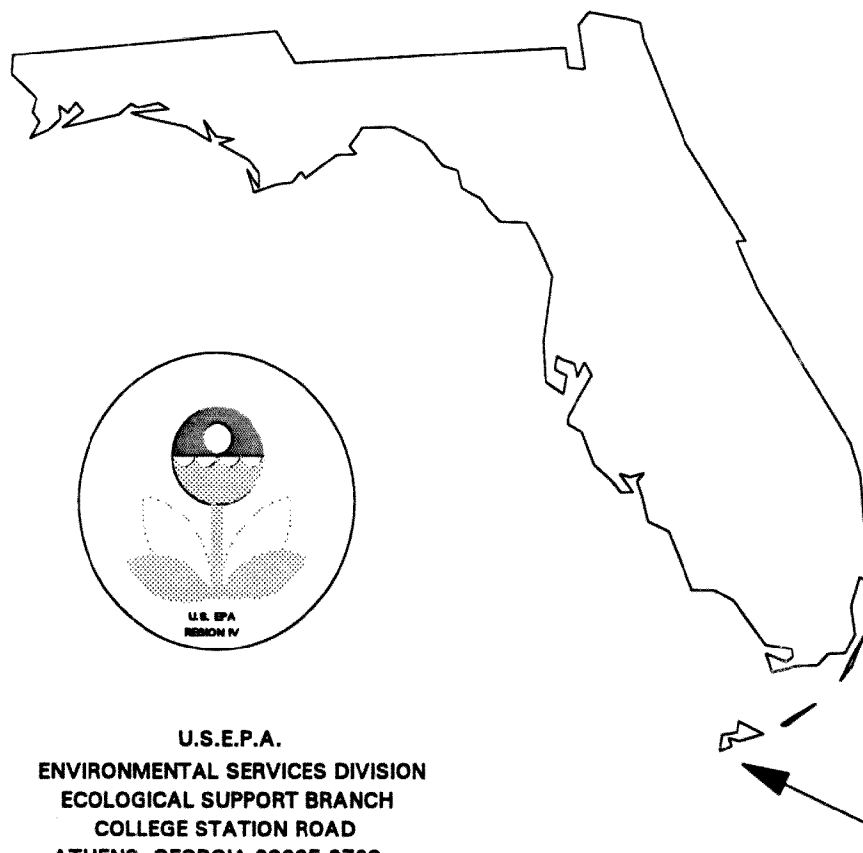


EPA 904/R-94/012

# DILUTION STUDY

## KEY WEST POTW DISCHARGE KEY WEST, FL

MAY 9 - 16, 1994



U.S.E.P.A.  
ENVIRONMENTAL SERVICES DIVISION  
ECOLOGICAL SUPPORT BRANCH  
COLLEGE STATION ROAD  
ATHENS, GEORGIA 30605-2720

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## ACKNOWLEDGEMENT

We sincerely appreciate the cooperation and support provided by the following; Mr R.J. Hebling and Mr Gus Rios of the Florida Department of Environmental Protection at Marathon, Florida, Mr Ed Castle of Operations Management International, Inc. and his staff who operate the City of Key West Wastewater treatment plant and, the United States Coast Guard Group - Key West. Their assistance and insight are greatly appreciated.

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## INTRODUCTION

The Environmental Protection Agency as part of their NPDES permit review process is evaluating the impacts of several municipal discharges to the coastal environment. This initiative includes a determination of appropriate measurement techniques for identification of effects to both the water column as well as the benthic communities.

As part of this process, the Water Management Division (WMD) requested the assistance of the Environmental Services Division (ESD) to identify the circulation/dilution patterns in the vicinity of the Key West outfall. The results of this study will be used to guide sampling protocols for further investigations of both the water column and the substrate in the vicinity of the wastewater plume migration.

In proceeding with this request, the ESD, in conjunction with the WMD planned and subsequently conducted a hydrographic study during the period of May 9 through May 16, 1994. The study focused on defining the dilution and dispersion patterns of the Key West POTW effluent as it mixes with the marine waters.

## CONCLUSIONS

- ◆ The outfall line appears to have separated at approximately 1000 meters from shore. In its existing configuration the discharge is through a single port at the 6 meter contour as opposed to a reported design which featured a diffuser at the 10 meter contour.
- ◆ Currents measured north of the outfall are aligned with the navigation channel paralleling the western shore of Key West. South of the outfall the current regime is dominated by the easterly flowing Florida Current.
- ◆ Effluent from the Key West POTW was diluted 6:1 at the effluent boil, 93:1 750 meters from the boil and, to 1900:1 at 4300 meters from the boil.
- ◆ Flood tides carried the traced wastewaters along the western shore of Key West via the navigation channel and continued through Garrison Bite above Flemming Key.
- ◆ On the ebb tide, currents directed the plume southeasterly for approximately 1000 meters, then the Florida Current directed the flow in a more easterly direction paralleling the southern shoreline of Key West.
- ◆ Mathematical model simulations were in close agreement with the field tracer data.
- ◆ Simulation of the dilution afforded by use of a diffuser section indicates that levels of dilution at 200 meters from the outfall could be an order of magnitude greater than with

the existing single port configuration.

- ◆ Nutrient levels measured in the boil and within the plume reflected enrichment above background within the first 200 meters from the outfall.
- ◆ Algal growth potential tests indicate nutrient enrichment is moderate 200 meters from the boil. The limiting nutrient was nitrogen.
- ◆ Semi-diurnal tides with a mean range of 1.3 feet was recorded during the survey.
- ◆ Winds were from the east-southeast and averaged 5 knots.

### **STUDY AREA**

The study area is located in the vicinity of Key West, Florida (Figure 1). Tides in this area are semi-diurnal with a mean range of 1.3 feet (NOS tide tables).

The City of Key West POTW discharges an average daily flow of 6 MGD through a submerged outfall which is directed southwesterly from the southern tip of Key West into the marine waters. The discharge line, extends from the shore near the southwest portion of the island southwesterly toward the navigation channel (Figure 1). Reportedly, the discharge line, originally extended to the 10 meter contour and included a diffuser section. Recent diver surveys (NOAA) as well as this EPA study however, indicate that the discharge line has separated and now discharges through a single port located approximately 1000 meters from shore at the 6 meter contour.

### **STUDY OBJECTIVES**

The overall study objective was to define the dilution characteristics of the discharge as it mixes with the marine waters. In order to accomplish this objective, an intensive survey was conducted. The following were the specific objectives at the Key West site:

- ◆ Determine the dilution variability in the receiving waters during a tidal cycle.
- ◆ Estimate the build-up concentration of wastewater under long term conditions.
- ◆ Measure the characteristics of the currents in the vicinity of the outfall.
- ◆ Determine the nutrient enrichment in the discharge plume.

## METHODS AND RESULTS

The basic strategy at the Key West site involved releasing a dye tracer (Rhodamine WT) into the POTW discharge line to the ocean in a continuous fashion for a full 25 hour tidal cycle. Boat mounted flow-through fluorometers were then used to measure the circulation and dilution of these traced waters in the oceanic system. Measurements of tracer concentration were made in these ambient waters during the initial 25 hour injection period as well as at 6 to 12 hour slack tide intervals for 2 to 3 days following the tracer injection.

### **Hydrographic Data**

Prior to commencing the tracer study, marker buoys as well as three recording current meters were deployed in the vicinity of the outfall (Figure 2). In addition, a water level recorder and recording wind speed and direction instrumentation were deployed at the Trumble Point United States Coast Guard Station located on Key West.

The buoys, placed at a distance of 200 meters from the outfall, served to provide a high degree of position control in the near field zone of the waste plume. Placement of the three current meters deployed during this survey (Figure 2) was based primarily upon historic current data. These data sources include National Oceanic and Atmospheric Administration (NOAA) Tidal Current Table information (6 sites shown), short term information from an existing instrument deployed near the outfall by NOAA's Acoustical Laboratory in Miami and, data from two instruments deployed by ESD during a short term study conducted in February, 1994. As shown by the depiction of this historic data (Figure 3), ebb and flood currents generally align with the passages between the keys. However, currents seaward of the outfall are dominated by easterly currents associated with the Florida Current which traverses easterly from the Gulf of Mexico toward the Atlantic Ocean.

Based on this information, the current meters were deployed in locations (shown on Figure 2) anticipated to be within the path of the traced effluent. All the meters were deployed within 1000 meters from the outfall to provide information within the dynamic near field region of the plume. The meters deployed at mid-depth were programmed to collect temperature, conductivity, salinity and, current speed and direction at 5 minute intervals during the period of 5/11-14/94.

Winds were from the northeast during the early part of the study and then rotated to a east/southeast direction during the later portion of the study (Figure 4 and Appendix A). Wind speeds averaged 2.5 meters/second.

Results of the current meter deployments are shown on Figures 5 - 13 and in Appendix A. The current meter located near channel marker 13 north of the outfall as well as the meter located south of the outfall near channel marker 12 (Figure 2) revealed current patterns very similar to the historic trends shown earlier on

Figure 3. As depicted on Figures 5-7 for the south meter and Figures 8-10 for the north meter, currents aligned with the navigation channel in nearly a north-south pattern and featured a net displacement to the south (Figures 7 & 10). However, in the case of the current meter deployed near the front range marker east of the outfall, currents were in an east-west alignment in a fashion more representative of the Florida Current (Figures 11-13). The principal feature of the currents recorded by this east meter deployment was the dominance of the western component of the currents. Net displacement at this location as shown by Figure 13 was to the west. Apparently, a localized vortex is formed in the waters immediately southwest of Key West as the result of mixing of the north-south currents aligned with the navigation channel and the easterly bias of the Florida Current.

Tide record established at the USCG Station at Trumble Point is shown on Figure 14. The average tide range during the survey period was 1.3 feet with minimum and maximum excursions of 0.5 and 2.1 feet respectively. The mean range reported in the NOAA Tide Tables is 1.3 feet.

### **Dye Dilution Study**

The 25 hour tracer injection period was planned to coincide with a high tide predicted to occur at 1110 on Thursday May 12. As shown on Figure 14, this high tide was followed by a low tide at 1800 and then by a weaker high and low before completing the cycle with a high tide occurring at 1215 on May 13. During this period, the Rhodamine WT tracer was introduced into the discharge line (after effluent dechlorinization) in a continuous fashion by means of a precision metering pump. The tracer injection commenced 2 1/2 hours (0825 on 5/12) prior to the predicted occurrence of the high tide to compensate for residence time of the wastewater in the outfall line.

Effluent flow rate, which averaged 6.4 MGD, was monitored (at the parshall flume upstream of the chlorine contact chamber) at 30 minute intervals so that the tracer injection pump could be adjusted to pace effluent flow characteristics in attempt to develop a mixed tracer/effluent concentration in the discharge line of 1000 PPB. A total volume of 25.4 liters of Rhodamine WT dye was injected over this period. As shown on Figure 15 the effluent pump operates at a rate of 5735 GPM. When the pump is off, the effluent continues to discharge by means of siphoning through the effluent pump. During the "off" cycle the effluent flow rate is 1500 GPM.

The resultant tracer concentration in the effluent as measured from samples collected from a sampling port on the effluent line at the POTW was 925 ppb (Figure 16).

The tracer release into the effluent wet well commenced at 0825 on 5/12/94. Monitoring for these traced wastewaters in the ocean began at 0930 on 5/12 and was accomplished by two crews utilizing boat-mounted flow-through fluorometers with the pump intake positioned at the 1 meter depth. Monitoring locations were concentrated on transects established along Loran lines, as well as keyed to channel markers and other fixed navigational aids. Loran



instrumentation was verified/adjusted by taking position readings at fixed navigation locations so that TD grids could be adjusted to known positions. In the vicinity of the outfall, buoys placed at 200 meters from the outfall provided a higher degree of positioning control near the zone of initial dilution (ZID).

Figures 17-21 depict the dye tracer isopleths described by the monitoring. During the initial monitoring period and the subsequent low tide sampling period on the afternoon and evening of 5/12 the traced waters followed a south by southeast pattern within the first 1000 meters from the outfall and then turned more easterly in nearly a parallel fashion in respect to the southern shoreline of Key West (Figures 17 & 18). As shown on Figure 18 tracer levels of 150 ppb were recorded at the boil and the 10 ppb isopleth extended 750 meters from the boil. Effluent dilution then, based upon a tracer concentration of 925 ppb in the effluent line, was 6:1 at effluent boil (925 ppb in effluent/150 ppb in the boil) and reached 93:1 (925 ppb/10 ppb) within 750 meters from the outfall.

During the flood tide (0930-1330 5/13/94) the currents distributed the traced wastewaters northerly along the navigation channel boarding the western end of Key West (Figure 19). Traced effluent west detected along the western extent of Fleming Key and then northeasterly through Garrison Bite.

Figures 20 and 21 depict the results of the monitoring on the slack tides after completion of the tracer release and serve to indicate the level of traced waters remaining/returning to the vicinity of the outfall. As shown on Figure 20 very little traced effluent remained in the area 6 hours after secession of the tracer release. After 24 hours (1045-1400 5/14/94) only a very small dye patch remained above detection levels (Figure 21).

The single port discharge configuration made monitoring the traced effluent very difficult in the zone near the outfall. With in the first 50 - 100 meters from the outfall a traverse of 10 or 20 meters would often produce a fluctuation of 1 - 2 orders of magnitude in fluorometric readings. With distance from the outfall the mixing process became more complete.

### **Dilution Model Predictions**

In an attempt to predict dilution levels of the Key West wastewater under existing conditions a plume model was applied. The model used was Cormix developed by G.H. Jirka and P.J. Akar of Cornell University (1991). Input data included effluent discharge characteristics, outfall design and geometric dimensions as well as, the receiving water density and velocity characteristics. The data base used and comparison period chosen was the first ebb tide occurring on 5/12/94 as shown on Figure 18.

Results of the modeling run with a listing of the input parameter values used are given in Appendix B. Comparisons of model predictions under existing conditions to the field data are provided in Figures 22,23 & 24. The model predictions compare favorably with the field tracer data. For example, dilution near the edge of the zone of initial dilution (ZID) where the plume is

experiencing dilution due to buoyancy and discharge velocities the model results, as depicted by the inflection point on Figure 22, is 6:1. This can be compared to a similar value obtained in the field measurements.

Figures 23 and 24 depict the extension of the predictions further away from the outfall. A comparison of far field dilution as shown in Figure 24, indicates that the tracer data describes a slightly lower degree of dilution with distance than does the model predictions. This disparity is small, as shown dilution measured at the limit (4300 meters) of the dye tracer transects was 1900:1 as compared to 2000:1 predicted by the model.

This calibrated model was then used to predict dilution that could occur; 1) under a different ambient velocity regime or, 2) if a diffuser section was added to the existing outfall configuration.

Figures 25 and 26 depict the dilution levels predicted by the model under ambient velocities ranging from 0.2 fps (0.06 m/s) to 0.7 fps (0.21 m/s). All other model input parameters were held the same as in the calibration phase. As shown on these figures, with increasing ambient currents, dilution increases. The magnitude of the differences becomes more pronounced with distance from the outfall. For example, at 200 meters from the outfall the model predicts dilutions ranging from 11:1 to 14:1 with these velocities, however at 2000 meters the dilutions predicted range from 100:1 to 370:1.

In order to provide an evaluation of dilution available with the discharge distributed over a greater area, the model was run with the calibration parameters (including velocity) but with a diffuser section added to the existing configuration. The simulated diffuser design selected for illustrative purposes consists of a 25 meter diffuser placed perpendicular to and attached to the end of the existing pipe. Six ports, each with a diameter of 0.25 meters are equally spaced along the diffuser section. The ports directed upward to the water surface are at 90° to the header pipe.

Results of the dilution predictions with the simulated diffuser are compared to the existing single port configuration in Figures 27 and 28 (model runs are in Appendix B). Readily apparent in the predictions is the improvement in dilution with the addition of the diffuser section. The inflection points shown on Figure 27 at approximately 100 meters for the diffuser design and at 10 meters for the existing configuration is the edge of the hydrodynamic mixing zone which is most sensitive to discharge configuration in the model. In this zone, the buoyancy of the effluent coupled with the distribution and velocity provided by the outfall design govern the dilution process. Outside this zone the dispersion characteristics of the receiving waters are prevalent in achieving further dilution. As shown in Figure 27, at 200 meters from the outfall the simulated diffuser section increased dilution levels ten fold (150:1 vs 13:1) over those obtained in the existing configuration. This simulation serves to illustrate the potential improvement in effluent dilution and dispersion obtainable through the use of a diffuser section. The design simulated is only one example of a variety of possible configurations.

## Nutrient Enrichment

Samples were collected within the discharge plume for chemical analysis during two sampling events. These events coincided with a flooding and an ebbing tide during the tracer release. During each of the two sampling events, samples were collected in the discharge boil, in the plume, and upstream of the outfall. Samples were preserved in the field and returned to ESD laboratories for analysis of TOC, NO<sub>2</sub>-NO<sub>3</sub>, NH<sub>3</sub>, TKN, and T-P.

Results of the analysis are given in Table 1.

TABLE 1  
CHEMICAL DATA (MG/L). MAY 1994  
(Tracer concentration noted is in ppb)

<u>STA</u>	<u>DATE/TIME</u>	<u>LOCATION</u>	<u>NH3</u>	<u>NO2-NO3</u>	<u>TKN</u>	<u>T-P</u>	<u>TOC</u>
KW-1	5/12 1740	AT BOIL* (Tracer 150)	<0.05	0.21	0.33	0.18	6.6
KW-2	5/12 1751	200M NORTH (Tracer 0.0)	<0.05	<0.05	0.17	0.02	2.6
KW-3	5/12 1732	200M SOUTH* (Tracer 6.3)	<0.05	<0.05	0.23	0.02	1.4
KW-4	5/13 0950	200M SOUTH (Tracer 0.0)	0.05	<0.05	0.28	0.02	1.0
KW-5	5/13 1126	NEAR BOIL* (Tracer 31.1)	0.05	0.08	0.22	0.06	1.0
KW-6	5/13 1142	200M NORTHWEST* (Tracer 15.9)	<0.05	0.05	0.25	0.03	1.0

\* DENOTES SAMPLE TAKEN WITHIN DISCHARGE PLUME

As seen from the above table, nutrient levels within the boil, sample KW-1 and to a lesser extent KW-5, taken near the boil reflect the presence of the wastewaters. This is particularly true in the case of the nitrite-nitrate nitrogen and total phosphorus forms of the nutrients present. The two samples taken from within the plume at a distance of 200 meters from the boil (KW-3, KW-6) had nearly similar nutrient levels to those of the samples taken out of the plume (KW-2, KW-4).

Algal growth potential tests (AGPT) were performed on samples collected in conjunction with those for analytical analysis. These AGPT tests serve two functions. They measure maximum growth potential of marine algae based upon the available nutrients in the sample. Secondly, nutrients added to the sample in the laboratory serve to determine the limiting nutrients relative to growth potential of the test organism. Samples for AGPT analysis were shipped to ESD laboratories for testing.

Table 2 provides the results of the AGPT tests and, Appendix C contains the laboratory report.

