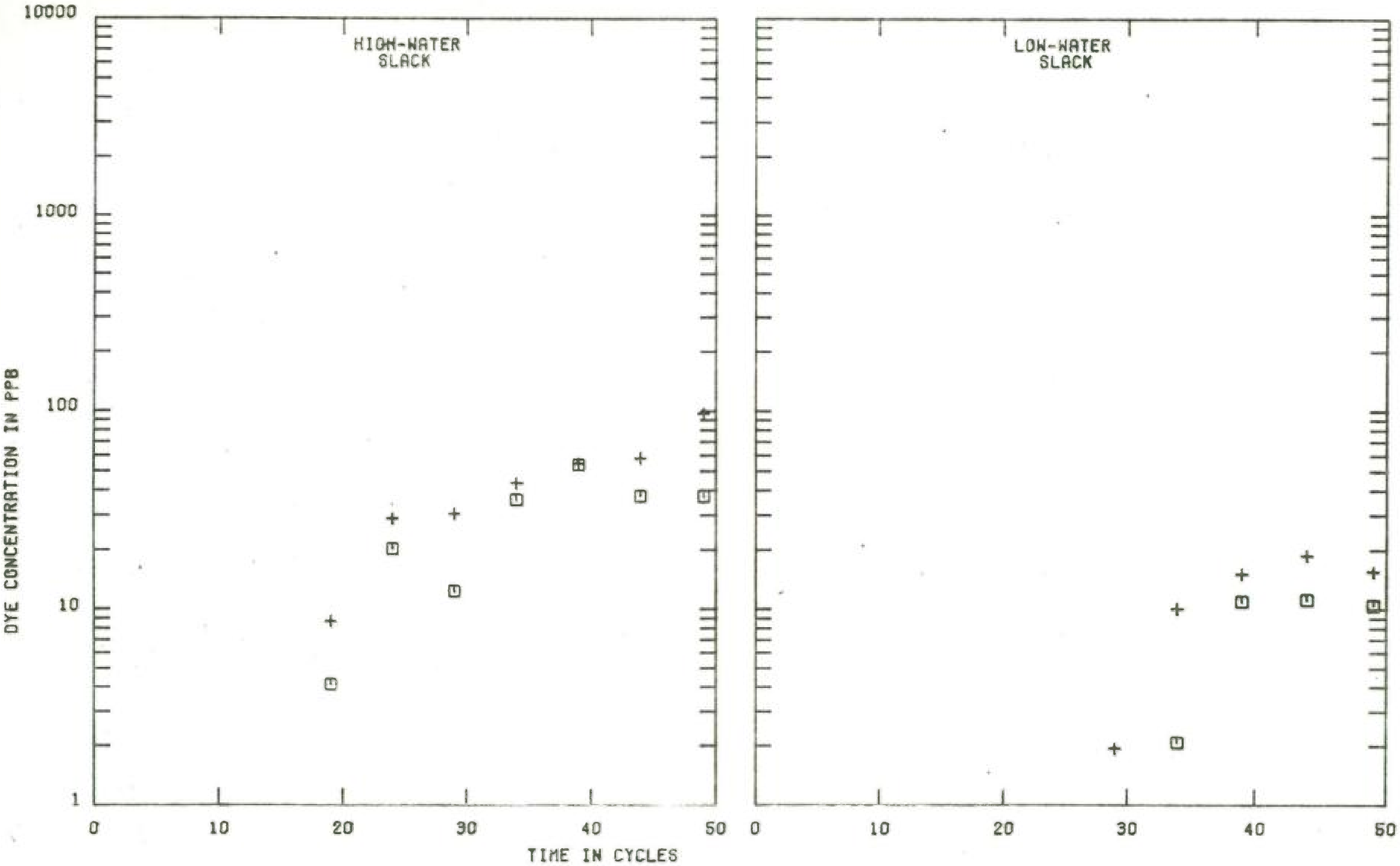
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
X —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 36



