INDIAN POINT NUCLEAR GENERATING STATION
THERMAL SURVEY PROGRAM

ROUTINE MONTHLY THERMAL MONITORING
SEPTEMBER 1977 SURVEY

REPORT No. 5

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.

MARCH 1980

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<u>Model Prototype Comparison - September 28, 1977</u>

I. INTRODUCTION

This report presents the results of the September 1977 routine monthly thermal monitoring survey of the thermal effluent from the Indian Point Nuclear Generating Station, located at Buchanan, New York. The station consists of three units, Indian Point Unit Nos. 1 and 2, owned and operated by the Consolidated Edison Company of New York, Inc. (Con Edison), and Indian Point Unit No. 3, owned by the Power Authority of the State of New York (PASNY) and operated by Con Edison at the time of this survey. The purpose of this survey is to fulfill regulatory requirements imposed upon Con Edison and PASNY by both the United States Nuclear Regulatory Commission (NRC), through the Environmental Technical Specification Requirements for Indian Point Unit Nos. 1, 2 and 3 (R-1)*, and the New York State Department of Environmental Conservation (NYSDEC), through the Section 401 Water Quality Certification for Indian Point Unit No. 3 (R-2). The licensed power levels for Unit Nos. 1, 2 and 3 correspond to electrical outputs of 285 MW(e) gross, 906 MW(e) gross and 1001 MW(e) gross, respectively. This report, as part of a series conducted for Indian Point Unit Nos. 2 and 3 (R-3a through R-3e), is similar to reports presenting the results of a prior thermal survey program for Indian Point Unit No. 2 alone (R-4a through R-4i).

Measurements of the temporal and spatial intensity and extent of the Indian Point thermal plume, as well as the natural temperature variation in the Hudson River in the vicinity of the plant, were made on September 27, 28 and 29, 1977 from three mobile monitoring platforms. On September 27 and 29, ambient temperature and conductivity measurements were taken during five successive major phases of the tidal cycle (ebb, low water slack, flood, high water slack, and ebb again) to define a reference temperature and a reference conductivity for the Hudson River in the vicinity of the Indian Point plant. These measurements were obtained at a river cross-section upstream from the plant at the Bear Mountain Bridge and at river cross-sections downstream from the plant at Grassy Point and at Croton Point during each tidal phase. Also, longitudinal temperature measurements were taken along the axis of the river during each tidal phase except second ebb concurrently from Stony Point north to the Bear Mountain Bridge and from Stony Point south to Croton Point.

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*Numbers in parentheses refer to similarly numbered references which appear in Chapter V.

The temporal and spatial intensity and extent of the thermal plume, down to at least 2°F excess temperature over ambient, was measured over the five consecutive major tidal phases on September 28. Ambient reference temperature and conductivity data were obtained at the upstream and downstream river cross sections during each tidal phase.

The station intake and discharge temperatures were measured periodically at the intake forebays and in the discharge canal, respectively, during the field operation on all three days.

The field procedure for the survey and the station operating data are described in Section II. The results are presented and discussed in Section III. A model prototype comparison(comparison of model results vs. field data), utilizing a mathematical model described in a previous report (R-5), is presented in Section IV.

The maximum lateral width and cross-sectional area of the river contained within the 4°F excess temperature isotherm, and the maximum surface water temperature occurred, for all tidal phases, in the general vicinity of the discharge. A comparison of these results with the requirements of the New York State thermal criteria is presented below.

Comparison of Survey Results with NYS Thermal Criteria

	Max. Lateral River Width Within 4°F Isotherm (%)	Max. River X - Sectional Area Within 4°F Isotherm (%)	Max. Surface Temperature (°F)
SURVEY RESULTS			
Tidal Phase			
High Water Slack	39.0		
Flood		8.6	
Second Ebb			81.0
NYS THERMAL CRITERIA	66.7	50.0	90.0

The survey values are well within the New York State Thermal Criteria (R-6).

II. FIELD PROCEDURE AND STATION OPERATING DATA

A. FIELD PROCEDURE

The equipment and procedures utilized during the survey have been described in detail in previous reports (R-3a through R-3c). A map of the study area is presented in Figure II-1.

Three boats and a shore crew were utilized for the survey. The measurements taken on September 27 and 29 were directed toward identifying both the spatial and temporal limits of the thermal plume and the natural variation of ambient water temperature in the Indian Point area. Hereinafter, the program for these two days will be denoted as that of an "ambient day". On September 28, the emphasis of the field measurements was on mapping the spatial and temporal characteristics of the thermal plume, and hence this particular program will be referred to as that of the "survey day". A summary of each day's activities is given below:

Tuesday, September 27 (First Ambient Day)

Ambient temperature measurements were taken during five consecutive major phases of the tidal cycle (ebb, low water slack, flood, high water slack, and ebb again) to define the limits of the Indian Point thermal plume. These measurements are described below:

a) Lateral ambient reference temperature scans were conducted during each tidal phase from the west bank to the east bank at the Bear Mountain Bridge (about 22,000 feet north of Indian Point), at Grassy Point (about 18,000 feet south of Indian Point), and at Croton Point (about 40,000 feet south of Indian Point). Data were acquired at 6 depths: surface, 3,6, 10,16 and 22 feet.

b) Conductivity and additional temperature profile measurements were taken from the east bank to the west bank at fixed locations during each tidal phase along the same transects described above for the lateral scans and at the Transmission Lines (about 3000 feet south of Indian Point). Data were obtained at discrete depths from the bottom to the surface.

c) Longitudinal temperature scans along the axis of the river were performed during the first four tidal phases concurrently from Stony Point north to the Bear Mountain Bridge and from Stony Point south to Croton Point.

d) Temperature measurements were made periodically throughout the day at the intakes for Units 2 and 3 and in the discharge canal. Conductivity measurements were also taken in the discharge canal. Generally, two intake readings and three discharge readings were taken during each tidal cycle.

<u>Wednesday, September 28 (Survey Day)</u>

The lateral scans, vertical profiles and intake and discharge measurements were taken during each tidal phase as on the "ambient day". However, the longitudinal temperature scans were replaced by near field and far field thermal plume mappings as described below. These mappings were performed during the five tidal phases.

a) <u>Near Field Mapping</u>

The near field scanning survey was initiated adjacent to the shoreline, downstream of the discharge structure. A series of lines were run parallel to the discharge canal. Each successive parallel line was run further out from the discharge canal towards the center of the river so that coverage was usually from the east shore out to about 1500 to 2000 feet from the shore. Each line began and ended where the temperature was less than 2°F above ambient or when the scan intruded into the far field region.

b) <u>Far Field Mapping</u>

The far field scanning survey commenced north of the station for ebb and low water slack mappings, and south of the station for flood and high water slack mappings. The boat began tracing the position of the plume by zigzagging across the river, turning back towards the opposite shore whenever the surface temperature was less than 1°F to 2°F above ambient, or when the last intruded into the near field region.

<u>Thursday, September 29 (Second Ambient Day)</u>

The same sequence of measurements was made as on Tuesday, September 27, the first ambient day.

Survey Sequence

A list of the scans, profiles and plume mappings performed during each tidal phase, along with the times of measurement, is presented in Appendix A. The relationship between the times of measurement and the actual tidal cycle for the three-day survey period is shown in Figures II-2, II-3 and II-4.

B. STATION OPERATING DATA

All three units at Indian Point have a once-through cooling system in which Hudson River water, drawn through separate intakes in front of each unit, is passed through the condensers, and is finally discharged into the Hudson River through a common discharge structure (Figure II-5). During the field operation, Indian Point Unit No. 2 operated at an average electrical output of 530 MW(e) on September 27, 700 MW(e) on September 28, and 855 MW(e) on September 29. Indian Point Unit No. 3 operated at an average electrical output of 800 MW(e) on September 27, 880 MW(e) on September 28, and 885 MW(e) on September 29. Unit No. 1 was out of service. The electrical generation for the Station for the survey period and for several days before and after the survey is tabulated in Appendix B and is illustrated in Figure II-6. The circulating water flow rates are presented in Appendix C.

III. RESULTS

A. SUMMARY

The ambient reference temperatures obtained during the survey for the lateral scans and vertical profiles are presented in Tables III-1 through III-4. Temperatures obtained during the longitudinal scans are presented in Table III-5. Intake and discharge temperatures for the survey period are given in Tables III-6 through III-8.

The survey reported on herein was characterized by modest temporal and spatial ambient temperature changes, typical of the fall when the estuary has begun to cool. For example, the Bear Mountain Bridge area-average water temperature decreased from 69.1°F at first flood on September 27 to 67.4°F at second flood on September 29, a decrease of 1.7°F in a 72-hour period. The ambient temperature differential between Bear Mountain and Croton Point, on September 28 was 2.7°F (LWS at Bear Mountain was 67.7°F and HWS at Croton Point was 70.4°F). These temperature differences were significantly greater than those observed in the August 1978 survey (R-3d) when the estuary temperature was relatively constant. The corresponding 72 hour temperature difference at the Bear Mountain Bridge was 0.3°F and the difference between Bear Mountain and Croton Point was 0.2°F.

The area-average ambient temperature for the Indian Point region was obtained by analysis of the ambient reference temperature and conductivity measurements from Croton Point, Grassy Point, and Bear Mountain Bridge transects. As described in detail in the June 1977 thermal survey report (R-3C), the longitudinal scans conducted along the axis of the river were also used to obtain an Indian Point area-average ambient temperature. The surface and the three-foot depth upper layer datum ambient temperatures at Indian Point were obtained by extrapolating the solar stratification (Appendix D) at both the Bear Mountain Bridge and Croton Point and/or Grassy Point to Indian Point and adding it to the Indian Point area-average ambient temperature.

The width of the plume was evaluated utilizing the three-foot depth measurements as a reference datum. The use of the three-foot depth measurements as an upper layer datum for computing the lateral width of the plume was concurred with by the NYSDEC (R-7). The methodology and rationale employed in the analysis of the Indian Point thermal effluent was discussed in detail in a previous report (R-4e).

The maximum cross-sectional area and lateral width of the plume contained within the 4°F excess temperature isotherm and the maximum water temperature during the September 1977 survey were as follows:

Comparison of Survey Results with NYS Thermal Criteria

	Max. Lateral River Width Within 4°F Isotherm (%)	Max. River X - Sectional Area Within 4°F Isotherm (%)	Max. Surface Temperature (°F)
SURVEY RESULTS			
<u>Tidal Phase</u>			
High Water Slack	39.0		
Flood		8.6	
Second Ebb			81.0
NYS THERMAL CRITERIA	66.7	50.0	90.0

The survey values were well within the New York State Thermal Criteria. Tabulated values for the intensity and extent of the plume for all tidal phases are presented in Table III-9. A discussion of the analyses and results is presented below.

B. AMBIENT TEMPERATURE

The ambient water temperature is the temperature that would exist without the influence of any artificial heat source. This temperature varies spatially and temporally and is influenced by local meteorological and hydrological factors including the morphology of the river and the topography of the surroundings. Such variation can be considerable in the Indian Point reach with changes as much as 2°F within a three-hour period. Hence, the ambient temperature cannot be directly measured by field surveys in the immediate vicinity of the power plant after the start of its operation. Furthermore, in the Hudson River, the ambient temperature cannot be determined by field measurements at reasonable distances away from a power plant, since, due to periodic reversing tidal flow and due to the existence of other plants along the estuary, these distances fall into regions influenced by the thermal effluents from other plants. It is therefore essential to employ appropriate analytical methods combined with field measurements to determine the true value of the Indian Point ambient temperature. For the purposes of this study, the ambient temperature in the plume region is obtained from an analysis of temperatures measured at Bear Mountain Bridge north of Indian Point and at Croton Point and Grassy Point south of Indian Point. The procedures utilized to determine ambient temperature at Indian Point region have been discussed in detail in previous reports (R-3a through R-3c).

Tables III-1 through III-4 contrast mean values of the temperature measurements used in the estimation of Indian Point ambient temperature. These measurements represent the results of the lateral scans and vertical profiles taken at the Bear Mountain Bridge, Grassy Point and Croton Point.

Tables III-10, III-11, and III-12 show the ambient temperatures for the Indian Point region which were calculated for various tidal phases on the survey dates.

The freshwater flows over the Troy Dam for the period preceeding the survey and during the survey itself are presented in Appendix E. The local meteorological conditions during the survey were monitored at two elevations, 33 feet and 400 feet, on the Indian Point meteorological tower. These meteorological data are presented in Appendix F.

C. PLUME EVALUATION

The area-average ambient temperature at depths below 6 feet was employed to evaluate the river's cross-sectional area and the upper layer ambient temperature was employed to evaluate the river's width contained within a particular excess temperature isotherm. This approach generally leads to a conservative estimate of the river's cross-sectional area contained within the 4°F excess temperature isotherm.

C.1 First Ebb

The results are:

September 28, 1977
First Ebb
Summary

		Upper Layer Datum	Cross-Sectional Area Datum
(1)	Ambient temperature (°F)	68.1	68.1
(2)	4°F excess temperature (°F)	72.1	72.1
(3)	Percentage of river's width contained within excess temperature isotherm(%)	12.0	----
(4)	Percentage of river's cross-sectional area contained within excess temperature isotherm(%)	----	5.8

Indian Point Station isotherm patterns at various depths from surface down to 22 feet below the surface during this tidal phase are shown in Figures III-1 through III-6. Figure III-7 depicts only the 4°F isotherm patterns at each depth location. Isotherm patterns in Figure III-7 are used to estimate the location and extent of the lateral width and the cross-sectional area of the 4°F isotherm.

The maximum lateral width of the 4°F excess temperature isotherm at the upper layer depth can be estimated from Figure III-7 as approximately 600 feet, or about 12.0% of the river's width. This occurs approximately 450 feet south of the discharge canal. At this location the river's width is about 5000 feet.

The location and extent of the maximum cross-sectional area contained within the 4°F isotherm can be determined by examination of Figure III-7. This cross-section occurs about 330 feet south of the discharge canal and occupies about 9300 square feet or 5.8% of the river's cross sectional area. The cross-sectional temperature pattern around this locale is depicted in Figures III-8 through III-11. The reduction in the cross-sectional area occupied by the 4°F isotherm is evident as one proceeds south from Indian Point South 1 (about 400 feet south of the discharge canal, Figure III-9) to Indian Point South 2 (about 1100 feet south of the discharge canal, Figure III-10) to the Transmission Lines (Figure III-11), where the 4°F isotherm disappears.

C.2 Low Water Slack

The results are:

September 28, 1977
Low Water Slack
Summary

		Upper Layer Datum	Cross-Sectional Area Datum
(1)	Ambient temperature (°F)	68.0	68.0
(2)	4°F excess temperature (°F)	72.0	72.0
(3)	Percentage of river's width contained within excess temperature isotherm(%)	14.7	----
(4)	Percentage of river's cross-sectional area contained within excess temperature isotherm(%)	----	7.7

Indian Point Station isotherm patterns at various depths from the surface down to 22 feet below the surface during this tidal phase are shown in Figures III-12 through III-17. Figure III-18 depicts only the 4°F isotherm patterns at each depth location. Isotherm patterns in Figure III-18 are used to estimate the location and extent of the lateral width and the cross-sectional area of the 4°F isotherm.

The maximum lateral extent of the 4°F isotherm at the upper layer depth is obtained from Figure III-18. It occurs about 460 feet south of the discharge structure. It has a linear extent of approximately 750 feet, which translates into a percentage lateral extent of about 14.7%. The river's width at this location is about 5100 feet. The plume configuration with its downstream orientation is suggestive of an early low water slack.

The location and extent of the maximum cross-sectional area contained within the 4°F isotherm can be determined by examination of Figure III-18. This cross section occurs about 100 feet south of the discharge canal and occupies about 12400 square feet, or 7.7% of the river's cross sectional area (Figure III-19). As indicated in Figures III-12 through III-17, the LWS isothermal mappings have a downstream orientation, indicative of late slack--early ebb. The lateral spreading of the plume in the downstream direction is evident from Figures III-20 and III-21, and at Indian Point South 2 (about 1100 feet south of the discharge canal, Figure III-21), the 4°F isotherm has almost dissipated entirely.

C.3 Flood

The results are:

September 28, 1977
Flood
Summary

		Upper Layer Datum	Cross-Sectional Area Datum
(1)	Ambient temperature (°F)	68.3	68.1
(2)	4°F excess temperature (°F)	72.3	72.1
(3)	Percentage of river's width contained within excess temperature isotherm (%)	14.3	----
(4)	Percentage of river's cross-sectional area contained within excess temperature isotherm (%)	----	8.6

Indian Point Station isotherm patterns at various depths from surface down to 22 feet below the surface during this tidal phase are shown in Figures III-22 through III-27. Figure III-28 depicts only the 4°F isotherm patterns at each depth location. Isotherm patterns in Figure III-28 are used to estimate the location and extent of the lateral width and the cross-sectional area of the 4°F isotherm.

The maximum lateral width of the 4°F isotherm at the upper layer depth can be estimated from Figure III-28 as approximately 700 feet, or about 14.3% of the river's width. This occurs perpendicular to the discharge canal. The river's width at this location is approximately 4900 feet.

The location and extent of the maximum cross-sectional area contained within the 4°F isotherm can be determined by examination of Figure III-28. This cross section occurs perpendicular to the discharge canal, with the plume extending almost straight out towards the west bank. The 4°F isotherm occupies about 13,800 square feet, on 8.6% of the river's cross-sectional area. Examination of Figures III-29 through III-31 reveals that the 4°F isotherm did not extend very far upstream during the time of measurement and dissipated just north of the discharge canal.

C.4 High Water Slack

The results are:

September 28, 1977 High Water Slack Summary		Upper Layer Datum	Cross-Sectional Area Datum
(1)	Ambient temperature (°F)	68.6	68.4
(2)	4°F excess temperature (°F)	72.6	72.4
(3)	Percentage of river's width contained within excess temperature isotherm (%)	39.0	----
(4)	Percentage of river's cross-sectional area contained within excess temperature isotherm (%)	----	7.0

Indian Point Station isotherm patterns at various depths from surface down to 22 feet below the surface during this tidal phase are shown in Figures III-32 through III-37. Figure III-38 depicts only the 4°F isotherm patterns at each depth location. Isotherm patterns in Figure III-38 are used to estimate the location and extent of the lateral width and the cross-sectional area of the 4°F isotherm.

The maximum lateral width of the river occupied by the 4°F excess temperature isotherm, measured at the upper layer index depth, is obtained from Figure III-38. It occurs about 1340 feet south of the discharge structure at the northern end of the Georgia-Pacific dock. The total linear lateral extent of the 4°F excess temperature isotherm is approximately 1800 feet, or about 39.0%. The river's width at this location is about 4600 feet.

The location and extent of the maximum cross-sectional area contained with the 4°F isotherm can be determined by examination of Figure III-38. This cross section occurs about 220 feet south of the discharge canal and occupies about 11200 square feet, or 7.0% of the river's cross-sectional area. This cross-section occurs between the discharge canal (Figure III-39) and Indian Point South 1 (Figure III-40). As the plume travels downstream to Indian Point South 2 (Figure III-41), the lateral width of the 4°F isotherm across the river increases while its depth decreases.

C.5 Second Ebb

The results are:

September 28, 1977
Second Ebb
Summary

		Upper Layer Datum	Cross-Sectional Area Datum
(1)	Ambient temperature (°F)	68.3	68.3
(2)	4°F excess temperature (°F)	72.3	72.3
(3)	Percentage of river's width contained within excess temperature isotherm(%)	12.2	----
(4)	Percentage of river's cross-sectional area contained within excess temperature isotherm(%)	----	3.7

Indian Point Station isotherm patterns at various depths from surface down to 22 feet below the surface during this tidal phase are shown in Figures III-42 through III-47. Figure III-48 depicts only the 4°F isotherm patterns at each depth location. Isotherm patterns in Figure III-48 are used to estimate the location and extent of the lateral width and the cross-sectional area of the 4°F isotherm.

The maximum upper layer lateral extent of the 4°F excess temperature isotherm, as determined from Figure III-48, occurs about 2000 feet south of the discharge canal, near the northern end of the Georgia Pacific Dock. The lateral intrusion into the river at this location is approximately 550 feet, or about 12.2% of the width of the river. The river's width at this location is about 4500 feet.

The location and extent of the maximum cross-sectional area contained within the 4°F isotherm can be determined by examination of Figure III-48. This cross section occurs about 600 feet south of the discharge canal, and occupies about 6000 square feet, or 3.7% of the river's cross sectional area. Examination of Figures III-49 through III-52 shows that the lateral width of the 4°F isotherm increases as it progresses downstream while its depth decreases. At the Transmission Lines (Figure III-52), the 4°F isotherm has almost completely disappeared.

D. CONDUCTIVITY

Conductivity profiles were obtained during each tidal phase at Croton Point, Grassy Point, the Transmission Lines and Bear Mountain Bridge. The average conductivity measurements obtained are presented in Tables III-13, III-14 and III-15. It is evident that the salt front (conductivity less than 300 umho, salinity less than 0.1 ppt) was just upstream of the Bear Mountain Bridge on September 27, since the tidal average conductivity at Bear Mountain was 337 umho. The salt front progressed downstream and reached the Indian Point area on September 28, as evidenced by the tidal average conductivity of 320 umho at the Transmission Lines. On September 29, the salt front reached Grassy Point, where the tidal average conductivity was 286 umho. Inspection of the tidal average conductivity at Croton Point also indicates the downstream movement of the salt front since the tidal average conductivity decreased from 3752 umho to 944 umho during the three-day survey. This downstream movement of the salt front is indicative of the strong fresh water flow of 34,200 cfs during the survey period.

Comparison of the surface average conductivity with the area-averaged conductivity reveals that there is a small vertical salinity gradient within the survey region. This is apparent from the fact that the ratio of area-average to surface conductivity at all stations is greater than unity. Examining the surface-average conductivity in Tables III-13 through III-15 also shows a downstream progression of the salt front due to downstream movement of fresh water flow.

IV. MODEL PROTOTYPE COMPARISON

A. INTRODUCTION

On April 10, 1979 Con Edison submitted to the NYSDEC a report describing mathematical model simulations of the Indian Point thermal plume and comparing the model results to field data (R-5). It was shown that the model could accurately predict the intensity and extent of the thermal plume. The NYSDEC concurred (R-8) with our recommendation that a comparison of model results and field data be included in all future thermal survey reports to further indicate the model's predictive capabilities. The results of the model-prototype comparison for the September 1977 thermal survey are described in this section.

B. DESCRIPTION OF MODEL

The mathematical model used in this study was described in detail in Reference R-5. It consists of multiple empirical formulations derived from the Indian Point thermal survey data taken during the last four years. The parameters selected for the empirical formulations by means of stepwise regression analysis include isothermal characteristics of the plume, ambient hydrological and meteorological data, and power plant operating conditions.

C. RESULTS

The plume patterns predicted by the model are compared with the actual plume patterns obtained from the field data in Figures IV-1 through IV-5, for first ebb, low water slack, flood, high water slack and second ebb, respectively, for September 28, 1977. In contrast to the irregular shapes of the field isotherms, the model patterns are smooth with a predictable skew distribution, as expected.

A comparison of both the model predictions and field data with the NYSDEC Thermal Criteria is presented in Table IV-1 for all tidal phases. Also included are the plume centerline length and river surface area of the 4°F excess temperature isotherm. Examination of these results reveals that for both first and second ebb, the model predicts almost exactly the lateral width and cross-sectional area of the plume. For low water slack and flood, the model is conservative and predicts a greater lateral width and cross-sectional area of the plume than the field data.

The model predictions for high water slack are lower than the field data. This is because the regression equations for high water slack were developed on the basis of a river velocity approaching zero. However, the high water slack survey was conducted during late slack-early ebb when the river velocity was considerably greater than zero. This explains the deviation between the model predictions and the field data.

It should be noted that for all tidal phases, the model predictions of the most severe lateral width and cross-sectional area of the 4°F excess temperature isotherm are well within the State's thermal criteria.

V. REFERENCES AND FOOTNOTES

(R-1) Appendix B to Facility Operating License DPR-26, Environmental Technical Specification Requirements, for Consolidated Edison Company of New York, Inc. Indian Point Nuclear Generating Unit Numbers 1, 2 and 3. Docket Nos. 50-3, 50-247 and 50-286, USNRC, December 12, 1975.

(R-2) Letter of May 2, 1975 from Mr. Ogden Reid, NYSDEC, to Mr. Carl L. Newman, Con Edison.

(R-3a) "Indian Point Nuclear Generating Station Thermal Survey Program, Routine Monthly Thermal Monitoring, October 1976 Survey, Report No. 1," Consolidated Edison Company of New York, Inc., February 1977.

(R-3b) "Indian Point Nuclear Generating Station Thermal Survey Program, Routine Monthly Thermal Monitoring, May 1977 Survey, Report No. 2," Consolidated Edison Company of New York, Inc., February 1978.

(R-3c) "Indian Point Nuclear Generating Station Thermal Survey Program, Routine Monthly Thermal Monitoring, June 1977 Survey, Report No. 3," Consolidated Edison Company of New York, Inc., August 1978.

(R-3d) "Indian Point Nuclear Generating Station Thermal Survey Program, Routine Monthly Thermal Mointoring, August 1977 Survey Report No. 4", Consolidated Edison Company of New York, Inc., February 1980.

(R-3e) "Indian Point Nuclear Generating Station Thermal Survey Program, Routine Monthly Thermal Monitoring, August 1978 Survey Report No. 6", Consolidated Edison Company of New York, Inc., October 1979.

(R-4a) "Indian Point No. 2 Routine Monthly Thermal Monitoring, Report No. 1, May 1974," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., September 1974.

(R-4b) "Indian Point No. 2 Routine Monthly Thermal Monitoring, Report No. 2, June 1974," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., December 1974.

(R-4c) "Indian Point No. 2 Routine Monthly Thermal Monitoring, Report No. 3, July 1974," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., March 1975.

(R-4d) "Indian Point No. 2 Routine Monthly Thermal Monitoring, Report No. 3, Supplement, July 1974," Consolidated Edison Company of New York, Inc., May 1975.

(R-4e) "Indian Point No. 2 Routine Monthly Thermal Monitoring for September 1974, Report No. 4," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., March 1976.

(R-4f) "Indian Point No. 2 Routine Monthly Thermal Monitoring for November 1974, Report No. 5," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., June 1976.

(R-4g) "Indian Point No. 2 Routine Monthly Thermal Monitoring for April 1975, Report No. 6," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., August 1976.

(R-4h) "Indian Point Nuclear Generating Station Intensive Thermal Survey Program, August and October 1974," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., March 1976.

(R-4i) "Indian Point Nuclear Generating Station, Intensive Thermal Survey Program, May 1975 Survey, Report No. 7," Prepared by Dames & Moore and Consolidated Edison Company of New York, Inc., December 1976.

(R-5) "Indian Point Nuclear Generating Station - Report On the Evaluation of Hydrothermal Studies, Volume No. 4., " Consolidated Edison Company of New York, Inc. April 1979.

(R-6) The New York State Thermal Criteria is found in the NYCRR Part 704, Title 6. It states that

a) At least 50 percent of the cross-sectional area and/or volume of the flow of the estuary including a minimum of one-third of the surface as measured from water edge to water edge at any stage of the tide, shall not be raised to more than 4°F over the temperature that existed before the addition of heat of artificial origin or a maximum of 83°F whichever is less."

b) The water temperature at the surface of an estuary shall not be raised to more than 90 degrees F at any point.

(R-7) Letter of November 14, 1975 from Mr. Thomas Quinn, NYSDEC, to Mr. John Szeligowski, Con Edison.

(R-8) Letter of May 7,1979 from Mr. Thomas Quinn, NYSDEC to Mr. John R. Jannarone, Con Edison

TABLES

TABLE III-1

AMBIENT REFERENCE TEMPERATURES
SEPTEMBER 27, 1977

		Average Scan Transect Temperature (°F)							Average Profile Transect Temperature (°F)		
Tidal Phase	Location	Time	Zero Foot Depth	Three Foot Depth	Six Foot Depth	Ten Foot Depth	Sixteen Foot Depth	Twenty-Two Foot Depth	Time	Surface(1) Average	Area Average
First Ebb	Bear Mountain Bridge	0413	69.1	69.2	69.1	69.1	69.1	69.1	0345	69.0	69.0
	Grassy Point	0424	71.3	71.4	71.4	71.3	71.4	71.4	0431	71.0	70.8
	Croton Point	0349	70.3	70.5	70.6	70.5	70.5	70.5	0342	70.0	70.0
Low Water Slack	Bear Mountain Bridge	0708	68.3	68.4	68.3	68.4	68.4	68.4	0653	68.0	68.0
	Grassy Point	0723	69.8	69.8	69.9	69.7	69.8	69.8	0729	69.8	69.8
	Croton Point	0652	70.5	70.6	70.7	70.7	70.8	70.8	0647	70.5	70.7
Flood	Bear Mountain Bridge	1018	68.6	68.5	68.4	68.5	68.4	68.4	1000	68.1	68.1
	Grassy Point	1017	70.2	70.1	70.1	70.0	70.2	70.4	1029	70.6	70.6
	Croton Point	0946	71.0	70.9	70.9	70.8	70.7	70.6	0949	71.0	70.7
High Water Slack	Bear Mountain Bridge	1253	69.3	69.3	69.2	69.2	69.1	69.1	1233	68.7	68.6
	Grassy Point	1306	71.0	70.9	70.9	70.9	70.9	70.9	1302	70.8	70.9
	Croton Point	1225	70.7	70.6	70.5	70.4	70.3	70.2	1222	70.7	70.3
Second Ebb	Bear Mountain Bridge	1644	68.7	68.7	68.7	68.7	68.7	68.6	1629	68.1	68.0
	Grassy Point	1704	70.6	70.6	70.7	70.5	70.5	70.5	1643	70.7	70.7
	Croton Point	1628	71.2	71.3	71.2	71.0	70.9	70.8	1559	71.2	71.0

(1) Surface to approximately -7 feet

TABLE III-2

AMBIENT REFERENCE TEMPERATURES
SEPTEMBER 28, 1977

		Average Scan Transect Temperature (°F)							Average Profile Transect Temperature (°F)		
Tidal Phase	Location	Time	Zero Foot Depth	Three Foot Depth	Six Foot Depth	Ten Foot Depth	Sixteen Foot Depth	Twenty-Two Foot Depth	Time	Surface Average [1]	Area Average
First Ebb	Bear Mountain Bridge	0441	67.9	68.1	68.1	68.1	68.1	68.1	0423	67.9	67.9
	Grassy Point	0450	69.4	69.5	69.5	69.4	69.4	69.4	0515	69.6	69.5
	Croton Point	0417	70.0	70.1	70.3	70.3	70.4	70.5	0419	69.9	70.1
Low Water Slack	Bear Mountain Bridge	0752	67.6	67.7	67.6	67.7	67.7	67.7	0738	67.4	67.4
	Grassy Point	0801	68.6	68.7	68.7	68.6	68.7	68.7	0818	68.6	68.6
	Croton Point	0731	69.7	69.1	69.9	69.8	69.9	69.9	0731	69.7	69.8
Flood	Bear Mountain Bridge	1025	67.8	67.9	67.8	67.8	67.8	67.8	1012	67.3	67.3
	Grassy Point	1106	69.5	69.4	69.3	69.1	69.1	69.1	1113	69.7	69.3
	Croton Point	1034	70.3	70.2	70.2	70.0	70.1	70.0	1026	70.3	70.0
High Water Slack	Bear Mountain Bridge	1355	68.8	68.8	68.7	68.7	68.6	68.5	1343	68.4	68.4
	Grassy Point	1401	70.0	70.0	70.0	69.8	69.7	69.6	1358	69.8	69.7
	Croton Point	1321	70.8	70.6	70.6	70.4	70.3	70.2	1312	70.6	70.3
Second Ebb	Bear Mountain	1713	68.0	68.2	68.2	68.2	68.2	68.2	1652	67.8	67.8
	Grassy Point	1743	69.7	69.7	69.7	69.6	69.7	69.7	1730	69.8	69.6
	Croton Point	1711	70.2	70.2	70.3	70.1	70.2	70.2	1645	70.1	70.1

[1] Surface to approximately - 7 feet

TABLE III-3

AMBIENT REFERENCE TEMPERATURES
SEPTEMBER 29, 1977

		Average Scan Transect Temperature (°F)							Average Profile Transect Temperature (°F)		
Tidal Phase	Location	Time	Zero Foot Depth	Three Foot Depth	Six Foot Depth	Ten Foot Depth	Sixteen Foot Depth	Twenty-Two Foot Depth	Time	Surface[1] Average	Area Average
First Ebb	Bear Mountain Bridge	0516	67.6	67.8	67.7	67.8	67.8	67.8	0456	67.6	67.5
	Grassy Point	0603	69.1	69.1	69.2	69.1	69.1	69.2	0604	68.7	68.7
	Croton Point	0506	69.1	69.1	69.1	69.1	69.3	69.4	0503	68.6	68.7
Low Water Slack	Bear Mountain Bridge	0831	67.1	67.2	67.1	67.2	67.2	67.2	0816	66.7	66.7
	Grassy Point	0853	68.1	68.1	68.1	68.0	68.1	68.2	0853	67.9	67.9
	Croton Point	0810	68.5	68.5	68.6	68.5	68.5	68.6	0808	68.1	68.1
Flood	Bear Mountain Bridge	1131	67.3	67.3	67.2	67.3	67.3	67.3	1115	66.9	66.9
	Grassy Point	1127	68.7	68.6	68.6	68.5	68.4	68.5	1145	68.2	68.1
	Croton Point	1053	68.8	68.7	68.8	68.7	68.7	68.7	1104	68.5	68.5
High Water Slack	Bear Mountain Bridge	1438	67.9	68.0	68.0	67.9	67.9	67.9	1422	67.4	67.4
	Grassy Point	1457	68.9	68.8	68.9	68.9	68.8	68.8	1448	68.5	68.5
	Croton Point	1421	69.1	69.1	69.1	69.1	69.1	69.1	1422	68.7	68.7
Second Ebb	Bear Mountain Bridge	1807	67.3	67.4	67.4	67.5	67.4	67.4	1737	67.0	66.9
	Grassy Point	1749	68.8	68.8	68.8	68.7	68.6	68.6	1818	68.7	68.6
	Croton Point	1717	68.3	68.2	68.3	68.3	68.4	68.6	1724	68.1	68.2

(1) Surface to approximately -7 feet.

TABLE III-4

SCANNING AREA-AVERAGE AMBIENT
REFERENCE TEMPERATURES

Date	Tidal Phase	Area Average Temperature (°F) Bear Mtn Bridge	Grassy Point	Croton Point
September 27	First Ebb	69.1	71.4	70.5
	Low Water Slack	68.4	69.8	70.8
	Flood	68.4	70.2	70.7
	High Water Slack	69.1	70.9	70.3
	Second Ebb	68.7	70.6	71.5
September 28	First Ebb	68.1	69.4	70.4
	Low Water Slack	67.7	68.7	69.9
	Flood	67.8	69.2	70.1
	High Water Slack	68.6	69.7	70.4
	Second Ebb	68.2	69.7	70.2
September 29	First Ebb	67.8	69.1	69.3
	Low Water Slack	67.2	68.1	68.5
	Flood	67.3	68.5	68.7
	High Water Slack	67.9	68.8	69.1
	Second Ebb	67.4	68.7	68.4

TABLE III-5
LONGITUDINAL SCAN TRANSECT TEMPERATURES - INDIAN POINT REGION

TIDAL PHASE	SEPTEMBER 27 TEMPERATURE (°F)	SEPTEMBER 29 TEMPERATURE (°F)
First Ebb	69.5	68.0
Low Water Slack	68.8	67.5
Flood	69.6	69.0
High Water Slack	70.0	68.1

TABLE III-6

INDIAN POINT INTAKE AND DISCHARGE TEMPERATURES
SEPTEMBER 27, 1977

	Unit No. 2 Intakes			Unit No. 3 Intakes			Discharge Canal			
		Temperature (°F)			Temperature (°F)			Temperature (°F)		
Tidal Phase	Time	North Bay	South Bay	Time	North Bay	South Bay	Time	East Wall	Mid Canal	West Wall
First Ebb	0345	69.4	69.5	0412	70.4	69.9	0342	86.0	86.3	85.7
	0455	69.5	69.7	0442	69.4	69.5	0424	87.3	87.1	86.3
							0514	87.8	87.8	87.2
LWS	0648	69.2	69.1	0740	68.9	68.7	0651	89.0	88.5	87.6
	0811	(1)	68.7	0853	68.6	68.6	0741	88.2	88.1	86.6
							0831	88.1	87.7	86.5
Flood	0953	70.8	70.2	1030	71.5	70.8	0951	89.0	88.8	87.7
	1110	71.0	(1)	1153	71.0	70.9	1041	88.6	88.5	86.7
							1127	87.3	87.6	85.9
HWS	1129	70.9	(1)	1305	70.3	70.7	1229	87.4	86.8	86.1
	1351	70.4	70.4	1430	70.2	70.6	1319	87.2	86.9	84.1
							1409	87.3	85.9	83.7
Second Ebb	1600	70.5	70.2	1639	69.8	69.9	1600	87.6	87.4	84.0
							1655	87.3	87.0	83.7

Note: Intake temperatures above were obtained at the north and south bays of both units and are the average of the values obtained at the surface, bottom and approximately 1/4 depth, 1/2 depth and 3/4 depth. Discharge canal temperatures were obtained at one cross section at approximately the same depth intervals, near the west wall, east wall and mid channel.

(1) No temperature data taken due to obstruction.

TABLE III-7

INDIAN POINT INTAKE AND DISCHARGE TEMPERATURES
SEPTEMBER 28, 1977

	Unit No. 2 Intakes			Unit No. 3 Intakes			Discharge Canal			
		Temperature (°F)			Temperature (°F)			Temperature (°F)		
Tidal Phase	Time	North Bay	South Bay	Time	North Bay	South Bay	Time	East Wall	Mid Canal	West Wall
First Ebb	0420	68.7	68.7(1)	0503	68.7	68.7	0426	86.3	86.1	83.4
	0540	68.3	68.2(1)	0622	68.3	68.2	0511	85.9	85.9	84.0
							0612	86.2	85.8	85.0
LWS	0734	68.0	67.9	0813	67.9	67.9	0734	86.7	86.4	84.7
	0855	67.8	67.8	0928	67.8	67.8	0825	86.9	86.6	84.9
							0913	86.8	86.6	84.2
Flood	1025	69.1	68.9	1103	69.2	69.2	1031	87.9	87.6	86.4
	1145	69.7	69.3	1224	69.2	69.1	1114	88.2	87.8	87.0
							1206	88.2	88.0	87.3
HWS	1319	69.4	69.1	1354	70.4	70.1	1319	88.2	88.3	86.3
	1432	69.9	69.4	1512	69.2	69.2	1409	89.0	88.7	87.3
							1500	88.4	88.3	87.0
Second Ebb	1657	69.3	69.3	1726	69.2	69.2	1646	89.5	89.4	89.2
	1805	68.8	68.6	1842	68.6	68.7	1738	89.3	89.2	89.2
							1820	89.1	89.0	88.8

Note: Intake temperatures above were obtained at the north and south bays of both units and are the average of the values obtained at the surface, bottom and approximately 1/4 depth, 1/2 depth and 3/4 depth. Discharge canal temperatures were obtained at one cross section at approximately the same depth intervals, near the west wall, east wall and mid channel.

(1) Temperature data taken at surface and 4 foot depth only due to obstruction.

TABLE III-8

INDIAN POINT INTAKE AND DISCHARGE TEMPERATURES
SEPTEMBER 29, 1977

	Unit No. 2 Intakes			Unit No. 3 Intakes			Discharge Canal			
		Temperature (°F)			Temperature (°F)			Temperature (°F)		
Tidal Phase	Time	North Bay	South Bay	Time	North Bay	South Bay	Time	East Wall	Mid Canal	West Wall
First Ebb	0505	67.6	67.6	0550	66.3	66.2	0530	89.1	88.8	88.4
	0625	67.5	67.5	0703	67.6	67.6	0600	88.5	88.1	88.2
							0643	88.3	88.2	88.0
LWS	0814	67.5	67.5	0854	67.4	67.4	0814	88.1	88.0	87.8
	0934	67.3	67.4	1014	67.6	68.0	0904	88.0	87.7	87.4
							0954	88.0	87.7	87.2
Flood	1059	69.6	69.8	1139	68.7	68.6	1056	89.6	89.5	89.8
	1219	68.7	69.6	1250	69.4	69.4	1146	89.2	89.5	89.8
							1240	89.3	89.3	89.6
HWS	1410	69.8	69.4	1437	69.2	69.2	1411	89.9	89.9	90.1
	1517	69.7	69.3	1557	68.8	68.6	1446	89.7	89.8	90.2
							1541	89.5	89.7	89.7
Second Ebb	1728	68.6	69.8	1808	68.2	68.2	1728	88.9	88.8	88.6
							1821	88.5	88.5	88.3

Note: Intake temperatures above were obtained at the north and south bays of both units and are the average of the values obtained at the surface, bottom and approximately 1/4 depth, 1/2 depth and 3/4 depth. Discharge canal temperatures were obtained at one cross section at approximately the same depth intervals, near the west wall, east wall and mid channel.

