NOAA Technical Memorandum NOS OES 006

EFFECTS OF DECEMBER 1992 NORTHEASTER ON WATER LEVELS

DATA REPORT

Silver Spring, Maryland
May 1993

noaa National Oceanic And Atmospheric Administration

U.S. DEPARTMENT OF COMMERCE
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EFFECTS OF DECEMBER 1992 NORTHEASTER

ON WATER LEVELS

DATA REPORT

I. INTRODUCTION

This report documents the water levels observed during the progression of the northeaster that affected the eastern seaboard from December 10 through December 14, 1992. The storm was of unusually long duration, stalling and changing directions several times as it moved out to sea. Several tidal cycles were impacted, resulting in a prolonged effect of the surge and high waves.

The Ocean and Lake Levels Division (OLLD), Office of Ocean and Earth Sciences (OES), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA) manages the operation of a national water level observation program; collects, processes, and analyzes water level and ancillary data; and produces standard time series and water level datum products. OLLD operates a National Water Level Observation Network (NWLON) of approximately 190 long-term continuously operating stations in the U.S. coastal waters, in the Great Lakes and connecting channels, and in the U.S. territories and possessions. OLLD also installs, operates, and maintains short-term water level stations to support other NOS, state and federal programs.

This report contains information from selected NWLON stations in operation during the storm. The maximum water elevations recorded during the storm are reported and compared to the maximum historical elevations observed over the period of record at each location. Storm surge, as defined in this report, is the difference between observed and predicted water elevations. Predicted tides are computed using standard NOS harmonic analysis and prediction algorithms. Characteristics of the storm surge at each location are included in this report. Finally, the predicted and observed time series are presented in a set of time series plots. Detailed analyses are not presented in this data report; however, some interpretive information is provided to emphasize the effects of the storm surge on water levels observed at the tide stations. This storm had major and far reaching effects. While the surge and high waves pounded the exposed coastline, the estuary and river areas experienced extreme high water levels and associated flooding.

The gauges, stilling wells, protective wells and pier support structures of the NWLON stations suffered varying amounts of damage from waves, high water and flooding. The primary water level gauge high water measurement limits were exceeded at The Battery, NY, Willets Point, NY, and at Bridgeport, CT. The observed high waters were obtained from the backup pressure gauges at each of these stations. Unfortunately, at The Battery, the backup gauge appears to have malfunctioned. The values presented show the minimum water levels reached during the storm for The Battery, with actual water levels probably higher.

II. MAXIMUM ELEVATIONS AND DATUM RELATIONSHIPS

Information on the observed maximum water level elevations during the storm are found in Table I. Appendix A are copies of the National Weather Service (NWS) Weekly Series of Daily Surface Weather Maps (December 9-15, 1992) which show the location of the storm front as of 7:00 AM EST and Appendix B is a set of station location chartlets for each station listed. Table I includes the following information for this storm: the date, time and height of the maximum water level above Mean Lower Low Water (MLLW), Mean Higher High Water (MHHW), and National Geodetic Vertical Datum (NGVD); the date and height of the maximum historical water level above MLLW; and the mean Great Diurnal Range (GT).

The heights are referenced to the MLLW and MHHW datums at each location. These datums are based on the 1960-78 National Tidal Datum Epoch. MLLW is the reference datum for NOAA nautical charts and the NOS published tide prediction tables. The MHHW datum is the mean elevation of the higher high water observed each tidal day. The maximum historical values are based on the entire period of record for each location, which is quite different at each station. Elevation comparisons to MHHW and the GT of tide are provided to put the effects of this particular storm in context with the normal elevation of a tidal high water at each location. The mean diurnal range is the difference in elevation between MHHW and MLLW and can be considered the average maximum daily vertical excursion of the water level at a given location.

The maximum historical observed water elevations were exceeded at three locations during this storm: Sandy Hook, NJ, Barnegat Inlet, NJ, and Duck Pier, NC. Barnegat Inlet and Duck Pier have relatively short historical records of 8 years and 14 years respectively. The maximum elevations during the storm were within one foot of the maximum historical elevations at several of the longest operating stations (e.g., Philadephia, PA, Atlantic City, NJ, The Battery, NY, and Bridgeport, CT).

In most tidal areas, the maximum height reached is strongly tied to the occurance of the storm with the phase of the tide. Extreme tides were not predicted for this period; however, the occurence of the storm was bracketed by the full moon (December 9) and the moon in perigee (December 13). Therefore, the high tides resulting from these alignment maxima contributed to the overall effects of the storm surge.

TABLE I. MAXIMUM OBSERVED WATER LEVEL ELEVATIONS AND HISTORICAL DATA COMPARISON

STATION	DATE/TIME (mo./day hr.min.)	HIGHEST OBSERVED ELEVATION (in feet) ABOVE MLLW	MHHW	NGVD	HISTORICAL ELEVATION (in feet) ABOVE MLLW DATE (mo./yr.)	ELEV.	DIURNAL RANGE
Eastport, ME	12/12 1206	21.27	1.95	11.99	6/77	24.12	19.32
Cutler, ME	12/12 1200	15.55	1.89	-	1/79	17.32	13.66
Bar Harbor, ME	12/12 1154	13.37	1.93	7.90	2/78	15.05	11.44
Portland, ME	12/12 1230	12.22	2.31	7.65	2/78	14.17	9.91
Boston, MA	12/12 1248	14.19	3.86	9.34	2/78	15.25	10.33
Woods Hole, MA	12/12 0924	5.13	2.88	4.66	8/54	10.39	2.25
Nantucket, MA	12/12 1236	6.87	3.27	-	10/91	8.11	3.60
Newport, RI	12/12 0900	6.53	2.61	5.13	9/38	13.53	3.92
Providence, RI	12/11 0900	7.32	2.36	5.47	9/38	17.71	4.96
New London, CT	12/11 0954	6.34	3.26	5.27	9/38	10.76	3.08
Bridgeport, CT	12/11 1130	12.21	4.88	9.29	9/38	12.44	7.33
Montauk, NY	12/11 0942	5.98	3.39	5.18	8/54	8.68	2.59
Willets Point, NY	12/11 1130	14.43	6.65	11.27	9/38	16.90	7.78
The Battery, NY *	12/11 0900	9.92	4.80	8.04	9/60	10.23	5.12
Sandy Hook, NJ	12/11 0854	10.45	5.25	8.68	3/62	10.33	5.20
Barnegat Inlet, NJ	12/11 0800	6.60	3.83	-	1/87	5.96	2.77
Atlantic City, NJ	12/11 0800	8.84	4.16	7.20	9/44	9.20	4.68
Cape May, NJ	12/11 0900	8.83	3.32	6.83	9/85	9.09	5.51
Philadelphia, PA	12/11 1442	9.98	3.23	7.69	11/50	10.79	6.75
Reedy Point, DE	12/11 1148	8.64	2.66	6.13	10/80	9.19	5.98
Lewes, DE	12/12 1024	8.01	3.28	6.28	3/62	9.49	4.73

* Values for The Battery, NY are minimum elevations from a malfunctioning backup gage. Actual elevations were probably more in line with those observed at Sandy Hook, NJ based on responses of the two locations to past major storms.

TABLE I. (continued) MAXIMUM OBSERVED WATER LEVEL ELEVATIONS AND HISTORICAL DATA COMPARISON

STATION	DATE/TIME (mo./day hr.min.)	HIGHEST OBSERVED ELEVATION (in feet) ABOVE MLLW	MHHW	NGVD	HISTORICAL ELEVATION (in feet) ABOVE MLLW DATE (mo./yr.)	ELEV.	DIURNAL RANGE
Cambridge, MD	12/11 0330	3.71	1.66	3.12	9/79	4.87	2.05
Baltimore, MD	12/10 2042	4.08	2.42	3.80	8/33	7.93	1.66
Annapolis, MD	12/11 0454	3.08	1.65	2.92	8/33	6.40	1.43
Solomons Island, MD	12/11 0130	3.13	1.62	2.78	8/55	4.53	1.51
Washington, DC	12/10 2236	5.56	2.38	4.71	10/42	11.29	3.18
Wachapreague, VA	12/12 1000	7.68	3.08	-	10/80	8.33	4.60
Kiptopeke, VA	12/12 0948	5.66	2.63	4.24	3/62	7.41	3.03
Lewisetta, VA	12/14 1707	3.16	1.63	2.88	3/83	3.62	1.53
Gloucester, VA	12/12 1036	5.19	2.46	4.03	3/62	6.63	2.73
Hampton Roads, VA	12/12 1024	5.59	2.79	4.42	8/33	8.39	2.80
Ches. Bay Brdg. Tnl., VA	12/12 0924	5.93	2.98	-	4/78	6.36	2.95
Duck Pier, NC	12/12 0918	6.71	2.95	5.13	4/88	6.68	3.76

NOTES:
Times are in EST; MLLW is Mean Lower Low Water datum; MHHW is Mean Higher High Water datum; NGVD is National Geodetic Vertical Datum.

III. STORM SURGE CHARACTERISTICS

Information on the maximum storm surge measured at each station is found in Table II. Storm surge is defined as the difference between the observed and predicted water level elevations. Predicted water level elevations are computed using standard NOS harmonic analysis and prediction algorithms. The timing of the maximum storm surge is largely dependent upon the timing of interaction of the tide and the storm passage, and the maximum storm surge may not coincide with the occurrence of the predicted tidal high water. Table II provides the following information for each station: the date and time of the maximum storm surge; the observed elevation of the water above MLLW at that time; the predicted elevation of the water above MLLW at that time; and the storm surge value (observed minus predicted elevations).

Time series of the storm surge are constructed by subtracting the predicted time series from the observed time series. Figures 1 through 7 are simultaneous plots of the storm surge for various geographical regions for a five-day time period centered around the time period of the storm. All of the storm surge figures use the same vertical scale (in feet) so that the magnitude of the surge can be put into perspective between stations and regions. Table II and the figures show that storm surge values over 7.00 feet were found at Willets Point, NY and Sandy Hook, NJ. The New York Bight and western Long Island Sound areas were particularly hard hit, as the topographic characteristics of these embayments facilitated trapping and enchancing the surge effects. The effects of the high energy waves and surf were evident in the noise levels in the data at all of the outside stations, even after partial filtering of the waves by stilling wells, protective wells, and sampling algorithms.

The storm surge plots for many of the stations show some degree of periodicity at the tidal frequencies. This is attributed to the process of the subtraction of two sinusoidal curves (predicted and observed) that are slightly out of phase because of the storm, and to the effect of the prolonged storm surge in modifying the normal sinusoidal shape of the observed tide curve. There was no smoothing of observed data prior to computing the storm surge values for plotting. Most plots for this storm show a steep rise to a maximum and then a slow trailing off over a few days.

The plots show maximum storm surge effects in the Chesapeake Bay early on December 11 with the largest surge occuring in the northern bay. The Mid-Atlantic coastal region and the New York Bight had maximum surge later in the morning on December 11 and western Long Island Sound and southern New England had maximum surge late on December 11. Long Island Sound storm surges show an interesting secondary oscillation on December 12 not seen in the other areas. New England areas north of Boston, MA were not significantly affected by storm surge as the storm track was more east-southeast on December 12-13 after leaving the coastal zone south of New England.

TABLE II. MAXIMUM STORM SURGE INFORMATION

STATION	DATE/TIME (mo./day hr.min.)	ELEVATION ABOVE MLLW (in feet) OBSERVED	PREDICTED	STORM SURGE
Eastport, ME	12/13 0400	9.91	8.72	1.19
Cutler, ME	12/13 1700	4.13	3.02	1.11
Bar Harbor, ME	12/13 1800	1.69	0.25	1.44
Portland, ME	12/12 1400	10.61	8.84	1.77
Boston, MA	12/12 1600	7.87	4.56	3.31
Woods Hole, MA	12/12 1300	3.89	1.33	2.56
Nantucket, MA	12/12 1100	6.43	3.04	3.39
Newport, RI	12/11 1300	3.12	-0.09	3.21
Providence, RI	12/11 1300	3.47	0.44	3.03
New London, CT	12/11 1800	4.38	0.16	4.22
Bridgeport, CT	12/11 1600	7.40	1.42	5.98
Montauk, NY	12/11 1500	4.18	0.08	4.10
Willets Point, NY	12/11 1700	7.70	0.18	7.52
The Battery, NY	12/11 1200	8.64*	2.59	6.05*
Sandy Hook, NJ	12/11 1200	8.90	1.87	7.03
Barnegat Inlet, NJ	12/12 0100	4.75	0.31	4.44
Atlantic City, NJ	12/11 0100	4.37	-0.31	4.68
Cape May, NJ	12/11 0200	4.36	-0.25	4.61
Philadelphia, PA	12/11 2300	5.76	0.89	4.87
Reedy Point, DE	12/11 0500	5.32	0.15	5.17
Lewes, DE	12/11 0200	3.66	-0.30	3.96

* Estimated to be higher, value obtained from backup pressure gage. Actual values probably closer to those at Sandy Hook, NJ.

TABLE II. (continued) MAXIMUM STORM SURGE INFORMATION

STATION	DATE/TIME (mo./day hr.min.)	ELEVATION ABOVE MLLW (in feet) OBSERVED	PREDICTED	STORM SURGE
Cambridge, MD	12/11 0100	3.30	0.52	2.78
Baltimore, MD	12/11 0500	3.21	0.49	2.72
Annapolis, MD	12/11 0400	3.06	0.51	2.55
Solomons Island, MD	12/11 0000	2.91	0.69	2.22
Washington, DC	12/10 2300	5.47	1.80	3.67
Wachapreague, VA	12/10 2000	7.36	3.68	3.68
Kiptopeke, VA	12/12 1400	3.33	0.82	2.51
Lewisetta, VA	12/10 2100	2.25	0.04	2.21
Gloucester, VA	12/12 1400	3.71	1.24	2.47
Hampton Roads, VA	12/12 1400	4.00	1.24	2.76
Ches. Bay Brdg. Tnl., VA	12/12 1400	3.41	0.48	2.93
Duck Pier, NC	12/12 1300	3.62	0.81	2.81

NOTES:
Storm surge is the difference between observed and predicted elevations; Times are in EST; MLLW is Mean Lower Low Water datum.

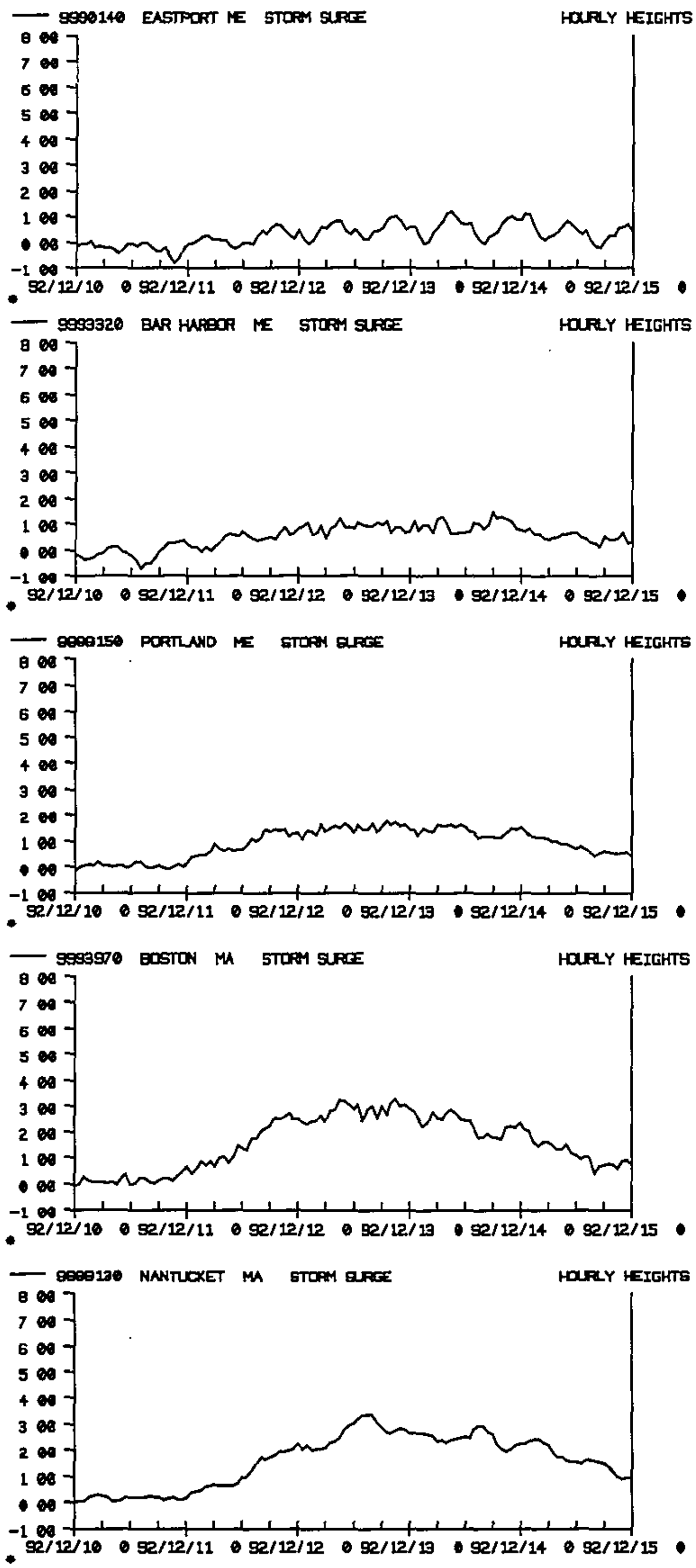


FIGURE 1. STORM SURGE - DECEMBER 1992 NORTHEASTER

NEW ENGLAND: EASTPORT, ME TO NANTUCKET SOUND

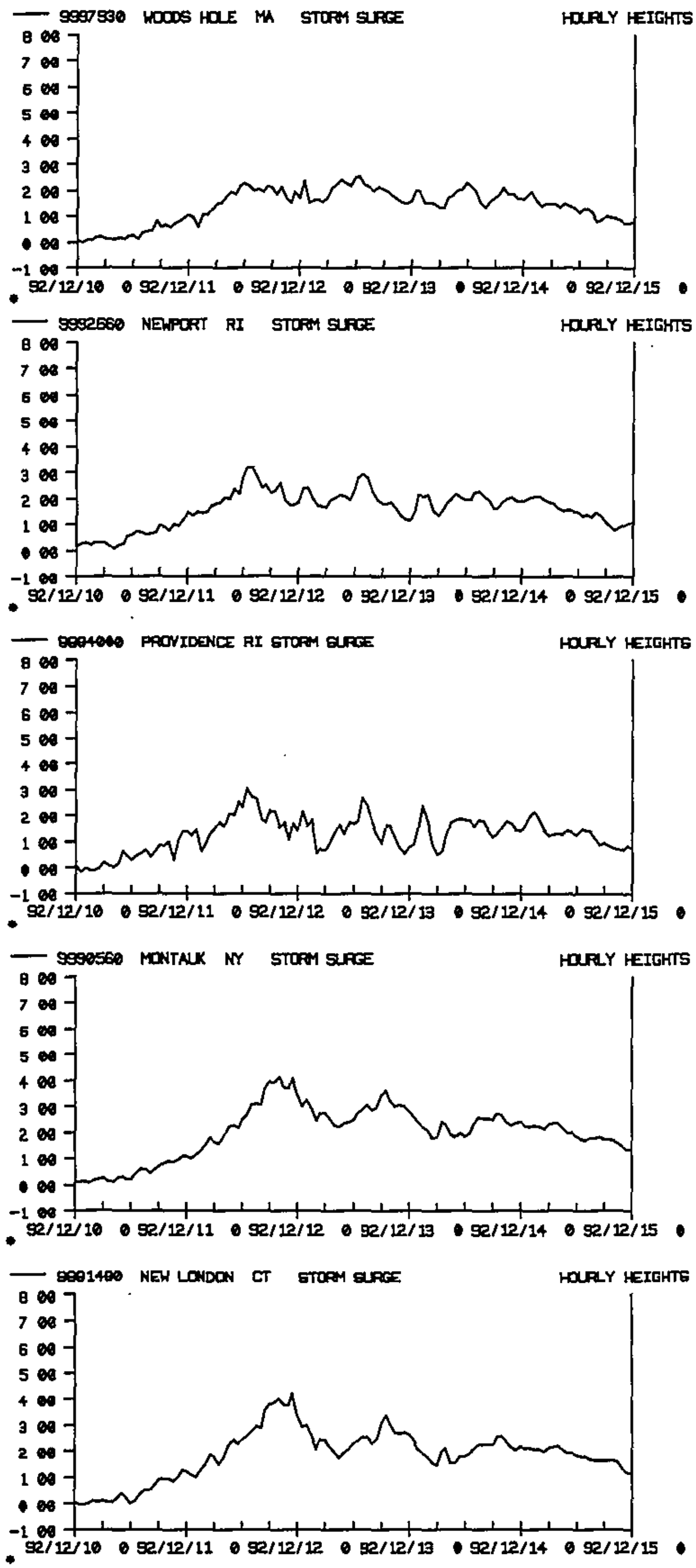


FIGURE 2. STORM SURGE - DECEMBER 1992 NORTHEASTER

BUZZARDS BAY TO EASTERN LONG ISLAND SOUND

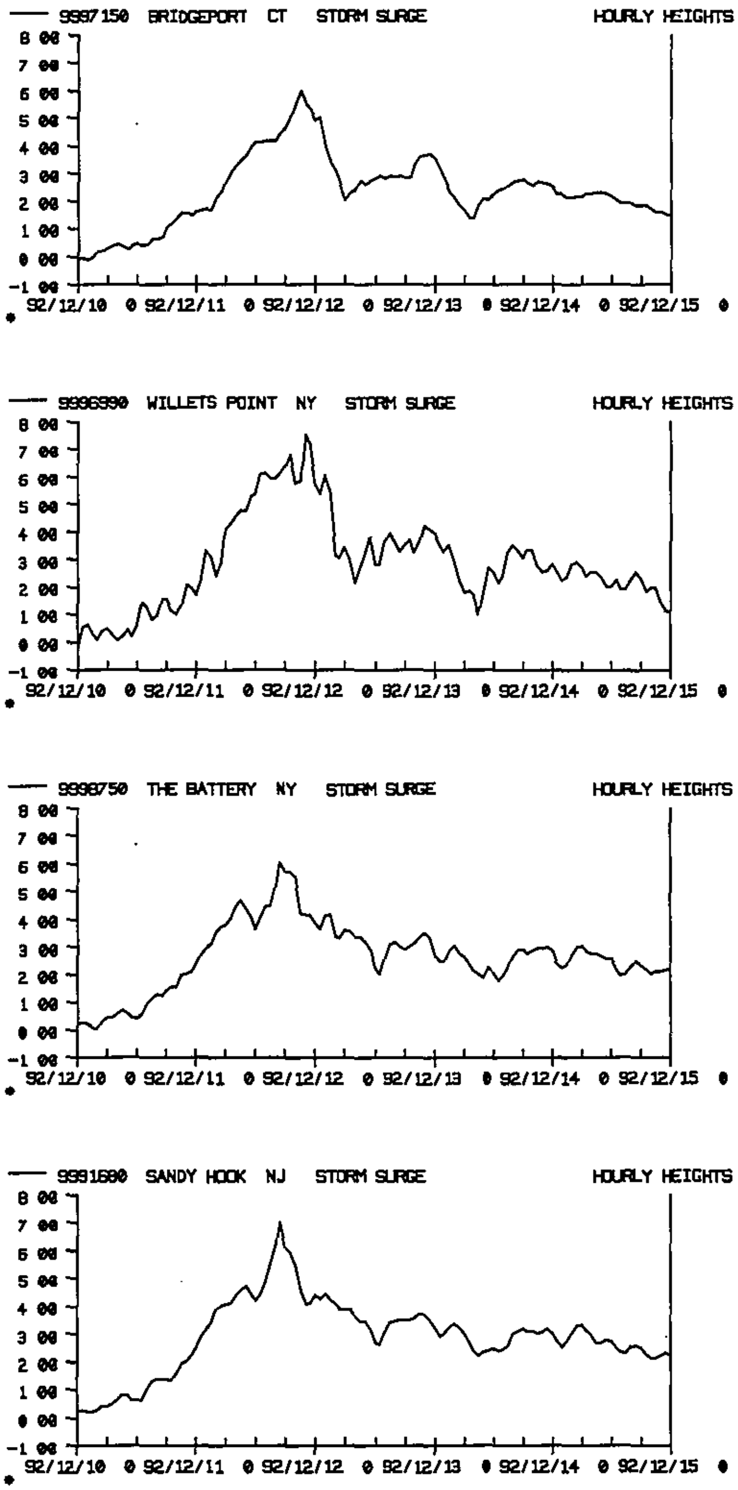


FIGURE 3. STORM SURGE - DECEMBER 1992 NORTHEASTER

WESTERN LONG ISLAND SOUND TO NEW YORK HARBOR

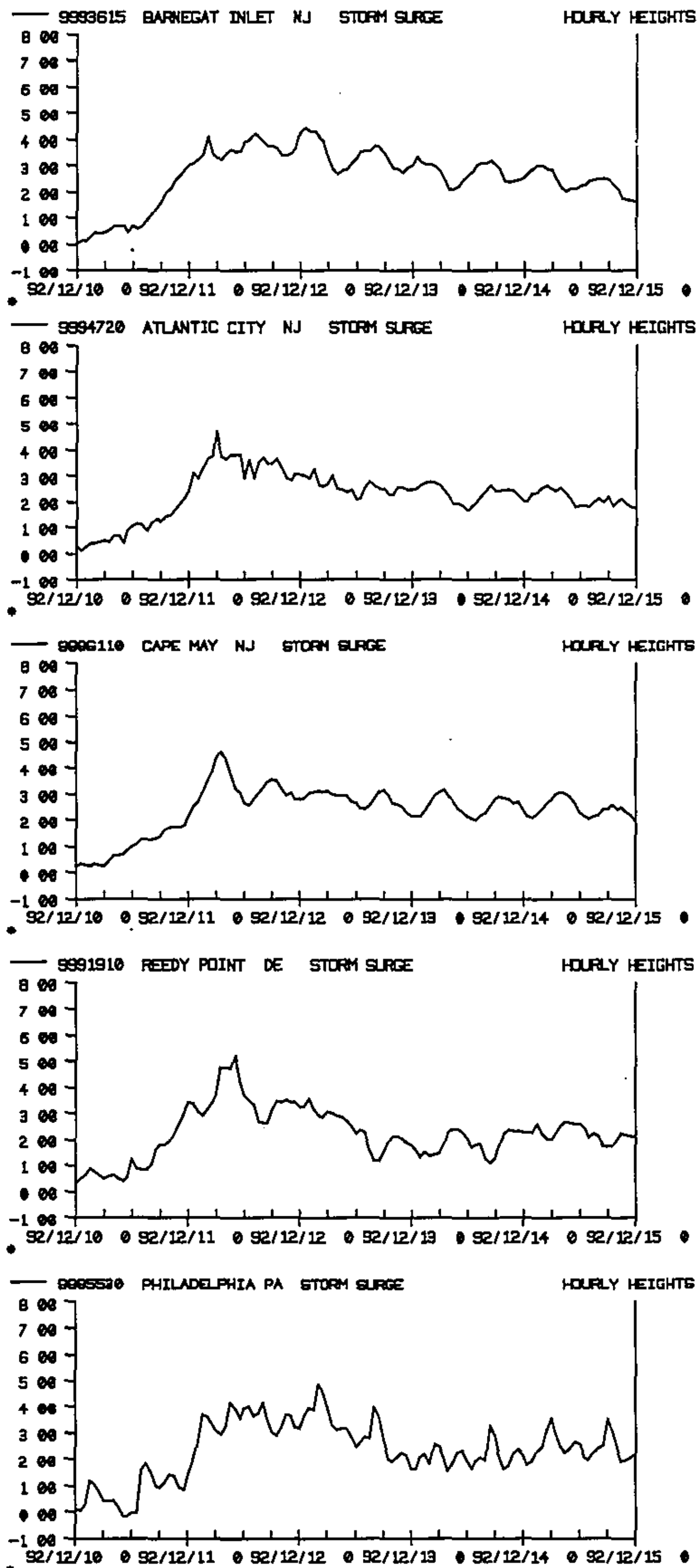


FIGURE 4. STORM SURGE - DECEMBER 1992 NORTHEASTER

EASTERN SEABOARD: NORTHERN NEW JERSEY TO DELAWARE BAY

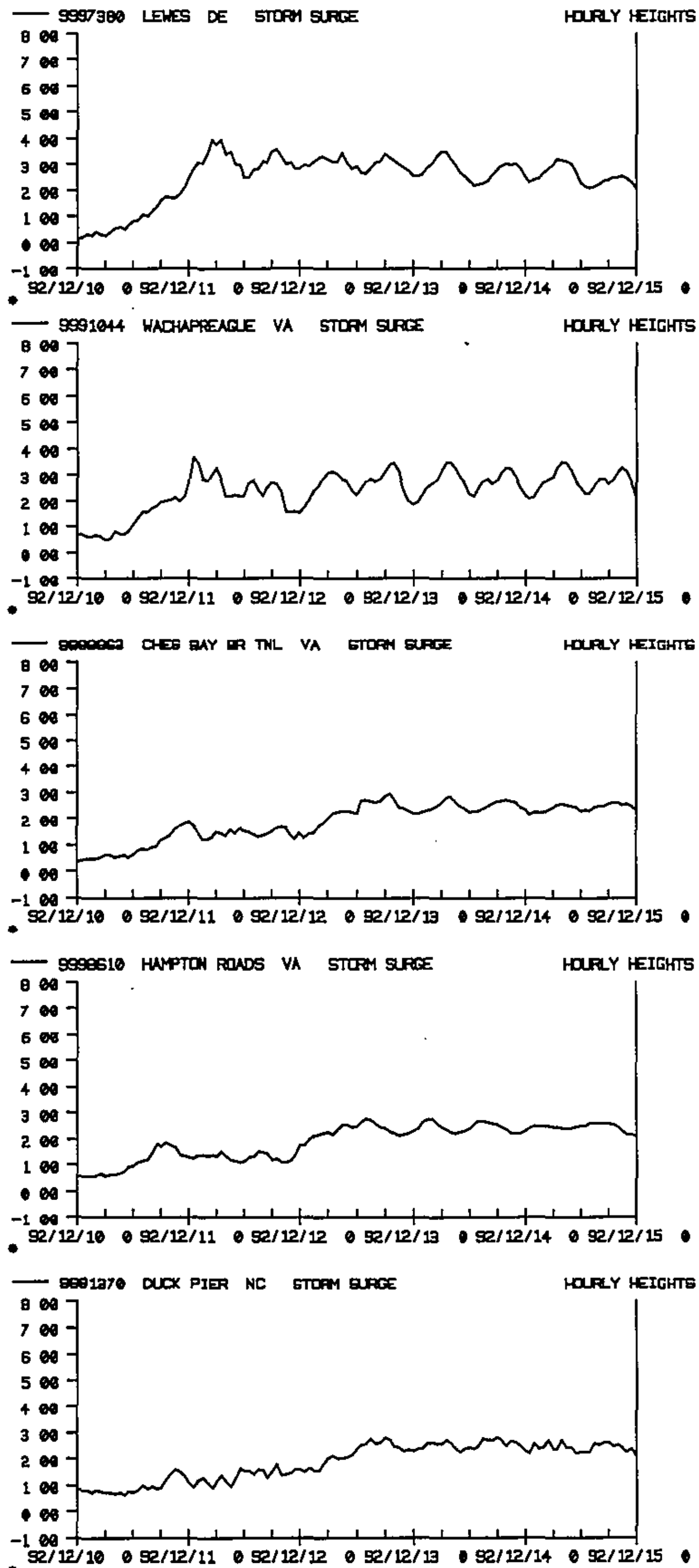


FIGURE 5. STORM SURGE - DECEMBER 1992 NORTHEASTER

EASTERN SEABOARD: DELAWARE BAY TO DUCK, NC

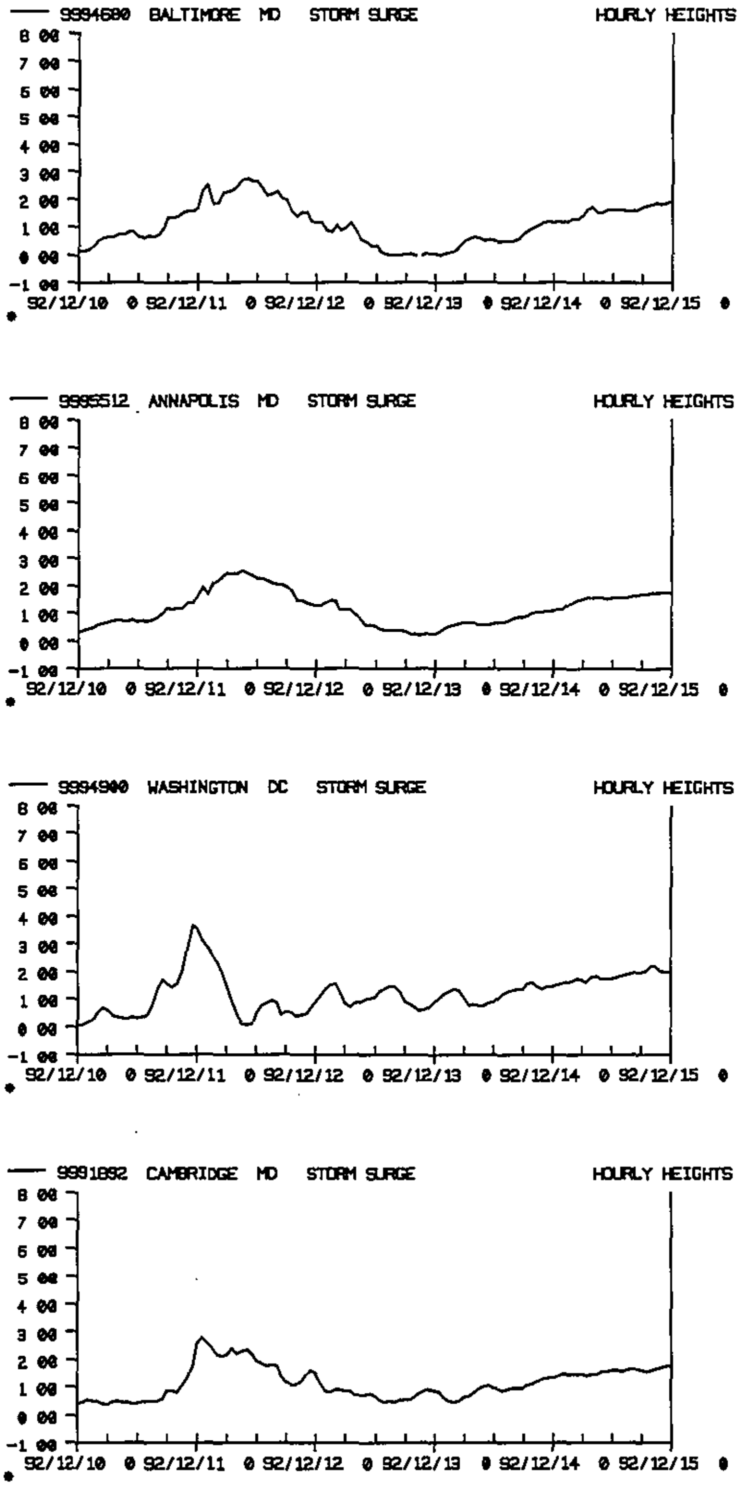


FIGURE 6. STORM SURGE - DECEMBER 1992 NORTHEASTER

CHESAPEAKE BAY

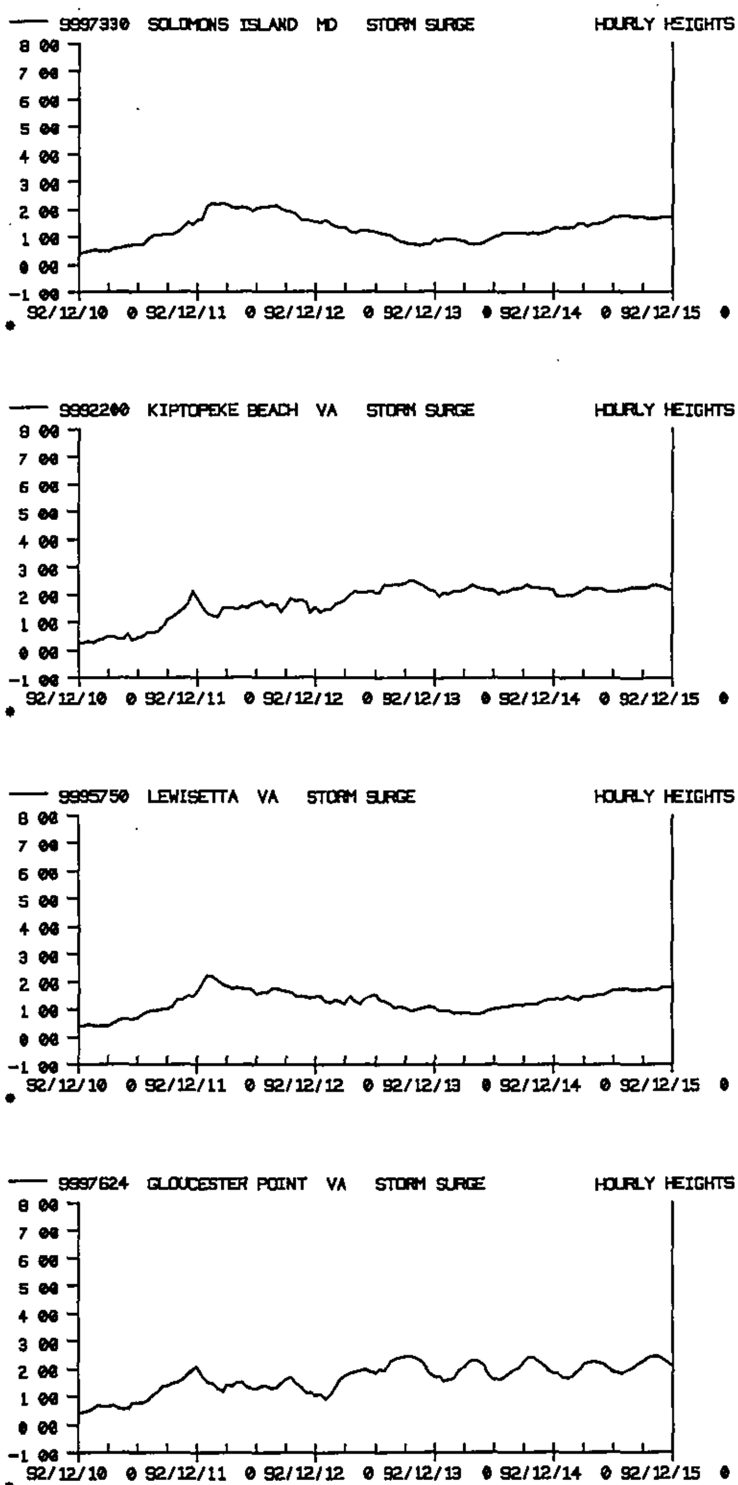
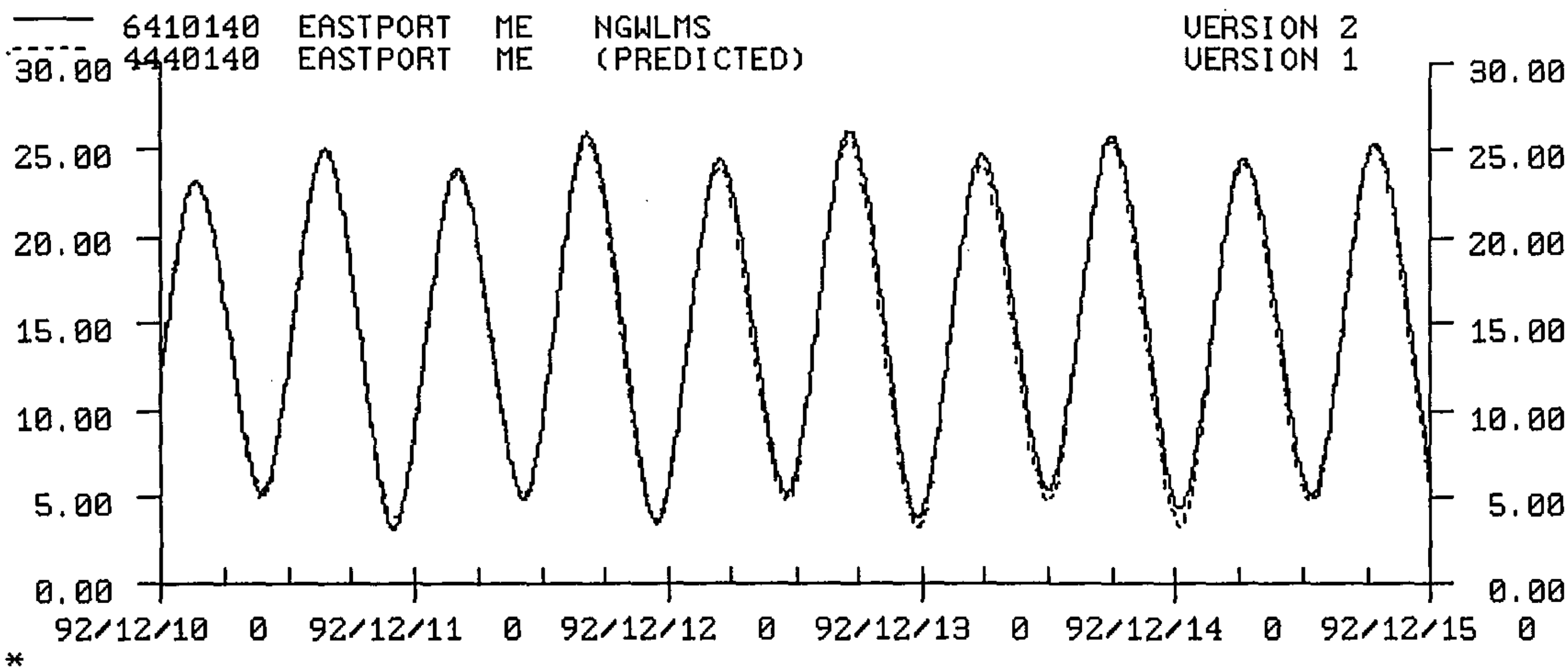