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

□ ——— BASE
\+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 39 MID-DEPTH

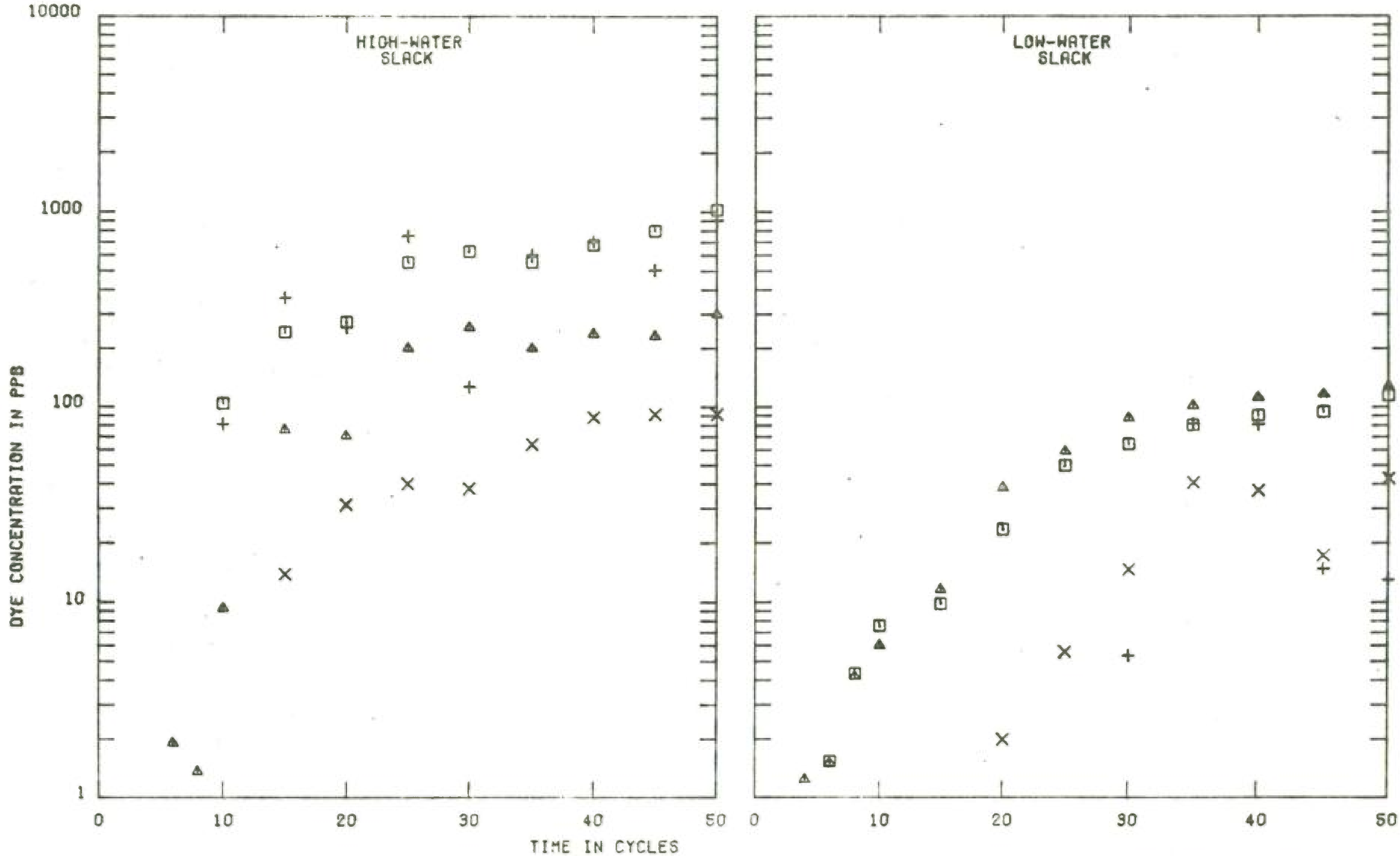


PLATE 157

TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

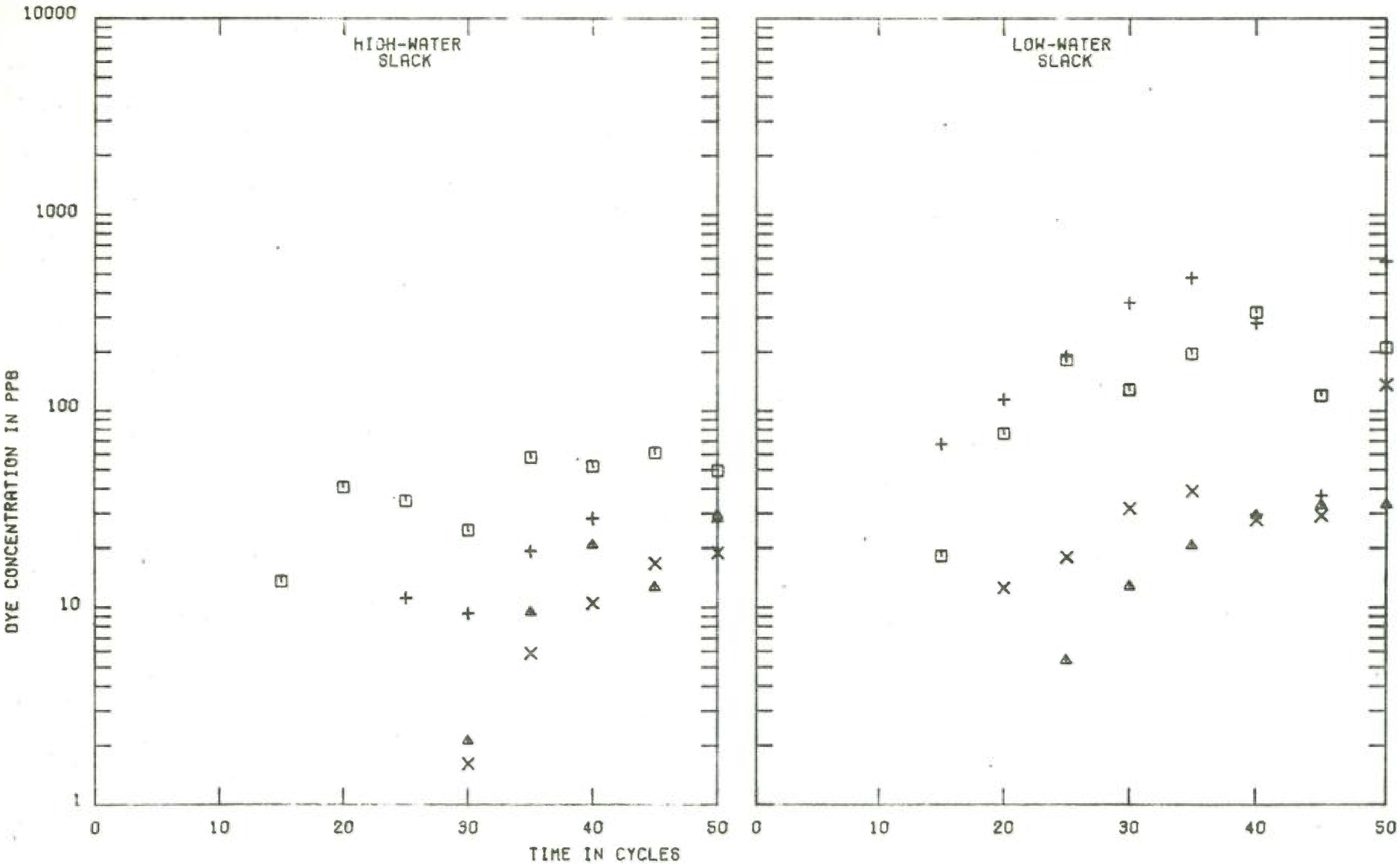
⊡ ————	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY- OUTFALL RELEASE

STATION 40



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

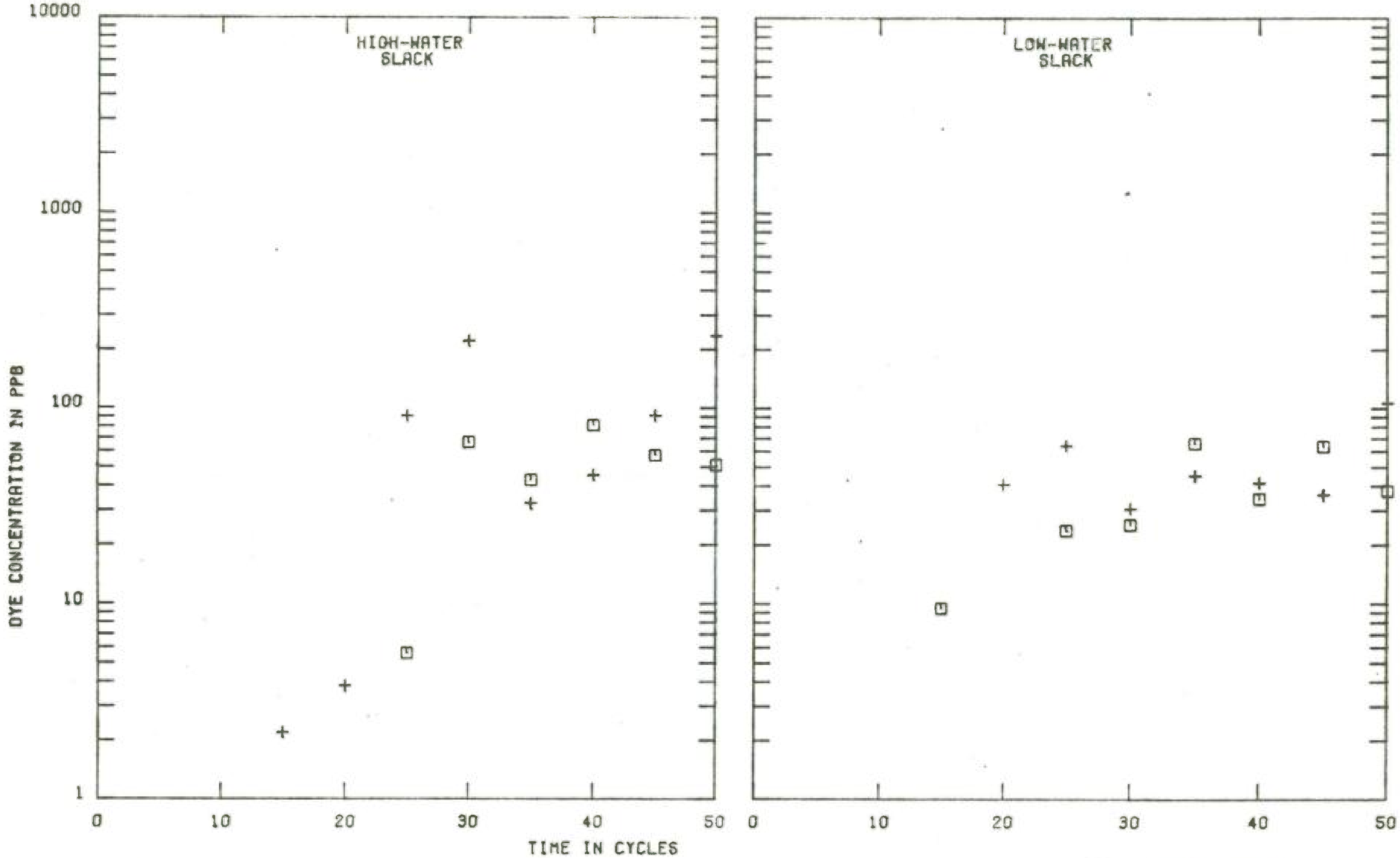
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 42