TABLE III-9

PERCENTAGE WIDTHS AND CROSS-SECTIONAL AREAS
COMPARISON WITH NEW YORK STATE THERMAL CRITERIA
SEPTEMBER 28, 1977

	Width		Cross-Sectional Area	
Tidal Phase	Excess Temperature (°F)	Percentage Width (%)	Excess Temperature (°F)	Percentage Area (%)
First Ebb	4.0	12.0	4.0	5.8
Low Water Slack	4.0	14.7	4.0	7.7
Flood	4.0	14.3	4.0	8.6
High Water Slack	4.0	39.0	4.0	7.0
Second Ebb	4.0	12.2	4.0	3.7
New York State Thermal Criteria	4.0	66.7	4.0	50.0

TABLE III-10

AMBIENT TABULATION - INDIAN POINT REGION
SEPTEMBER 27, 1977

Tidal Phase	Surface Average Temperature (°F)	Upper Layer (3 Foot Depth) Average Temperature (°F)	Area-Average Average Temperature (°F)
First Ebb	67.3	67.4	67.3
Low Water Slack	66.9	66.9	66.9
Flood	67.2	67.1	67.1
High Water Slack	67.9	67.8	67.6
Second Ebb	68.9	68.9	68.8

TABLE III-11

AMBIENT TABULATION - INDIAN POINT REGION
SEPTEMBER 28, 1977

Tidal Phase	Surface Average Temperature (°F)	Upper Layer (3 Foot Depth) Average Temperature (°F)	Area-Average Average Temperature (°F)
First Ebb	67.9	68.1	68.1
Low Water Slack	67.9	68.0	68.0
Flood	68.3	68.3	68.1
High Water Slack	68.6	68.6	68.4
Second Ebb	68.2	68.3	68.3

TABLE III-12

AMBIENT TABULATION - INDIAN POINT REGION
SEPTEMBER 29, 1977

Tidal Phase	Surface Average Temperature (°F)	Upper Layer (3 Foot Depth) Average Temperature (°F)	Area-Average Average Temperature (°F)
First Ebb	67.7	67.7	67.8
Low Water Slack	67.6	67.6	67.6
Flood	67.6	67.5	67.5
High Water Slack	67.4	67.4	67.4
Second Ebb	67.4	67.4	67.4

TABLE III-13

CONDUCTIVITY MEASUREMENTS
SEPTEMBER 27, 1977

	Area-Average Conductivity (umho) x10²					Surface-Average Conductivity [1] (umho) x10²			
Tidal Phase	Croton Point[2]	Grassy Point[2]	Trans-mission Lines[3]	Dis-charge Canal[4]	Bear Mtn. Bridge[5]	Croton Point[2]	Grassy Point[2]	Trans-mission Lines[3]	Bear Mtn. Bridge[5]
First Ebb	42.17	20.30	5.76	6.57	4.18	34.96	18.02	7.88	4.20
LWS	32.46	5.94	3.84	4.00	2.90	29.92	5.58	3.76	2.89
Flood	33.86	14.54	6.02	5.48	2.89	26.05	13.38	4.91	2.88
HWS	43.72	17.54	10.52	6.28	3.71	41.22	13.56	8.76	3.70
Second Ebb	35.40	13.99	4.66	4.99	3.20	31.11	9.43	4.66	3.27

1 Surface to approximately -7 feet
2 Measurements conducted at four lateral locations
3 Measurements conducted at three lateral locations
4 Average of discharge canal measurements
5 Measurements conducted at two lateral locations

TABLE III-14

CONDUCTIVITY MEASUREMENTS
SEPTEMBER 28, 1977

	Area-Average Conductivity (umho) x10²					Surface-Average Conductivity [1] (umho) x10²			
Tidal Phase	Croton Point[2]	Grassy Point[2]	Trans-mission Lines[3]	Dis-charge Canal[4]	Bear Mtn. Bridge[5]	Croton Point[2]	Grassy Point[2]	Trans-mission Lines[3]	Bear Mtn. Bridge[5]
First Ebb	23.74	5.18	2.90	4.66	2.83	19.01	4.85	2.88	2.80
LWS	11.48	3.99	2.62	2.80	2.51	8.86	3.32	2.69	2.51
Flood	16.29	4.12	3.11	3.05	2.52	10.76	4.16	3.20	2.51
HWS	25.86	5.37	3.89	3.54	2.77	22.78	4.99	3.68	2.76
Second Ebb	16.79	4.02	3.48	3.18	2.69	14.13	3.74	3.41	2.68

1 Surface to approximately -7 feet
2 Measurements conducted at four lateral locations
3 Measurements conducted at three lateral locations
4 Average of discharge canal measurements
5 Measurements conducted at two lateral locations

TABLE III-15

CONDUCTIVITY MEASUREMENTS
SEPTEMBER 29, 1977

Tidal Phase	Area-Average Conductivity (umho) x10²					Surface-Average Conductivity [1] (umho) x10²			
	Croton Point[2]	Grassy Point[2]	Trans-mission Lines[3]	Dis-charge Canal[4]	Bear Mtn. Bridge[5]	Croton Point[2]	Grassy Point[2]	Trans-mission Lines[3]	Bear Mtn. Bridge[5]
First Ebb	12.32	3.07	2.58	2.74	2.62	10.97	3.06	2.53	2.61
LWS	4.24	2.57	2.49	2.57	2.49	4.21	2.53	2.57	2.50
Flood	7.27	2.79	2.52	2.64	2.50	7.17	2.88	2.53	2.50
HWS	15.39	3.15	2.76	2.74	2.57	14.57	3.12	2.69	2.57
Second Ebb	8.00	2.73	2.68	2.65	2.53	6.93	2.69	2.69	2.53

[1] Surface to approximately -7 feet
[2] Measurements conducted at four lateral locations
[3] Measurements conducted at three lateral locations
[4] Average of discharge canal measurements
[5] Measurements conducted at two lateral locations

TABLE IV-1

COMPARISON OF PHYSICAL CHARACTERISTICS OF
4°F EXCESS TEMPERATURE ISOTHERMS FOR SEPTEMBER 28, 1977

	First Ebb		Low Water Slack	
	Field Data	Model Prediction	Field Data	Model Prediction
A. Most Severe Lateral Width, ft (%of River dimension)[1]	600 (12.0%)	500 (11.8%)	750 (14.7%)	1,000 (19.6%)
B. Most Severe Cross Section Area, ft^2 (%of River dimension)[2]	9,300 (5.8%)	9,500 (5.9%)	12,400 (7.7%)	16,000 (10.0%)
C. Plume Centerline Length, ft	1,700	2,200	1,000	1,200
D. River Surface Area, ft^2	580,000	780,000	400,000	580,000

1 NYS Thermal Criteria states that a maximum of 67% of the lateral surface width may be raised 4° F over the temperature that existed before the addition of heat of artificial origin, or to a maximum of 83°F, whichever is less.

2 NYS Thermal Criteria states that a maximum of 50% of the cross sectional area or volume of flow may be raised 4°F over the temperature that existed before the addition of heat of artificial origin, or to a maximum of 83°F, whichever is less.

TABLE IV-I (Continued)

COMPARISON OF PHYSICAL CHARACTERISTICS OF
4°F EXCESS TEMPERATURE ISOTHERMS FOR SEPTEMBER 28, 1977

	Flood		High Water Slack	
	Field Data	Model Prediction	Field Data	Model Prediction
A. Most Severe Lateral Width, ft (% of River dimension)[1]	700 (14.3%)	1,000 (20.4%)	1,800 (39.0%)	1,100 (22.0%)
B. Most Severe Cross Section Area, ft^2 (% of River dimension)[2]	13,800 (8.6%)	19,300 (12.0%)	11,200 (7.0%)	7,000 (4.5%)
C. Plume Centerline Length, ft	1,450	1,700	2,400	1,500
D. River Surface Area, ft^2	350,000	620,000	2,080,000	620,000

1 NYS Thermal Criteria states that a maximum of 67% of the lateral surface width may be raised 4°F over the temperature that existed before the addition of heat of artificial origin, or to a maximum of 83°F, whichever is less.

2 NYS Thermal Criteria states that a maximum of 50% of the cross sectional area or volume of flow may be raised 4°F over the temperature that existed before the addition of heat of artificial origin, or to a maximum of 83°F, whichever is less.

TABLE IV-1 (Continued)

COMPARISON OF PHYSICAL CHARACTERISTICS OF
4°F EXCESS TEMPERATURE ISOTHERMS FOR SEPTEMBER 28, 1977

	Second Ebb	
	Field Data	Model Prediction
A. Most Severe Lateral Width, ft (%of River dimension)[1]	550 (12.2%)	600 (12.0%)
B. Most Severe Cross Section Area, ft^2 (%of River dimension)[2]	6,000 (3.7%)	6,200 (3.8%)
C. Plume Centerline Length, ft	2,500	3,000
D. River Surface Area, ft^2	1,080,000	1,200,000

1 NYS Thermal Criteria states that a maximum of 67% of the lateral surface width may be raised 4°F over the temperature that existed before the addition of hear of artificial origin, or to a maximum of 83°F, whichever is less.

2 NYS Thermal Criteria states that a maximum of 50% of the cross sectional area or volume of flow may be raised 4°F over the temperature that existed before the addition of heat of artificial origin, or to a maximum of 83°F, whichever is less.

FIGURES

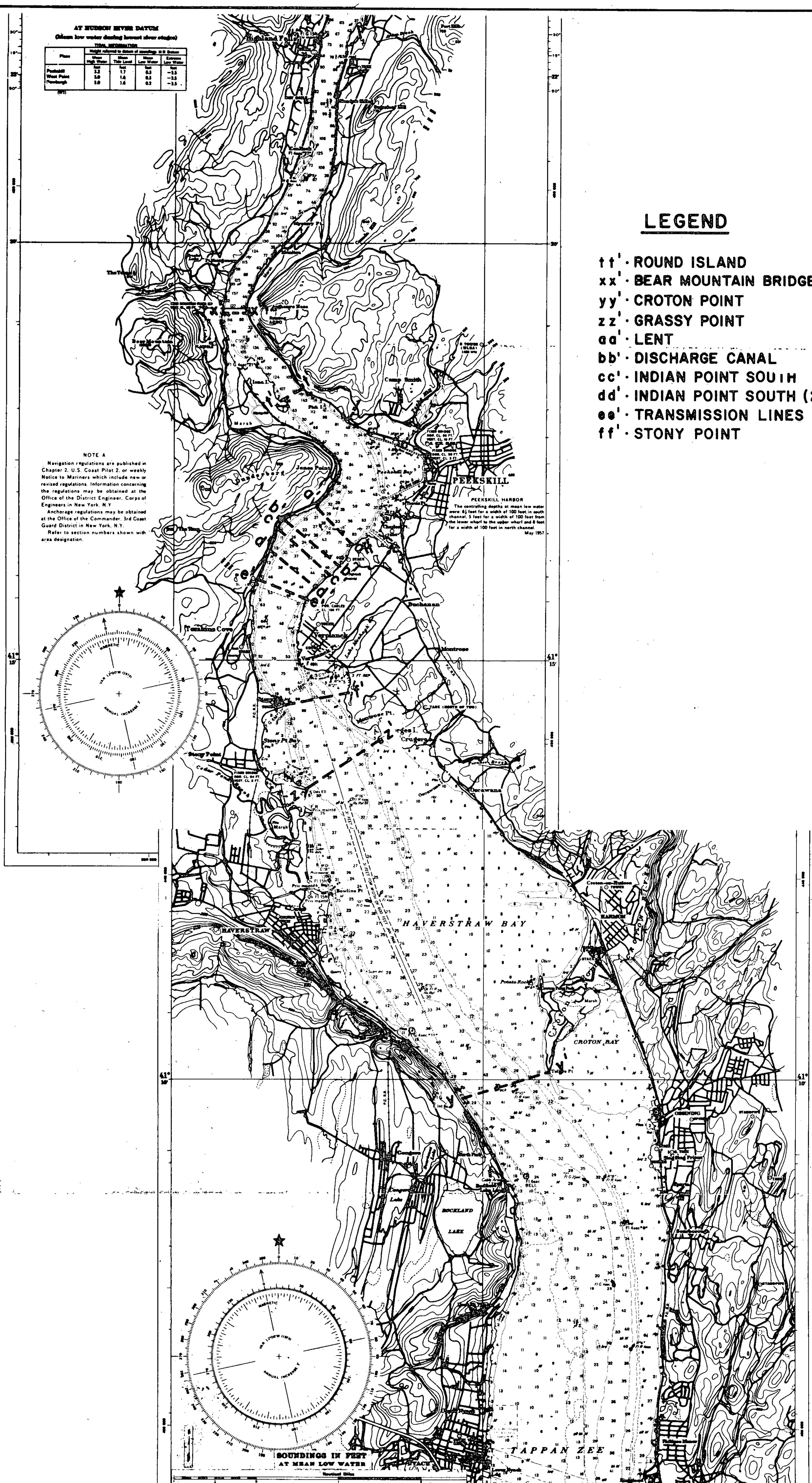
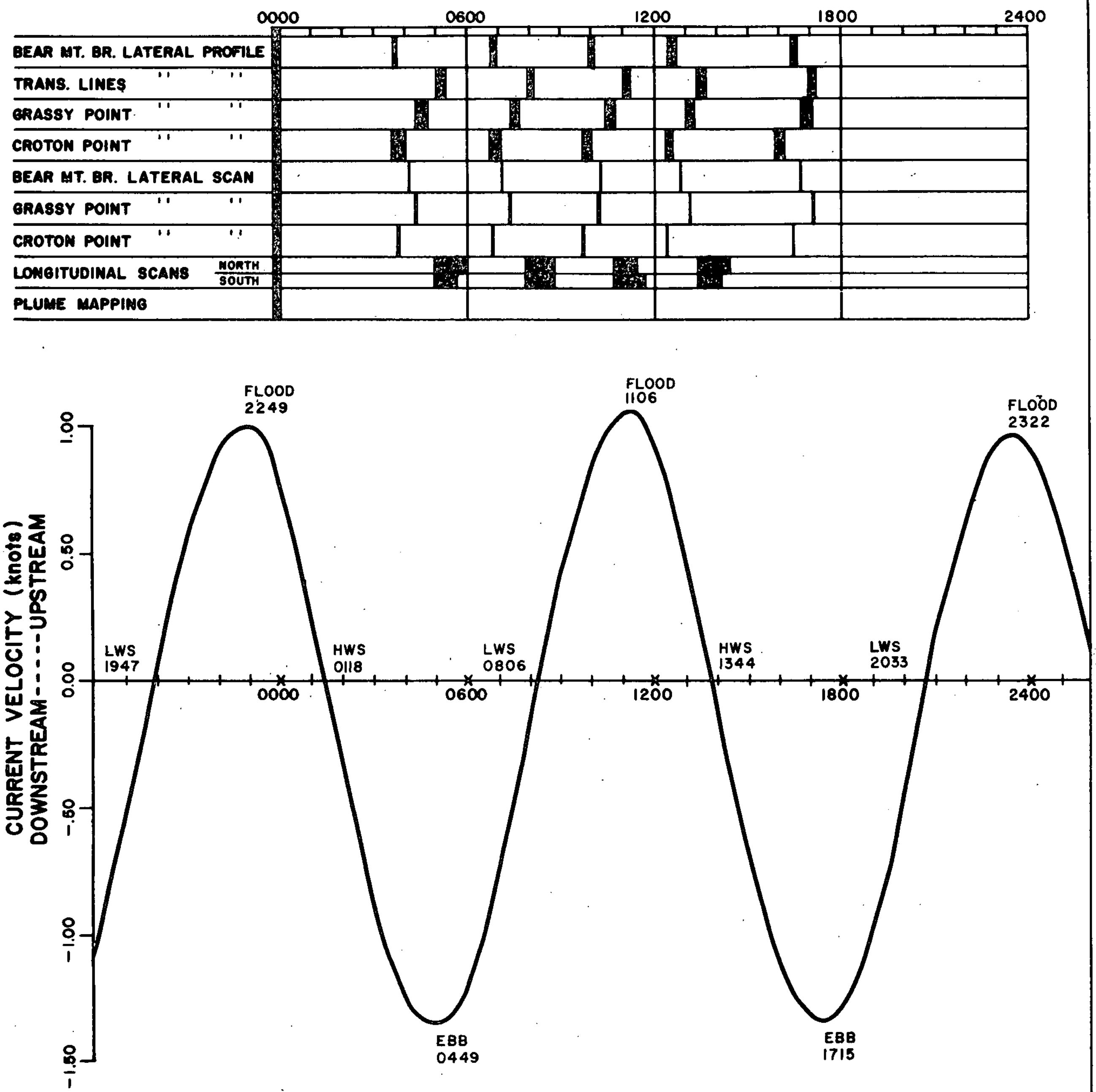


FIGURE II-1

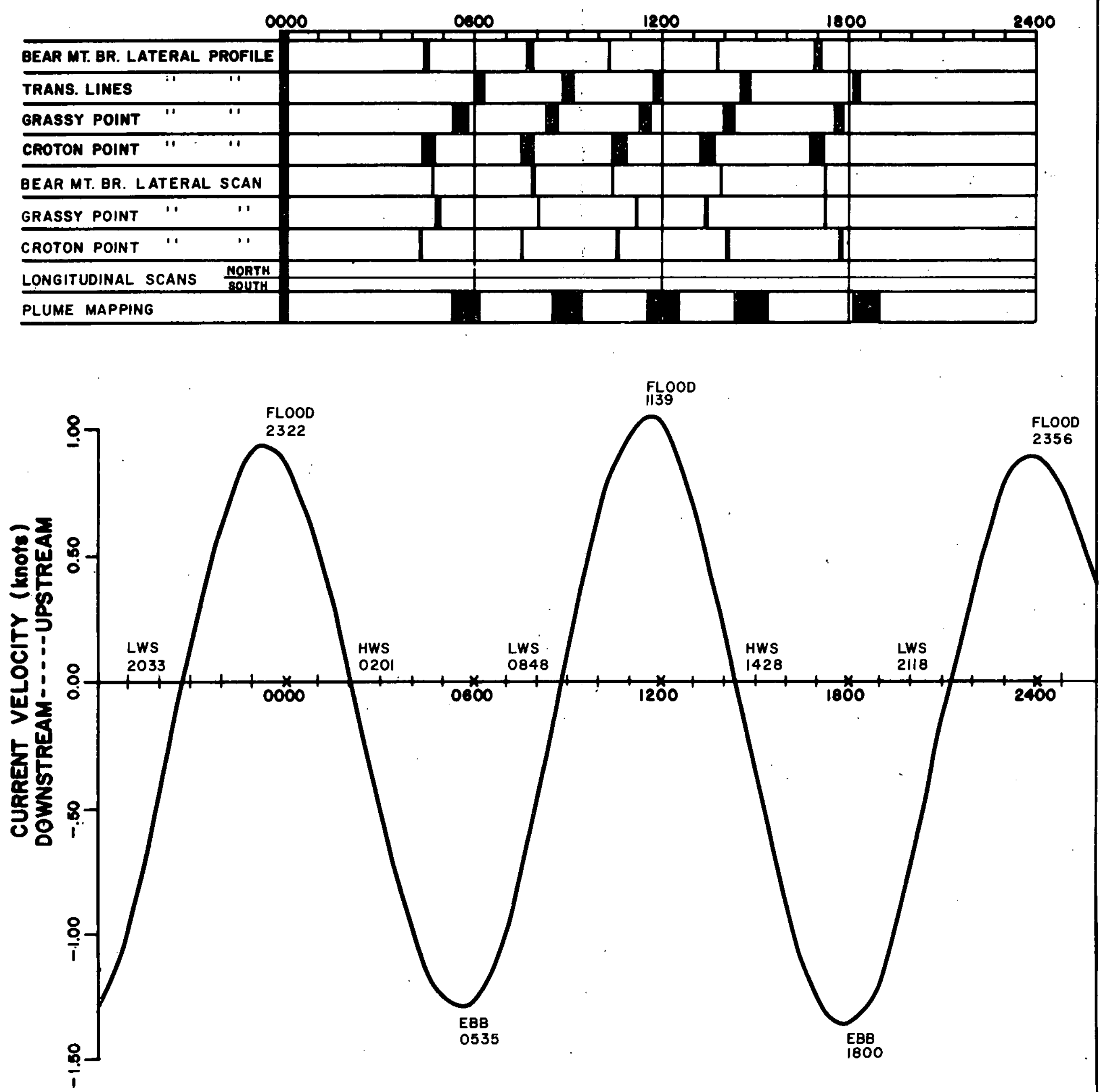
LOCATION OF AMBIENT REFERENCE TRANSECTS AND CROSS-SECTIONAL PATTERNS



TIDAL CURRENT AND TIME SEQUENCE
OF CONDUCTIVITY AND TEMPERATURE MEASUREMENTS
SEPTEMBER 27, 1977

REF: TIDAL CURRENT TABLES, 1977
ATLANTIC COAST OF NORTH
AMERICA [AT PEEKSKILL] NOAA

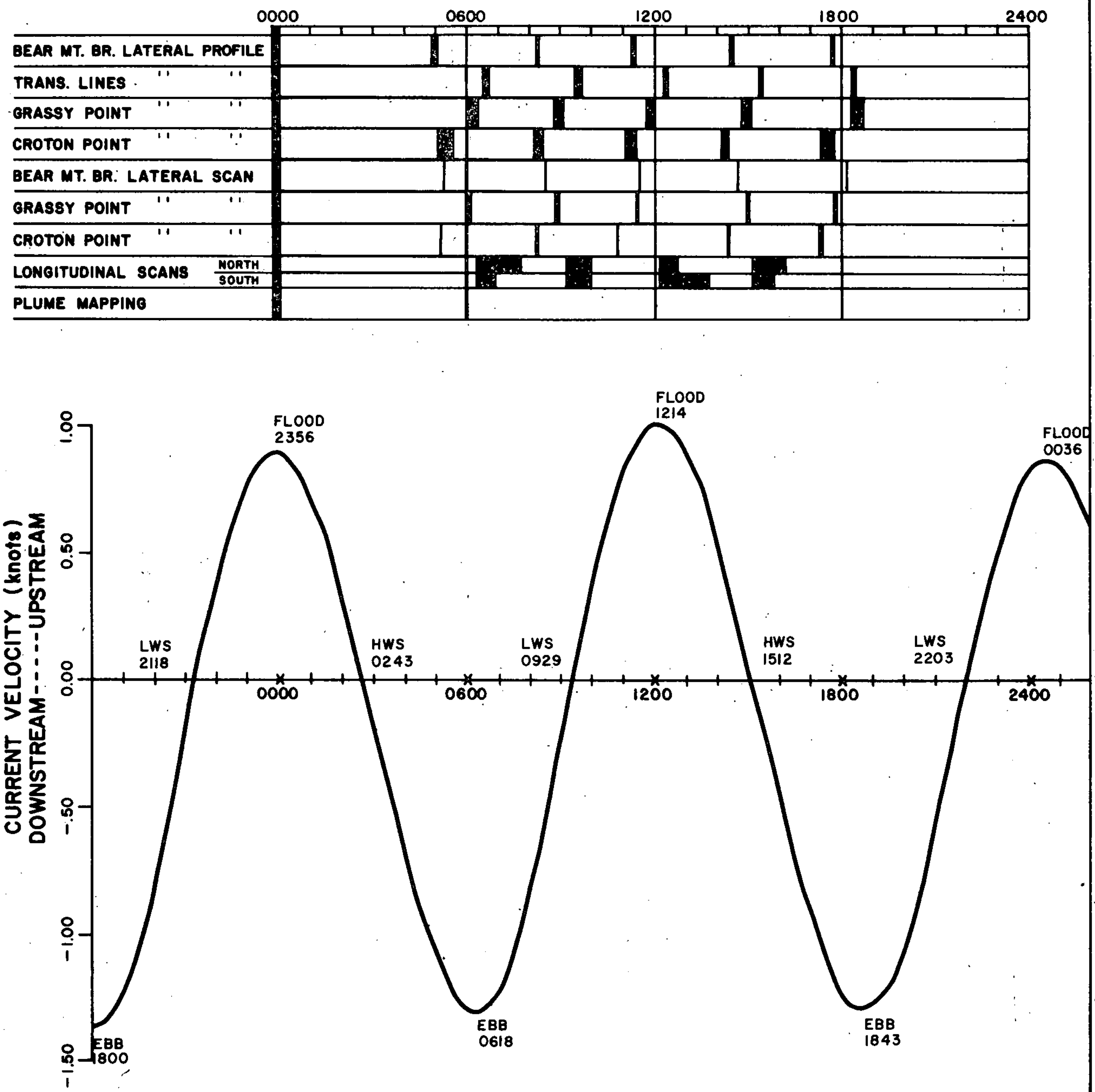
FIGURE II-2



TIDAL CURRENT AND TIME SEQUENCE
OF CONDUCTIVITY AND TEMPERATURE PROFILE MEASUREMENTS
SEPTEMBER 28, 1977

REF: TIDAL CURRENT TABLES, 1977
ATLANTIC COAST OF NORTH
AMERICA [AT PEEKSKILL] NOAA

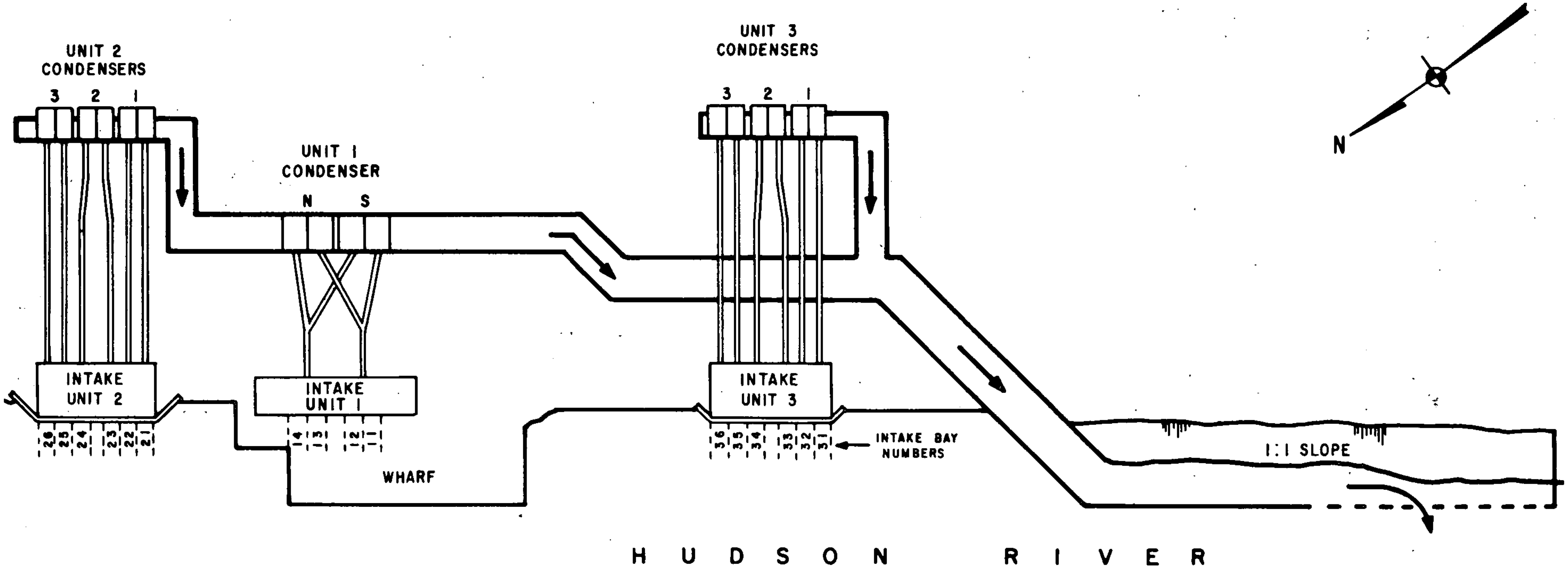
FIGURE II-3



TIDAL CURRENT AND TIME SEQUENCE
OF CONDUCTIVITY AND TEMPERATURE MEASUREMENTS
SEPTEMBER 29, 1977

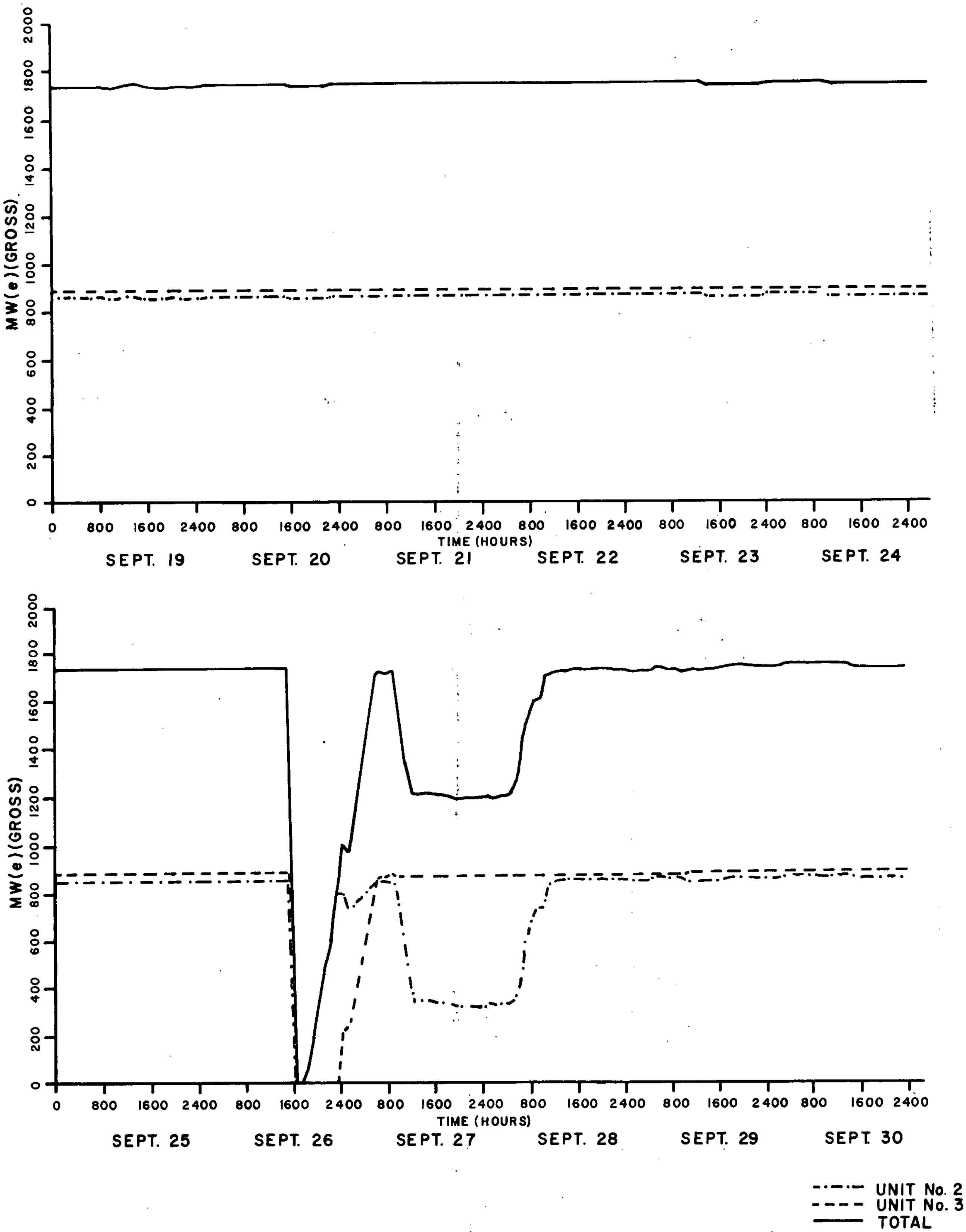
REF: TIDAL CURRENT TABLES, 1977
ATLANTIC COAST OF NORTH
AMERICA [AT PEEKSKILL] NOAA

FIGURE II-4



INDIAN POINT STATION
CIRCULATING WATER SYSTEM

FIGURE II-5



INDIAN POINT STATION ELECTRICAL GENERATION
SEPTEMBER 19 - SEPTEMBER 30, 1977

FIGURE II-6

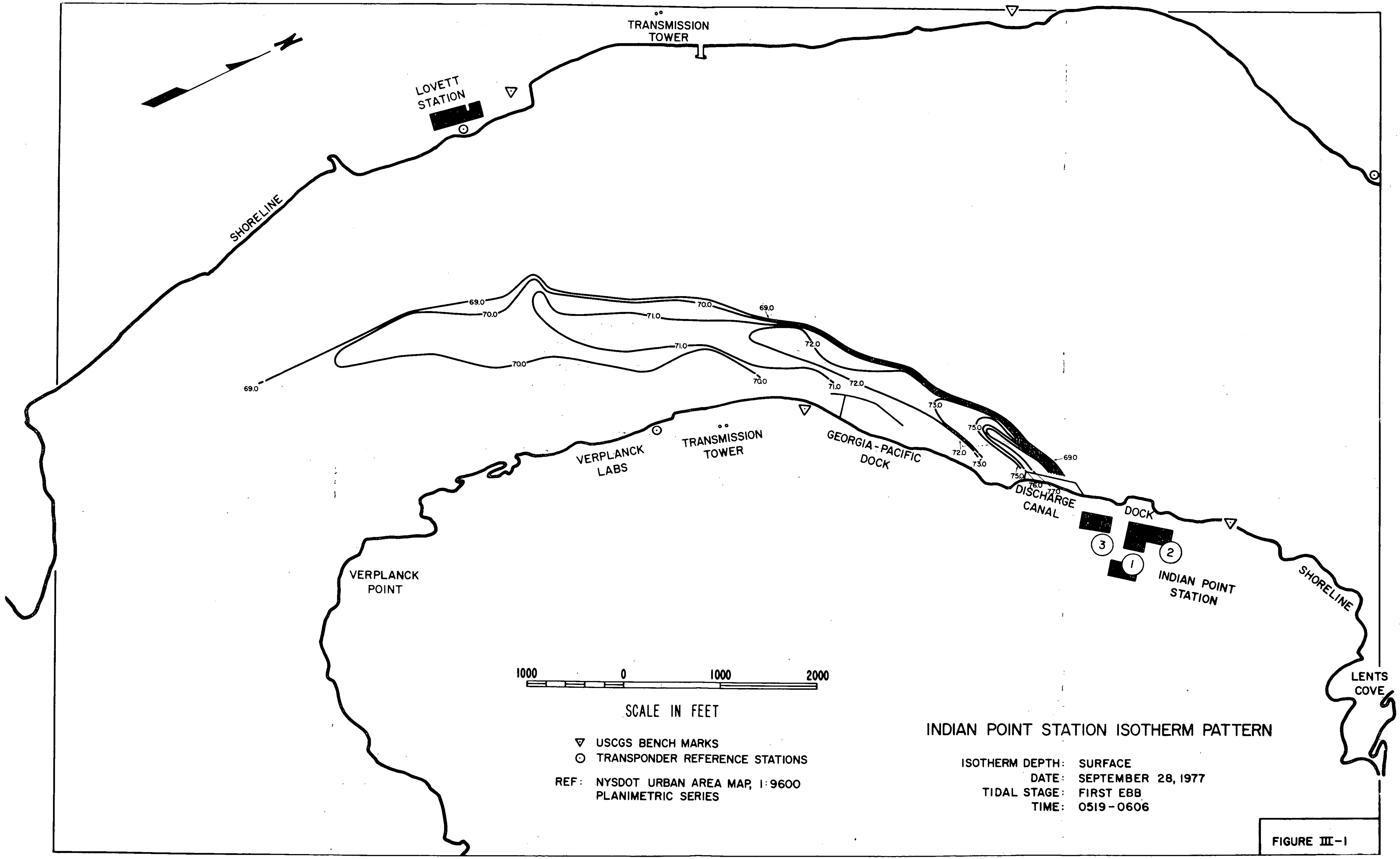

TRANSMISSION TOWER
LOVETT STATION
SHORELINE
69.0
70.0
71.0
72.0
73.0
75.0
76.0
77.0
VERPLANCK LABS
TRANSMISSION TOWER
GEORGIA-PACIFIC DOCK
DISCHARGE CANAL
DOCK
3
2
1
INDIAN POINT STATION
SHORELINE
VERPLANCK POINT
LENTS COVE
1000
0
1000
2000
SCALE IN FEET
USCGS BENCH MARKS
TRANSPONDER REFERENCE STATIONS
REF: NYSDOT URBAN AREA MAP, 1:9600 PLANIMETRIC SERIES
INDIAN POINT STATION ISOTHERM PATTERN
ISOTHERM DEPTH: SURFACE
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FIRST EBB
TIME: 0519-0606

FIGURE III-1

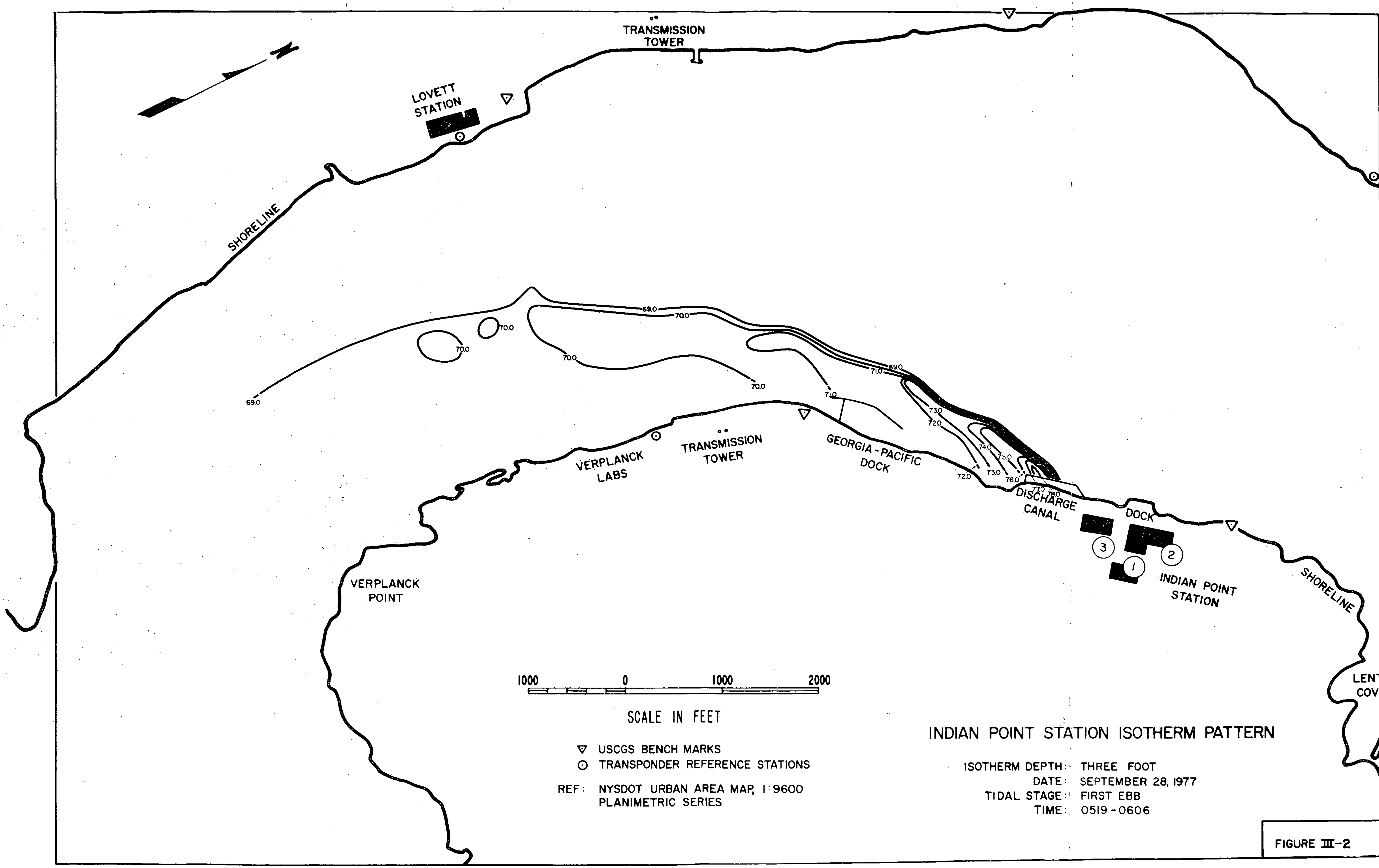

TRANSMISSION TOWER
LOVETT STATION
SHORELINE
69.0
70.0
71.0
72.0
73.0
74.0
75.0
76.0
77.0
78.0
VERPLANCK LABS
TRANSMISSION TOWER
GEORGIA-PACIFIC DOCK
DISCHARGE CANAL
DOCK
3
2
1
INDIAN POINT STATION
SHORELINE
VERPLANCK POINT
LENTS COVE
1000
0
1000
2000
SCALE IN FEET
USCGS BENCH MARKS
TRANSPONDER REFERENCE STATIONS
REF: NYSDOT URBAN AREA MAP, 1:9600 PLANIMETRIC SERIES
INDIAN POINT STATION ISOTHERM PATTERN
ISOTHERM DEPTH: THREE FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FIRST EBB
TIME: 0519-0606