FIGURE 7. STORM SURGE - DECEMBER 1992 NORTHEASTER

CHESAPEAKE BAY

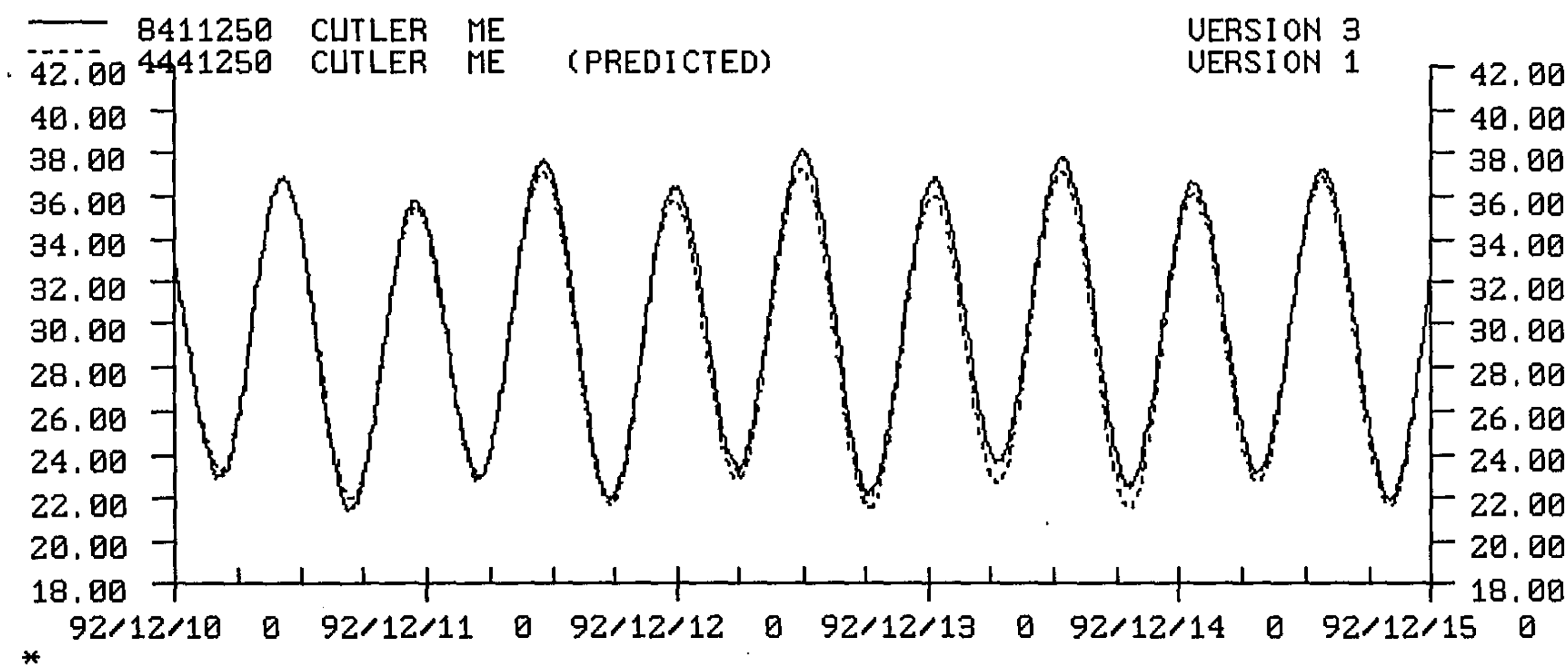
IV. COMPARISON PLOTS: OBSERVED VS. PREDICTED

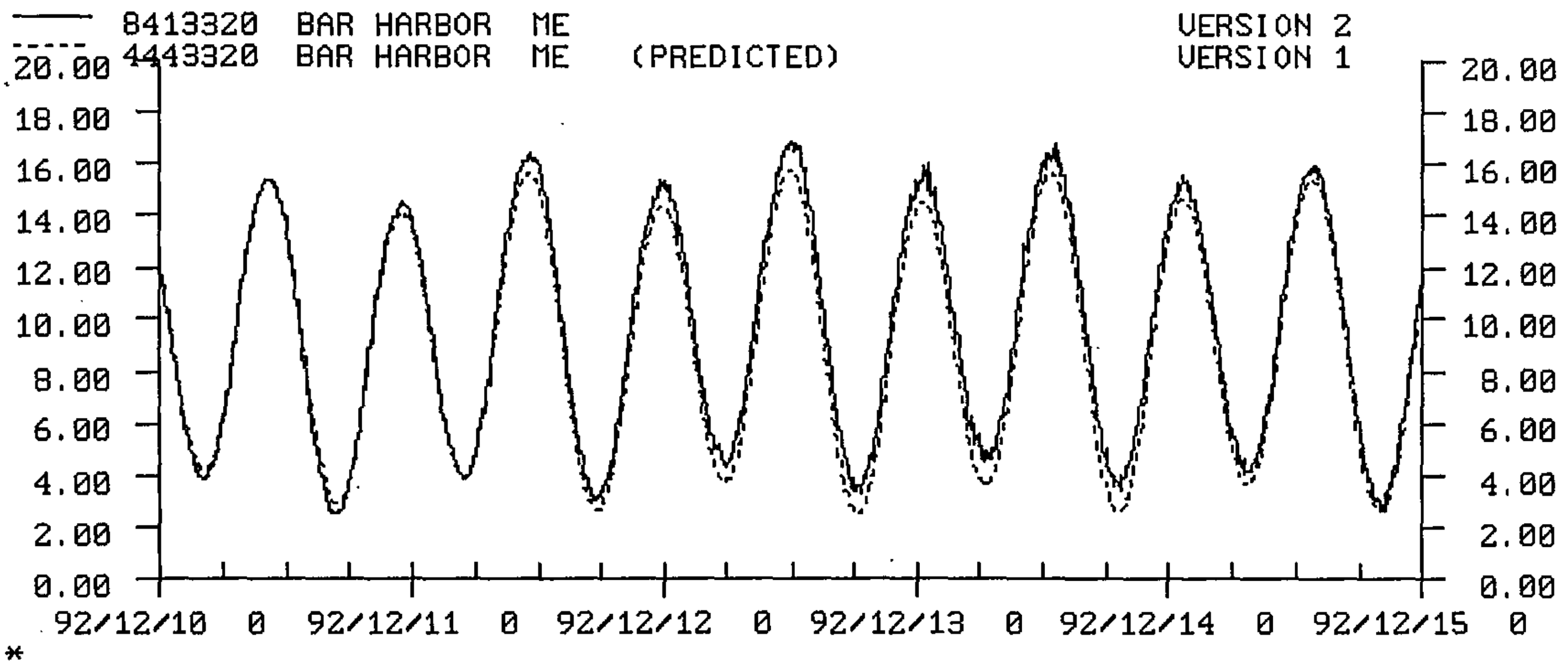
This section is a set of plots showing the simultaneous observed and predicted 6-minute interval water level time series for each station from which the storm surge signatures in Section III were derived. The effects of the timing and magnitude of the storm surge on the predicted tides are clearly seen. The plots labeled "NGWLMS" are on Greenwich Mean Time (GMT) and the remainder are on Eastern Standard Time (EST). All water level elevations are in feet.



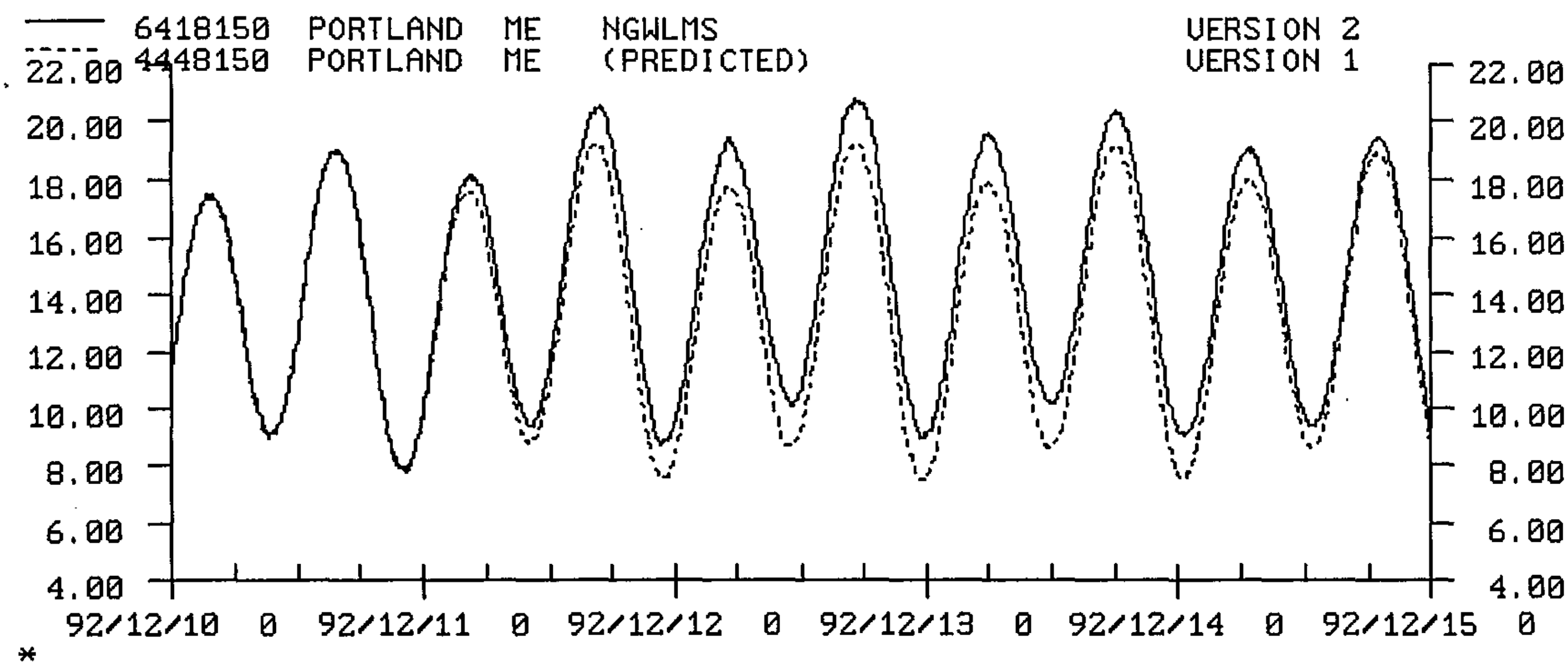
6410140 EASTPORT ME NGWLMS
4440140 EASTPORT ME (PREDICTED)
VERSION 2
VERSION 1
30.00
25.00
20.00
15.00
10.00
5.00
0.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0
*

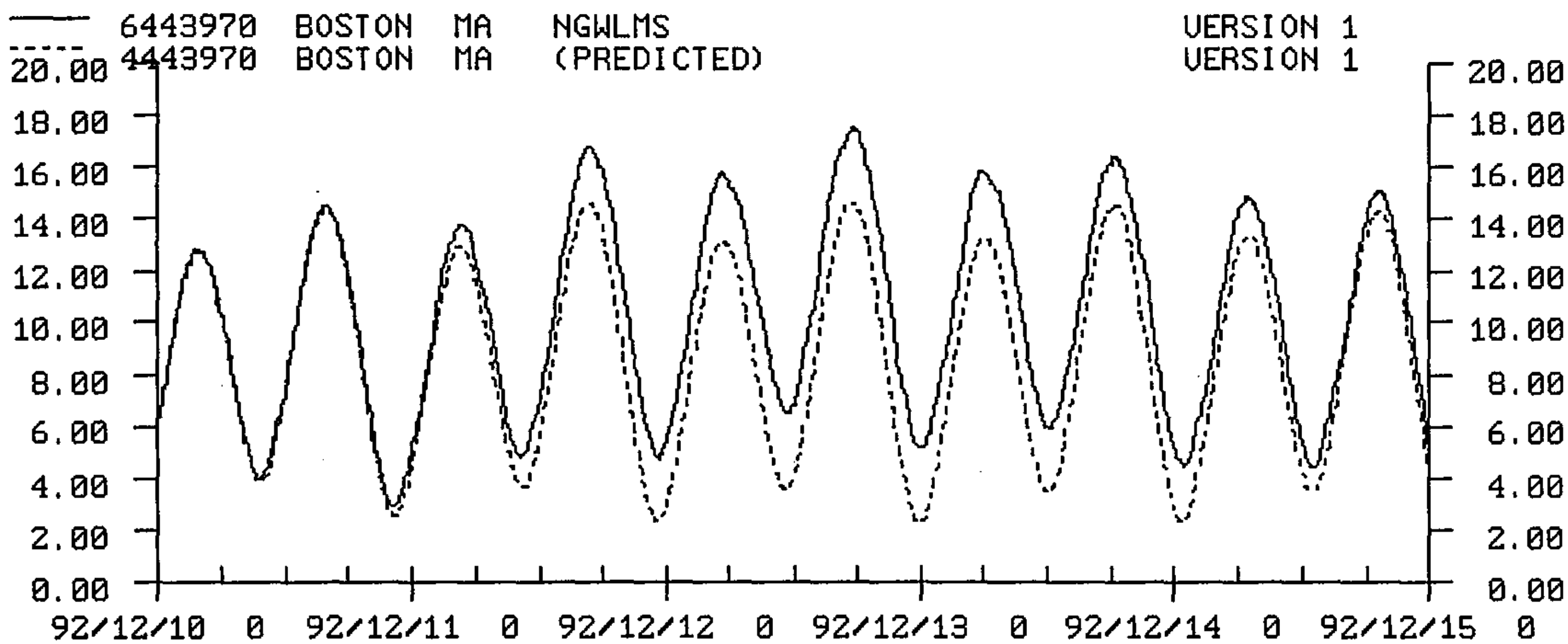
17


8411250 CUTLER ME
4441250 CUTLER ME (PREDICTED)
VERSION 3
VERSION 1
42.00
40.00
38.00
36.00
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0
*



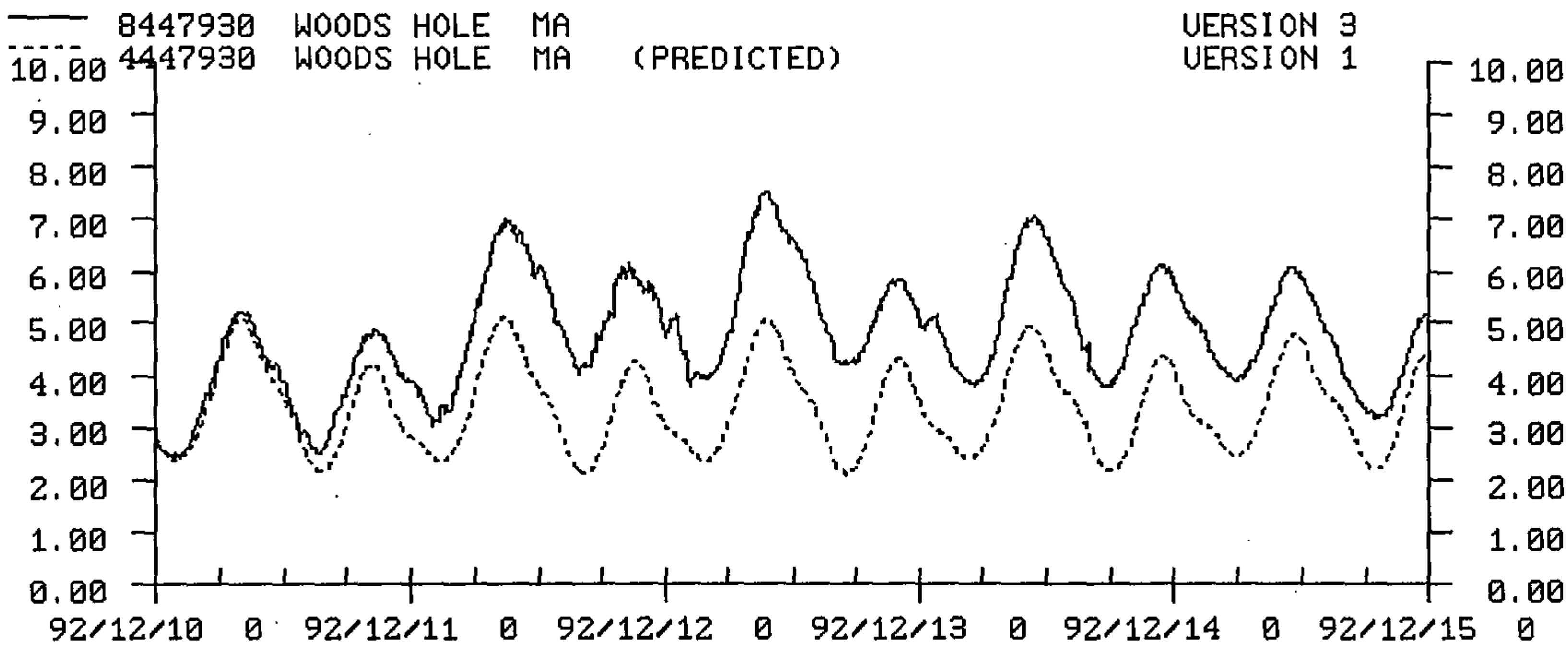
8413320 BAR HARBOR ME VERSION 2
4443320 BAR HARBOR ME (PREDICTED) VERSION 1
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0


6418150 PORTLAND ME NGWLMS VERSION 2
4448150 PORTLAND ME (PREDICTED) VERSION 1
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0
*



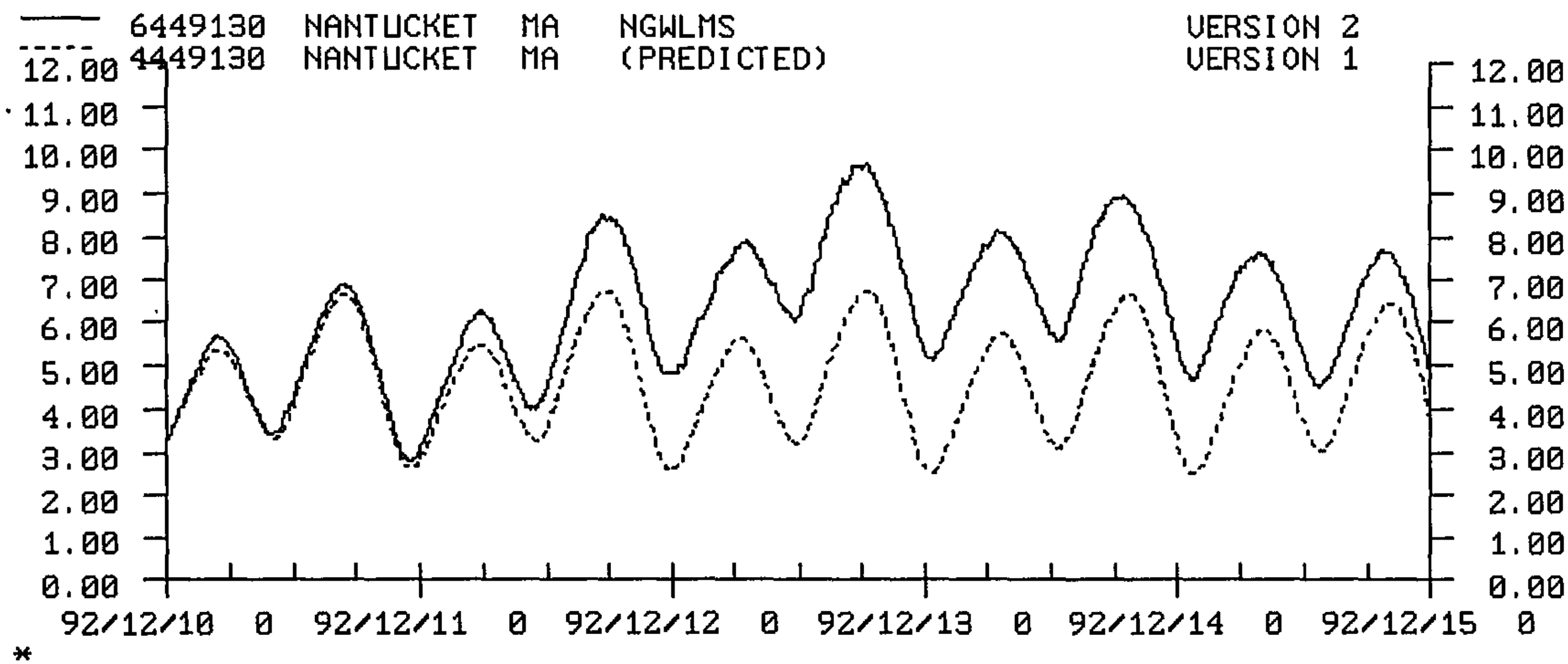
6443970 BOSTON MA NGWLMS VERSION 1
4443970 BOSTON MA (PREDICTED) VERSION 1
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0

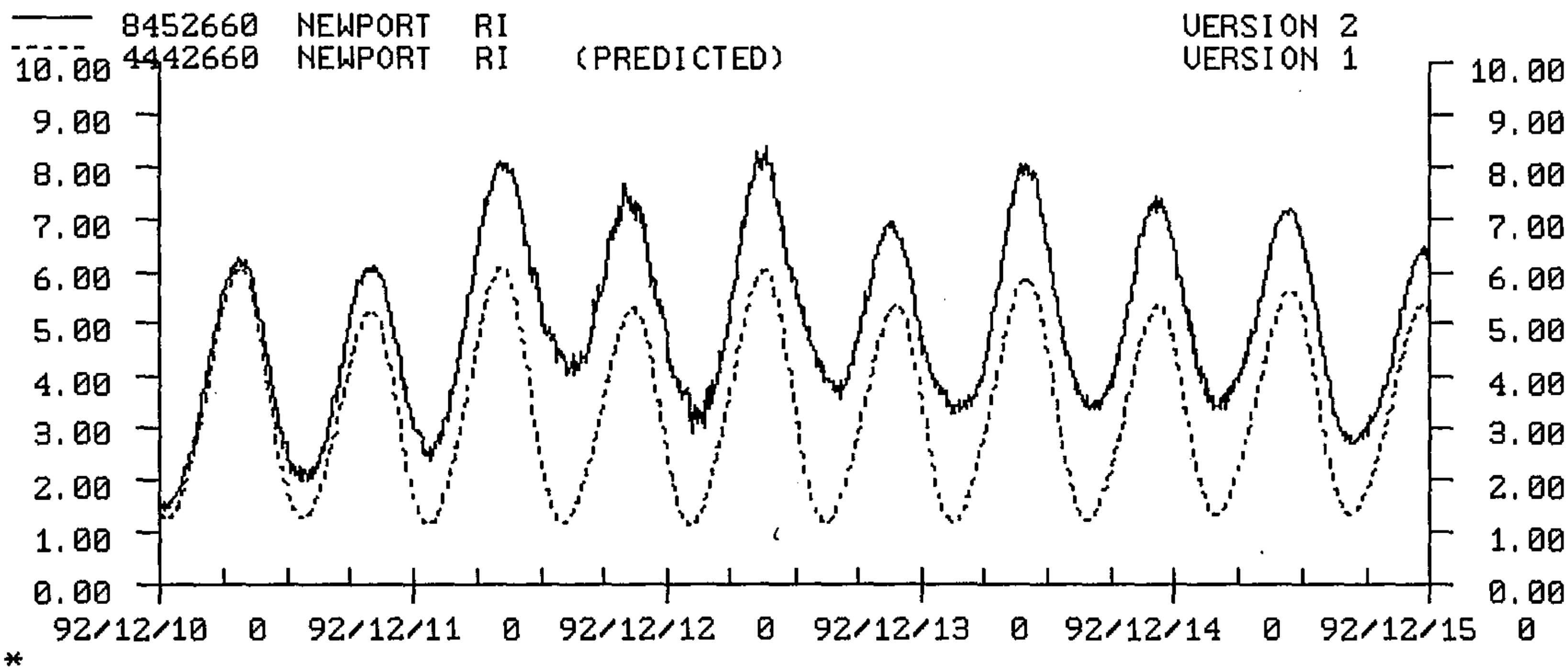
*



8447930 WOODS HOLE MA
4447930 WOODS HOLE MA (PREDICTED)
VERSION 3
VERSION 1
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0

*


6449130 NANTUCKET MA NGWLMS
4449130 NANTUCKET MA (PREDICTED)
VERSION 2
VERSION 1
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0


8452660 NEWPORT RI
4442660 NEWPORT RI (PREDICTED)
VERSION 2
VERSION 1
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
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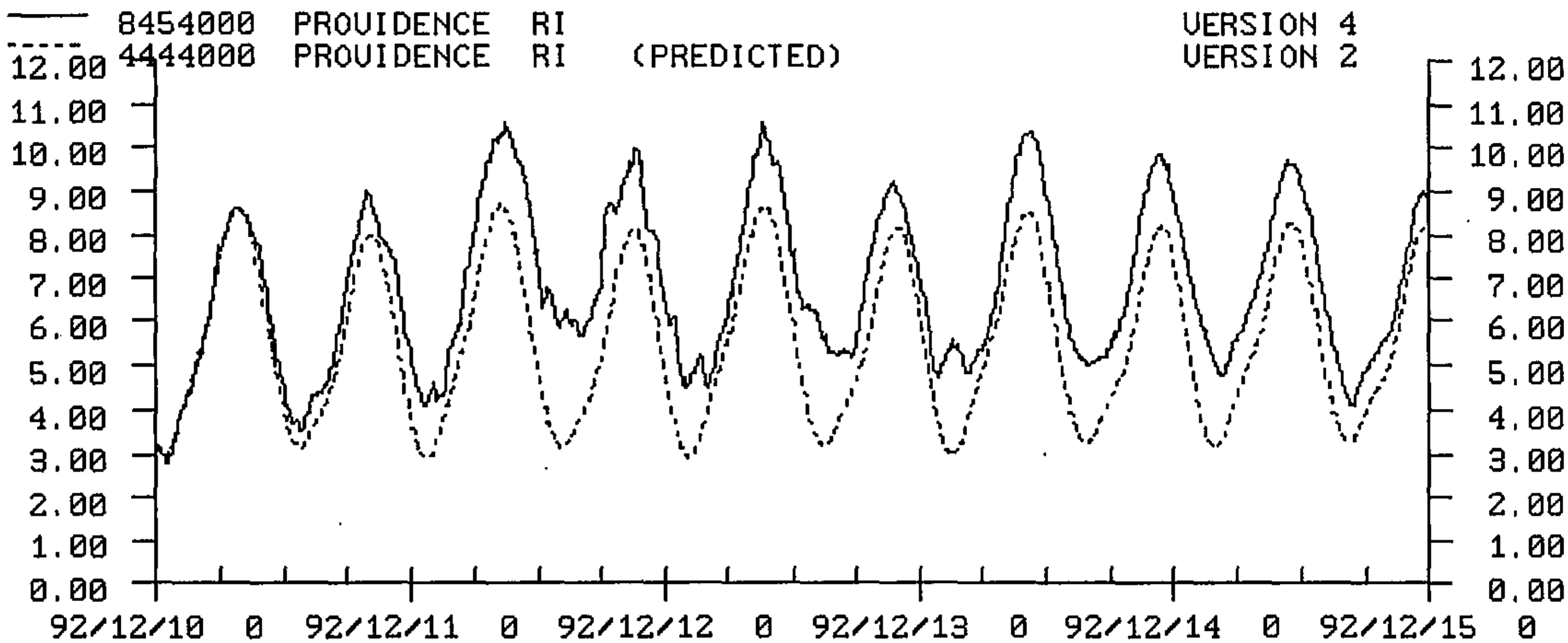
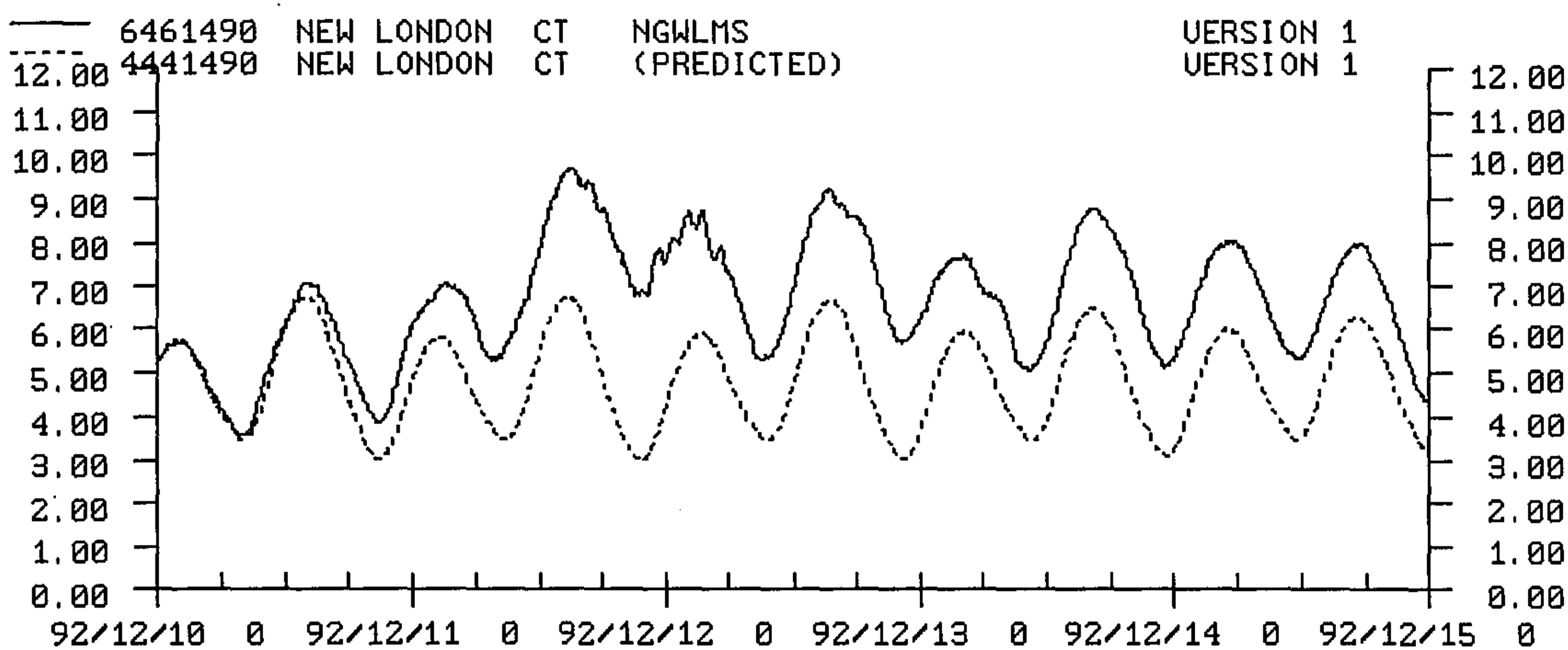
92/12/10 0
92/12/11 0
92/12/12 0
92/12/13 0
92/12/14 0
92/12/15 0



8454000 PROVIDENCE RI VERSION 4
4444000 PROVIDENCE RI (PREDICTED) VERSION 2
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
92/12/10 0 92/12/11 0 92/12/12 0 92/12/13 0 92/12/14 0 92/12/15 0