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ——— BASE
+ — — — PLAN 1

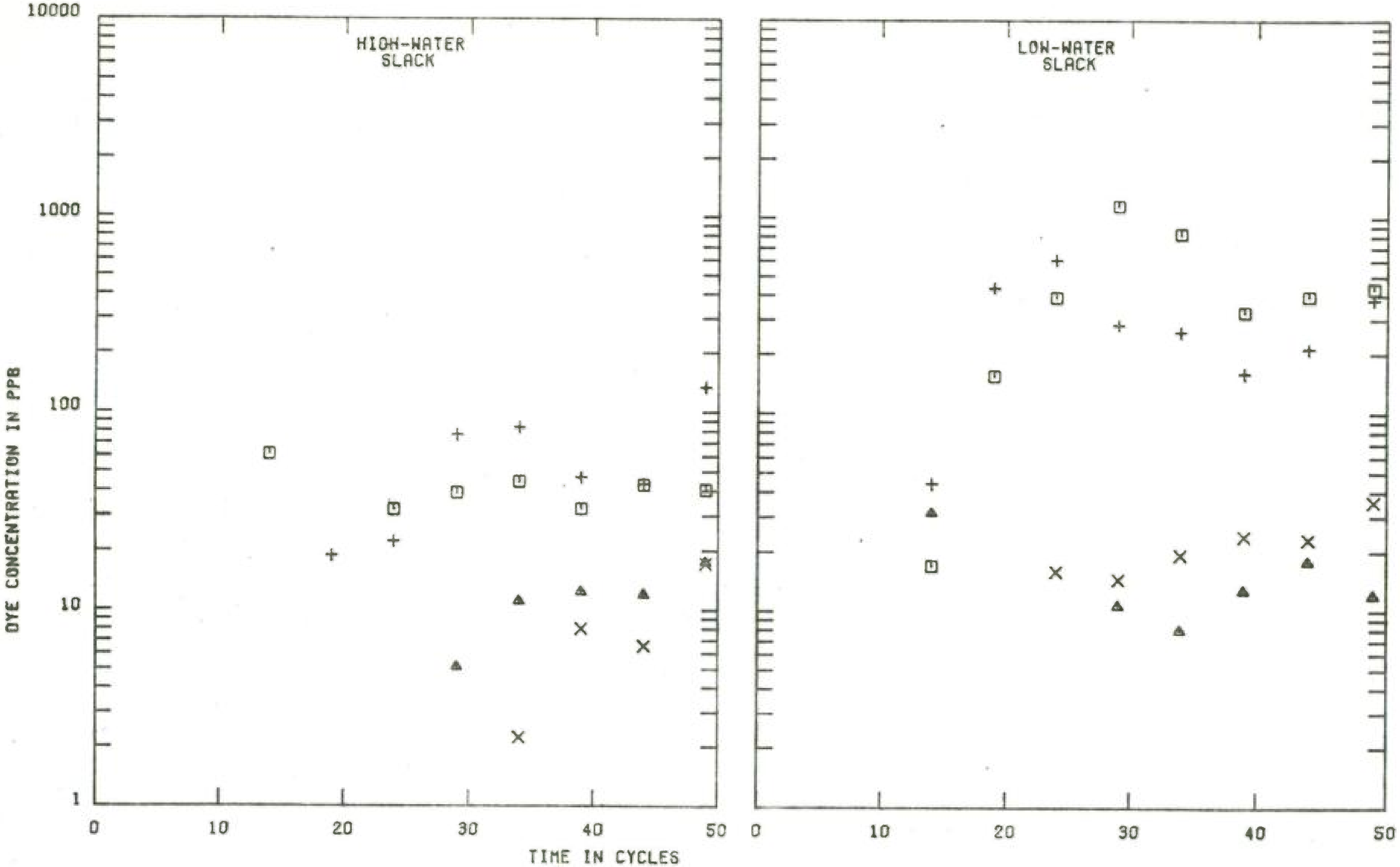
NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 43 MID-DEPTH

PLATE 160



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

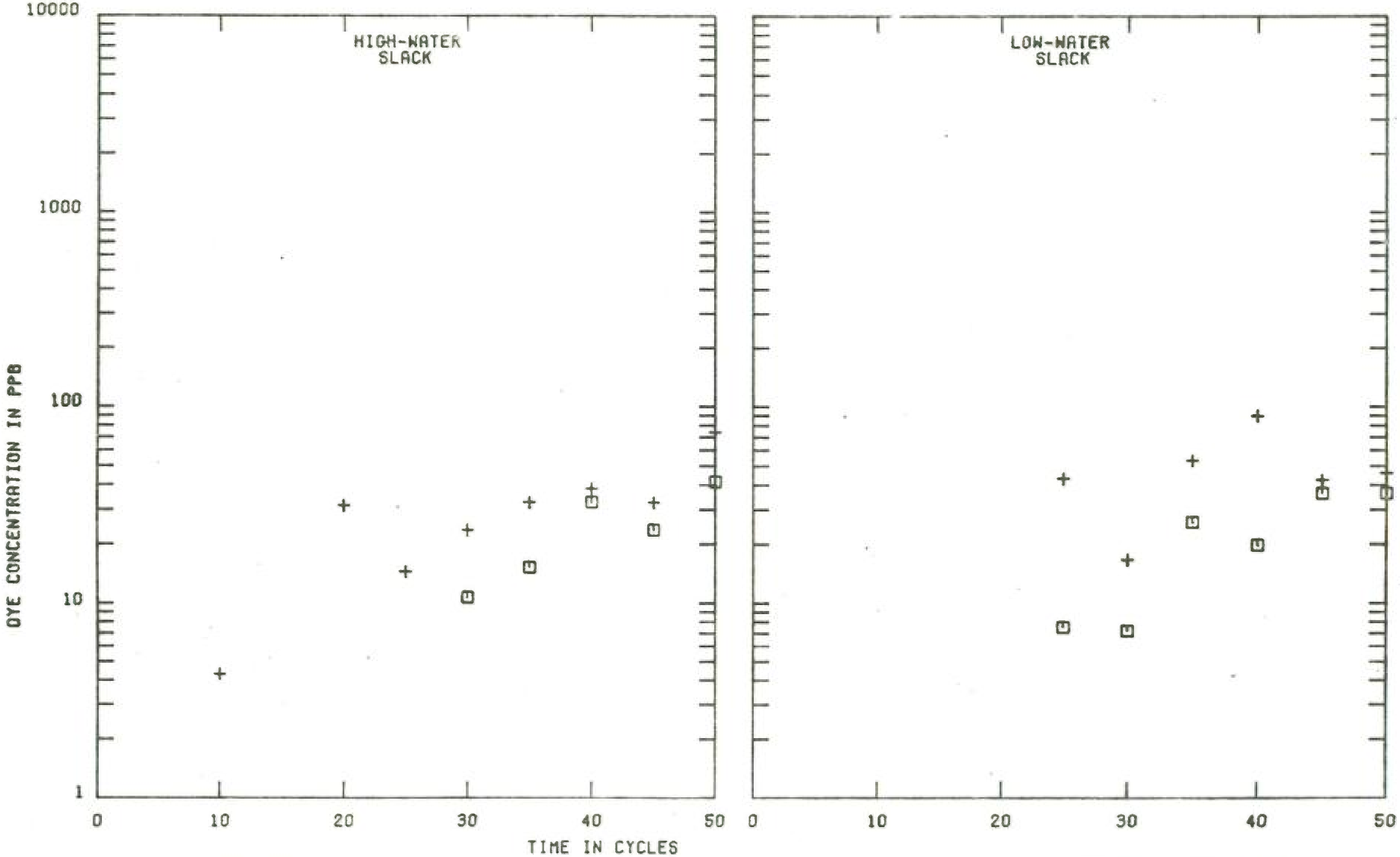
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —··—··	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 44