**TABLE 2**  
**ALGAL GROWTH POTENTIAL TEST**  
**MAXIMUM STANDING CROP (MSC) OF DUNALIELLA TERTIOLECTA**  
**DRY WEIGHT (mg/L)**

STATION/ LOG #	TREATMENT*	REP 1 HIGH	REP 2 LOW	REP 3	MEAN	RANGE
KW-1	CONTROL	46.42	40.17	42.11	42.90	6.25
	C+N	100.47	91.12	91.68	94.42	9.35
	C+P	34.88	30.97	31.51	32.45	3.91
KW_-2	CONTROL	---	14.70	13.36	14.03	1.34
	C+N	14.65	16.02	13.05	14.57	2.97
	C+P	18.19	13.58	17.45	16.41	4.61
KW-3	CONTROL	20.28	14.88	17.75	17.64	5.40
	C+N	22.28	18.62	19.68	20.19	3.66
	C+P	22.34	18.04	19.74	20.04	4.30
KW-4	CONTROL	9.19	7.23	7.94	8.12	1.96
	C+N	11.33	9.71	10.55	10.53	1.62
	C+P	14.76	12.29	13.79	13.61	2.47
KW-5	CONTROL	24.89	21.48	22.93	23.10	3.41
	C+N	41.41	36.45	38.19	38.68	4.96
	C+P	28.55	21.86	24.7	25.04	6.69
KW-6	CONTROL	24.56	14.74	19.72	19.67	9.82
	C+N	31.87	25.29	27.94	28.37	6.58
	C+P	22.45	17.3	17.64	19.13	5.15

\*C+N = Control + Nitrogen

\*C+P = Control + Phosphorus

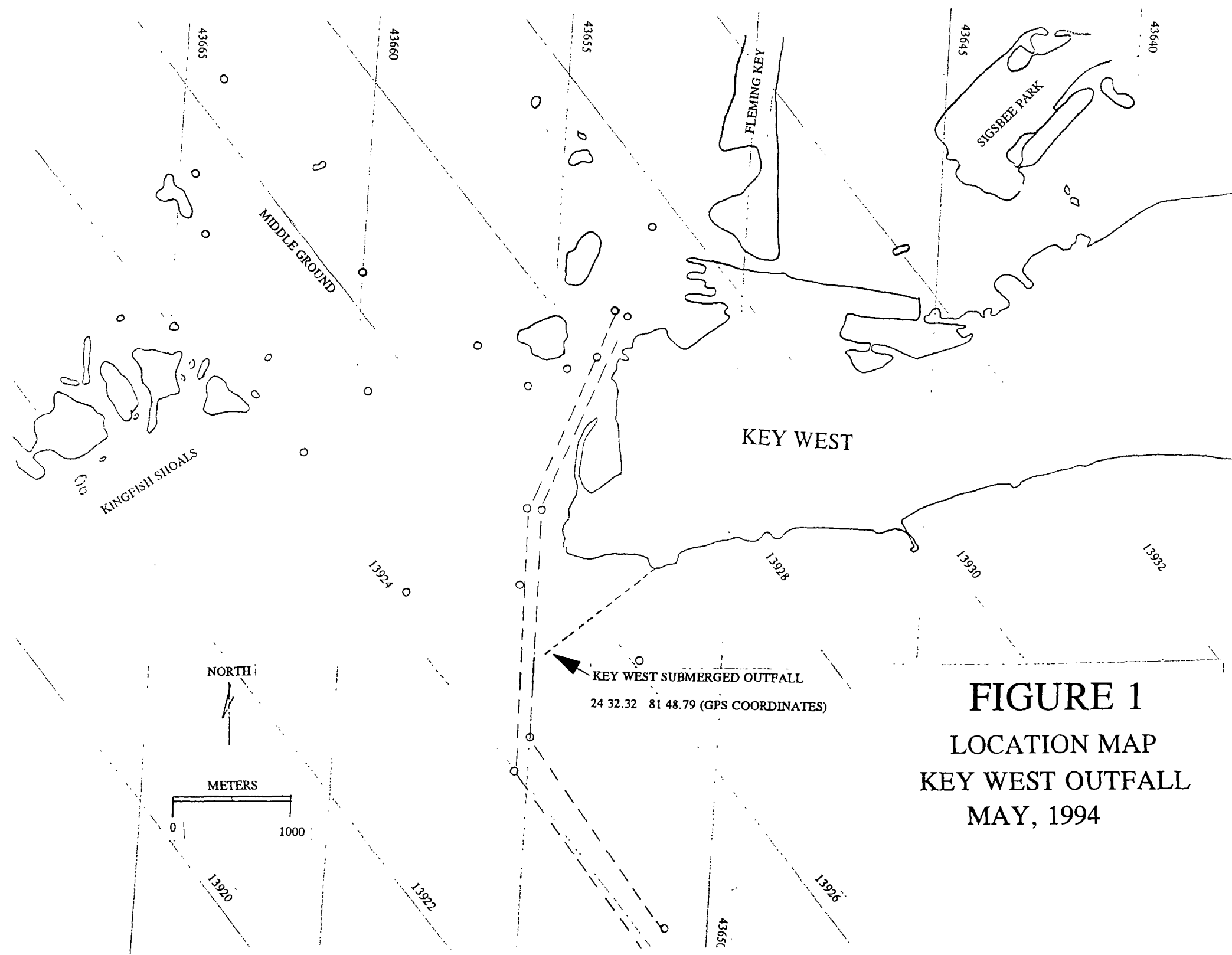
Although there are no published marine AGPT dry weight levels which are dicative of enrichment, the Florida Department of Environmental Protection

considers a level of 10 mg/l as enriched. Laboratory results indicate that up-current stations KW-2 and KW-4 would be slightly enriched, boil stations KW-1 and KW-5 were grossly enriched (42.9 and 23.1 mg/l) and, down-current thin plume stations KW-3 and KW-6 are moderately enriched, but diluted (Table 2).

Nutrient limitation studies indicate that the samples collected from the boil or from within the plume were strongly nitrogen limited. The remaining stations were co-limiting to both nitrogen and phosphorus, meaning both nutrients were required to stimulate growths greater than the untreated samples.

#### **QUALITY ASSURANCE**

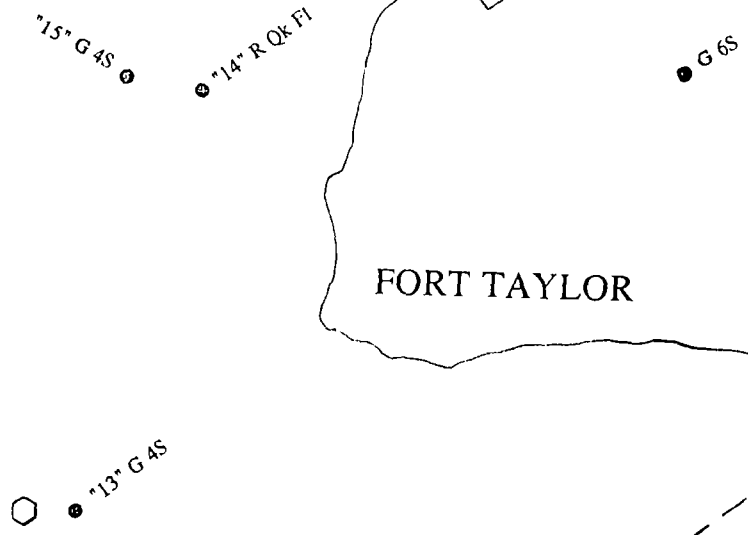
Field activities and sampling protocols followed ESD standard operating procedures (SOP) manuals.



**FIGURE 1**  
**LOCATION MAP**  
**KEY WEST OUTFALL**  
**MAY, 1994**

**FIGURE 2**  
**SITE DETAIL**  
**CURRENT METER DEPLOYMENTS**  
**MAY, 1994**

KEY WEST



FORT TAYLOR

SUBMERGED OUTFALL

KEY:

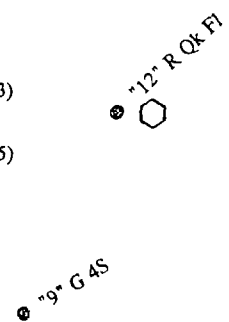
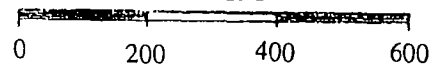
● EXISTING NAVIGATION AIDS

○ CURRENT METER DEPLOYMENTS (3)

△ NAVIGATION AID DEPLOYMENTS (5)

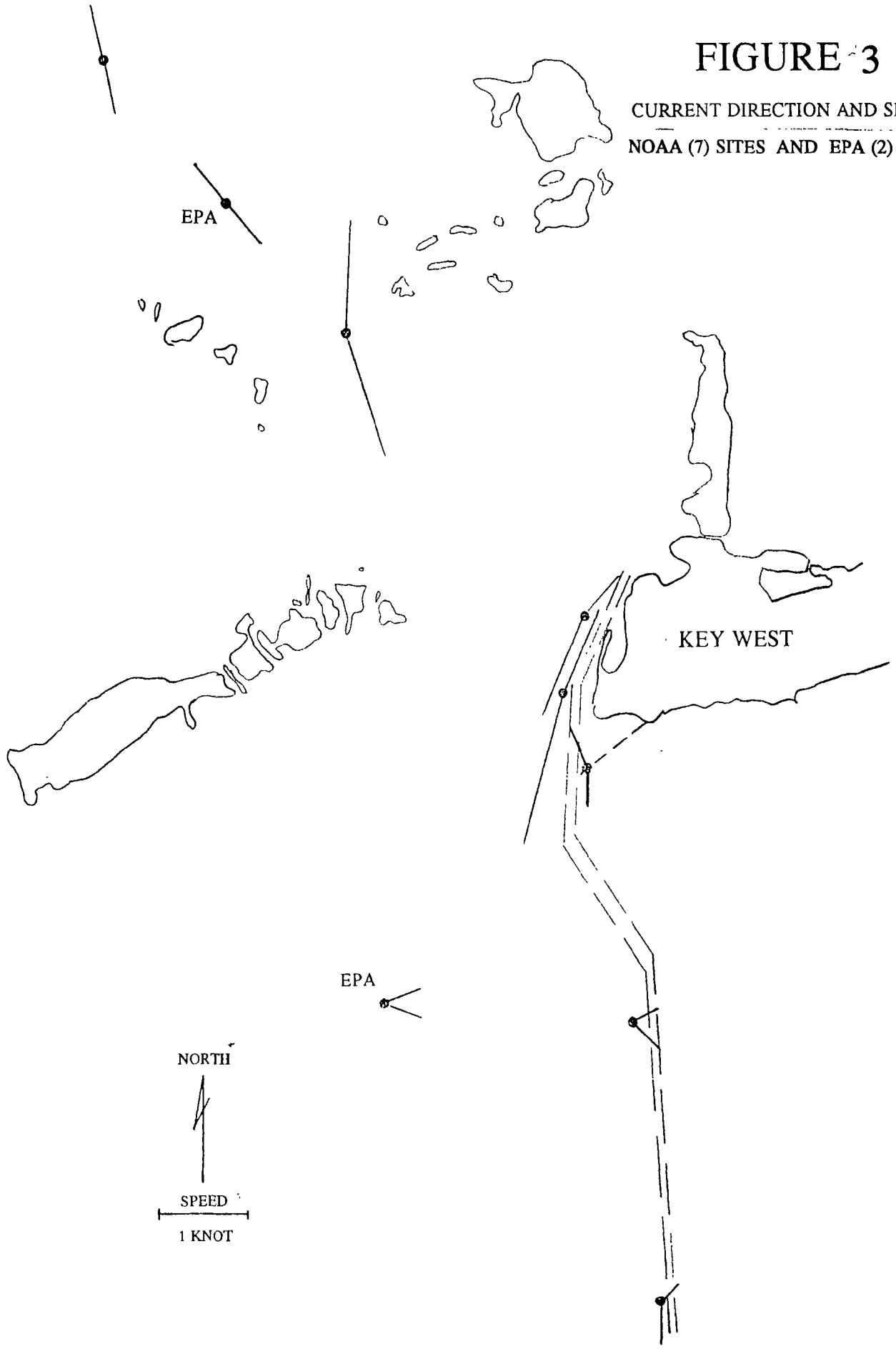
NORTH

METERS



# FIGURE 3

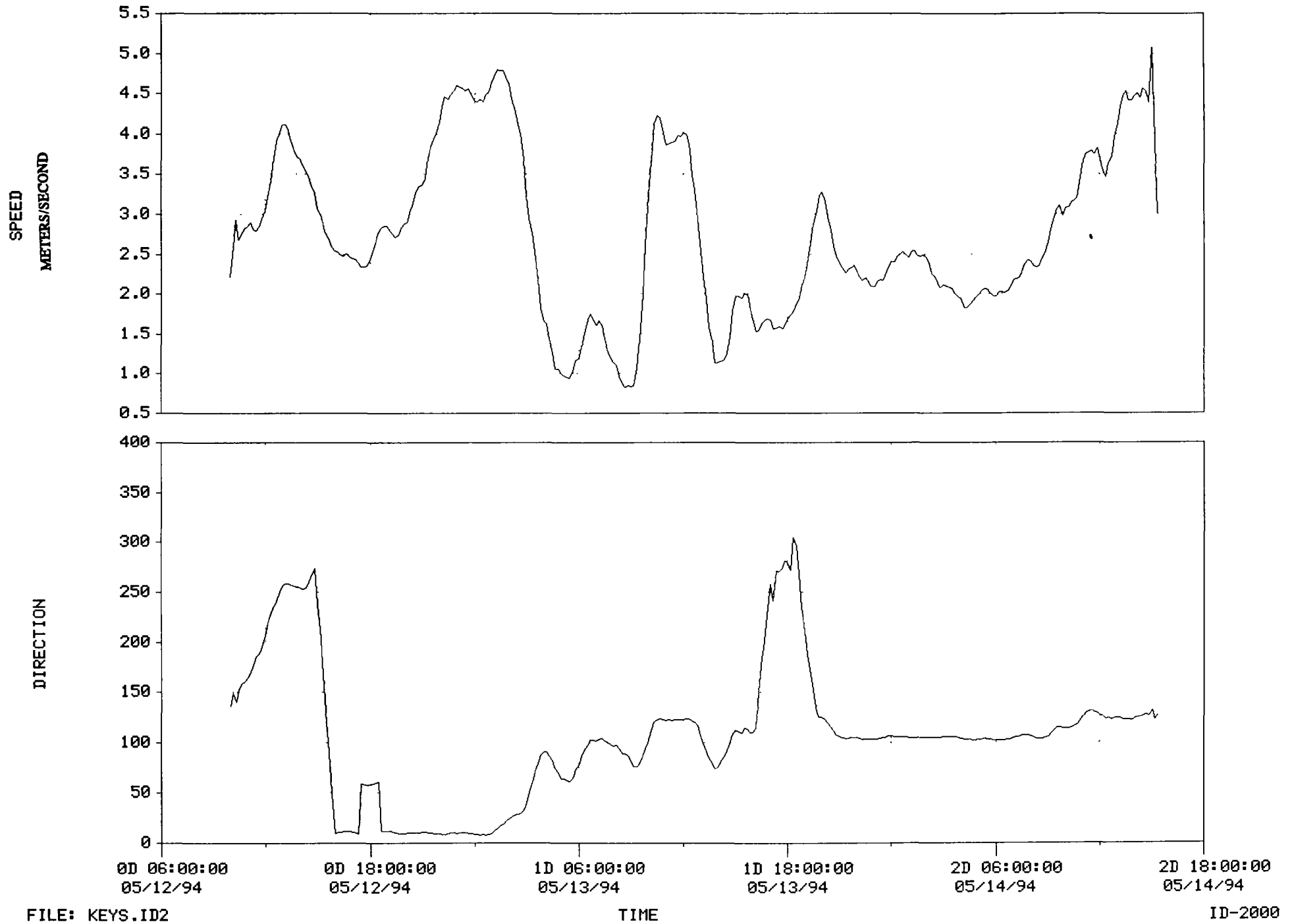
CURRENT DIRECTION AND SPEED  
NOAA (7) SITES AND EPA (2) SITES