*


6461490 NEW LONDON CT NGWLMS
4441490 NEW LONDON CT (PREDICTED)
VERSION 1
VERSION 1
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
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1.00
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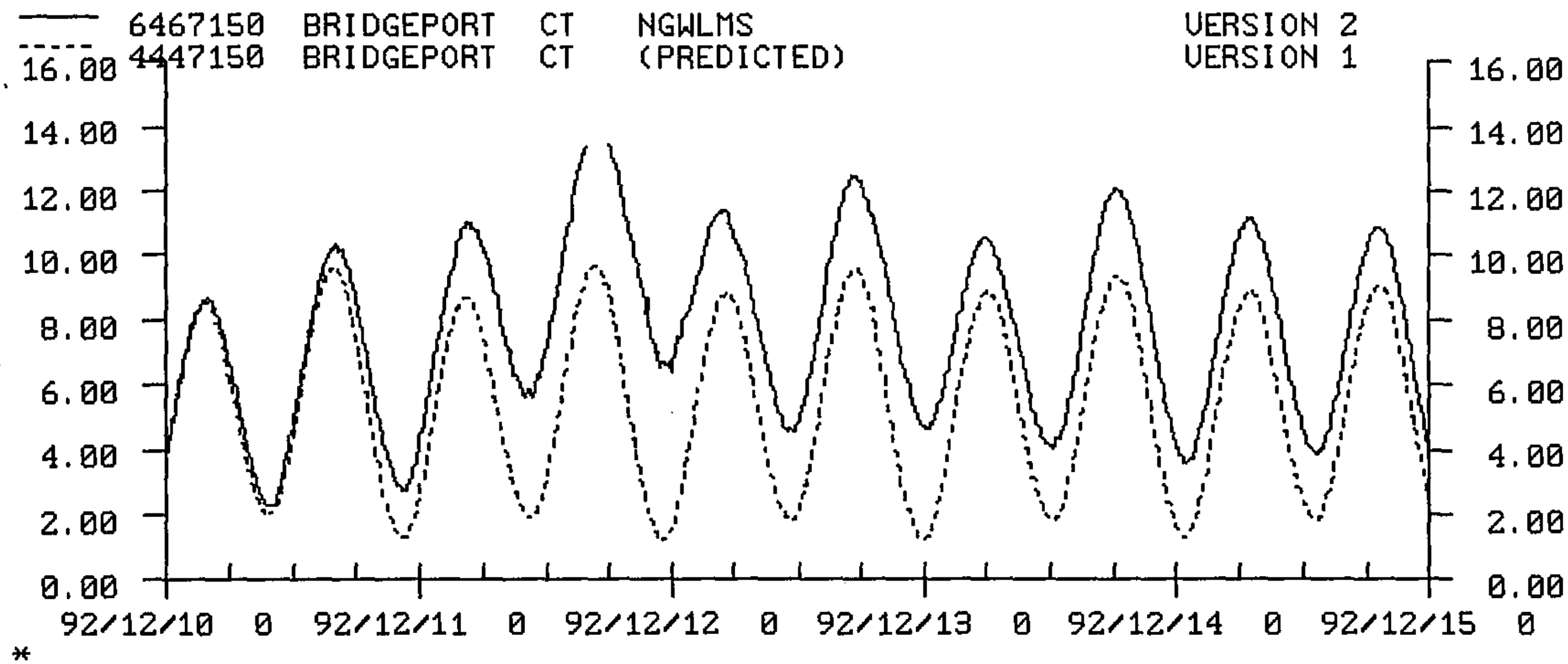
6467150 BRIDGEPORT CT NGWLMS VERSION 2
4447150 BRIDGEPORT CT (PREDICTED) VERSION 1
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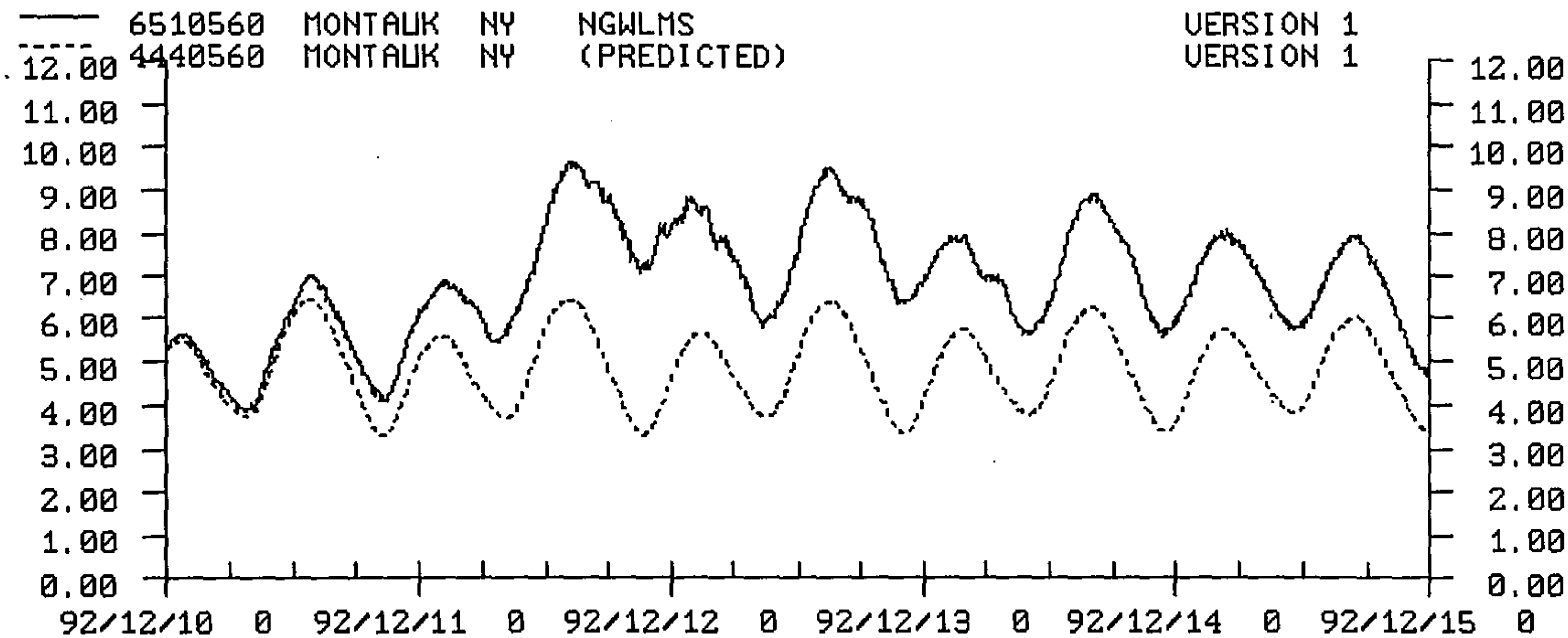

6510560 MONTAUK NY NGWLMS
4440560 MONTAUK NY (PREDICTED)
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VERSION 1
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7.00
6.00
5.00
4.00
3.00
2.00
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92/12/13 0
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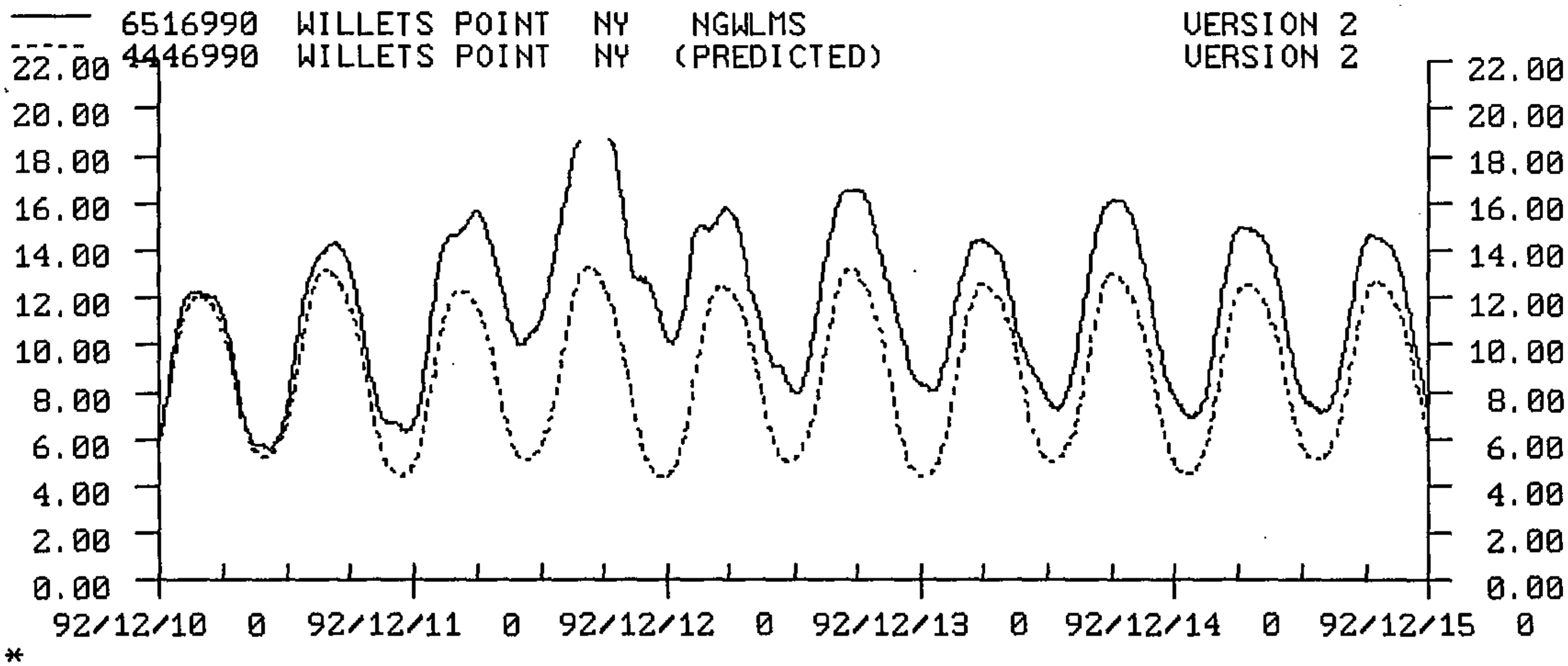
92/12/15 0



6516990 WILLETS POINT NY NGWLMS VERSION 2
4446990 WILLETS POINT NY (PREDICTED) VERSION 2
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14.00
12.00
10.00
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2.00
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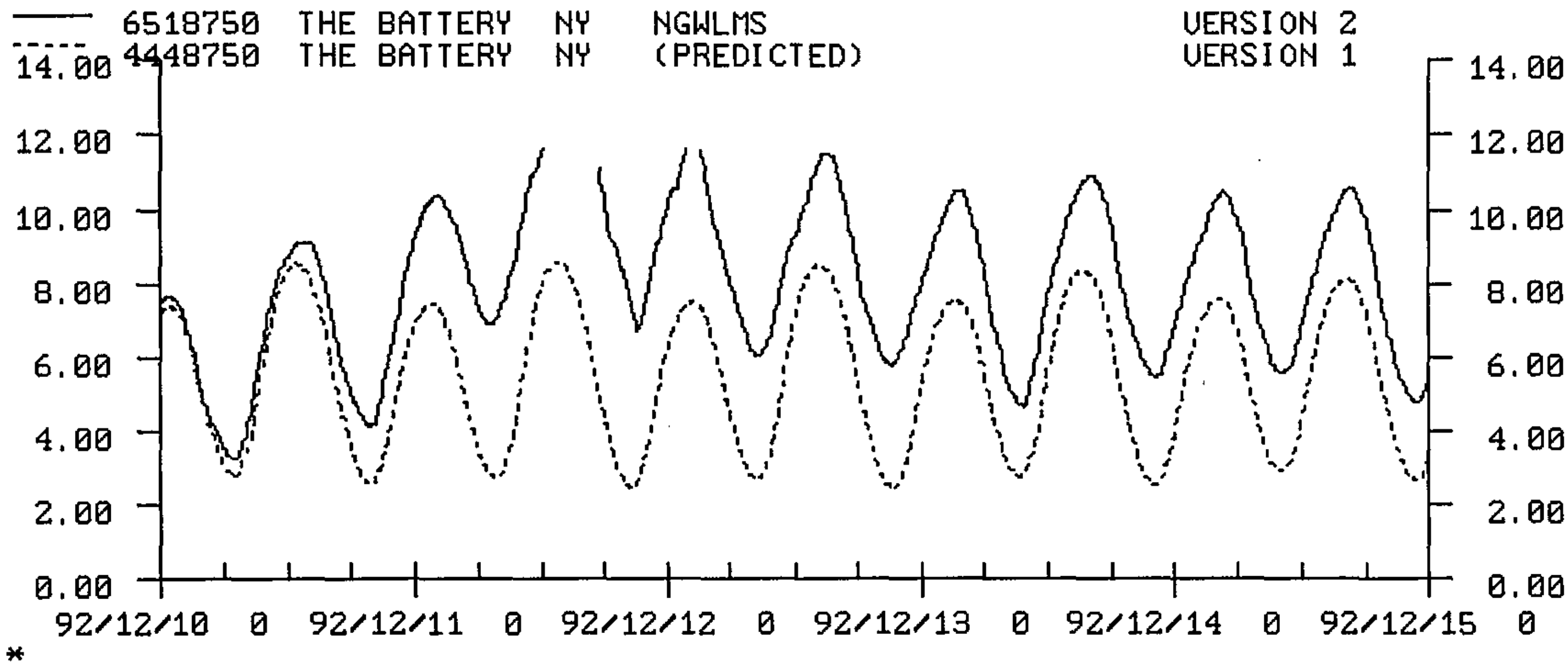
6518750 THE BATTERY NY NGWLMS VERSION 2
4448750 THE BATTERY NY (PREDICTED) VERSION 1
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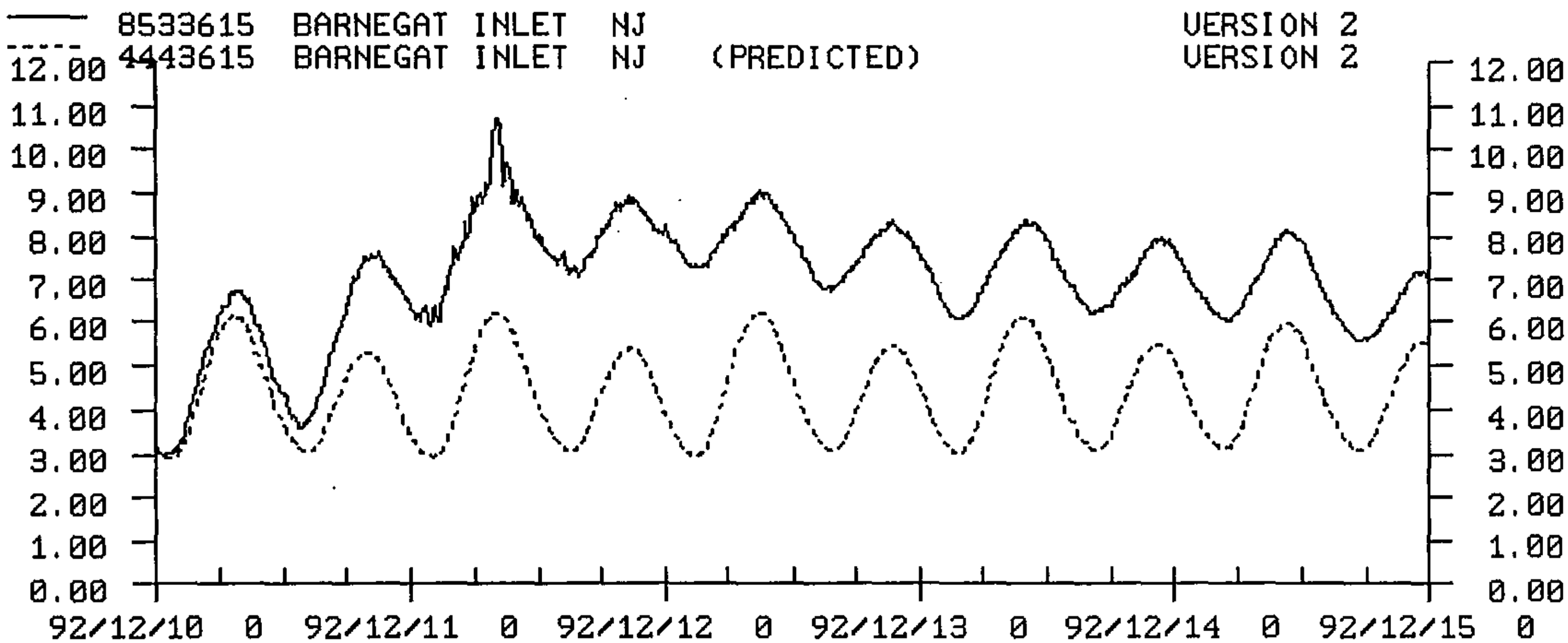
8533615 BARNEGAT INLET NJ VERSION 2
4443615 BARNEGAT INLET NJ (PREDICTED) VERSION 2
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7.00
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5.00
4.00
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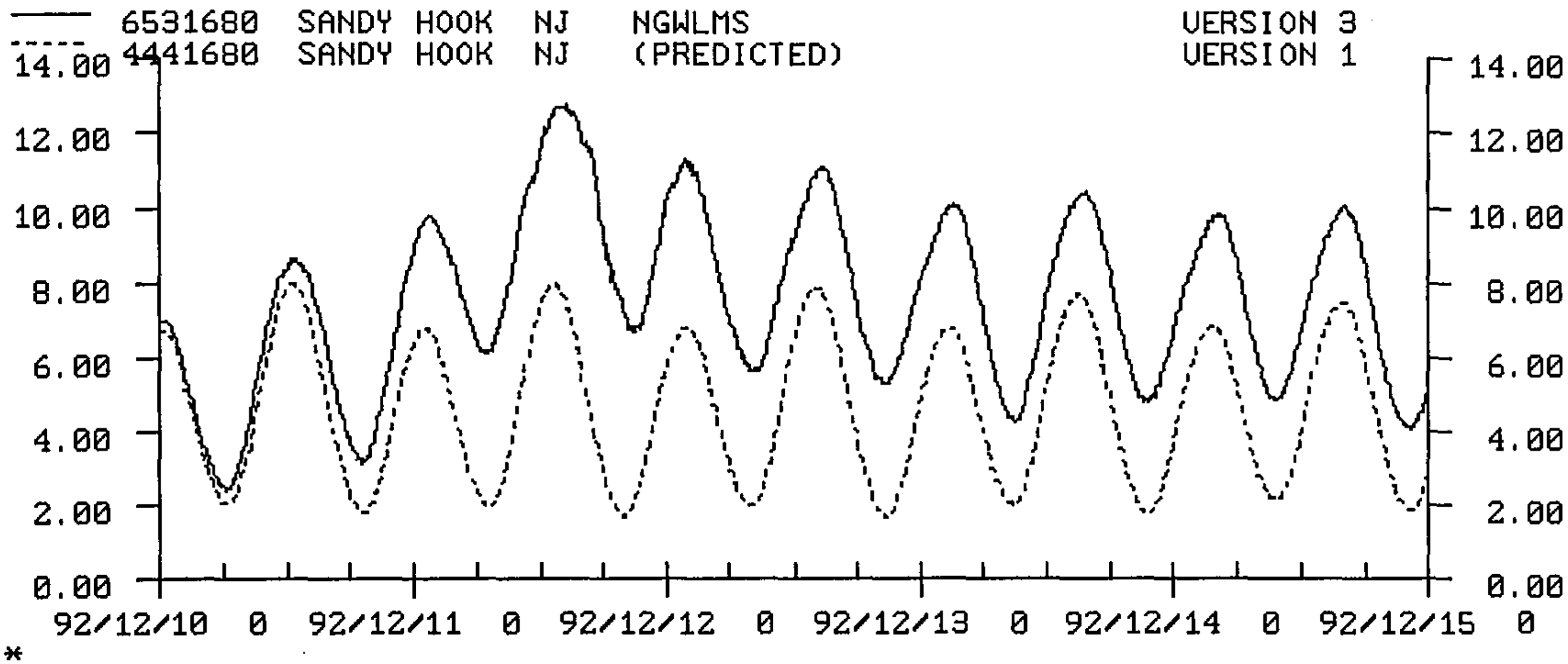

6531680 SANDY HOOK NJ NGWLMS
VERSION 3
4441680 SANDY HOOK NJ (PREDICTED)
VERSION 1
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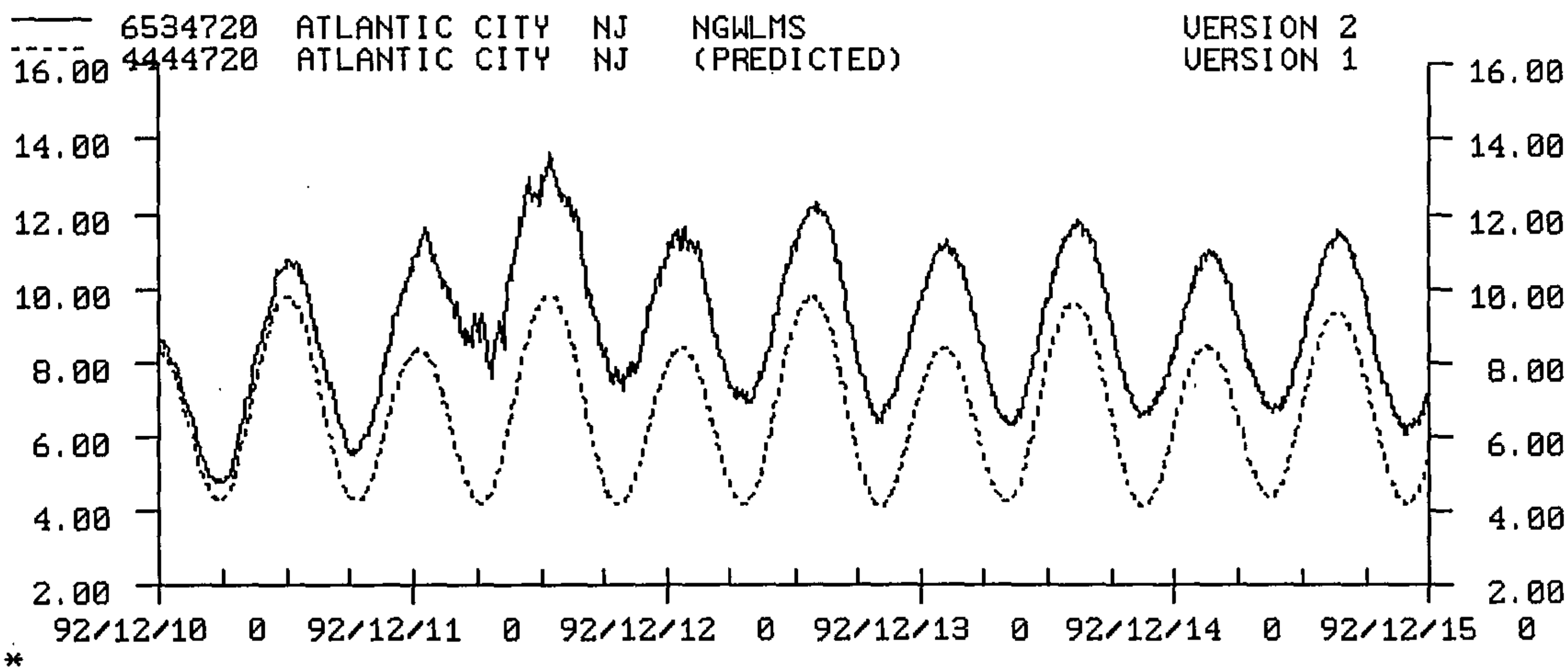

6534720 ATLANTIC CITY NJ NGWLMS VERSION 2
4444720 ATLANTIC CITY NJ (PREDICTED) VERSION 1
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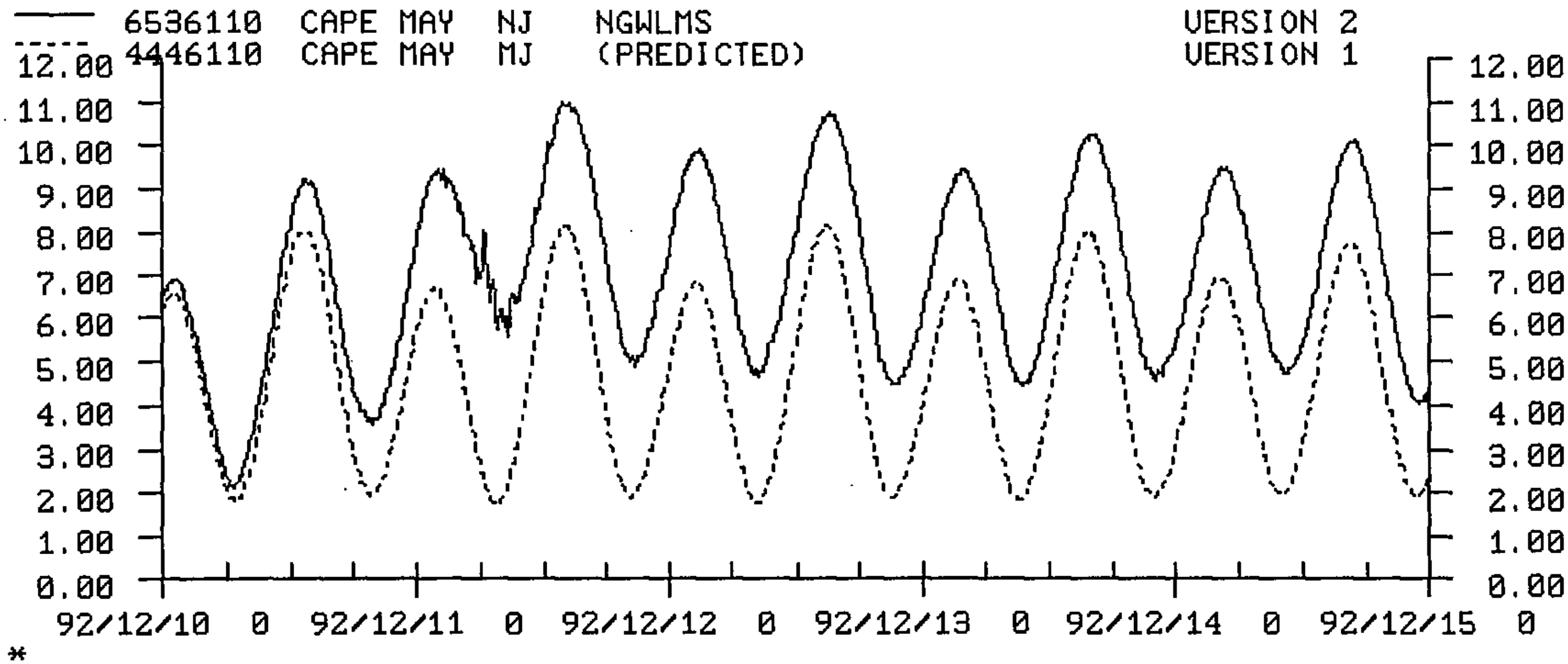
6536110 CAPE MAY NJ NGWLMS VERSION 2
4446110 CAPE MAY MJ (PREDICTED) VERSION 1
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7.00
6.00
5.00
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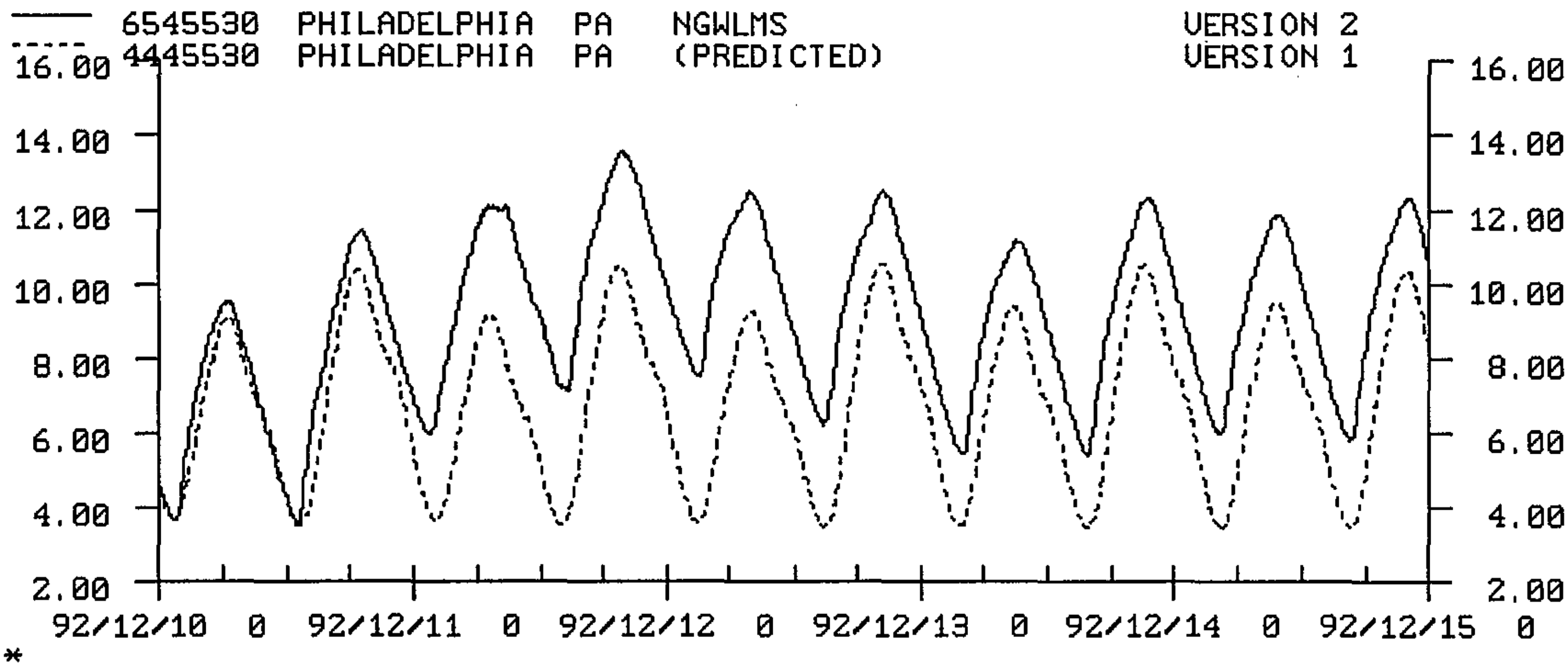
6545530 PHILADELPHIA PA NGWLMS VERSION 2
4445530 PHILADELPHIA PA (PREDICTED) VERSION 1
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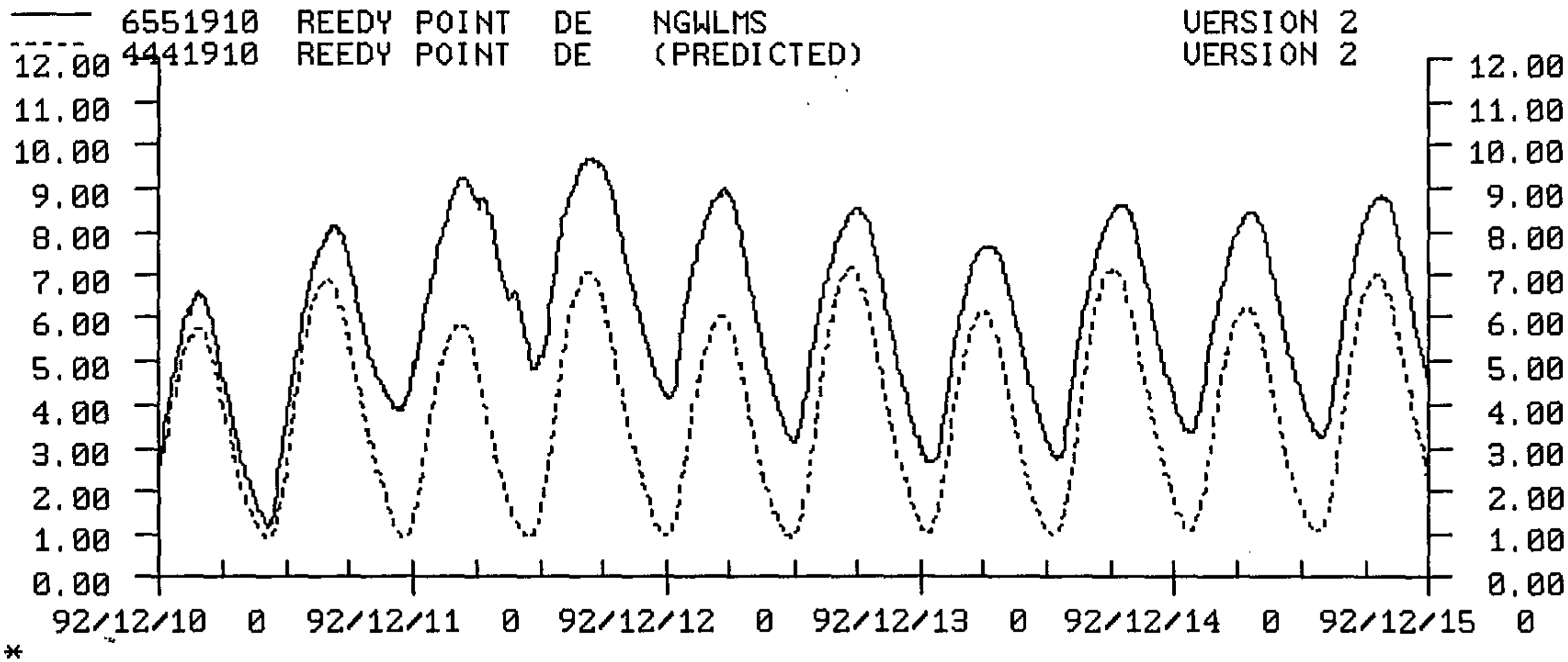
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4441910 REEDY POINT DE (PREDICTED) VERSION 2
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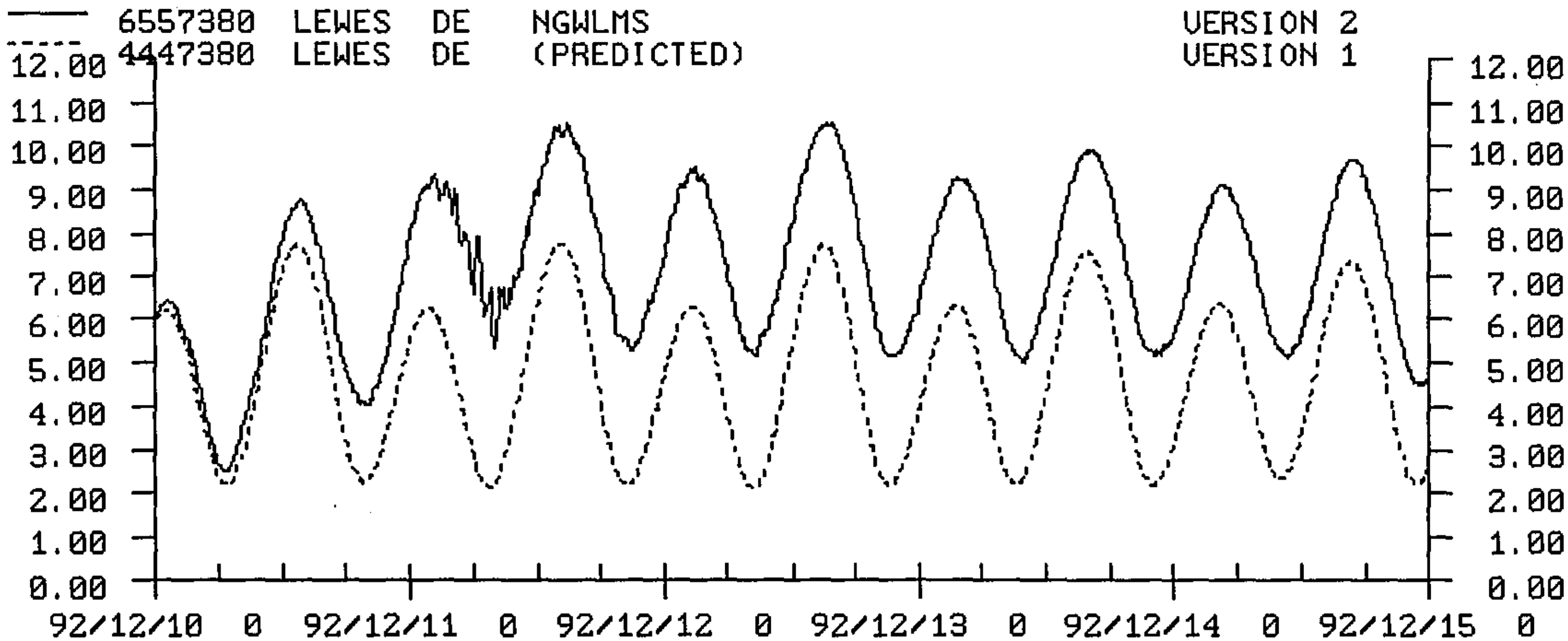
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4447380 LEWES DE (PREDICTED) VERSION 1
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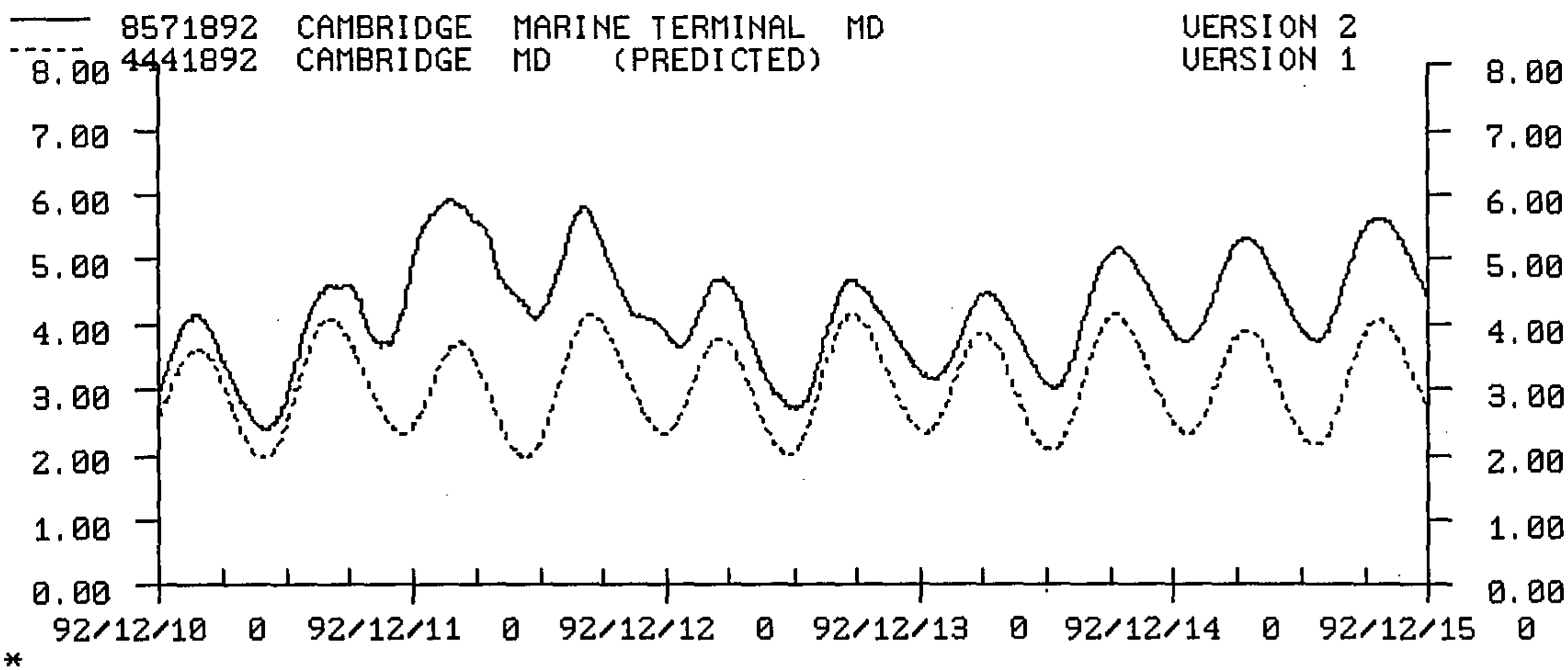
8571892 CAMBRIDGE MARINE TERMINAL MD
VERSION 2
4441892 CAMBRIDGE MD (PREDICTED)
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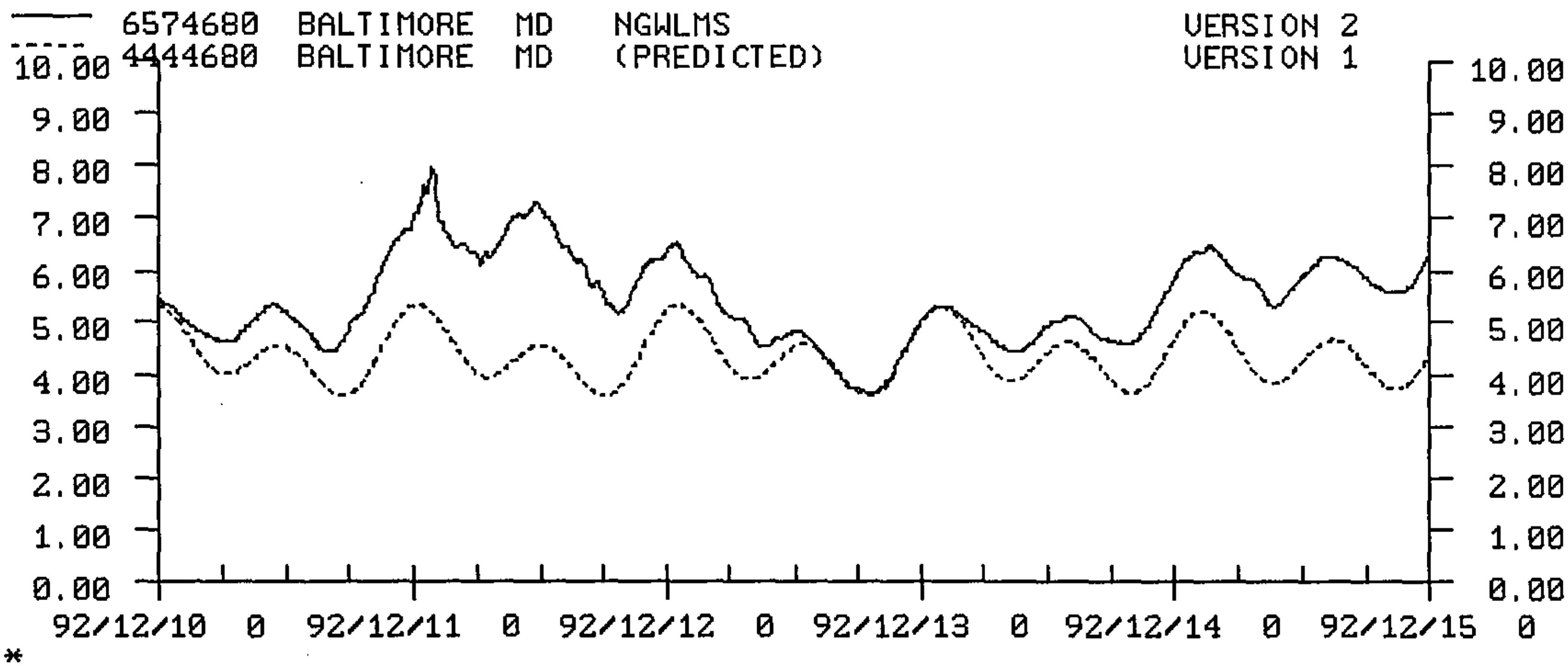