FIGURE III-2

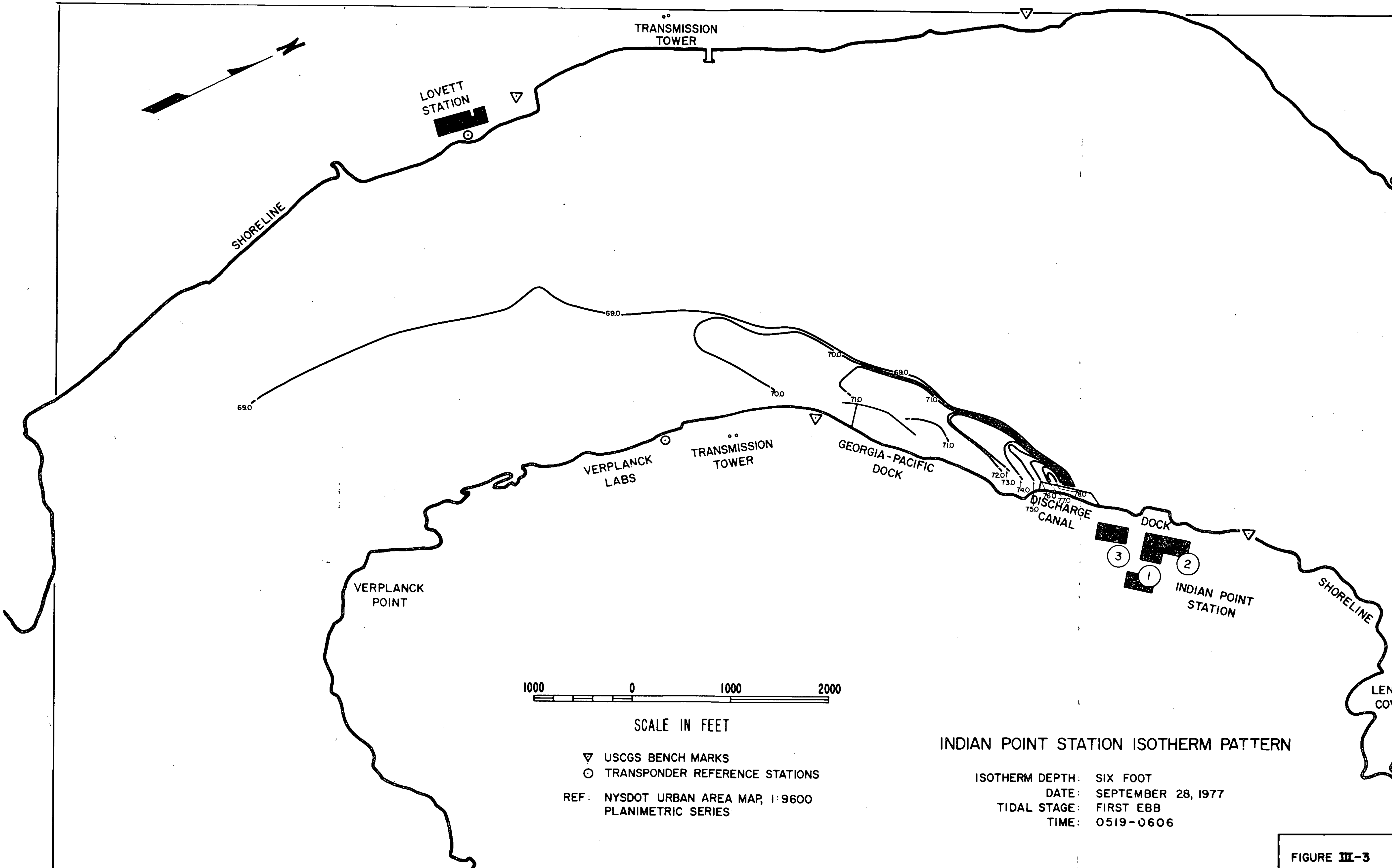
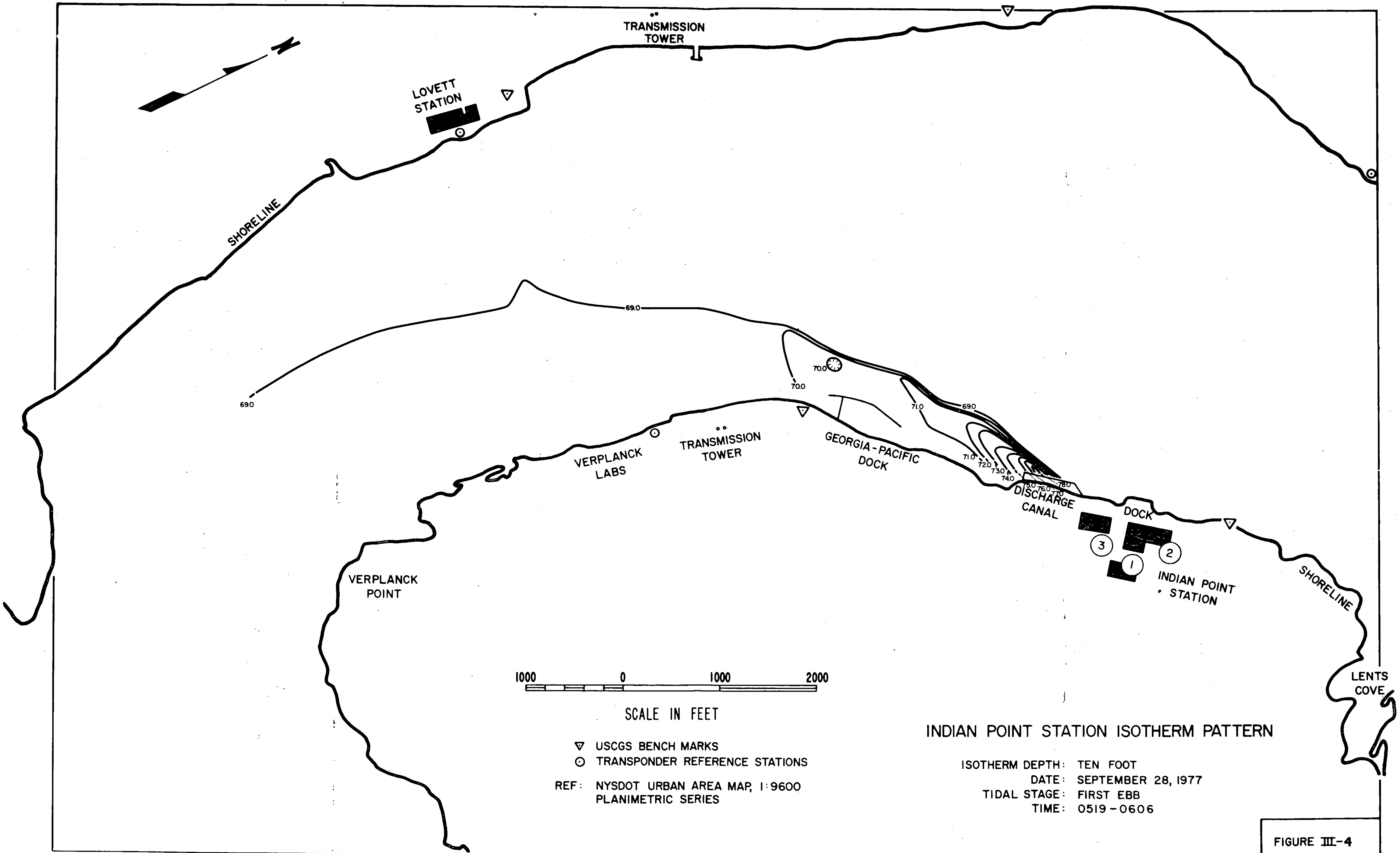

TRANSMISSION TOWER
LOVETT STATION
SHORELINE
69.0
70.0
69.0
71.0
72.0
73.0
74.0
75.0
76.0
77.0
78.0
VERPLANCK LABS
TRANSMISSION TOWER
GEORGIA-PACIFIC DOCK
DISCHARGE CANAL
DOCK
3
2
1
INDIAN POINT STATION
SHORELINE
VERPLANCK POINT
LENTS COVE
1000 0 1000 2000
SCALE IN FEET
USCGS BENCH MARKS
TRANSPONDER REFERENCE STATIONS
REF: NYSDOT URBAN AREA MAP, 1:9600 PLANIMETRIC SERIES
INDIAN POINT STATION ISOTHERM PATTERN
ISOTHERM DEPTH: SIX FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FIRST EBB
TIME: 0519-0606

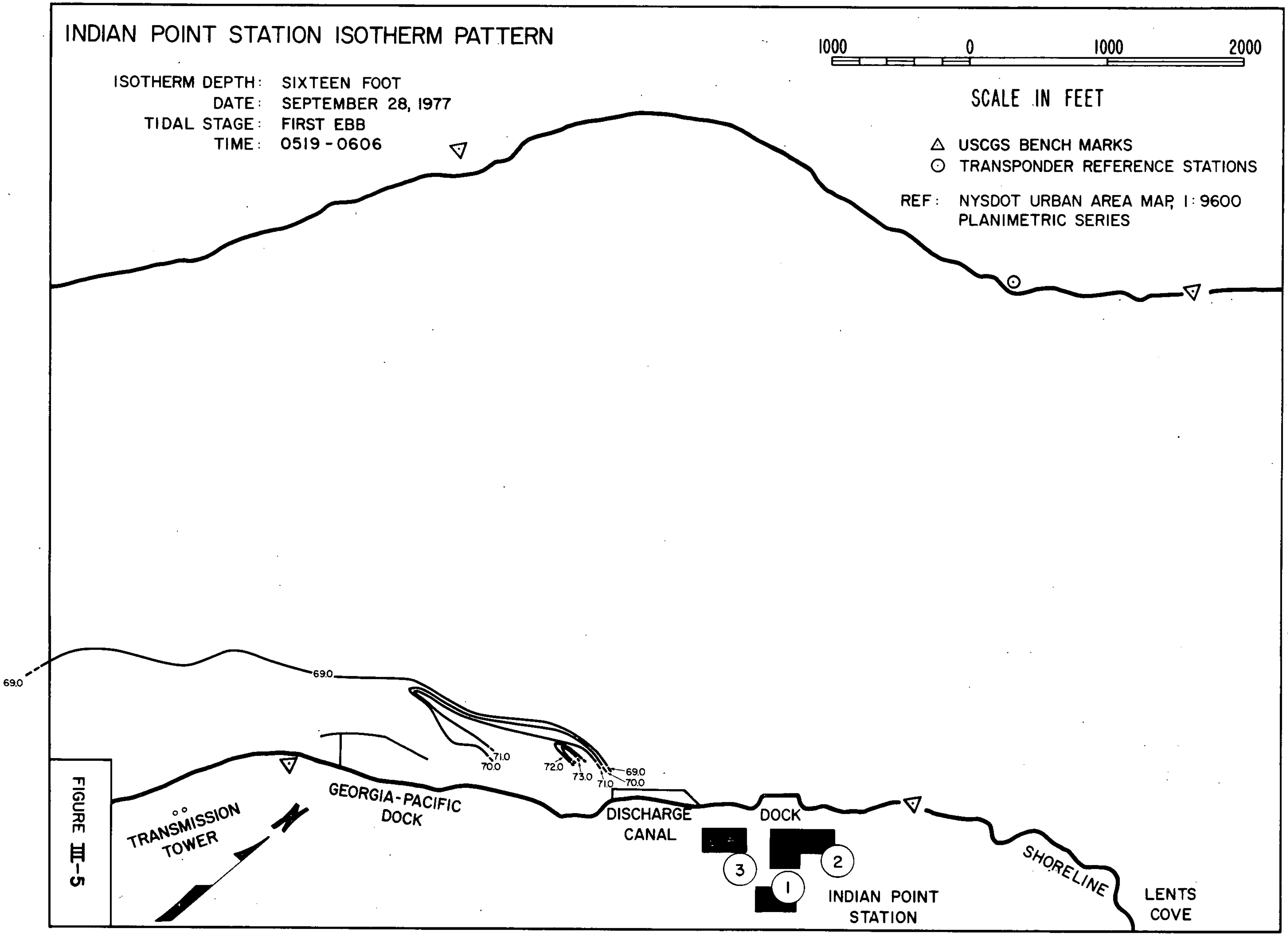
FIGURE III-3



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: TEN FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FIRST EBB
TIME: 0519-0606

FIGURE III-4



INDIAN POINT STATION ISOTHERM PATTERN
ISOTHERM DEPTH: SIXTEEN FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FIRST EBB
TIME: 0519 - 0606
1000 0 1000 2000
SCALE IN FEET
USCGS BENCH MARKS
TRANSPONDER REFERENCE STATIONS
REF: NYSDOT URBAN AREA MAP, 1:9600
PLANIMETRIC SERIES
69.0
69.0
71.0
70.0
72.0
73.0
71.0
69.0
70.0
TRANSMISSION TOWER
GEORGIA-PACIFIC DOCK
DISCHARGE CANAL
DOCK
3
2
1
INDIAN POINT STATION
SHORELINE
LENTS COVE

FIGURE III-5

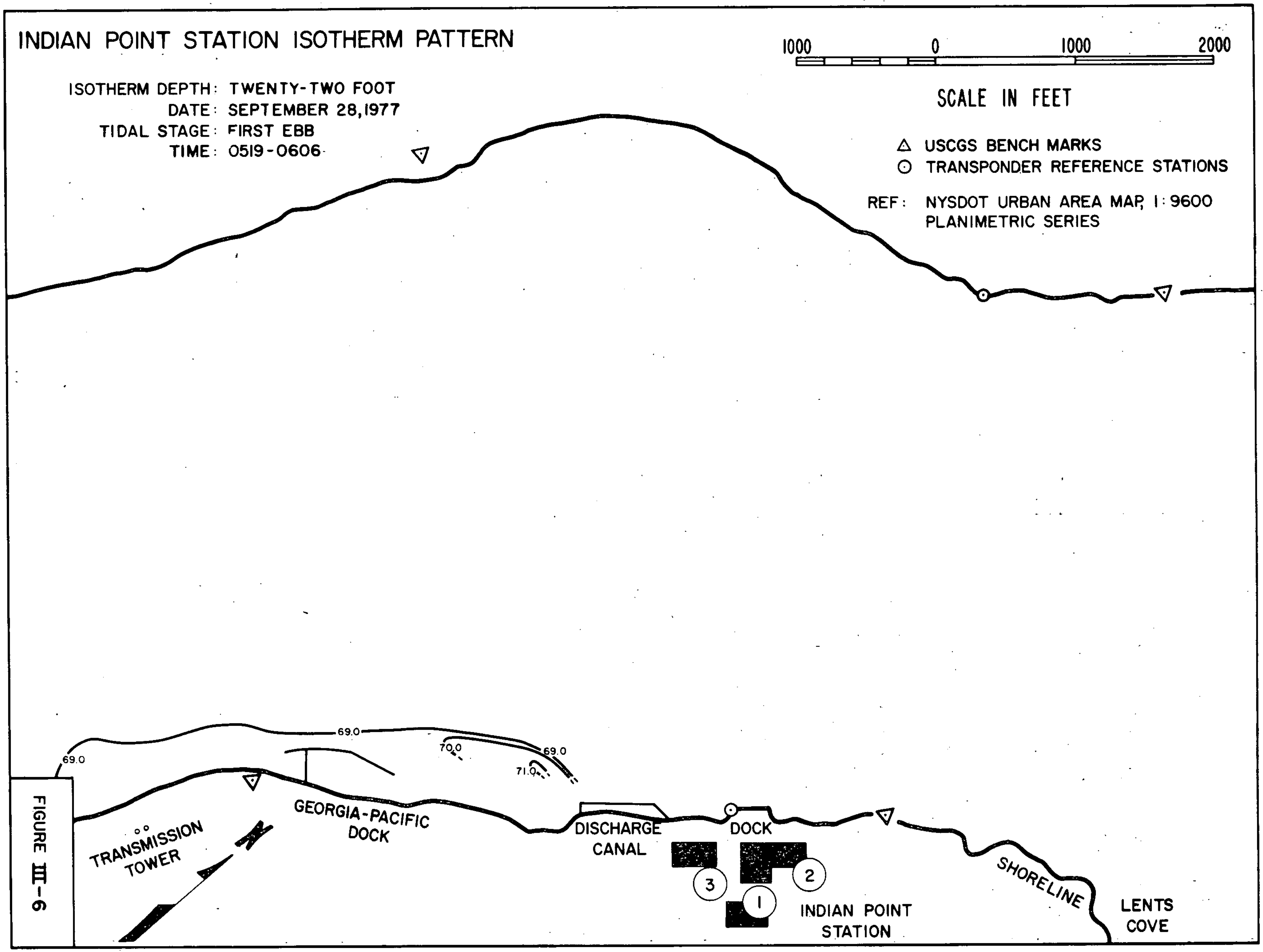

INDIAN POINT STATION ISOTHERM PATTERN
ISOTHERM DEPTH: TWENTY-TWO FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FIRST EBB
TIME: 0519-0606
1000
0
1000
2000
SCALE IN FEET
USCGS BENCH MARKS
TRANSPONDER REFERENCE STATIONS
REF: NYSDOT URBAN AREA MAP, 1:9600
PLANIMETRIC SERIES
69.0
69.0
70.0
69.0
71.0
TRANSMISSION
TOWER
GEORGIA-PACIFIC
DOCK
DISCHARGE
CANAL
DOCK
3
2
1
INDIAN POINT
STATION
SHORELINE
LENTS
COVE

FIGURE III-6

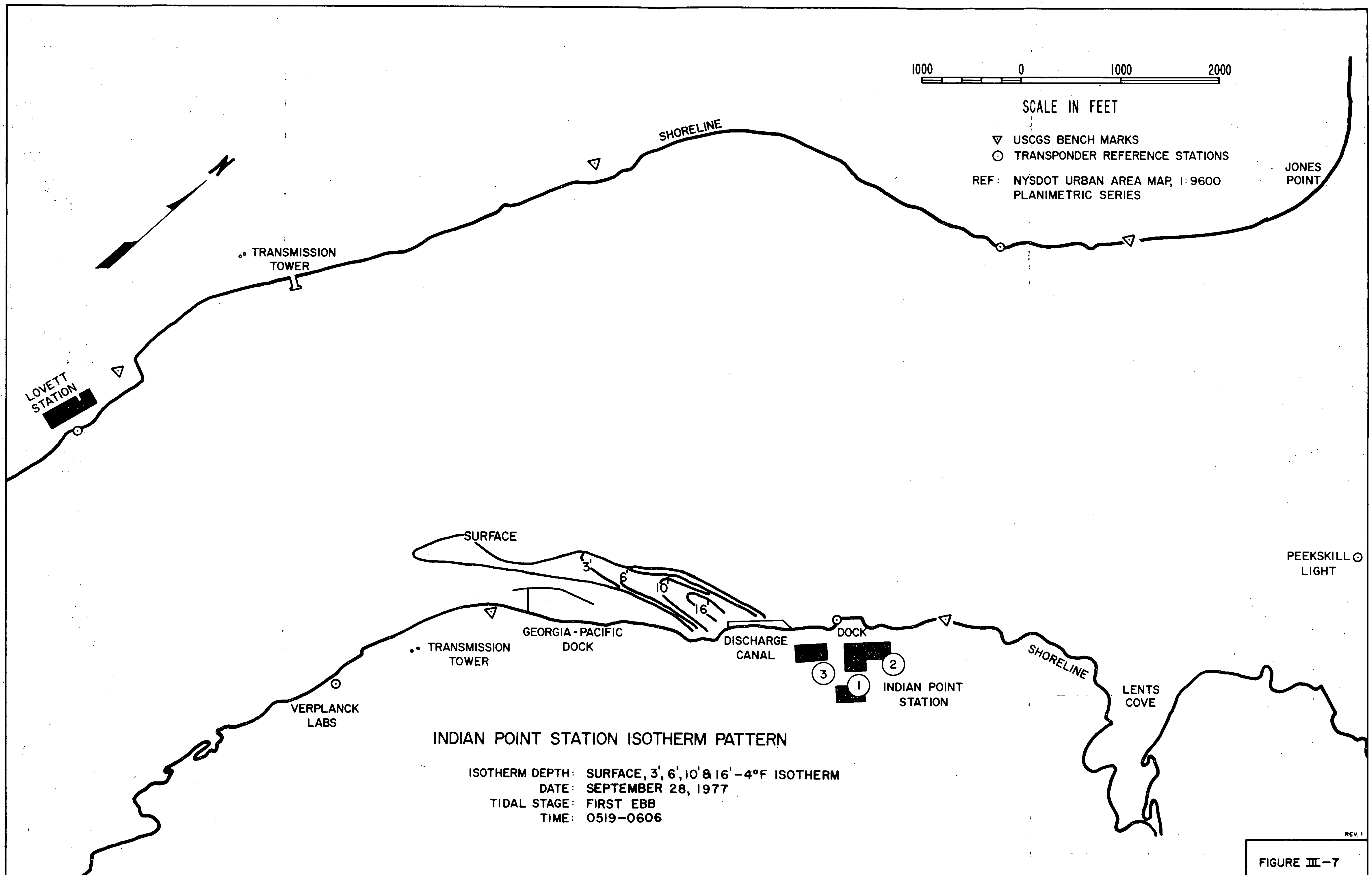
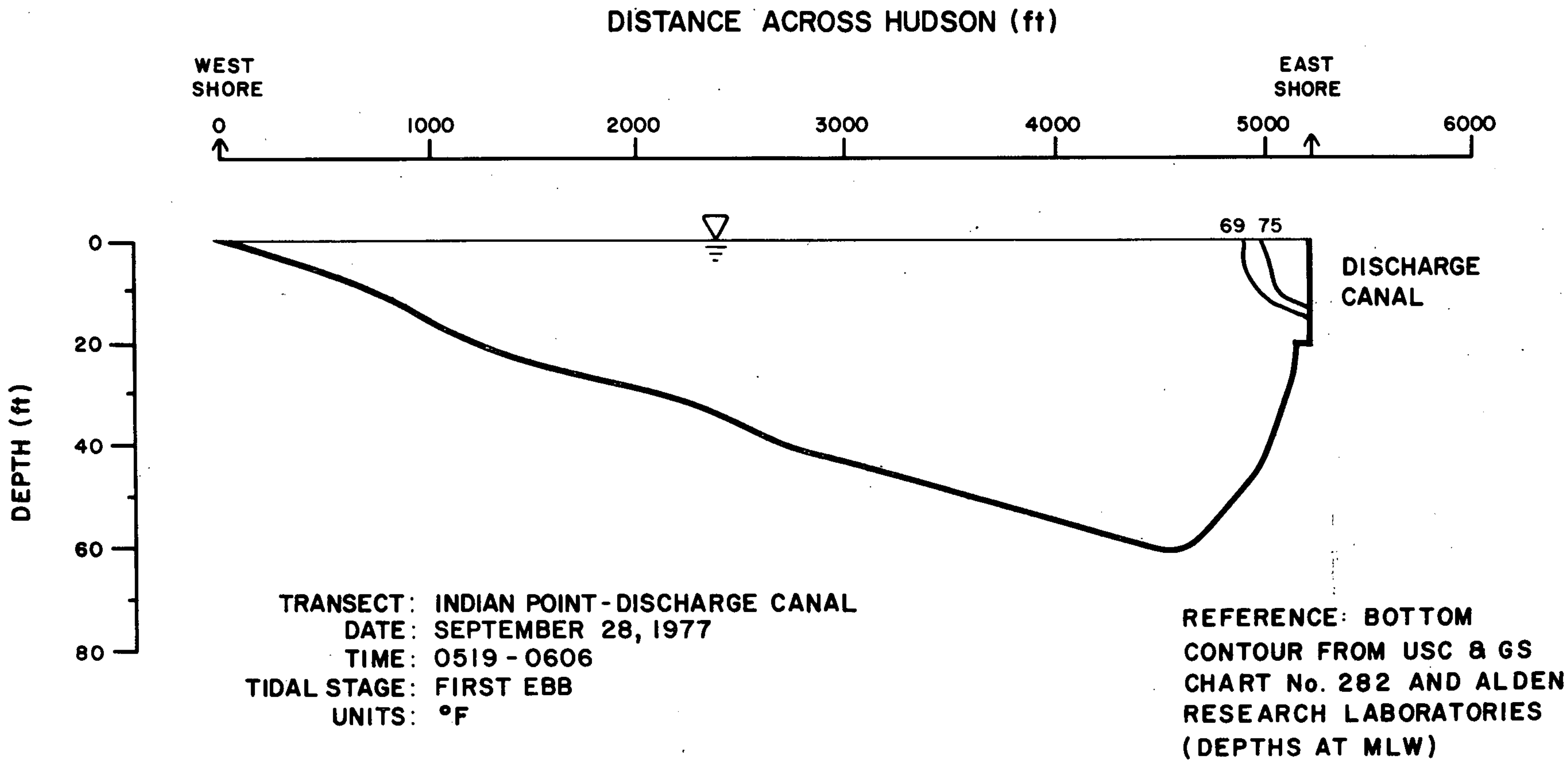
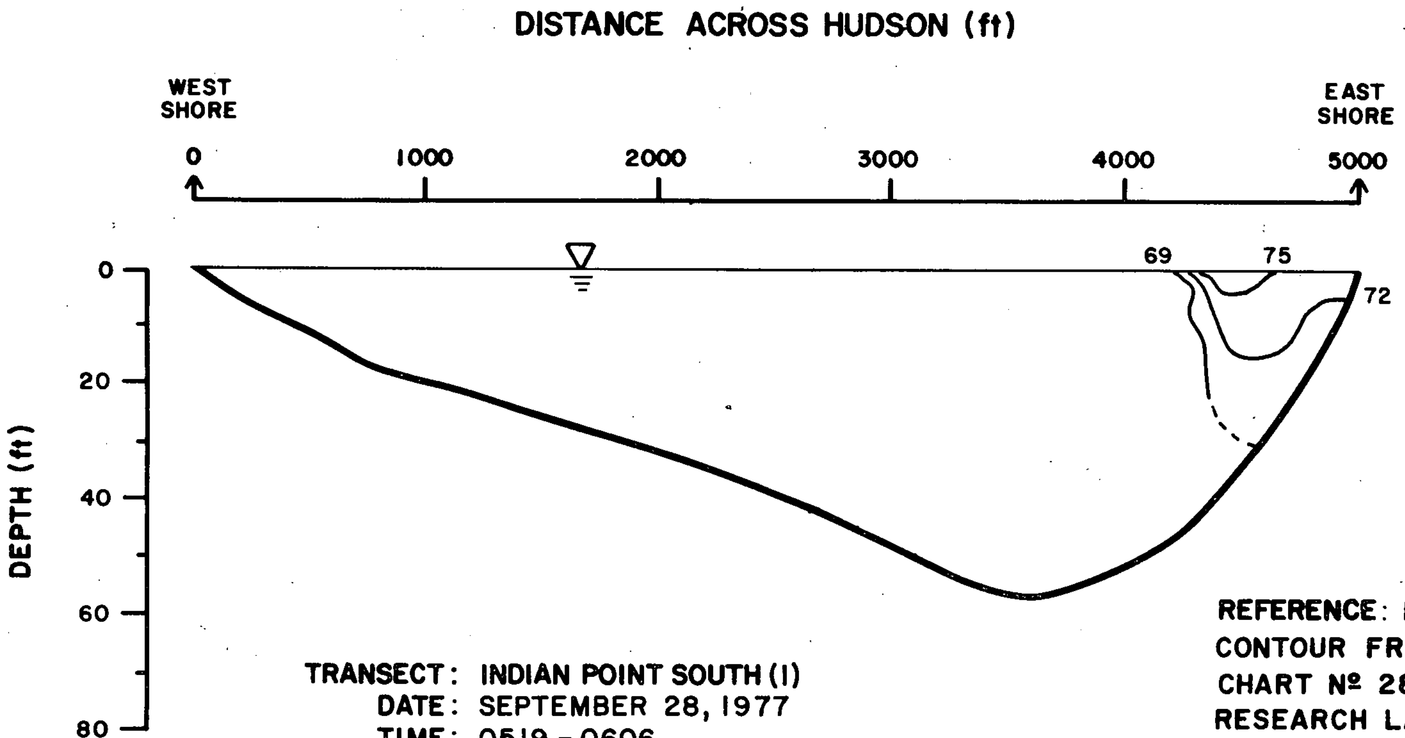

1000 0 1000 2000
SCALE IN FEET
USCGS BENCH MARKS
TRANSPONDER REFERENCE STATIONS
REF: NYSDOT URBAN AREA MAP, 1:9600 PLANIMETRIC SERIES
SHORELINE
JONES POINT
TRANSMISSION TOWER
LOVETT STATION
SURFACE
3'
6'
10'
16'
PEEKSKILL LIGHT
GEORGIA-PACIFIC DOCK
TRANSMISSION TOWER
DISCHARGE CANAL
DOCK
3
2
1
INDIAN POINT STATION
SHORELINE
LENTS COVE
VERPLANCK LABS
INDIAN POINT STATION ISOTHERM PATTERN
ISOTHERM DEPTH: SURFACE, 3', 6', 10' & 16' - 4°F ISOTHERM
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FIRST EBB
TIME: 0519-0606
REV. 1

FIGURE III-7



CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT-DISCHARGE CANAL:
FIRST EBB

FIGURE III-8

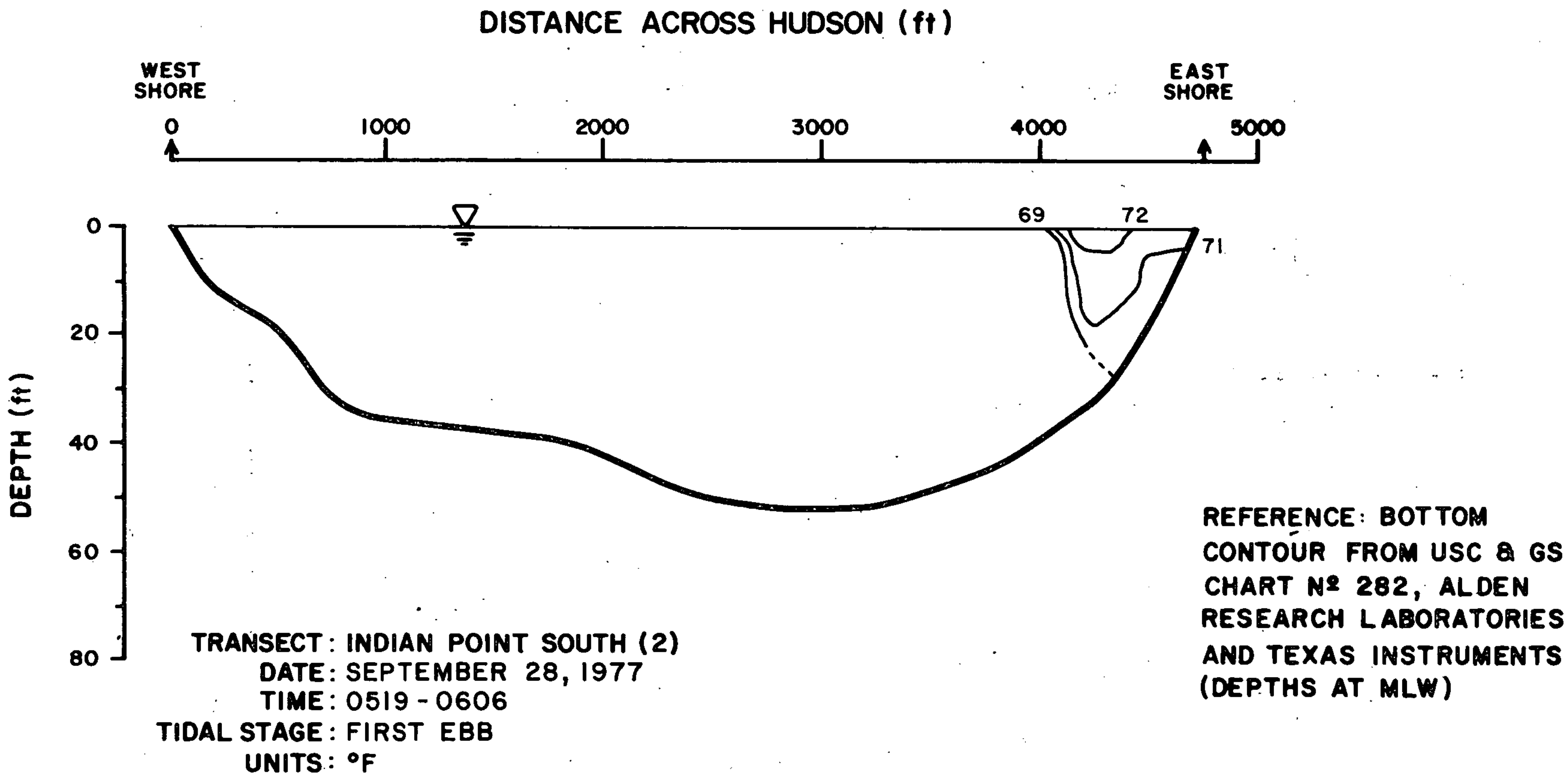


TRANSECT: INDIAN POINT SOUTH (I)
DATE: SEPTEMBER 28, 1977
TIME: 0519 - 0606
TIDAL STAGE: FIRST EBB
UNITS: °F

REFERENCE: BOTTOM CONTOUR FROM USC & GS CHART № 282 AND ALDEN RESEARCH LABORATORIES (DEPTHS AT MLW)

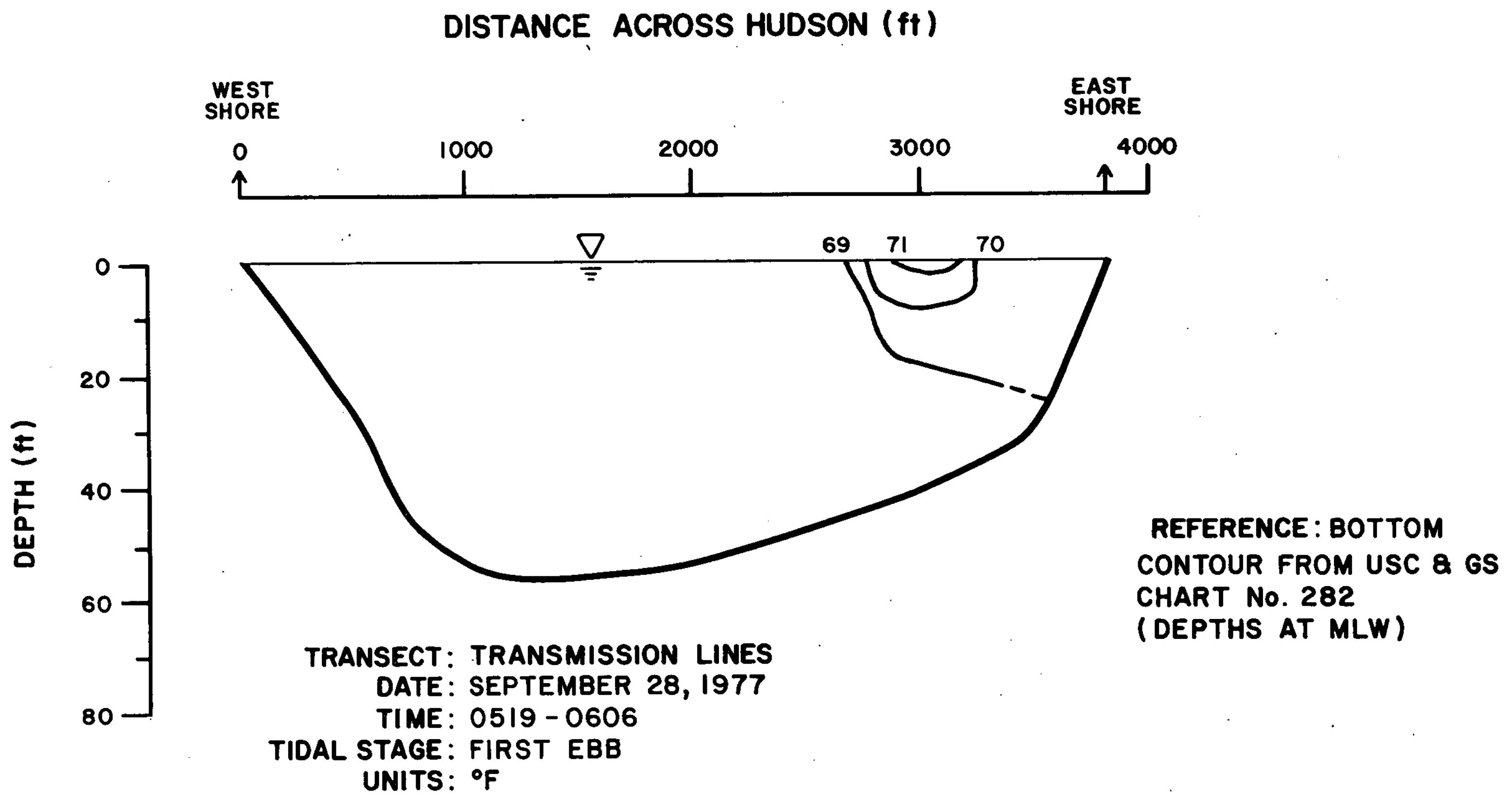
CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (I):
FIRST EBB

FIGURE III - 9



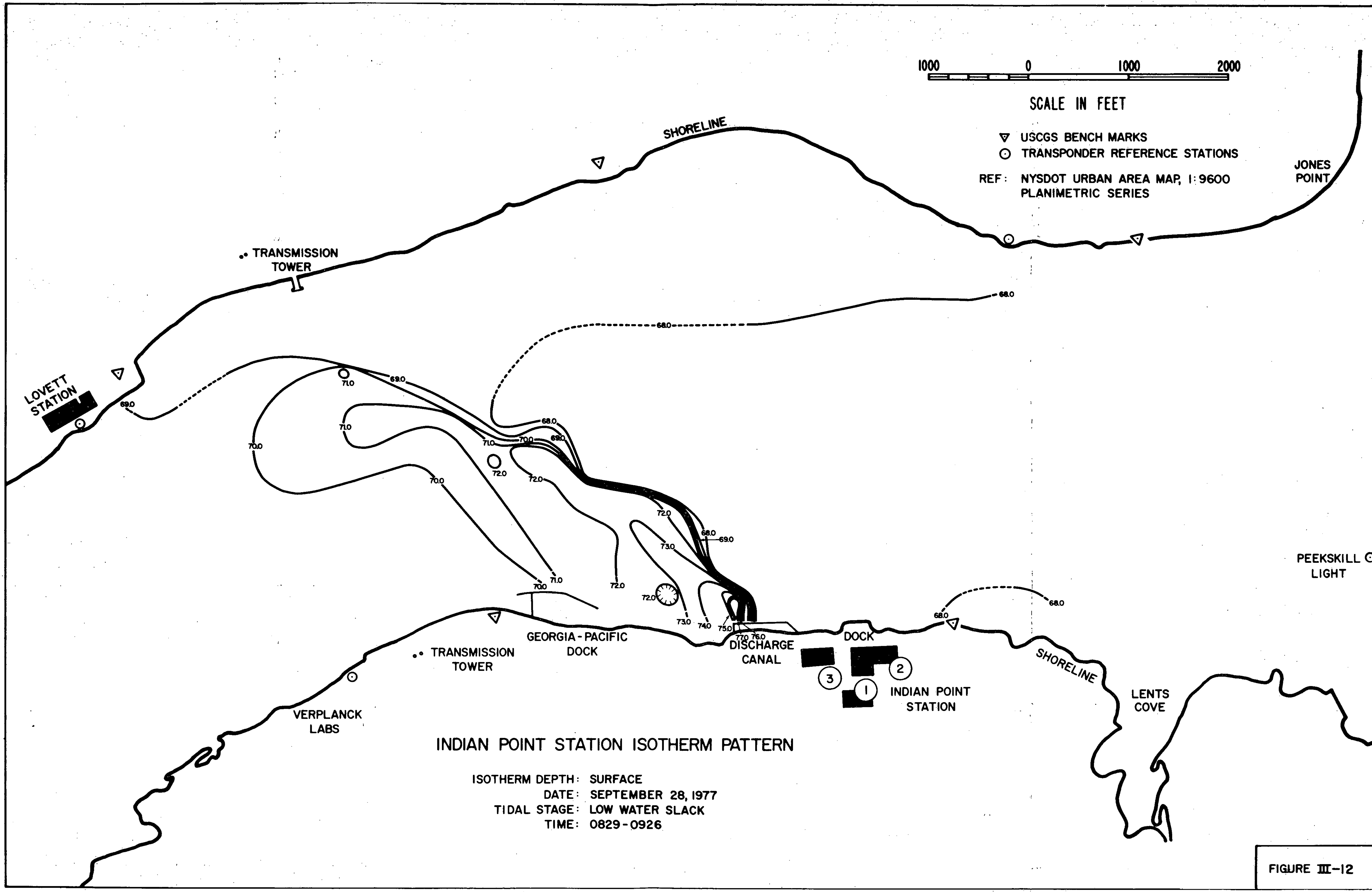
CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (2):
FIRST EBB