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

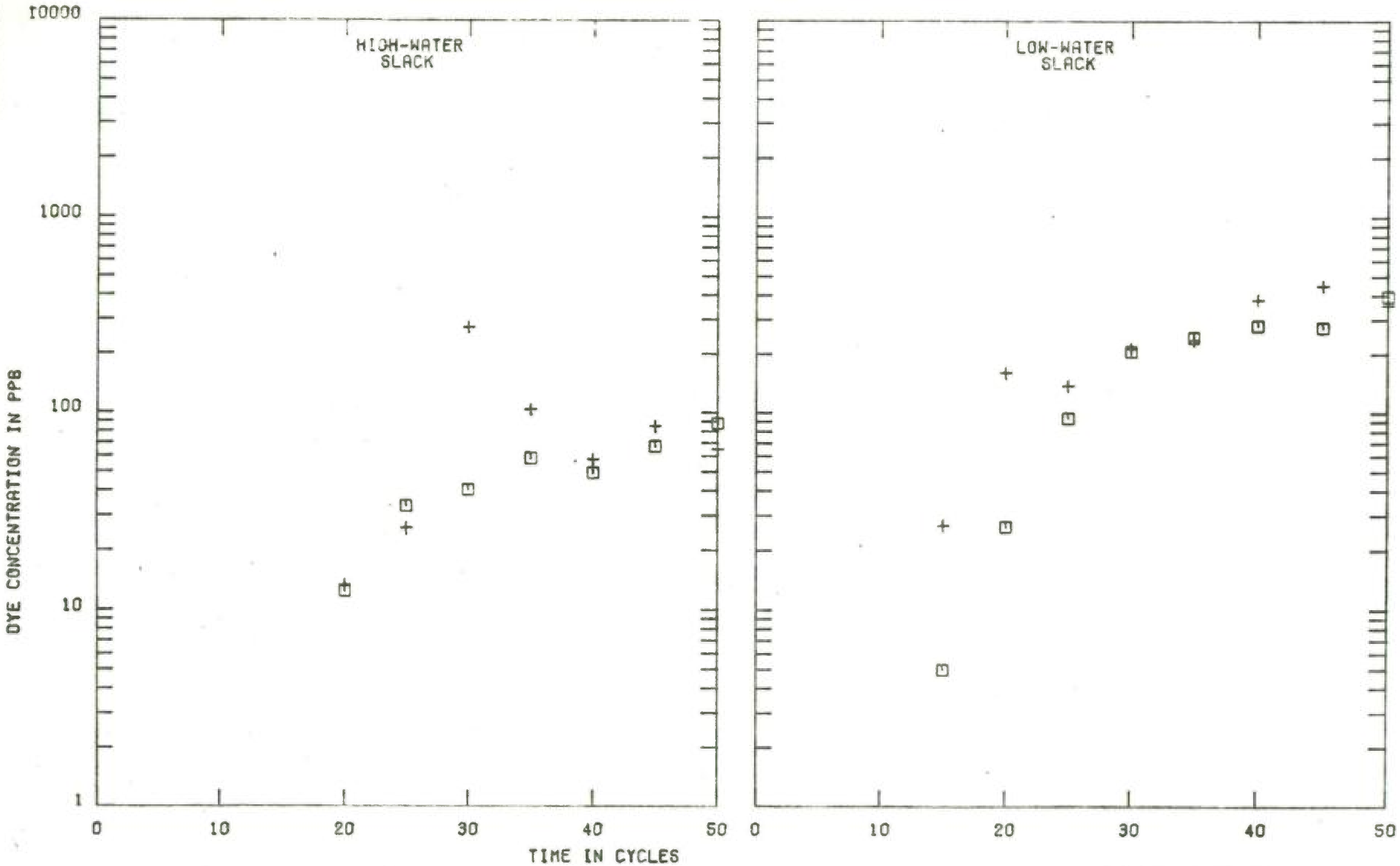
LEGEND

⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 45 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

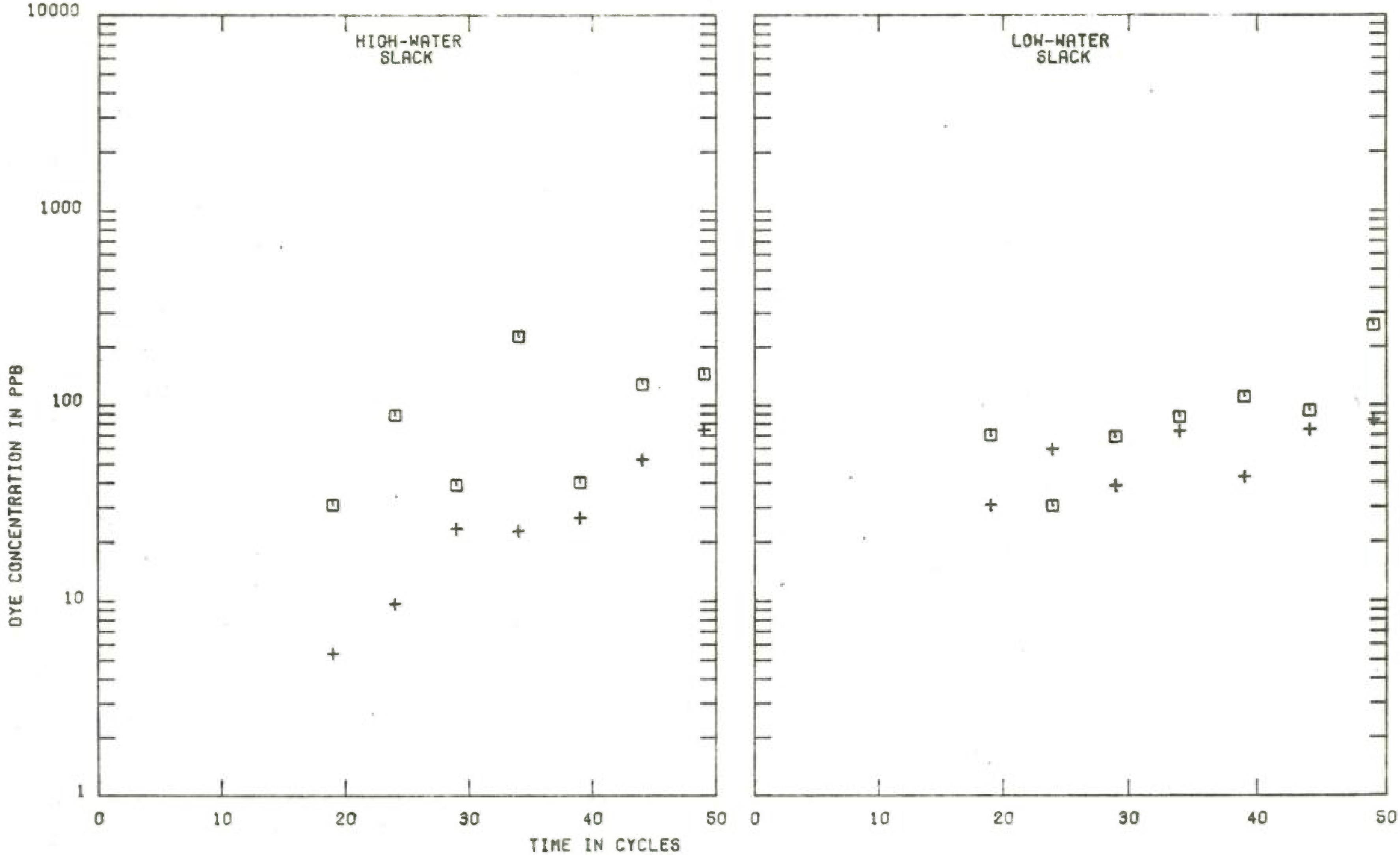
⊡ ——— BASE
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 46 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