WIND DATA (180 POINT  
KEY W FLORIDA  
MAY , 1994

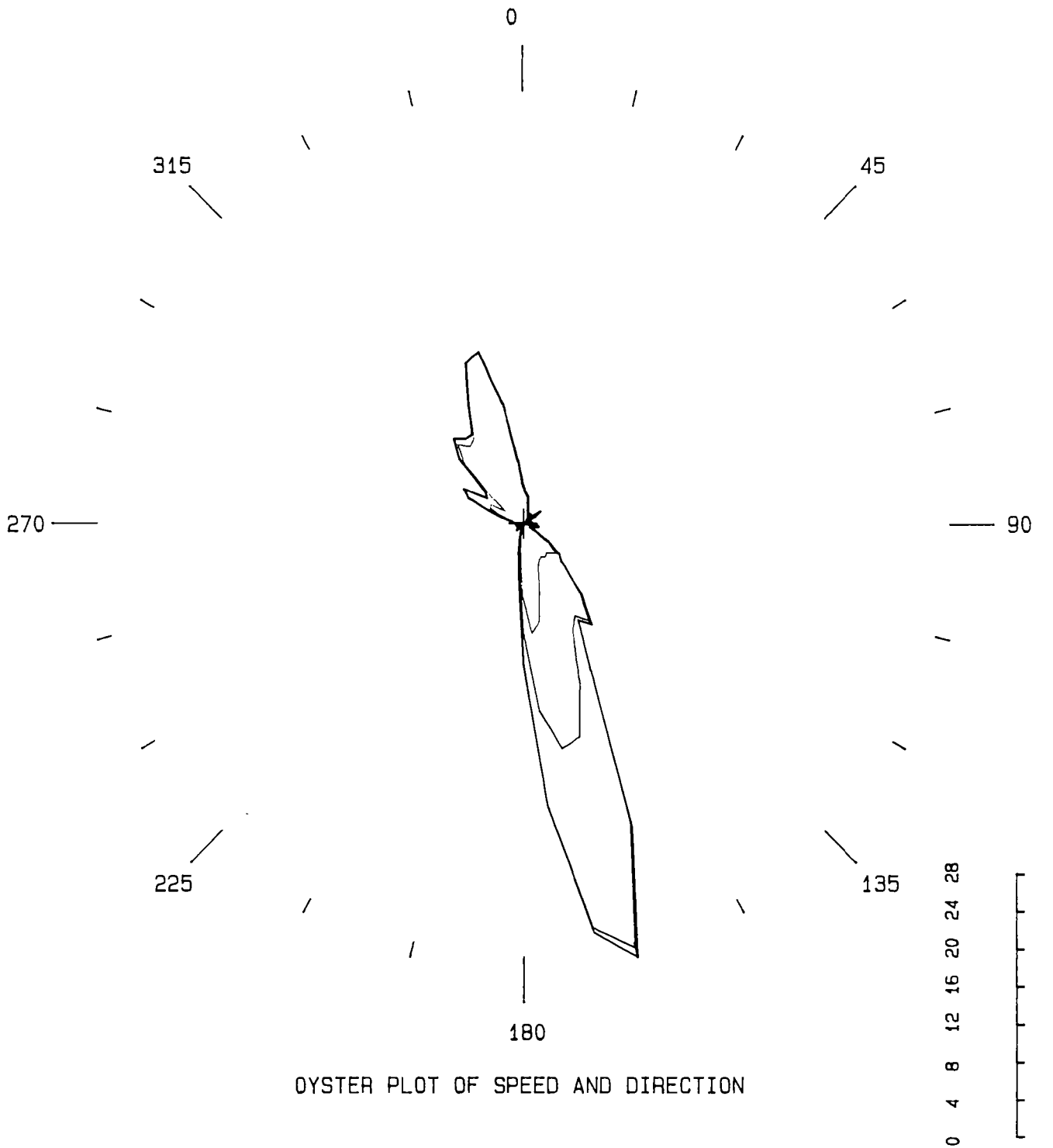
FIGURE 4



**FIGURE 5**  
**SOUTH CURRENT METER**  
**OYSTER PLOT**

KEY WEST OUTFALL STUDY - SOUTH-SOUTHEAST CURRENT METER

Speed Class Interval = 20.00



OYSTER PLOT OF SPEED AND DIRECTION

From 11-MAY-94 To 14-MAY-94

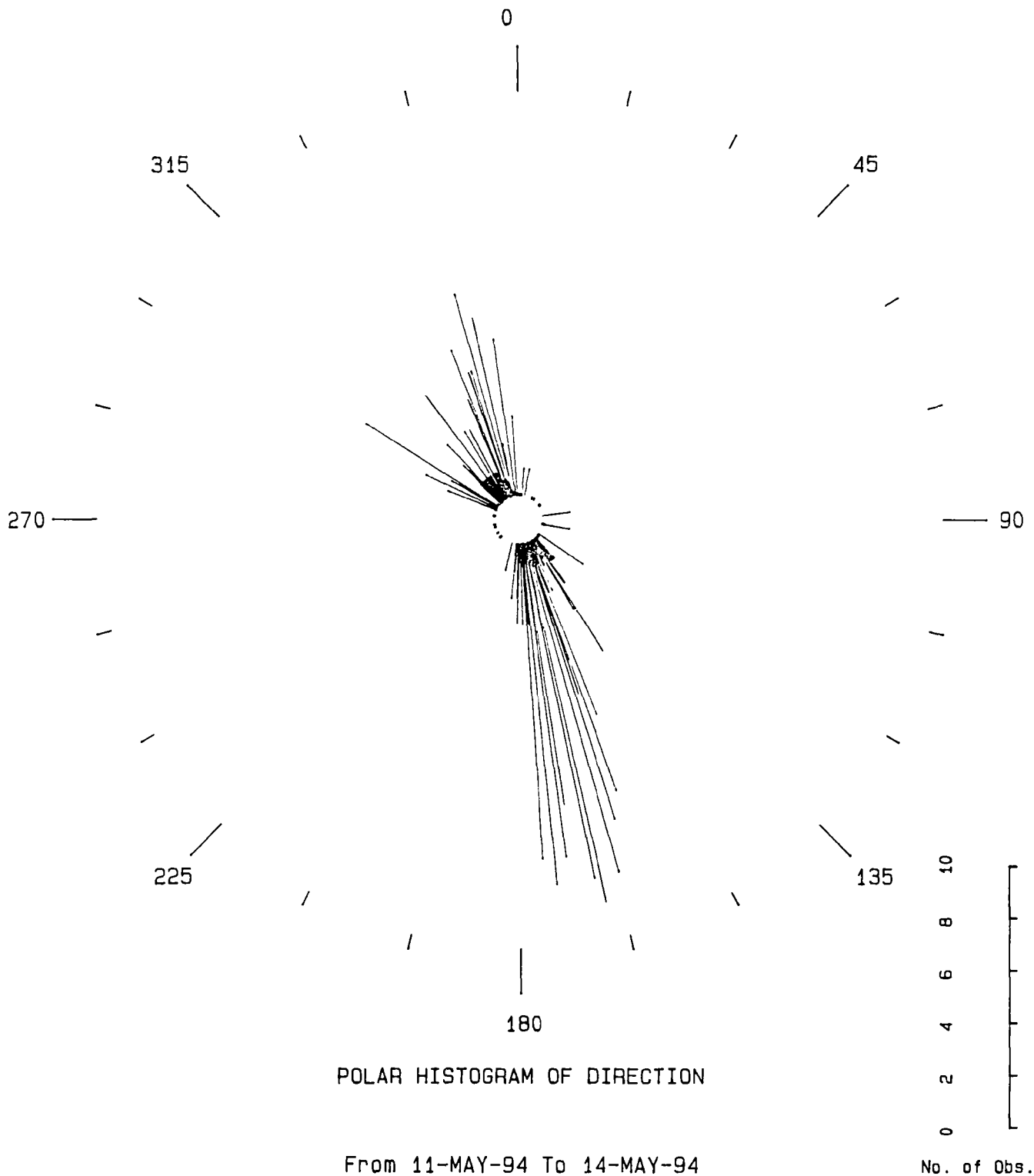
ENDECO Type 174SSM Solid State Memory Current Meter

FIGURE 6

SOUTH CURRENT METER

POLAR HISTOGRAM

KEY WEST OUTFALL STUDY - SOUTH-SOUTHEAST CURRENT METER



ENDECO Type 174SSM Solid State Memory Current Meter

FIGURE 7

ENDECO Type 174 SOUTH CURRENT METER · Current Meter  
PROGRESSIVE VECTOR PLOT

KEY WEST OUTFALL STUDY - SOUTH-SOUTHEAST CURRENT METER

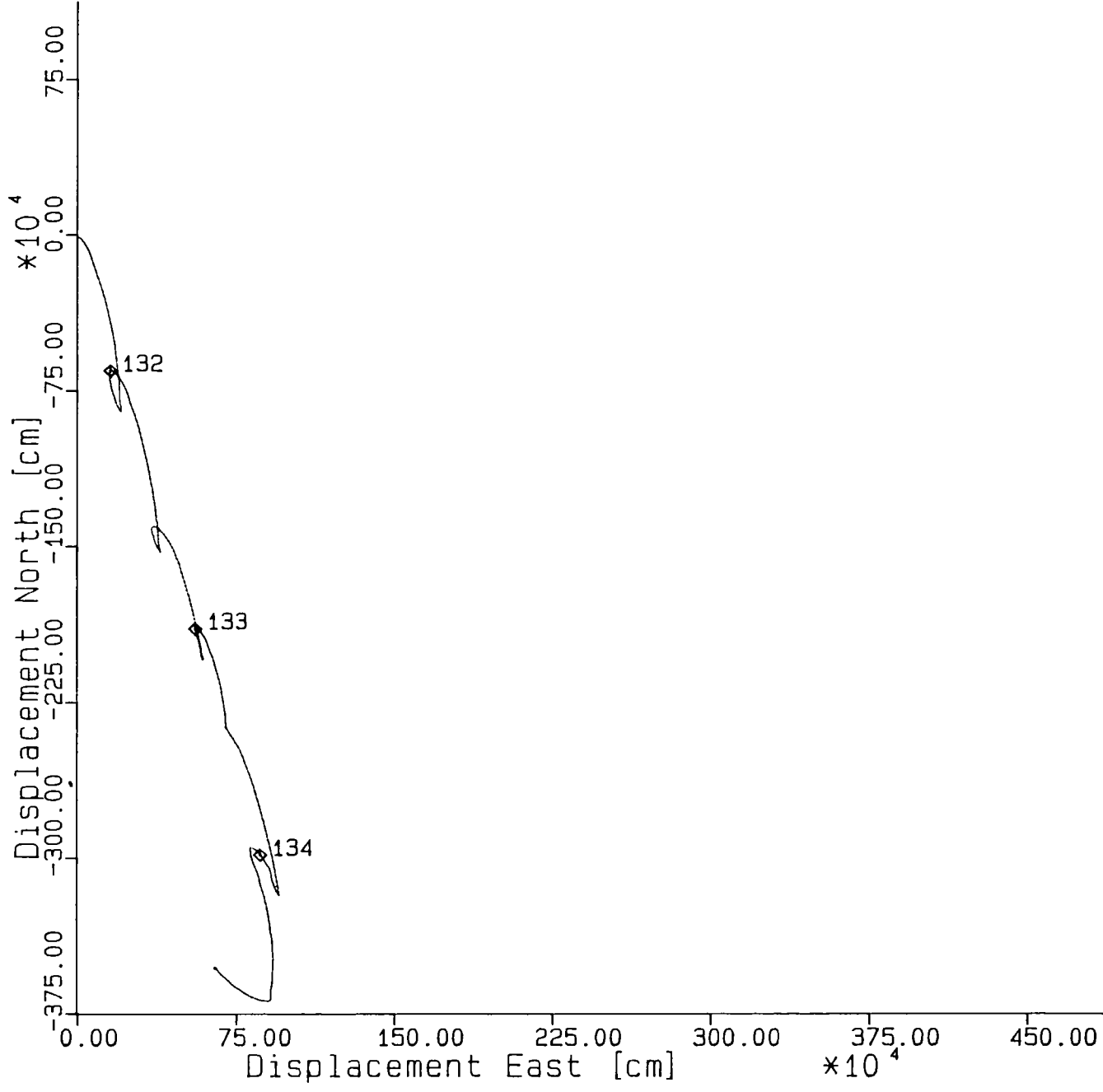


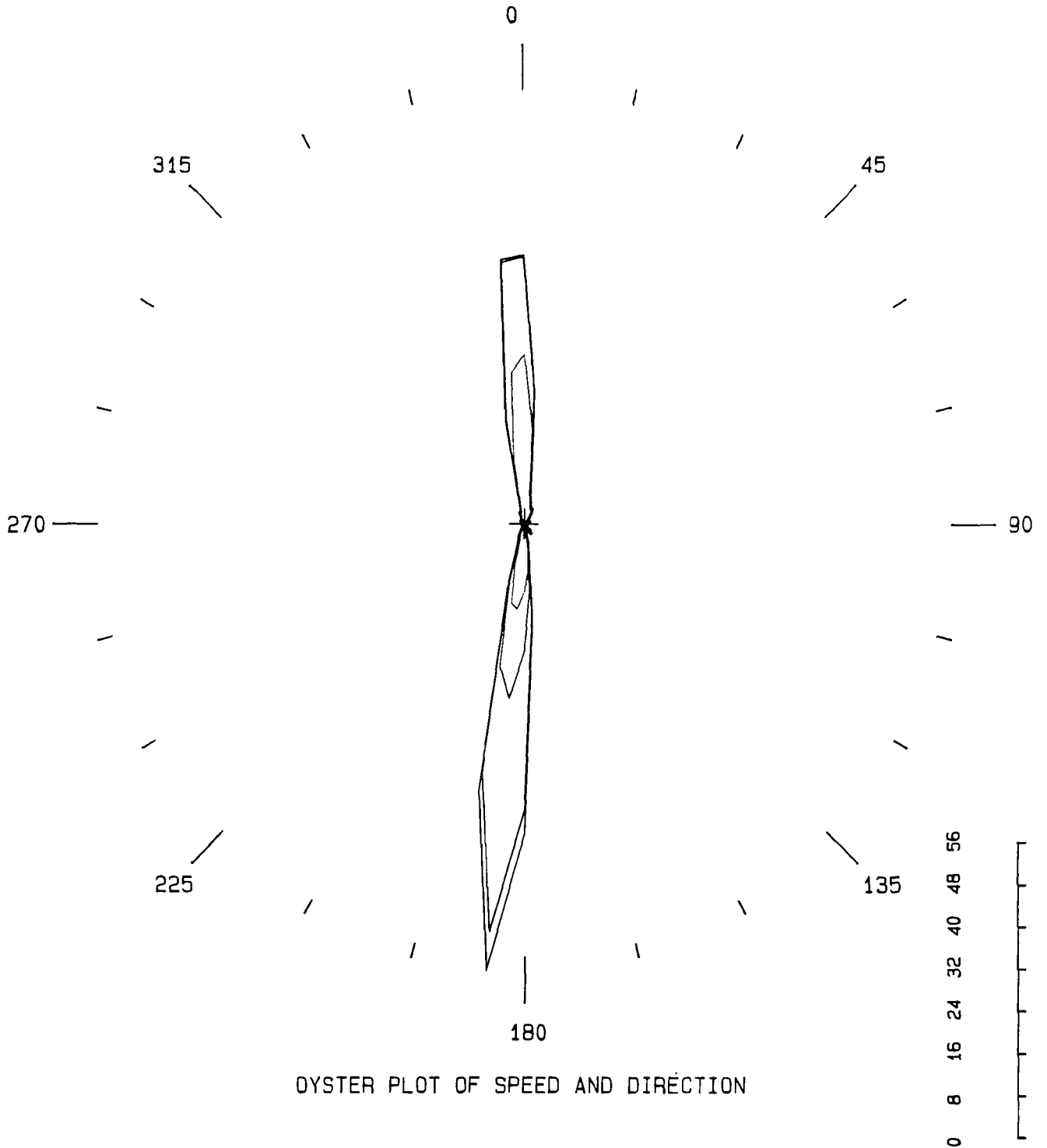
FIGURE 8

NORTH CURRENT METER

OYSTER PLOT

KEY WEST OUTFALL STUDY - NORTHWEST CURRENT METER

Speed Class Interval = 20.00



OYSTER PLOT OF SPEED AND DIRECTION

From 11-MAY-94 To 14-MAY-94

0 8 16 24 32 40 48 56  
No. of Obs.

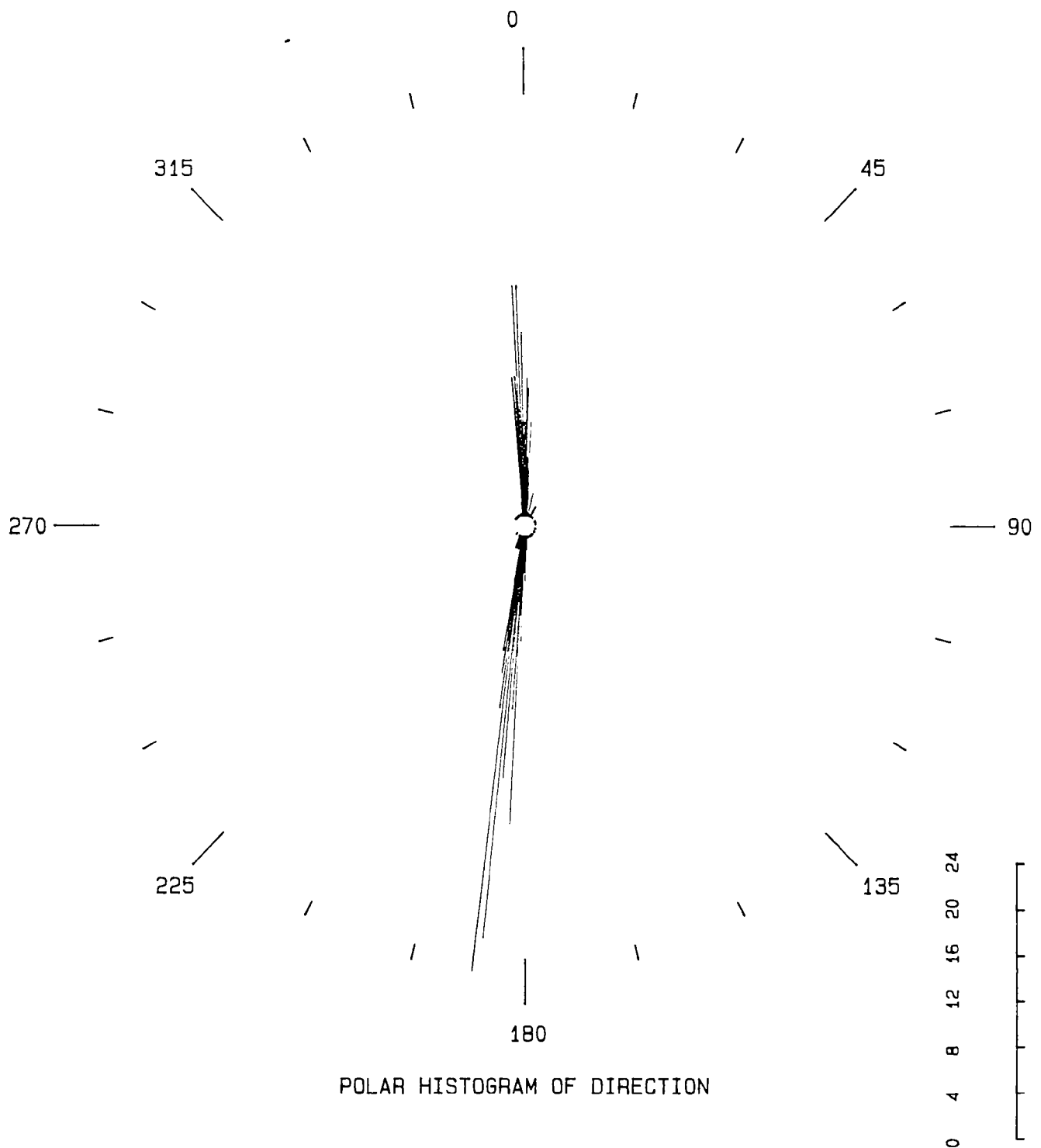
ENDECO Type 174SSM Solid State Memory Current Meter

FIGURE 9

NORTH CURRENT METER

POLAR HISTOGRAM

KEY WEST OUTFALL STUDY - NORTHWEST CURRENT METER



POLAR HISTOGRAM OF DIRECTION

From 11-MAY-94 To 14-MAY-94

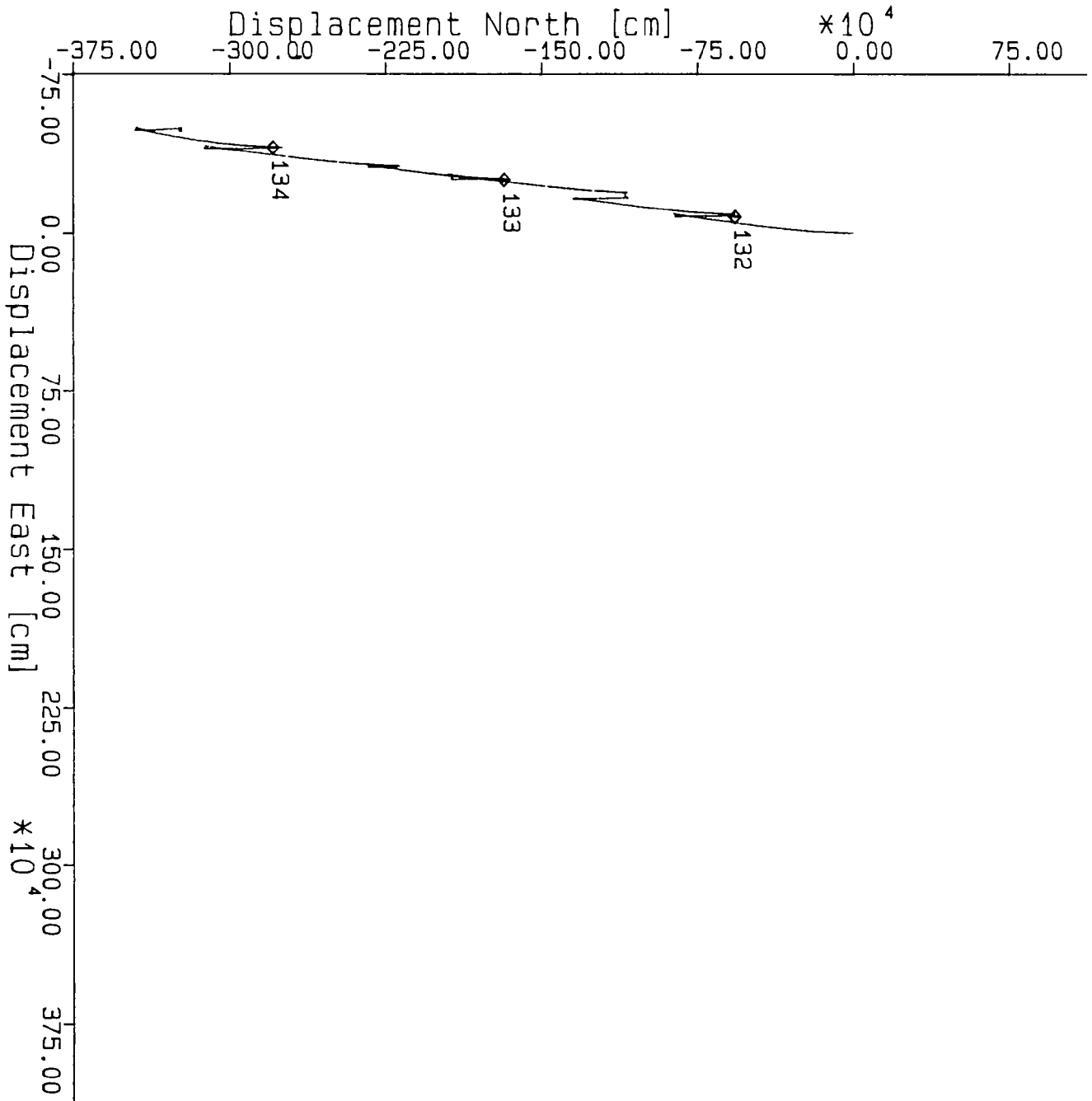
No. of Obs.