6574680 BALTIMORE MD NGWLMS
4444680 BALTIMORE MD (PREDICTED)
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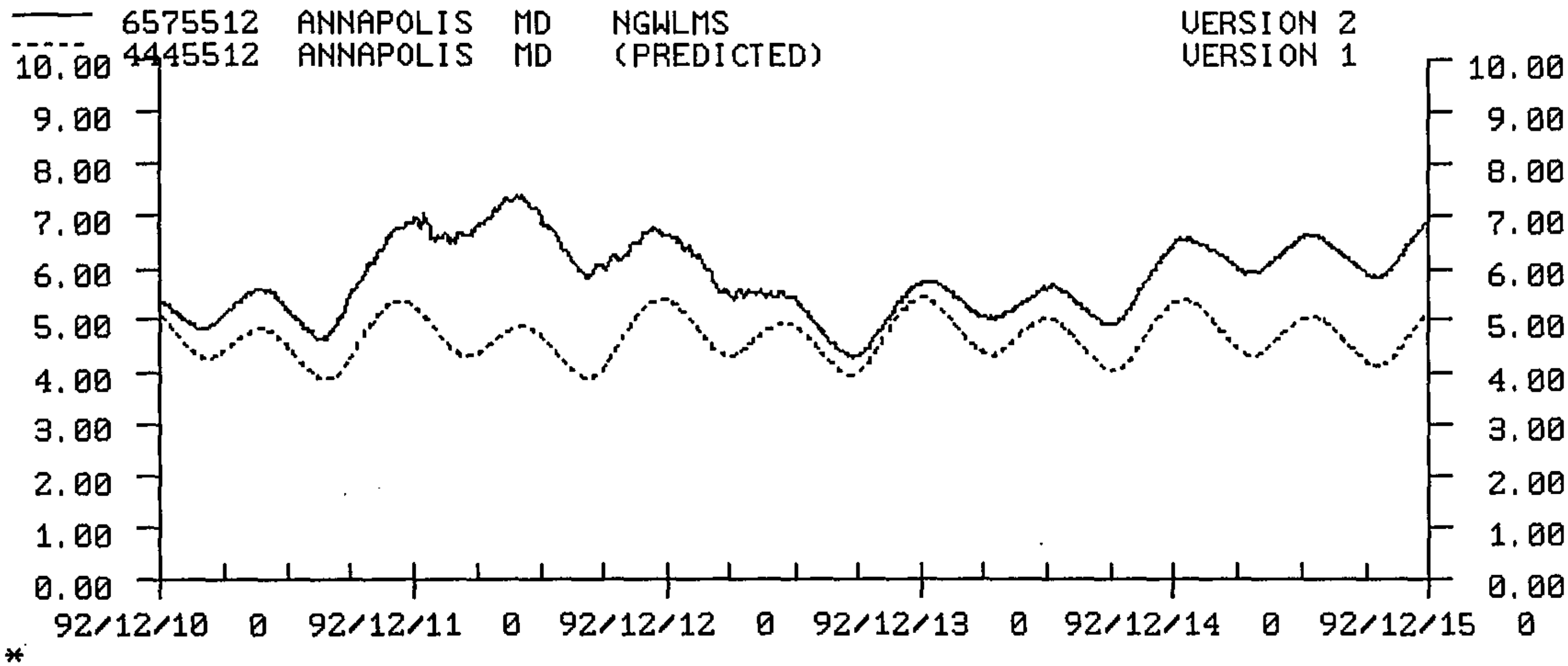
6575512 ANNAPOLIS MD NGWLMS VERSION 2
4445512 ANNAPOLIS MD (PREDICTED) VERSION 1
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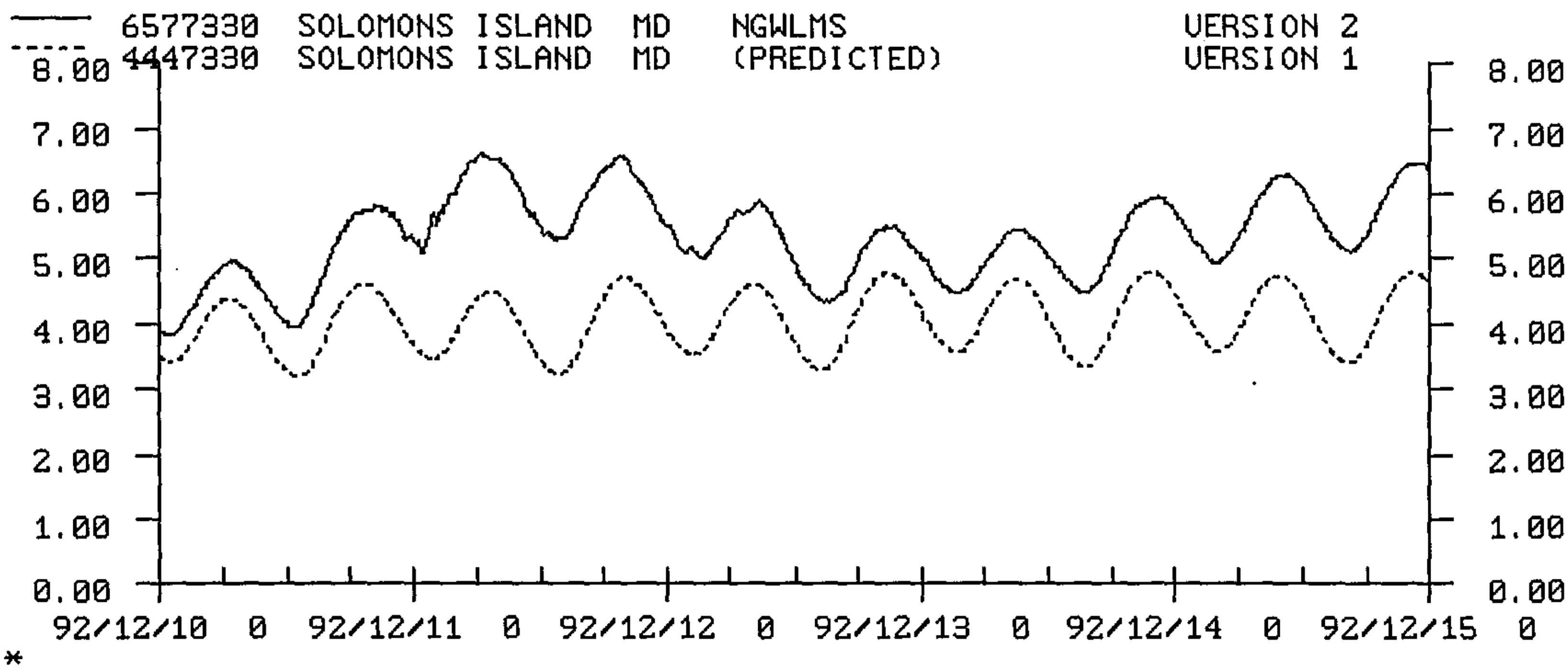
6577330 SOLOMONS ISLAND MD NGWLMS VERSION 2
4447330 SOLOMONS ISLAND MD (PREDICTED) VERSION 1
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4.00
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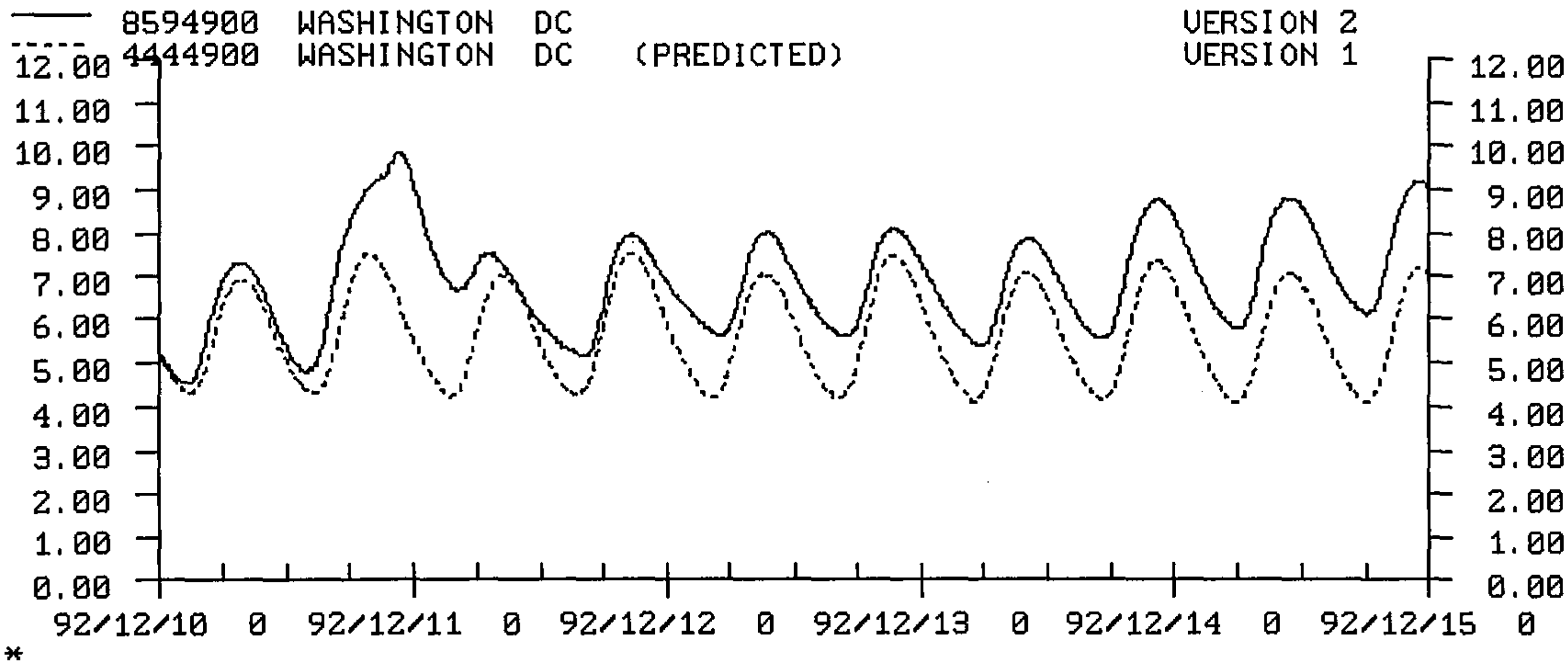
41


8594900 WASHINGTON DC
4444900 WASHINGTON DC (PREDICTED)
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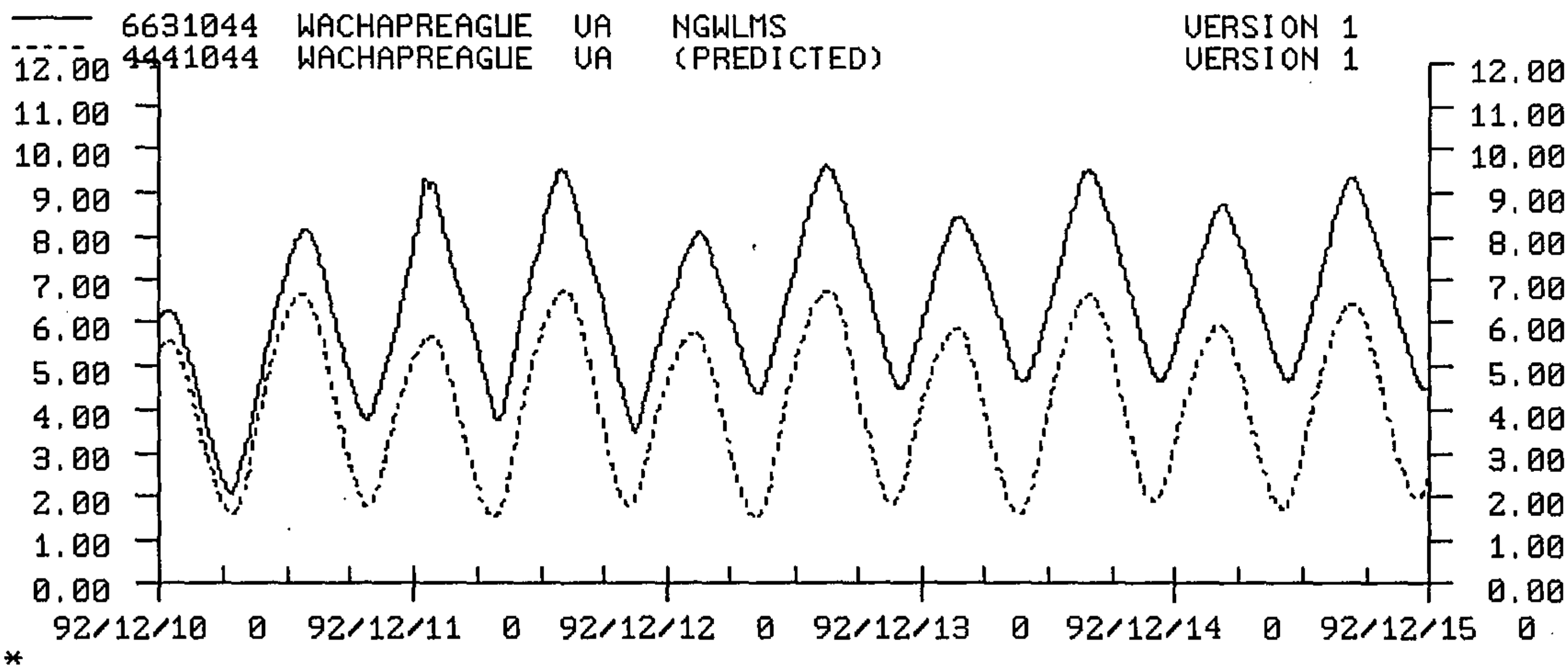
6631044 WACHAPREAGUE VA NGWLMS VERSION 1
4441044 WACHAPREAGUE VA (PREDICTED) VERSION 1
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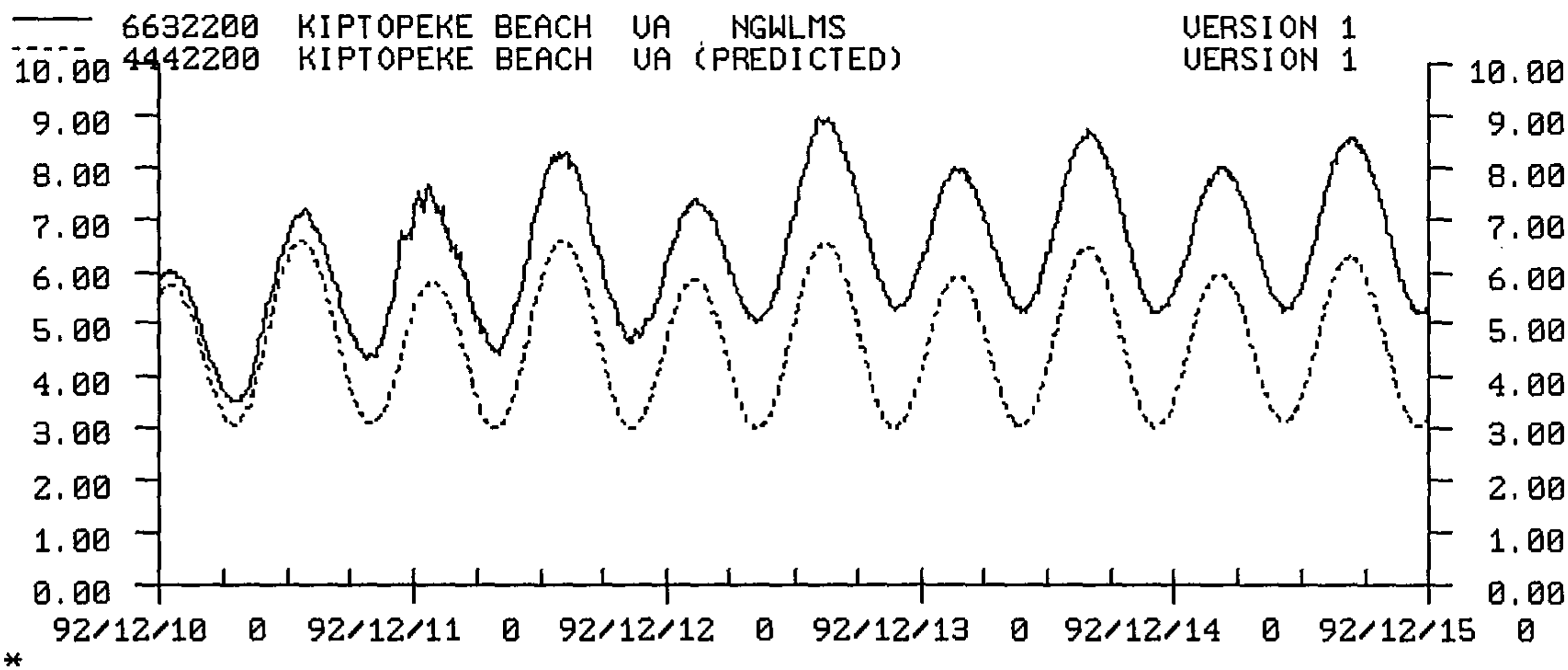

6632200 KIPTOPEKE BEACH VA NGWLMS VERSION 1
4442200 KIPTOPEKE BEACH VA (PREDICTED) VERSION 1
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6.00
5.00
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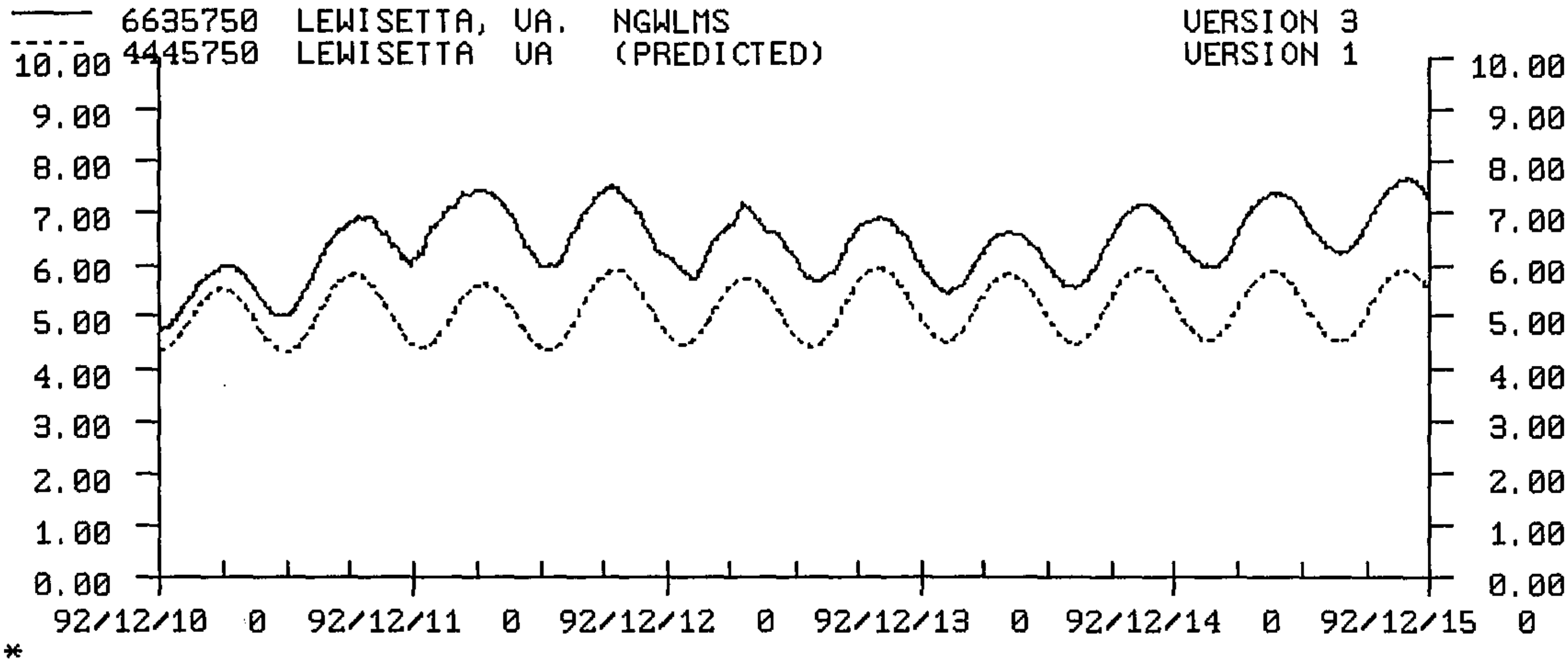
6635750 LEWISETTA, VA. NGWLMS
4445750 LEWISETTA VA (PREDICTED)
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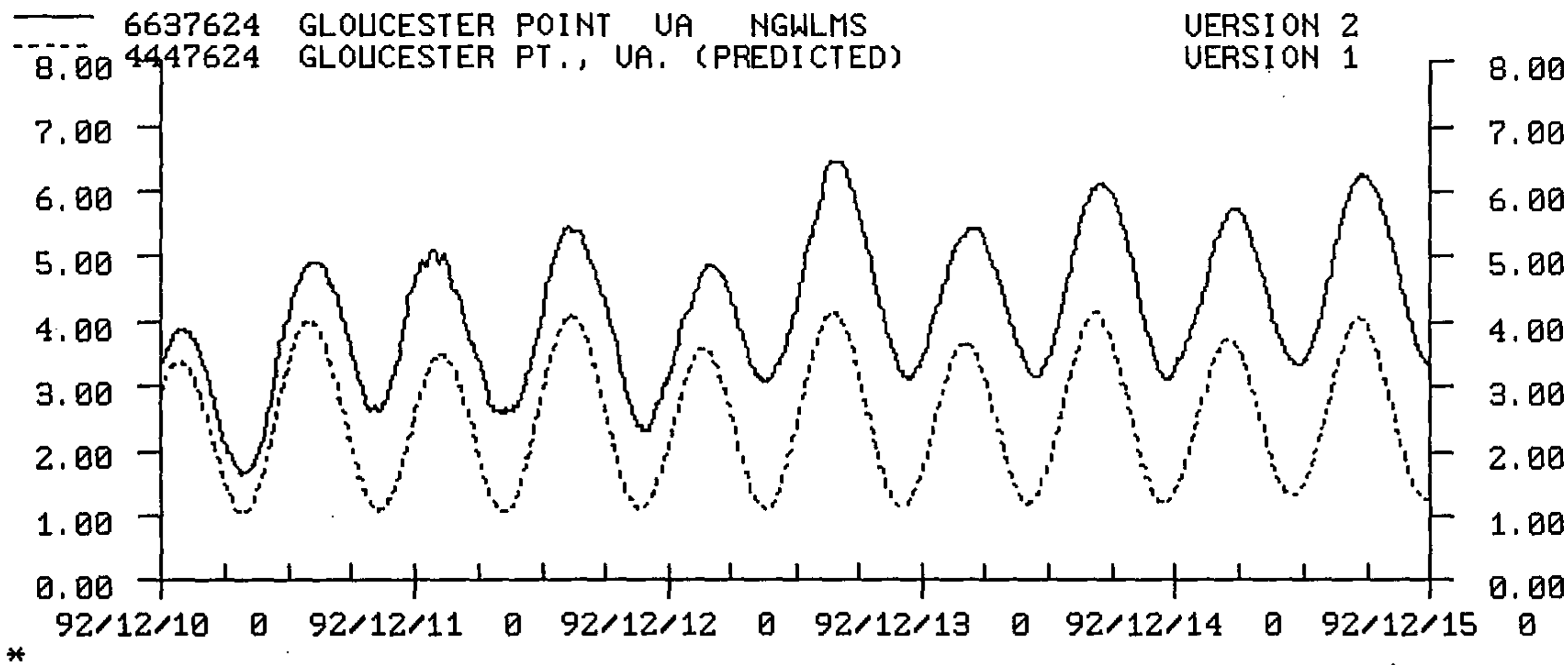
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4447624 GLOUCESTER PT., VA. (PREDICTED)
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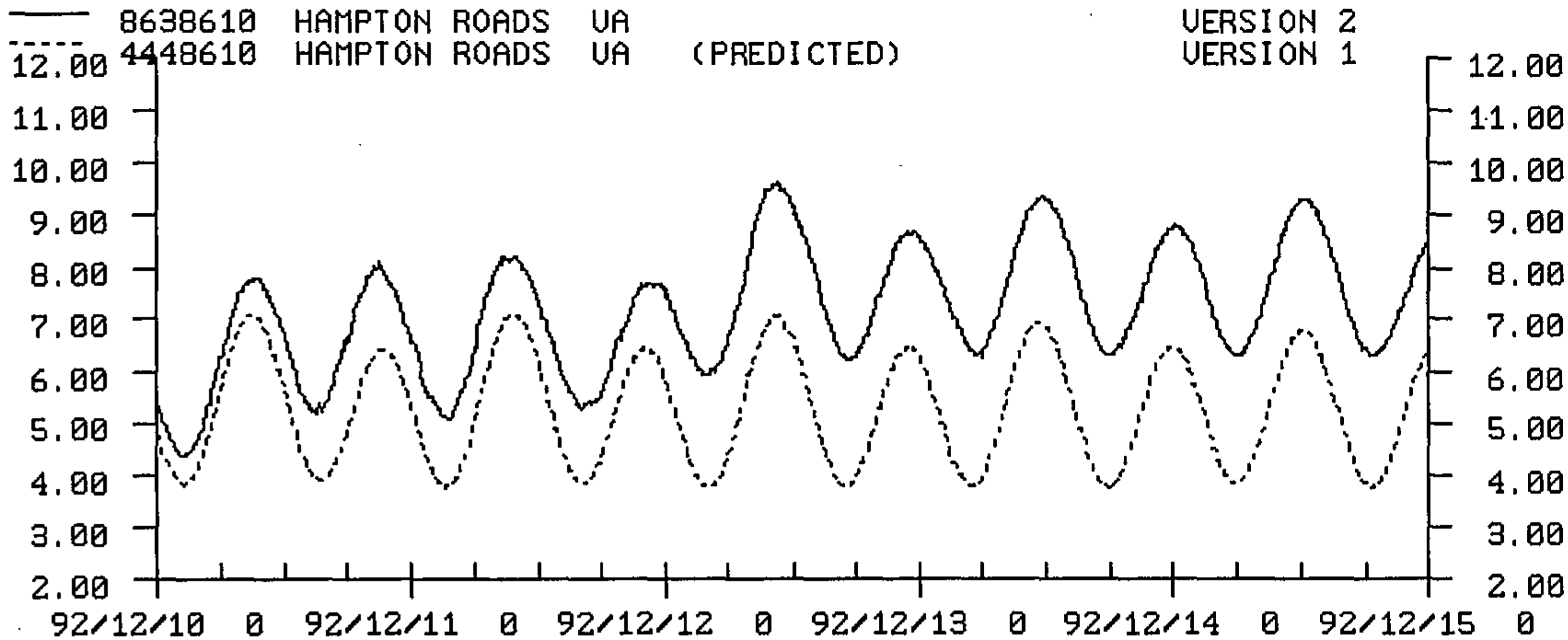
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4448610 HAMPTON ROADS VA (PREDICTED)
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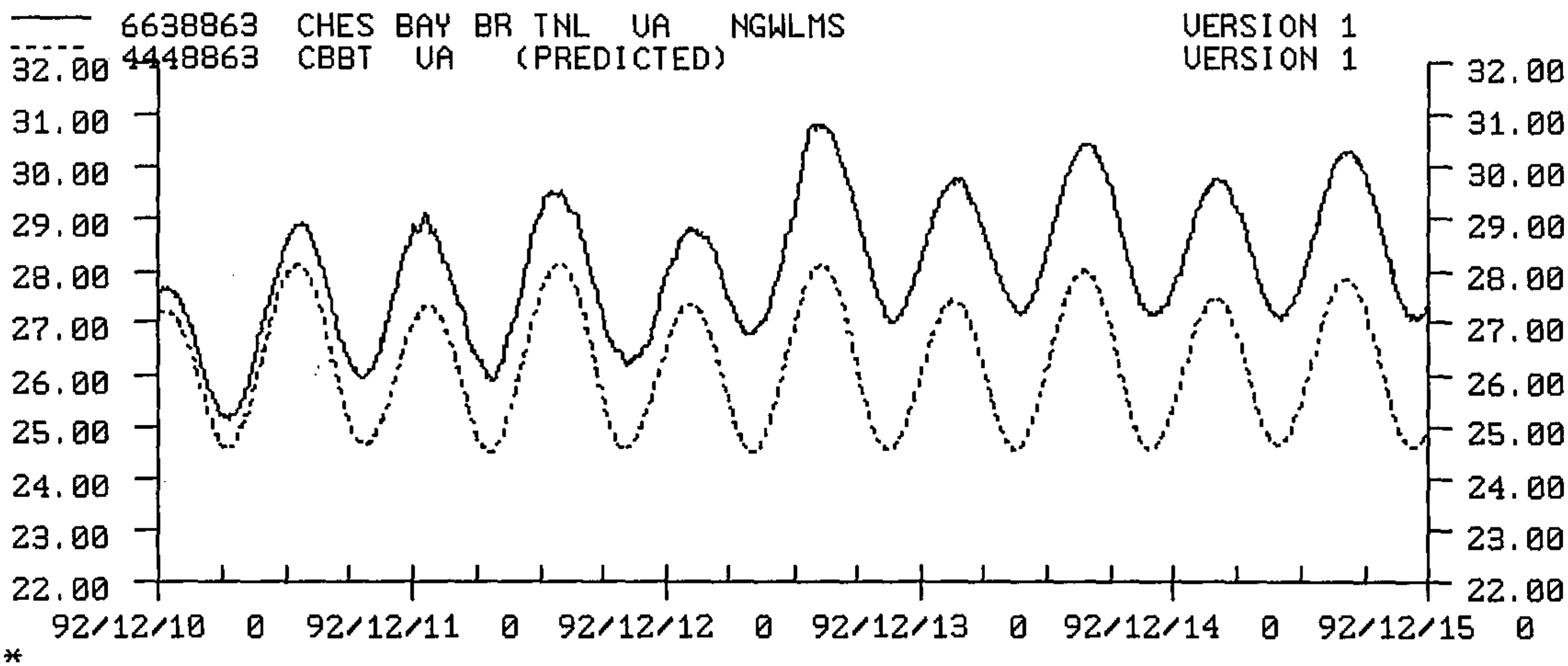
6638863 CHES BAY BR TNL VA NGWLMS
4448863 CBBT VA (PREDICTED)
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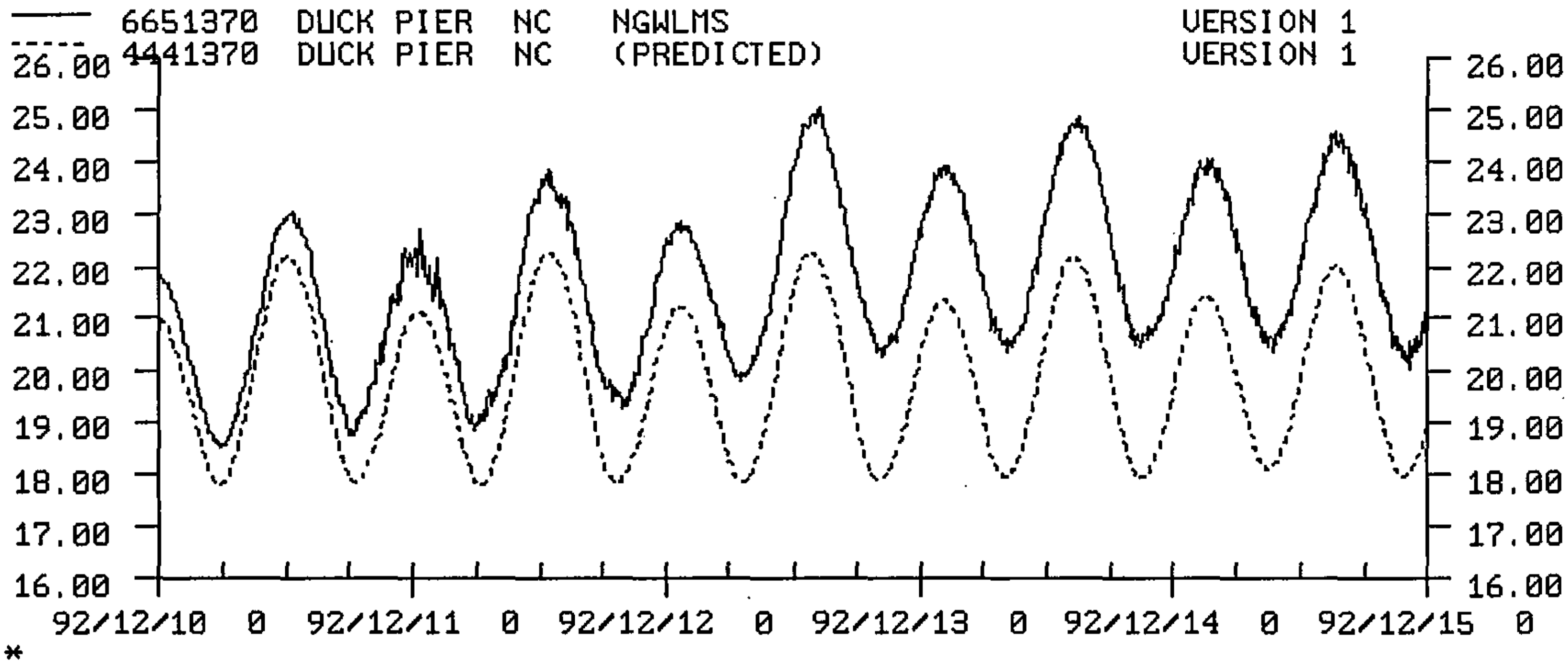
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20.00
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17.00
16.00
92/12/10 0
92/12/11 0
92/12/12 0
92/12/13 0
92/12/14 0
92/12/15 0
*

V. SUMMARY

The continuous operation of the National Water Level Observation Network (NWLON) has resulted in an important data set documenting the effects of an unusual major storm on the water levels in the U.S. coastal ocean.

Maximum recorded historical highest water levels were exceeded at three NWLON stations: Sandy Hook, NJ, Barnegat Inlet, NJ, and Duck Pier, NC. Except for Sandy Hook, NJ, historical levels were not exceeded at the stations with the longer historical records. The maximum levels did come within a foot of the historical maxima at several stations, however. Maximum storm surge values (observed minus predicted water levels) of over 5.0 feet were measured at Reedy Point, DE, Sandy Hook, NJ, The Battery, NY, Willets Point, NY, and Bridgeport, CT. Significant storm surge was seen in the observations as far south as Duck Pier, NC.

Preliminary data recorded during the storm were provided to the U.S. Army Corps of Engineers, the National Weather Service, and to FEMA. Information on tidal datums, storm surge, and time series analyses from the stations listed in this report and from other NOS stations can be obtained from:

NOAA/National Ocean Service
Office of Ocean and Earth Sciences
Ocean and Lake Levels Division
Products and Services Branch, N/OES23
SSMC4, Station 7622
1305 East-West Hwy.
Silver Spring, MD 20910-3233

Telephone: (301) 713-2877
FAX: (301) 713-4435

ACKNOWLEDGEMENTS

This report represents the cumulative efforts of Ocean and Lake Levels Division personnel. We would like to acknowledge the support of Measurement Branch personnel, who are responsible for the operation and maintenance of the water level stations; and, Tidal Analysis Branch and Products and Services Branch personnel, who are responsible for the processing and analysis of the data and input into the preparation of this report.

National Oceanic and Atmospheric Administration • National Weather Service • National Meteorological Center
Meteorological Operations Division & Climate Analysis Center

DEPARTMENT OF COMMERCE • UNITED STATES OF AMERICA •

daily weather maps

Weekly Series DECEMBER 7 – 13, 1992

The charts in this publication are the principal charts of the former Weather Bureau publication, "Daily Weather Map." They are the Surface Weather Map, the 500-Millibar Height Contours chart, the Highest and Lowest Temperatures chart, and the Precipitation Areas and Amounts chart. All charts for each day are arranged on a single page. They are derived from operational weather maps prepared by the National Meteorological Center, National Weather Service. The symbols on the Surface Weather Map and the 500-Millibar Height Contours chart are standard international symbols. Copies of an explanatory sheet are available from the Climate Analysis Center (address below). NOAA is responsible for managing, printing, and distributing these maps. The contents may be reprinted freely, with proper credit.