FIGURE III - 10



CROSS-SECTIONAL TEMPERATURE PATTERN
AT TRANSMISSION LINES:
FIRST EBB

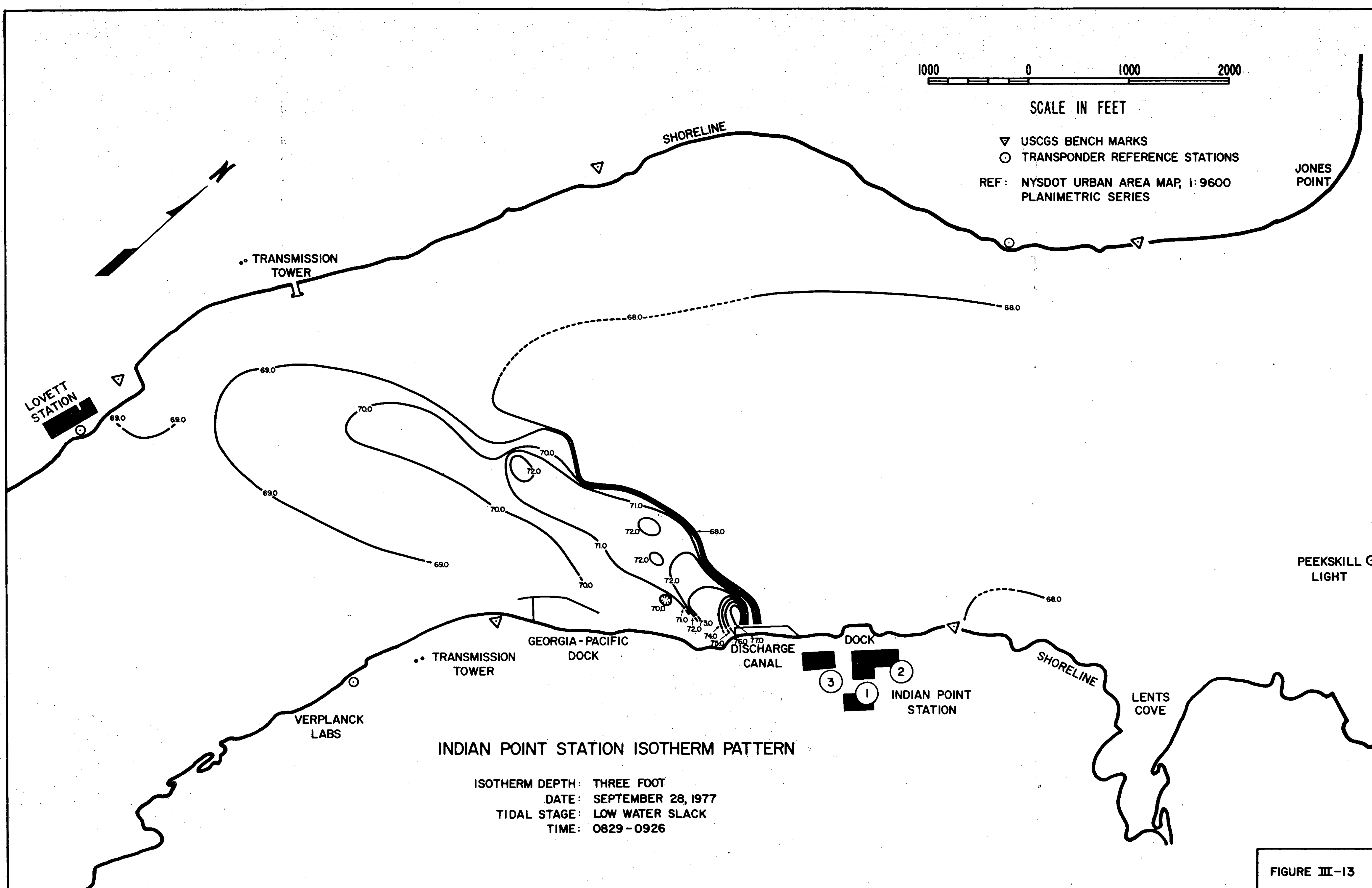
FIGURE III - 11



INDIAN POINT STATION ISOTHERM PATTERN

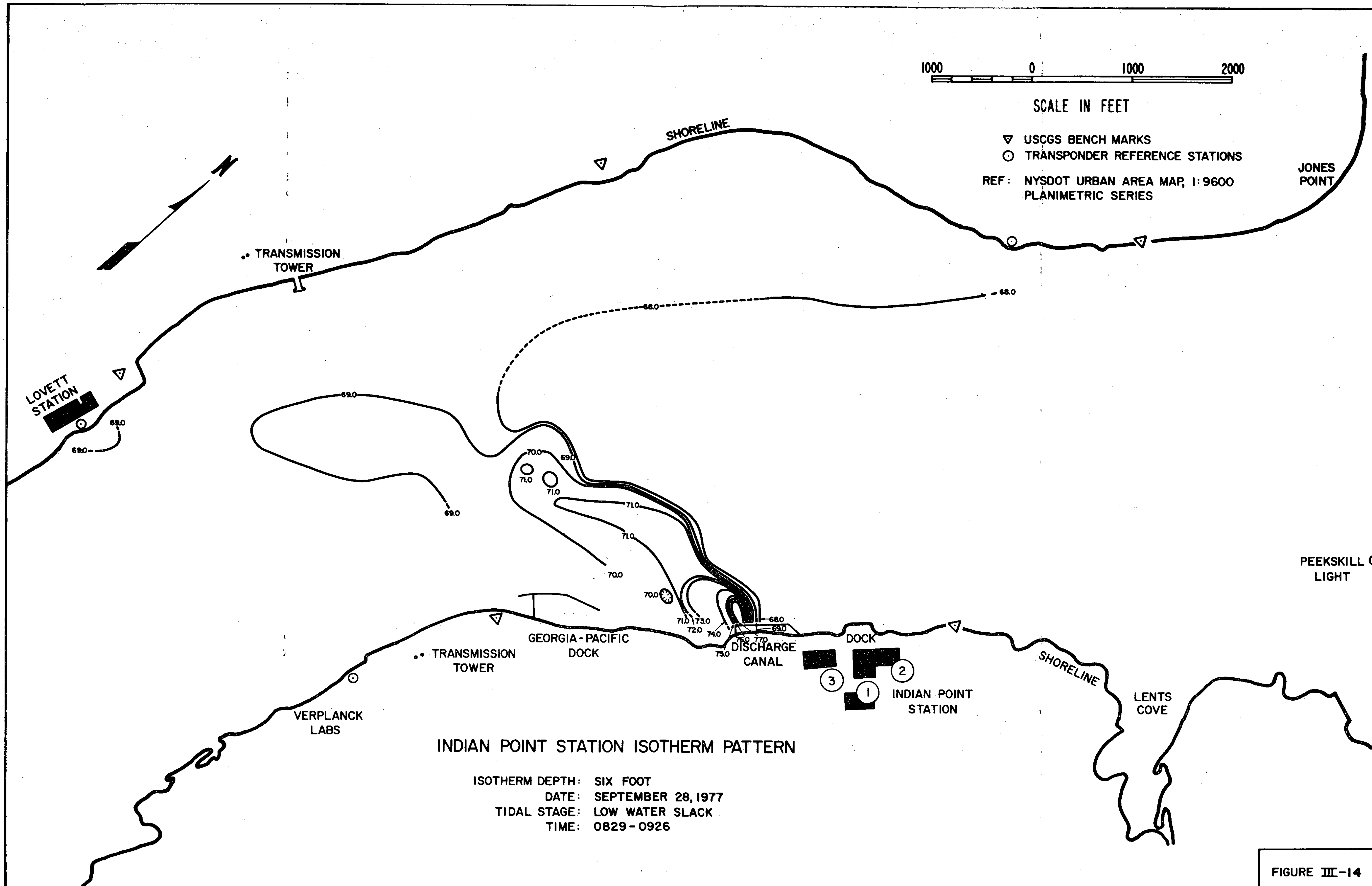
ISOTHERM DEPTH: SURFACE
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: LOW WATER SLACK
TIME: 0829-0926

FIGURE III-12



INDIAN POINT STATION ISOTHERM PATTERN

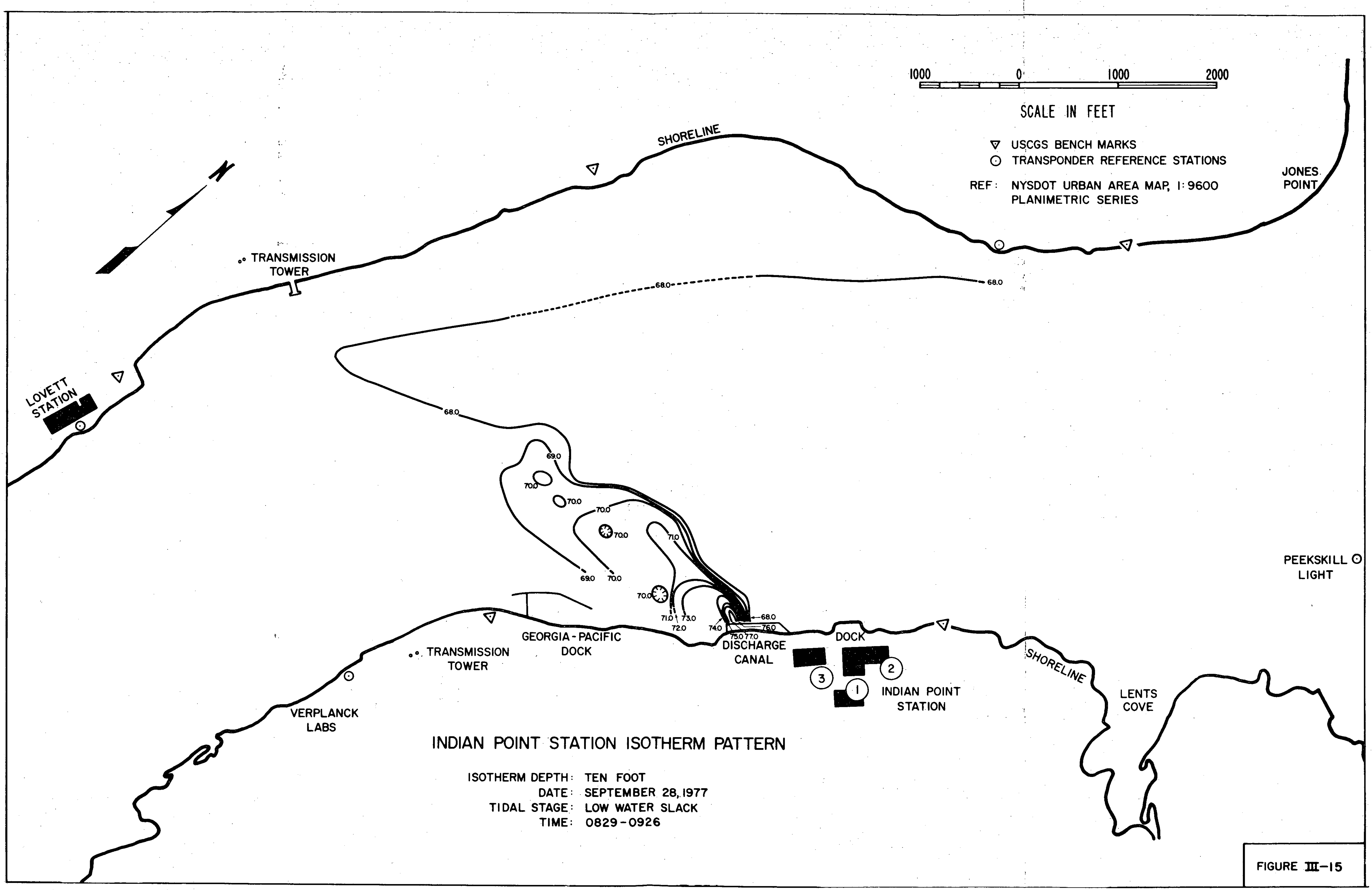
ISOTHERM DEPTH: THREE FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: LOW WATER SLACK
TIME: 0829-0926



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: SIX FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: LOW WATER SLACK
TIME: 0829-0926

FIGURE III-14



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: TEN FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: LOW WATER SLACK
TIME: 0829-0926

FIGURE III-15

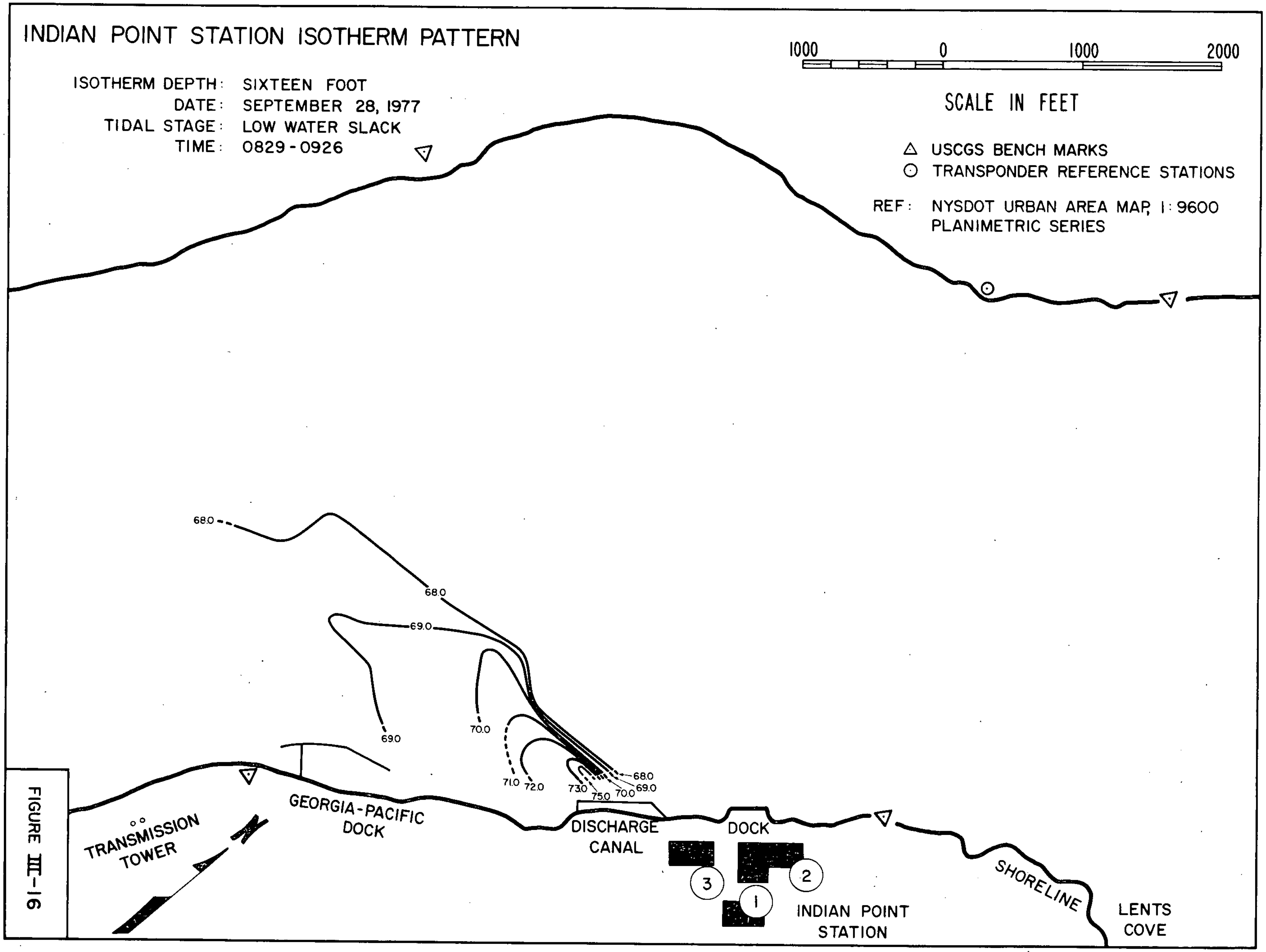


FIGURE III-16

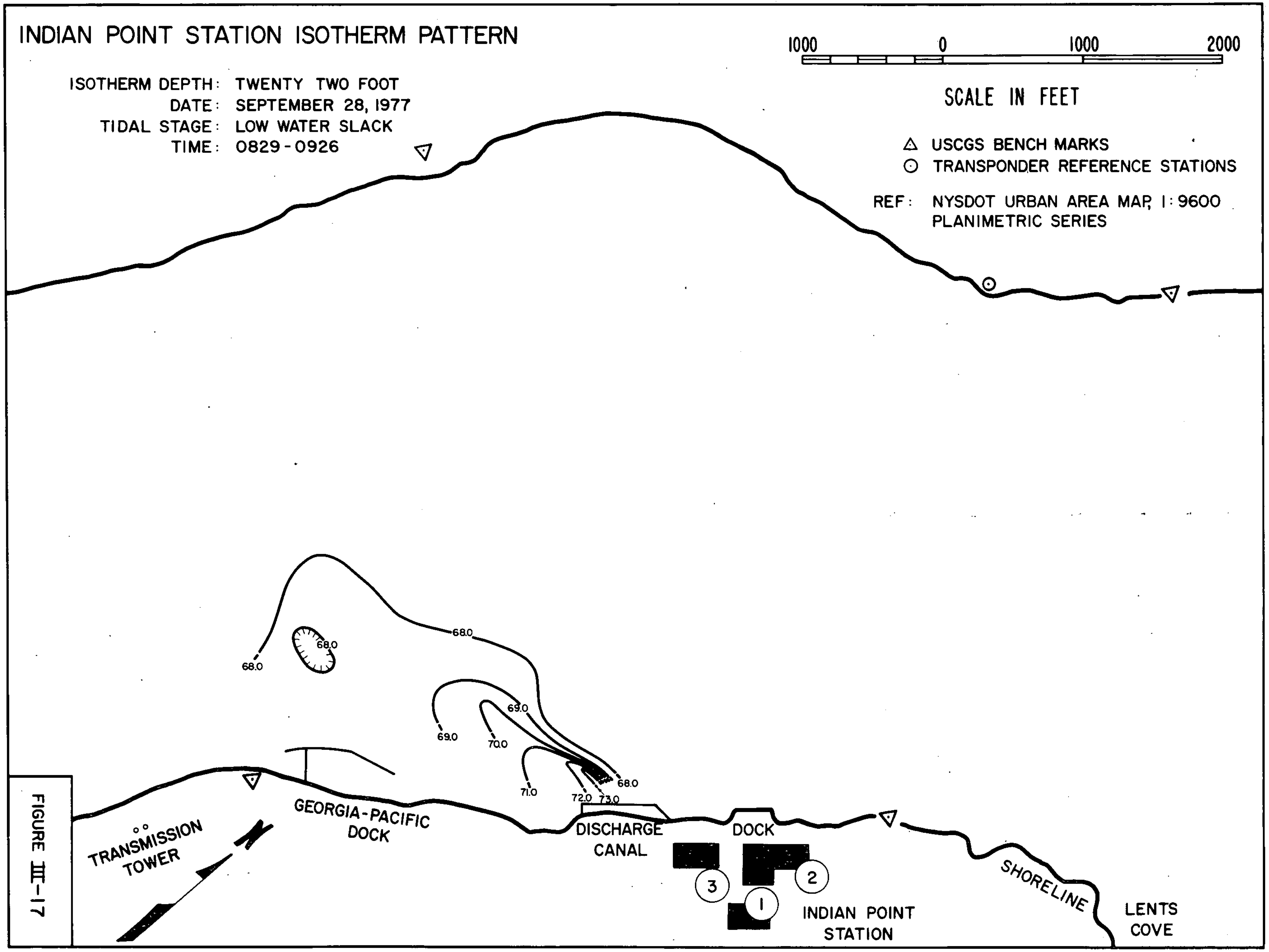
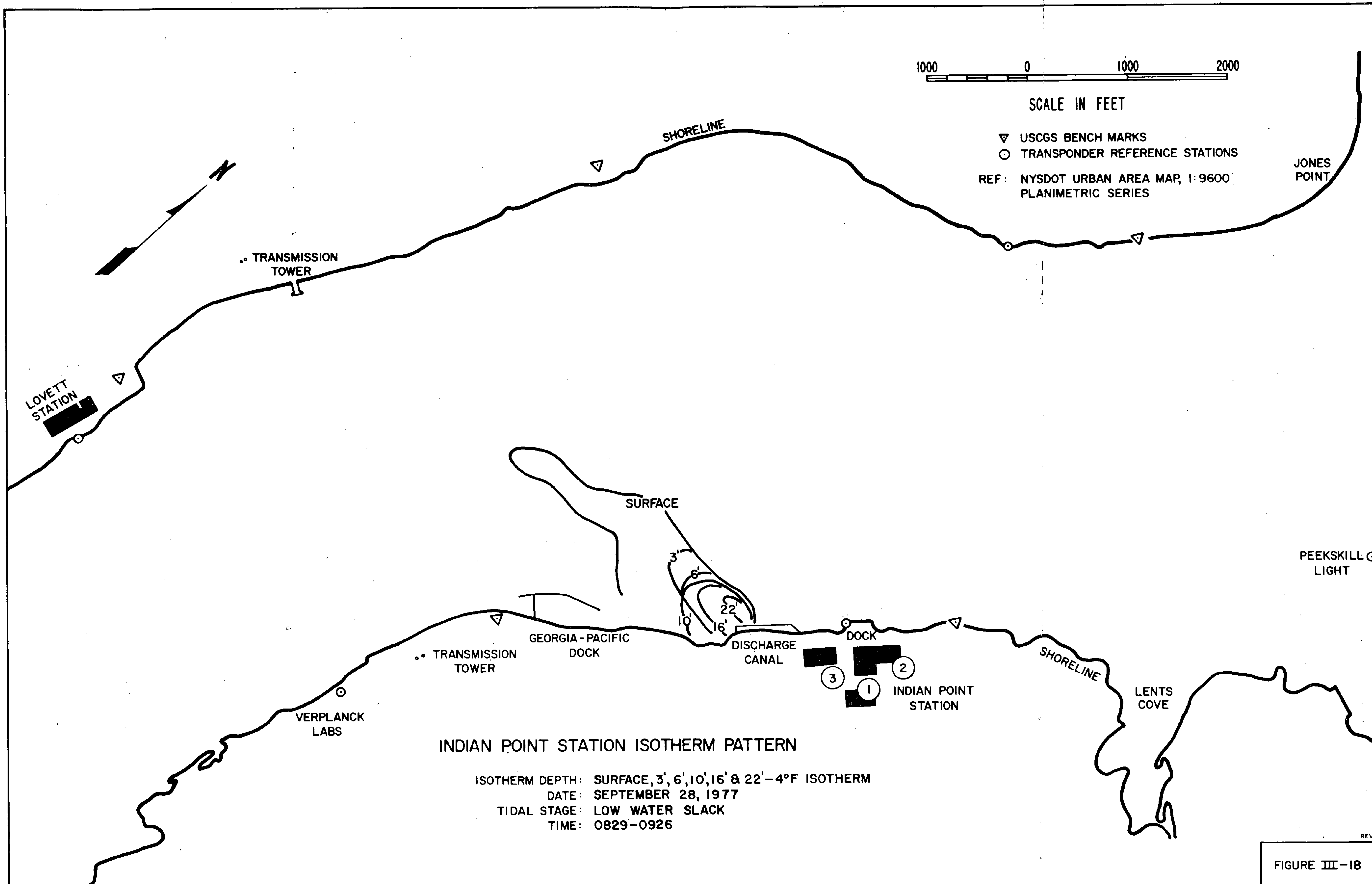


FIGURE III-17

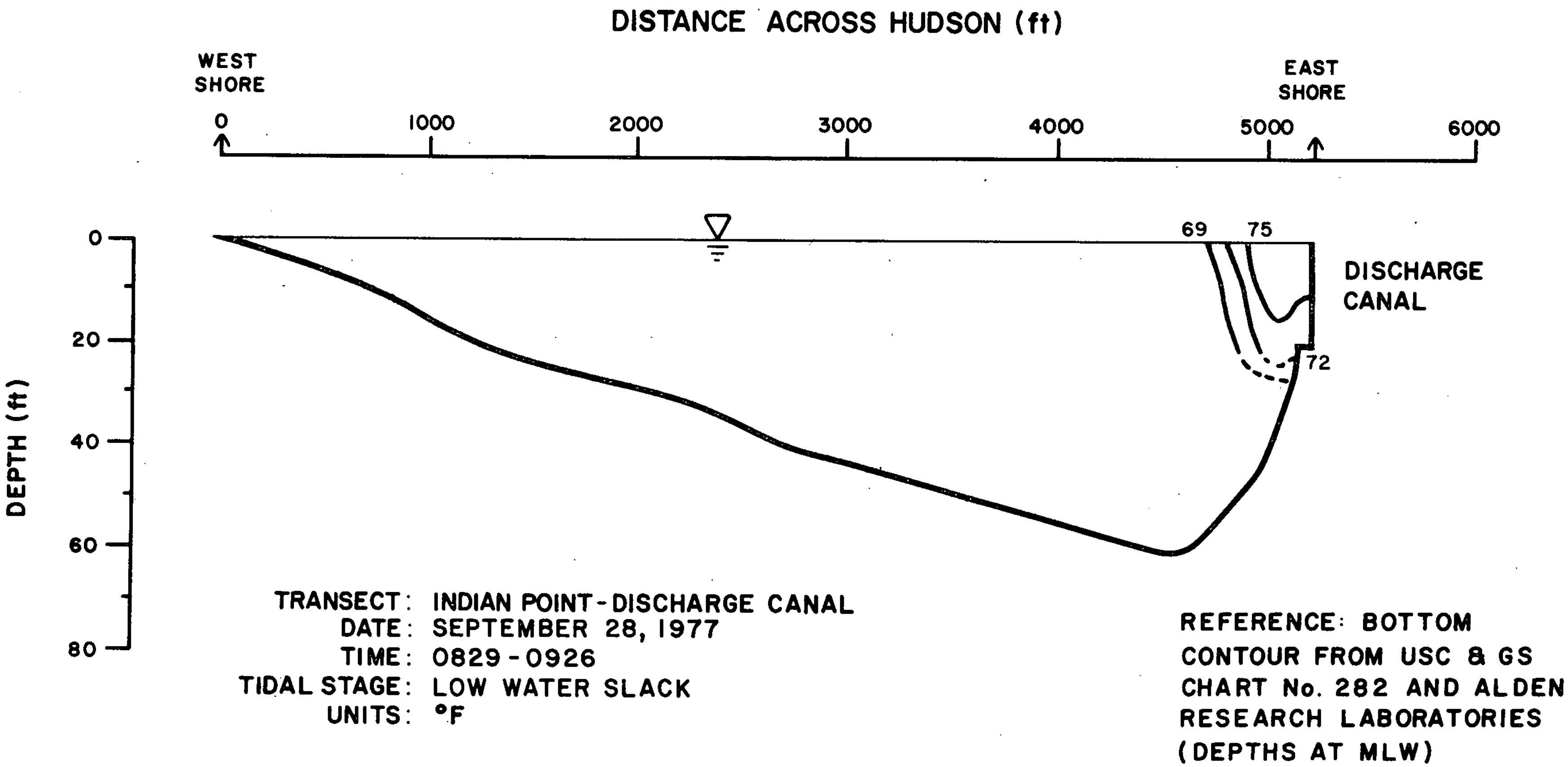


INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: SURFACE, 3', 6', 10', 16' & 22' - 4°F ISOTHERM
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: LOW WATER SLACK
TIME: 0829-0926

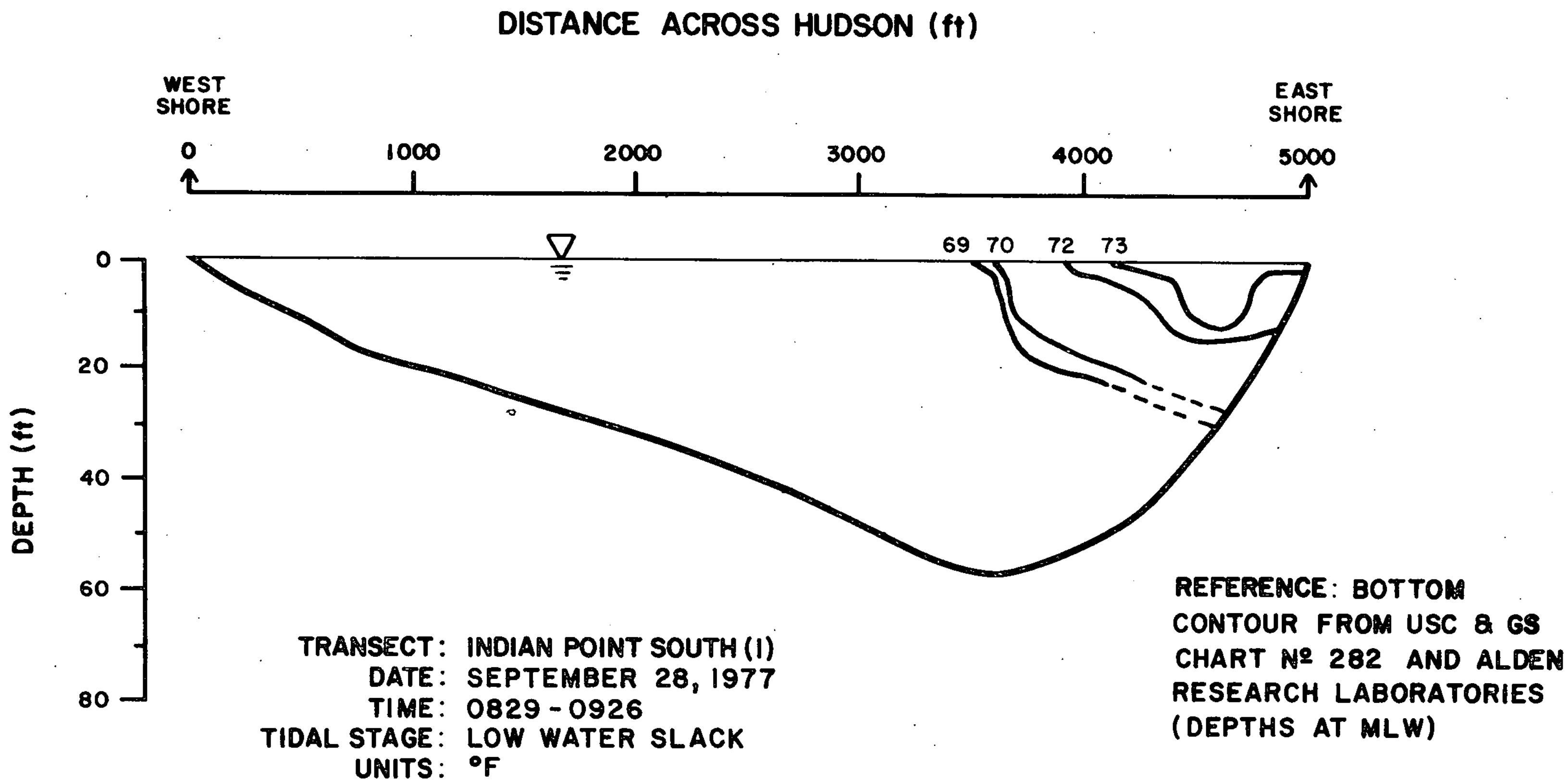
REV. 1

FIGURE III-18



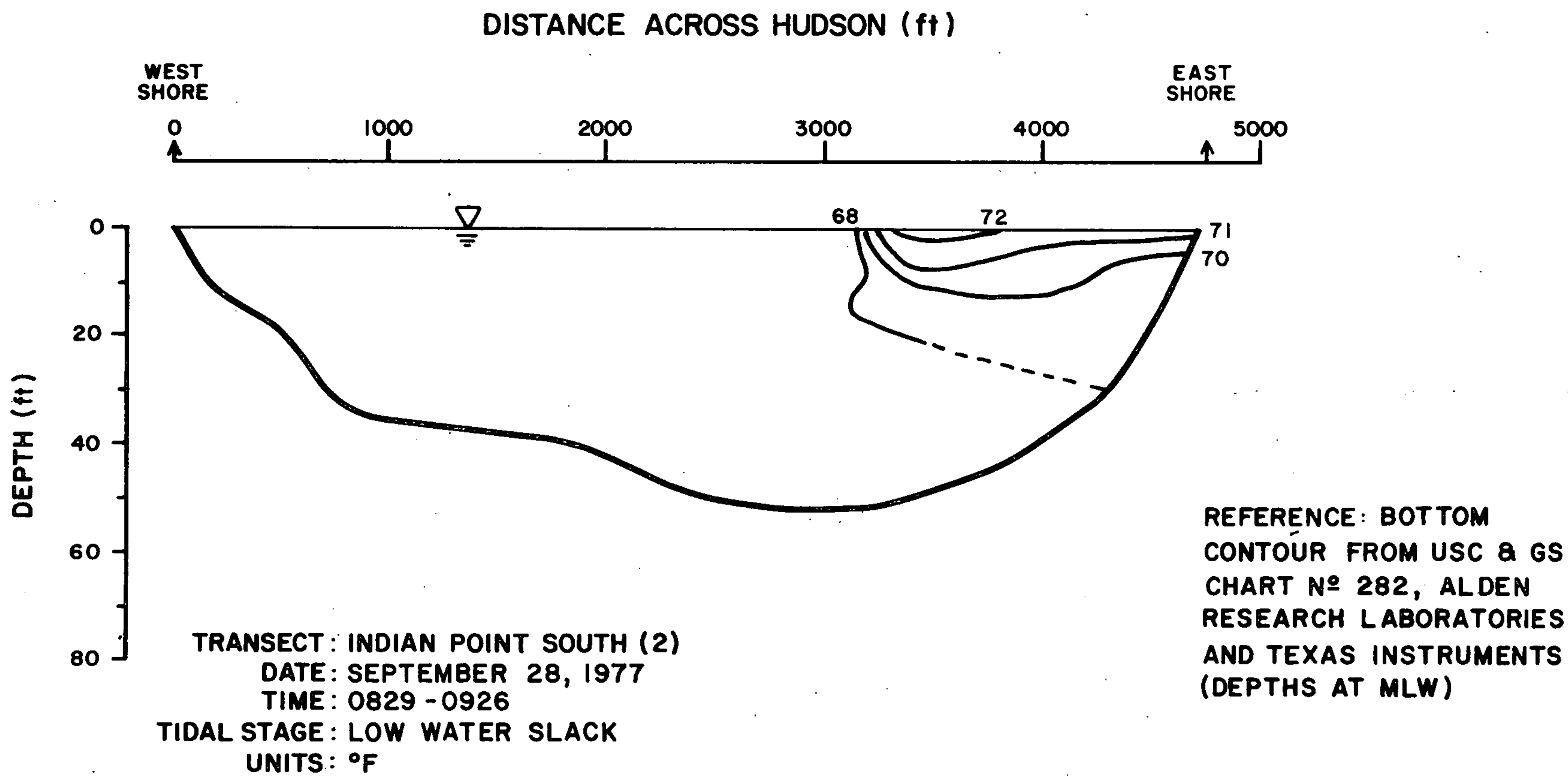
CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT-DISCHARGE CANAL:
LOW WATER SLACK

FIGURE III-19



CROSS - SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (I):
LOW WATER SLACK