ENDECO Type 174SSM Solid State Memory Current Meter

FIGURE 10

ENDECO Type 1 NORTH CURRENT METER  
Progressive Vector Plot

KEY WEST OUTFALL STUDY - NORTHWEST CURRENT METER



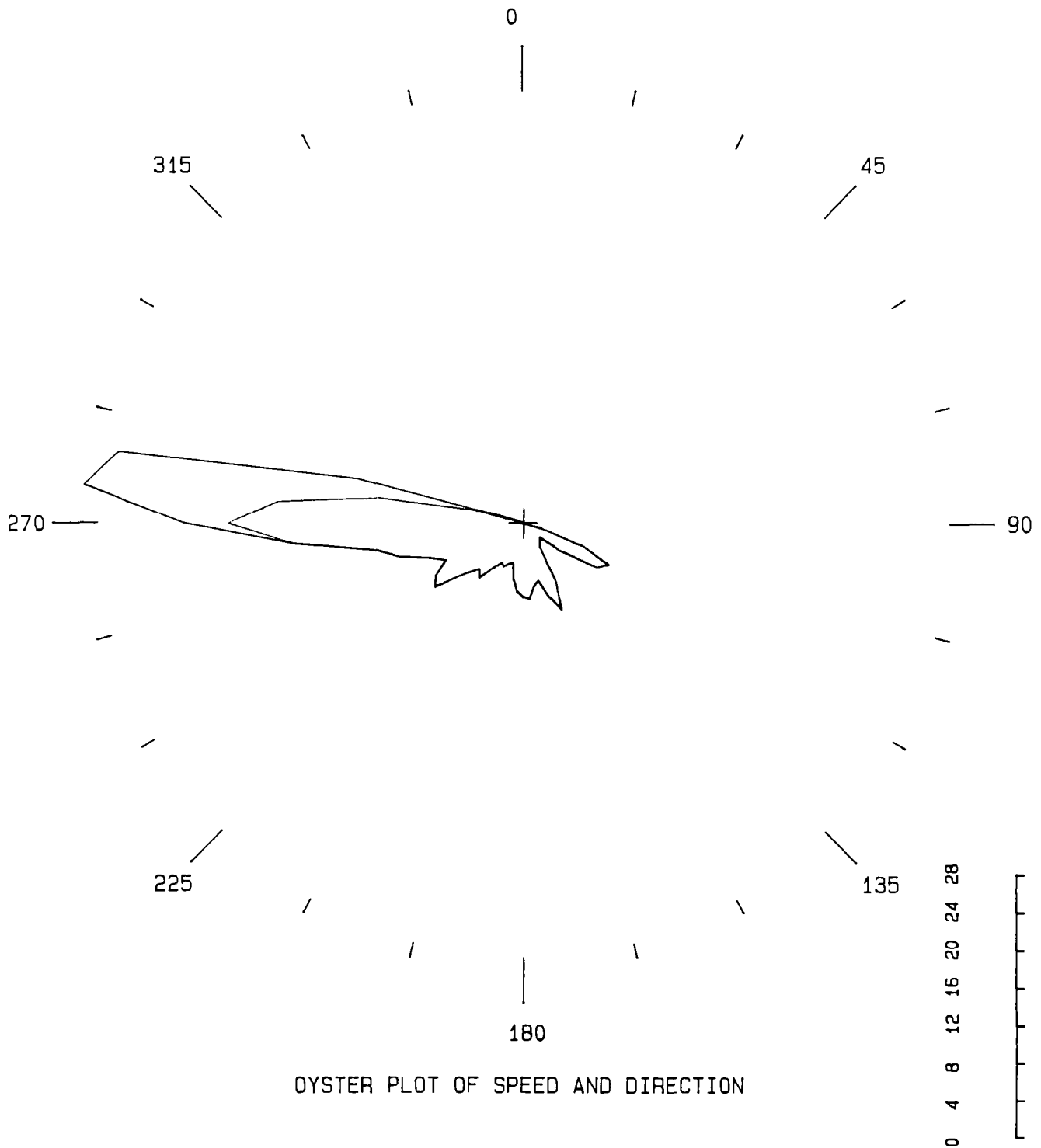
# FIGURE 11

## EAST CURRENT METER

### OYSTER PLOT

KEY WEST OUTFALL STUDY - EAST-SOUTHEAST CURRENT METER

Speed Class Interval = 20.00



OYSTER PLOT OF SPEED AND DIRECTION

From 11-MAY-94 To 14-MAY-94

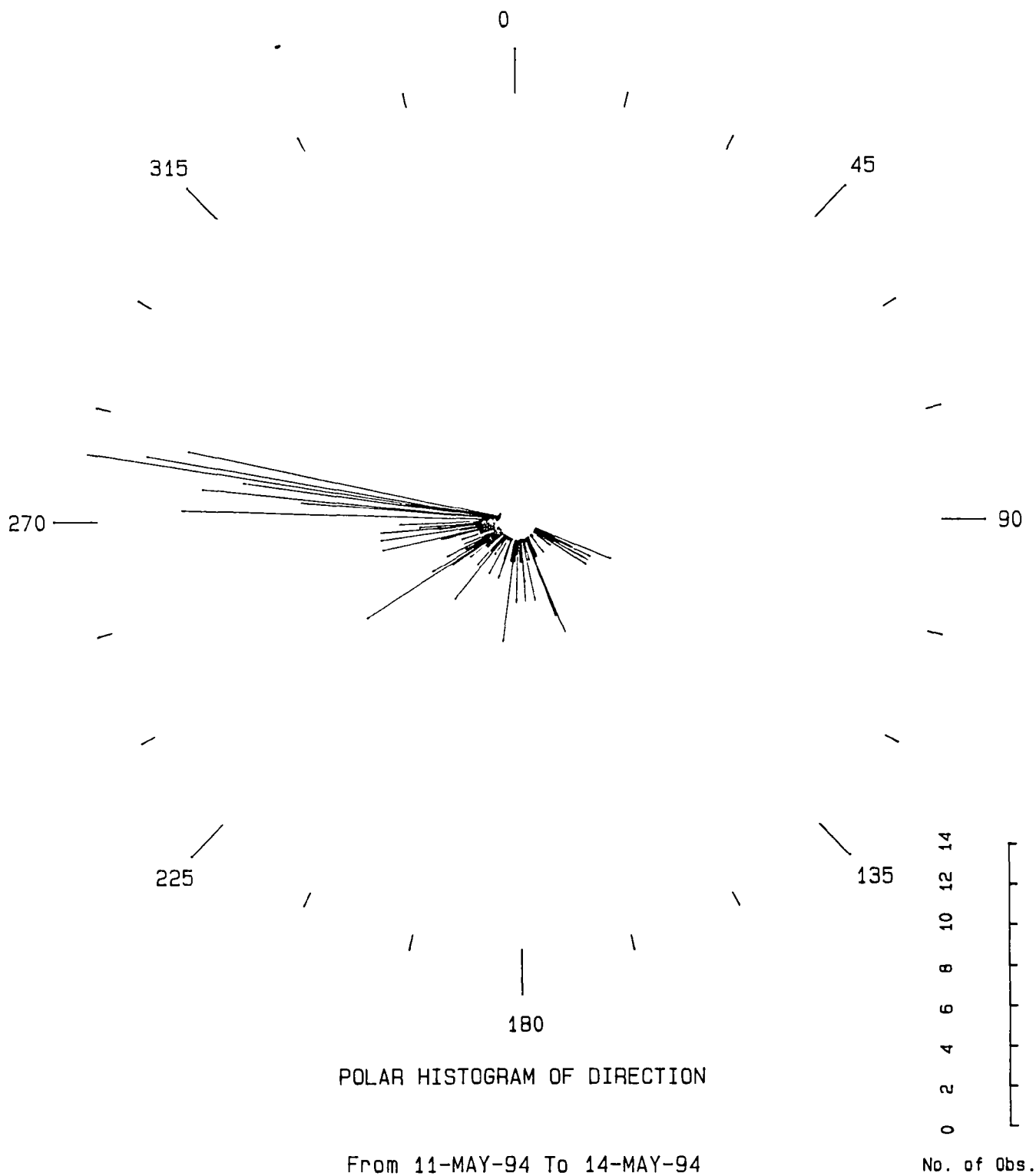
ENDECO Type 174SSM Solid State Memory Current Meter