Orders for annual subscriptions and single copies may be sent to Daily Weather Maps, Climate Analysis Center, Room 808 World Weather Building, Washington, D.C. 20233.

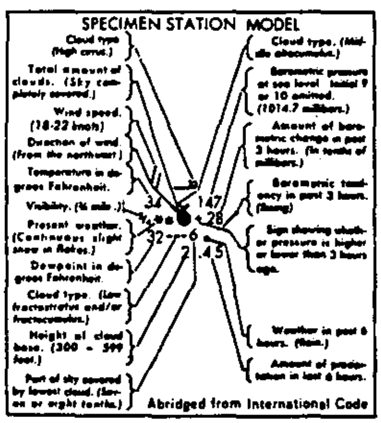
The price of the Daily Weather Maps is $60 per year for domestic mailing, $75 per year for foreign mailing and $1.50 for single issues. Only checks or money orders (including international postal money orders), made payable to the Department of Commerce, NOAA, are acceptable.

The Surface Weather Map shows station data and the analysis for 7:00 a.m., EST. Tracks of well-defined low pressure areas are indicated by a chain of arrows; locations of these centers at 6, 12, and 18 hours preceding map time are indicated by small white crosses in black squares. Areas of precipitation are indicated by shading. The weather reports printed here are only a fraction of those on which the analyses are based. Occasional apparent discrepancies between the printed station data and the analyses result from the absence of station reports not included here because of lack of space.

The 500-Millibar Height Contours chart shows height contours and isotherms of the 500-millibar surface at 7:00 a.m., EST. Height contours are shown as continuous lines labeled in dekameters above sea level. Isotherms are shown as dashed lines labeled in degrees Celsius. Arrows show the wind direction and speed at the 500-millibar level.

The Highest and Lowest Temperature chart shows the maximum temperature for the 12-hour period ending 7:00 p.m. EST of the previous day and the minimum temperature for the 12-hour period ending 7:00 a.m. EST. The names of the reporting points are shown on the Surface Weather Map. The maximum temperature is plotted above the station location, and the minimum temperature is plotted below.

The Precipitation Areas and Amounts chart shows areas (shaded) that had precipitation during the 24 hours ending at 7:00 a.m., EST, with amounts to the nearest hundredth of an inch. Incomplete totals are underlined. "T" indicates a trace of precipitation. Dashed lines, in season, show the depth of snow on the ground in inches at 7:00 a.m., EST.



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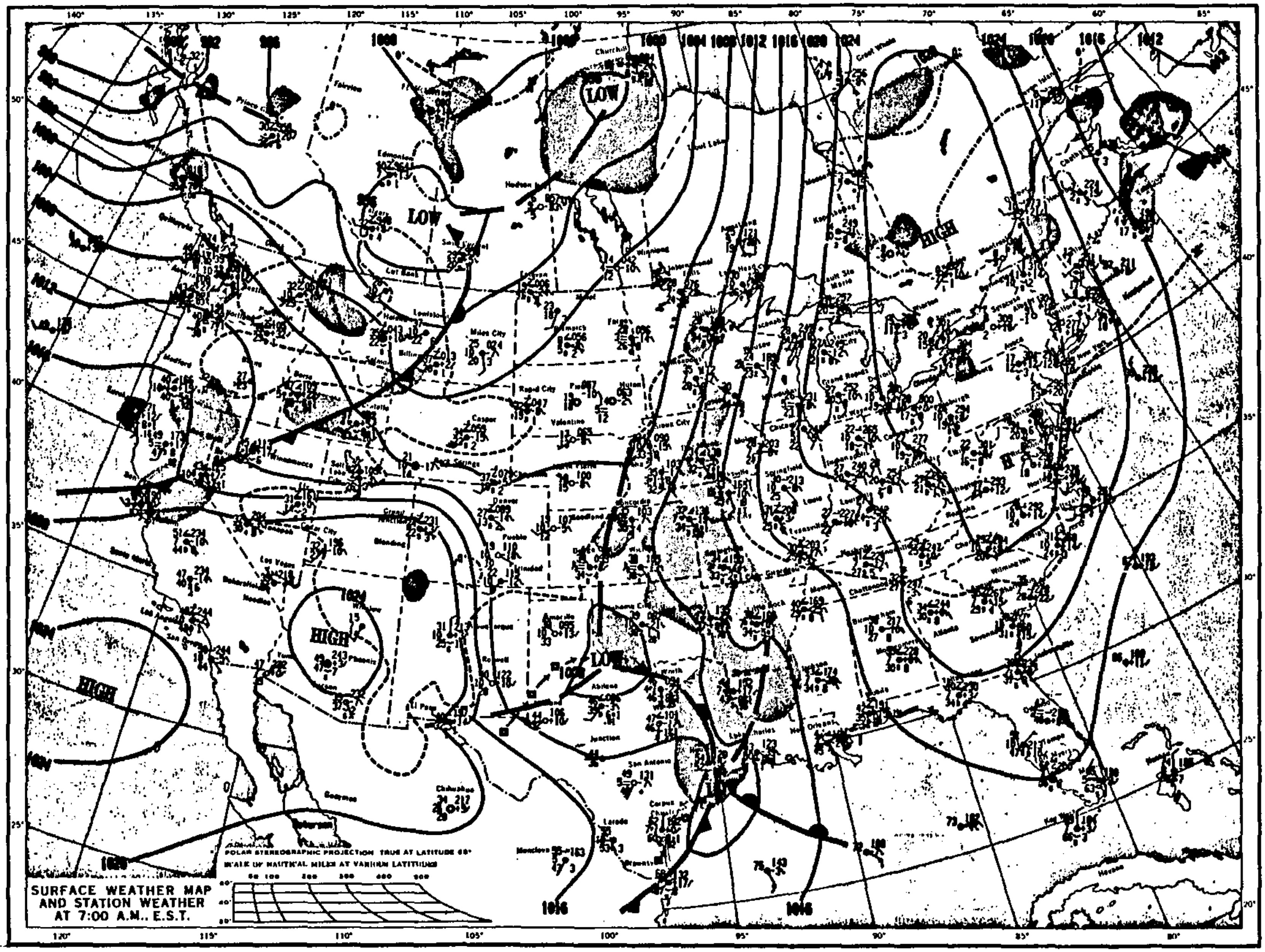
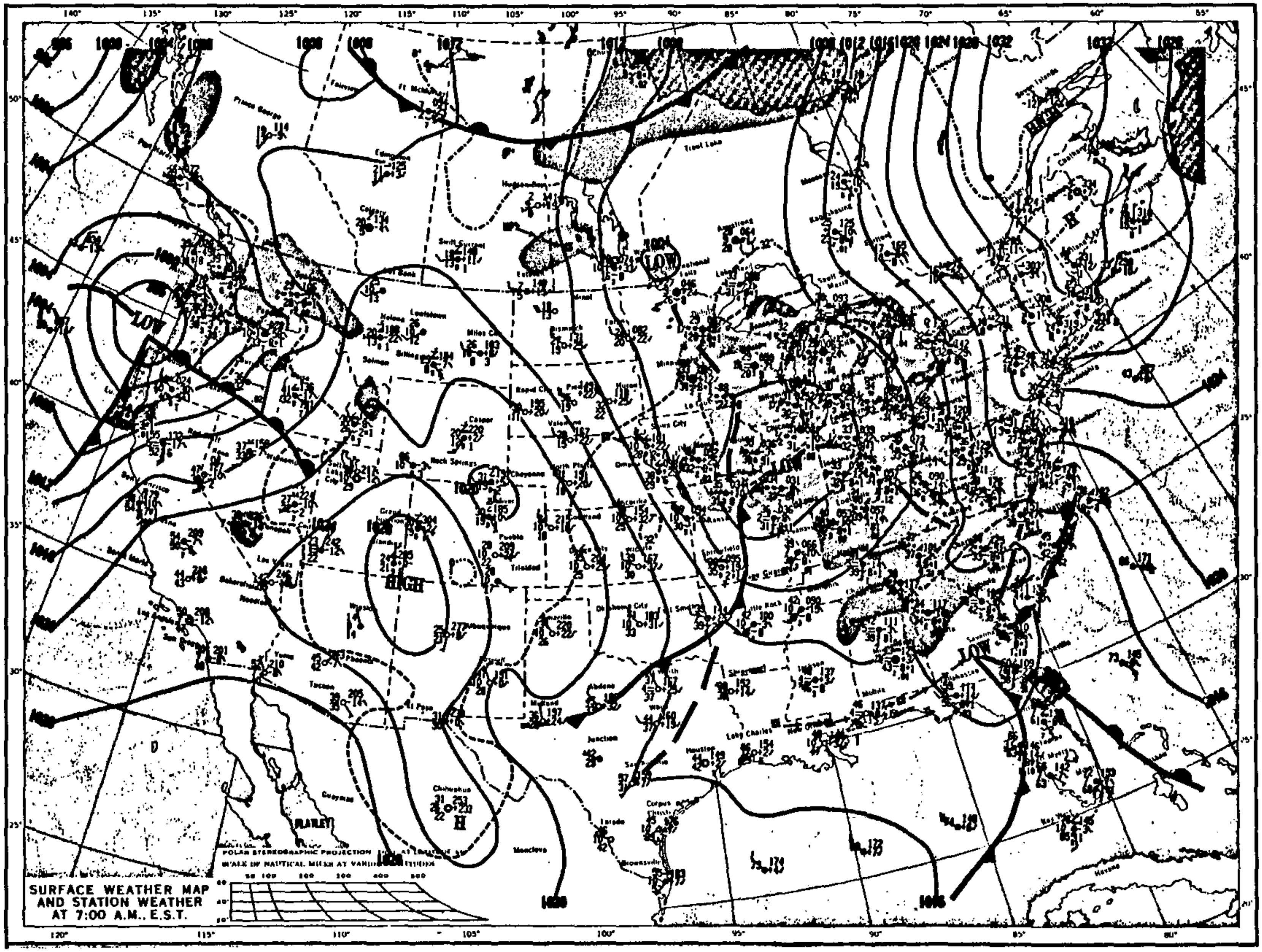
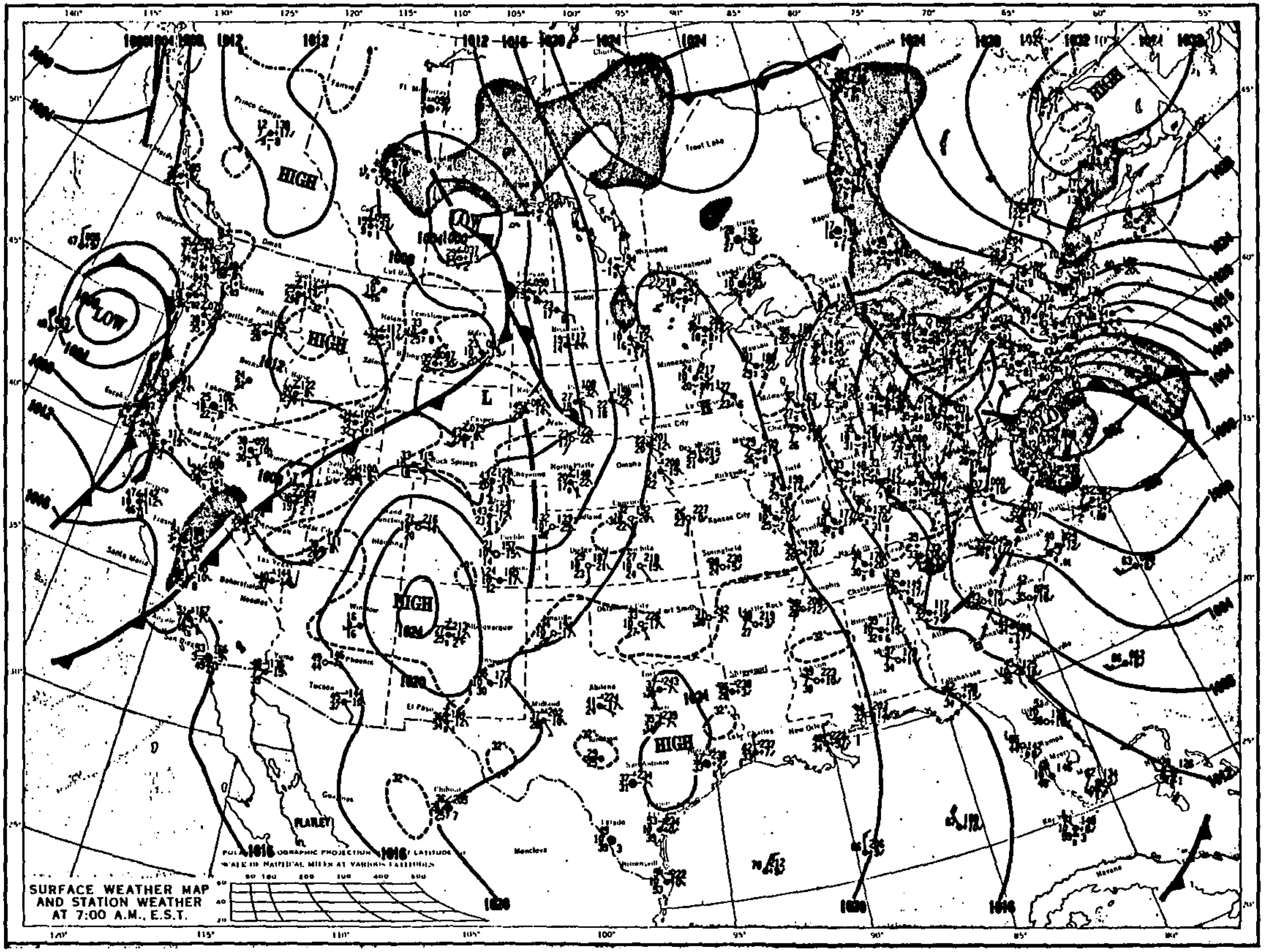
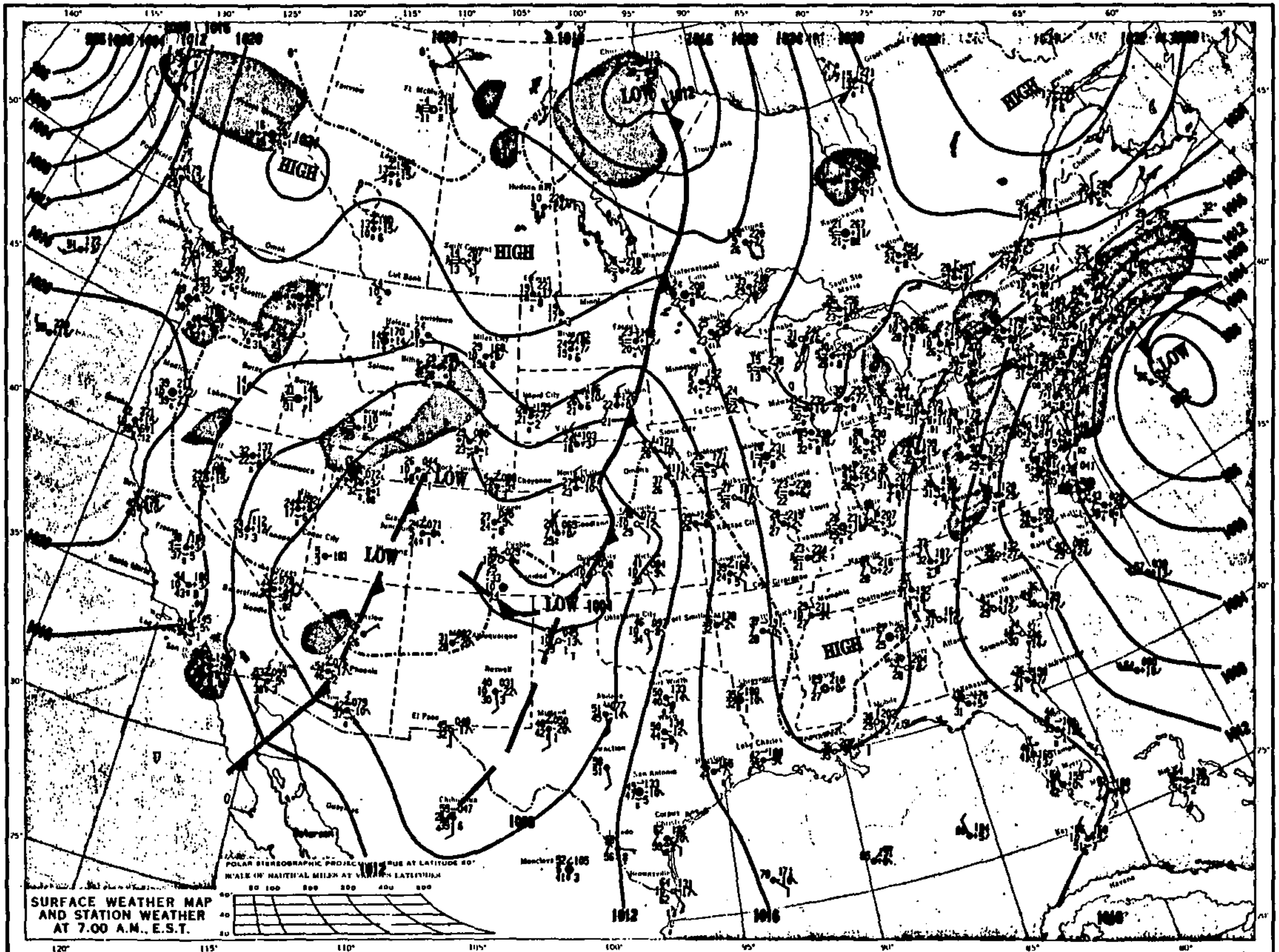
WEDNESDAY, DECEMBER 9, 1992




SURFACE WEATHER MAP
AND STATION WEATHER
AT 7:00 A.M., E.S.T.
HIGH
LOW
LOW
LOW
LOW

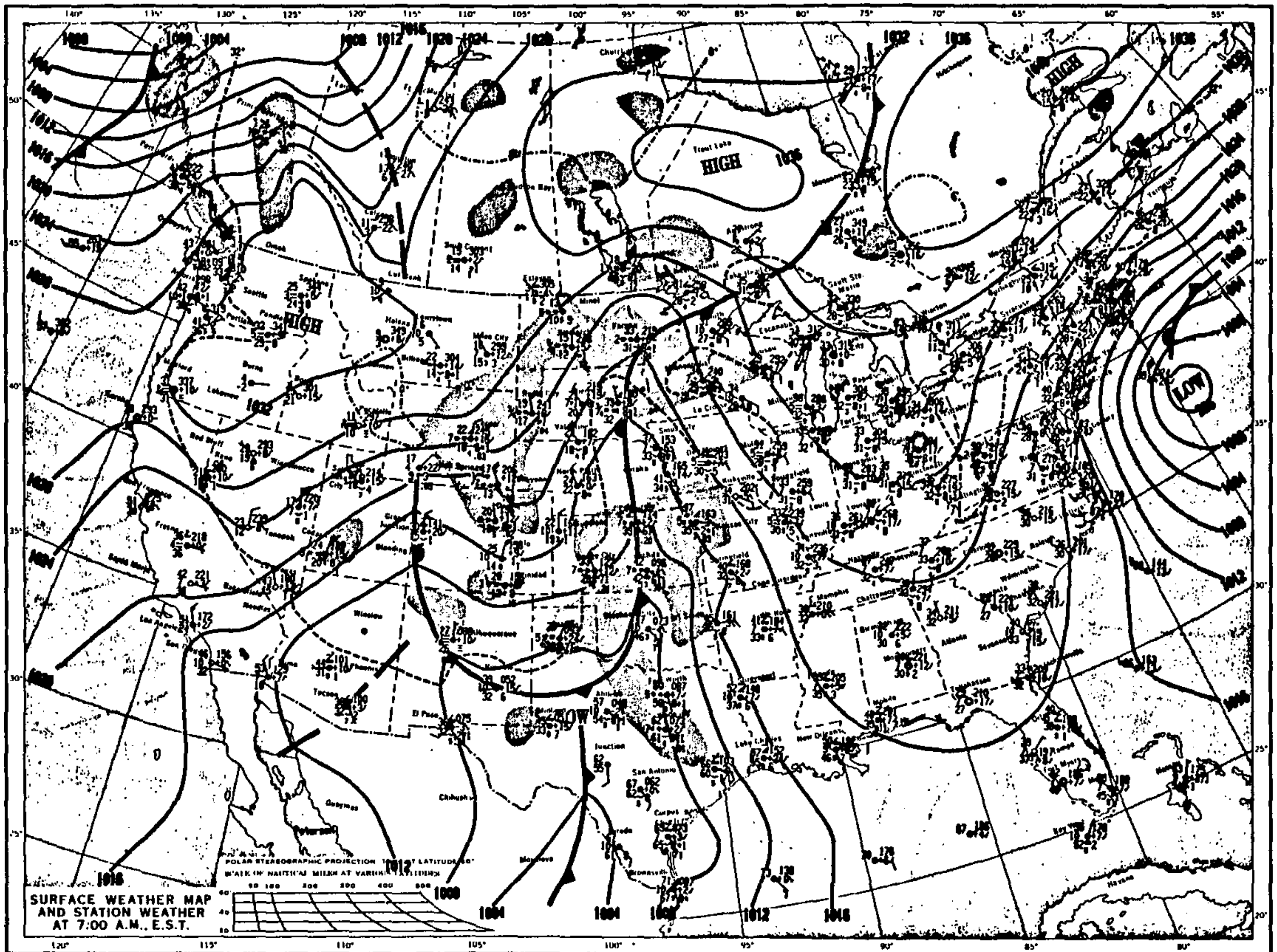
FRIDAY, DECEMBER 11, 1992



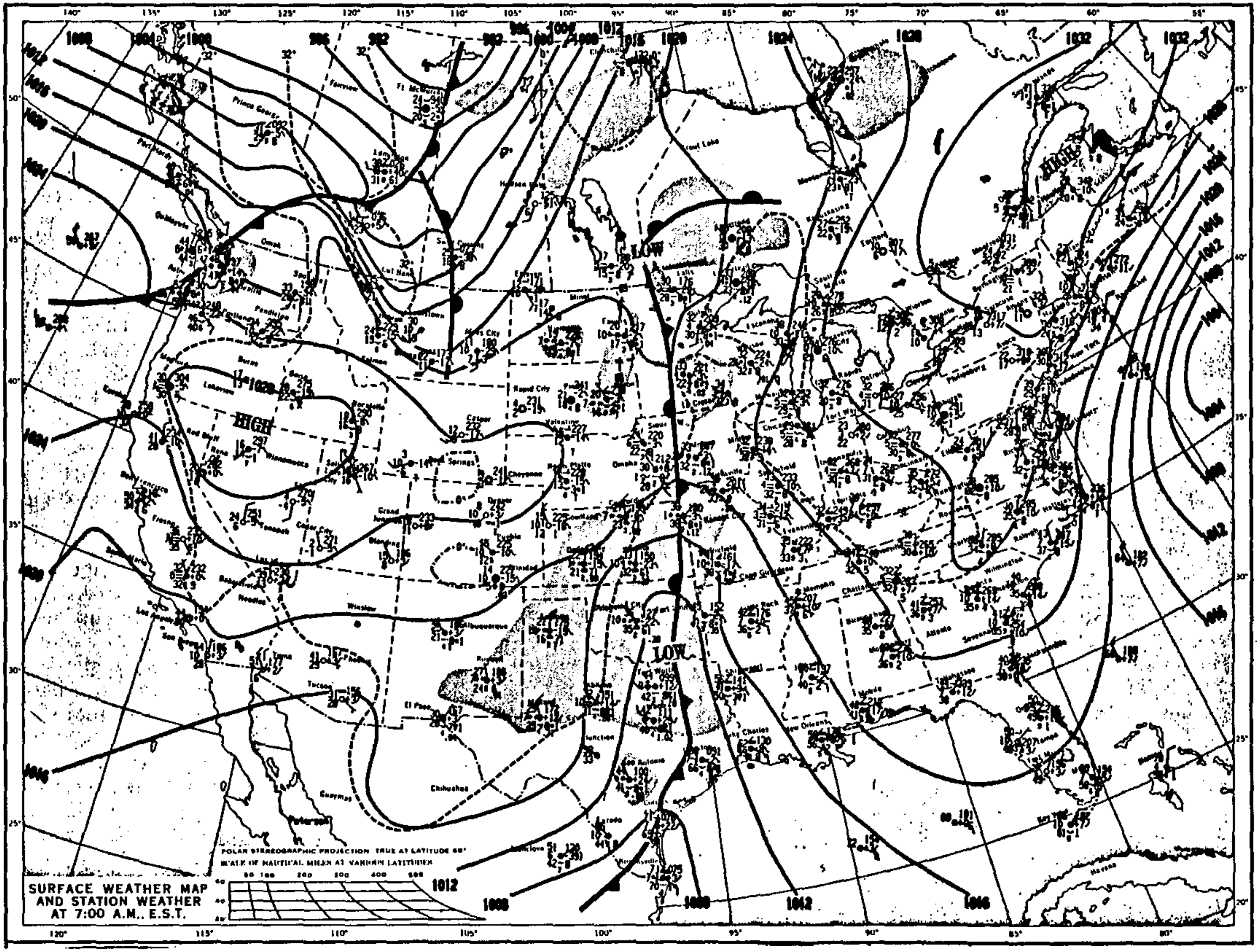


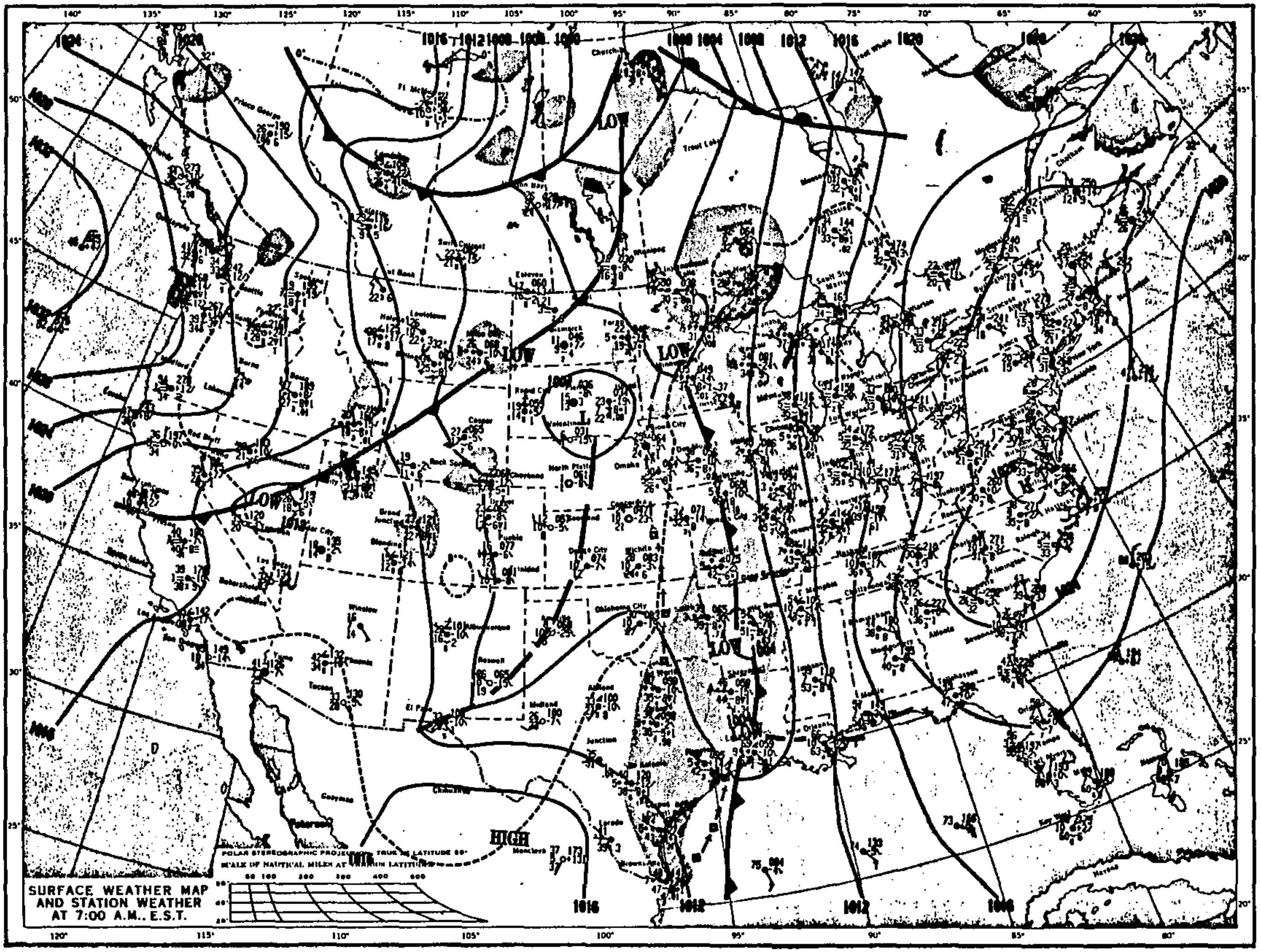
SURFACE WEATHER MAP
AND STATION WEATHER
AT 7.00 A.M., E.S.T.