□ ——— BASE

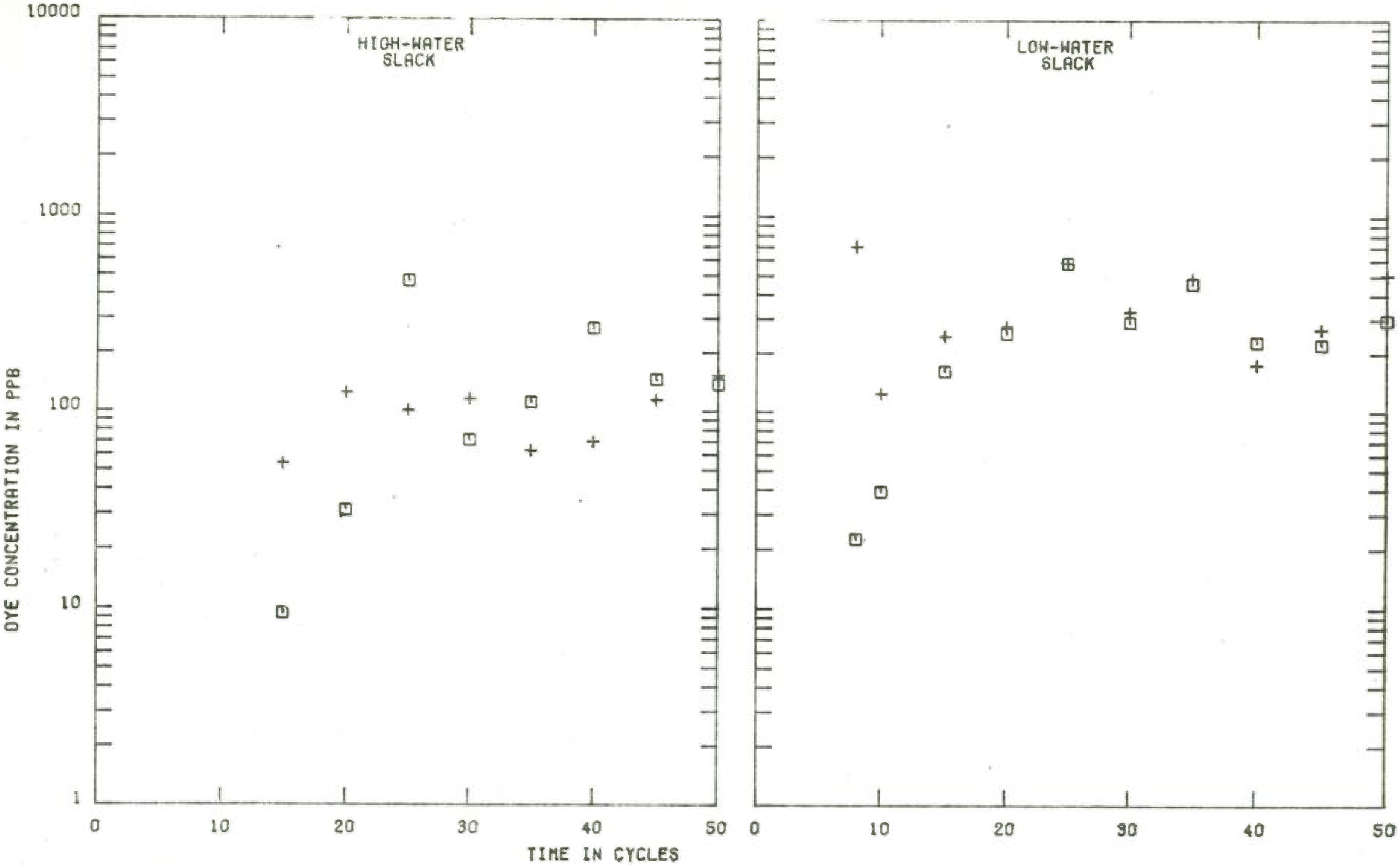
+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 47 MID-DEPTH

PLATE 164



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

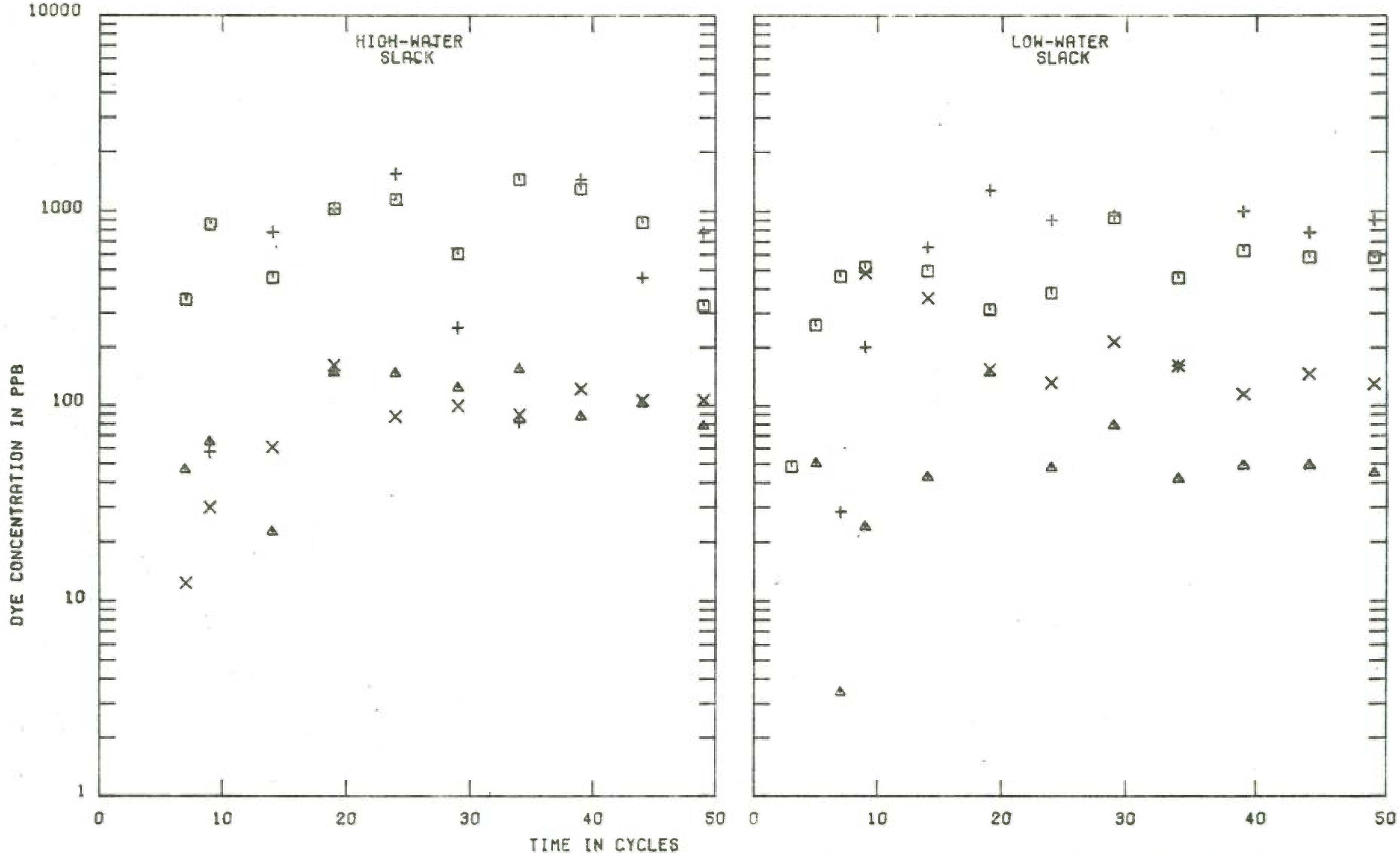
⊡ ——— BASE
\+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1 ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 48 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

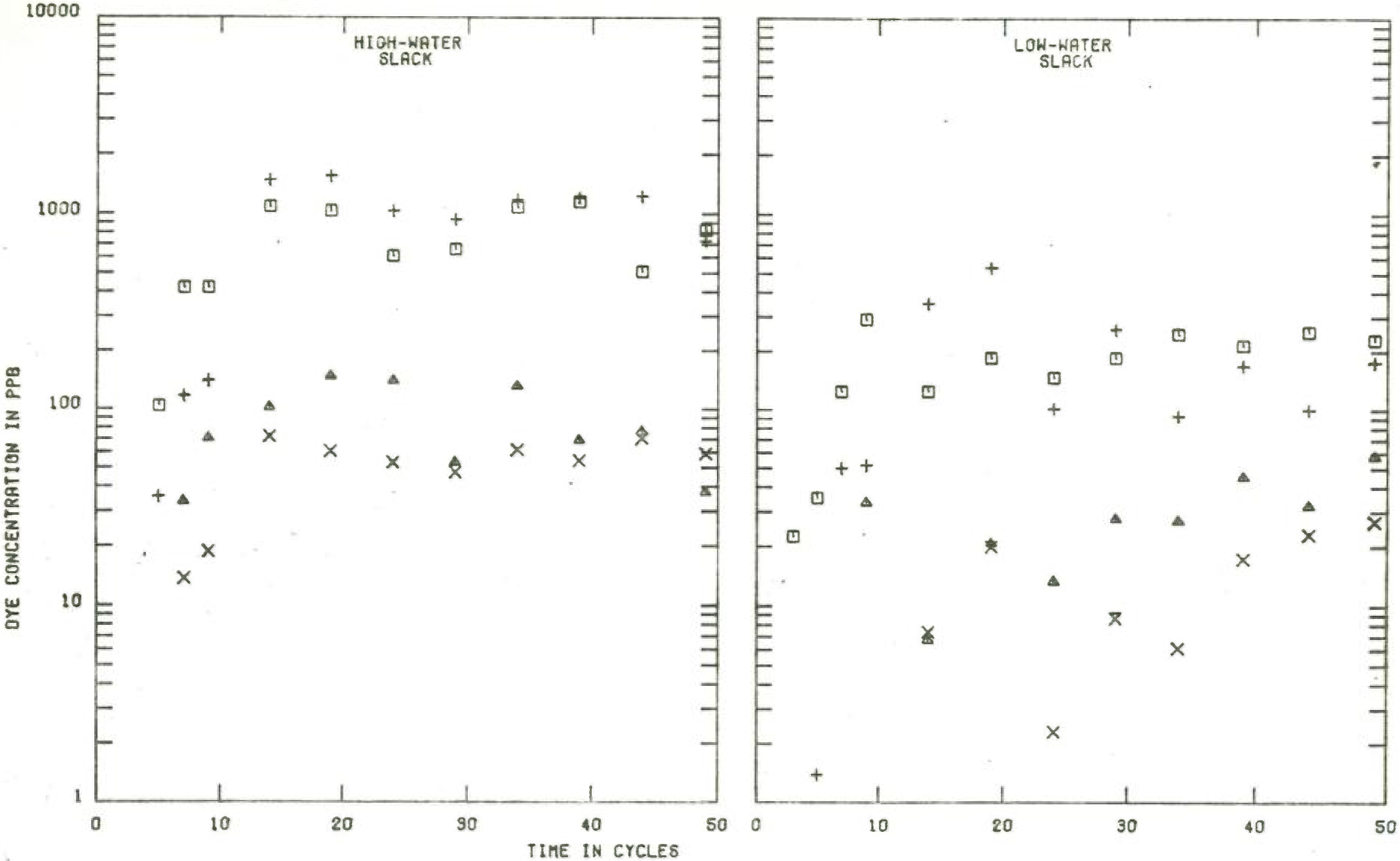
□ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —···—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 49