# FIGURE 12

## EAST CURRENT METER POLAR HISTOGRAM

KEY WEST OUTFALL STUDY - EAST-SOUTHEAST CURRENT METER

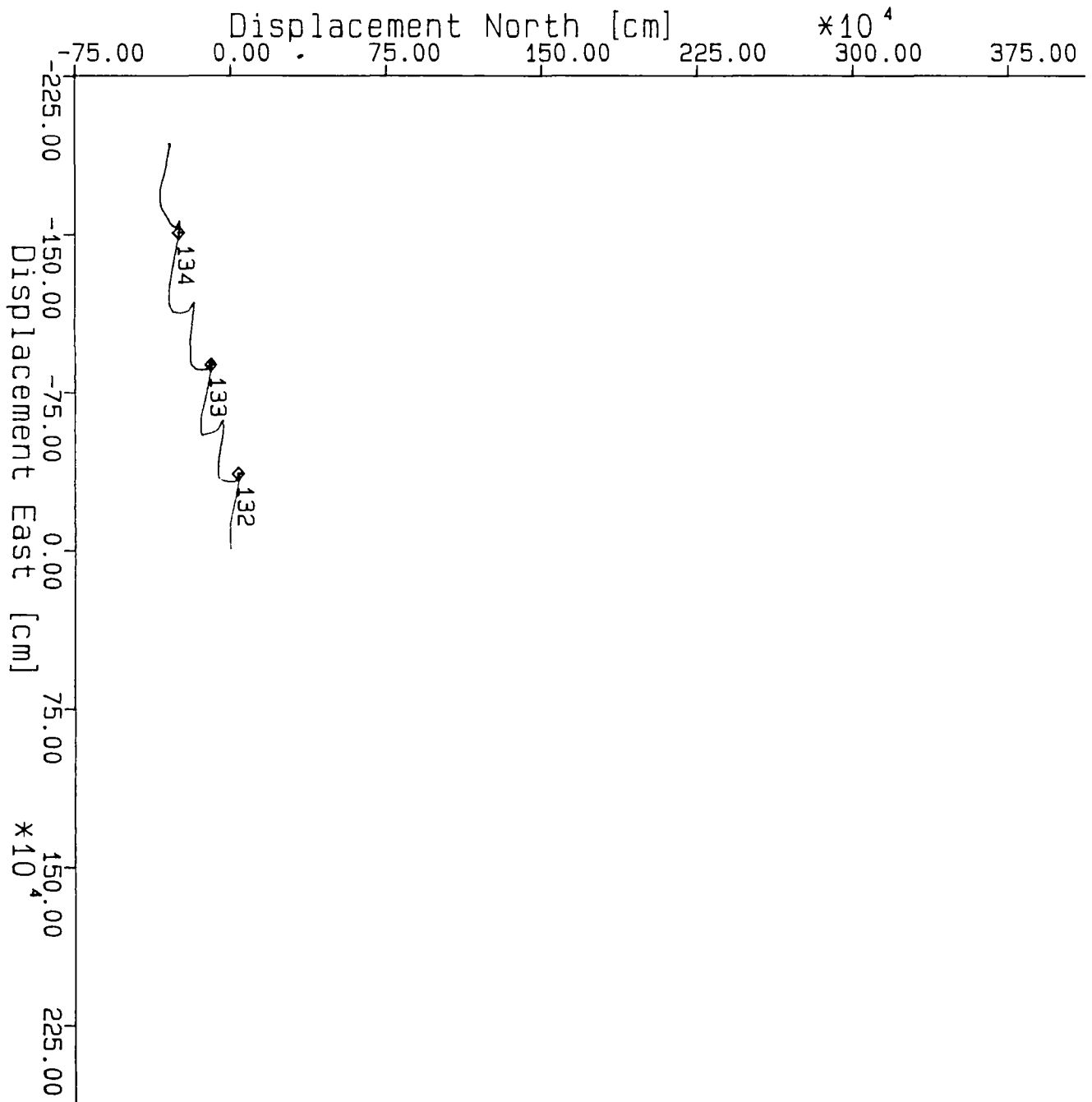


ENDECO Type 174SSM Solid State Memory Current Meter

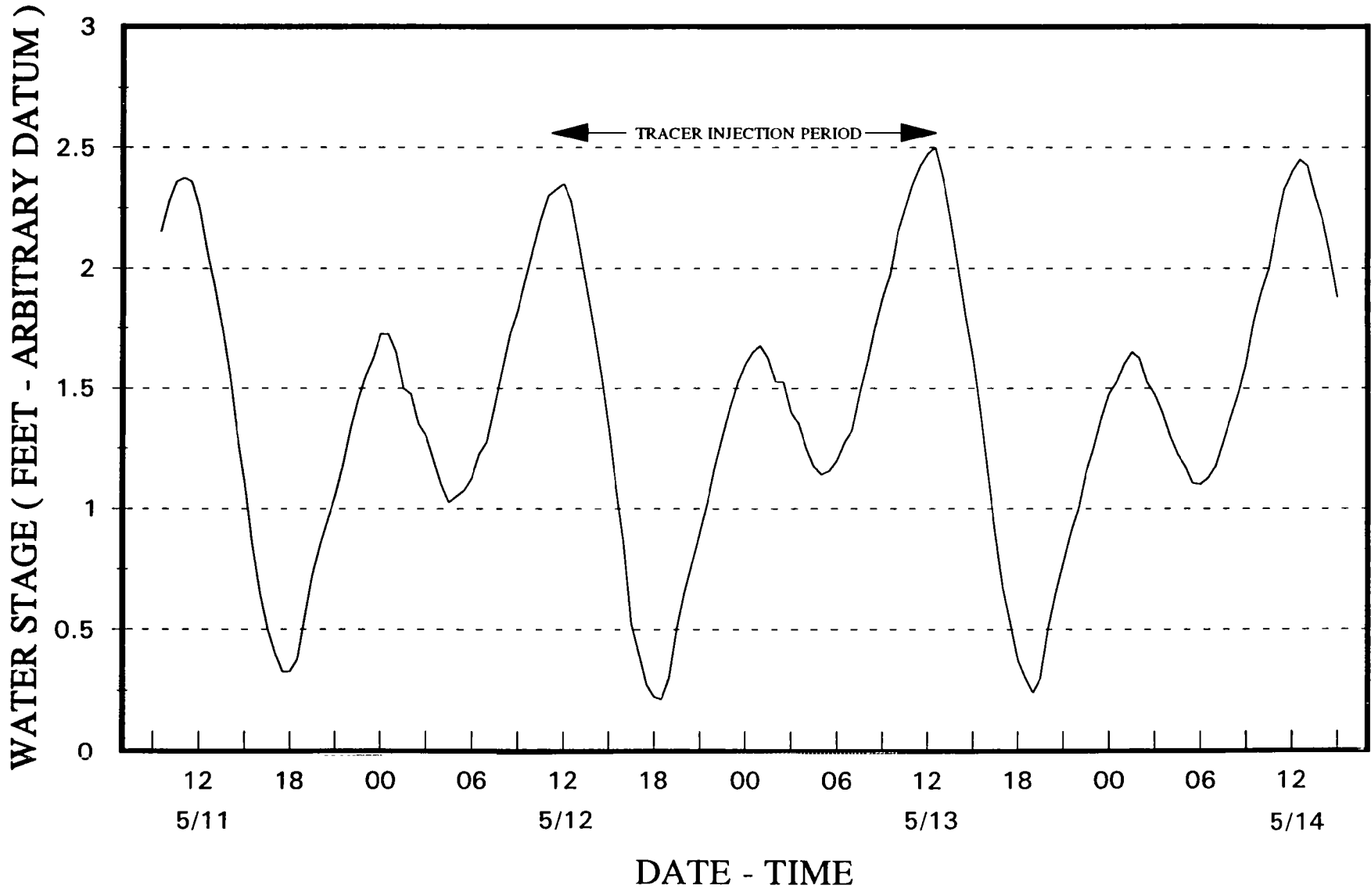
FIGURE 13

ENDECO Type 17, EAST CURRENT METER y Current Meter  
PROGRESSIVE VECTOR PLOT

KEY WEST OUTFALL STUDY - EAST-SOUTHEAST CURRENT METER

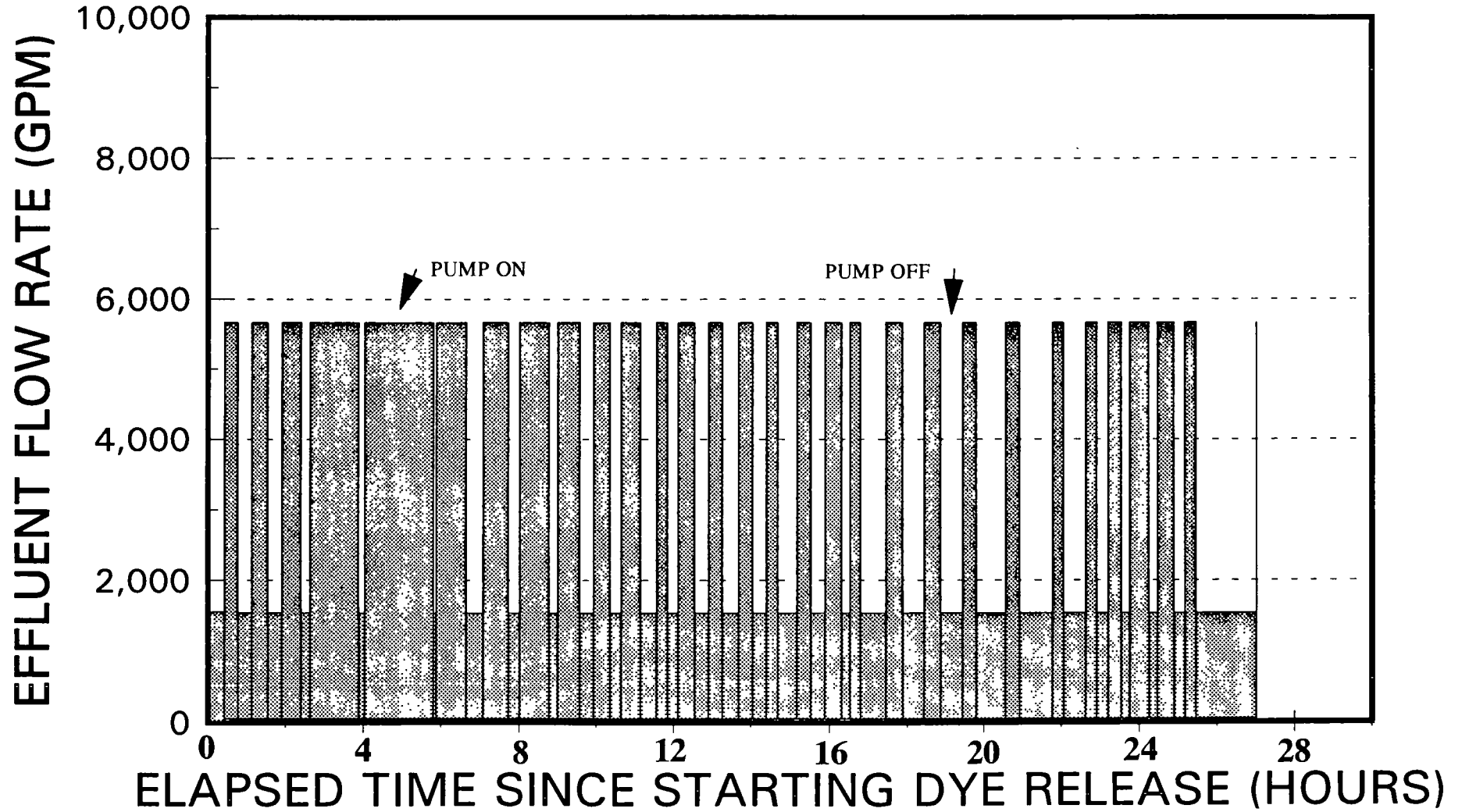


**FIGURE 14**  
**TIDE RECORD - KEY WEST AT TRUMBLE PT.**  
**KEY WEST, FLORIDA MAY 11-14/94**

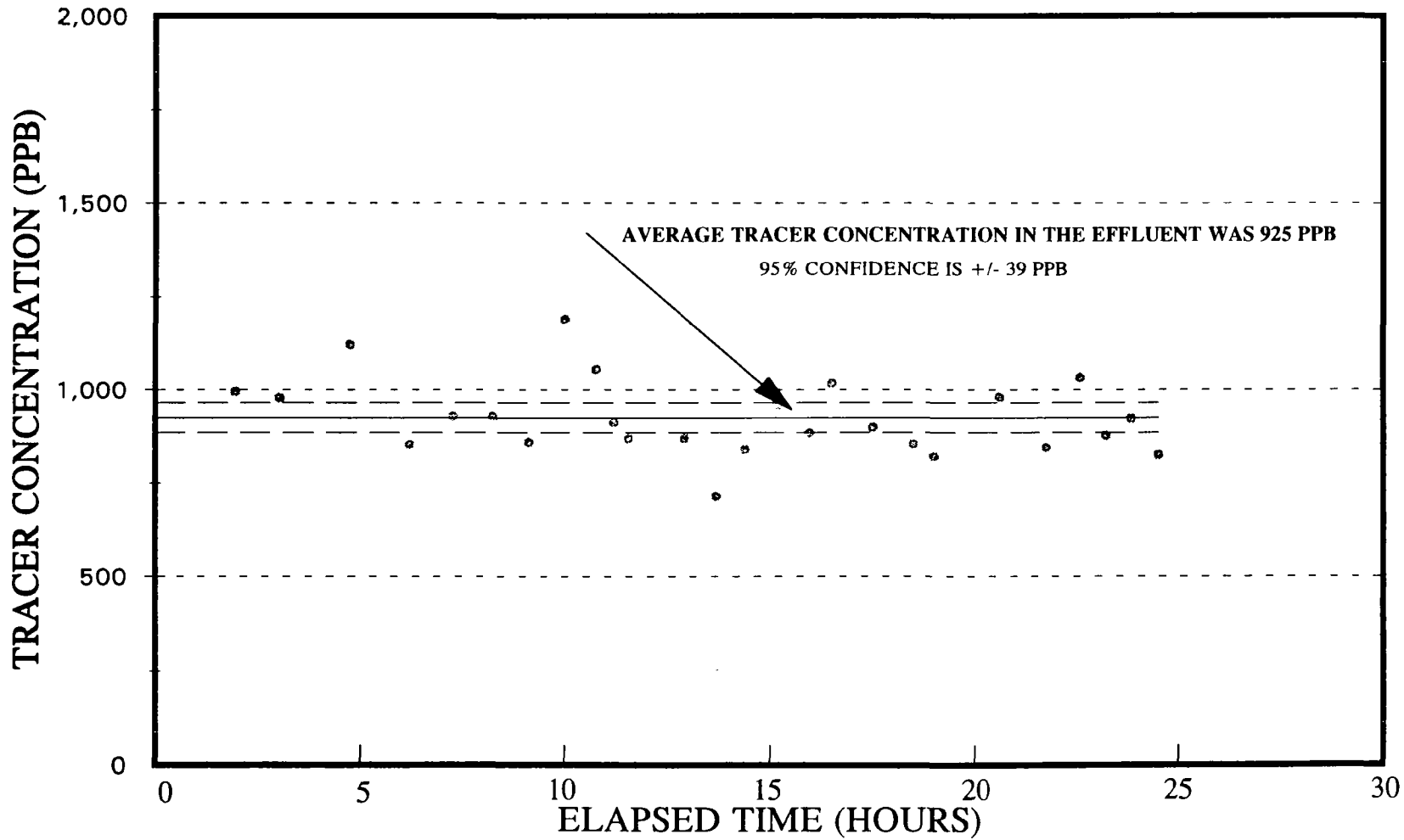


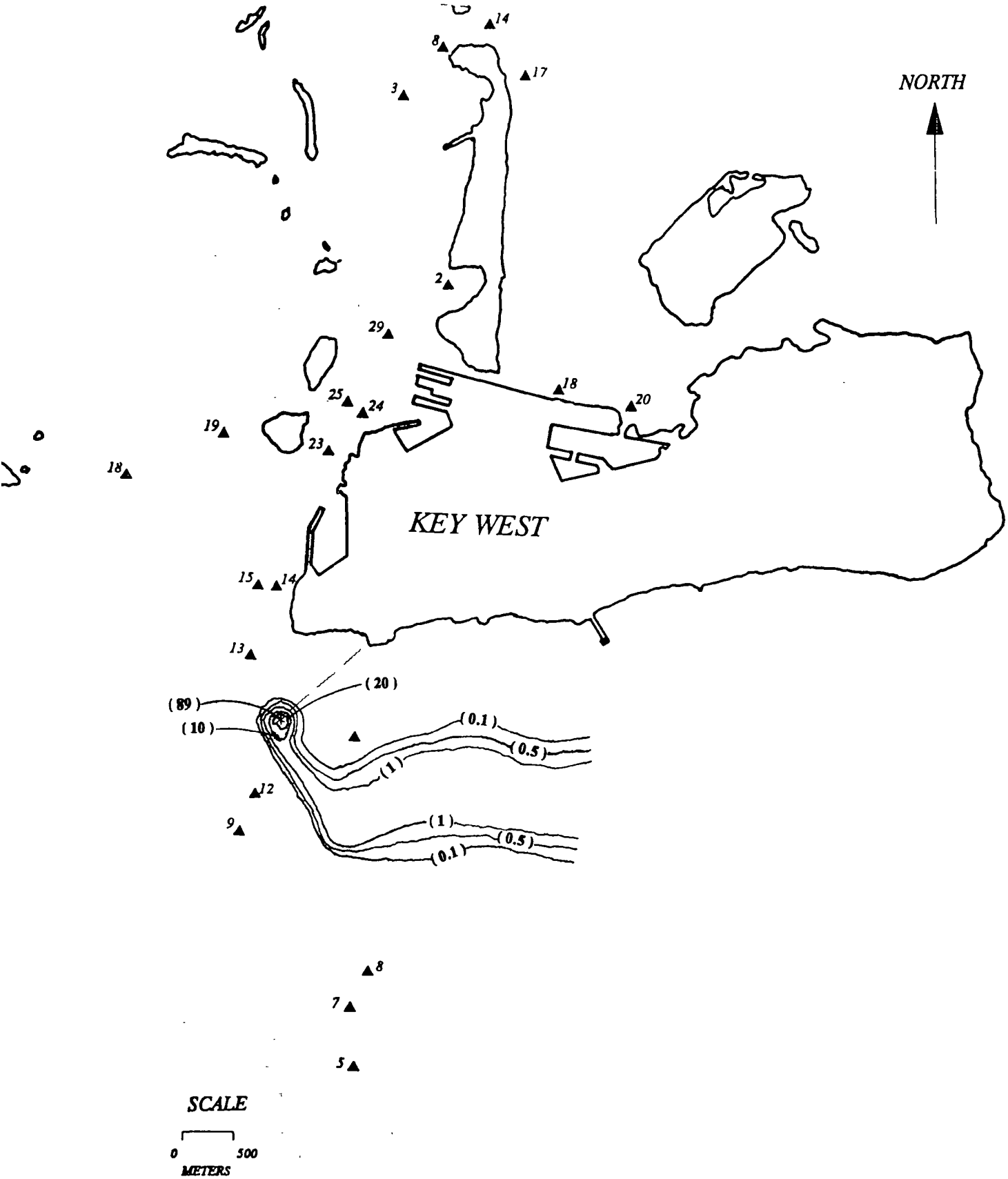
# FIGURE 15

## KEY WEST POTW - EFFLUENT PUMP CYCLES MAY 12 - 13, 1994

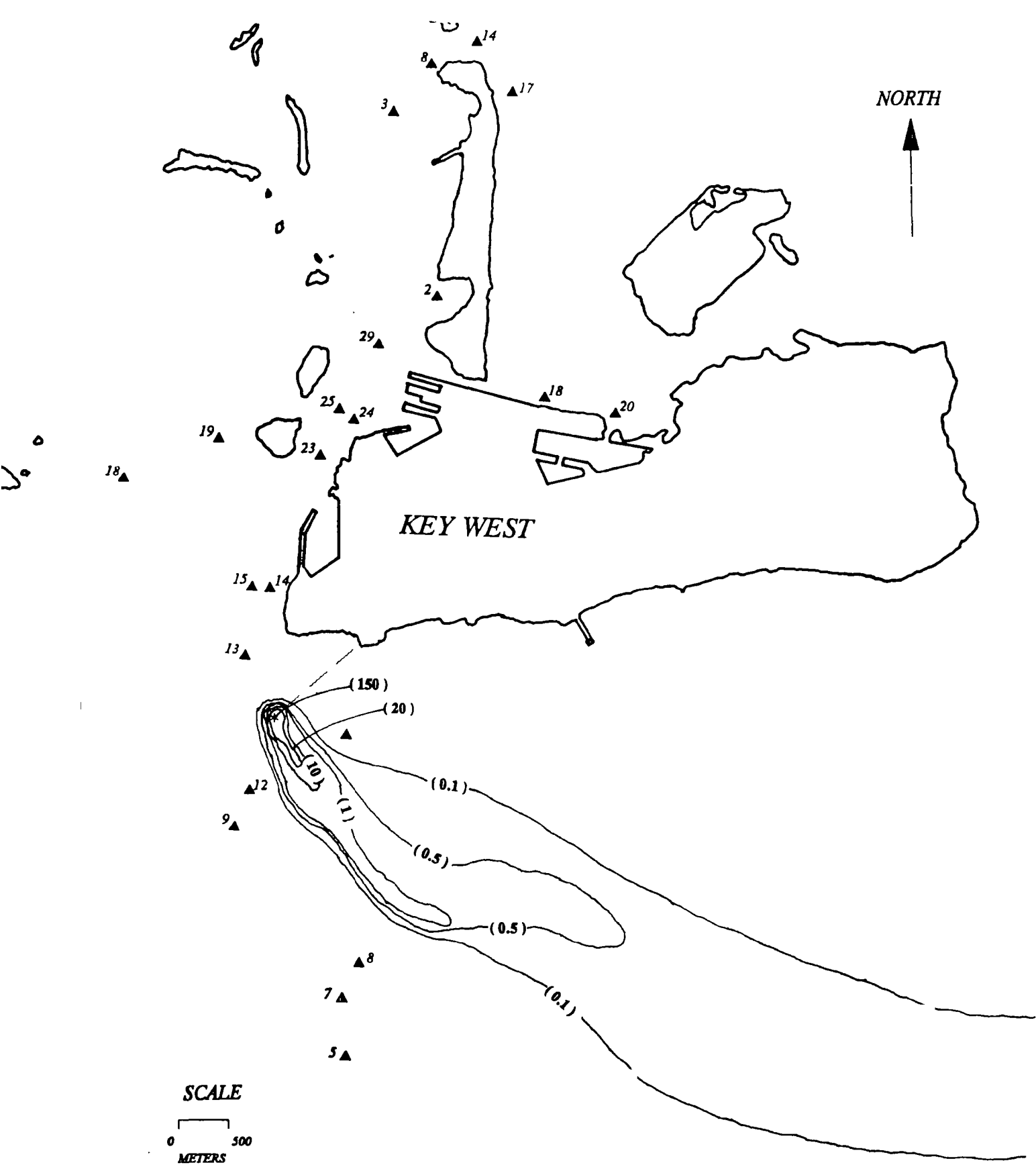


**FIGURE 16**  
**TRACER CONCENTRATION IN EFFLUENT**  
**5/12 - 13/94**



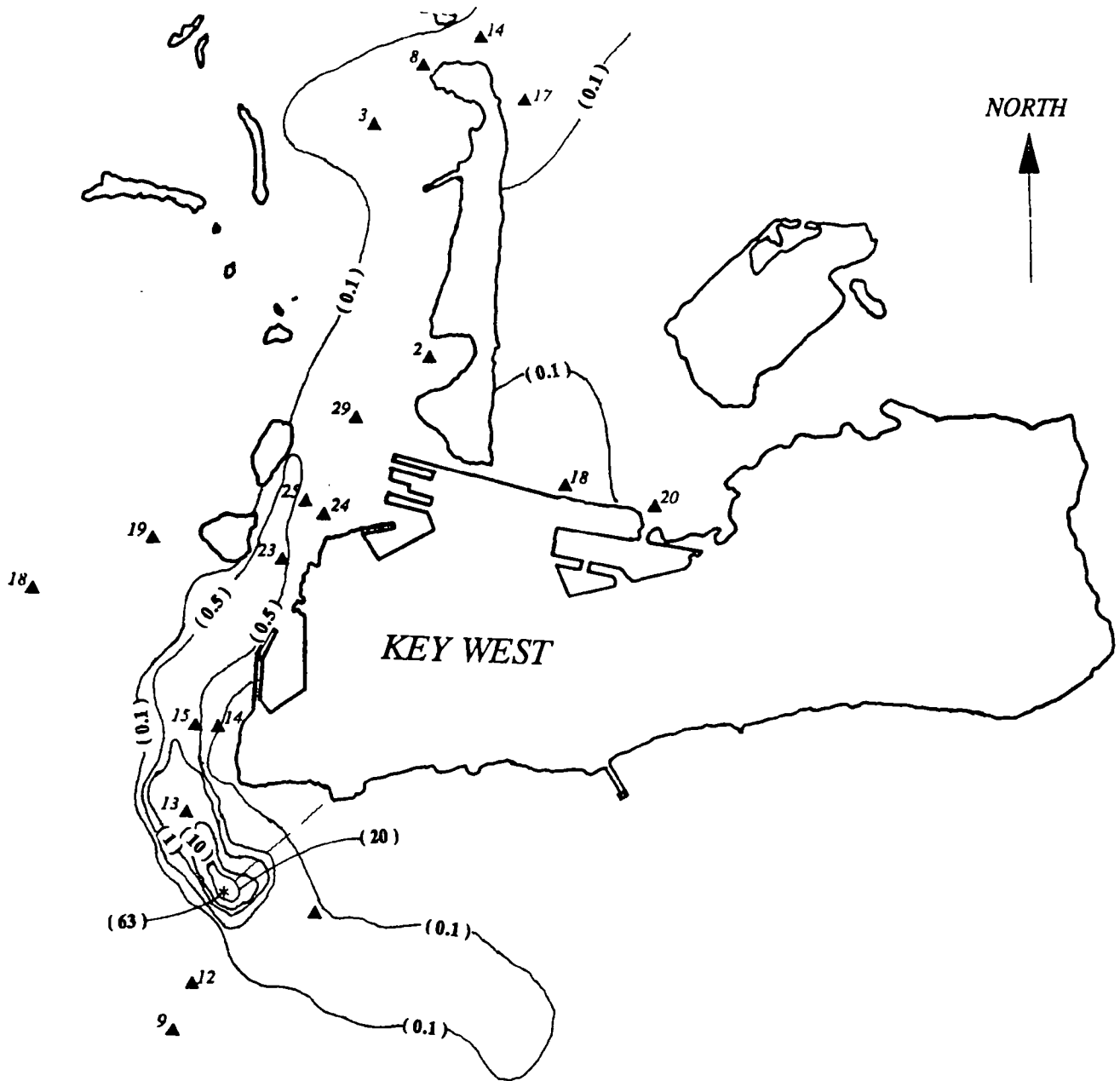


**FIGURE 17**  
 DYE TRACER ISOPLETHS (UG/L)  