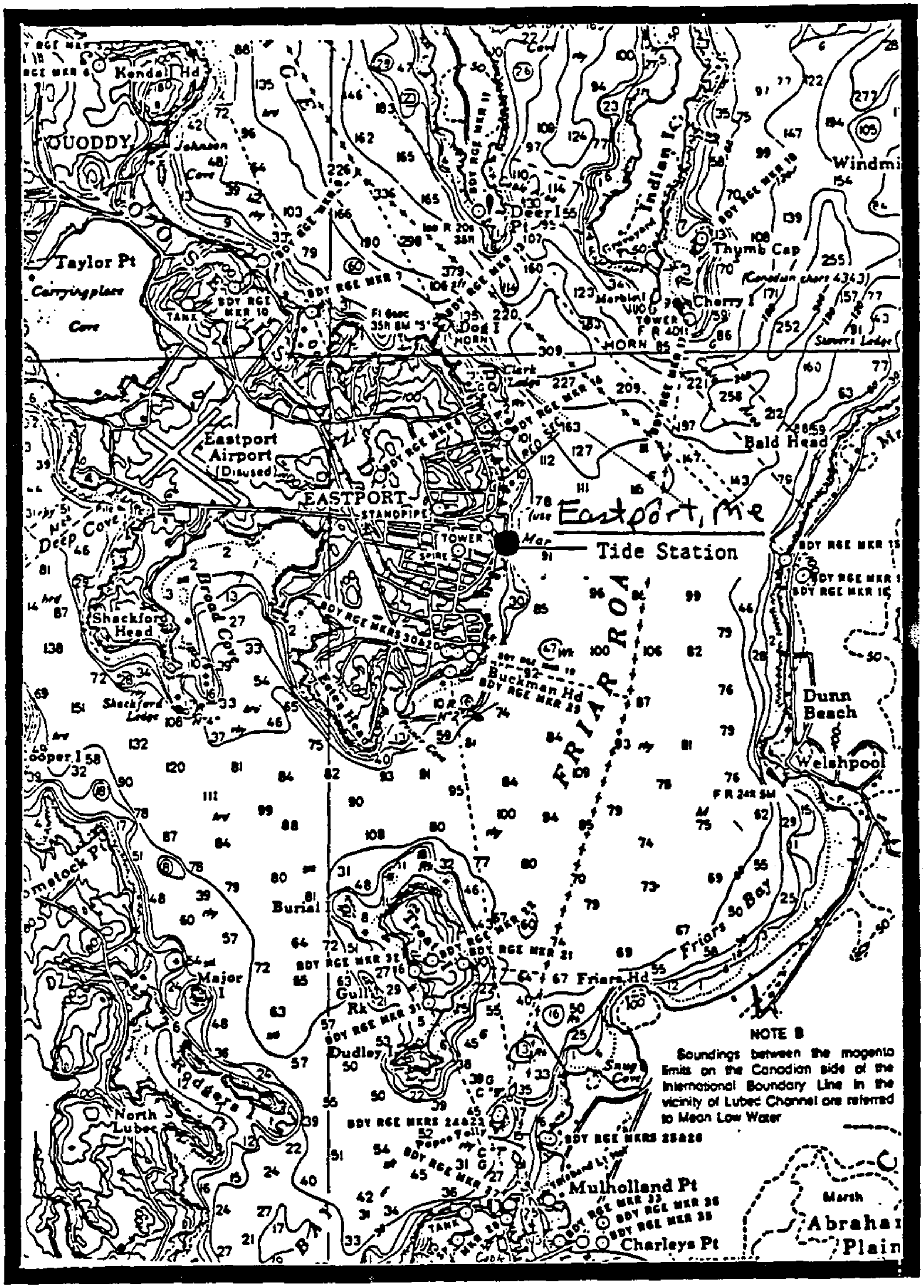
SUNDAY, DECEMBER 13, 1992



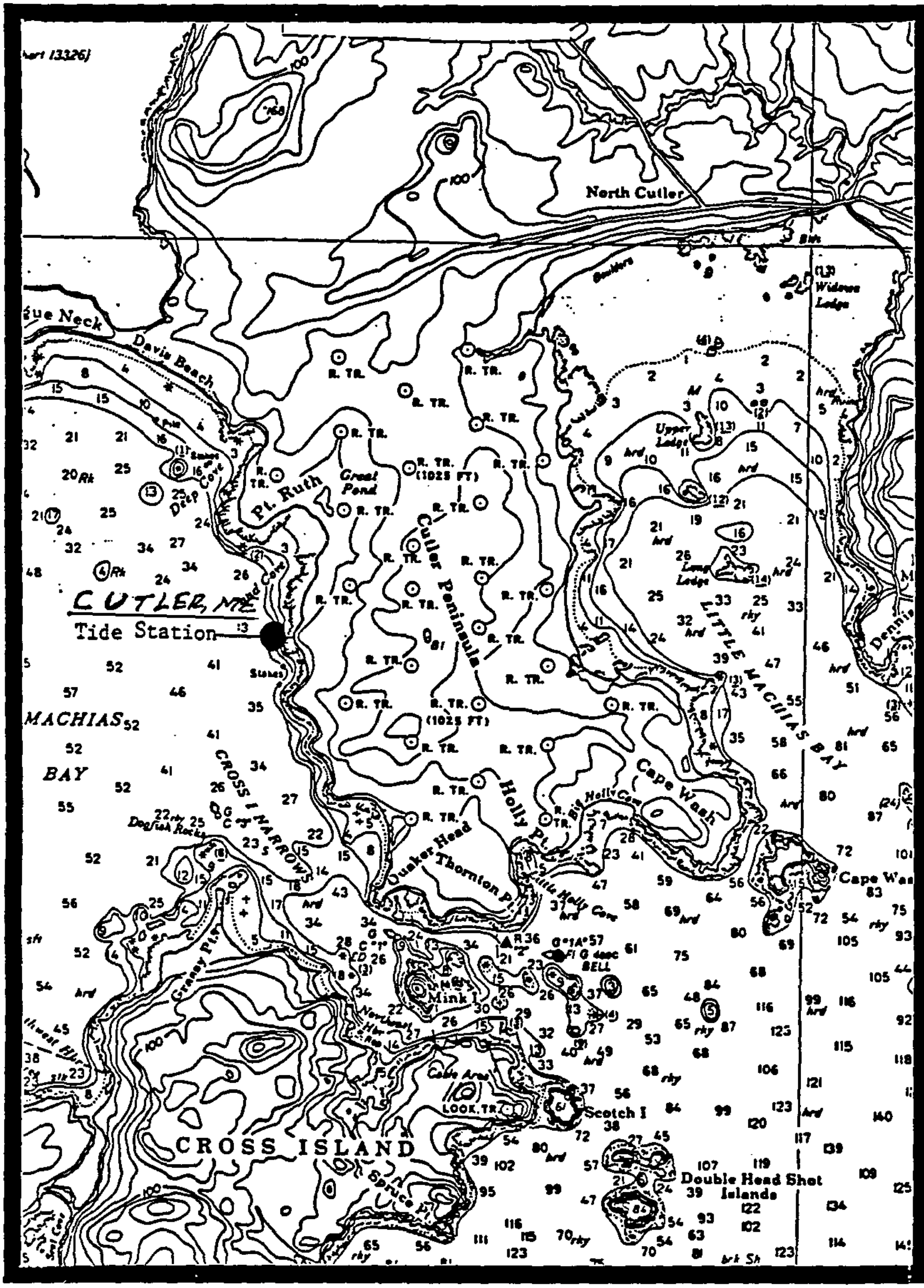
MONDAY, DECEMBER 14, 1992



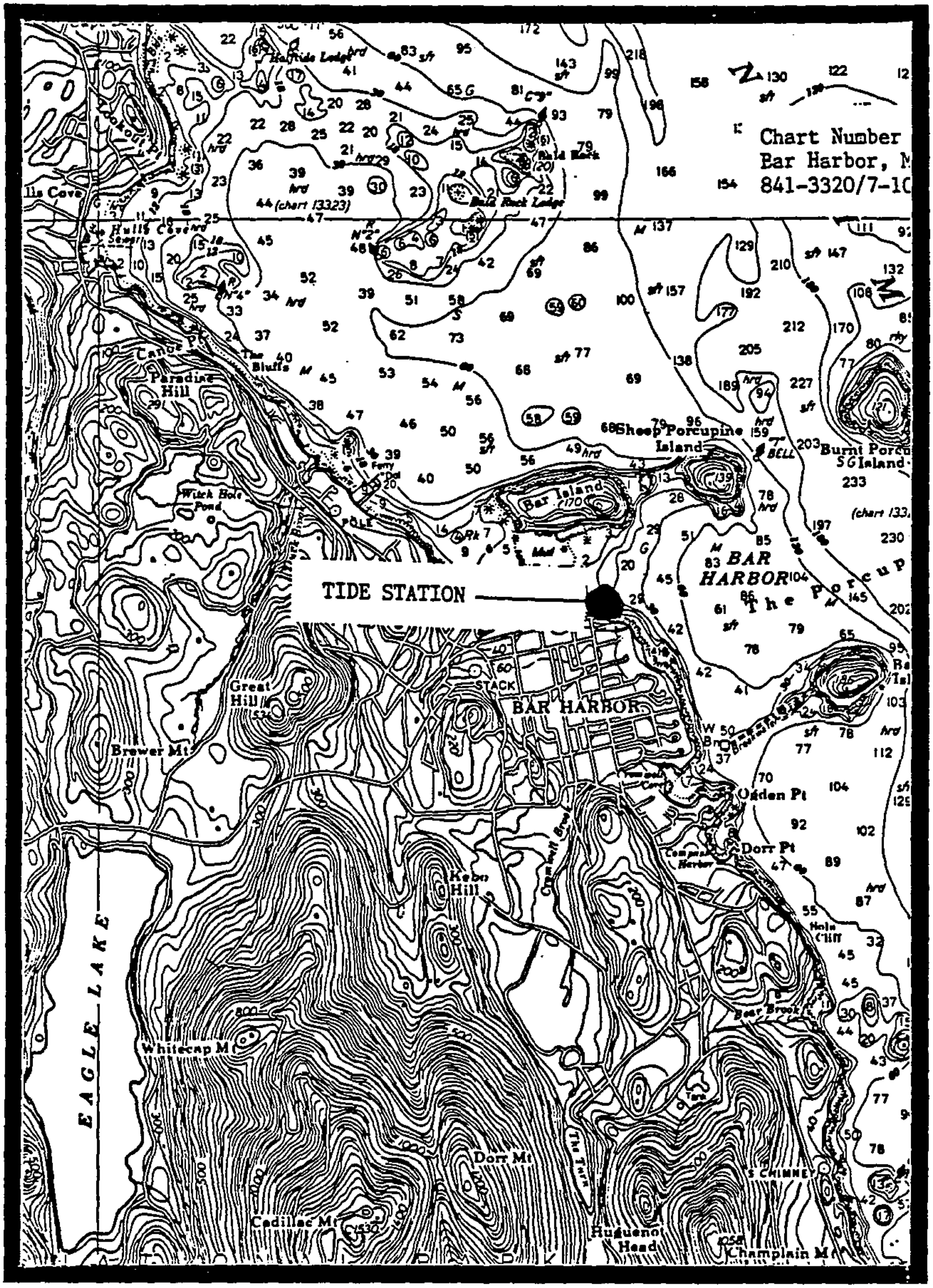

SURFACE WEATHER MAP
AND STATION WEATHER
AT 7:00 A.M., E.S.T.
HIGH
LOW



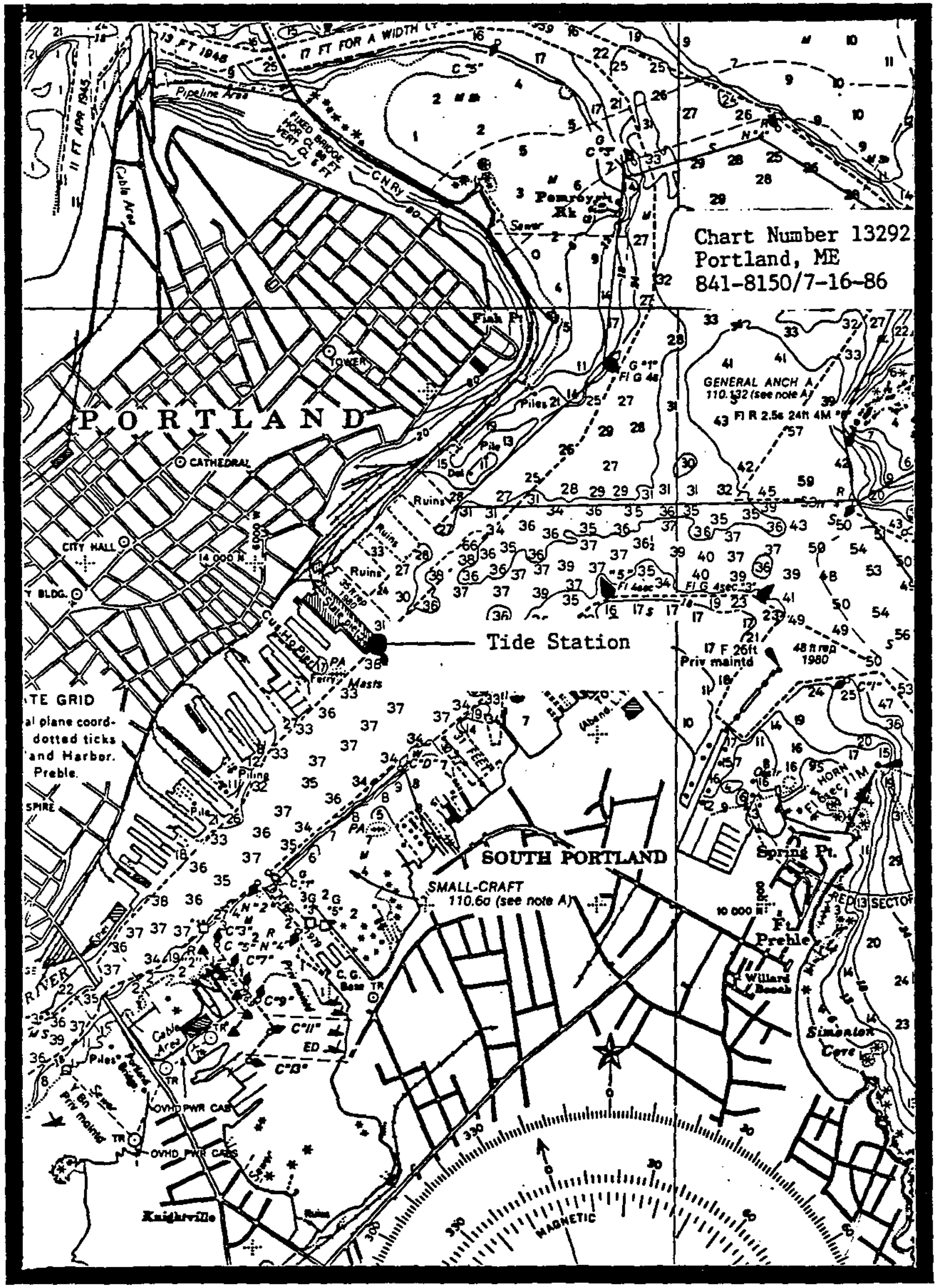
8410140 EASTPCRT, ME LAT. 44° 54.2'N LON. 66° 59.1'W



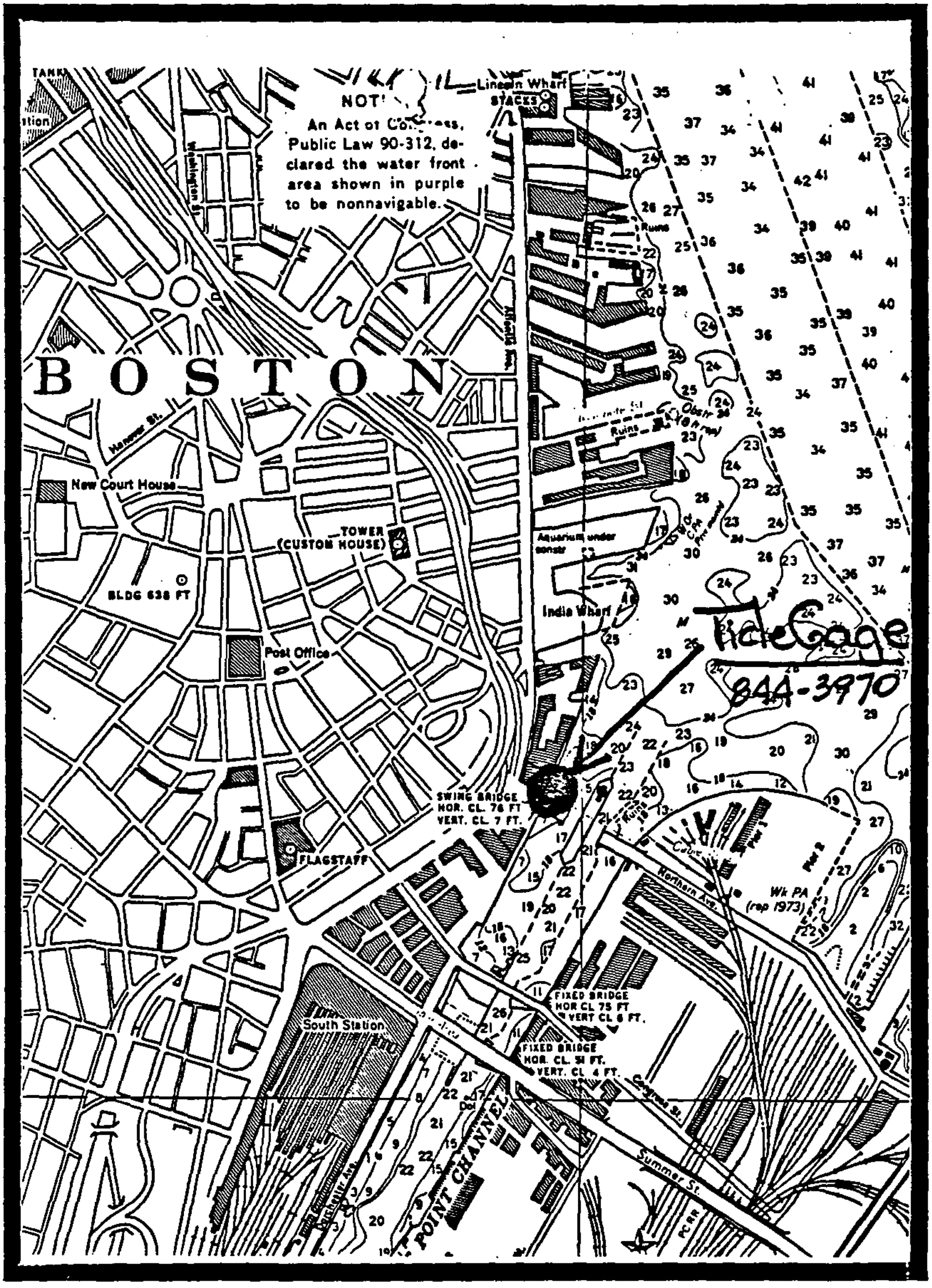
8411250 CUTLER, ME LAT. 44° 38.5'N LON. 67° 17.8'W



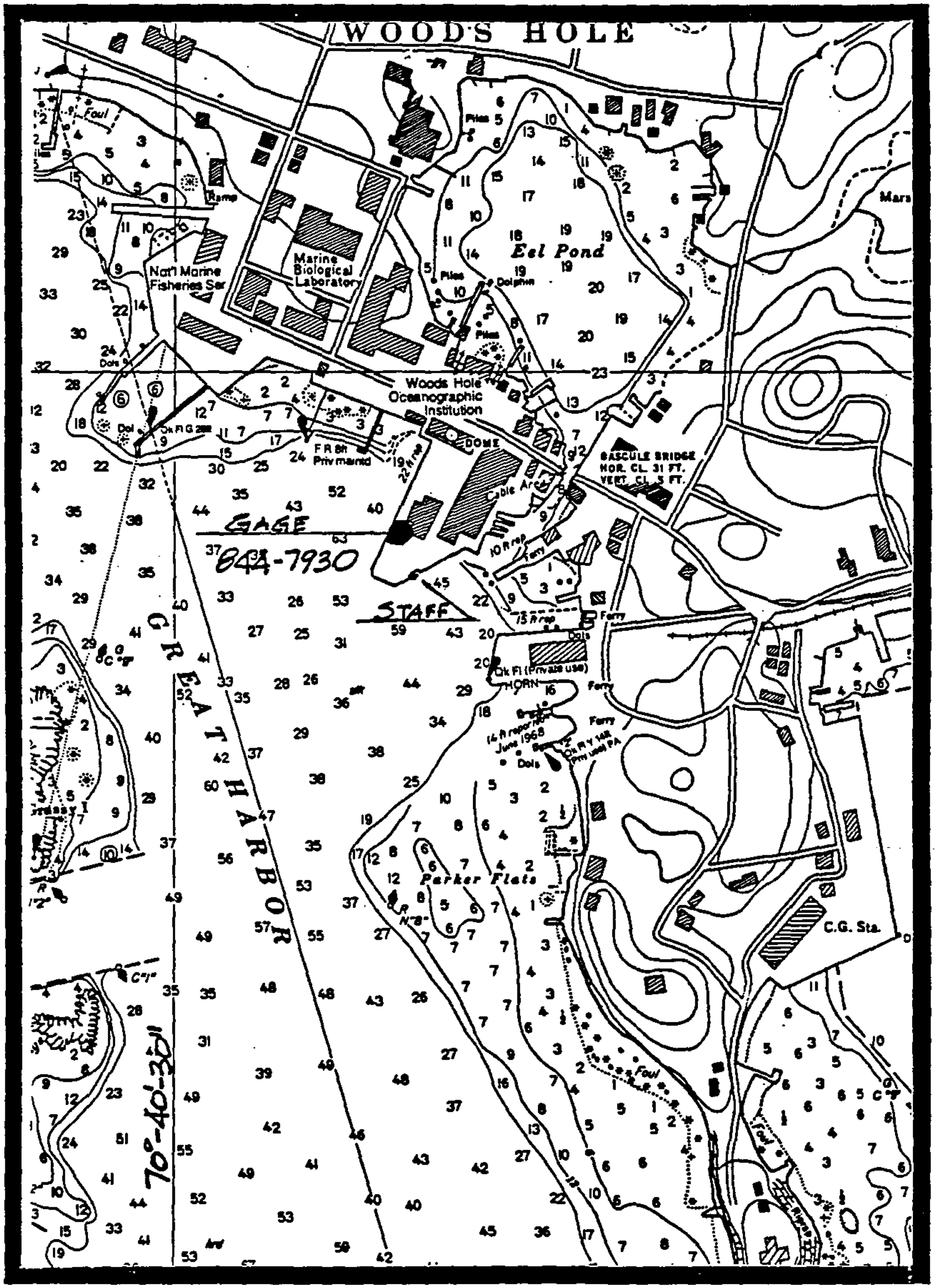
8413320 BAR HARBOR, ME LAT. 44° 23.5'N LON. 68° 12.3'W



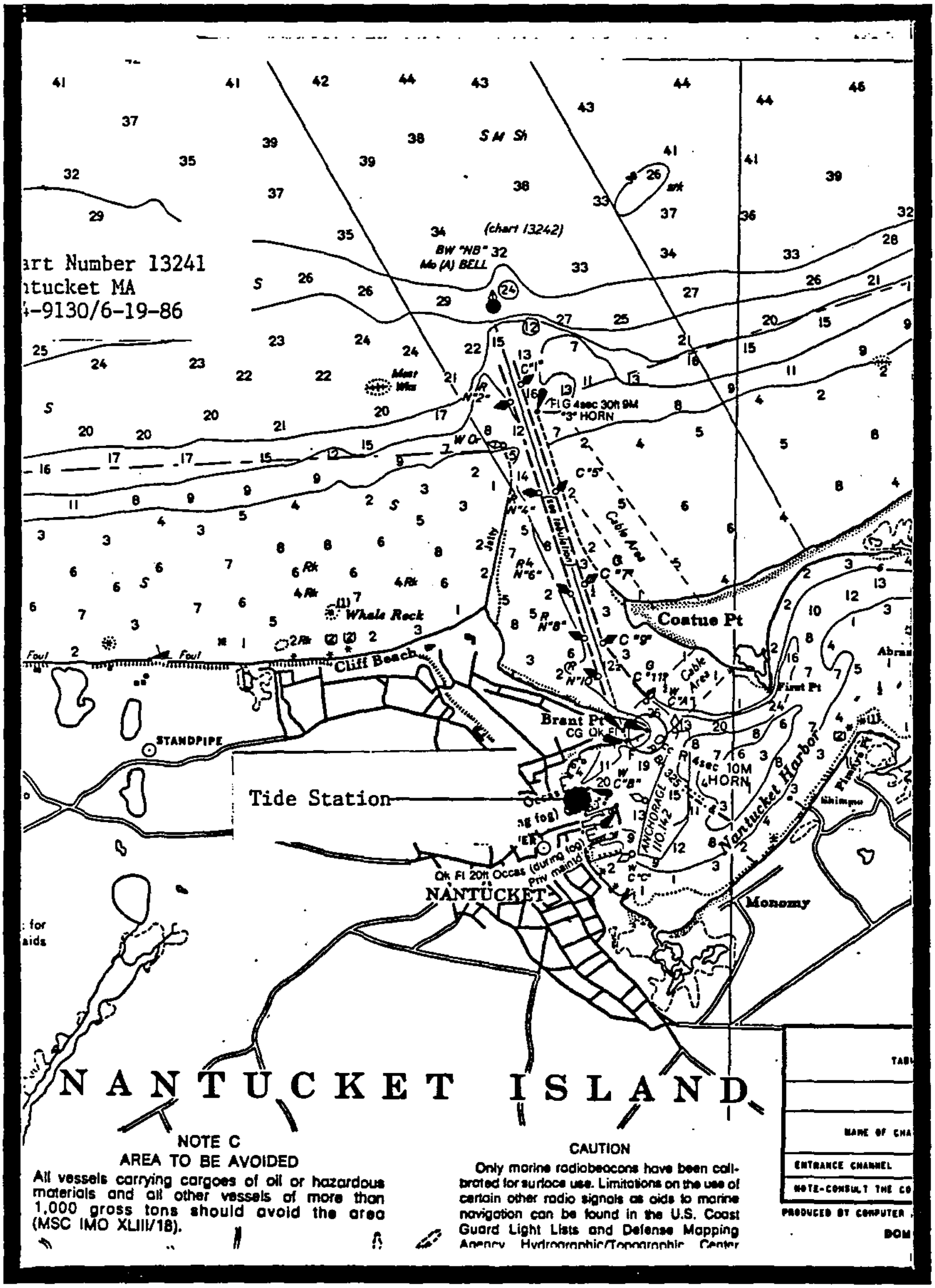
8418150 PORTLAND, ME LAT. 43° 39.4'N LON. 70° 14.8'W



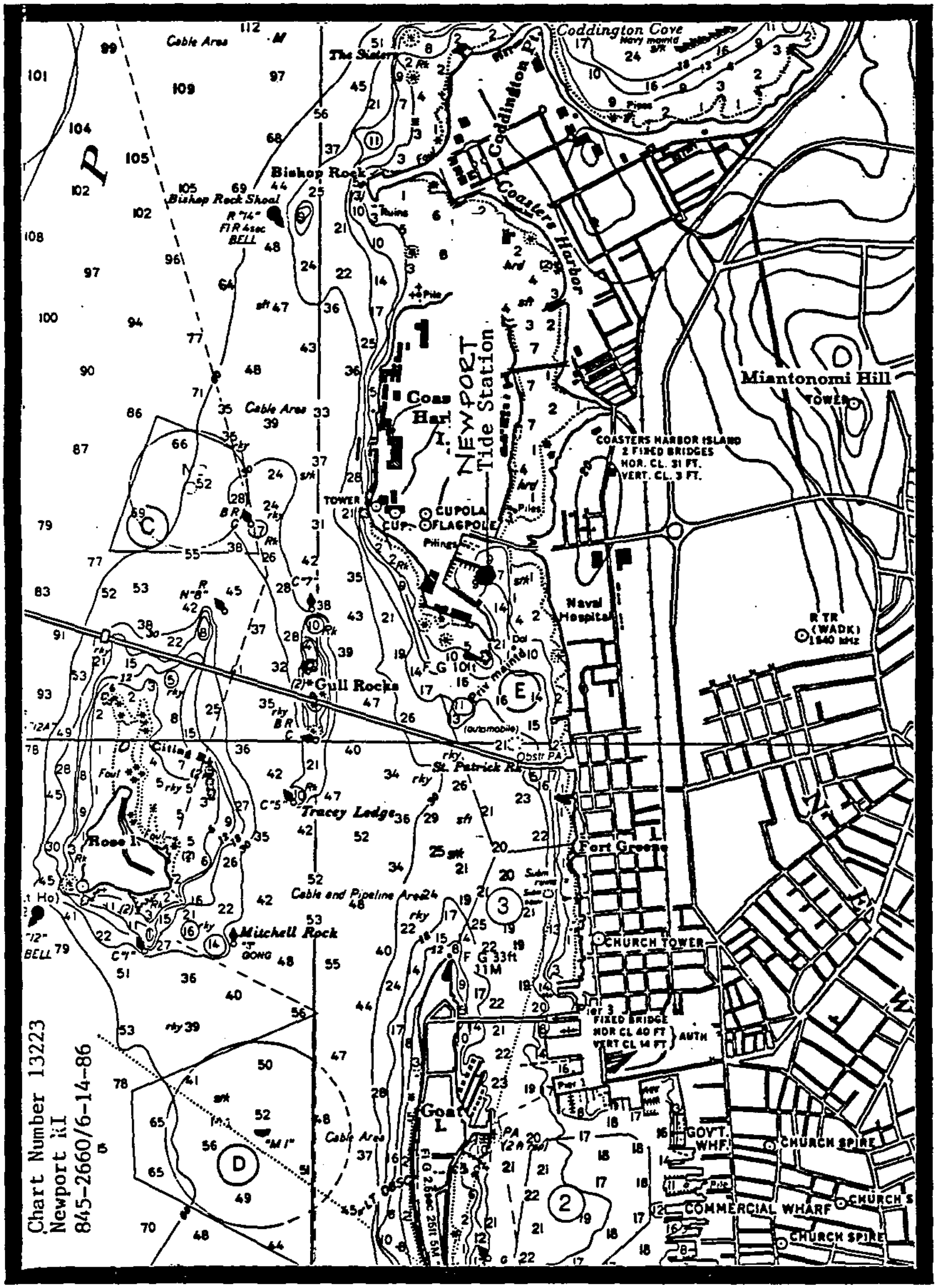
8443970 BOSTON, MA LAT. 42° 21.3'N LON. 71° 3.0'W



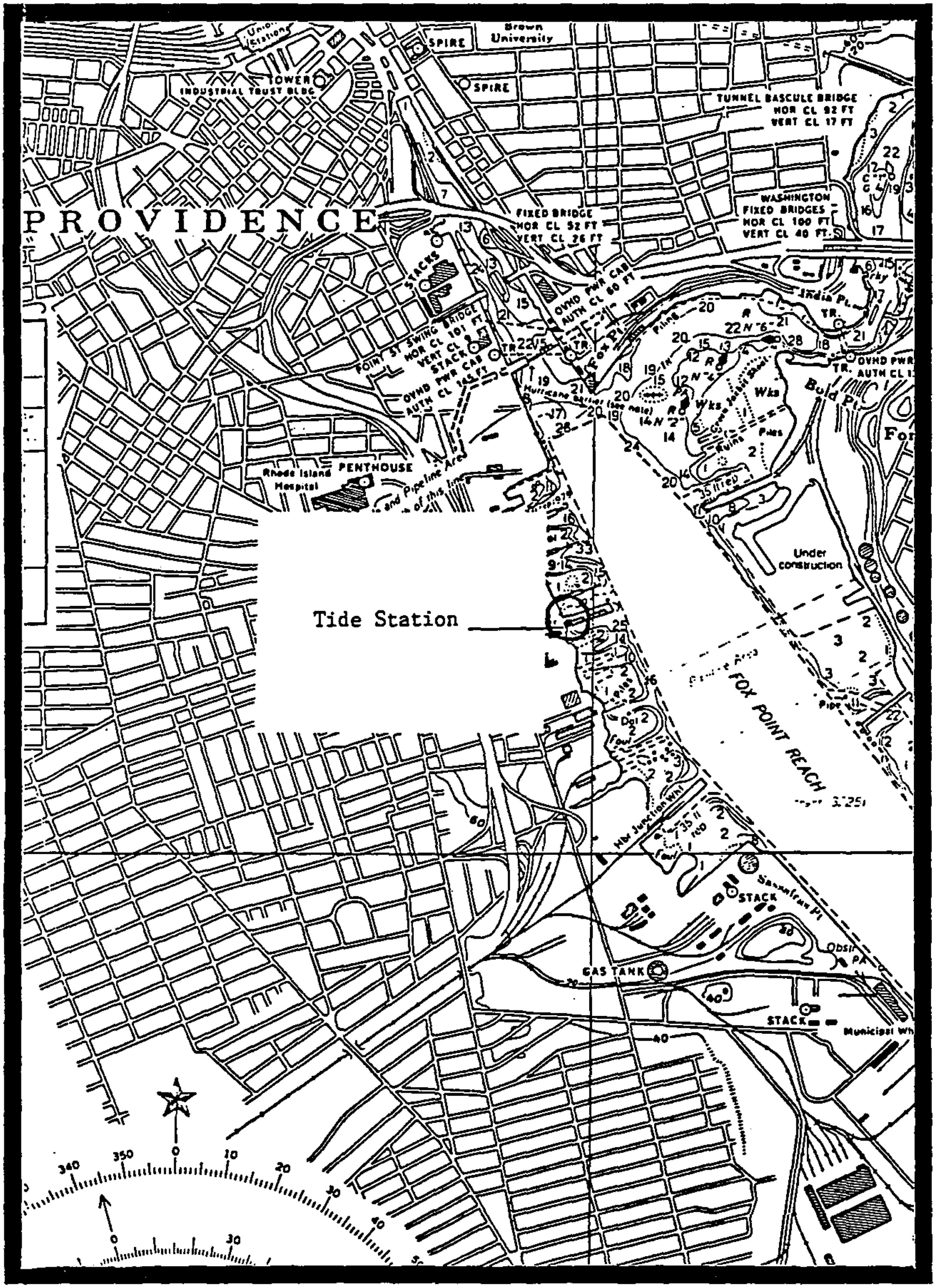
8447930 WOODS HOLE, MA LAT. 41° 31.5'N LON 70° 40.4'W



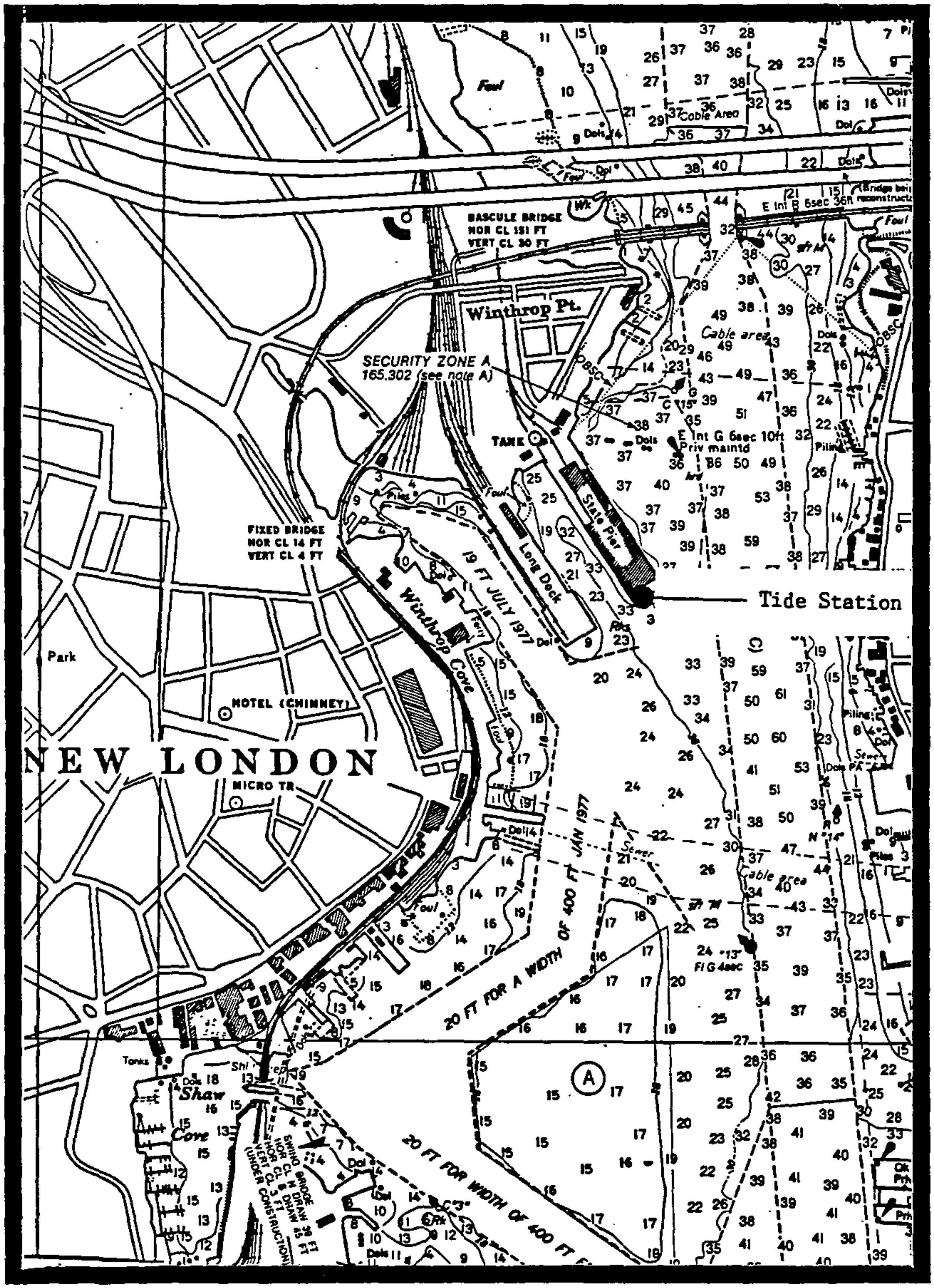
8449130 NANTUCKET, MA LAT. 41° 17.2'N LON. 70° 5.7'W



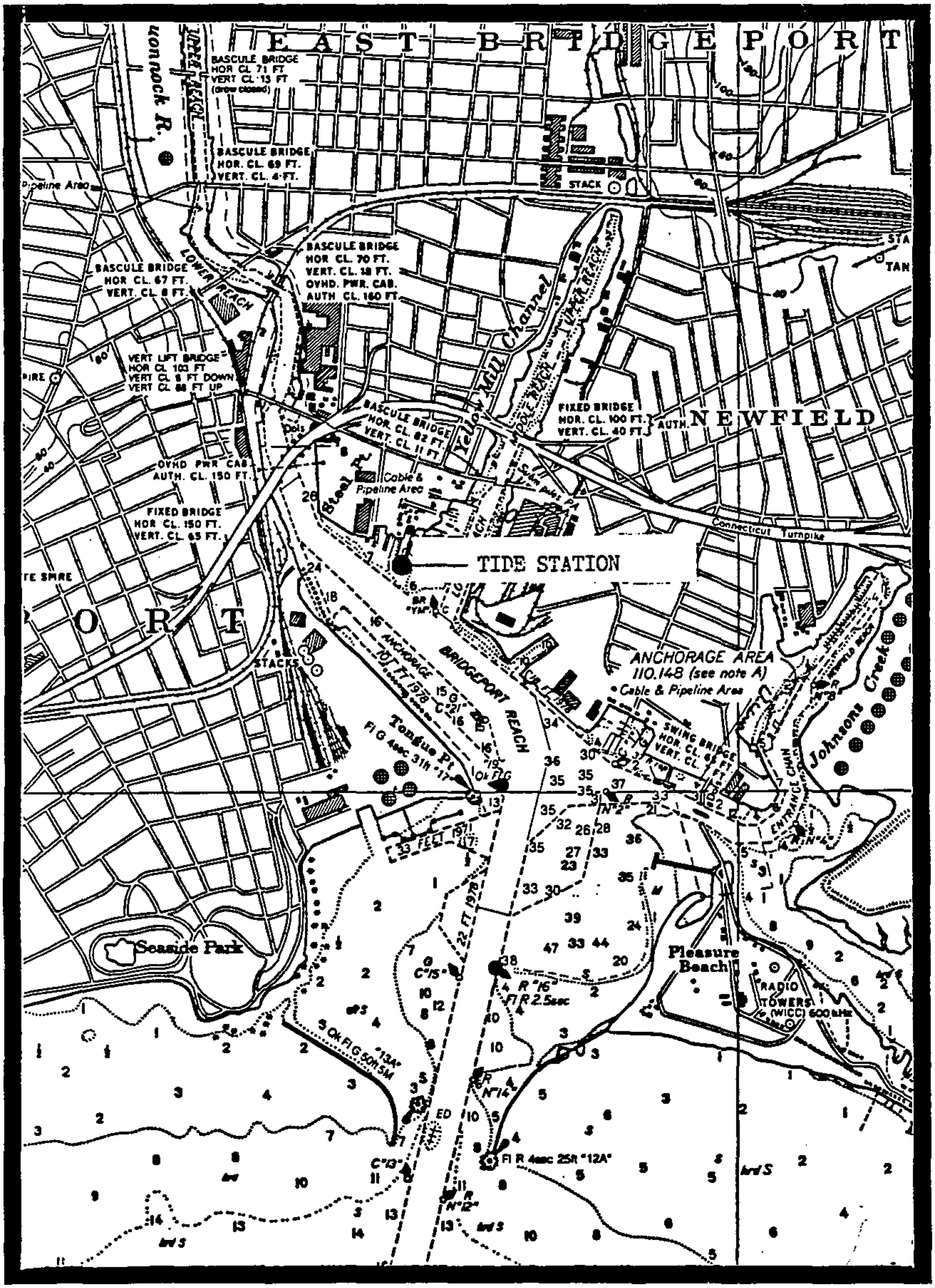
8452660 NEWPORT, RI LAT. 41° 30.3'N LON. 71° 19.6'W