FIGURE III - 20



CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (2):
LOW WATER SLACK

FIGURE III-21

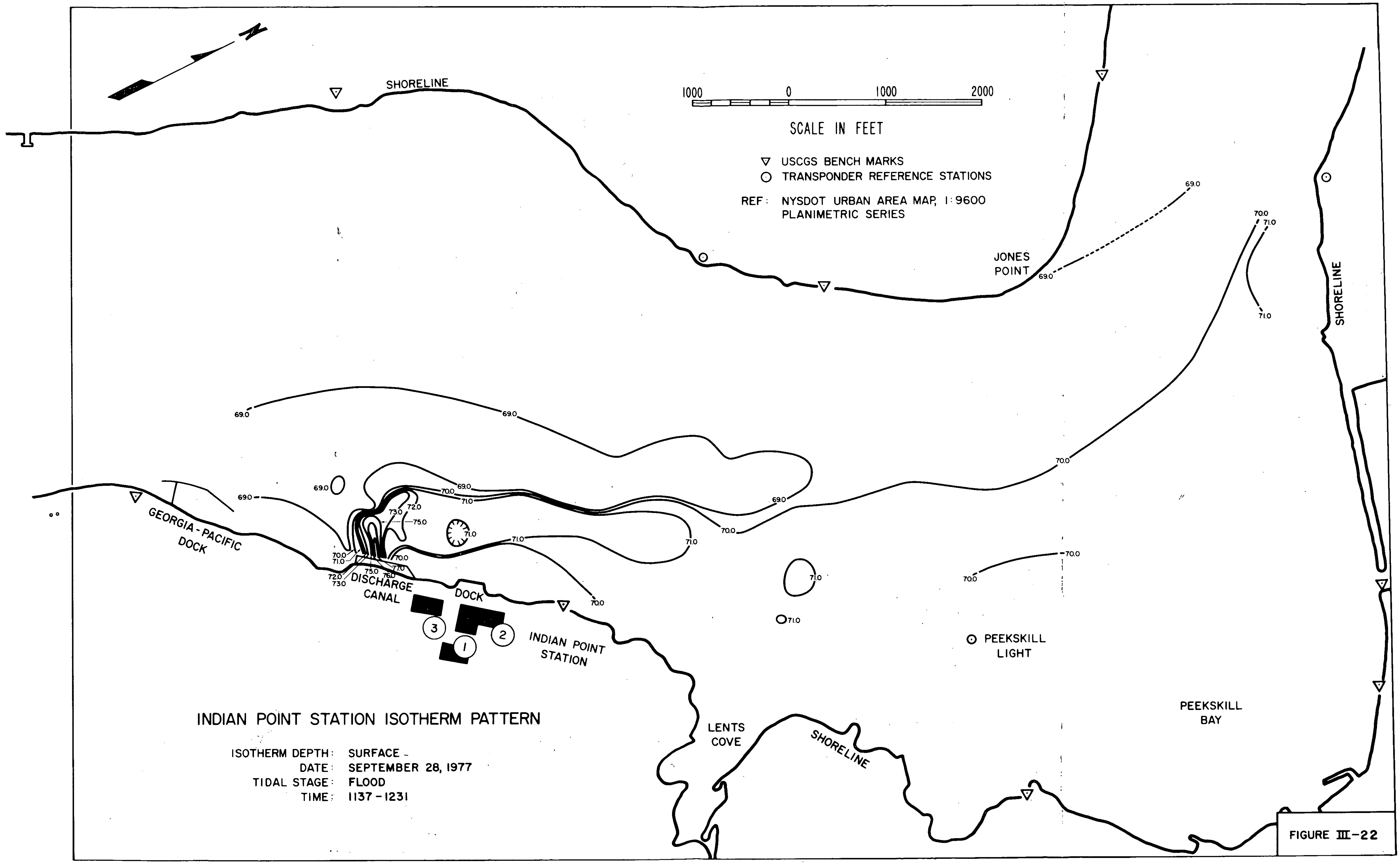
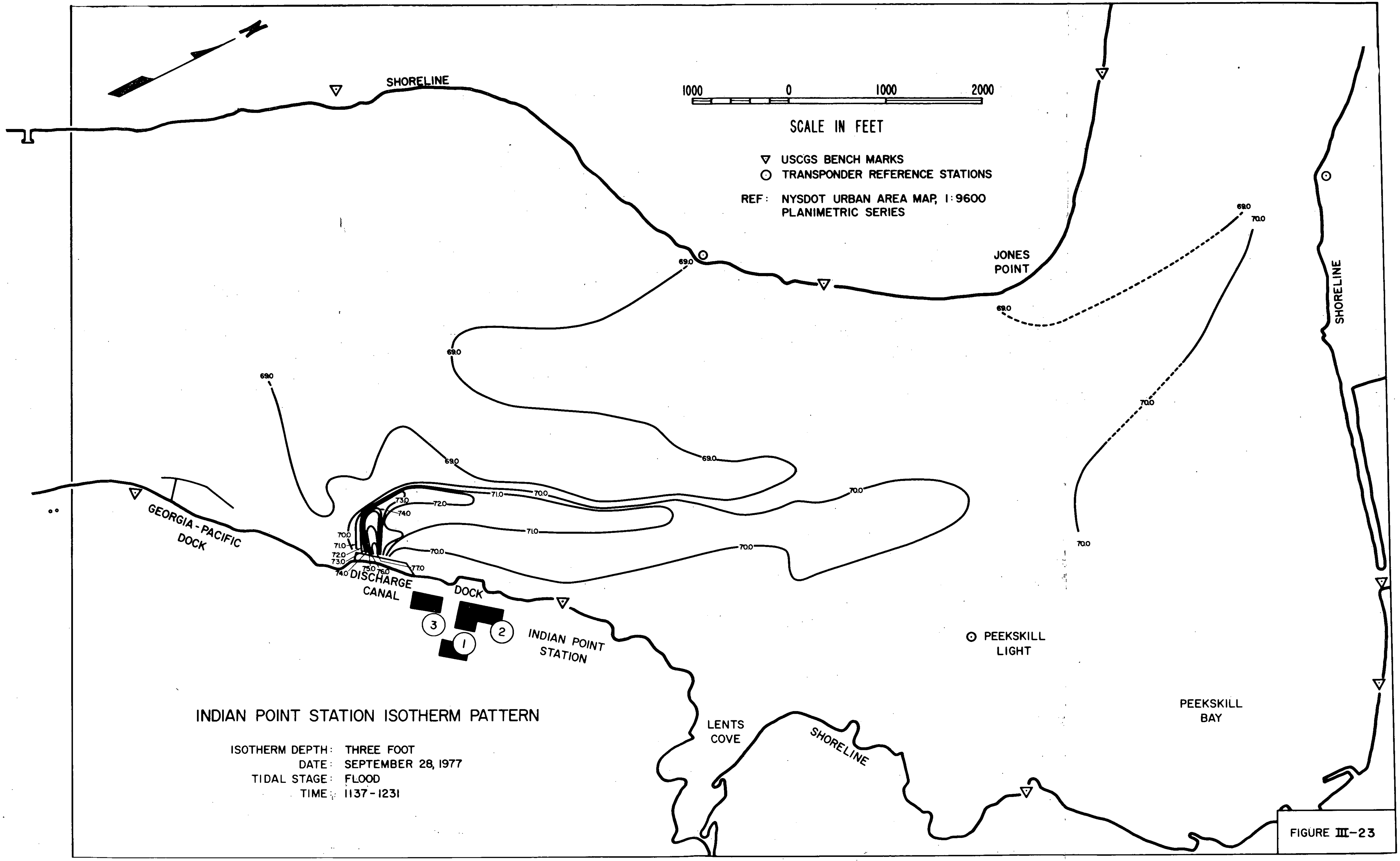


FIGURE III-22



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: THREE FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FLOOD
TIME: 1137-1231

FIGURE III-23

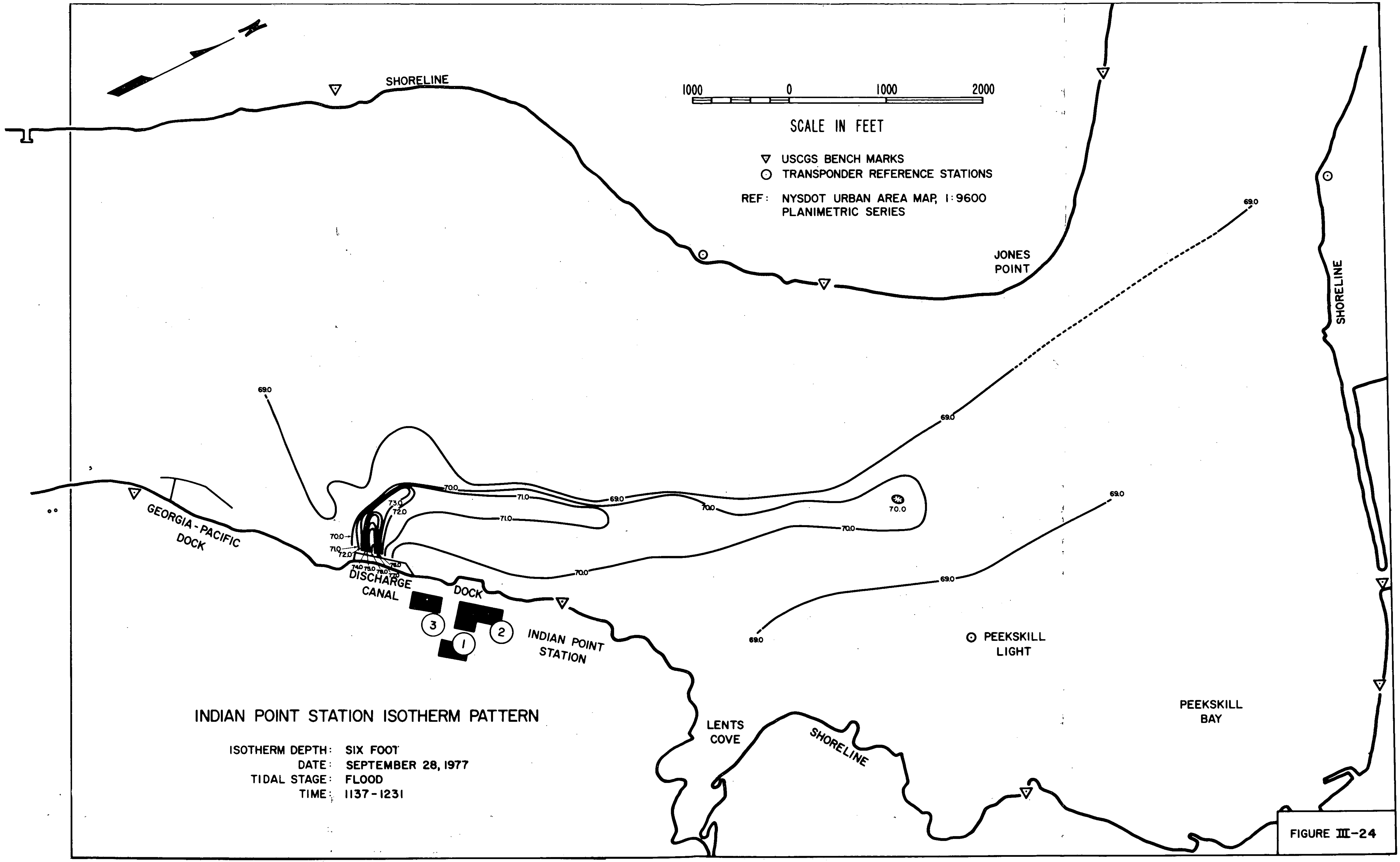
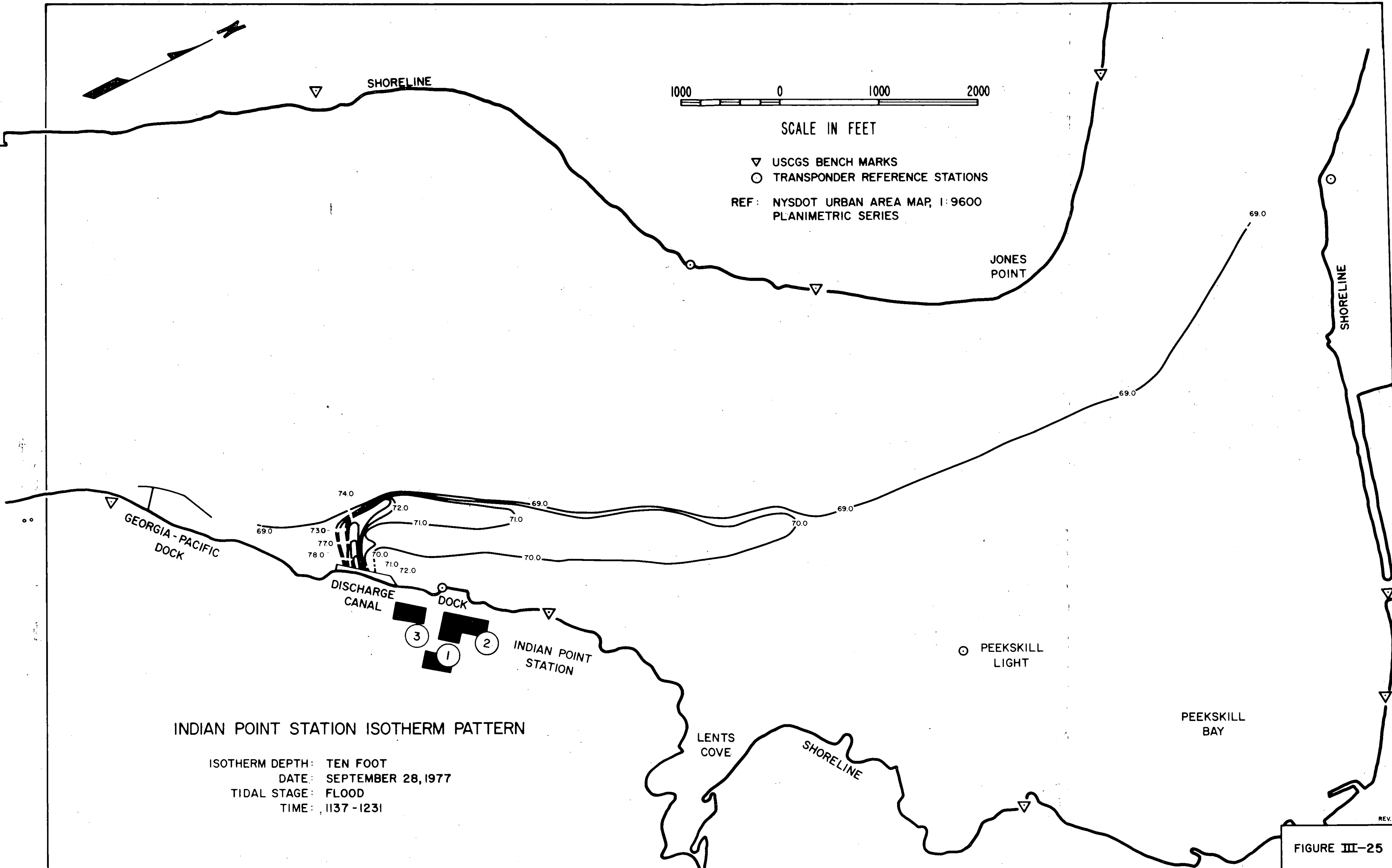


FIGURE III-24



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: TEN FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: FLOOD
TIME: 1137-1231

FIGURE III-25

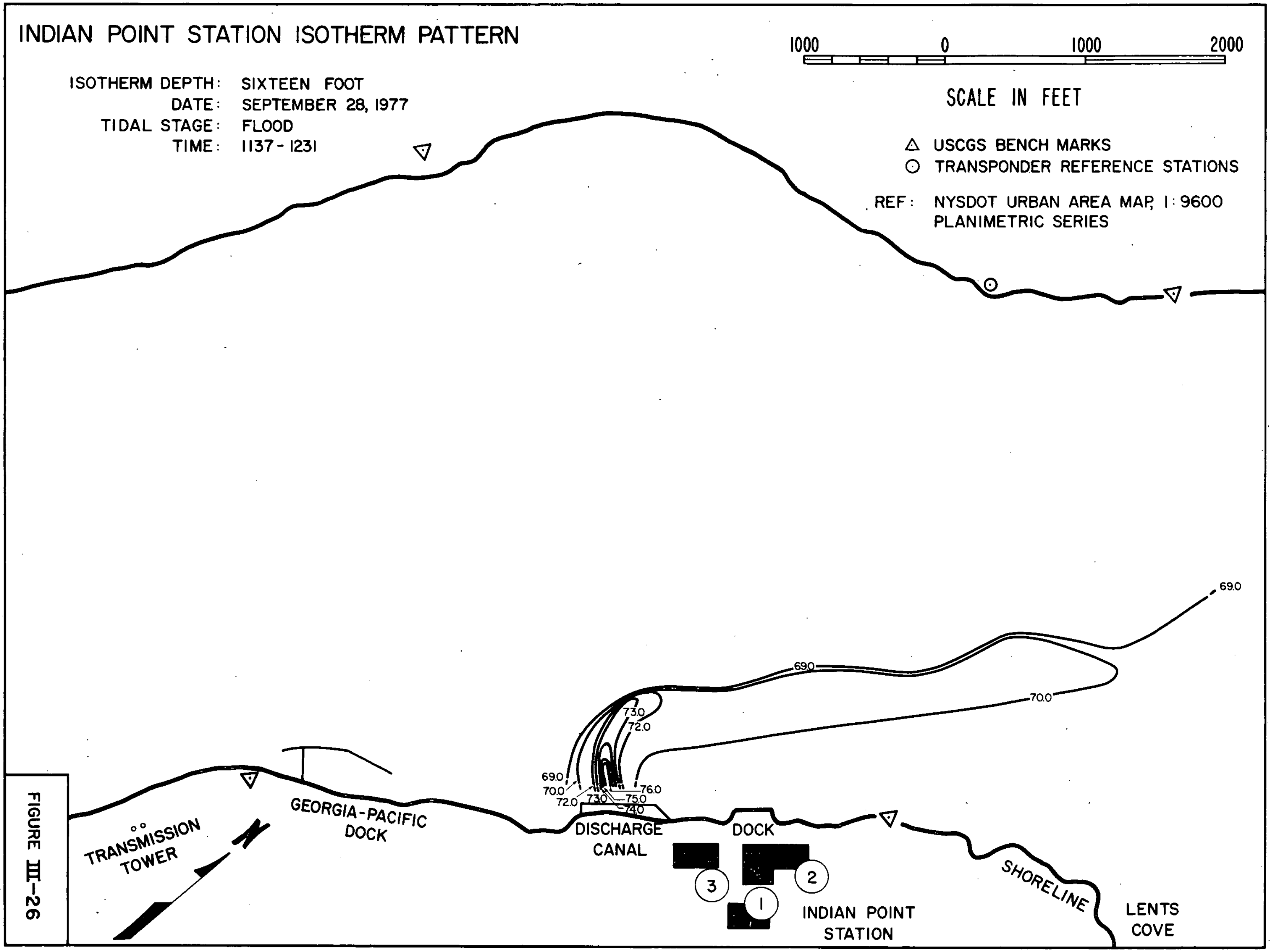


FIGURE III-26

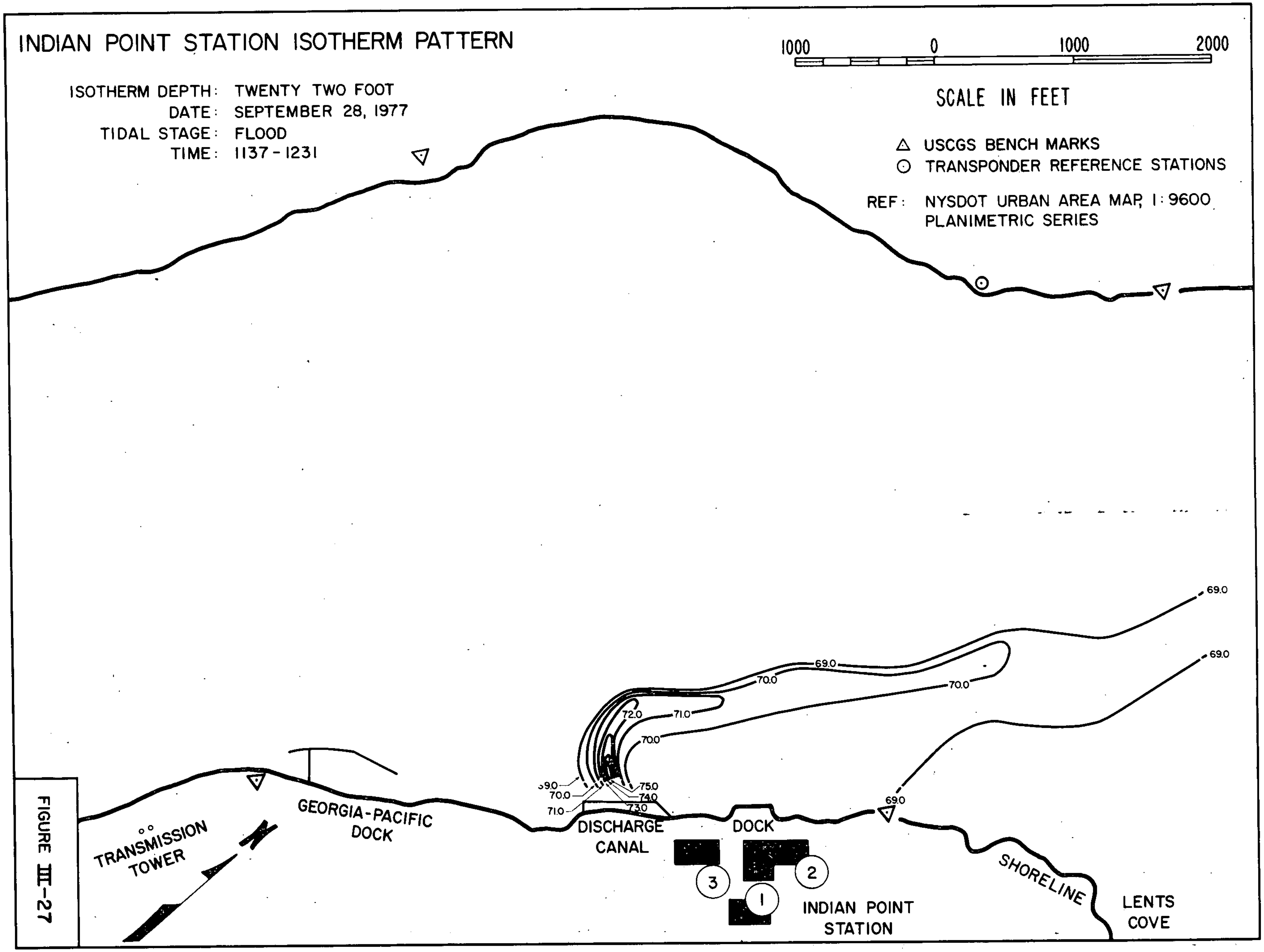


FIGURE III-27

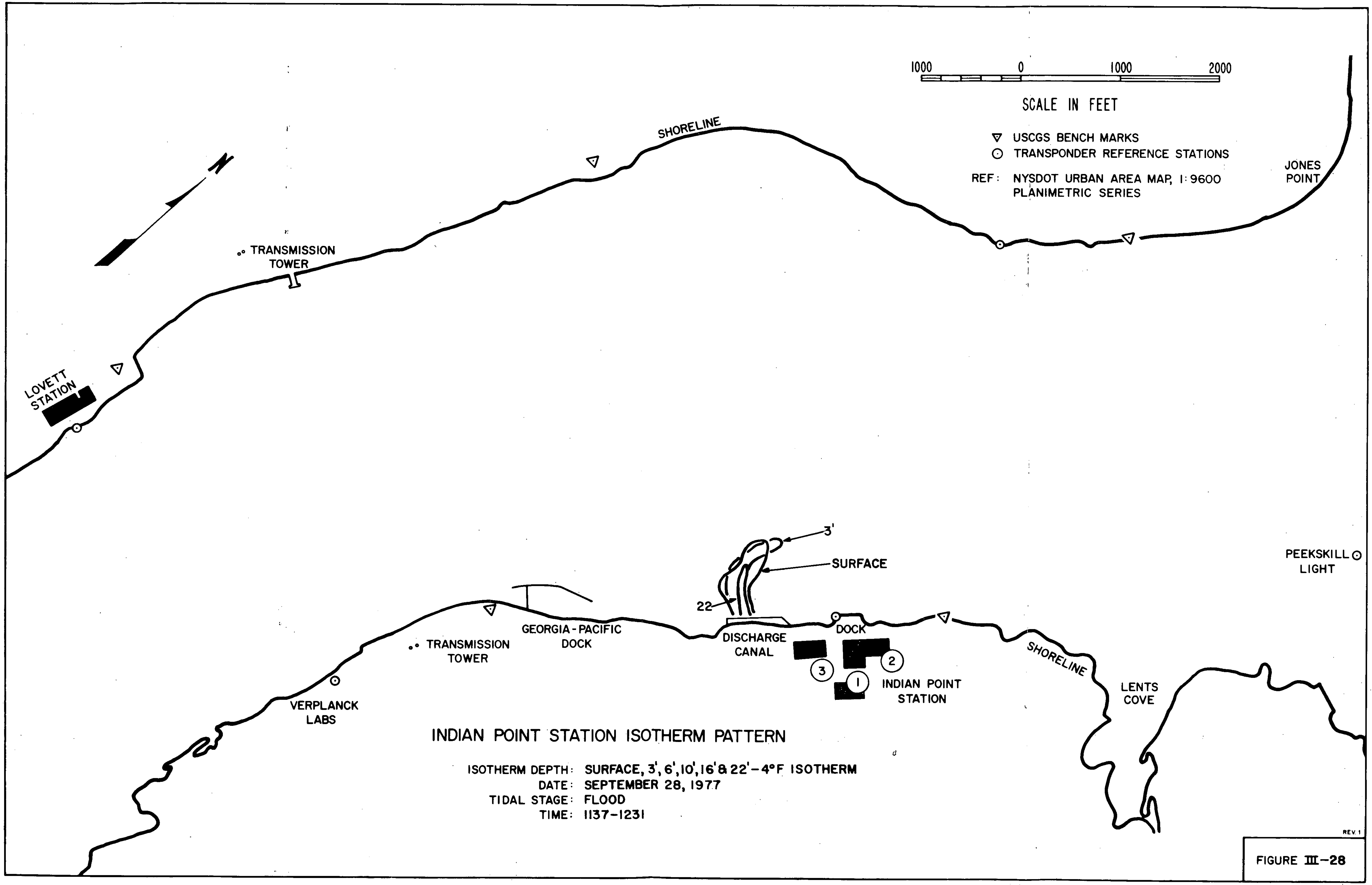
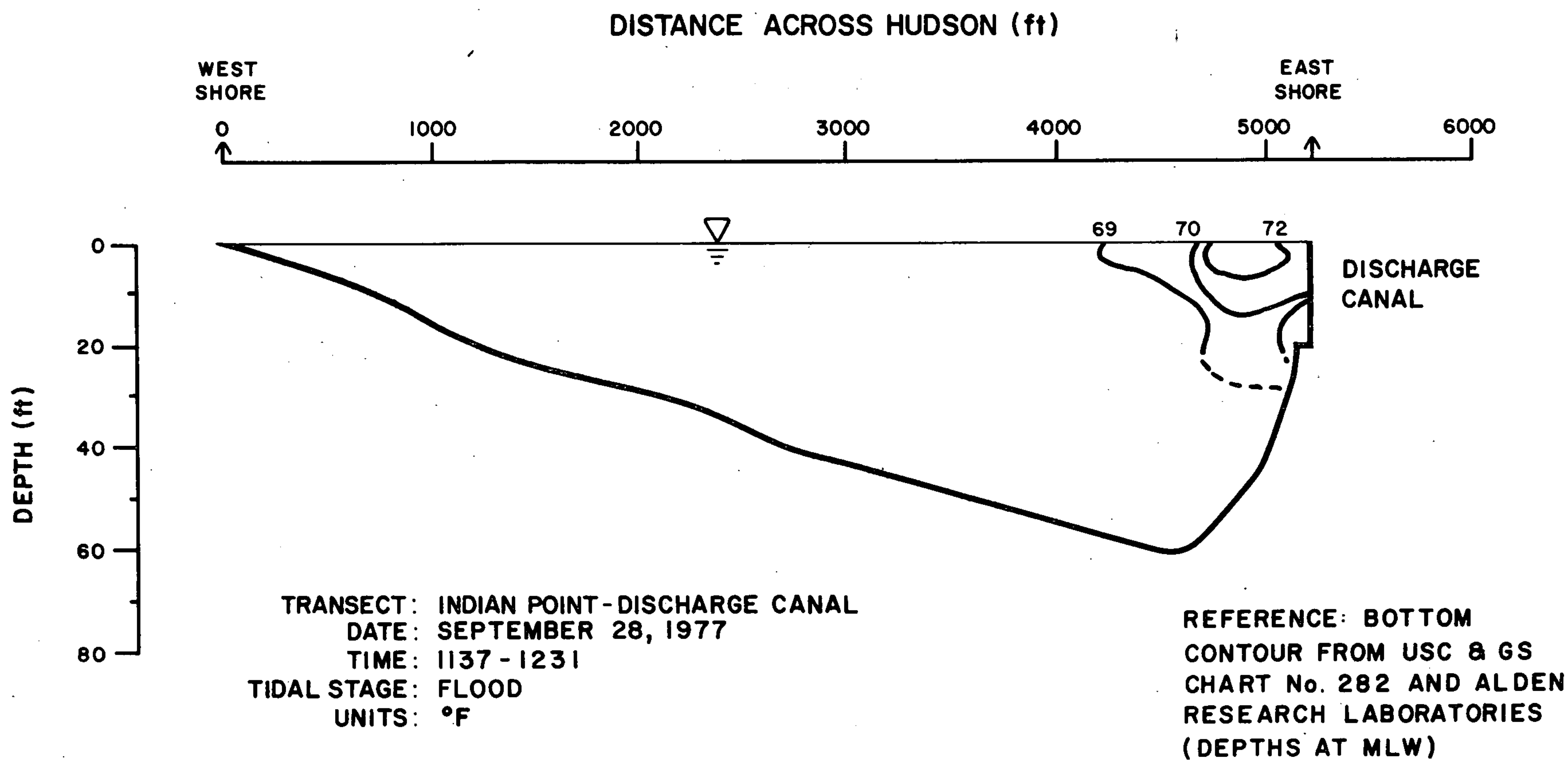
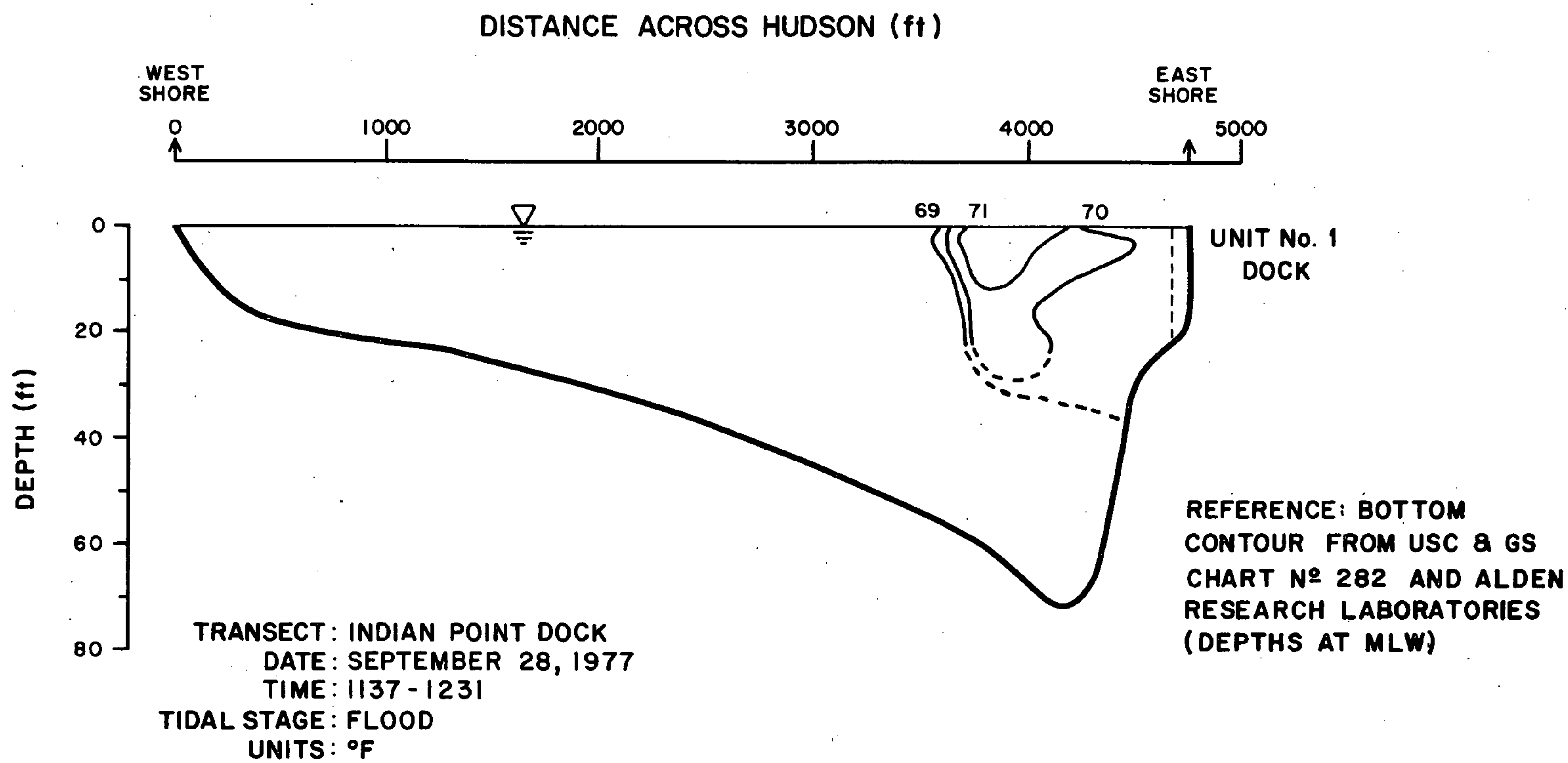


FIGURE III-28



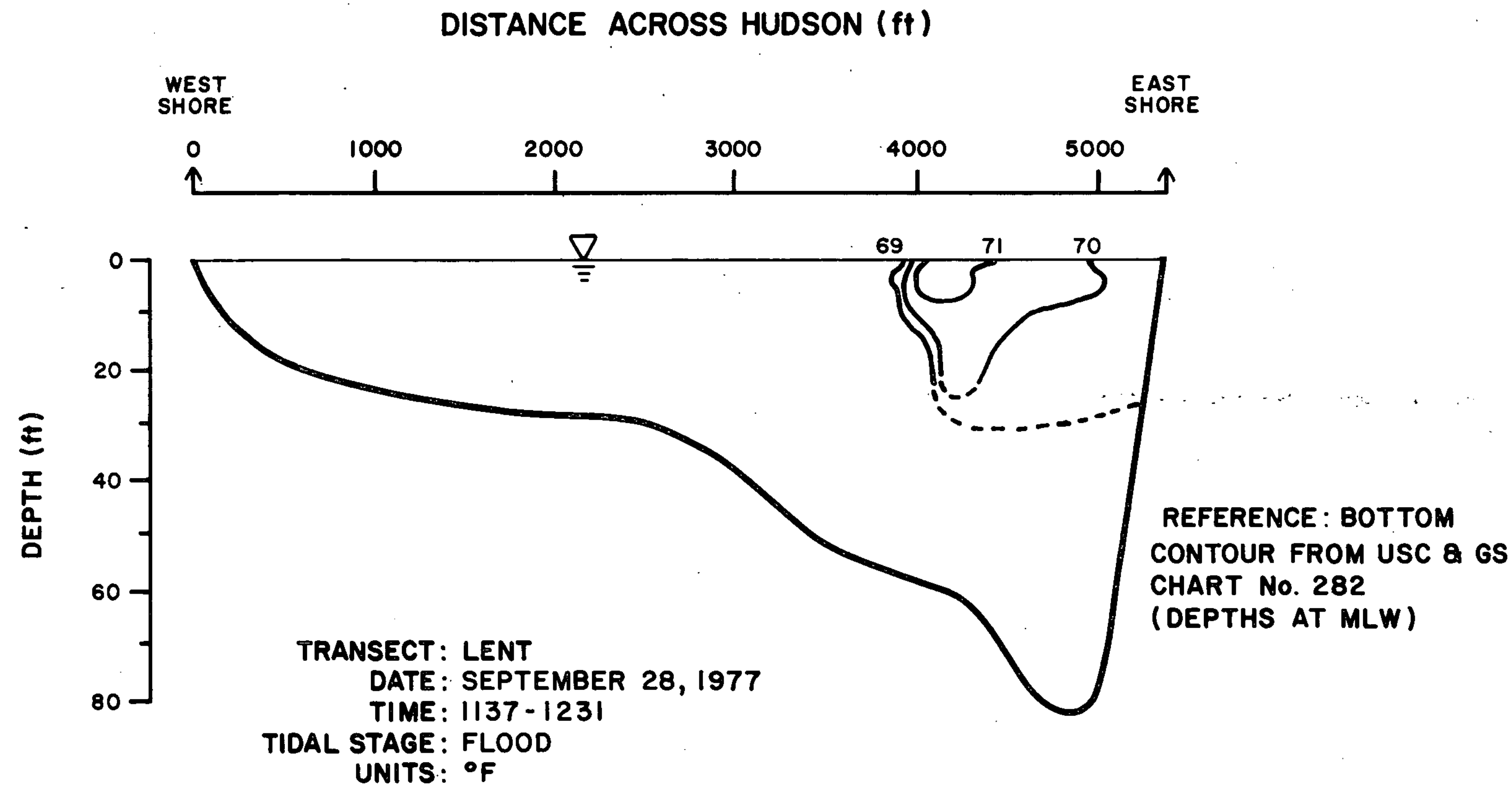
CROSS-SECTIONAL TEMPERATURE PATTERN AT INDIAN POINT-DISCHARGE CANAL: FLOOD

FIGURE III-29



CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT DOCK:
FLOOD

FIGURE III-30

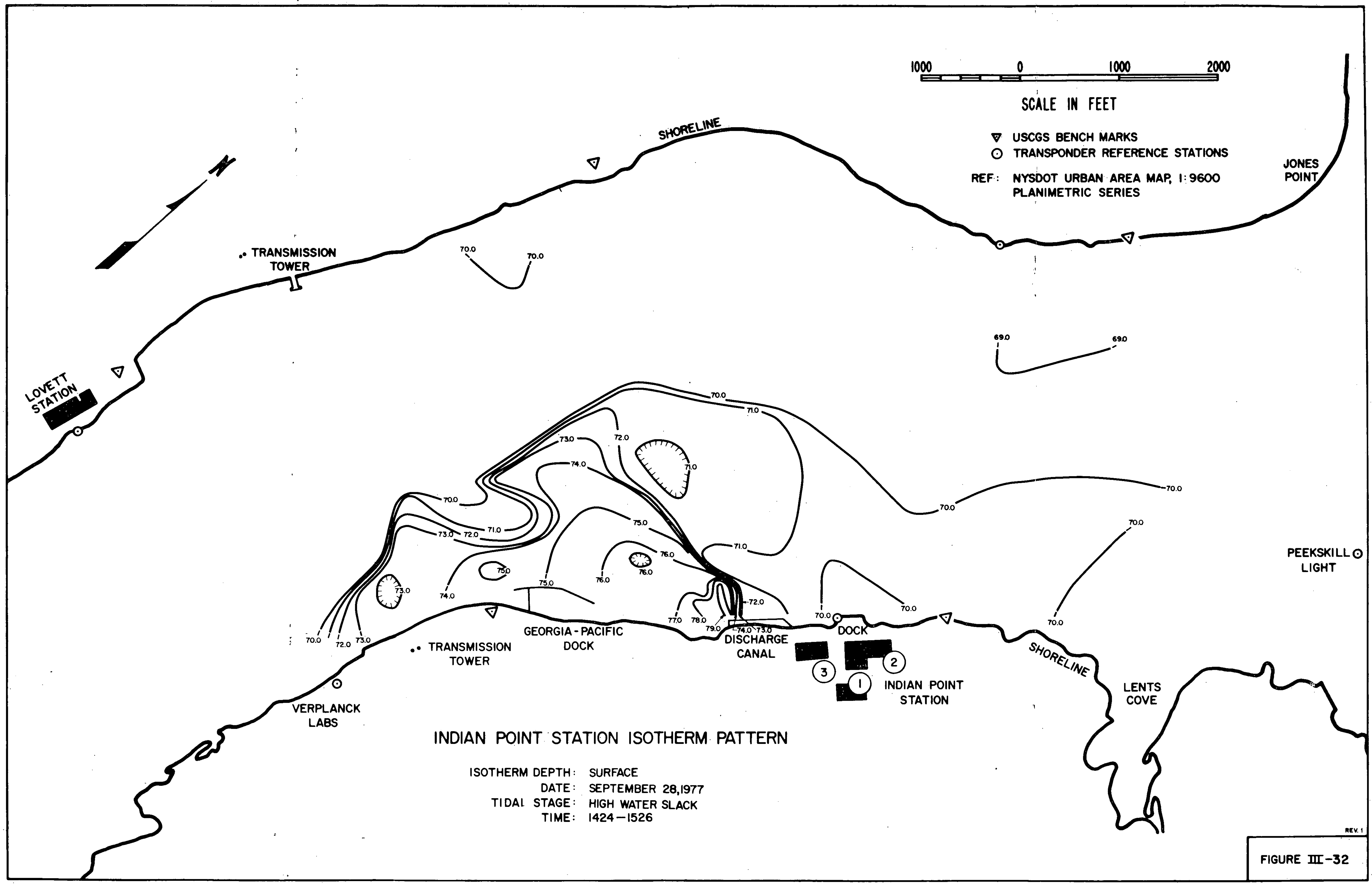


CROSS-SECTIONAL TEMPERATURE PATTERN

AT LENT:

FLOOD

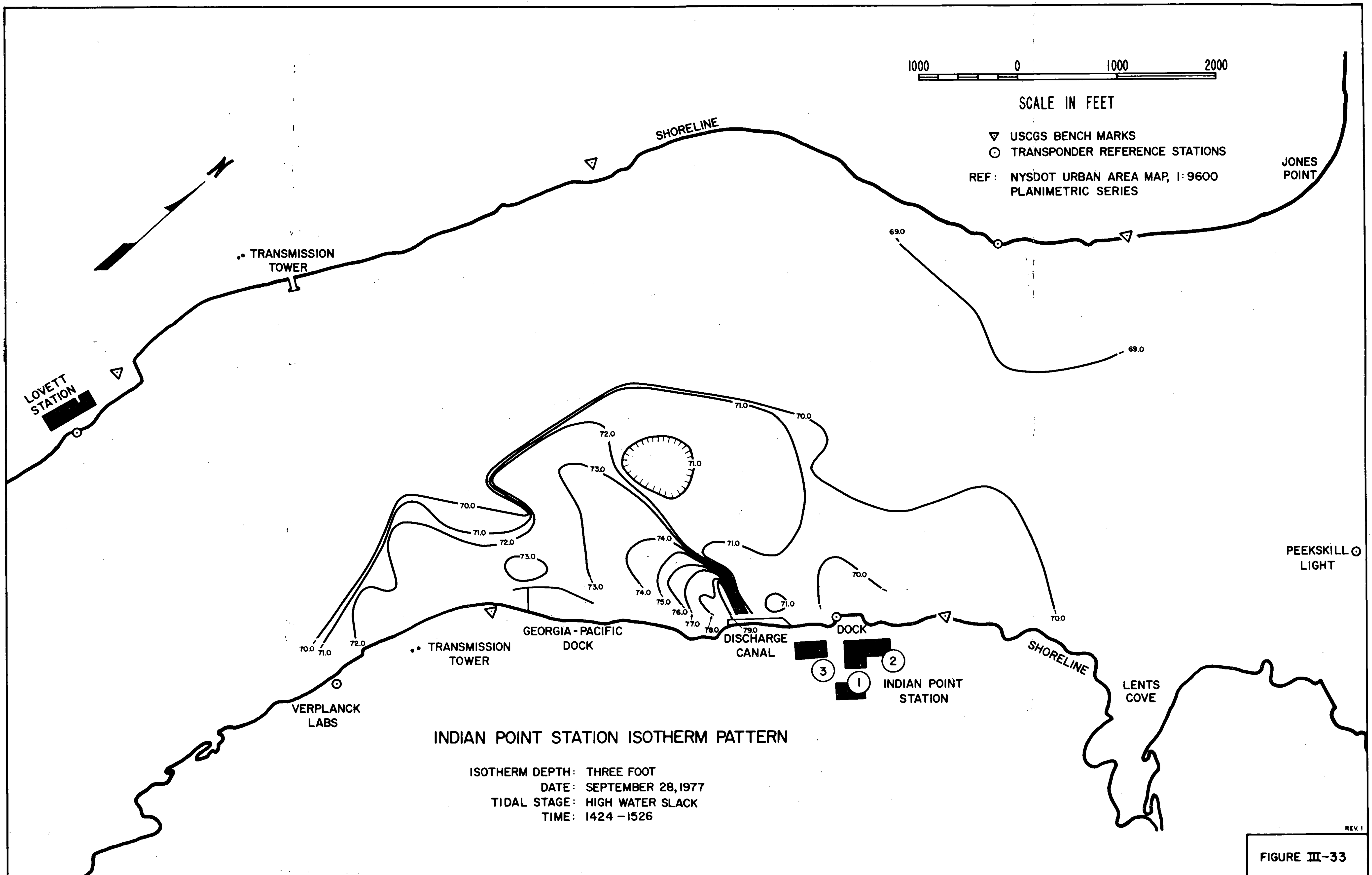
FIGURE III - 31



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: SURFACE
DATE: SEPTEMBER 28,1977
TIDAL STAGE: HIGH WATER SLACK
TIME: 1424—1526