PLATE 166



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

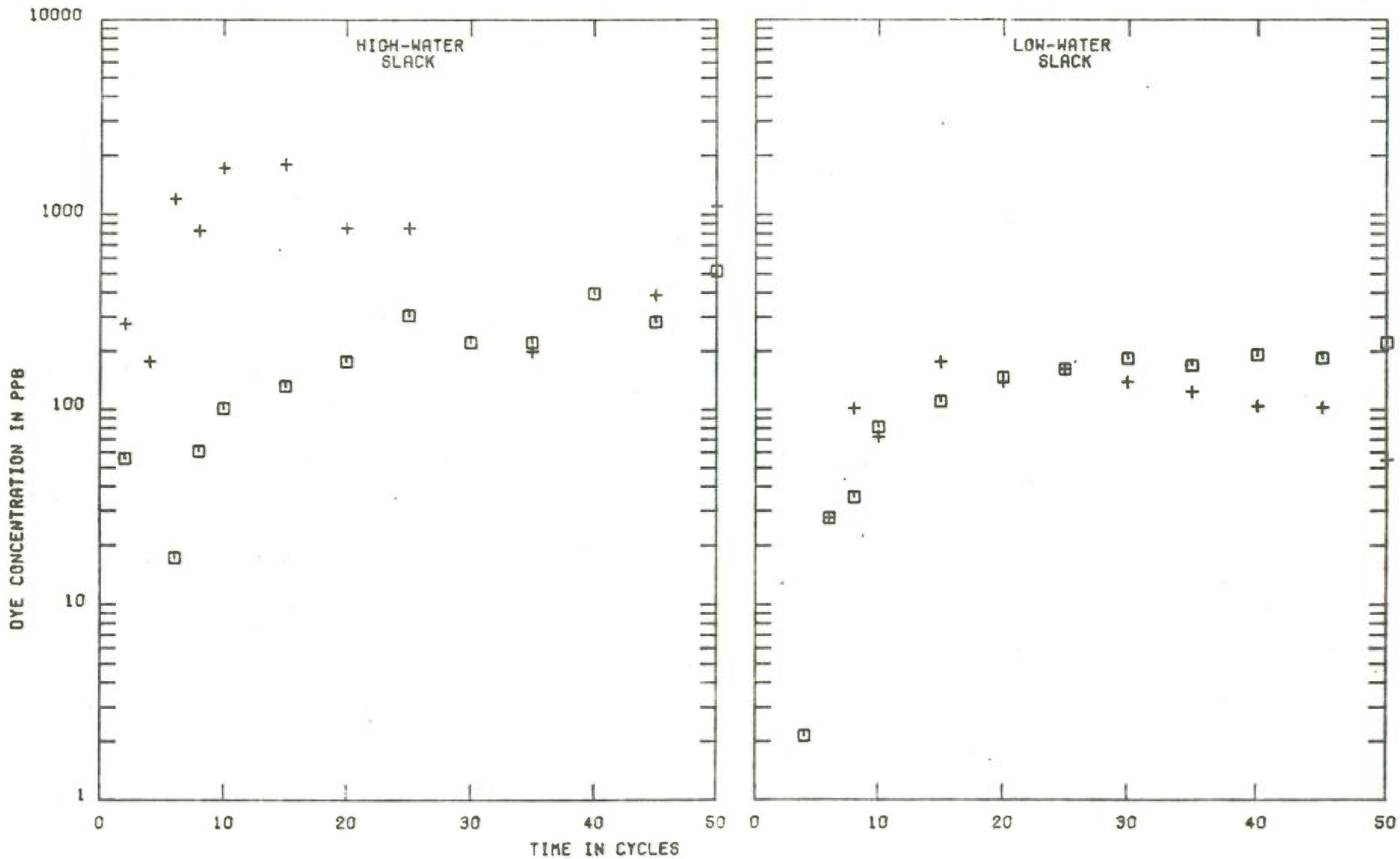
LEGEND

Symbol		
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	BASE
+ —·—·—	SURFACE	PLAN 1
× —·—·—·—	BOTTOM	PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 50