 INITIAL PERIOD 1130-1530 5/12  
 KEY WEST, FL  
 MAY, 1994



**FIGURE 18**  
 DYE TRACER ISOPLETHS (UG/L)  
 LOW TIDE 1700-1945 5/12

KEY WEST, FL  
 MAY, 1994



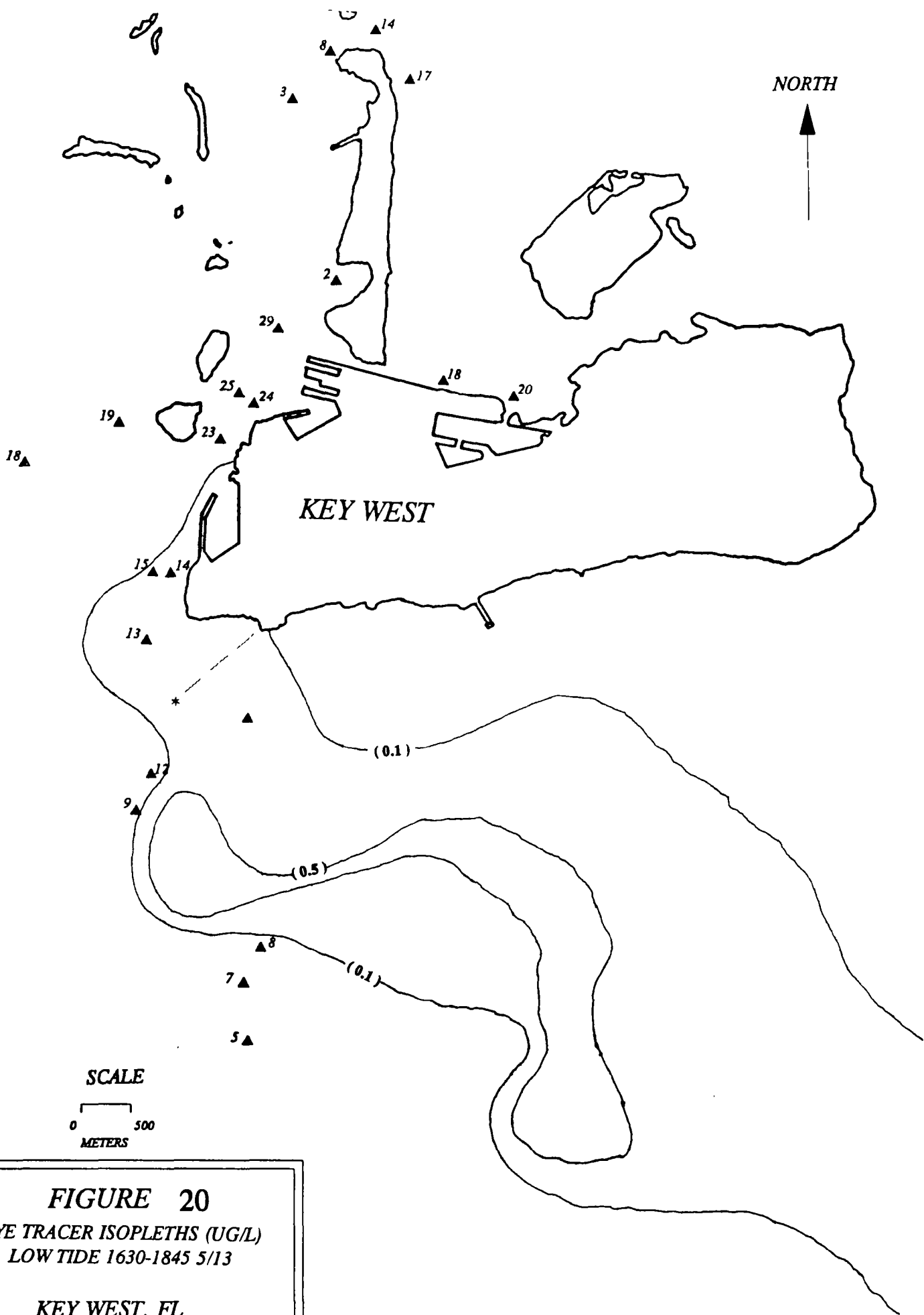
**FIGURE 19**

*E* TRACER ISOPLETHS (UG/L)  
HIGH TIDE 0930-1330 5/13

KEY WEST, FL

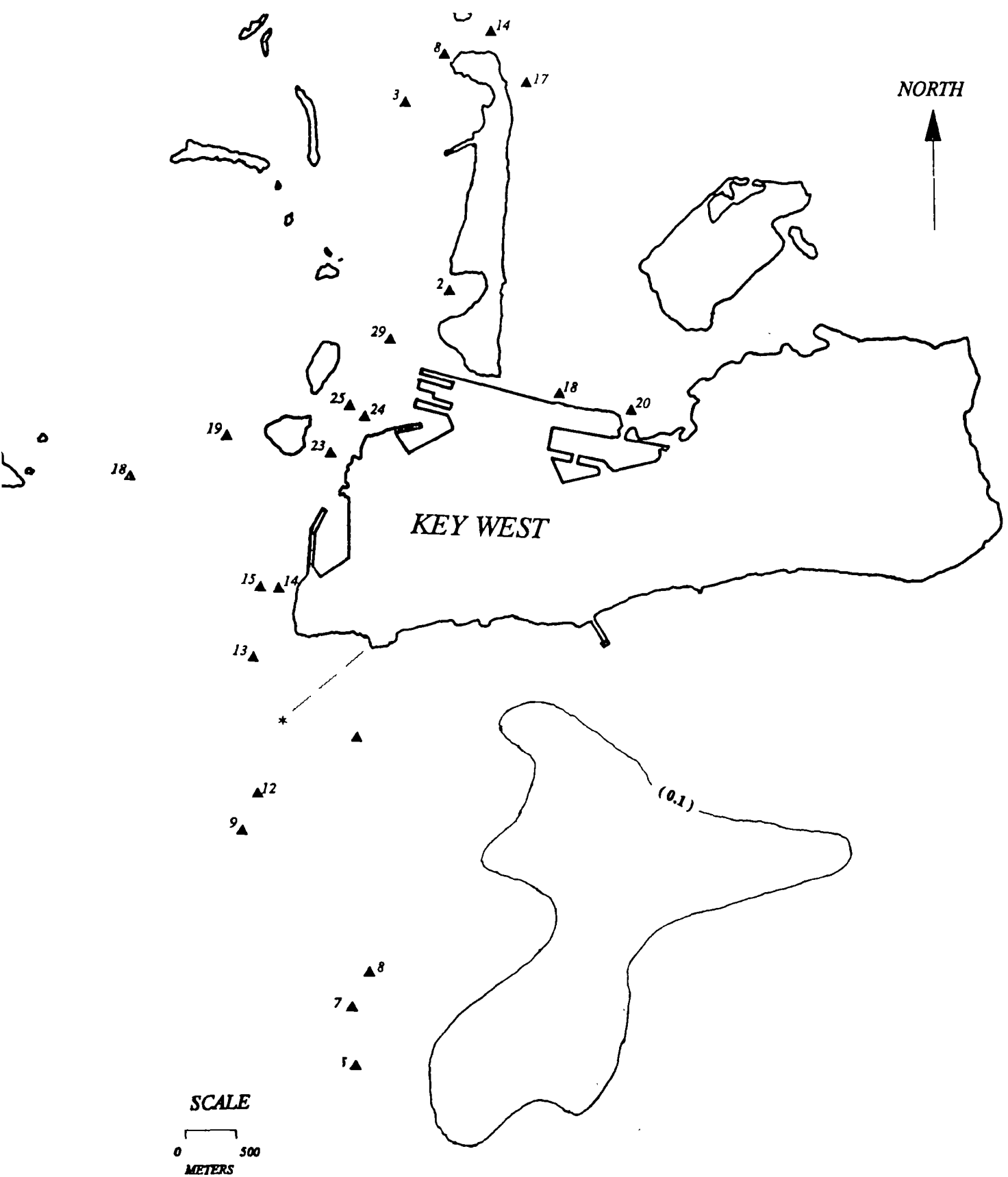
MAY, 1994





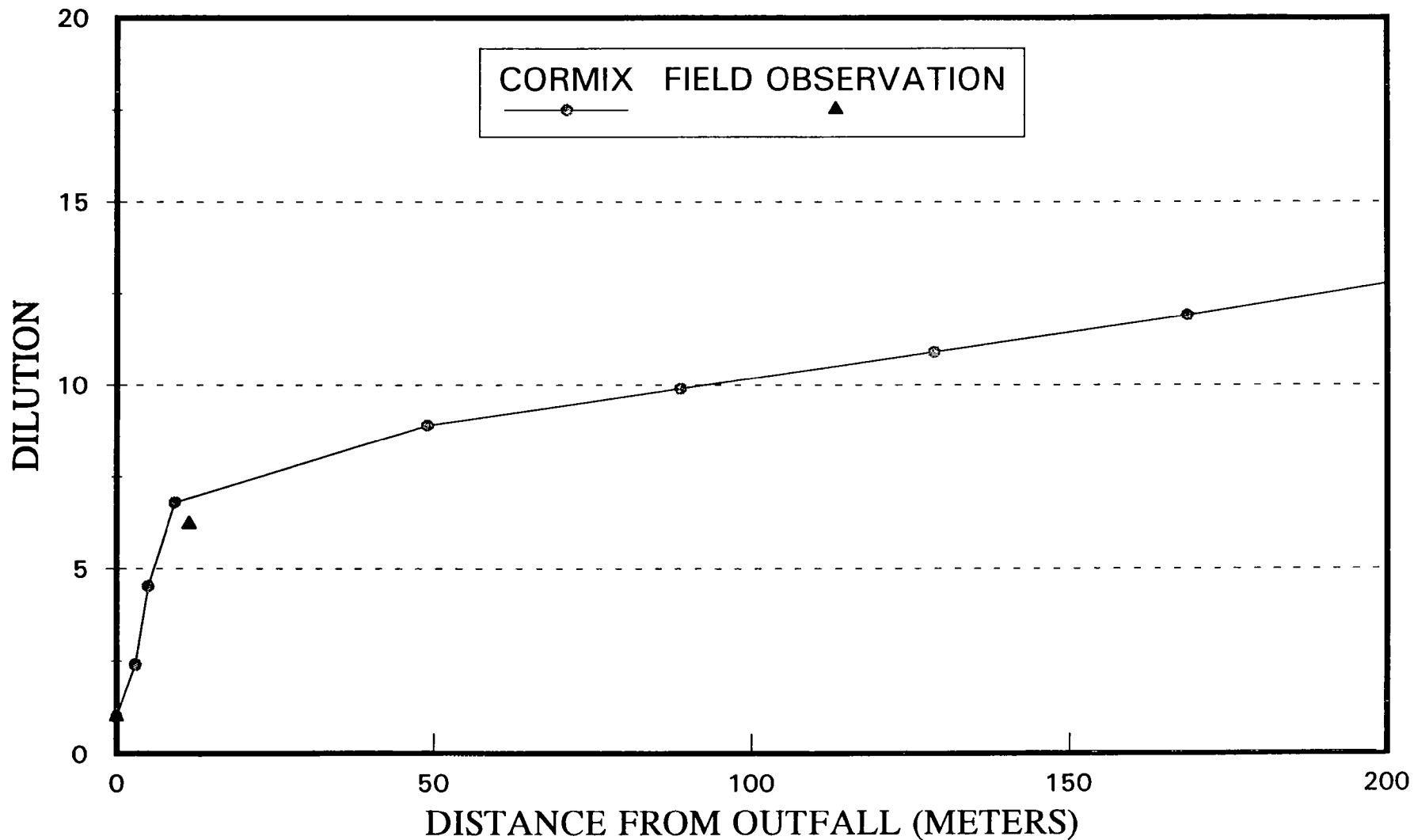
**FIGURE 20**  
 DYE TRACER ISOPLETHS (UG/L)  
 LOW TIDE 1630-1845 5/13

**KEY WEST, FL**  
**MAY, 1994**

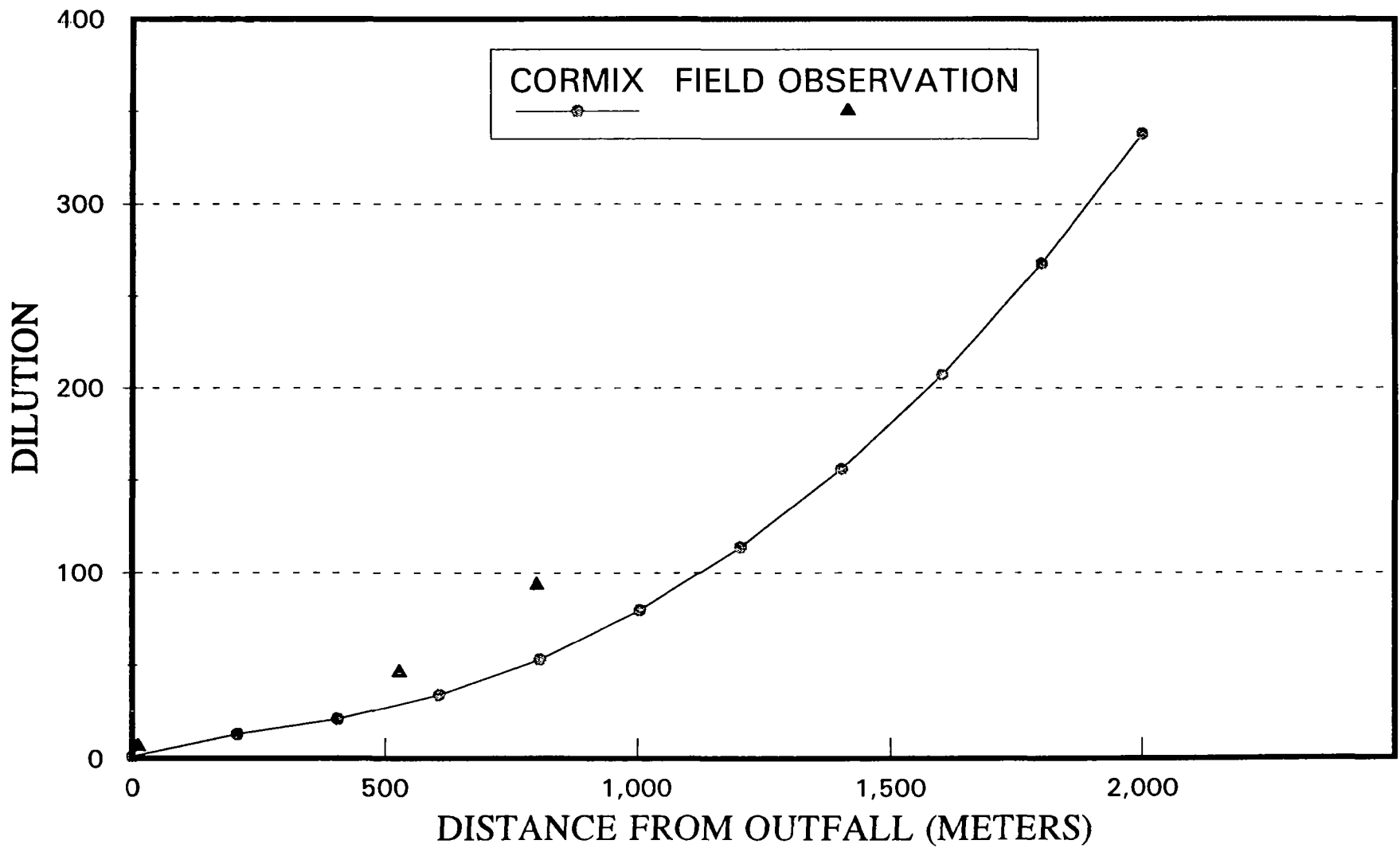


**FIGURE 21**  
 DYE TRACER ISOPLETHS (UG/L)  
 HIGH TIDE 1045-1400 5/14  
 KEY WEST, FL  
 MAY, 1994

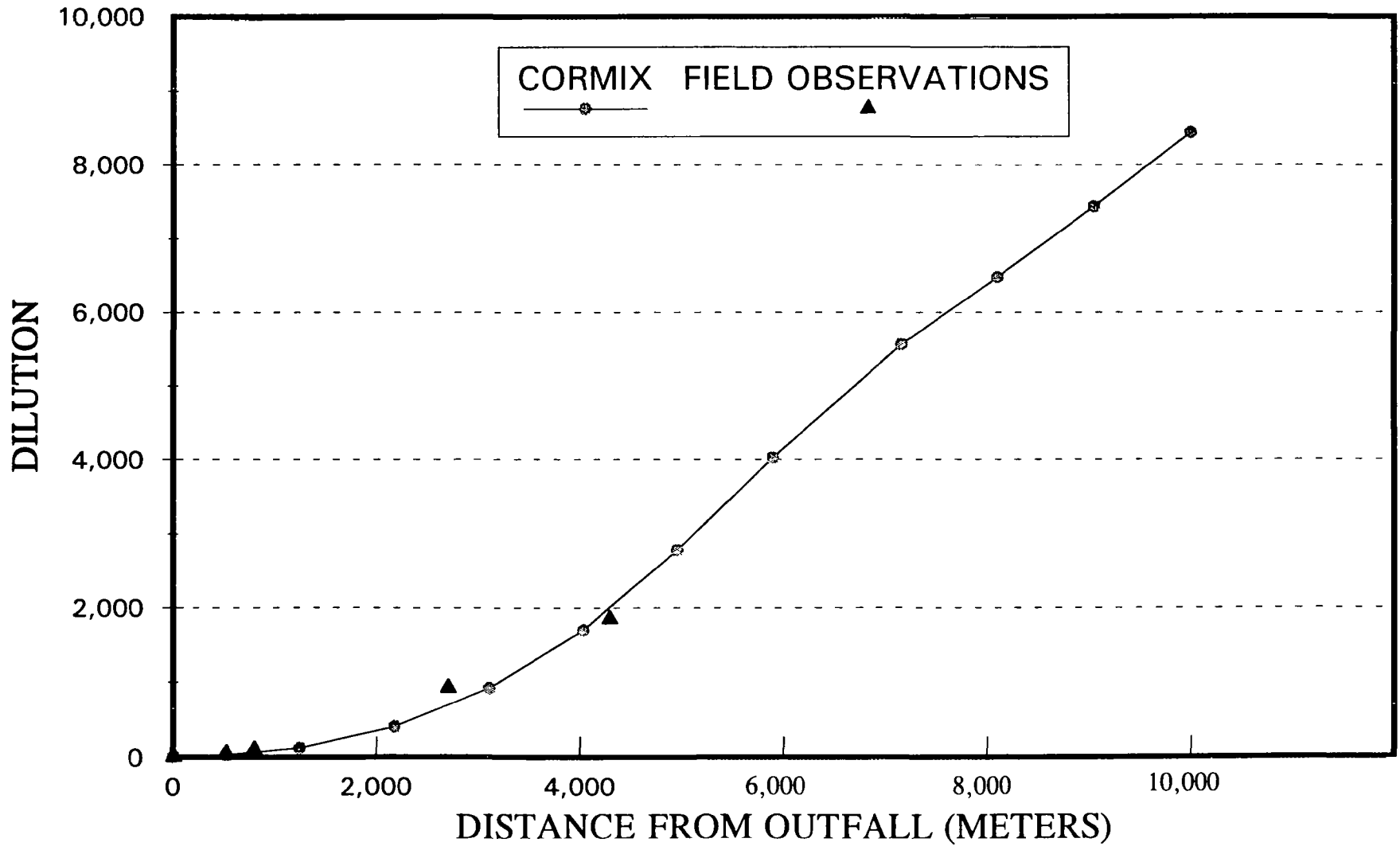
**FIGURE 22**  
**MODEL PREDICTIONS - ZONE OF INITIAL DILUTION**  
**CORMIX MODEL - MAY, 1994**



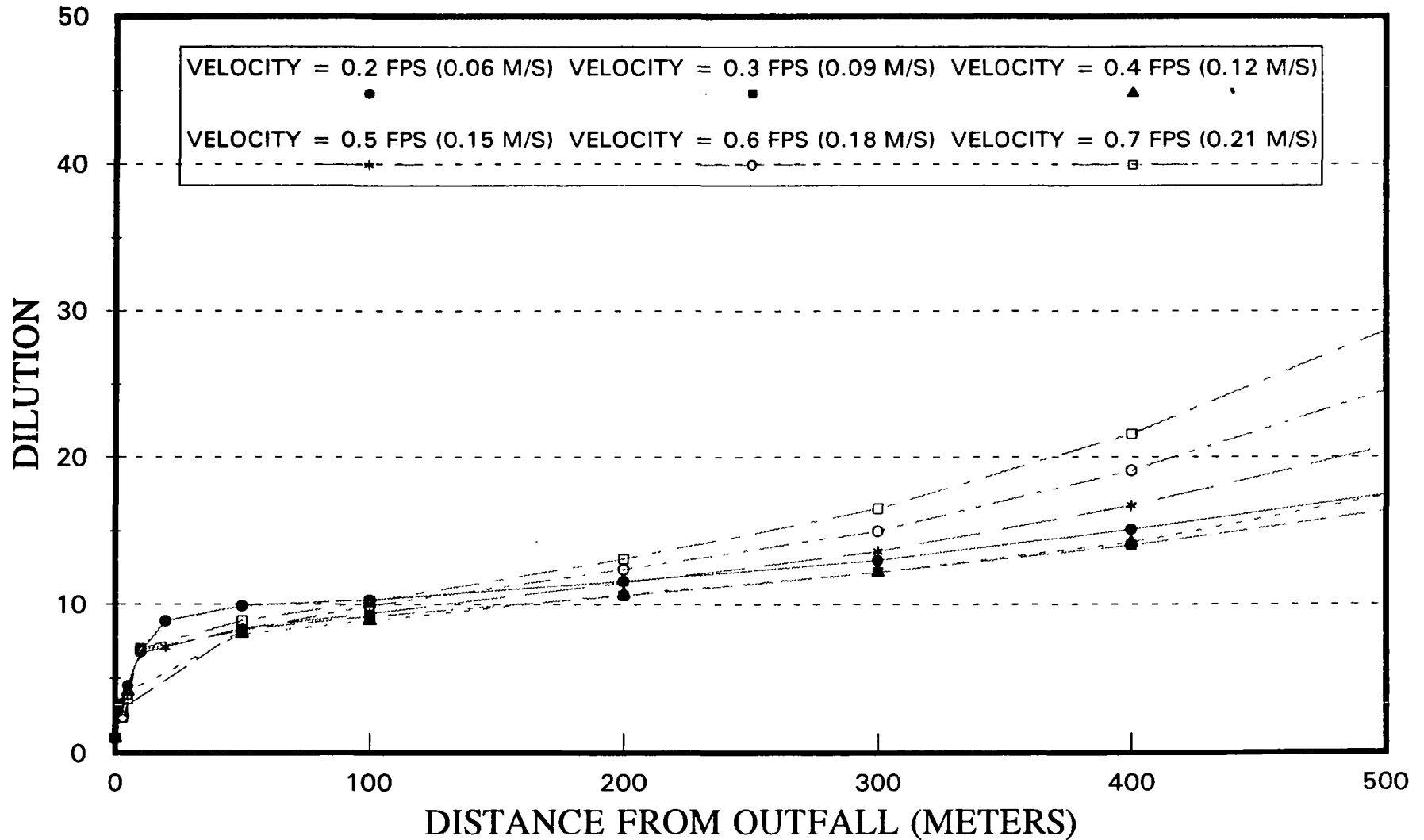
**FIGURE 23**  
**MODEL PREDICTIONS - NEAR FIELD DILUTION**  
**CORMIX MODEL - MAY, 1994**