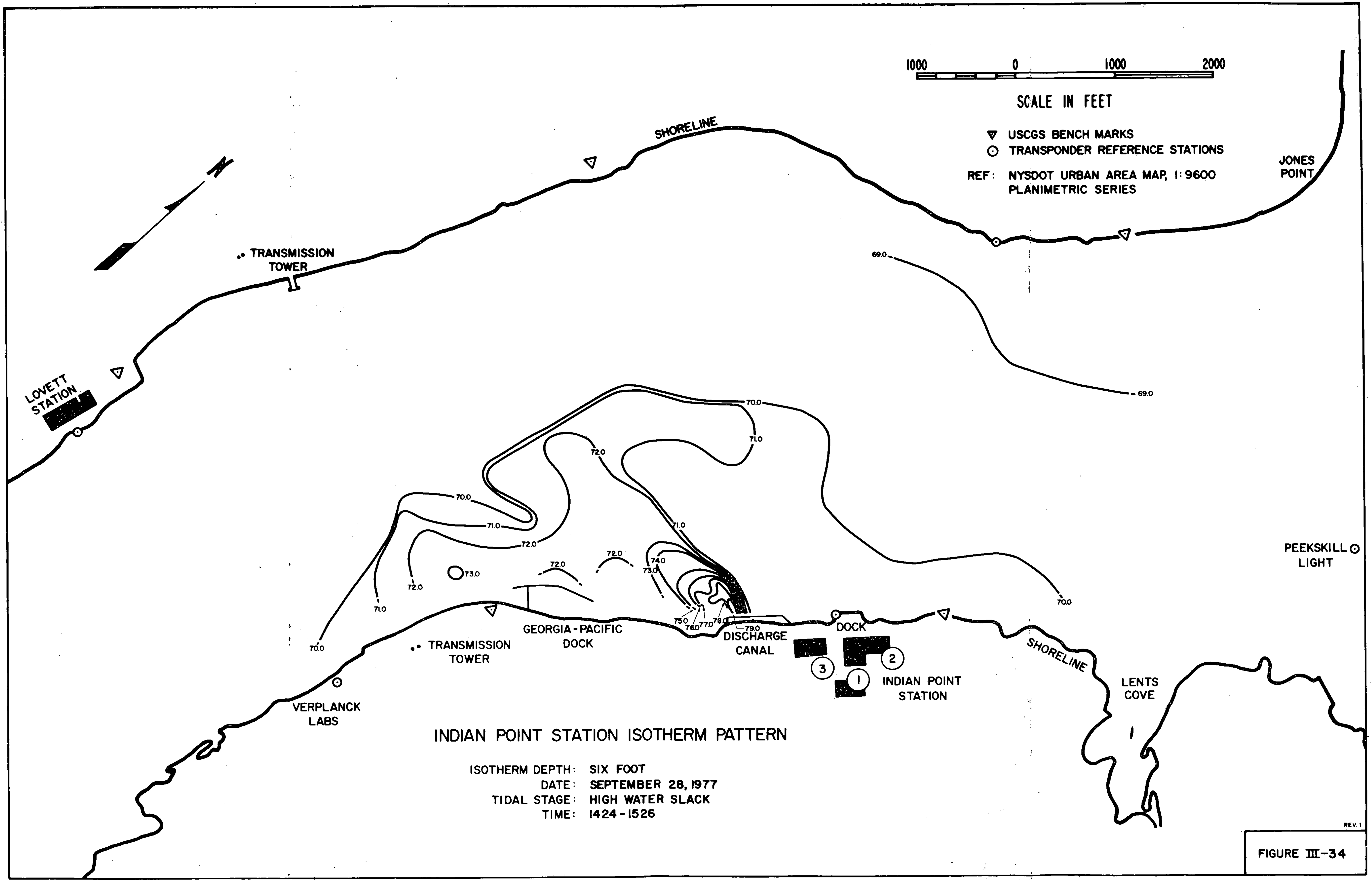
FIGURE III-32



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: THREE FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: HIGH WATER SLACK
TIME: 1424 - 1526

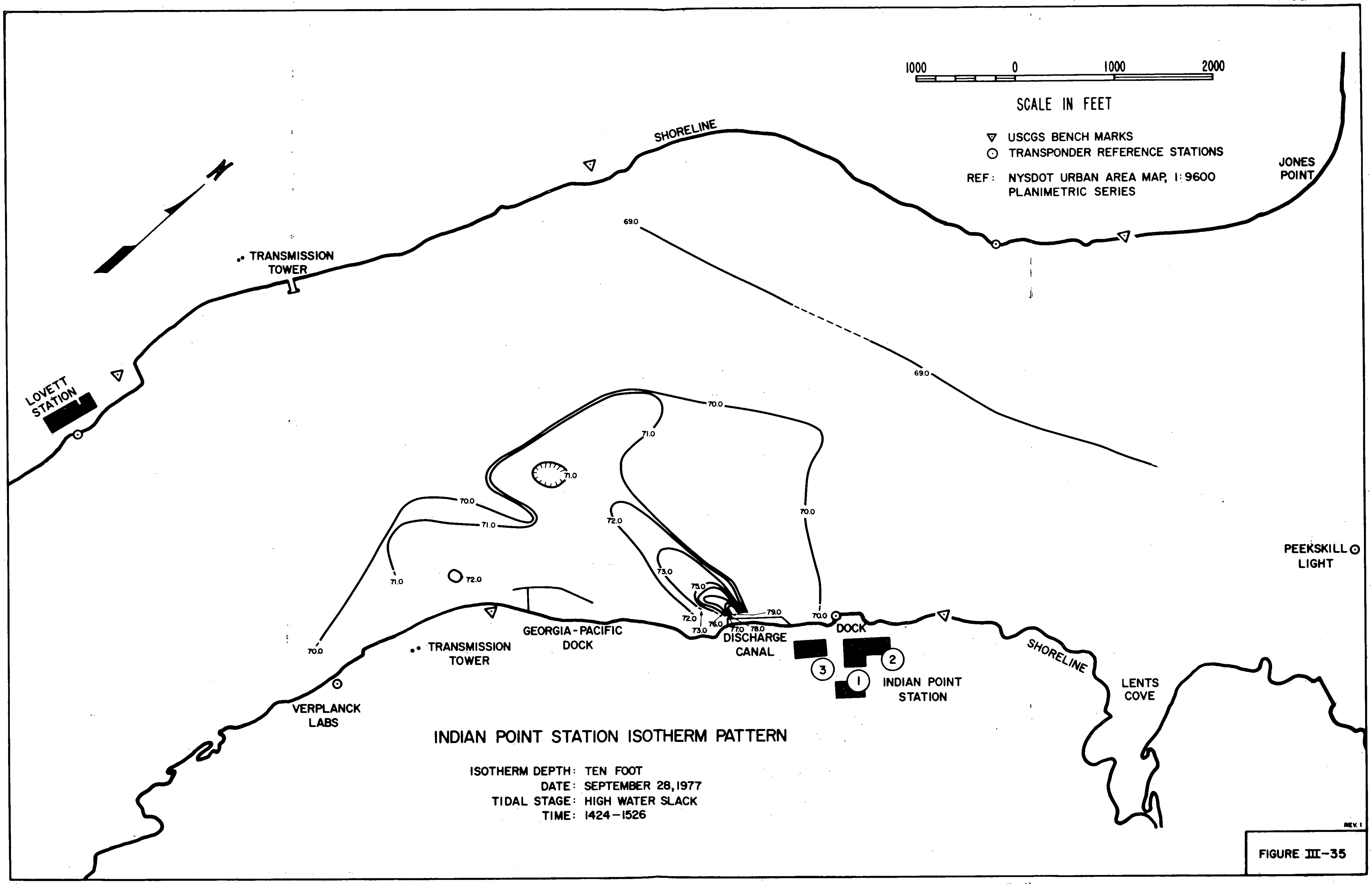
FIGURE III-33



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: SIX FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: HIGH WATER SLACK
TIME: 1424-1526

FIGURE III-34



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: TEN FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: HIGH WATER SLACK
TIME: 1424–1526

FIGURE III-35

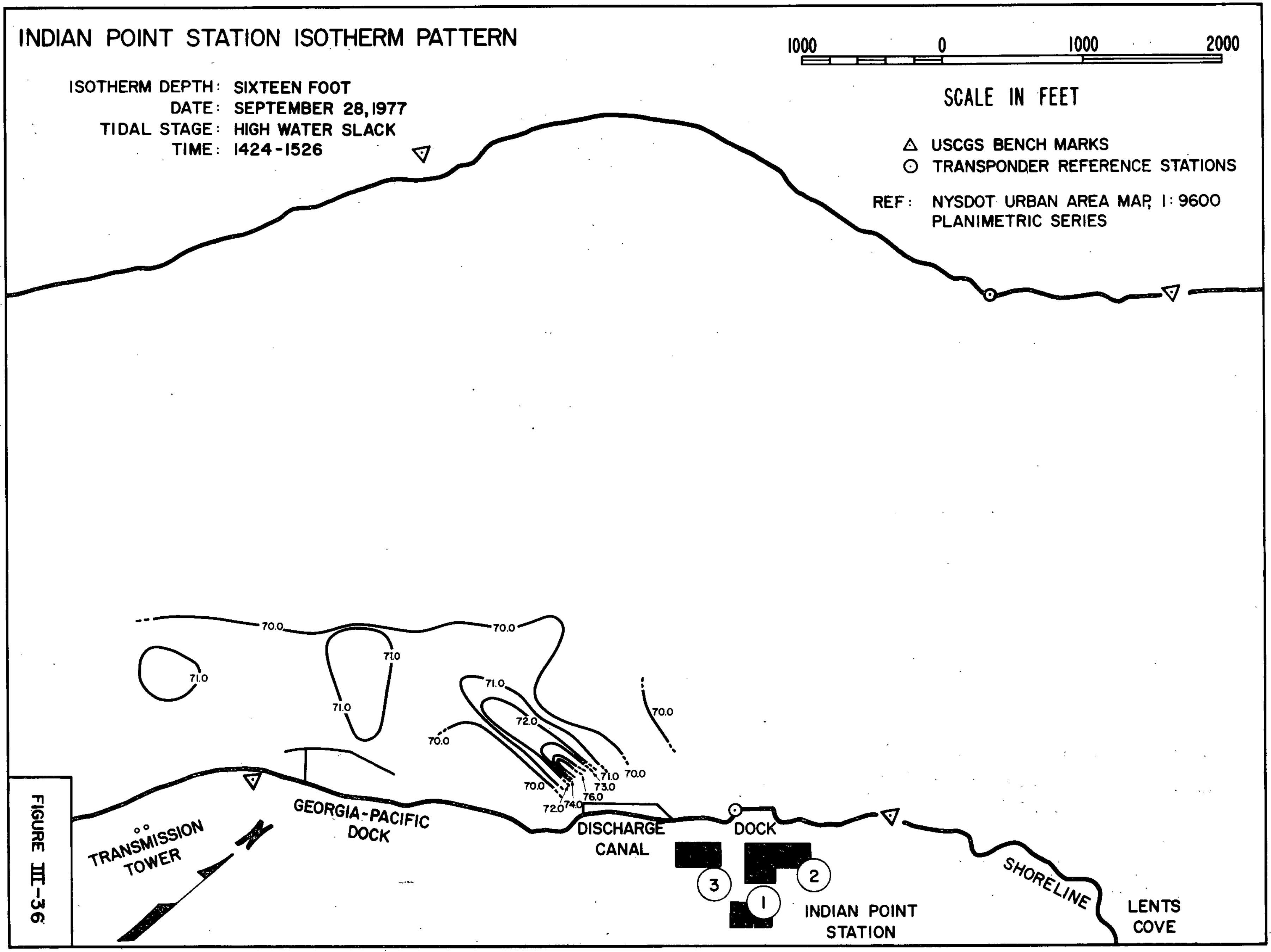


FIGURE III-36

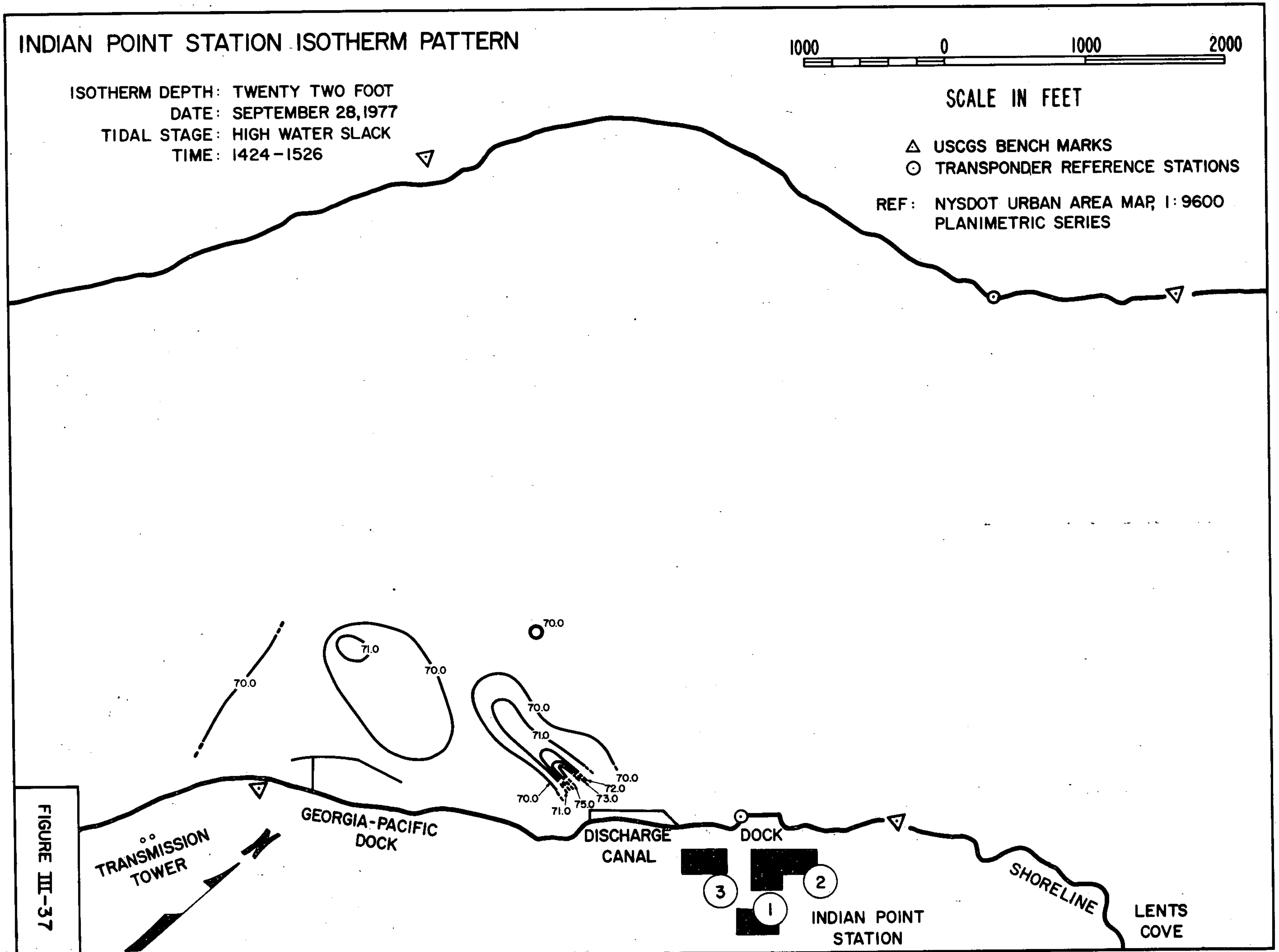
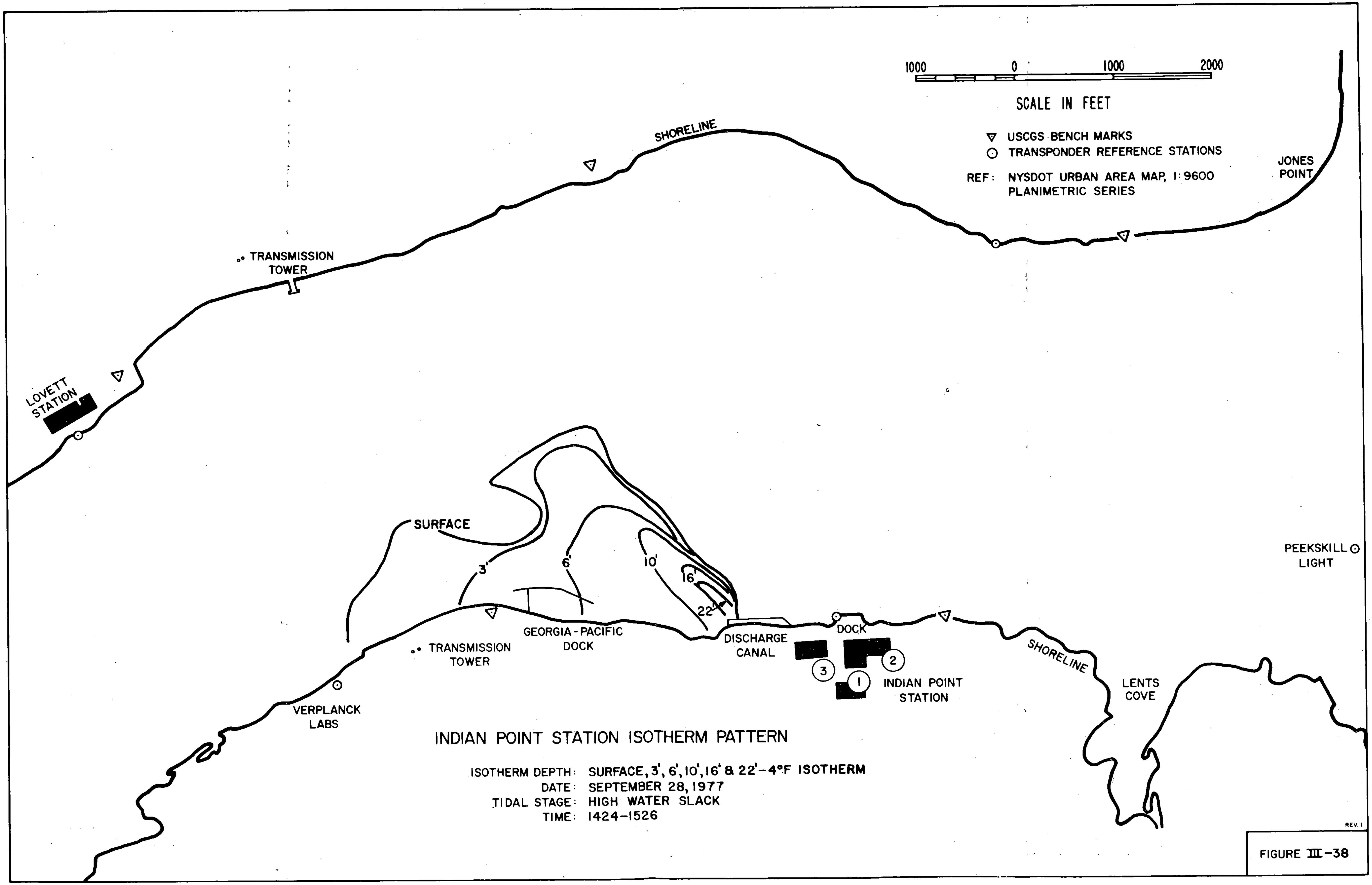


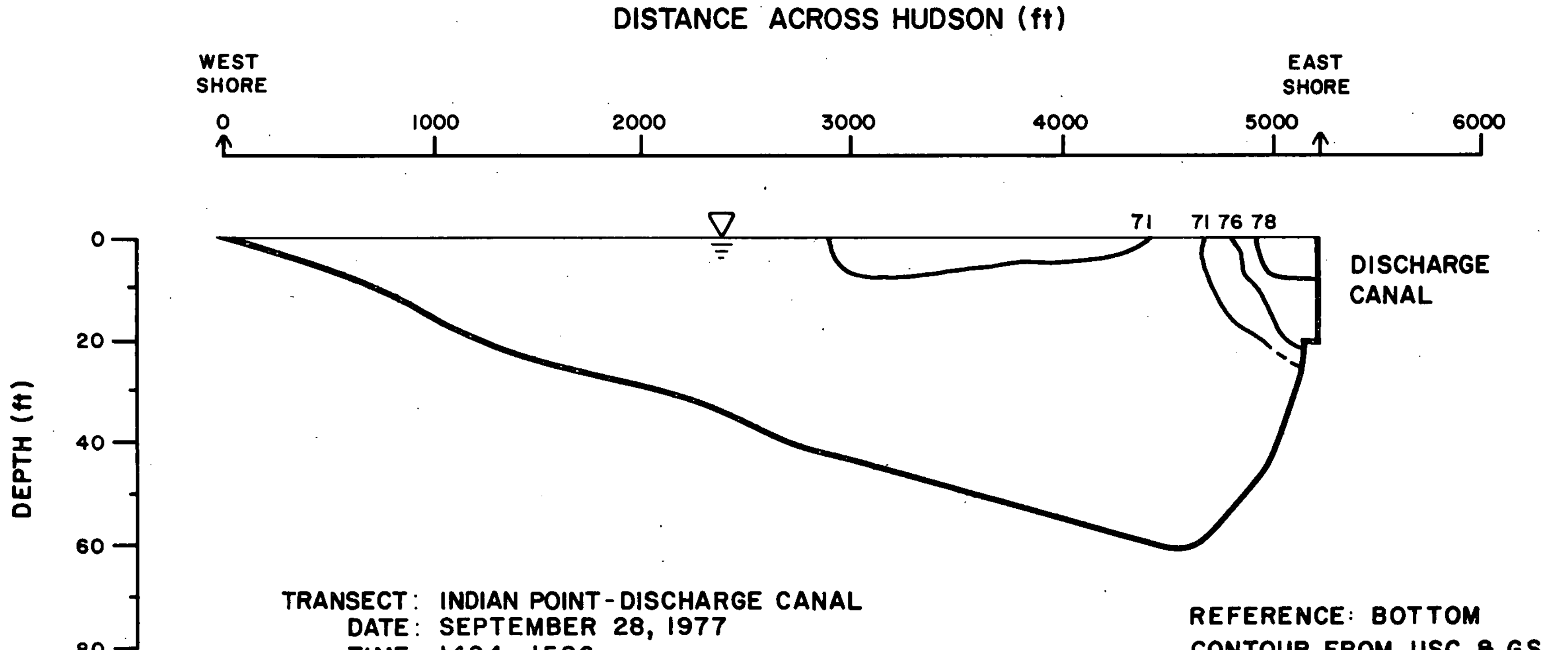
FIGURE III-37



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: SURFACE, 3', 6', 10', 16' & 22'–4°F ISOTHERM
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: HIGH WATER SLACK
TIME: 1424–1526

FIGURE III-38

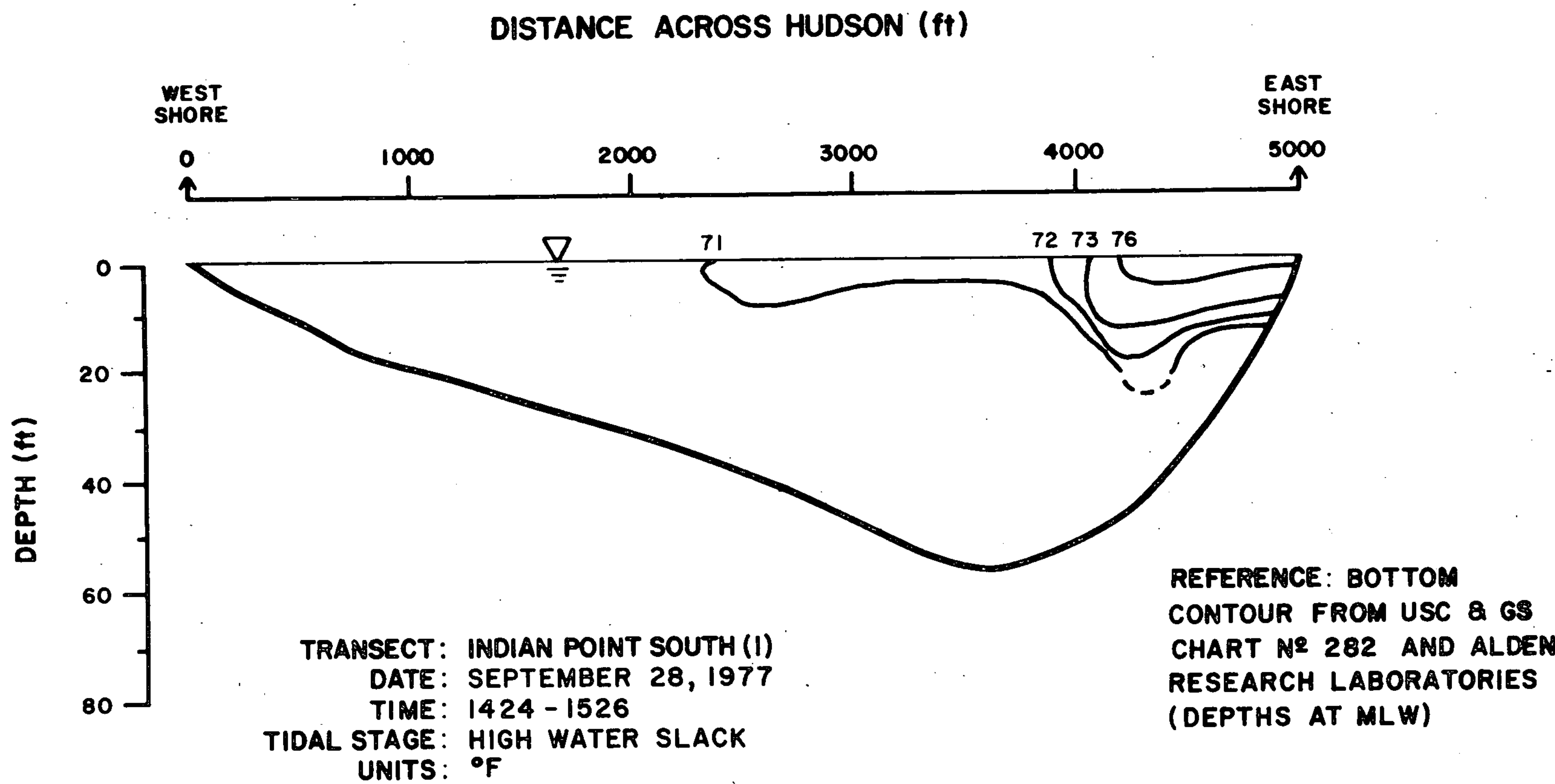


TRANSECT: INDIAN POINT-DISCHARGE CANAL
DATE: SEPTEMBER 28, 1977
TIME: 1424-1526
TIDAL STAGE: HIGH WATER SLACK
UNITS: °F

REFERENCE: BOTTOM CONTOUR FROM USC & GS CHART No. 282 AND ALDEN RESEARCH LABORATORIES (DEPTHS AT MLW)

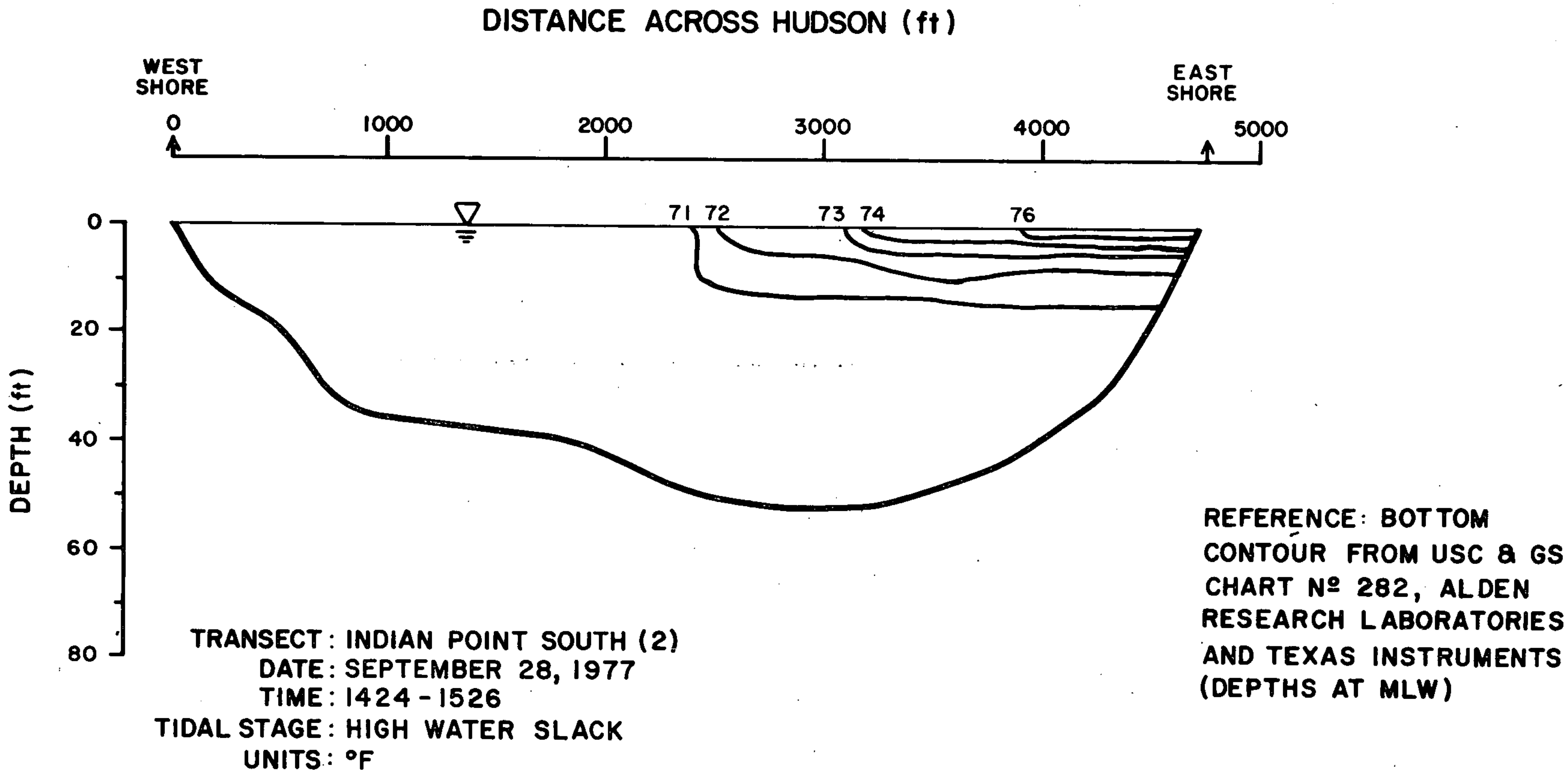
CROSS-SECTIONAL TEMPERATURE PATTERN AT INDIAN POINT-DISCHARGE CANAL: HIGH WATER SLACK

FIGURE III-39



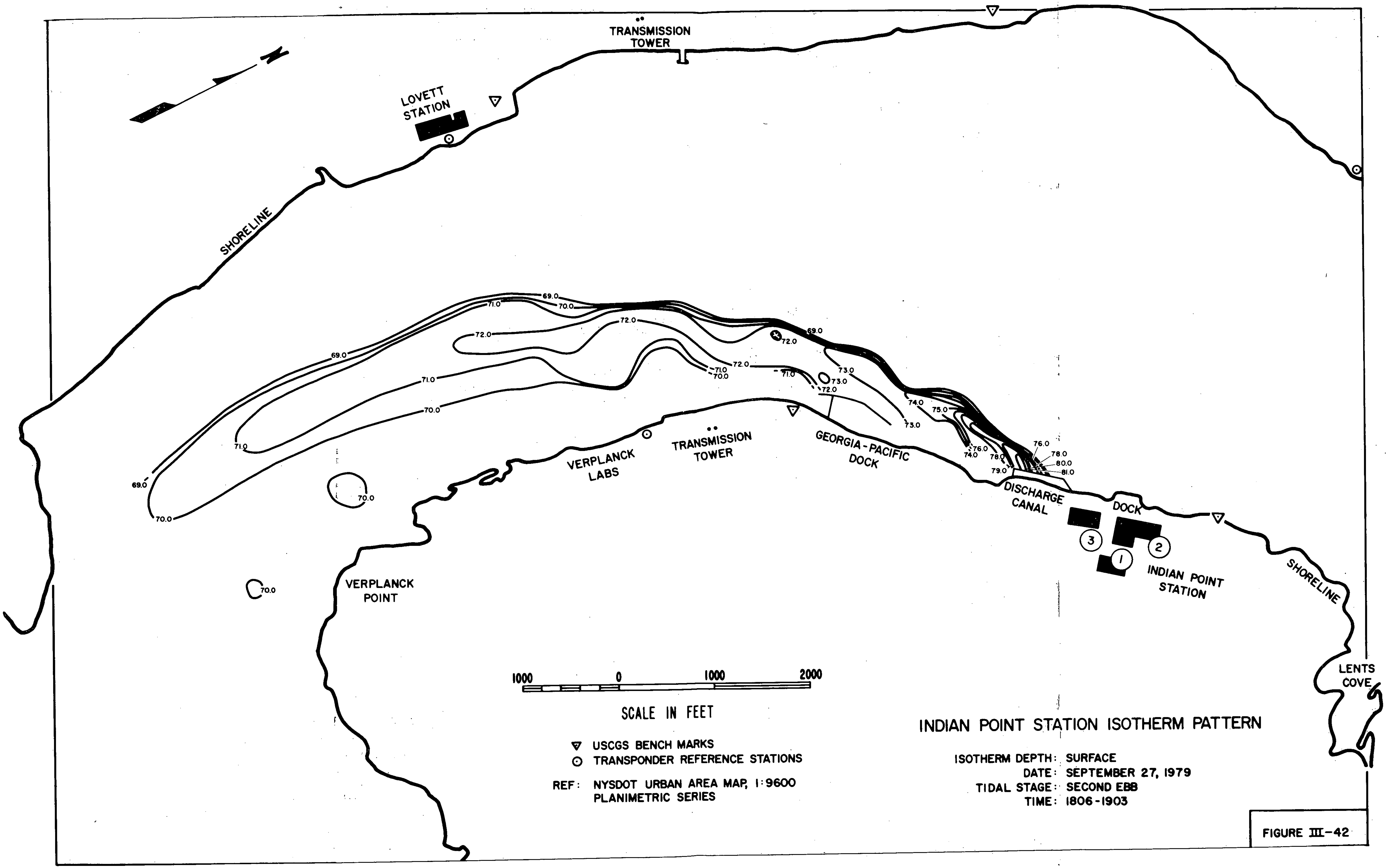
CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (I):
HIGH WATER SLACK

FIGURE III-40



CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (2):
HIGH WATER SLACK

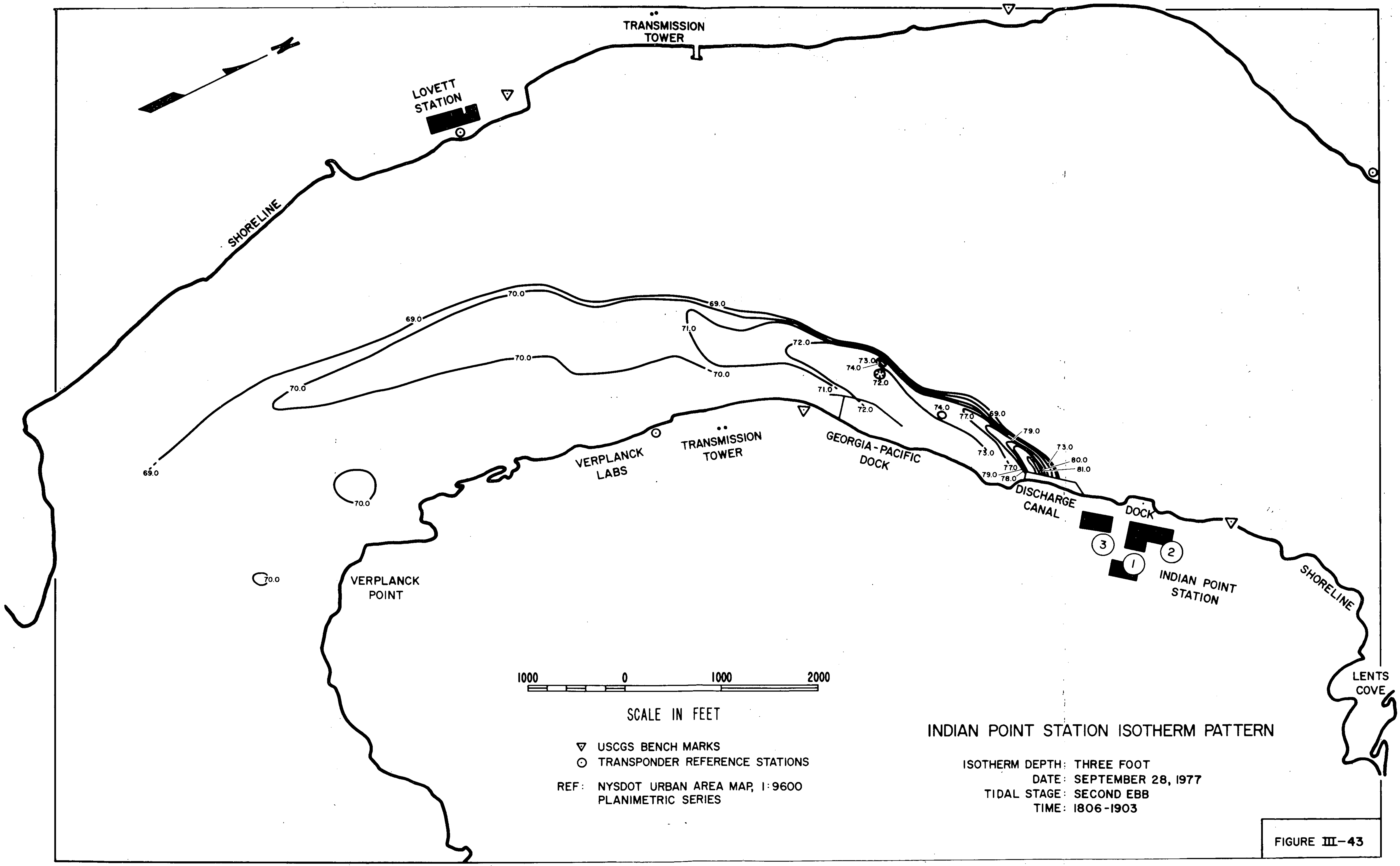
FIGURE III-41



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: SURFACE
DATE: SEPTEMBER 27, 1979
TIDAL STAGE: SECOND EBB
TIME: 1806-1903