8454000 PROVIDENCE, RI LAT. 41° 48.4'N LON. 71° 24.1'W

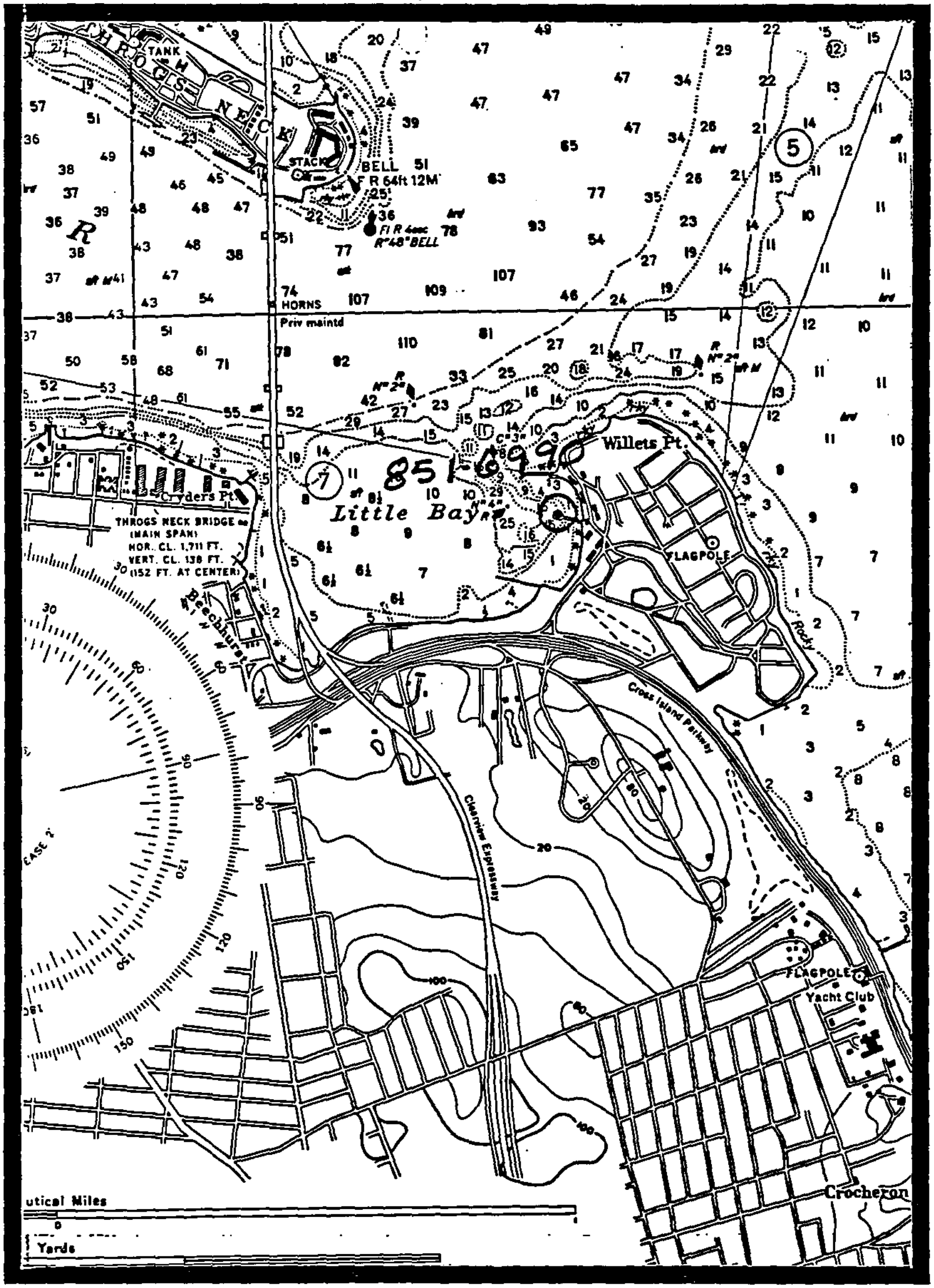


8461490 NEW LONDON, CT LAT.41° 21.3'N LON. 72° 5.2'W

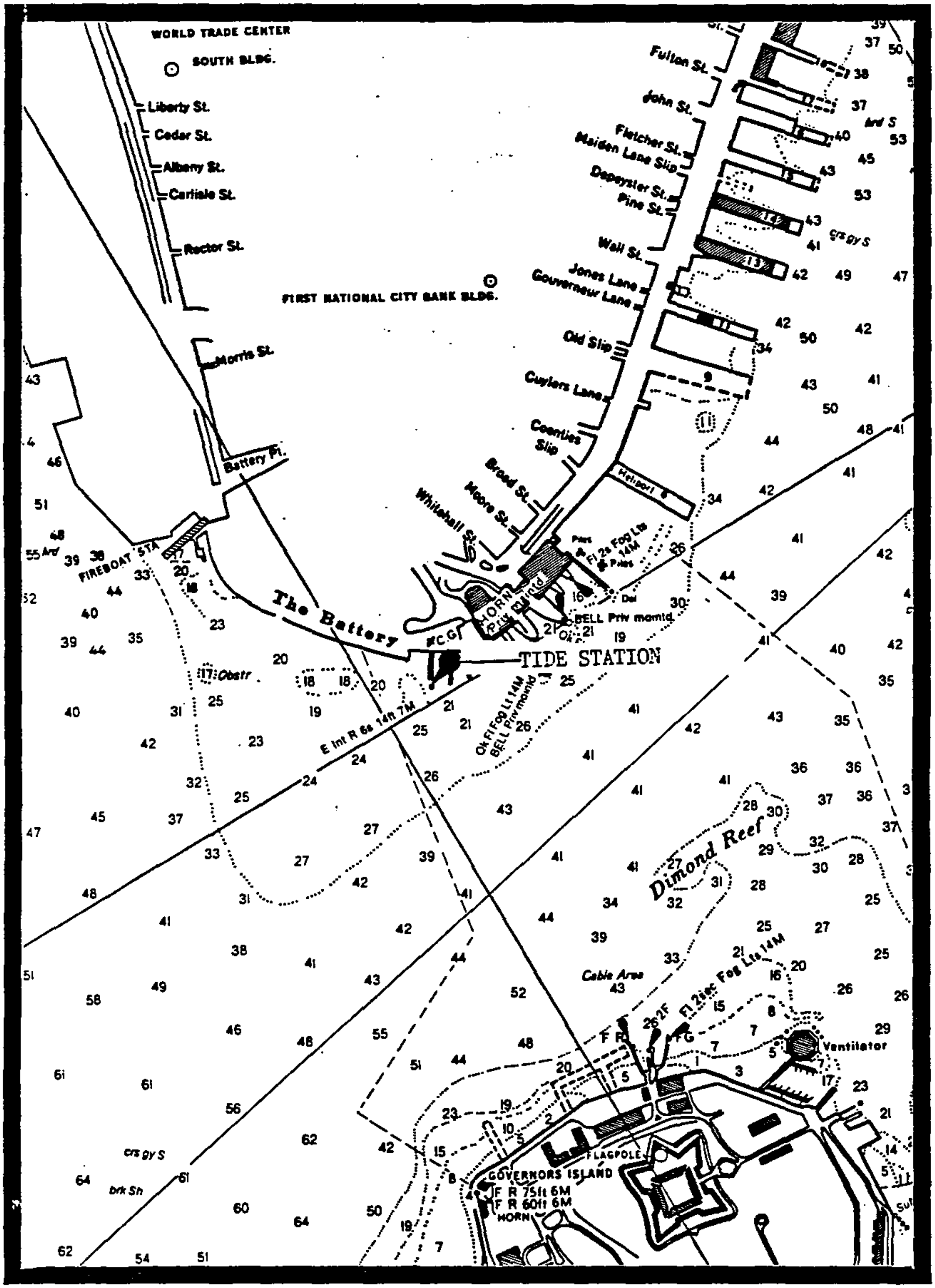


8467150 BRIDGEPORT, CT LAT. 41° 10.4'N LON. 73° 10.9'W

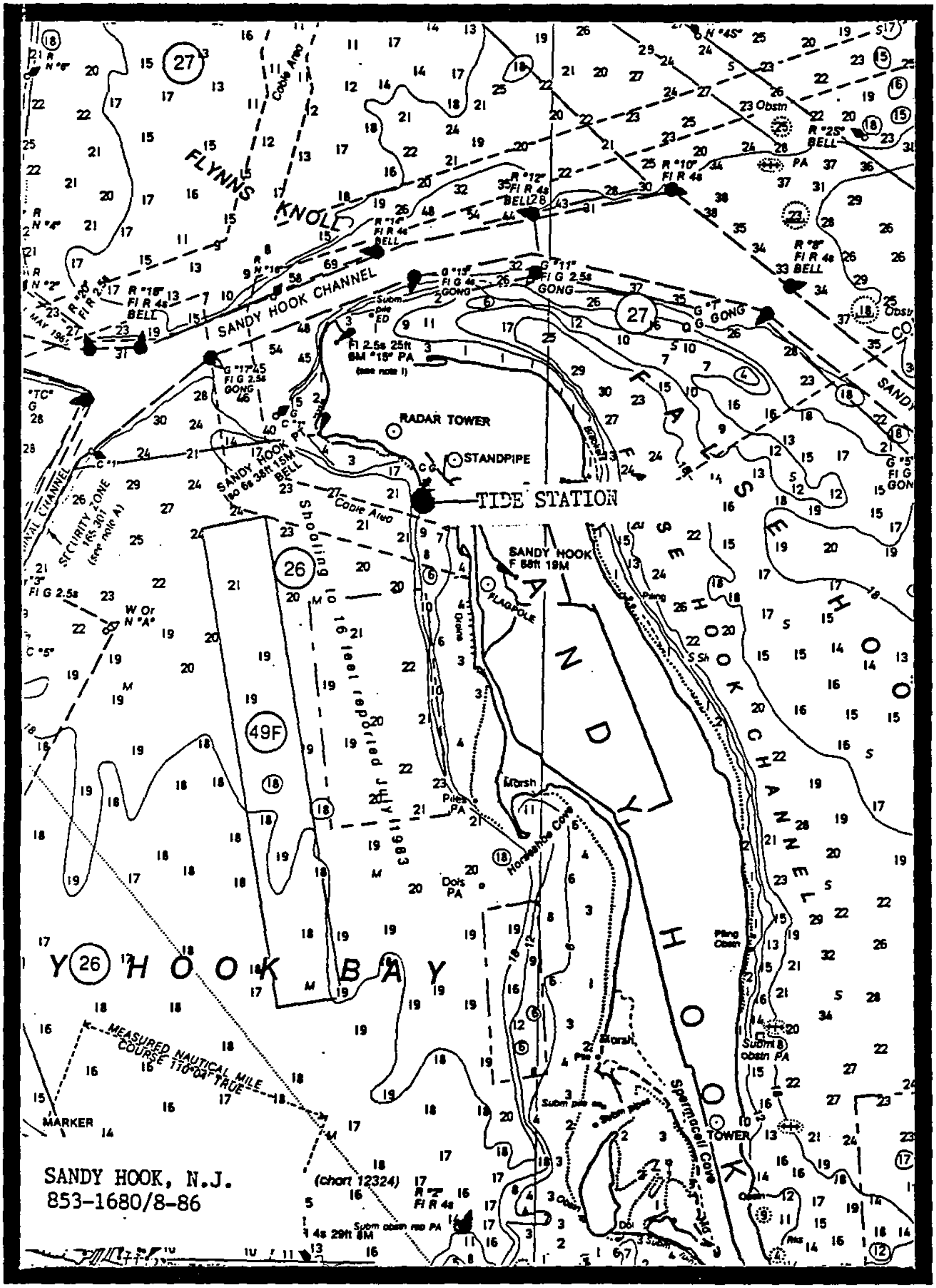
8510560 MONTAUK, NY LAT. 41° 2.9'N LON. 71° 57.6'W



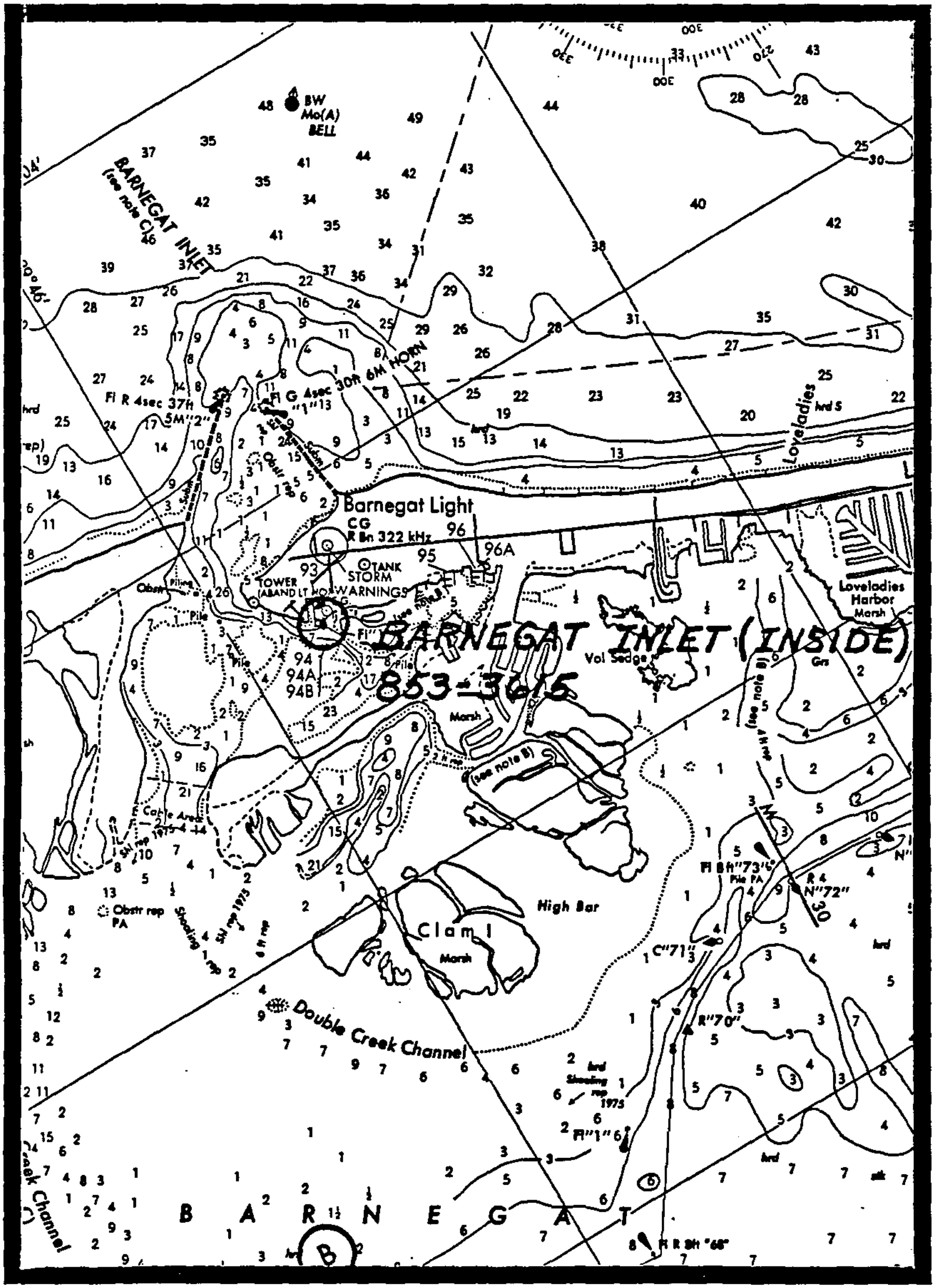
8516990 WILLETS POINT, NY LAT. 40° 47.6'N LON. 73° 46.9'W



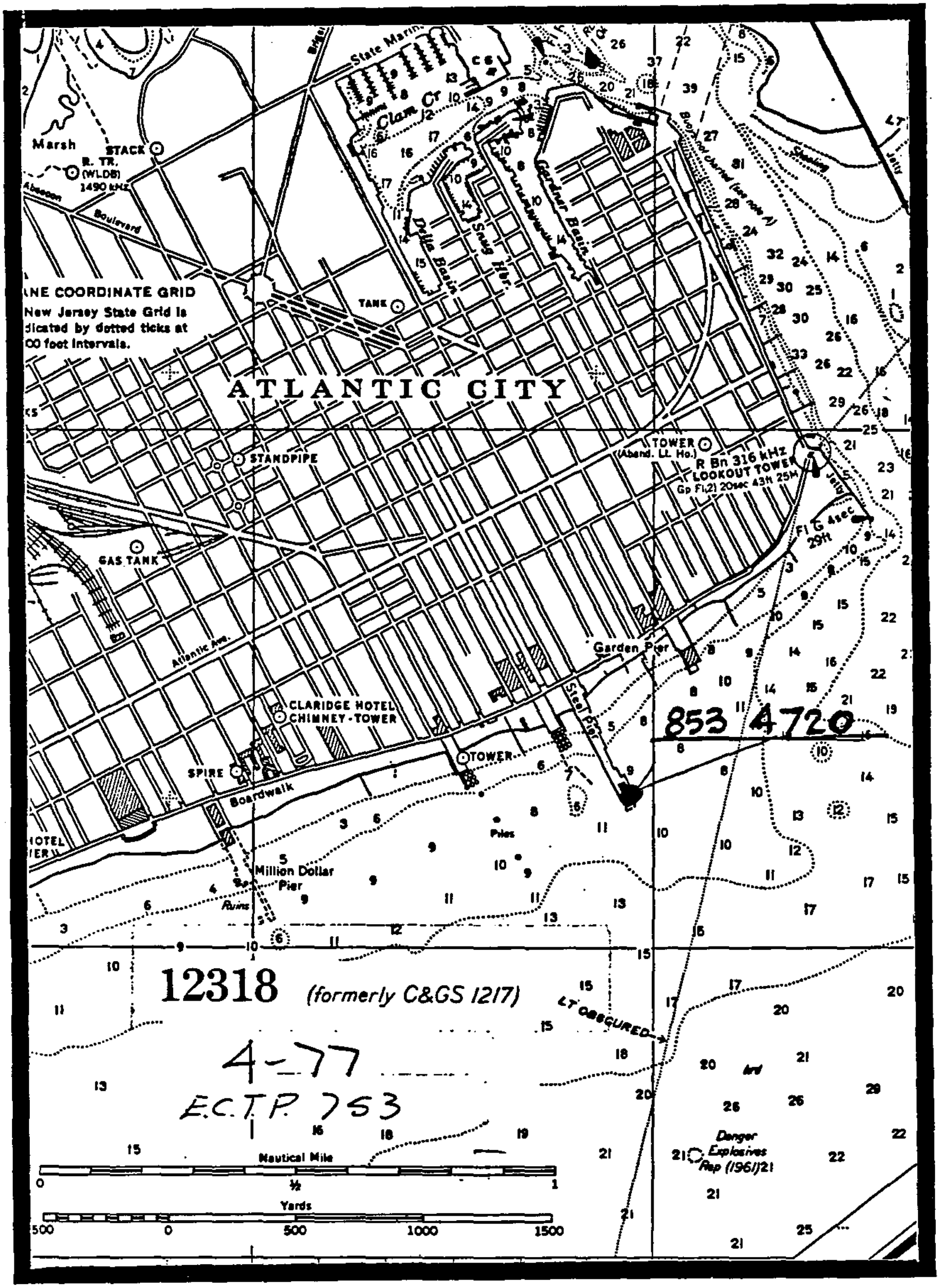
8518750 THE BATTERY, NY LAT. 40° 42.0'N LON. 74° 0.9'W



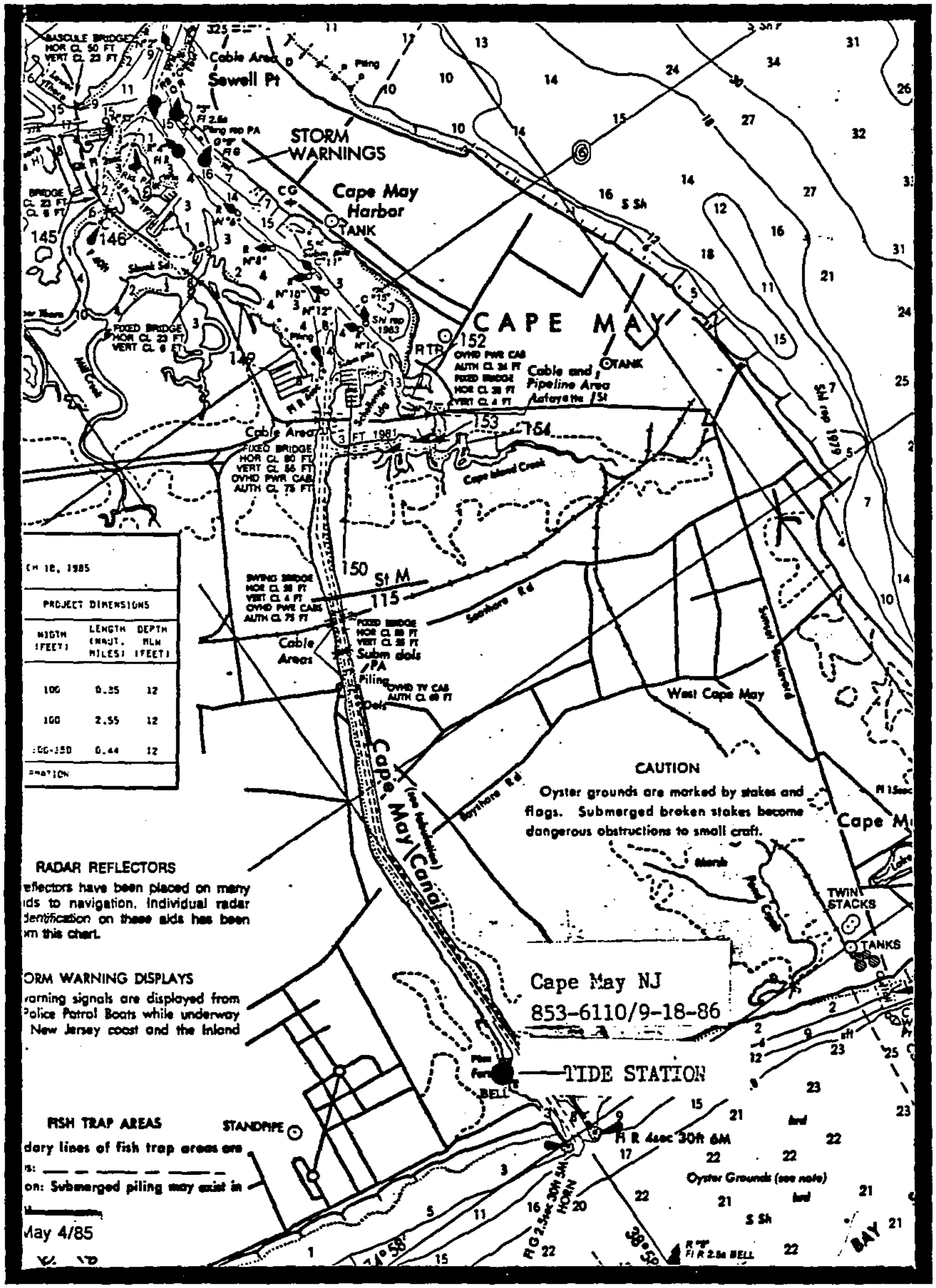
8531680 SANDY HOOK, NJ LAT. 40° 28.0'N LON. 74° 0.6'W



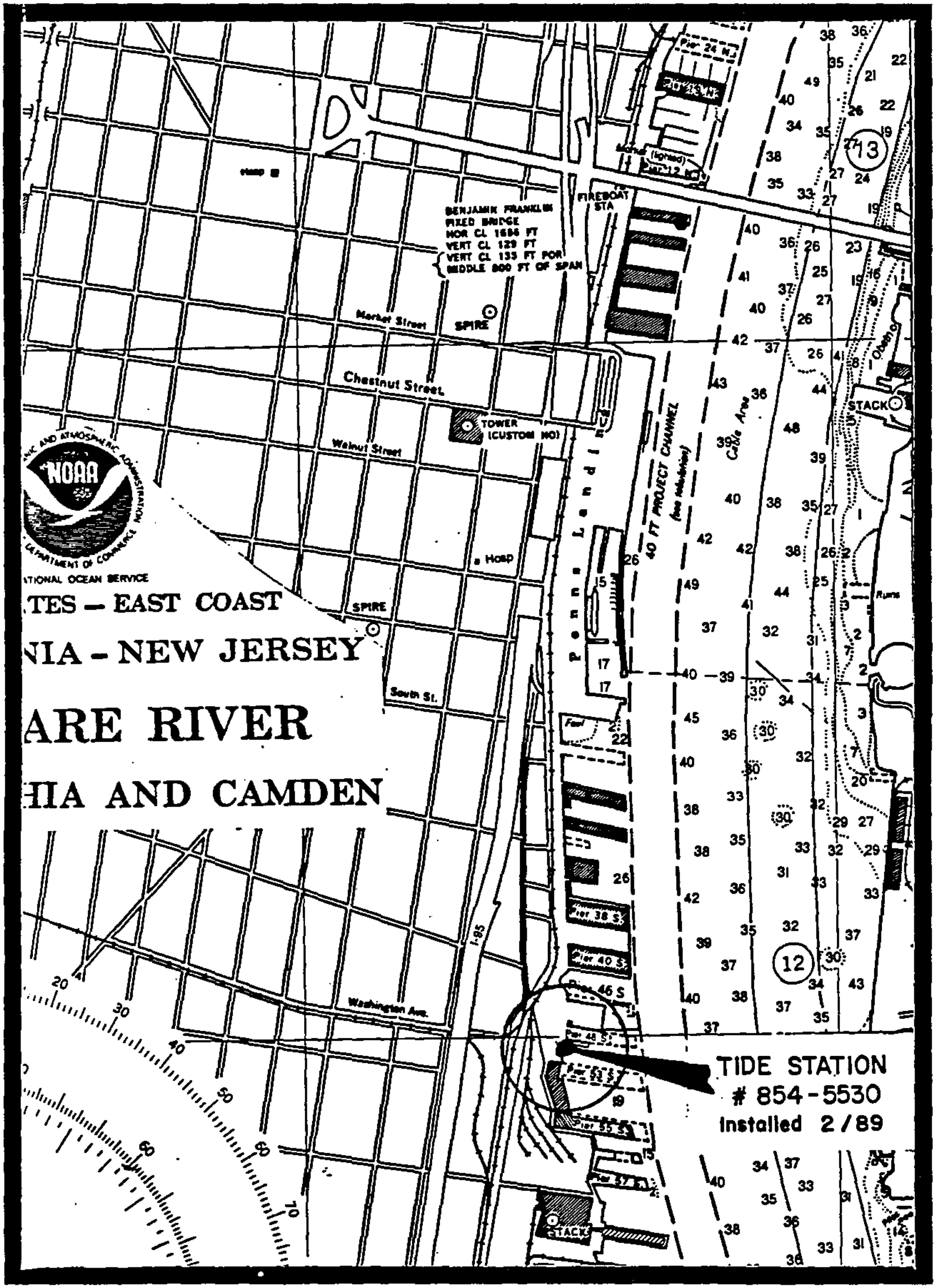
8533615 BARNEGAT INLET, NJ LAT. 39° 45.7'N LON. 74° 6.6'W



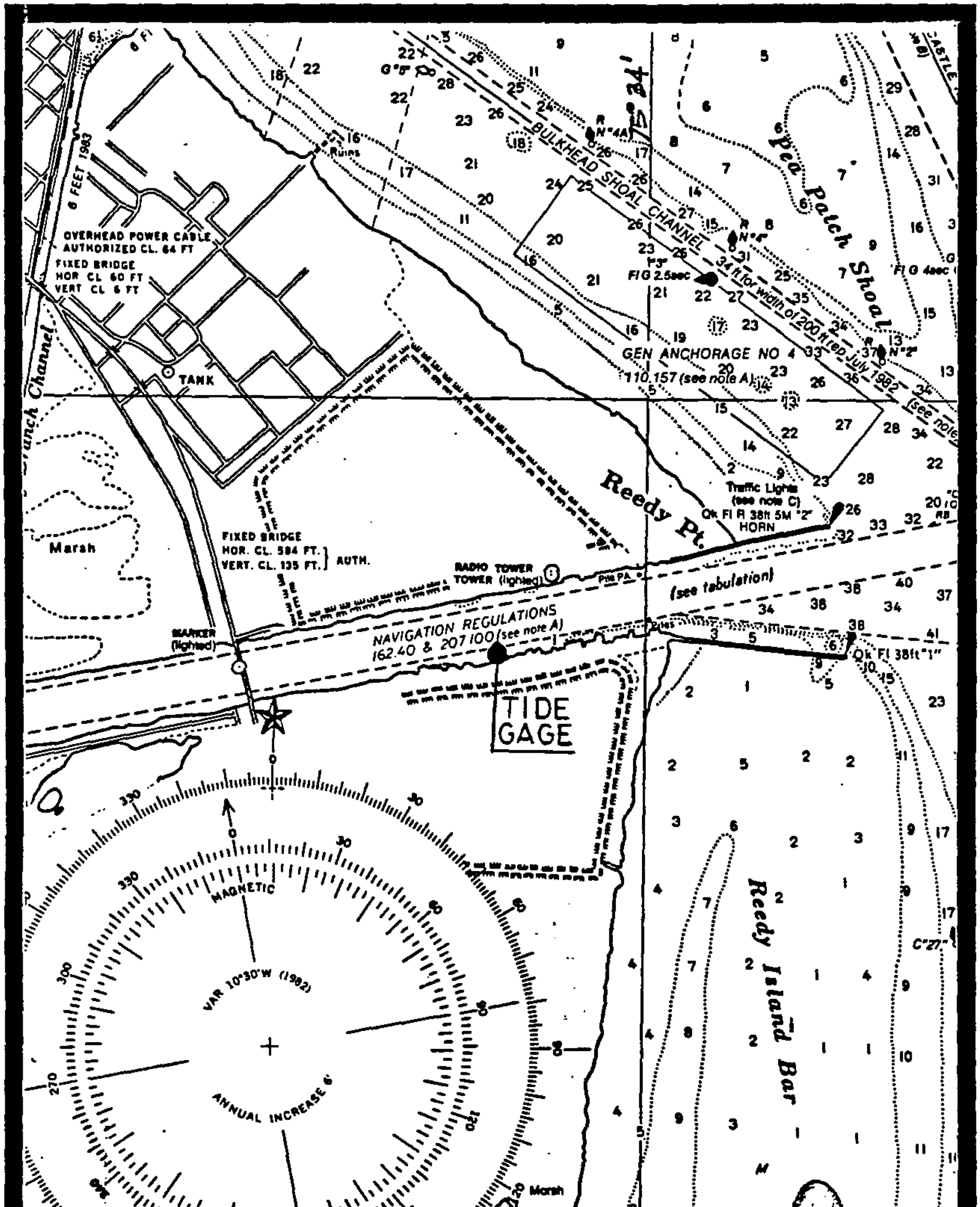
8534720 ATLANTIC CITY, NJ LAT. 39° 21.3'N LON. 74° 25.1'W



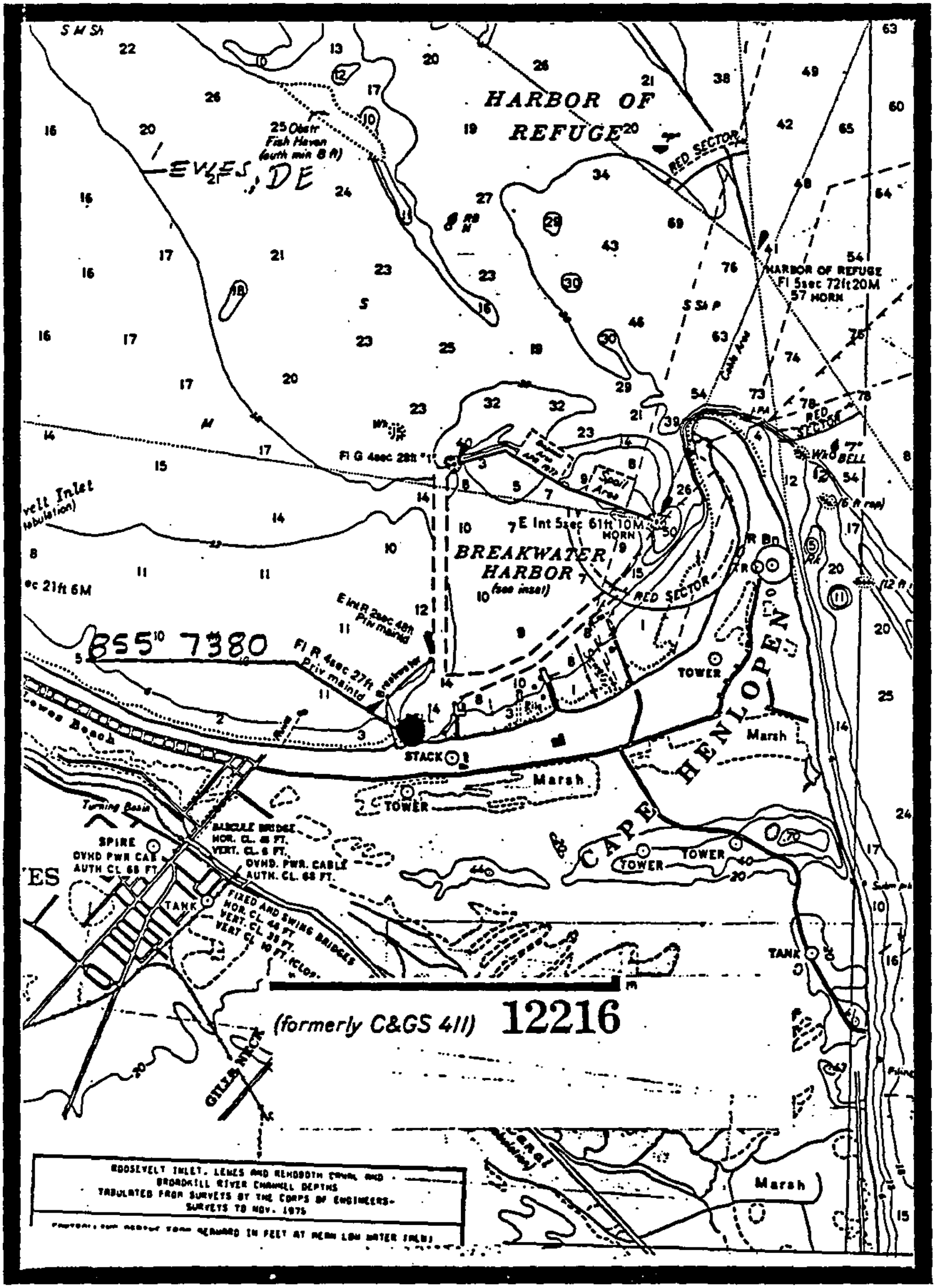
8536110 CAPE MAY, NJ LAT. 38° 58.1'N LON. 74° 57.6'W



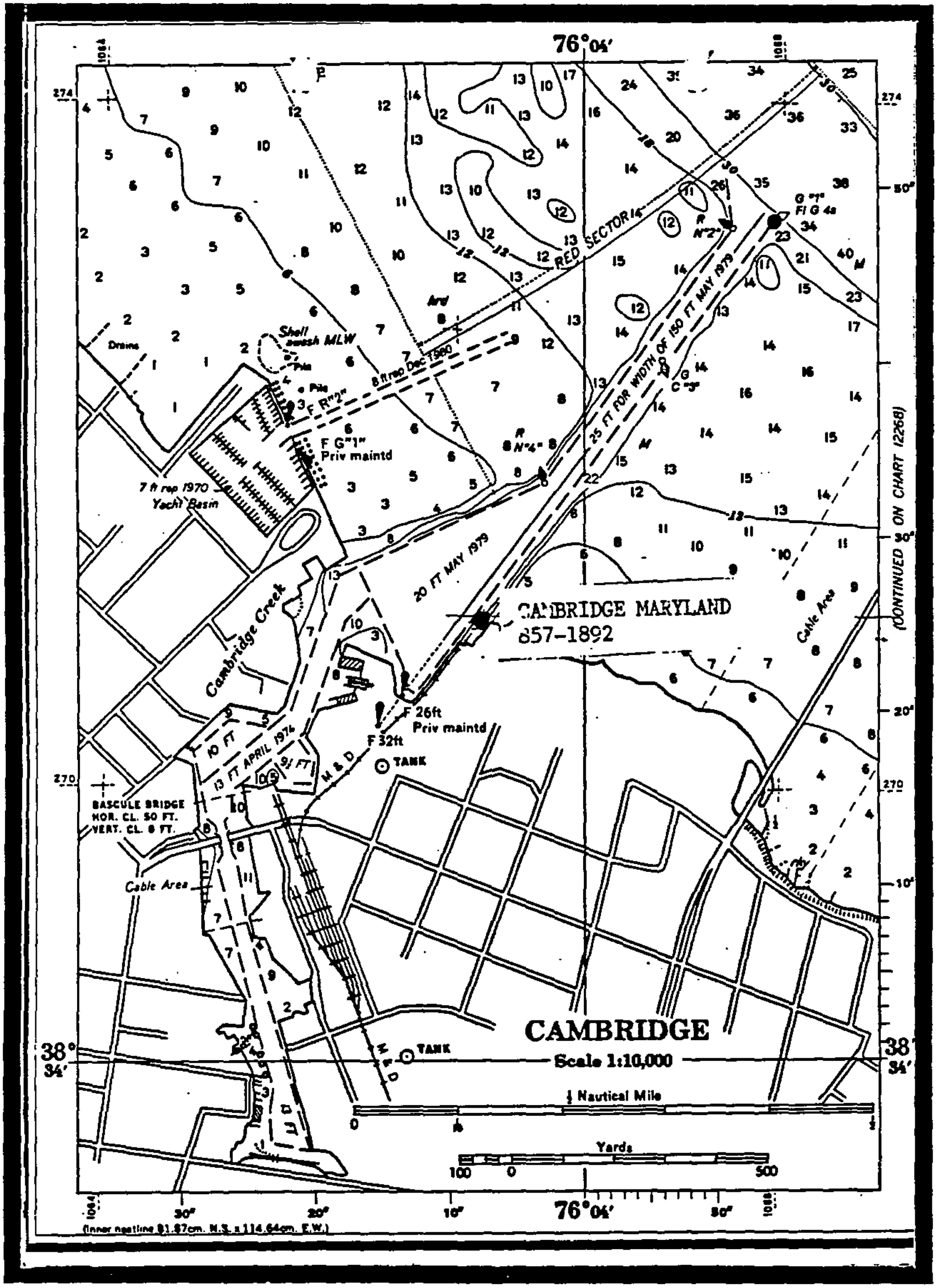
8545530 PHILADELPHIA, PA LAT. 39° 56.0'N LON. 75° 8.5'W



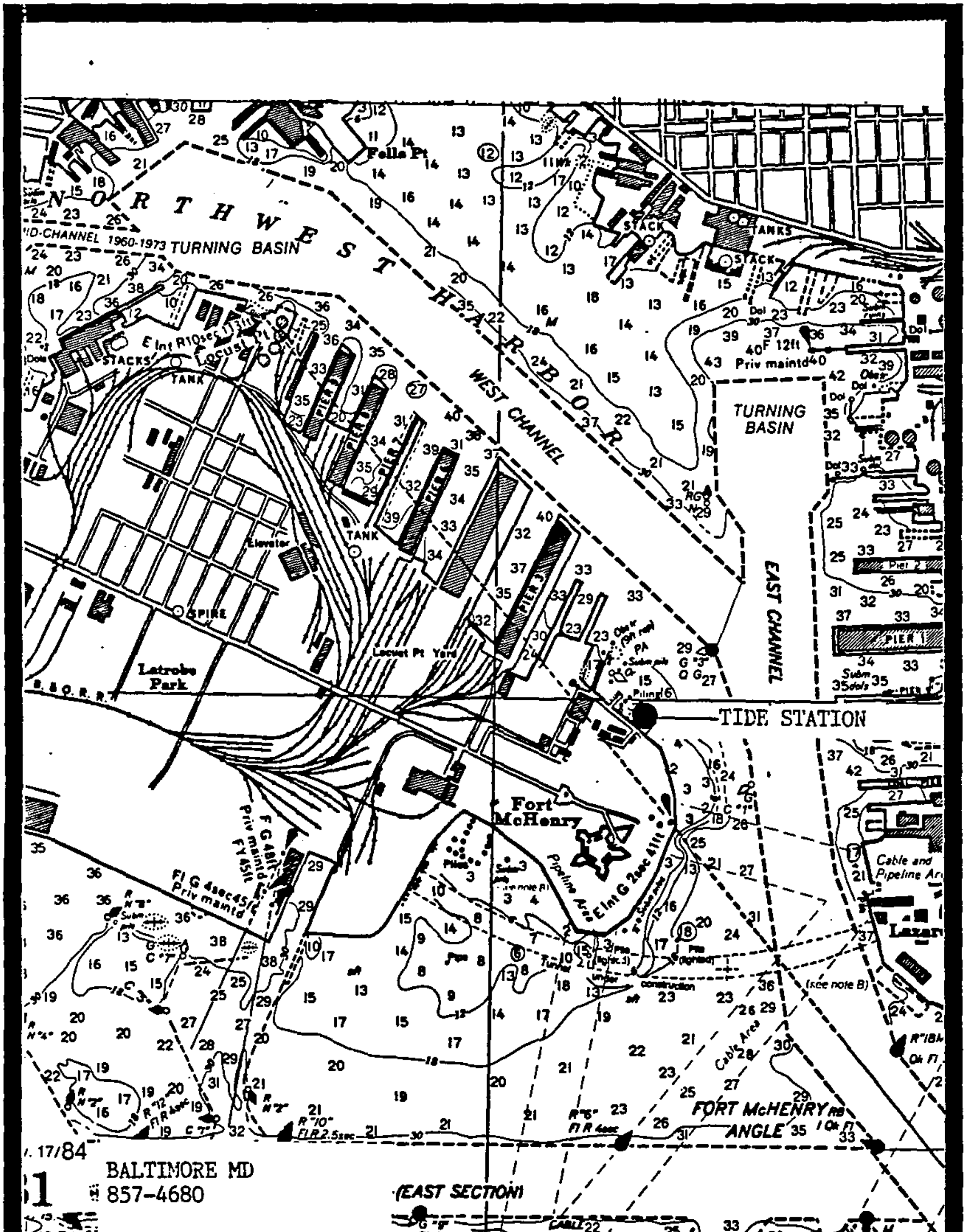
8551910 REEDY POINT, DE LAT. 39° 33.6'N LON. 75° 34.3'W