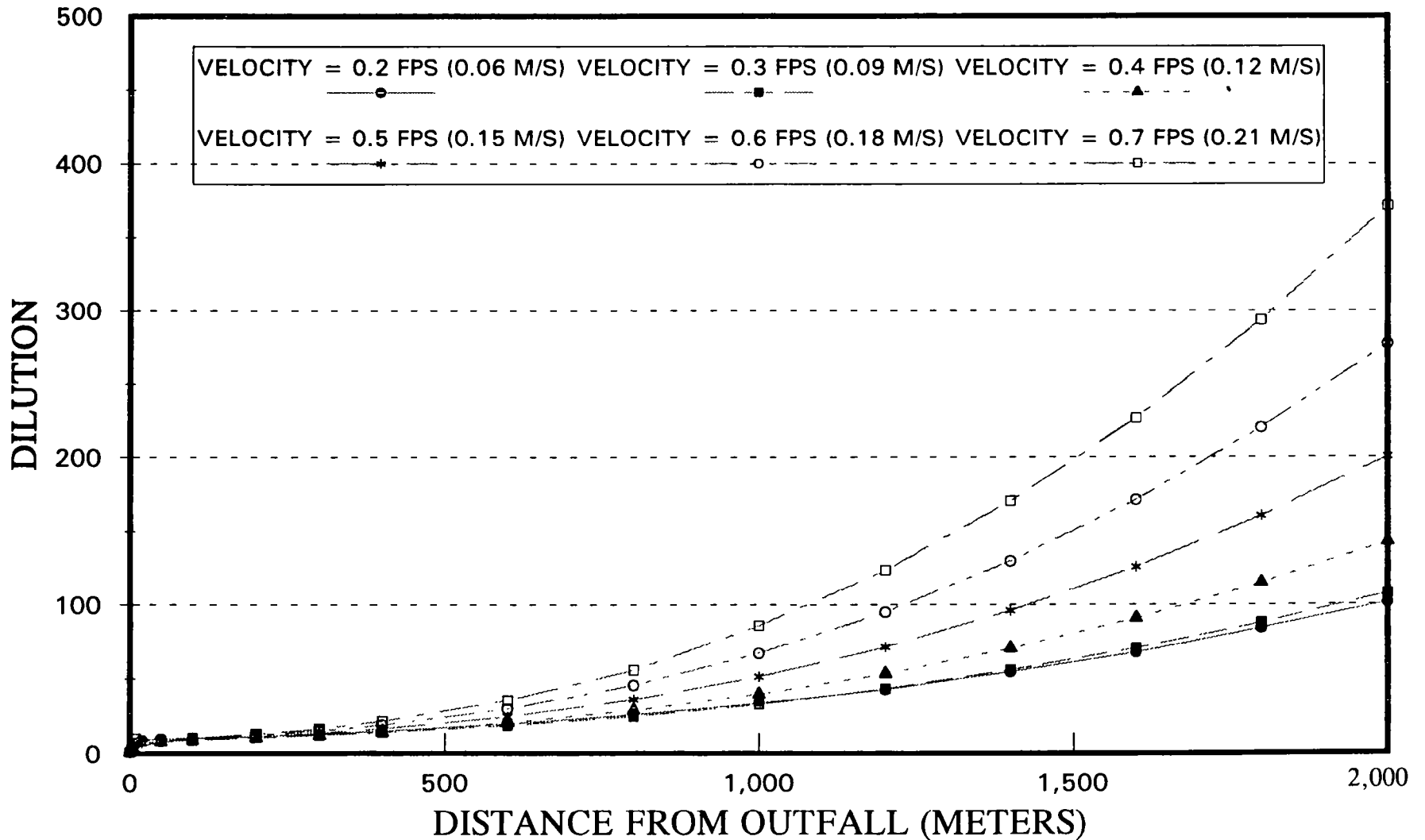
**FIGURE 24**  
**MODEL PREDICTIONS - FAR FIELD DILUTION**  
**CORMIX MODEL - MAY ,1994**



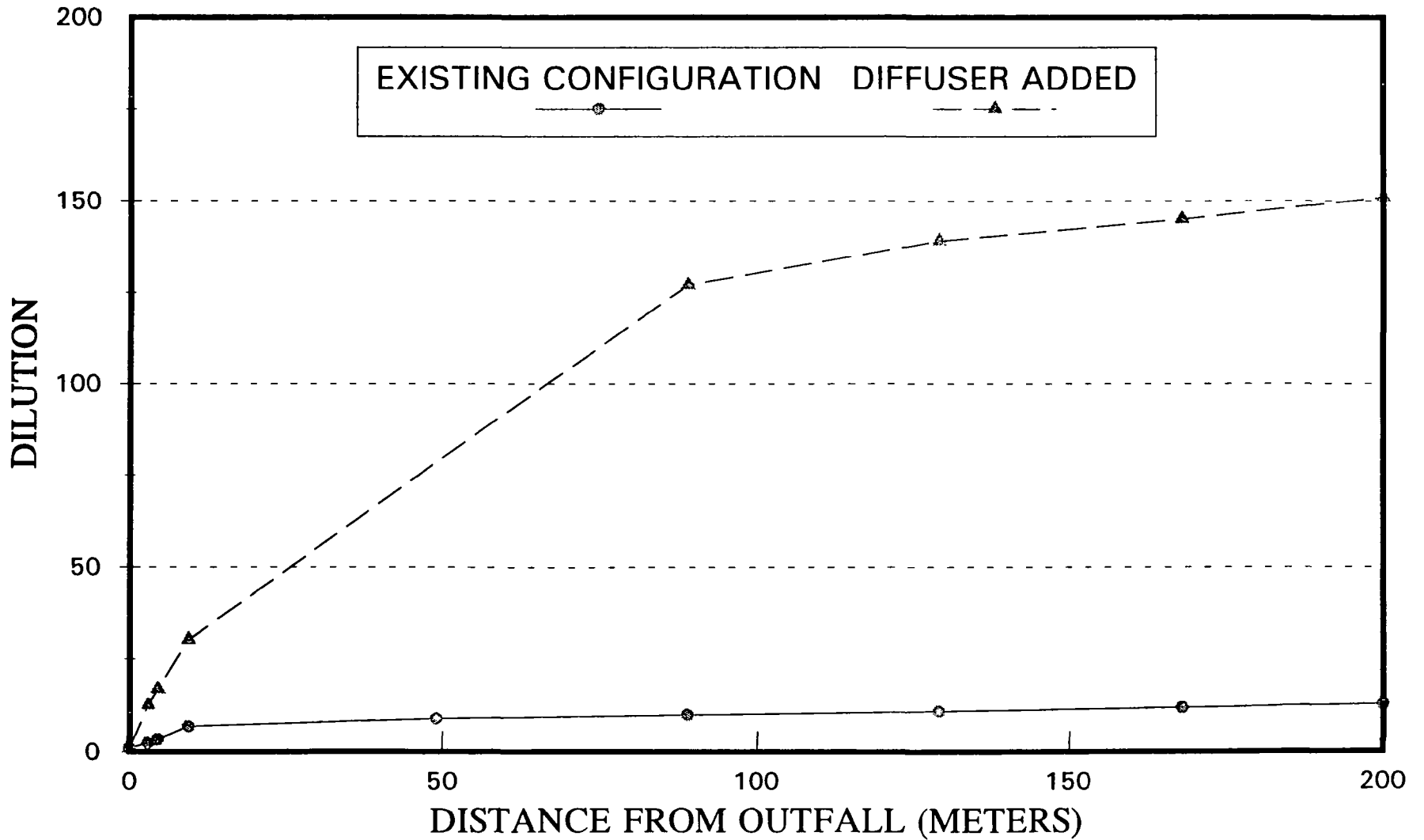
**FIGURE 25**  
**MODEL PREDICTIONS - ZID**  
**CORMIX MODEL - VARIABLE AMBIENT CURRENT**



**FIGURE 26**  
**MODEL PREDICTIONS - NEAR FIELD**  
**CORMIX MODEL - VARIABLE AMBIENT CURRENT**

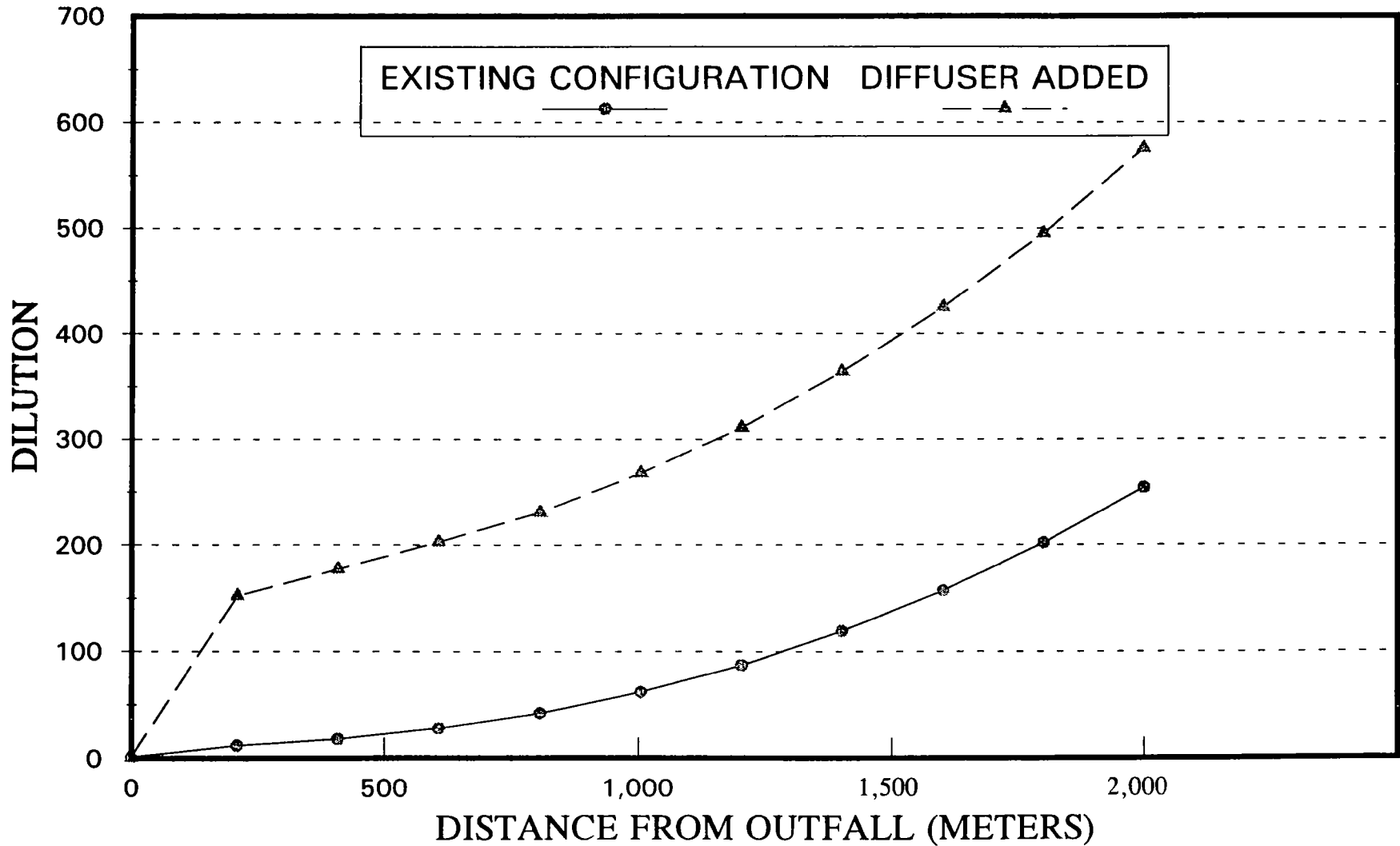


**FIGURE 27**  
**MODEL PREDICTIONS - ZONE OF INITIAL DILUTION**  
**CORMIX MODEL - DIFFUSER ADDED**





**FIGURE 28**  
**MODEL PREDICTIONS - NEAR FIELD DILUTION**  
**CORMIX MODEL - DIFFUSER ADDED**



# APPENDIX A

\* WIND DATA \*

WIND DATA  
 TRUMBO PT  
 MAY 12-14  
 KEY WEST, FL

DATE	TIME MIN	WIND SPEED M/S	WIND DIR DEG	DIR STD DEV
5 12 1994	1020	2.929	140.3	14.36
5 12 1994	1030	2.79	145.9	20.17
5 12 1994	1040	2.889	159.4	22.25
5 12 1994	1050	2.859	167.4	20.92
5 12 1994	1100	2.543	165.8	23.21
5 12 1994	1110	2.562	175.1	29.87
5 12 1994	1120	3.156	165.1	28.42
5 12 1994	1130	3.078	168.8	26.12
5 12 1994	1140	3.171	189.3	25.82
5 12 1994	1150	2.303	205.3	24.44
5 12 1994	1200	2.724	228	22.86
5 12 1994	1210	2.908	190.9	25.45
5 12 1994	1220	3.192	218.4	21.44
5 12 1994	1230	3.899	243.5	14.41
5 12 1994	1240	4.29	255.4	8.63
5 12 1994	1250	4.57	258.3	7.37
5 12 1994	1300	4.243	256	11.89
5 12 1994	1310	4.2	259.5	9.97
5 12 1994	1320	3.755	257.8	11.66
5 12 1994	1330	3.815	262	8.47
5 12 1994	1340	3.947	256.5	6.379
5 12 1994	1350	3.731	256.3	7.81
5 12 1994	1400	3.729	248.5	8.53
5 12 1994	1410	3.369	250.3	11.19
5 12 1994	1420	3.69	254.7	7.98
5 12 1994	1430	3.464	249.6	8.11
5 12 1994	1440	3.404	252	9.56
5 12 1994	1450	3.393	267.8	21.73
5 12 1994	1500	3.169	294.5	12.57
5 12 1994	1510	3.012	297.6	15.52
5 12 1994	1520	2.693	295.6	15.18
5 12 1994	1530	2.281	1.493	31.34
5 12 1994	1540	2.976	9.55	27.42
5 12 1994	1550	2.676	5.768	29.47
5 12 1994	1600	2.475	10.17	30.5
5 12 1994	1610	2.656	11.85	25.57
5 12 1994	1620	2.356	11.27	30.19
5 12 1994	1630	2.319	13.4	26.92
5 12 1994	1640	2.237	12.7	27.75
5 12 1994	1650	2.682	8.79	21.53
5 12 1994	1700	2.588	12.41	24.3
5 12 1994	1710	2.703	9.25	23.24
5 12 1994	1720	2.334	11.27	26.72
5 12 1994	1730	2.276	8.98	25.64
5 12 1994	1740	2.179	7.07	30.22
5 12 1994	1750	1.954	7.16	33.6
5 12 1994	1800	2.347	354.2	34.33

WIND DATA  
 TRUMBO PT  
 MAY 12-14  
 KEY WEST, FL

DATE	TIME MIN	WIND SPEED M/S	WIND DIR DEG	DIR STD DEV
5 12	1994	1810	2.58	5.664 30.88
5 12	1994	1820	2.767	8.47 28.27
5 12	1994	1830	2.966	11.84 24
5 12	1994	1840	2.992	14.28 22.55
5 12	1994	1850	2.814	15.84 24.49
5 12	1994	1900	2.91	13.41 22.47
5 12	1994	1910	2.703	10.3 24.29
5 12	1994	1920	2.805	8.66 27.7
5 12	1994	1930	2.774	7.83 25.11
5 12	1994	1940	2.509	9.77 25.31
5 12	1994	1950	2.718	10.38 24.6
5 12	1994	2000	2.533	9.49 23.95
5 12	1994	2010	3.129	7.46 27.1
5 12	1994	2020	3.37	9.26 24.37
5 12	1994	2030	3.134	11.34 20.48
5 12	1994	2040	2.878	12.71 21.9
5 12	1994	2050	3.416	9.12 21.4
5 12	1994	2100	3.487	11.33 19.28
5 12	1994	2110	3.491	11.27 21
5 12	1994	2120	3.67	7.13 17.2
5 12	1994	2130	3.397	10.19 19.28
5 12	1994	2140	3.763	13.17 12.01
5 12	1994	2150	4.696	8.23 16.25
5 12	1994	2200	4.33	8.63 15.93
5 12	1994	2210	4.188	6.888 18.31
5 12	1994	2220	3.987	10.23 12.25
5 12	1994	2230	4.669	6.402 14.69
5 12	1994	2240	4.764	7.6 12.19
5 12	1994	2250	4.594	11.55 12.14
5 12	1994	2300	4.449	12.38 11.83
5 12	1994	2310	4.683	12.74 11.58
5 12	1994	2320	4.592	7.65 15.34
5 12	1994	2330	4.429	7.02 13.63
5 12	1994	2340	4.527	11.69 11.8
5 12	1994	2350	4.671	7.14 14.26
5 13	1994	0	4.412	9.76 12.03
5 13	1994	10	4.545	10.73 11.18
5 13	1994	20	4.184	7.41 15.47
5 13	1994	30	4.053	6.771 20.65
5 13	1994	40	4.408	6.94 17.71
5 13	1994	50	4.713	5.883 17.98
5 13	1994	100	4.457	7.95 18
5 13	1994	110	4.976	6.662 16.8
5 13	1994	120	4.846	16.48 13.14
5 13	1994	130	4.922	14.6 10.78
5 13	1994	140	4.626	23.14 11.82
5 13	1994	150	5.049	23.88 10.89