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

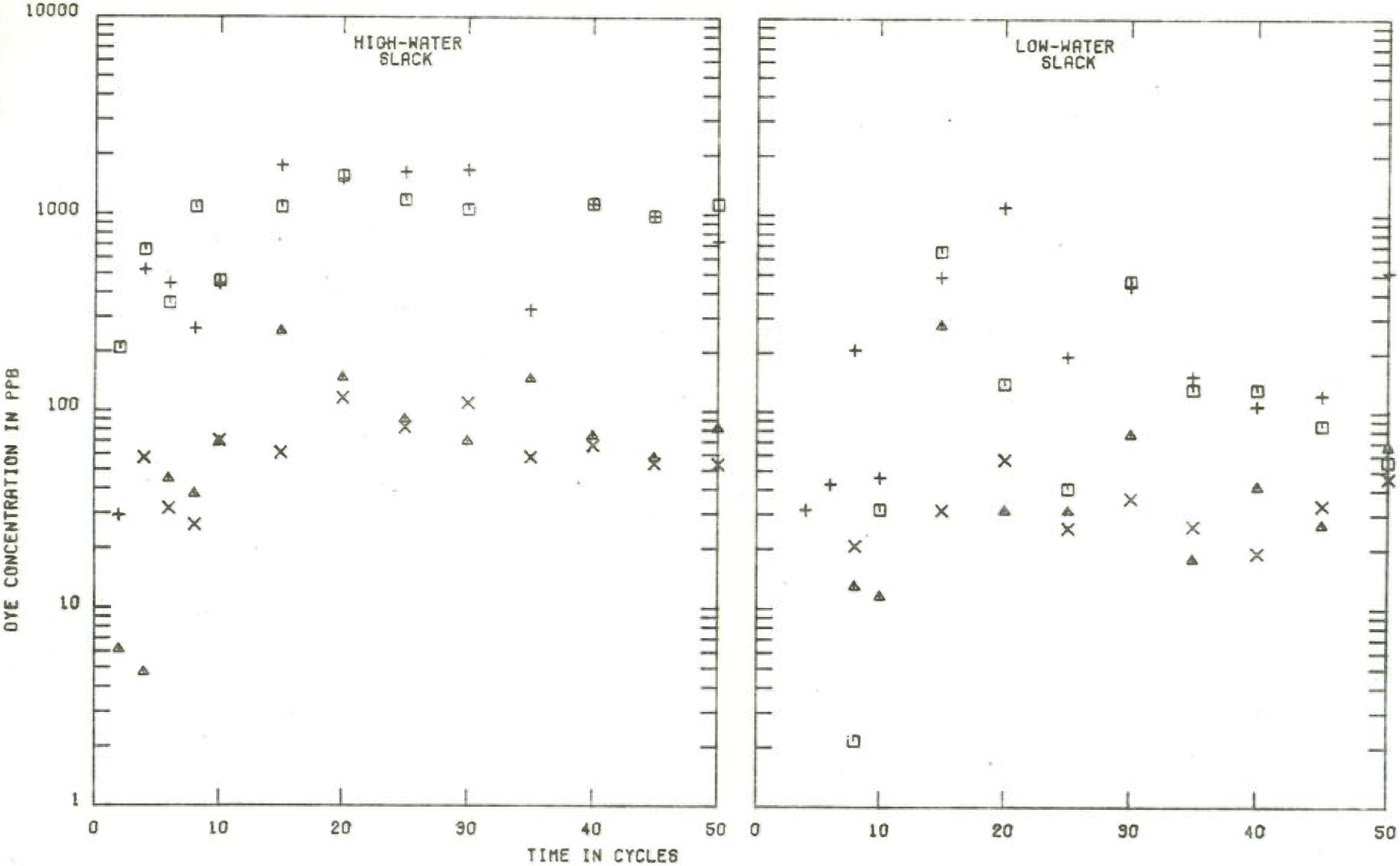
LEGEND

⊡ ——— BASE
\+ — — — PLAN 1

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 51 MID-DEPTH



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

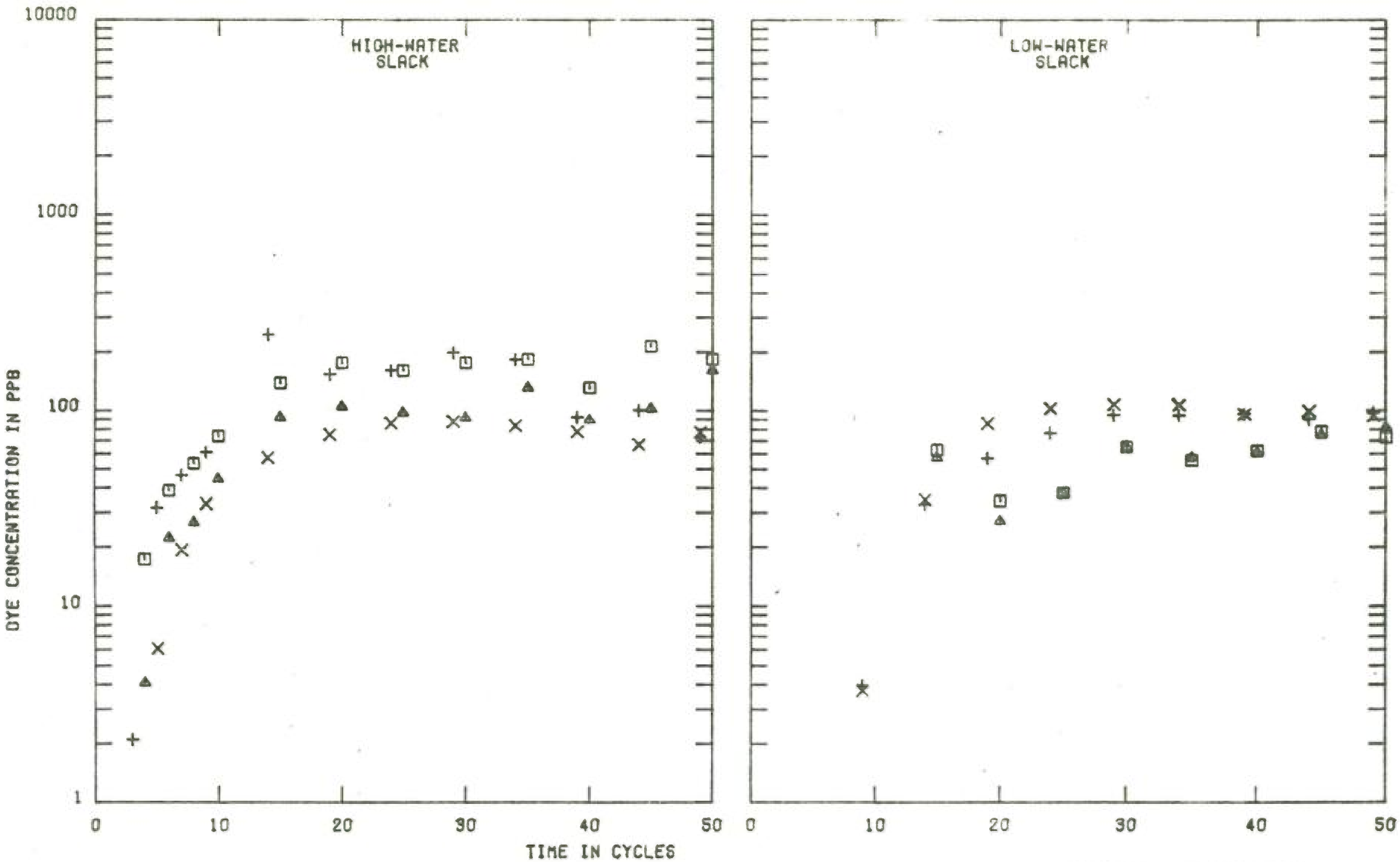
⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
X —---	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 52



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

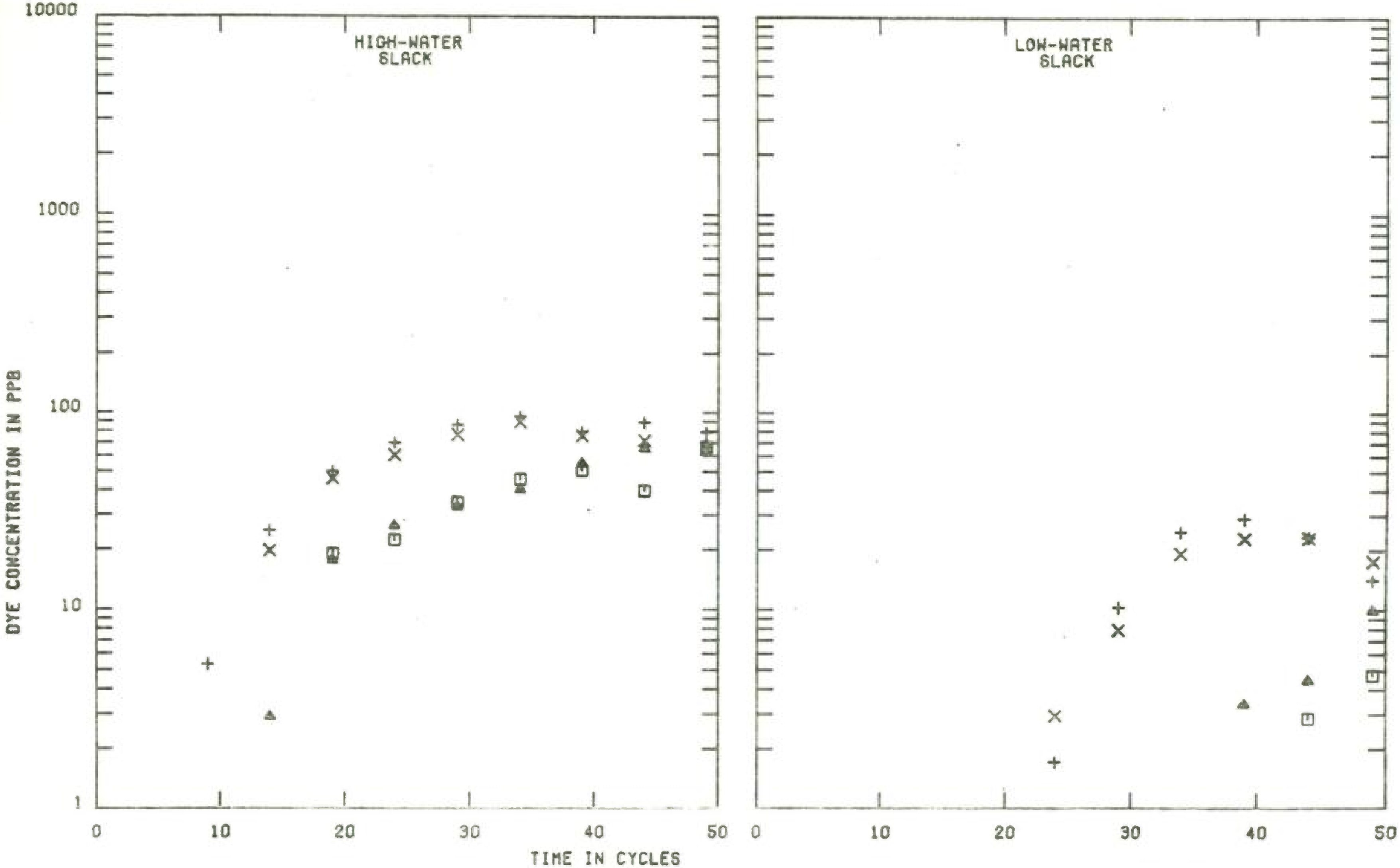
LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—	SURFACE	PLAN 1
× —··—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 53