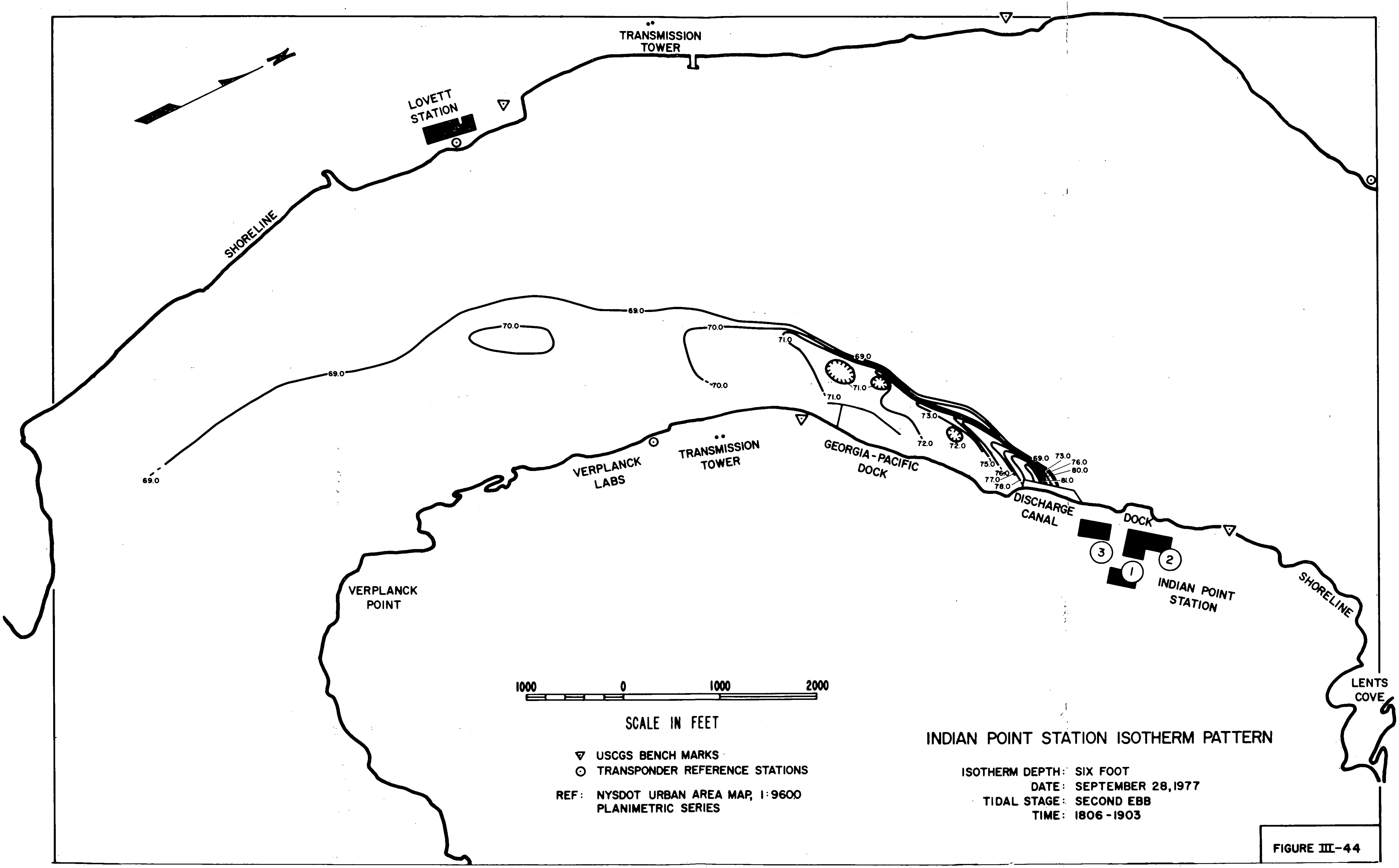
FIGURE III-42



INDIAN POINT STATION ISOTHERM PATTERN

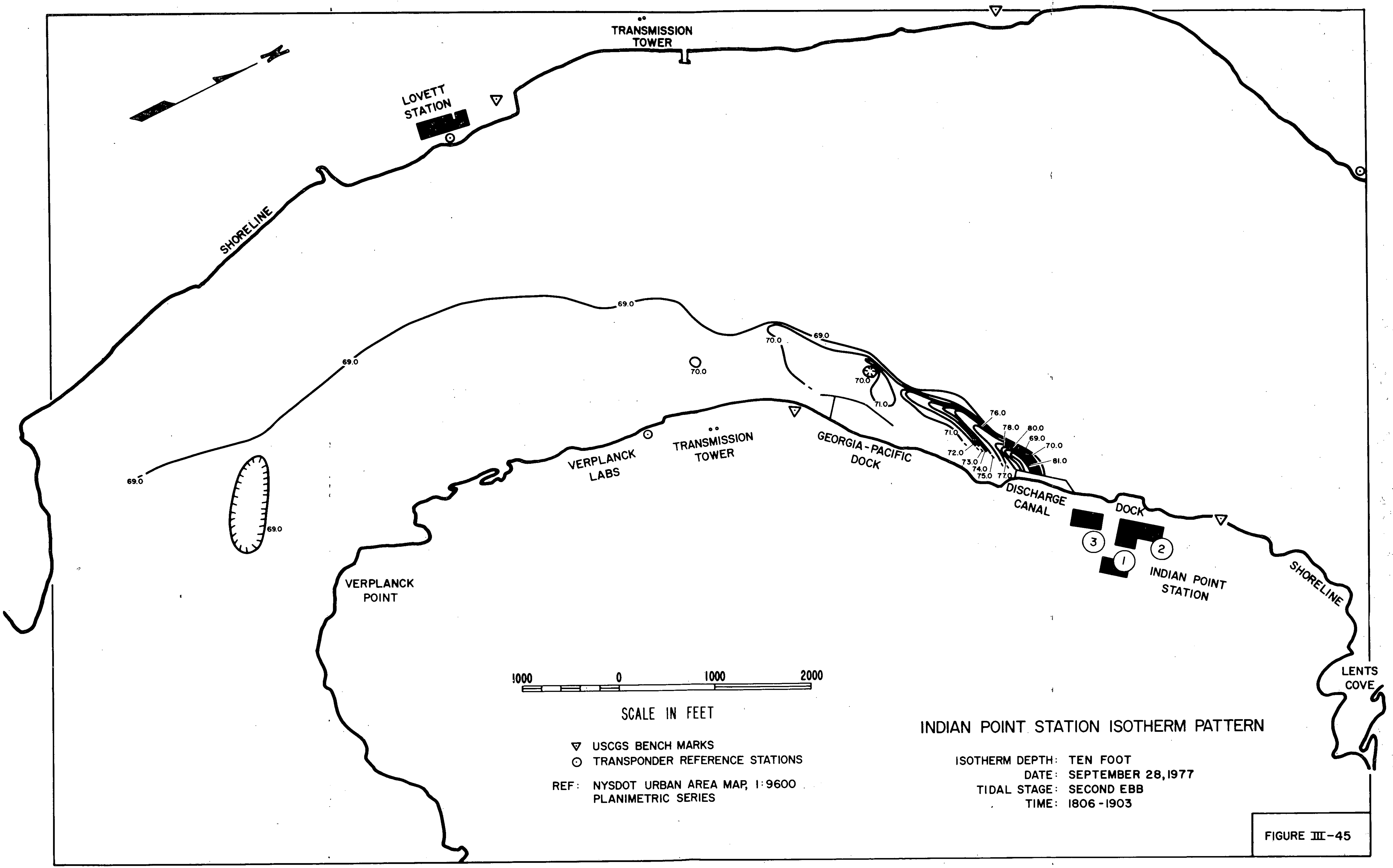
ISOTHERM DEPTH: THREE FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: SECOND EBB
TIME: 1806-1903

FIGURE III-43



INDIAN POINT STATION ISOTHERM PATTERN

FIGURE III-44



INDIAN POINT STATION ISOTHERM PATTERN

ISOTHERM DEPTH: TEN FOOT
DATE: SEPTEMBER 28, 1977
TIDAL STAGE: SECOND EBB
TIME: 1806-1903

FIGURE III-45

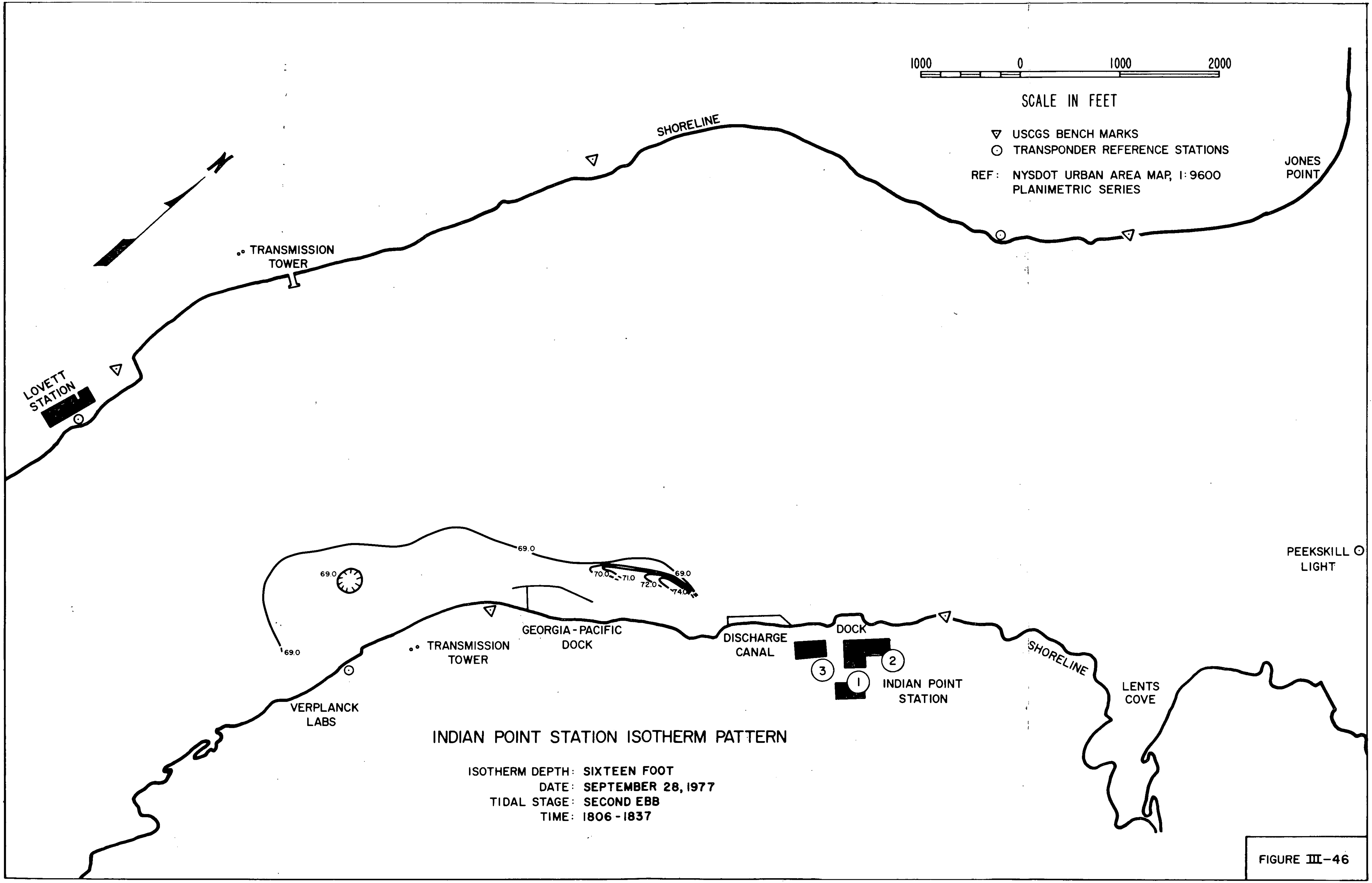


FIGURE III-46

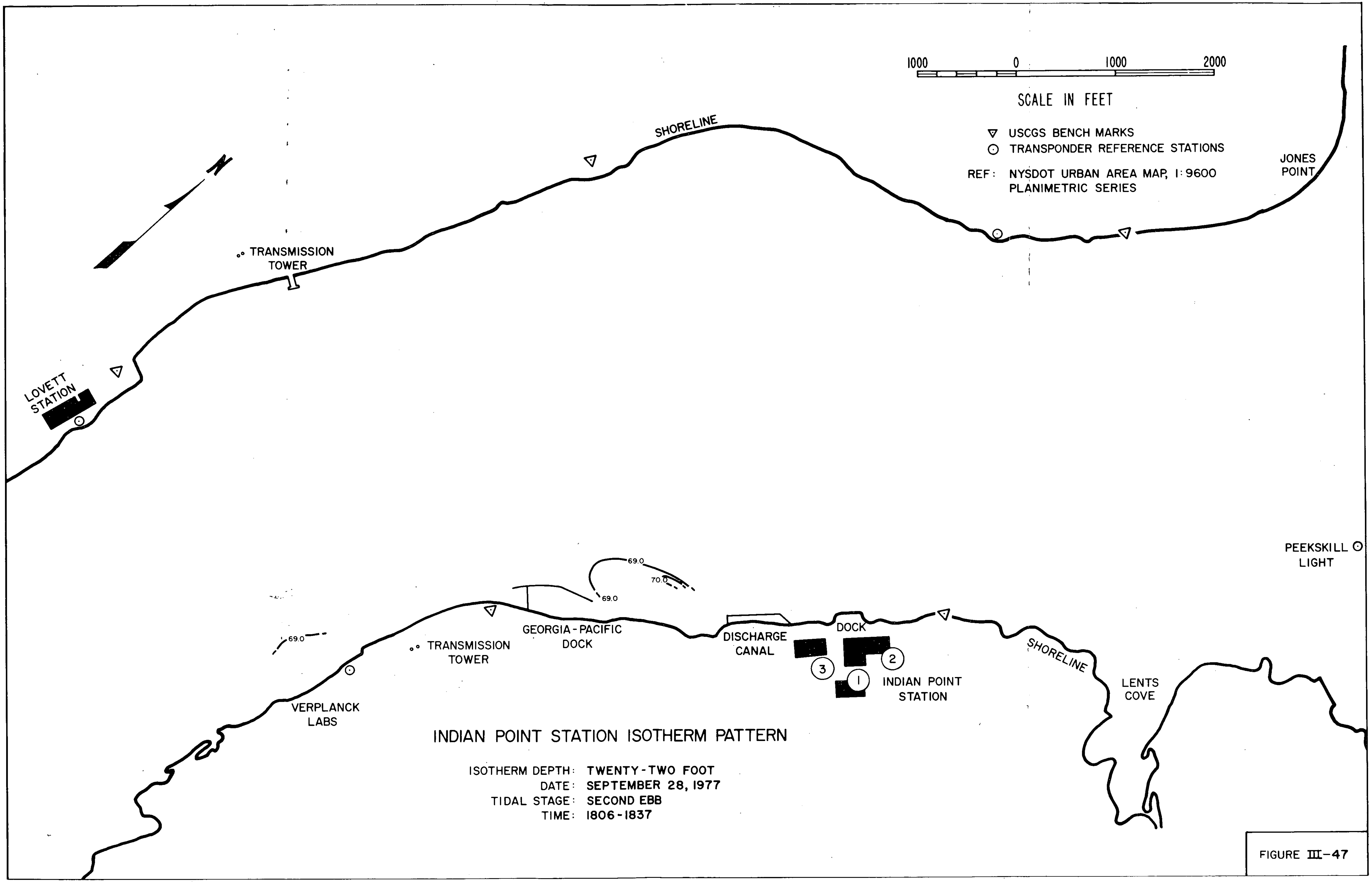


FIGURE III-47

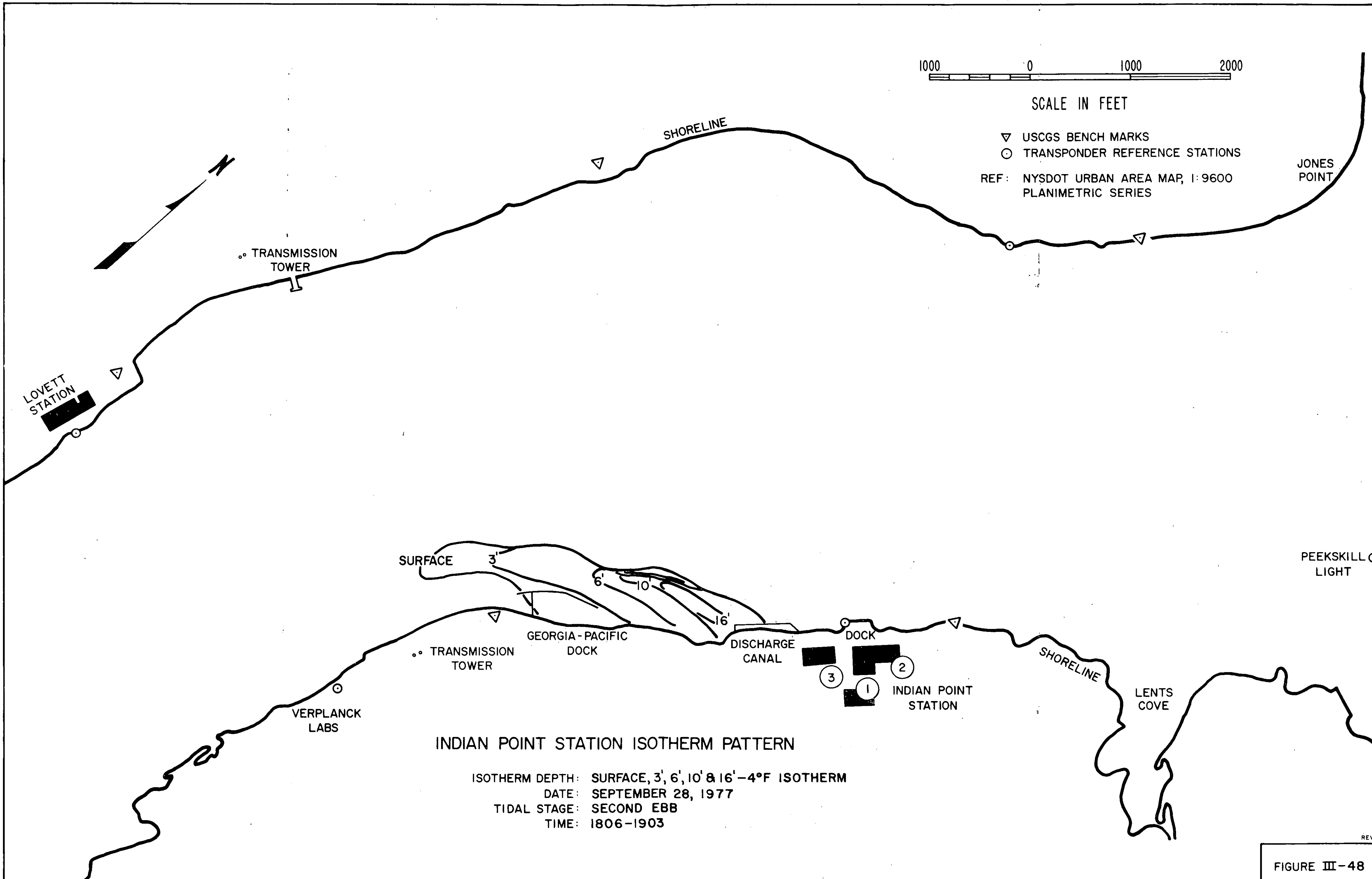
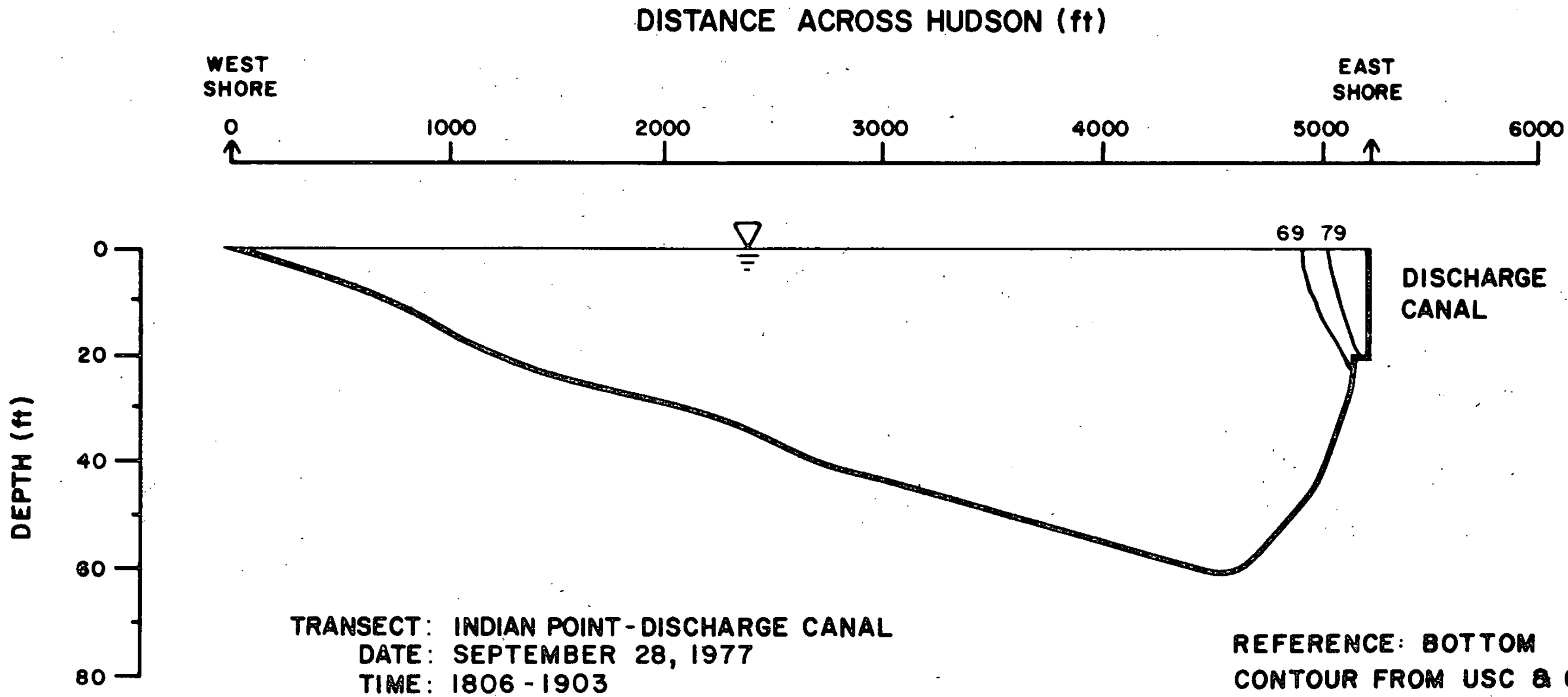


FIGURE III-48

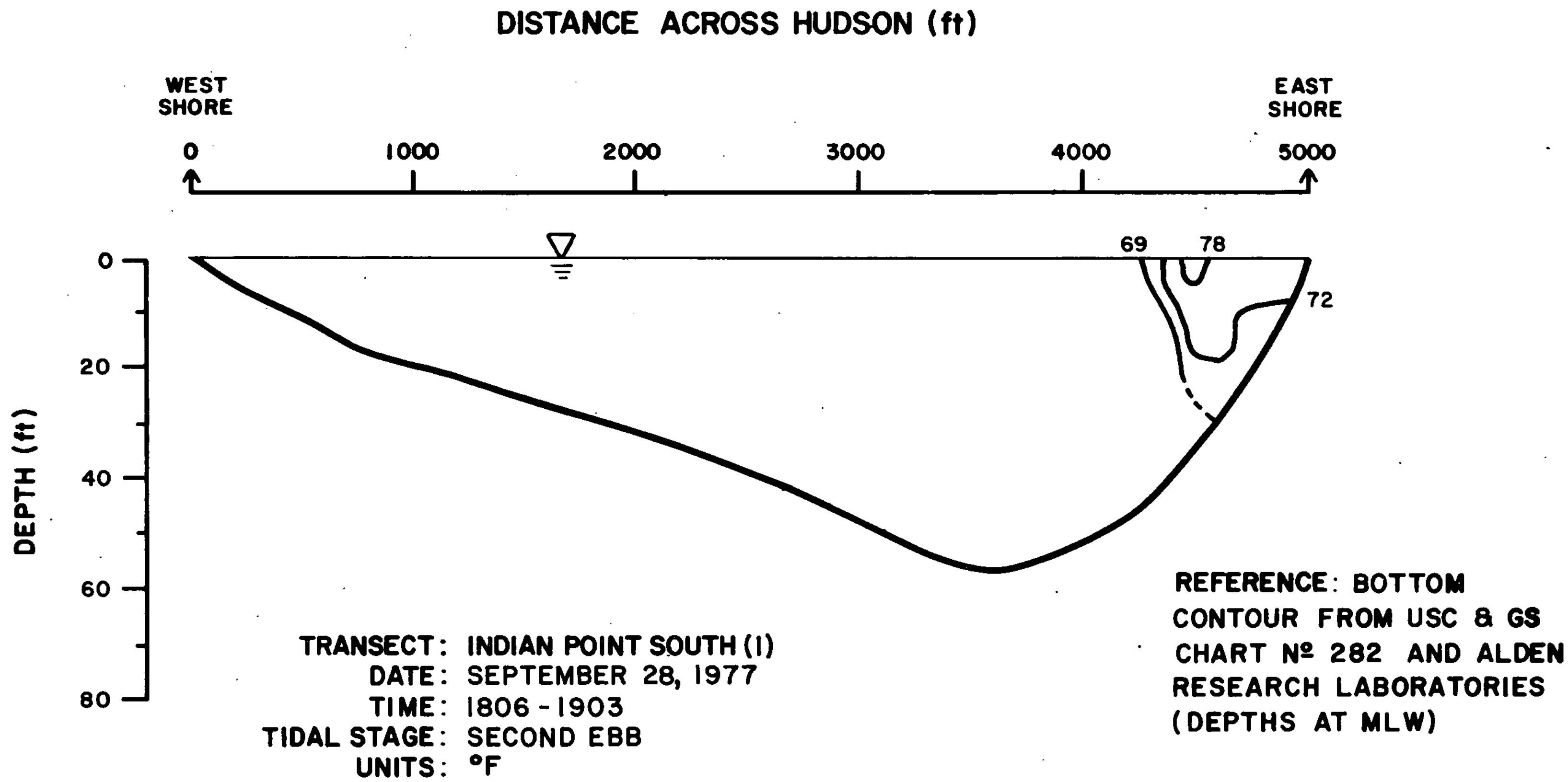


TRANSECT: INDIAN POINT-DISCHARGE CANAL
DATE: SEPTEMBER 28, 1977
TIME: 1806-1903
TIDAL STAGE: SECOND EBB
UNITS: °F

REFERENCE: BOTTOM CONTOUR FROM USC & GS CHART No. 282 AND ALDEN RESEARCH LABORATORIES (DEPTHS AT MLW)

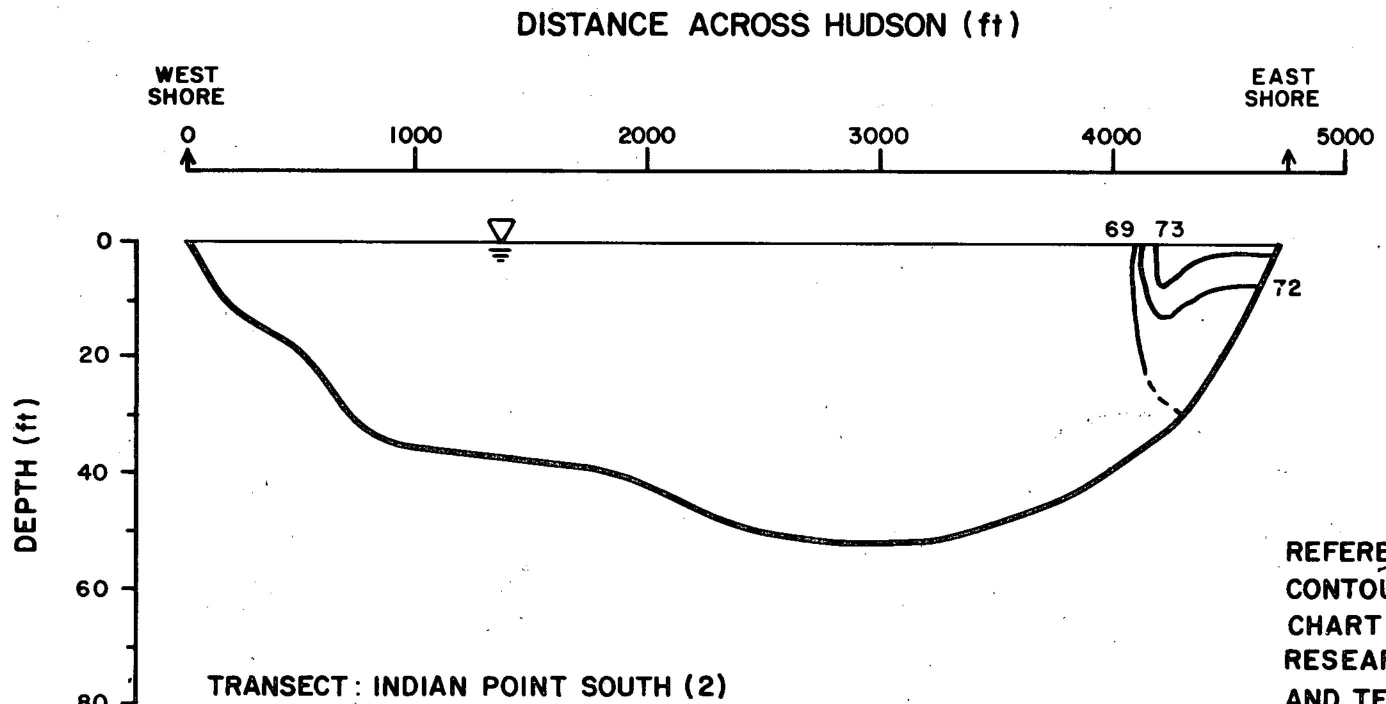
CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT-DISCHARGE CANAL:
SECOND EBB

FIGURE III-49



CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (I):
SECOND EBB

FIGURE III - 50

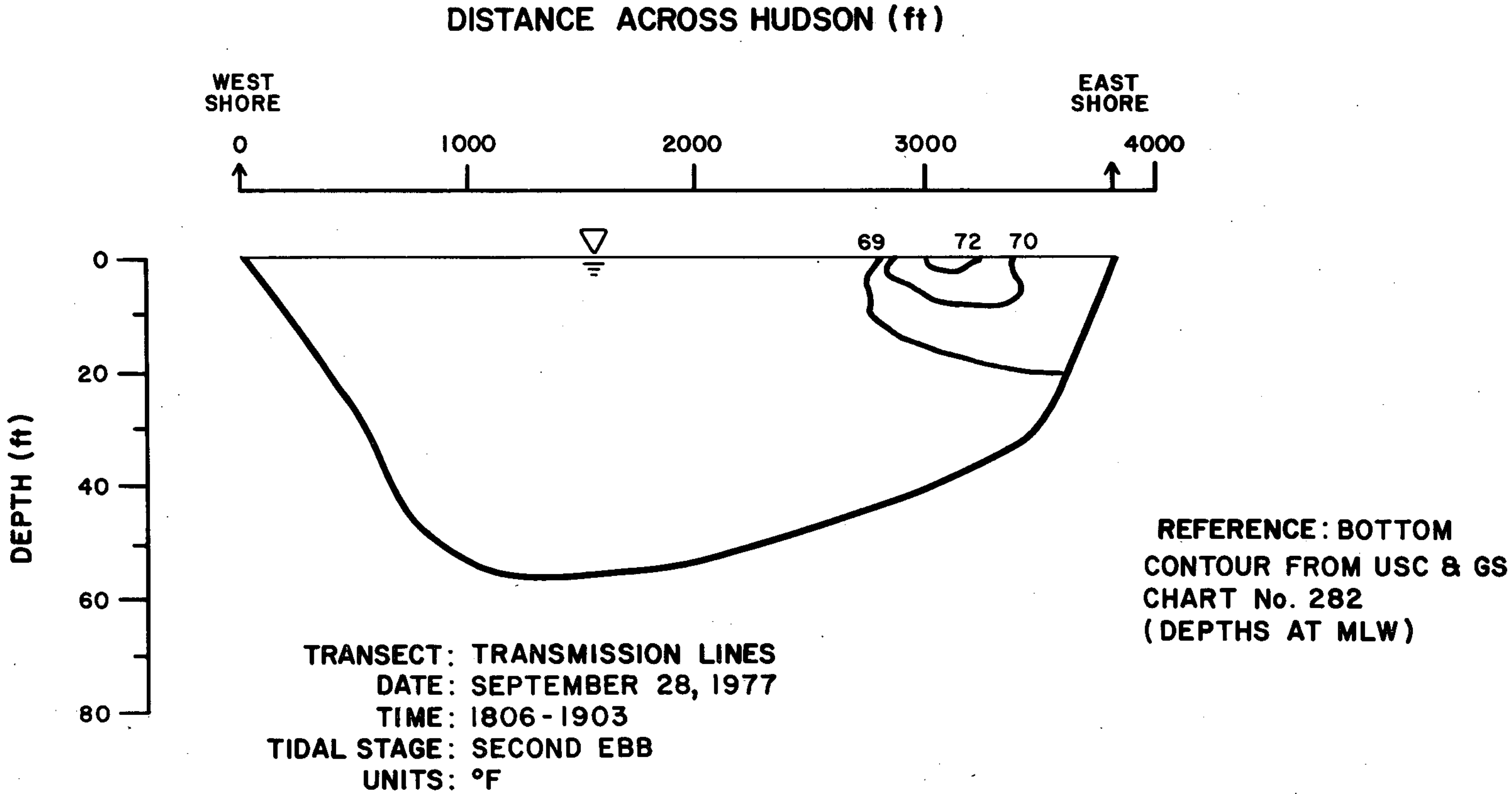


TRANSECT: INDIAN POINT SOUTH (2)
DATE: SEPTEMBER 28, 1977
TIME: 1806 - 1903
TIDAL STAGE: SECOND EBB
UNITS: °F

REFERENCE: BOTTOM CONTOUR FROM USC & GS CHART Nº 282, ALDEN RESEARCH LABORATORIES AND TEXAS INSTRUMENTS (DEPTHS AT MLW)