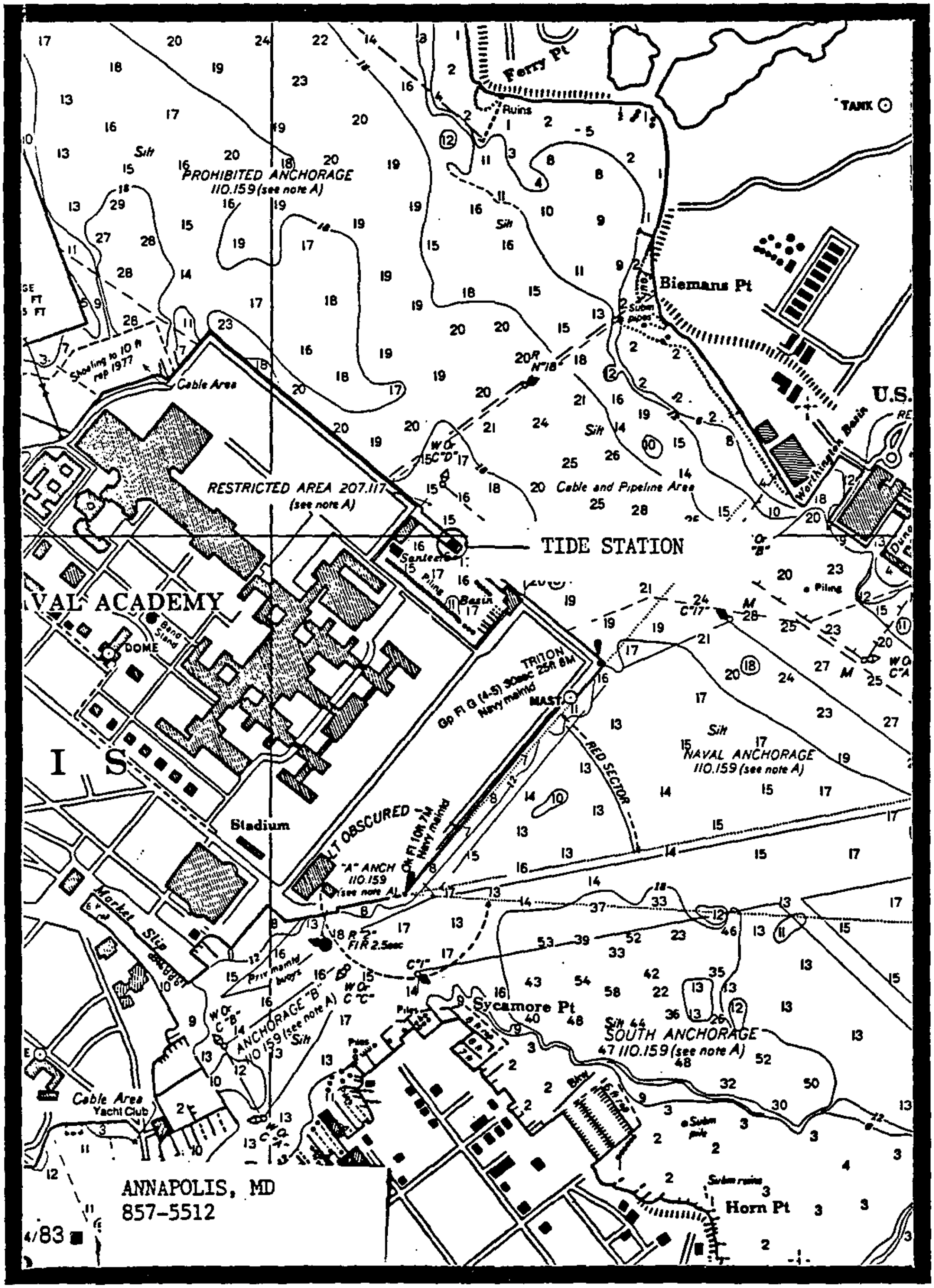
8557380 LEWES, DE LAT. 38° 46.9'N LON. 75° 7.2'W



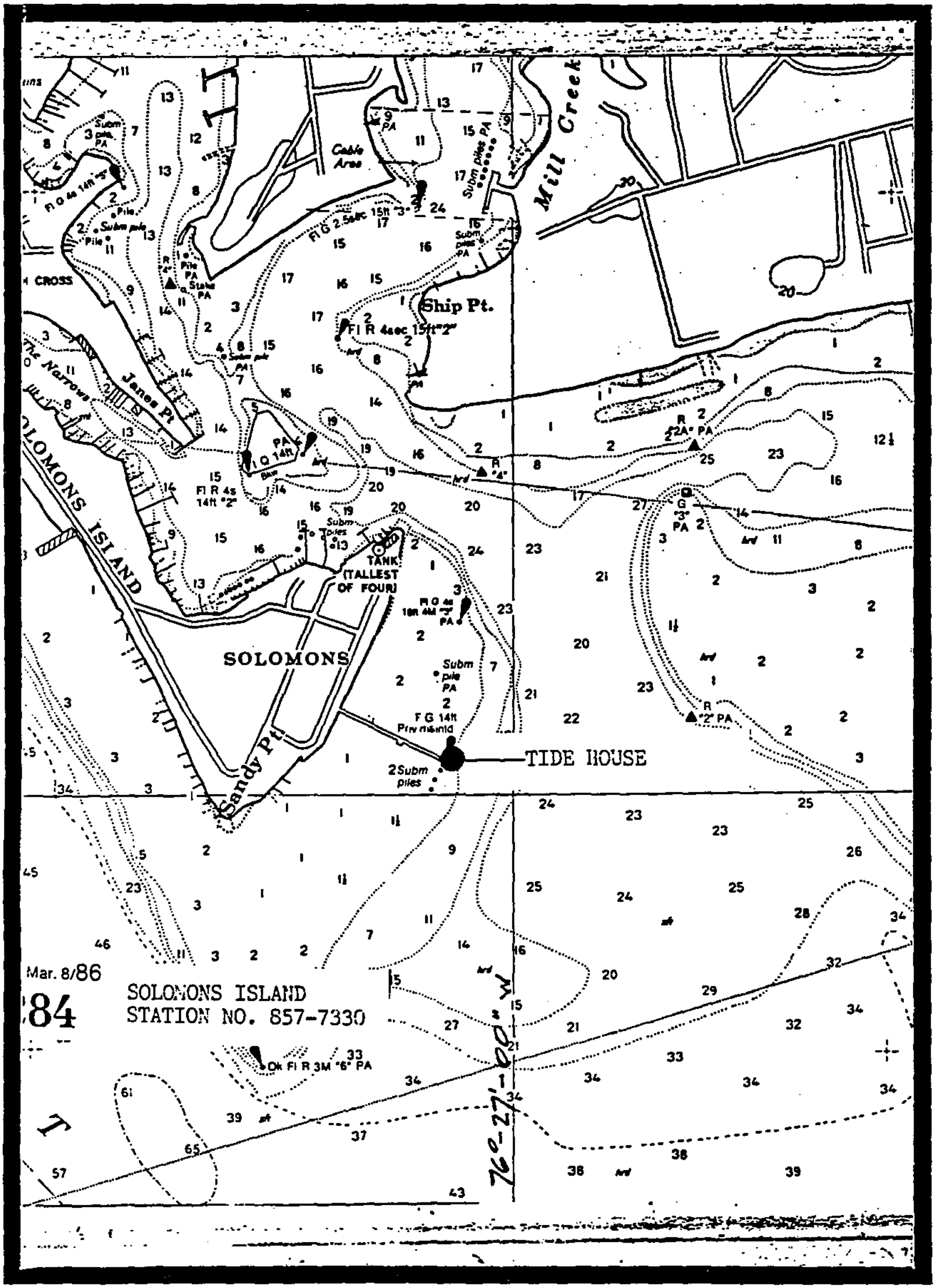
8571892 CAMBRIDGE, MD LAT. 38° 34.5'N LON. 76° 4.3'W



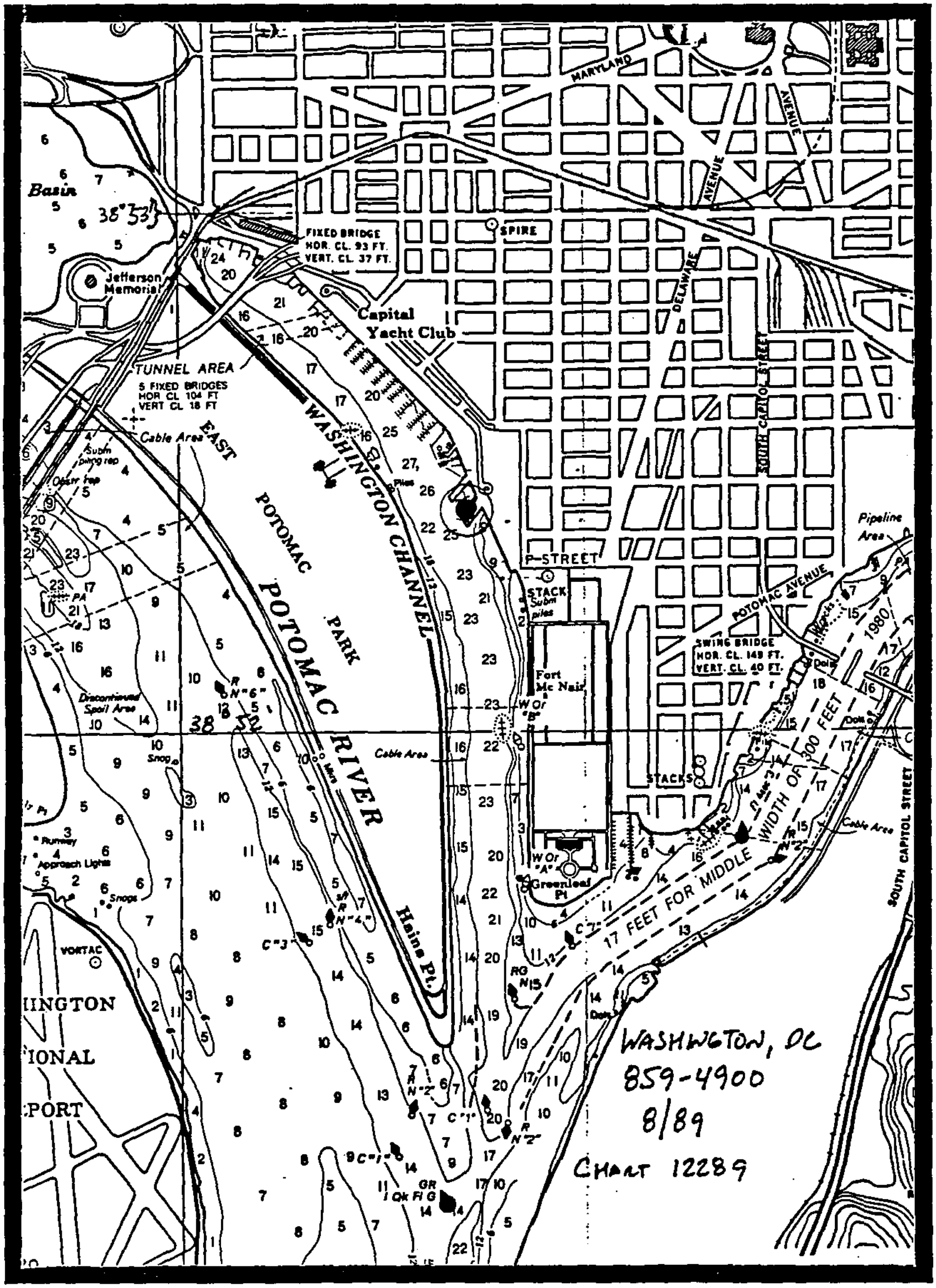
8574680 BALTIMORE, MD LAT. 39° 16.0'N LON. 76° 34.7'W



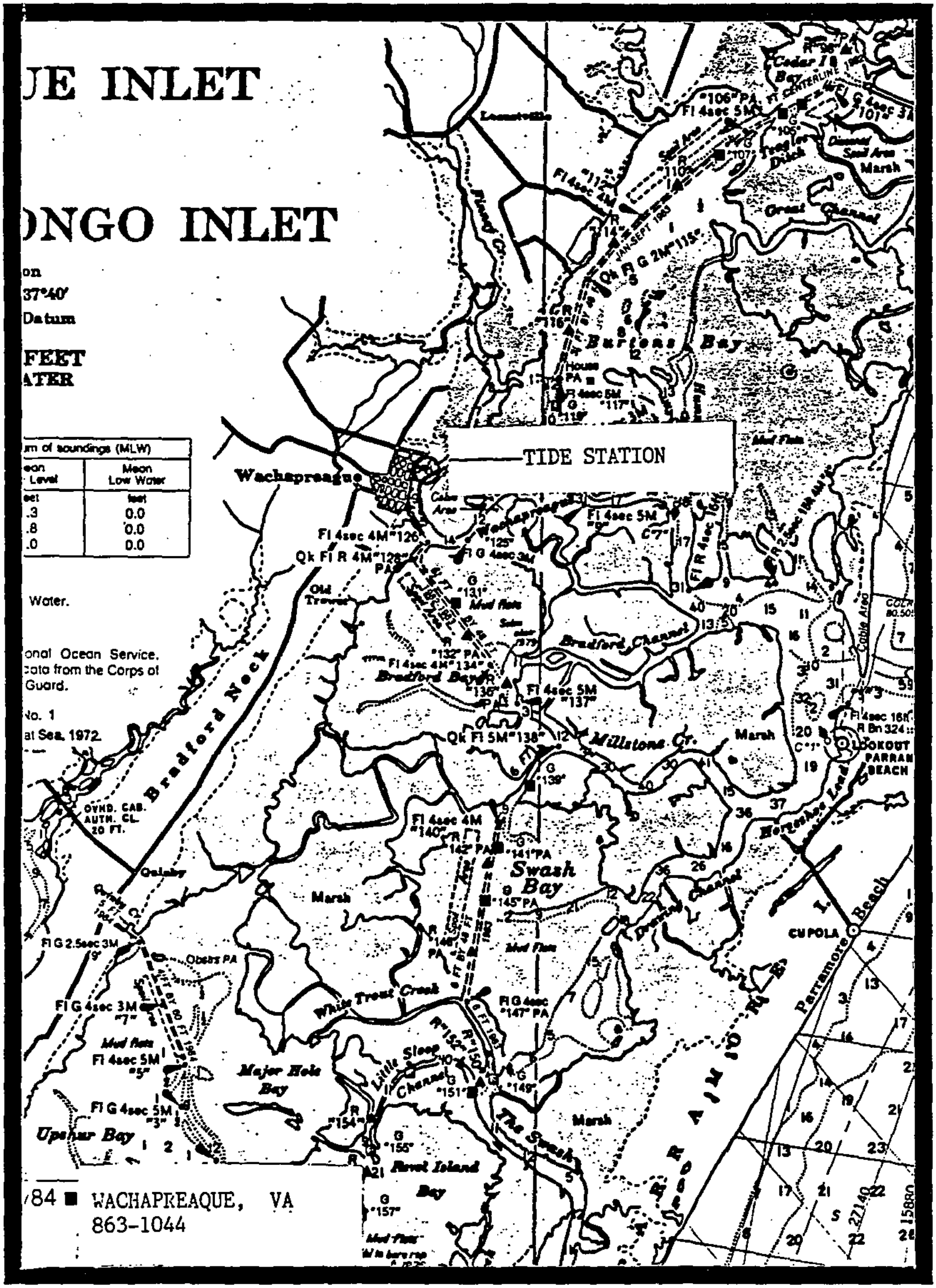
8575512 ANNAPOLIS, MD LAT. 38° 59.0'N LON. 76° 28.8'W



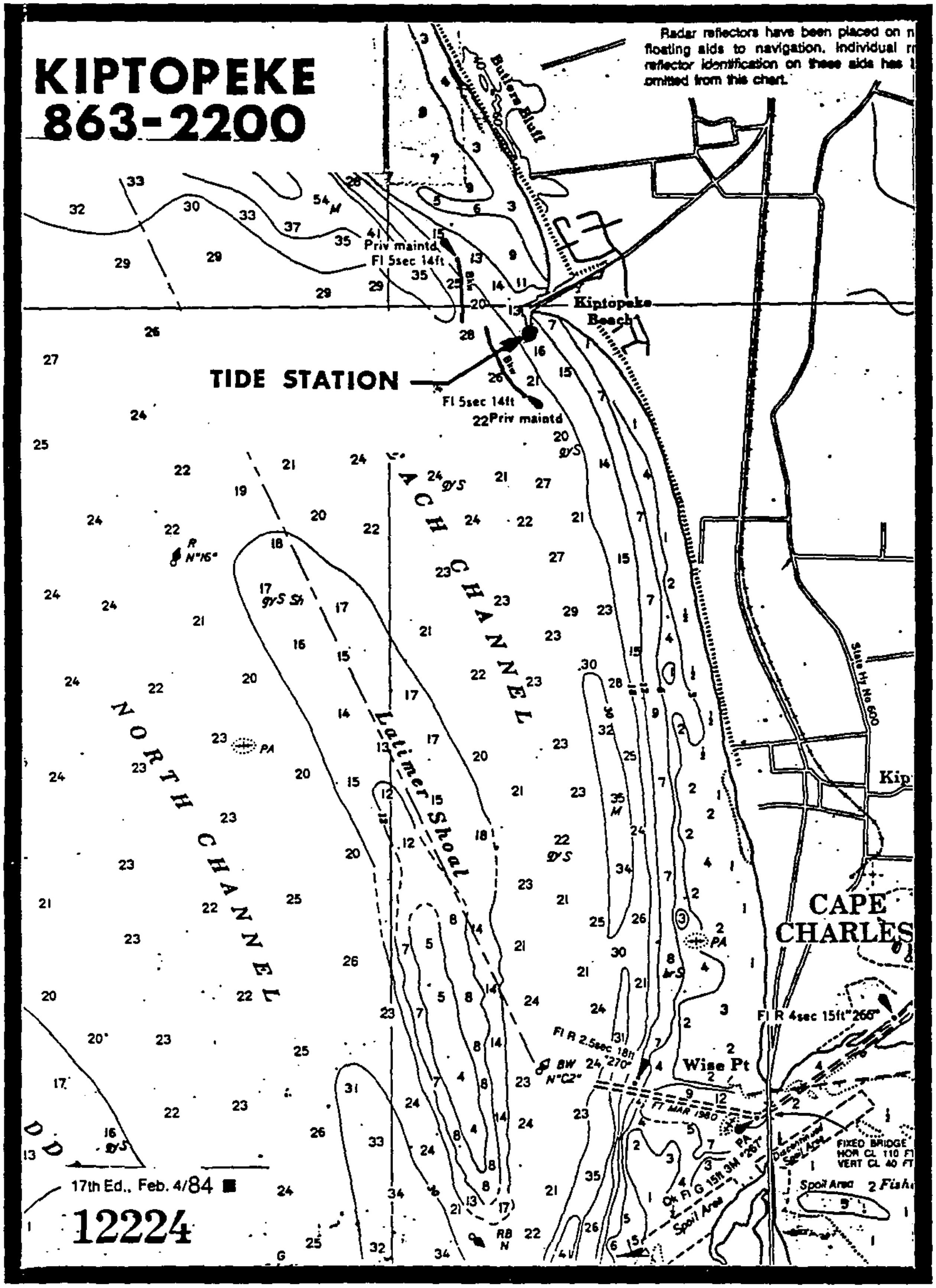
8577330 SOLOMONS ISLAND, MD LAT. 38° 19.0'N LON. 76° 27.2'W



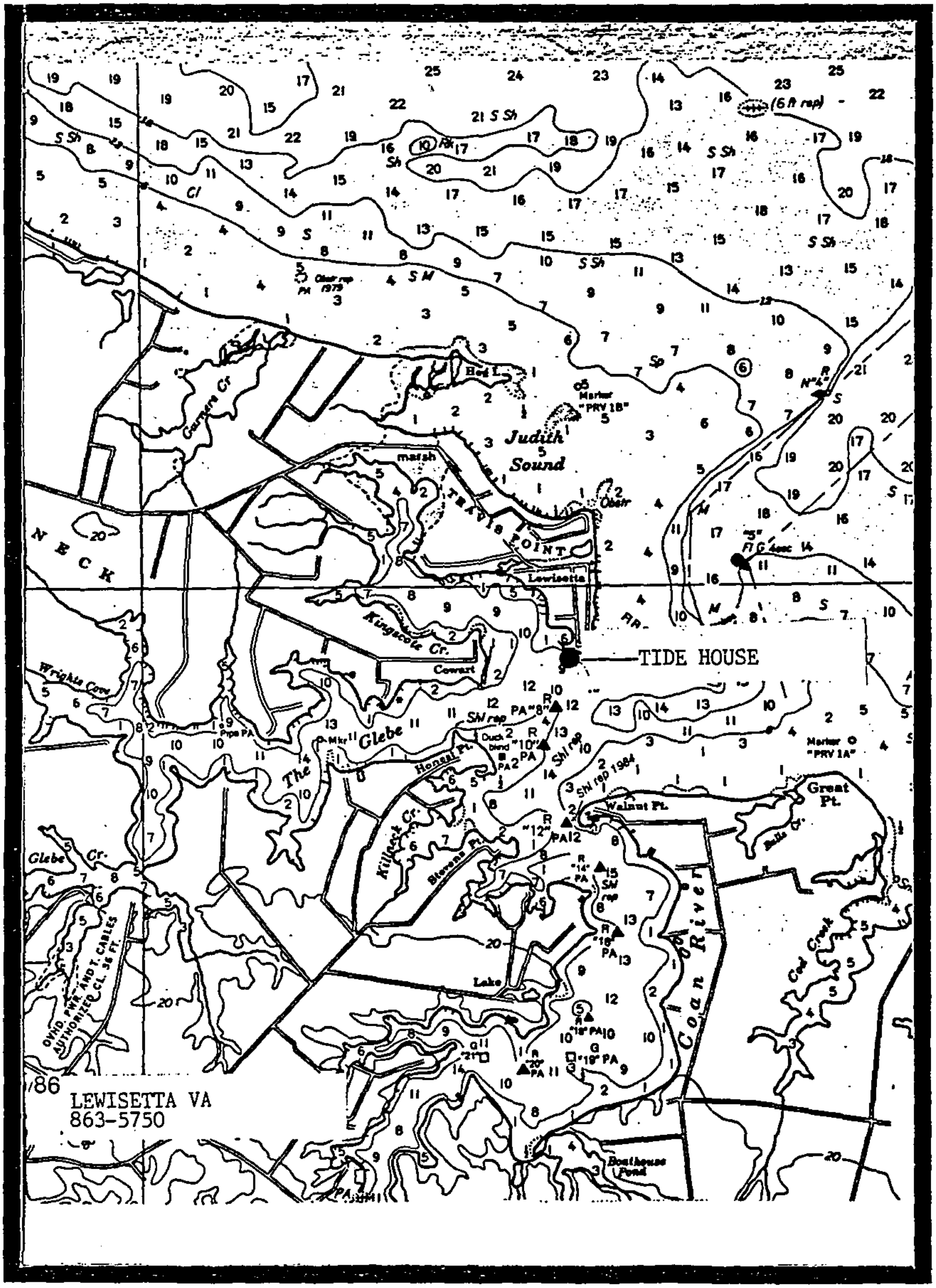
8594900 WASHINGTON, DC LAT. 38° 52.5'N LON. 77° 1.4'W



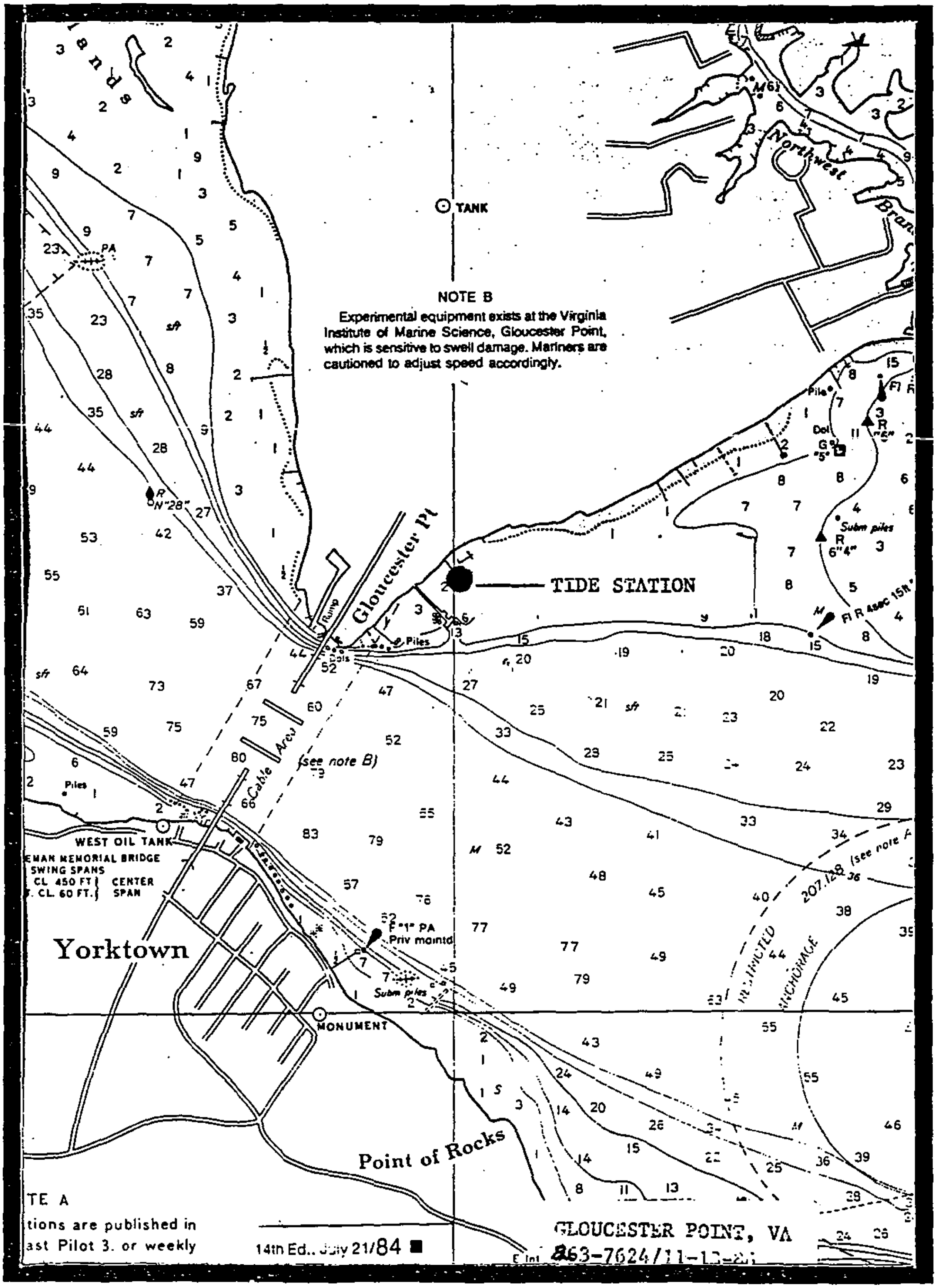
8631044 WACHAPREAGUE, VA LAT. 37° 36.4'N LON. 75° 41.2'W



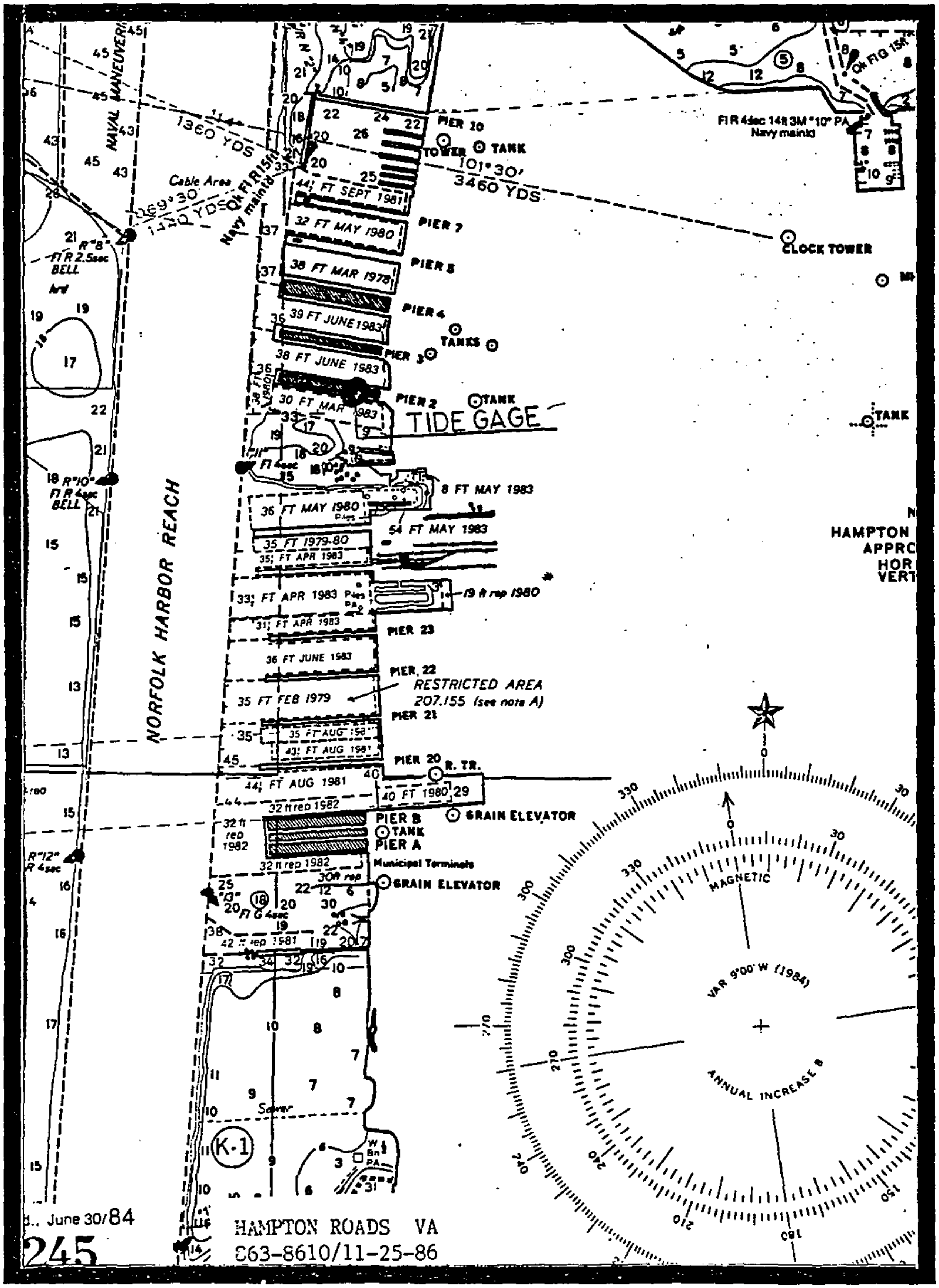
8632200 KIPTOPEKE, VA LAT. 37° 10.0'N LON. 75° 59.3'W



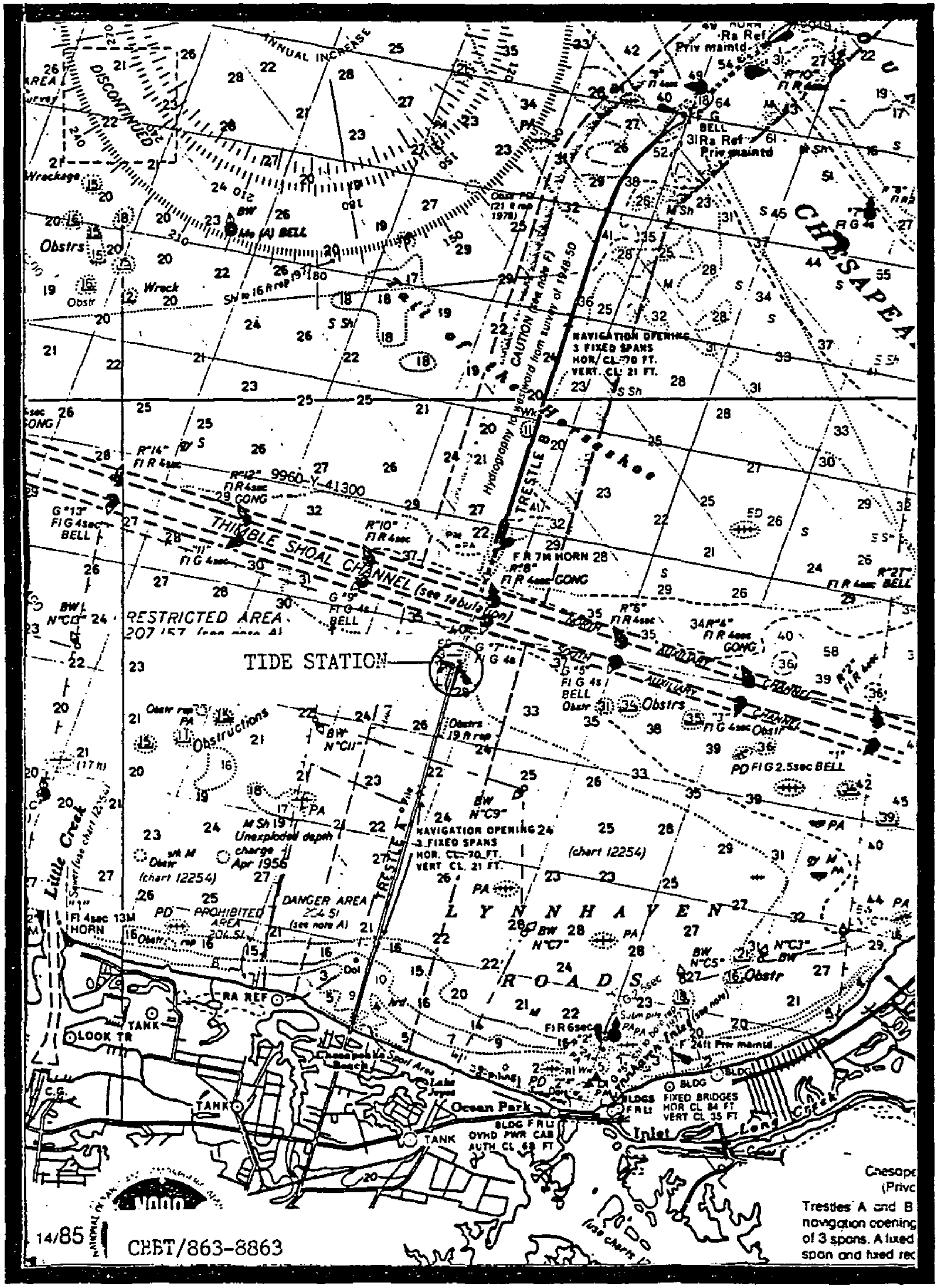
8635750 LEWISETTA, VA LAT. 37° 59.8'N LON. 76° 27.8'W



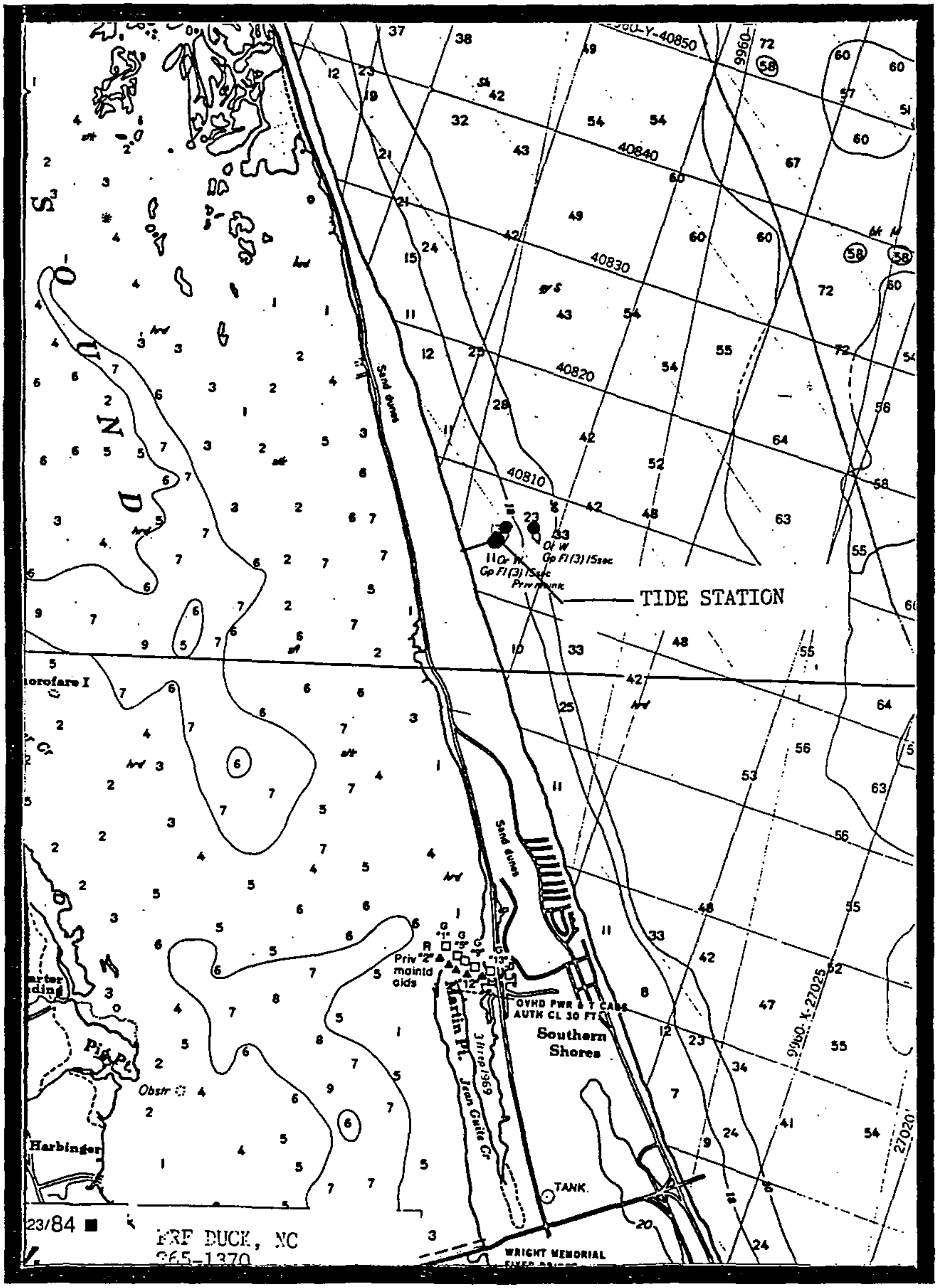
8637624 GLOUCESTER POINT, VA LAT. 37° 14.8'N LON. 76° 30.0'W



8638610 HAMPTON ROADS, VA LAT. 36° 56.8'N LON. 76° 19.8'W



8638863 CHES. BAY BR. TUN., VA LAT. 36° 58.1'N LON. 76° 6.8'W



8651370 DUCK PIER, NC LAT. 36° 11.0'N LON. 75° 44.6'W