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7	FT
HUDSON RIVER INFLOW	12000.0	CFS
RARITAN RIVER INFLOW	1770.0	CFS
OCEAN SALINITY (TOTAL SALT)	30.0	PPT
INITIAL DYE CONCENTRATION	100000.0	PPB

LEGEND

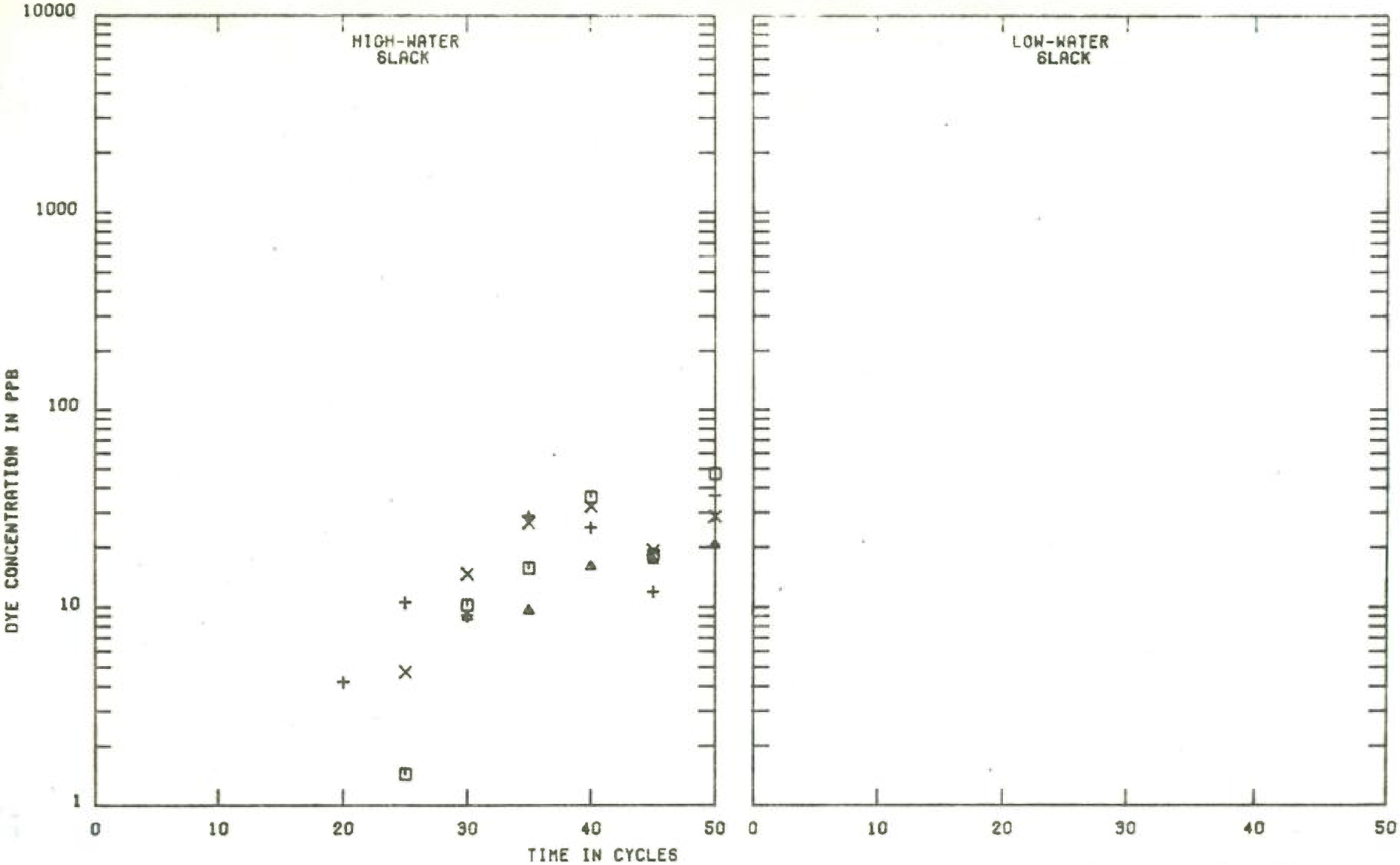
⊡ ———	SURFACE	BASE
△ — — —	BOTTOM	
+ —-—-	SURFACE	PLAN 1
× ------	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION
RARITAN BAY OUTFALL RELEASE

STATION 54

PLATE 174



TEST CONDITIONS

TIDAL RANGE AT SANDY HOOK	4.7 FT
HUDSON RIVER INFLOW	12000.0 CFS
RARITAN RIVER INFLOW	1770.0 CFS
OCEAN SALINITY (TOTAL SALT)	30.0 PPT
INITIAL DYE CONCENTRATION	100000.0 PPB

LEGEND

⊡ ———	SURFACE	BASE
▲ — — —	BOTTOM	
+ —·—·—	SURFACE	PLAN 1
× —···—	BOTTOM	

NEW YORK HARBOR MODEL
NORTON POINT DIKE STUDY

EFFECTS OF PLAN 1
ON DYE DISPERSION

RARITAN BAY OUTFALL RELEASE

STATION 58

RUN D PASSAIC VALLEY OUTFALL 4/26/8

SLACK

STATIONS	PLATE #		Presence of dye after X tidal cycles: H	Presence of dye after X tidal cycles: L
1	81			
2	82			
3	83			
4	84			
5 (MID-DEPTH)	85	Coney Is.	4	6
6	86		4	3
7 (MID-DEPTH)	87			
8	88	LOWER BAY/OCEAN		
9	89			
10	90	Sandy Hook Bay		
11	91			
12	92			
14	93	Chapel Hills Navigation Channel (CHNC)		
16	94	Ambrose N.C.		
17	95	CHNC		
21	96	Coney Is.	5	3
22 (MID DEPTH)	97		4.6	5
- 24	98		3	3
- 26	99		4.6	3
- 27	100		3.8	1.9
- 28	101	CHNC	3.8	2.
32 (MID DEPTH)	102	GRAVESEND BAY	1.9	4.6
33	103		1.9	4.
34	104			
35	105	NARROWS		
36	106			
- 37	107		2	1.9
38 (MID-DEPTH)	108	HOFFMAN/SWINBURNE	3	3
39 (MID-DEPTH)	109		3	3
40	110		3.8	1.9
41 (MID-DEPTH)	111		3.8	3.8
42	112		1.9	3.8
- 43 (MID-DEPTH)	113	Northern Lower Bay	6	3.8
44 (MID- ")	114		3	9
- 45 (MID- ")	115		6	9
- 46 (MID- ")	116	GREAT KILLS	6	10
47 (MID- ")	117		4.6	14

STATIONS

48	118	
50	119	
51 (MID-DEPTH)	121	
52	122	
53	123	
54	124	AK
55	125	(NEWARK BAY)
56	126	KVK
57	127	KVK
58	128	PT. OF RELEASE
59	129	
60	130	

NORTON PT. DIKE STUDY 1975