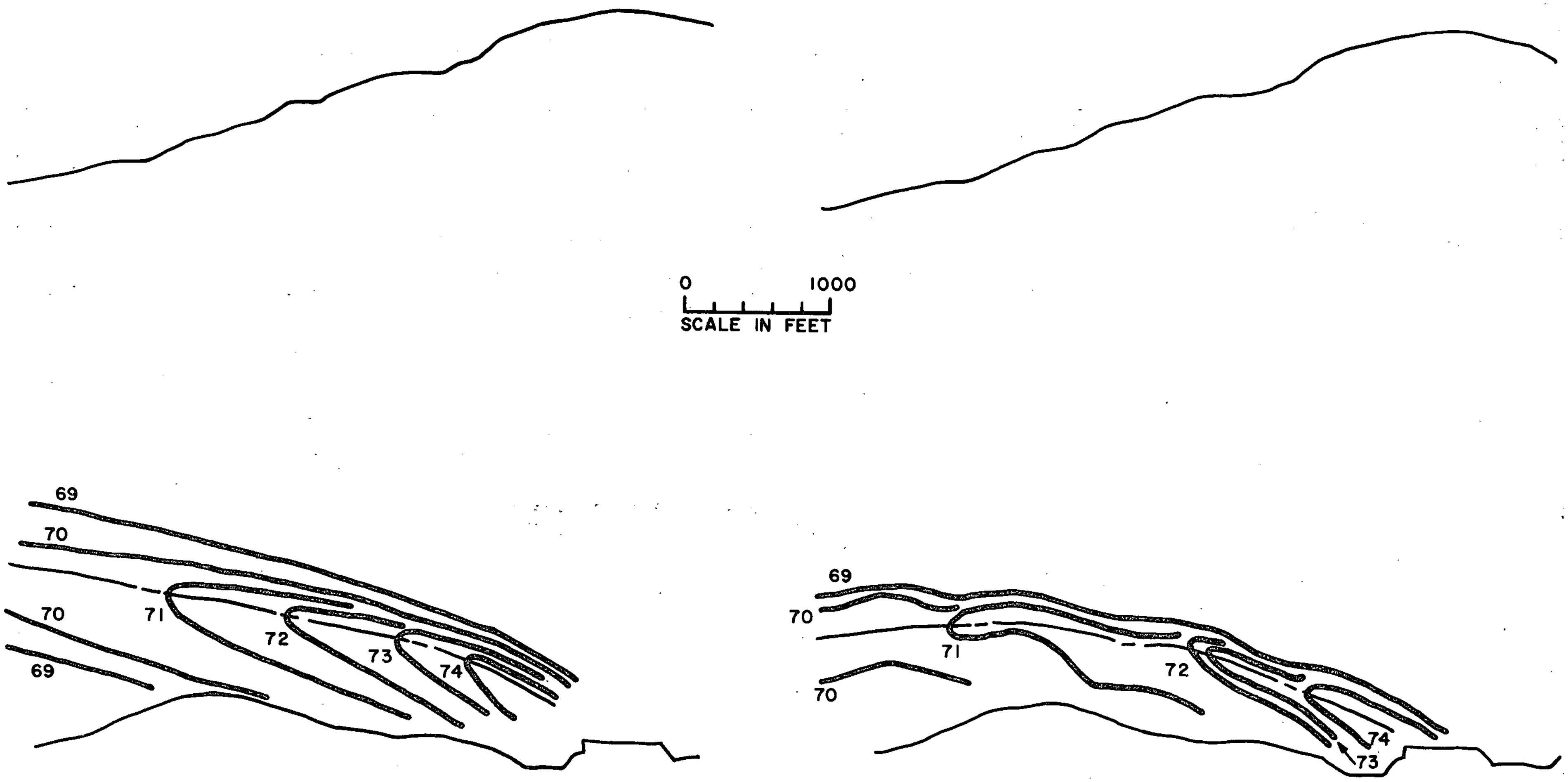
CROSS-SECTIONAL TEMPERATURE PATTERN
AT INDIAN POINT SOUTH (2):
SECOND EBB

FIGURE III-51



CROSS-SECTIONAL TEMPERATURE PATTERN
AT TRANSMISSION LINES:
SECOND EBB

FIGURE III - 52

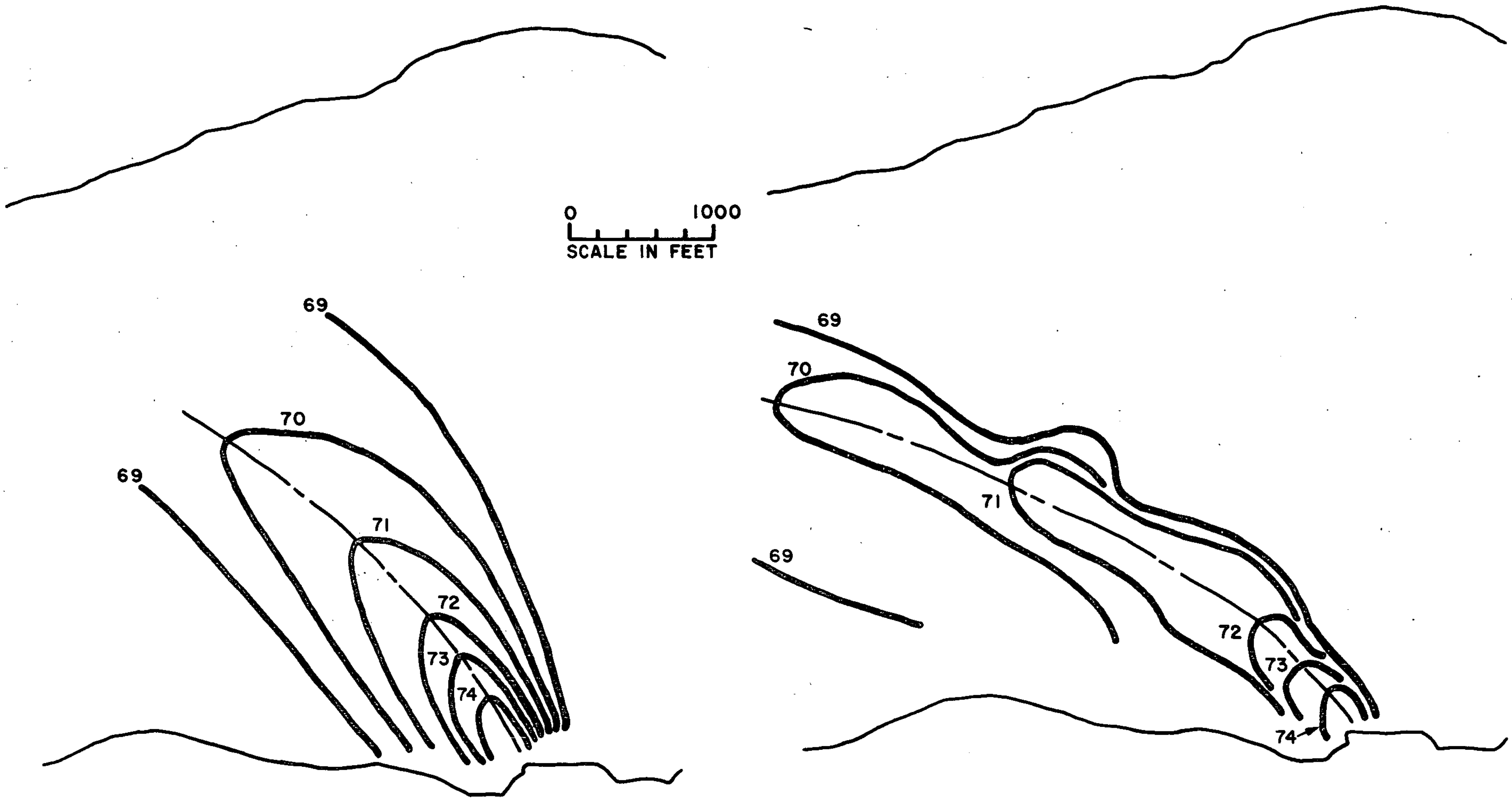


A. MODEL PREDICTION

B. FIELD DATA ISOTHERMS

COMPARISON OF UPPER LAYER ISOTHERMS
FIRST EBB FOR SEPTEMBER 28, 1977

FIGURE IV-1

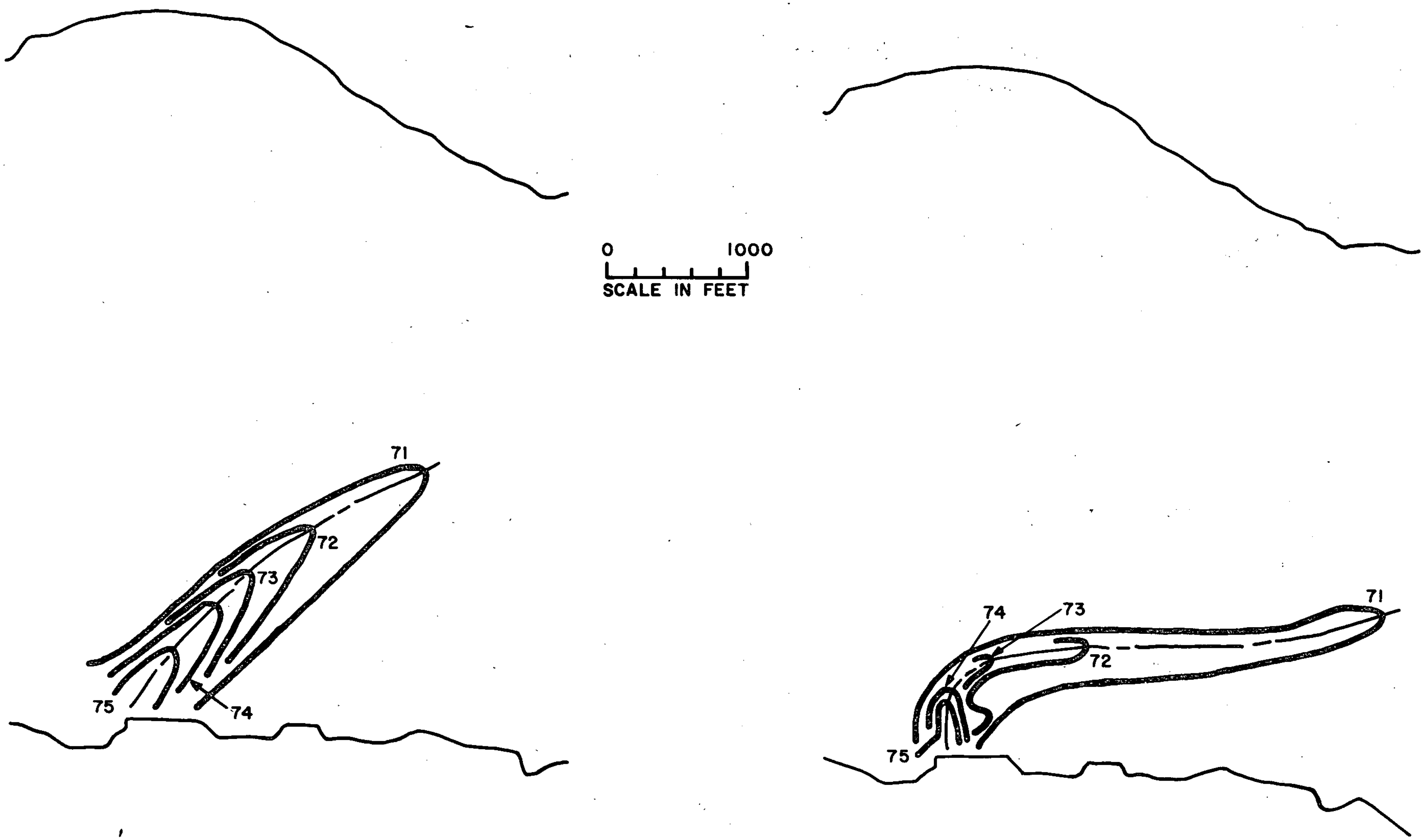


A. MODEL PREDICTION

B. FIELD DATA ISOTHERMS

COMPARISON OF UPPER LAYER ISOTHERMS
LOW WATER SLACK FOR SEPTEMBER 28, 1977

FIGURE IV-2

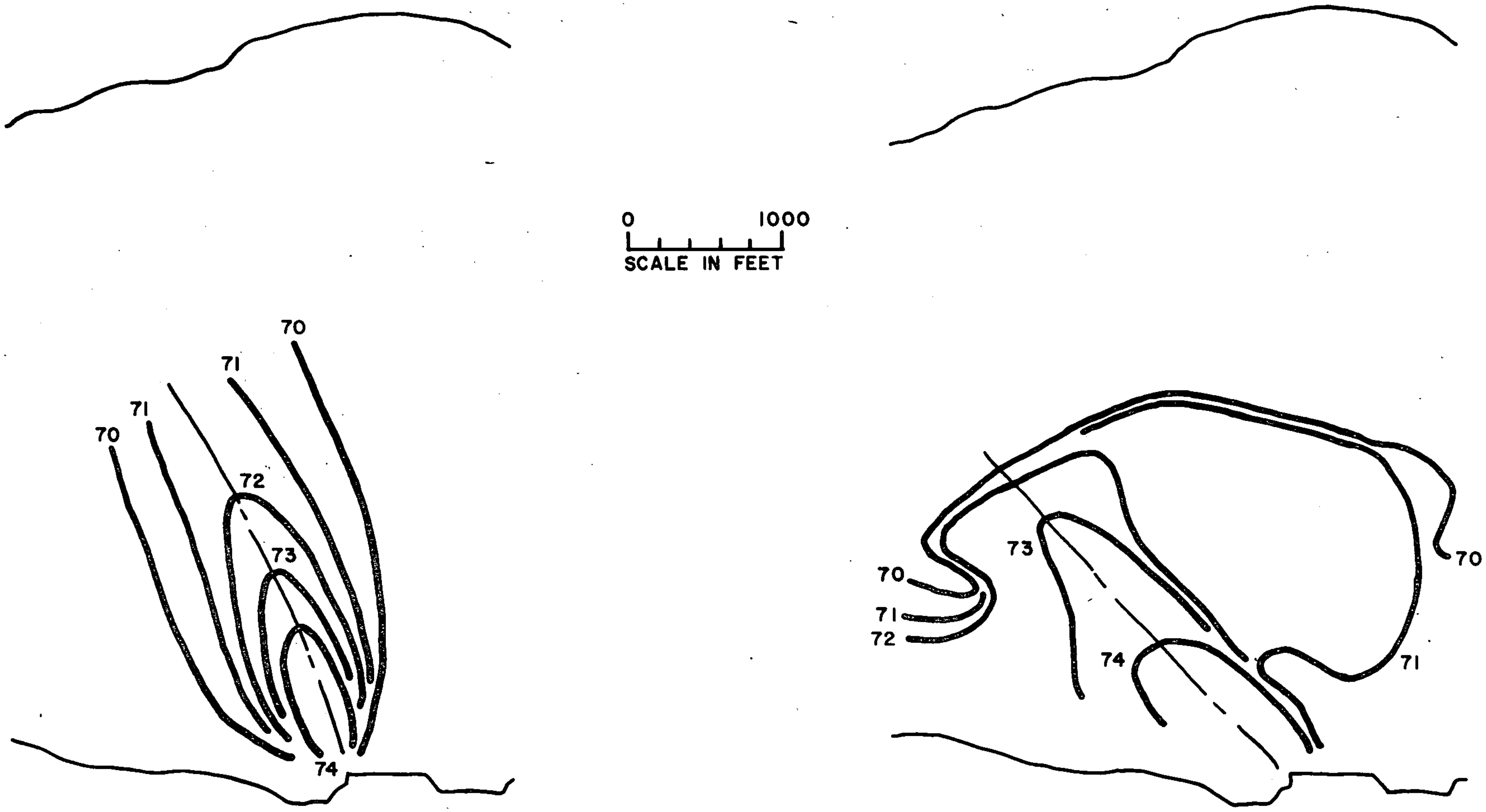


A. MODEL PREDICATION

B. FIELD DATA ISOTHERMS

COMPARISON OF UPPER LAYER ISOTHERMS
FLOOD FOR SEPTEMBER 28, 1977

FIGURE IV-3

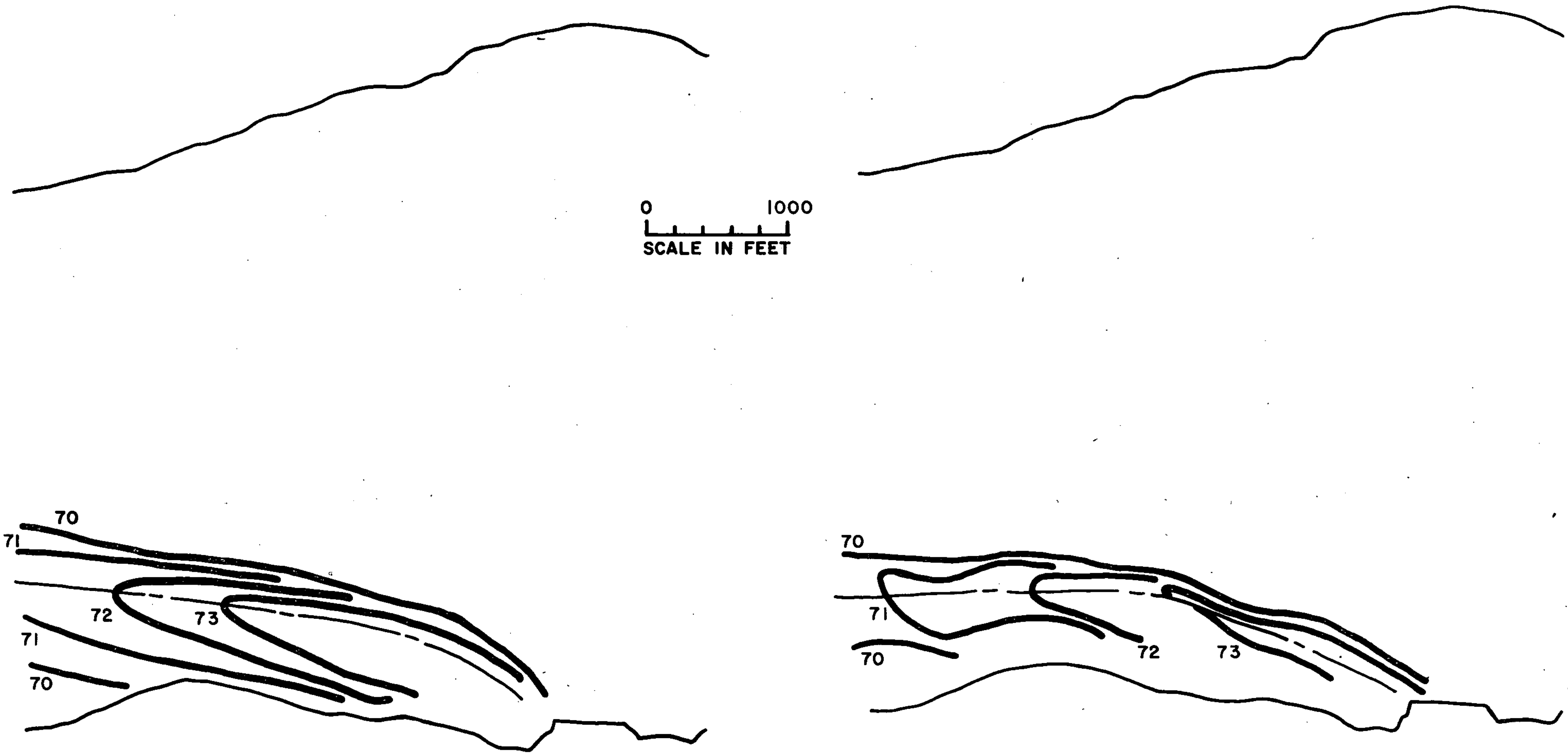


A. MODEL PREDICTION

B. FIELD DATA ISOTHERMS

COMPARISON OF UPPER LAYER ISOTHERMS
HIGH WATER SLACK FOR SEPTEMBER 28, 1977

FIGURE IV-4



A. MODEL PREDICATION

B. FIELD DATA ISOTHERMS

COMPARISON OF UPPER LAYER ISOTHERMS
SECOND EBB FOR SEPTEMBER 28, 1977

FIGURE IV-5

APPENDICES

APPENDIX A

SURVEY SEQUENCE

September 27, 1977

First Ebb

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 0345-0356)

Transmission Lines vertical profile transect (temperature and conductivity-time of measurement: 0506-0525)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 0431-0454)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 0342-0407)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 0413-0415)

Grassy Point lateral scanning transect (temperature - time of measurement: 0424-0431)

Croton Point lateral scanning transect (temperature - time of measurement: 0349-0356)

Bear Mountain Bridge - Stony Point longitudinal scanning transect (temperature - time of measurement: 0504-0604)

Croton Point-Stony Point longitudinal scanning transect (temperature - time of measurement: 0504-0542)

Low Water Slack

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 0653-0703)

Transmission Lines vertical profile transect (temperature and conductivity-time of measurement: 0757-0815)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 0729-0746)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 0647-0708)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 0703-0711)

Grassy Point lateral scanning transect (temperature - time of measurement: 0723-0730)

Croton Point lateral scanning transect (temperature - time of measurement: 0652-0659)

Bear Mountain Bridge - Stony Point longitudinal scanning transect (temperature - time of measurement: 0757-0850)

Croton Point - Stony Point longitudinal scanning transect (temperature - time of measurement: 0759-0850)

Flood

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1000-1012)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 1103-1118)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 1029-1052)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 0949-1008)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1018-1021)

Grassy Point lateral scanning transect (temperature - time of measurement: 1017-1024)

Croton Point lateral scanning transect (temperature - time of measurement: 0946-0953)

Bear Mountain Bridge - Stony Point longitudinal scanning transect (temperature-time of measurement: 1047-1131)

Croton Point - Stony Point longitudinal scanning transect (temperature - time of measurement: 1048-1148)

High Water Slack

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1233-1245)

Transmission Lines vertical profile transect (temperature and conductivity-time of measurement: 1331-1348)

Grassy Point vertical profile transect (temperature and conductivity-time of measurement: 1302-1320)

Croton Point vertical profile transect (temperature and conductivity-time of measurement: 1222-1239)

Bear Mountain Bridge lateral scanning transect (temperature-time of measurement: 1253-1256)

Grassy Point lateral scanning transect (temperature-time of measurement: 1308-1314)

Croton Point lateral scanning transect (temperature - time of measurement: 1225-1232)

Bear Mountain Bridge - Stony Point longitudinal scanning transect (temperature - time of measurement: 1327-1425)

Croton Point - Stony Point longitudinal scanning transect (temperature - time of measurement: 1326-1411)

Second Ebb

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1629-1637)

Transmission lines vertical profile transect (temperature and conductivity-time of measurement: 1658-1715)

Grassy Point vertical profile transect (temperature and conductivity-time of measurement: 1643-1707)

Croton Point vertical profile transect (temperature and conductivity-time of measurement: 1559-1616)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1644-1647)

Grassy Point lateral scanning transect (temperature - time of measurement: 1704-1711)

Croton Point lateral scanning transect (temperature - time of measurement: 1628-1634)

September 28, 1977

First Ebb

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 0423-0434)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 0558-0615)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 0515-0545)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 0419-0442)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 0441-0443)

Grassy Point lateral scanning transect (temperature - time of measurement: 0450-0457)

Croton Point lateral scanning transect (temperature - time of measurement: 0417-0424)

Thermal plume mapping scan: near field. (temperature - time of measurement: 0519-0551)

Thermal plume mapping scan: far field. (temperature - time of measurement: 0521-0606)

Low Water Slack

Bear Mountain Bridge vertical profile transect. (temperature and conductivity - time of measurement: 0738-0747)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 0853-0910)

Grassy Point vertical profile transect. (temperature and conductivity - time of measurement: 0818-0839)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 0731-0755)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 0757-0759)

Grassy Point lateral scanning transect (temperature - time of measurement: 0801-0808)

Croton Point lateral scanning transect (temperature - time of measurement: 0731-0801)

Thermal plume mapping scan: near field. (temperature - time of measurement: 0829-0907)

Thermal plume mapping scan: far field. (temperature- time of measurement: 0831-0926)

Flood

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1012-1018)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 1145-1204)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 1113-1134)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 1026-1053)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1025-1028)

Grassy Point lateral scanning transect (temperature - time of measurement: 1106-1113)

Croton Point lateral scanning transect (temperature - time of measurement: 1034-1042)

Thermal plume mapping scan: near field (temperature - time of measurement: 1137-1213)

Thermal plume mapping scan: far field (temperature - time of measurement: 1138-1231)

High Water Slack

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1343-1350)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 1431-1448)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 1358-1419)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 1312-1336)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1355-1357)

Grassy Point lateral scanning transect (temperature - time of measurement: 1401-1408)

Croton Point lateral scanning transect (temperature - time of measurement: 1321-1349)

Thermal plume mapping scan: near field (temperature - time of measurement: 1424-1458)

Thermal plume mapping scan: far field (temperature - time of measurement: 1429-1526)

Second Ebb

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1652-1702)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 1803-1818)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 1730-1746)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 1645-1705)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1713-1716)

Grassy Point lateral scanning transect (temperature - time of measurement: 1743-1749)

Croton Point lateral scanning transect (temperature - time of measurement: 1711-1717)

Thermal plume mapping scan: near field (temperature - time of measurement: 1806-1837)

Thermal plume mapping scan: far field (temperature - time of measurement: 1806-1903)

September 29, 1977

First Ebb

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 0456-0508)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 0633-0648)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 0604-0621)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 0503-0539)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 0516-0518)

Grassy Point lateral scanning transect (temperature - time of measurement: 0603-0610)

Croton Point lateral scanning transect (temperature - time of measurement: 0506-0518)

Bear Mountain Bridge - Stony Point longitudinal scanning transect (temperature - time of measurement: 0623-0744)

Croton Point - Stony Point longitudinal scanning transect (temperature - time of measurement: 0624-0655)

Low Water Slack

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 0816-0824)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 0932-0949)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 0853-0911)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 0808-0828)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 0831-0833)

Grassy Point lateral scanning transect (temperature - time of measurement: 0853-0900)

Croton Point lateral scanning transect (temperature - time of measurement: 0810-0817)

Bear Mountain Bridge-Stony Point longitudinal scanning transect (temperature - time of measurement: 0914-1003)

Croton Point - Stony Point longitudinal scanning transect (temperature - time of measurement: 0915-1003)

Flood

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1115-1127)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 1214-1227)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 1145-1201)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 1104-1126)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1131-1135)

Grassy Point lateral scanning transect (temperature - time of measurement: 1127-1133)

Croton Point lateral scanning transect (temperature - time of measurement: 1053-1058)

Bear Mountain Bridge - Stony Point longitudinal scanning transect (temperature - time of measurements: 1211-1248)

Croton Point - Stony Point longitudinal scanning transect (temperature - time of a measurement: 1211-1345)

High Water Slack

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1422-1432)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 1520-1533)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 1448-1505)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 1404-1424)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1438-1441)

Grassy Point lateral scanning transect (temperature - time of measurement: 1457-1503)

Croton Point lateral scanning transect (temperature - time of measurement: 1421-1424)

Bear Mountain Bridge - Stony Point longitudinal scanning transect (temperature - time of measurement: 1511-1612)

Croton Point - Stony Point longitudinal scanning transect (temperature - time of measurement: 1511-1554)

Second Ebb

Bear Mountain Bridge vertical profile transect (temperature and conductivity - time of measurement: 1737-1747)

Transmission Lines vertical profile transect (temperature and conductivity - time of measurement: 1820-1831)

Grassy Point vertical profile transect (temperature and conductivity - time of measurement: 1818-1842)

Croton Point vertical profile transect (temperature and conductivity - time of measurement: 1724-1749)

Bear Mountain Bridge lateral scanning transect (temperature - time of measurement: 1807-1809)

Grassy Point lateral scanning transect (temperature - time of measurement: 1749-1755)

Croton Point lateral scanning transect (temperature - time of measurement: 1717-1725)

APPENDIX B

INDIAN POINT STATION ELECTRICAL GENERATION
DURING SURVEY

Date	Time	Unit No. 2 MWe (Gross)	Unit No. 3 MWe (Gross)	Total MWe (Gross)
09/23/77	0100	870	890	1760
	0200	870	890	1760
	0300	870	890	1760
	0400	870	890	1760
	0500	870	890	1760
	0600	870	890	1760
	0700	870	890	1760
	0800	870	890	1760
	0900	870	890	1760
	1000	870	890	1760
	1100	870	890	1760
	1200	870	890	1760
	1300	870	890	1760
	1400	870	890	1760
	1500	860	890	1750
	1600	860	890	1795
	1700	860	890	1750
	1800	860	890	1750
	1900	860	890	1750
	2000	860	890	1750
	2100	860	890	1750
	2200	860	890	1750
	2300	860	890	1750
	2400	860	890	1750
09/24/77	0100	870	890	1760
	0200	870	890	1760
	0300	870	890	1760
	0400	870	890	1760
	0500	870	890	1760
	0600	870	890	1760
	0700	870	890	1760
	0800	870	890	1760
	0900	870	890	1760
	1000	865	890	1755
	1100	865	890	1755
	1200	860	890	1750

Date	Time	Unit No. 2 MWe (Gross)	Unit No. 3 MWe (Gross)	Total MWe (Gross)
	1300	860	890	1750
	1400	860	890	1750
	1500	860	890	1750
	1600	860	890	1750
	1700	860	890	1750
	1800	860	890	1750
	1900	860	890	1750
	2000	860	890	1750
	2100	860	890	1750
	2200	860	890	1750
	2300	860	890	1750
	2400	860	890	1750
09/25/77	0100	860	890	1750
	0200	860	890	1750
	0300	860	890	1750
	0400	860	890	1750
	0500	860	890	1750
	0600	860	890	1750
	0700	860	890	1750
	0800	860	890	1750
	0900	860	890	1750
	1000	860	890	1750
	1100	860	890	1750
	1200	860	890	1750
	1300	860	890	1750
	1400	860	890	1750
	1500	860	890	1750
	1600	860	890	1750
	1700	860	890	1750
	1800	860	890	1750
	1900	860	890	1750
	2000	860	890	1750
	2100	860	890	1750
	2200	860	890	1750
	2300	860	890	1750
	2400	860	890	1750

Date	Time	Unit No. 2 MWe (Gross)	Unit No. 3 MWe (Gross)	Total MWe (Gross)
09/26/77	0100	860	890	1750
	0200	860	890	1750
	0300	860	890	1750
	0400	860	890	1750
	0500	860	890	1750
	0600	860	890	1750
	0700	860	890	1750
	0800	860	890	1750
	0900	860	890	1750
	1000	860	890	1750
	1100	860	890	1750
	1200	860	890	1750
	1300	860	890	1750
	1400	860	890	1750
	1500	860	890	1750
	1600	0	0	0
	1700	0	0	0
	1800	70	0	70
	1900	200	0	200
	2000	370	0	370
	2100	510	0	510
	2200	620	0	620
	2300	800	0	800
	2400	800	200	1000
09/27/77	0100	730	260	990
	0200	750	360	1110
	0300	780	480	1260
	0400	800	620	1420
	0500	830	730	1560
	0600	860	870	1730
	0700	860	880	1740
	0800	850	880	1730
	0900	850	890	1740
	1000	660	880	1540
	1100	475	880	1345
	1200	340	880	1220

Date	Time	Unit No. 2 MWe (Gross)	Unit No. 3 MWe (Gross)	Total MWe (Gross)
	1300	340	880	1220
	1400	340	880	1220
	1500	345	880	1225
	1600	340	880	1220
	1700	335	880	1215
	1800	330	880	1210
	1900	320	880	1200
	2000	320	880	1200
	2100	320	880	1200
	2200	320	880	1200
	2300	320	880	1200
	2400	320	880	1200
09/28/77	0100	330	880	1210
	0200	320	880	1200
	0300	330	880	1210
	0400	330	880	1210
	0500	350	880	1230
	0600	420	880	1300
	0700	590	880	1470
	0800	680	880	1560
	0900	740	880	1620
	1000	740	880	1620
	1100	840	880	1720
	1200	850	880	1730
	1300	855	880	1735
	1400	850	880	1730
	1500	860	880	1740
	1600	855	880	1735
	1700	860	880	1740
	1800	860	880	1740
	1900	860	880	1740
	2000	860	880	1740
	2100	860	880	1740
	2200	860	880	1740
	2300	860	880	1740
	2400	860	880	1740

Date	Time	Unit No. 2 MWe (Gross)	Unit No. 3 MWe (Gross)	Total MWe (Gross)
09/29/77	0100	850	880	1730
	0200	850	880	1730
	0300	850	880	1730
	0400	850	880	1730
	0500	860	880	1740
	0600	870	880	1750
	0700	860	880	1740
	0800	855	880	1735
	0900	860	880	1740
	1000	845	880	1725
	1100	845	880	1735
	1200	845	890	1735
	1300	845	890	1735
	1400	845	890	1735
	1500	845	890	1735
	1600	855	890	1745
	1700	860	890	1750
	1800	860	890	1750
	1900	860	890	1750
	2000	865	890	1750
	2100	860	890	1750
	2200	860	890	1750
	2300	860	890	1750
	2400	860	890	1750
09/30/77	0100	860	890	1750
	0200	860	890	1750
	0300	870	890	1760
	0400	870	890	1760
	0500	870	890	1760
	0600	870	890	1760
	0700	870	890	1760
	0800	870	890	1760
	0900	870	890	1760
	1000	870	890	1760
	1100	870	890	1760
	1200	870	890	1760

Date	Time	Unit No. 2 MWe (Gross)	Unit No. 3 MWe (Gross)	Total MWe (Gross)
	1300	870	890	1760
	1400	870	890	1760
	1500	860	890	1750
	1600	860	890	1750
	1700	860	890	1750
	1800	860	890	1750
	1900	860	890	1750
	2000	860	890	1750
	2100	860	890	1750
	2200	860	890	1750
	2300	860	890	1750
	2400	860	890	1750

APPENDIX C

INDIAN POINT CIRCULATING WATER FLOW

Date	Time From	Time To	Unit No. 2 Circulator No. 21	22	23	24	25	26	Unit No. 2 Unit[1] Total (GPM)	Unit No. 3 Circulator No. 31	32	33	34	35	36	Unit No. 3 Unit[1] Total (GPM)	Station[1] Total (GPM)
09/24/77	0000	2400	On	On	On	On	On	On	865,000	On	On	On	On	On	On	865,000	1,964,500[1]
09/25/77	0000	2400	On	On	On	On	On	On	865,000	On	On	On	On	On	On	865,000	1,964,500[2]
09/26/77	0000	2400	On	On	On	On	On	On	865,000	On	On	On	On	On	On	865,000	1,964,400[2]
09/27/77	0000	2400	On	On	On	On	On	On	860,800	On	On	On	On	On	On	865,000	1,960,300[2]
09/28/77	0000	2400	On	On	On	On	On	On	860,900	On	On	On	On	On	On	865,000	1,926,800[3]
09/29/77	0000	0956	On	On	On	On	On	On	860,000	On	On	On	On	On	On	865,000	1,851,000[4]
	0956	1550	On	Off	On	On	On	On	720,000	On	On	On	On	On	On	865,000	1,711,000[5]
	1550	2400	On	On	On	On	On	On	860,000	On	On	On	On	On	On	865,000	1,851,000[5]
09/30/77	0000	2400	On	On	On	On	On	On	860,000	On	On	On	On	On	On	865,000	1,851,000[4]

(1) Includes 140,000 GPM per circulator when circulator is on and 5,000 GPM service water flow from each of 6 service water pumps
(2) 234,500 GPM from Circulators 11 and 12 on Unit No. 1.
(3) Circulator 11 off at 1630. Average Unit No. 1 flow 200,900 GPM.
(4) 126,000 GPM from Circulators 11 and 12 on Unit No. 1.
(5) Circulator 22 off at 0956 on Unit No. 2, Circulator 12 on at 1550.

APPENDIX D

SOLAR STRATIFICATION COMPUTATIONS
SEPTEMBER 27, 1977

	MEASURED			COMPUTED
	North Reach	South Reach		
	Bear Mountain Stratification (°F)	Grassy Point Stratification (°F)	Croton Point Stratification (°F)	Indian Point Stratification (°F)
First Ebb	0.0/0.0 0.0/0.0	-0.1/0.0 0.0/0.1	0.0/0.0 0.0/0.0	0.0/0.0 0.0/0.1
Low Water Slack	0.0/0.1 -0.1/0.0	0.0/0.0 0.1/0.1	-0.2/-0.1 -0.1/-0.1	-0.1/0.0 0.0/0.0
Flood	0.0/0.1 0.1/0.1	-0.1/-0.1 0.1/0.1	0.2/0.2 0.2/0.2	0.1/0.1 0.1/0.1
High Water Slack	0.2/0.2 0.2/0.2	0.1/0.0 0.2/0.0	0.4/0.3 0.3/0.2	0.2/0.2 0.2/0.1
Second Ebb	0.0/0.0 0.0/0.0	0.1/0.1 0.1/0.1	-0.3/-0.3 0.2/0.2	0.0/-0.1 0.1/0.1

Note: Stratification temperatures listed above are as follows:

$$\frac{[\text{surface - area-average}]/[\text{3 foot depth - area average}]}{([\text{surface - 10 foot depth}]/[\text{3 foot depth - 10 foot depth}])}$$

SOLAR STRATIFICATION COMPUTATIONS
SEPTEMBER 28, 1977

	MEASURED			COMPUTED
	North Reach	South Reach		
	Bear Mountain Stratification (°F)	Grassy Point Stratification (°F)	Croton Point Stratification (°F)	Indian Point Stratification (°F)
First Ebb	-0.2/0.0 over -0.2/0.0	0.0/0.1 over 0.1/0.2	-0.4/-0.3 over -0.3/-0.2	-0.2/-0.1 over 0.2/0.0
Low Water Slack	0.0/0.0 over 0.0/0.0	-0.1/0.0 over 0.0/0.1	-0.2/-0.1 over -0.2/-0.1	-0.1/0.0 over -0.1/0.0
Flood	0.0/0.1 over 0.0/0.1	0.3/0.2 over 0.4/0.3	0.2/0.1 over 0.3/0.2	0.1/0.1 over 0.2/0.2
High Water Slack	0.2/0.2 over 0.1/0.1	0.3/0.2 over 0.3/0.2	0.3/0.3 over 0.3/0.3	0.2/0.2 over 0.2/0.2
Second Ebb	-0.1/0.1 over -0.1/0.0	0.0/0.0 over 0.1/0.1	0.0/0.1 over 0.0/0.1	-0.1/0.0 over 0.0/0.1

Note: Stratification temperatures listed above are as follows:

$$\frac{[\text{surface - area-average}]/[\text{3 foot depth - area average}]}{([\text{surface - 10 foot depth}]/[\text{3 foot depth - 10 foot depth}])}$$

SOLAR STRATIFICATION COMPUTATIONS
SEPTEMBER 29, 1977

	MEASURED			COMPUTED
	North Reach	South Reach		
	Bear Mountain Stratification (°F)	Grassy Point Stratification (°F)	Croton Point Stratification (°F)	Indian Point Stratification (°F)
First Ebb	-0.2/0.0 -0.2/0.0	0.0/0.0 0.0/0.1	-0.2/-0.2 0.0/0.0	-0.1/-0.1 -0.1/0.0
Low Water Slack	0.0/0.0 0.0/0.0	0.0/0.0 0.1/0.1	0.0/0.0 0.1/0.1	0.0/0.0 0.0/0.0
Flood	0.0/0.0 0.0/0.0	0.2/0.1 0.2/0.2	0.1/0.0 0.1/0.0	0.1/0.0 0.1/0.0
High Water Slack	0.1/0.1 0.0/0.0	0.0/0.0 0.0/0.0	0.0/-0.2 0.1/0.0	0.1/0.0 0.0/0.0
Second Ebb	-0.1/0.0 -0.1/-0.1	0.1/0.1 0.1/0.1	-0.1/-0.1 0.0/0.0	0.0/0.0 0.0/0.0

Note: Stratification temperatures listed above are as follows:

$$\frac{[\text{surface - area-average}]/[\text{3 foot depth - area average}]}{([\text{surface - 10 foot depth}]/[\text{3 foot depth - 10 foot depth}])}$$

APPENDIX E

RIVER GAUGE FLOW OVER TROY LOCK
(INCLUDING POWER HOUSE[1])

Date	Flow (cfs)	Date	Flow (cfs)
July 1, 1977	6640	August 1, 1977	3730
2	5300	2	6720
3	4320	3	5590
4	4060	4	5160
5	3790	5	5480
6	5570	6	4730
7	6070	7	4450
8	4900	8	3320
9	5360	9	5420
10	4950	10	4480
11	4630	11	4220
12	7880	12	7650
13	7660	13	7860
14	9720	14	7460
15	8420	15	4230
16	6440	16	5380
17	5710	17	4490
18	4530	18	4920
19	5940	19	5960
20	7930	20	6420
21	7100	21	5310
22	4960	22	4230
23	4440	23	5680
24	4450	24	7040
25	5620	25	6150
26	5470	26	6640
27	6600	27	7500
28	5430	28	6310
29	4810	29	3530
30	4660	30	4390
31	4510	31	4160

(1) Provisional Data for Hudson River at Green Island (Station No. 01358000) courtesy of United States Department of the Interior, Geological Survey, Water Resources Division, Albany, New York.

Date	Flow (cfs)
September 1, 1977	6140
2	5780
3	5180
4	4310
5	3780
6	4540
7	4750
8	4640
9	4920
10	4230
11	3460
12	3220
13	3310
14	4850
15	11600
16	9890
17	11600
18	15100
19	16000
20	27100
21	43400
22	25400
23	21800
24	19900
25	17200
26	24600
27	40800
28	32900
29	28900
30	23000

APPENDIX F

INDIAN POINT STATION METEOROLOGICAL DATA
SEPTEMBER 27, 1977

Hour Ending At	Ambient Temperature 33' Elev. (°F)	Dew Point 33' Elev. (°F)	Wind Speed 33' Elev. (mph)	Wind Speed 400' Elev. (mph)	Net Radiation (cal/cm^2/min)
0100	63.7	59.2	3.5	7.0	-0.13
0200	62.2	59.2	3.5	12.0	-0.13
0300	61.1	58.5	1.5	7.0	-0.13
0400	59.0	58.0	1.0	10.0	-0.16
0500	59.0	57.2	2.0	16.0	-0.16
0600	63.2	50.0	2.0	13.0	-0.13
0700	63.8	49.7	2.5	12.0	-0.06
0800	62.3	54.0	5.0	8.0	0.13
0900	69.0	50.1	6.0	20.0	0.47
1000	70.5	49.8	6.0	20.0	0.81
1100	72.2	49.8	6.5	20.0	0.97
1200	74.5	49.4	7.5	22.0	1.09
1300	75.8	49.3	5.0	18.0	0.88
1400	75.8	51.2	4.5	16.0	0.78
1500	75.2	51.2	4.5	12.0	0.50
1600	73.2	53.6	5.0	14.0	0.19
1700	71.5	53.3	4.5	16.0	0.09
1800	69.3	54.1	2.0	8.0	0.00
1900	67.8	54.7	3.5	10.0	-0.09
2000	66.4	55.8	2.5	10.0	-0.13
2100	63.8	56.6	1.0	8.0	-0.09
2200	62.8	57.4	1.0	6.0	-0.06
2300	62.2	58.2	2.0	8.0	-0.13
2400	60.3	58.7	1.5	4.0	-0.13

INDIAN POINT STATION METEOROLOGICAL DATA
SEPTEMBER 28, 1977

Hour Ending At	Ambient Temperature 33' Elev. (°F)	Dew Point 33' Elev. (°F)	Wind Speed 33' Elev. (mph)	Wind Speed 400' Elev. (mph)	Net Radiation (cal/cm²/min)
0100	59.8	58.2	4.0	6.0	-0.13
0200	59.8	58.2	2.0	3.5	-0.13
0300	58.0	56.9	3.5	7.0	-0.13
0400	57.7	57.2	3.0	7.0	-0.13
0500	56.5	56.1	4.5	7.0	-0.13
0600	57.7	57.1	1.5	2.0	-0.09
0700	56.5	56.1	1.5	4.0	-0.09
0800	57.6	57.3	1.5	2.0	0.09
0900	61.0	56.2	4.0	14.0	0.50
1000	64.7	53.7	4.0	10.0	0.81
1100	66.5	53.8	5.0	12.0	1.06
1200	68.0	53.7	3.0	7.0	0.94
1300	70.0	53.6	4.0	12.0	0.94
1400	71.5	54.0	6.0	14.0	1.13
1500	71.8	53.8	3.5	12.0	0.88
1600	69.8	52.0	3.5	16.0	0.13
1700	71.7	54.9	2.0	12.0	-0.06
1800	62.5	55.0	2.0	14.0	0.00
1900	62.6	54.8	4.5	19.5	-0.13
2000	62.4	55.1	2.5	10.0	-0.13
2100	62.0	53.2	2.5	10.0	-0.13
2200	61.5	52.3	3.0	12.0	-0.13
2300	60.8	51.0	4.0	8.0	-0.13
2400	60.1	49.6	6.5	18.0	-0.16

INDIAN POINT STATION METEOROLOGICAL DATA
SEPTEMBER 29, 1977

Hour Ending At	Ambient Temperature 33' Elev. (°F)	Dew Point 33' Elev. (°F)	Wind Speed 33' Elev. (mph)	Wind Speed 400' Elev. (mph)	Net Radiation (cal/cm²/min)
0100	58.5	47.4	10.0	28.0	-0.16
0200	57.0	46.2	8.0	24.0	-0.16
0300	56.1	46.5	6.5	22.0	-0.16
0400	55.0	46.3	5.5	22.0	-0.16
0500	54.4	45.9	6.5	23.0	-0.16
0600	53.5	44.9	4.0	16.0	-0.16
0700	53.3	44.4	5.0	20.0	-0.13
0800	54.2	44.0	3.0	12.0	0.06
0900	55.8	42.5	5.0	11.0	0.47
1000	57.7	41.2	5.5	18.0	0.78
1100	59.0	40.4	6.0	17.0	1.00
1200	61.5	41.2	7.0	21.0	1.13
1300	63.3	40.8	6.5	20.0	1.16
1400	64.6	41.8	5.5	18.0	1.06
1500	66.0	42.0	5.0	18.0	0.81
1600	65.8	43.1	5.5	18.0	0.63
1700	65.3	41.9	5.0	20.0	0.31
1800	64.6	41.0	3.0	10.0	-0.06
1900	62.7	40.9	3.5	14.0	-0.16
2000	61.8	40.3	4.5	16.0	-0.16
2100	60.3	41.0	4.5	20.0	-0.16
2200	61.3	43.9	3.0	12.0	-0.13
2300	60.4	44.0	3.5	9.0	-0.09
2400	60.3	44.2	2.0	6.0	-0.09