WIND DATA  
 TRUMBO PT  
 MAY 12-14  
 KEY WEST, FL

DATE	TIME MIN	WIND SPEED M/S	WIND DIR DEG	DIR STD DEV	
5 13	1994	200	4.624	23.77	11.18
5 13	1994	210	4.439	22.64	11.64
5 13	1994	220	4.435	29.64	8.96
5 13	1994	230	4.205	29.27	9.53
5 13	1994	240	3.628	31.93	8.14
5 13	1994	250	3.918	31.14	8.38
5 13	1994	300	3.641	31.4	7.71
5 13	1994	310	3.73	29.88	8.53
5 13	1994	320	2.234	47.05	30.27
5 13	1994	330	1.224	77.7	29.78
5 13	1994	340	2.26	101.8	22.11
5 13	1994	350	2.277	102.4	15.39
5 13	1994	400	2.348	104.6	17.88
5 13	1994	410	1.194	90.3	19.85
5 13	1994	420	1.199	85	26.32
5 13	1994	430	1.077	69.8	27.8
5 13	1994	440	1.005	79.4	26.49
5 13	1994	450	.972	73.8	30
5 13	1994	500	1.051	71.3	33.08
5 13	1994	510	.896	48.38	47.78
5 13	1994	520	1.176	61.63	30.36
5 13	1994	530	.845	44.1	31.71
5 13	1994	540	.879	66.45	31.88
5 13	1994	550	.821	65.84	28.62
5 13	1994	600	.888	68.35	37.52
5 13	1994	610	1.712	98.3	20.59
5 13	1994	620	1.805	103.7	16.93
5 13	1994	630	1.352	99.1	17.25
5 13	1994	640	1.851	101.4	15.22
5 13	1994	650	2.118	106.2	14.67
5 13	1994	700	1.98	104.9	15.19
5 13	1994	710	1.425	101.4	16.97
5 13	1994	720	1.231	99.1	16
5 13	1994	730	1.254	97.8	18.41
5 13	1994	740	1.832	108.7	18.02
5 13	1994	750	1.345	108.3	17.7
5 13	1994	800	.943	87.1	26.79
5 13	1994	810	.854	94.1	32.1
5 13	1994	820	.908	90.3	29.21
5 13	1994	830	.825	87.7	27.44
5 13	1994	840	.965	102	34.14
5 13	1994	850	.878	89.8	60.64
5 13	1994	900	.663	69.86	33.22
5 13	1994	910	.697	87.5	70.3
5 13	1994	920	1	79.4	50.76
5 13	1994	930	.823	49.85	51.4
5 13	1994	940	.885	56.74	45.68

WIND DATA  
 TRUMBO PT  
 MAY 12-14  
 KEY WEST, FL

DATE	TIME MIN	WIND SPEED M/S	WIND DIR DEG	DIR STD DEV
5 13	1994	950	2.552	102.1 39.83
5 13	1994	1000	3.413	112.9 17.08
5 13	1994	1010	4.604	124.2 15.59
5 13	1994	1020	4.912	130.4 13.16
5 13	1994	1030	4.372	122.5 20.53
5 13	1994	1040	4.821	129.5 16.14
5 13	1994	1050	4.178	114.8 15.43
5 13	1994	1100	3.325	121 17.46
5 13	1994	1110	3.174	122 15.91
5 13	1994	1120	3.282	115.9 17.58
5 13	1994	1130	3.848	124.6 17.4
5 13	1994	1140	4.44	126.4 13.77
5 13	1994	1150	5.028	127.4 12.95
5 13	1994	1200	4.227	118.9 16.41
5 13	1994	1210	3.829	120.2 16.82
5 13	1994	1220	3.135	122.5 27.51
5 13	1994	1230	3.522	119.6 16.07
5 13	1994	1240	3.722	127.3 19.93
5 13	1994	1250	3.611	128.3 17.79
5 13	1994	1300	2.402	106.3 20.46
5 13	1994	1310	2.832	117.2 16.64
5 13	1994	1320	1.321	92.8 52.83
5 13	1994	1330	1.01	56.92 47.97
5 13	1994	1340	1.214	68.76 46.62
5 13	1994	1350	1.144	70 25.18
5 13	1994	1400	1.183	78.8 25.13
5 13	1994	1410	1.038	71.8 23.31
5 13	1994	1420	1.031	78.7 34.3
5 13	1994	1430	1.291	102.1 34.62
5 13	1994	1440	1.174	103.3 42.92
5 13	1994	1450	1.297	92.1 53.56
5 13	1994	1500	1.676	117.7 28.01
5 13	1994	1510	2.781	126.4 21.38
5 13	1994	1520	3.192	132.3 20.99
5 13	1994	1530	2.393	115.4 23.14
5 13	1994	1540	1.256	88.3 51.94
5 13	1994	1550	.976	92.3 52.96
5 13	1994	1600	1.746	127.7 36.56
5 13	1994	1610	1.538	111.6 38.07
5 13	1994	1620	1.499	104.1 55.21
5 13	1994	1630	2.43	130 48.18
5 13	1994	1640	1.281	141.3 33.81
5 13	1994	1650	1.315	347.5 75
5 13	1994	1700	1.631	325.1 27.81
5 13	1994	1710	1.988	242.6 27.61
5 13	1994	1720	1.679	294.4 43.87
5 13	1994	1730	1.315	324.1 52.61

WIND DATA  
 TRUMBO PT  
 MAY 12-14  
 KEY WEST, FL

DATE	TIME MIN	WIND SPEED M/S	WIND DIR DEG	DIR STD DEV
5 13	1994	1740	1.683	8.35 27.49
5 13	1994	1750	1.419	353 32.59
5 13	1994	1800	1.449	345.3 35.98
5 13	1994	1810	1.383	347.8 34.33
5 13	1994	1820	2.36	292.5 18.22
5 13	1994	1830	2.207	284.8 13.71
5 13	1994	1840	1.648	265.5 15.36
5 13	1994	1850	1.985	243.1 20.42
5 13	1994	1900	2.162	292.4 22.33
5 13	1994	1910	1.936	146.5 63.76
5 13	1994	1920	2.432	115.7 19.64
5 13	1994	1930	3.117	124.3 16.62
5 13	1994	1940	3.317	125.8 13.5
5 13	1994	1950	3.459	127.1 15.65
5 13	1994	2000	3.677	129.7 10.19
5 13	1994	2010	3.35	132.4 10.65
5 13	1994	2020	3.263	120.5 15.03
5 13	1994	2030	2.764	113.6 15.71
5 13	1994	2040	2.258	106.1 14.52
5 13	1994	2050	2.016	102.1 19.19
5 13	1994	2100	2.254	101.6 15.63
5 13	1994	2110	2.258	106.1 15.99
5 13	1994	2120	2.494	102.6 15.47
5 13	1994	2130	2.635	109.1 15.17
5 13	1994	2140	2.361	106.5 17.02
5 13	1994	2150	1.854	100.3 18.84
5 13	1994	2200	2.289	102.6 15.05
5 13	1994	2210	2.379	107.4 15.02
5 13	1994	2220	2.519	105.2 16.24
5 13	1994	2230	1.971	104.8 17.48
5 13	1994	2240	2.12	101 17.07
5 13	1994	2250	2.062	100.5 20.28
5 13	1994	2300	2.094	101.5 17.26
5 13	1994	2310	1.997	103.4 15.57
5 13	1994	2320	1.921	103 29.08
5 13	1994	2330	2.467	108.2 16.01
5 13	1994	2340	2.386	106.8 14.79
5 13	1994	2350	2.365	105.2 18.61
5 14	1994	0	1.973	103.5 16.59
5 14	1994	10	2.556	106 15.26
5 14	1994	20	2.692	110.3 15.93
5 14	1994	30	2.348	103.6 17.05
5 14	1994	40	2.476	105.3 15.96
5 14	1994	50	2.854	106.2 14.56
5 14	1994	100	2.559	103.6 14.65
5 14	1994	110	2.192	105.3 16.54
5 14	1994	120	2.352	104.3 16.38

WIND DATA  
 TRUMBO PT  
 MAY 12-14  
 KEY WEST, FL

DATE	TIME MIN	WIND SPEED M/S	WIND DIR DEG	DIR STD DEV	
5 14	1994	130	2.429	105.2	16.55
5 14	1994	140	2.86	106.2	15.42
5 14	1994	150	2.501	104.5	16.15
5 14	1994	200	2.483	104.3	16.88
5 14	1994	210	2.435	106	16.64
5 14	1994	220	2.332	105.5	15.61
5 14	1994	230	2.219	101.5	15.97
5 14	1994	240	1.933	104.9	15.02
5 14	1994	250	1.904	105.3	17.24
5 14	1994	300	2.167	105.6	15.42
5 14	1994	310	2.001	105.9	17.13
5 14	1994	320	1.989	104.9	16.57
5 14	1994	330	2.612	109.7	15.57
5 14	1994	340	2.037	103.6	16.27
5 14	1994	350	1.798	102.8	15.43
5 14	1994	400	1.851	105.5	14.43
5 14	1994	410	1.75	104.7	17.62
5 14	1994	420	1.692	101.4	15.03
5 14	1994	430	1.825	102.6	15.82
5 14	1994	440	1.84	100	15
5 14	1994	450	2.015	103.3	15.14
5 14	1994	500	2.064	103	15.57
5 14	1994	510	2.192	103.7	15.73
5 14	1994	520	2.01	104.4	16.22
5 14	1994	530	2.002	103.2	14.77
5 14	1994	540	2.131	103.7	15.43
5 14	1994	550	2.054	103.7	15.79
5 14	1994	600	1.921	99.3	15.47
5 14	1994	610	1.812	102.3	16.61
5 14	1994	620	1.894	100.7	15.18
5 14	1994	630	1.97	101	13.77
5 14	1994	640	2.399	105.8	16.4
5 14	1994	650	2.102	104.2	15.69
5 14	1994	700	1.966	104.3	14.85
5 14	1994	710	2.093	101.6	14.78
5 14	1994	720	2.222	106.3	16.26
5 14	1994	730	2.501	110.5	16.08
5 14	1994	740	2.09	107	16.3
5 14	1994	750	2.465	108	16.77
5 14	1994	800	2.616	113.1	15.87
5 14	1994	810	2.564	105	17.24
5 14	1994	820	2.479	102.9	18.87
5 14	1994	830	2.174	98	18.5
5 13	1994	840	2.018	99.8	22.4
5 14	1994	850	2.025	98.9	26.83
5 14	1994	900	2.593	107.8	20.88
5 14	1994	910	3.357	113.8	15.6



WIND DATA  
 TRUMBO PT  
 MAY 12-14  
 KEY WEST, FL

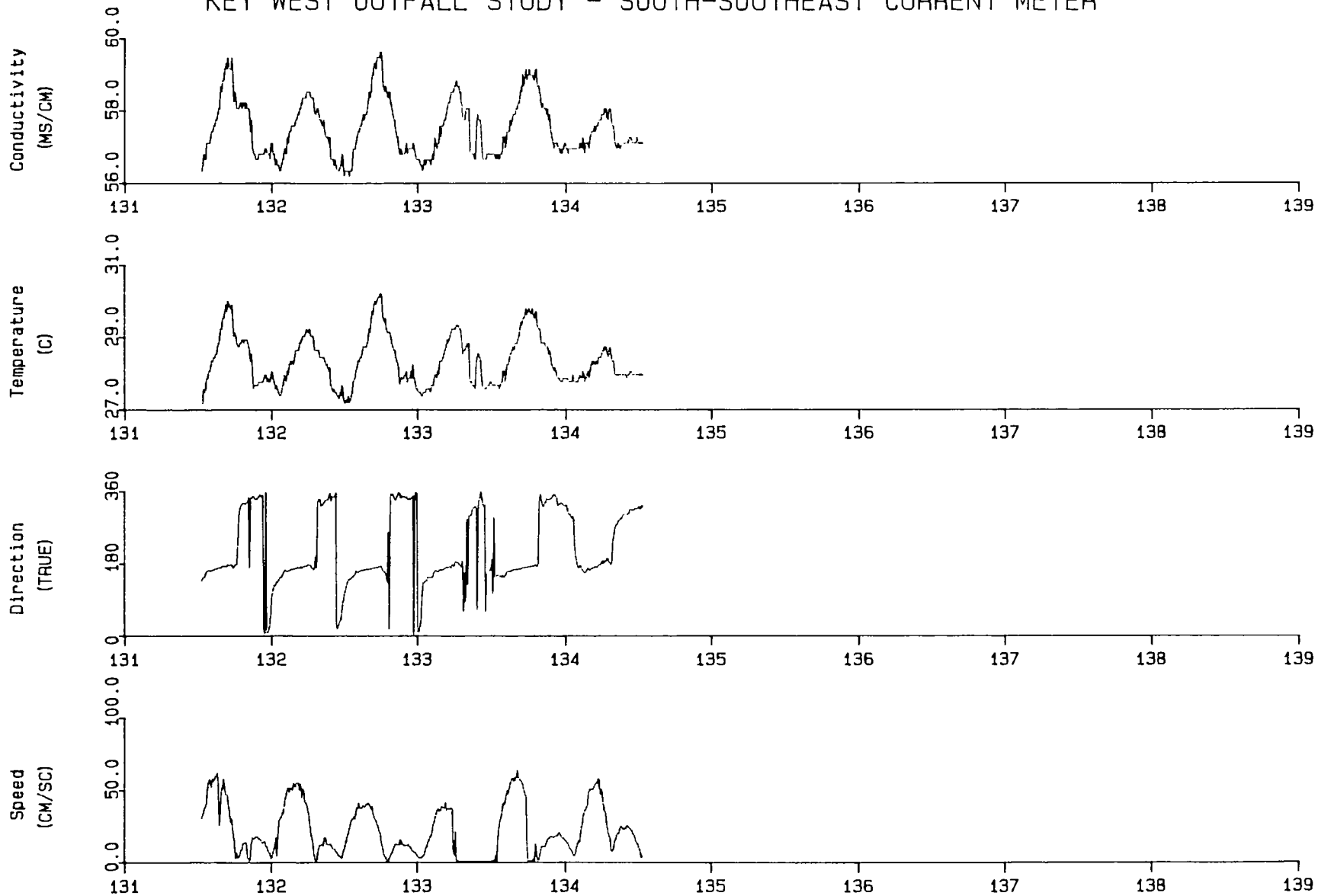
DATE	TIME MIN	WIND SPEED M/S	WIND DIR DEG	DIR STD DEV
5 14	1994	920	2.934	113.1
5 14	1994	930	3.4	110.6
5 14	1994	940	3.314	120
5 14	1994	950	3.085	121.5
5 14	1994	1000	2.758	116.1
5 14	1994	1010	2.862	109.1
5 14	1994	1020	2.482	109
5 14	1994	1030	3.621	111.1
5 14	1994	1040	3.48	113.2
5 14	1994	1050	3.728	125.7
5 14	1994	1100	3.137	128.1
5 14	1994	1110	3.087	125.3
5 14	1994	1120	4.222	135.2
5 14	1994	1130	4.348	139
5 14	1994	1140	4.198	134.8
5 14	1994	1150	3.618	127.4
5 14	1994	1200	3.88	134.7
5 14	1994	1210	2.861	112.3
5 14	1994	1220	3.603	122.3
5 14	1994	1230	3.19	117.7
5 14	1994	1240	3.426	128.6
5 14	1994	1250	3.681	121.5
5 14	1994	1300	4.794	129.2
5 14	1994	1310	4.552	127.6
5 14	1994	1320	4.439	124.4
5 14	1994	1330	4.83	119.2
5 14	1994	1340	4.718	117.1
5 14	1994	1350	4.278	120.3
5 14	1994	1400	4.143	117.3
5 14	1994	1410	3.997	131
5 14	1994	1420	4.489	124
5 14	1994	1430	4.829	130.9
5 14	1994	1440	5.073	132.3
5 14	1994	1450	4.322	119.3

2.744

## APPENDIX A

\* SOUTH CURRENT METER DATA \*

KEY WEST OUTFALL STUDY - SOUTH-SOUTHEAST CURRENT METER



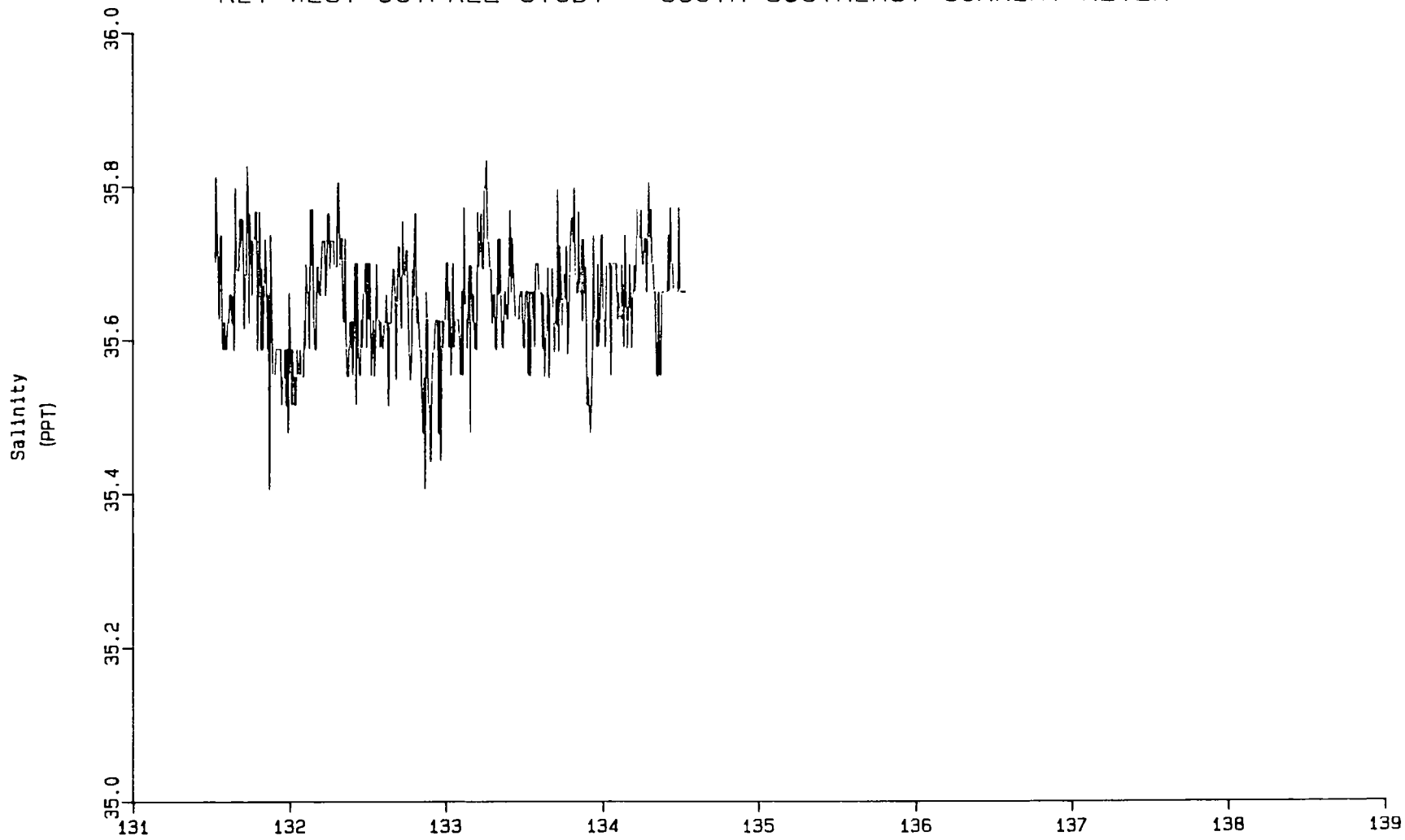
JULIAN DAYS

11-MAY-94 to 14-MAY-94

Endeco Type 174SSM Current Meter

Page: 1

KEY WEST OUTFALL STUDY - SOUTH-SOUTHEAST CURRENT METER



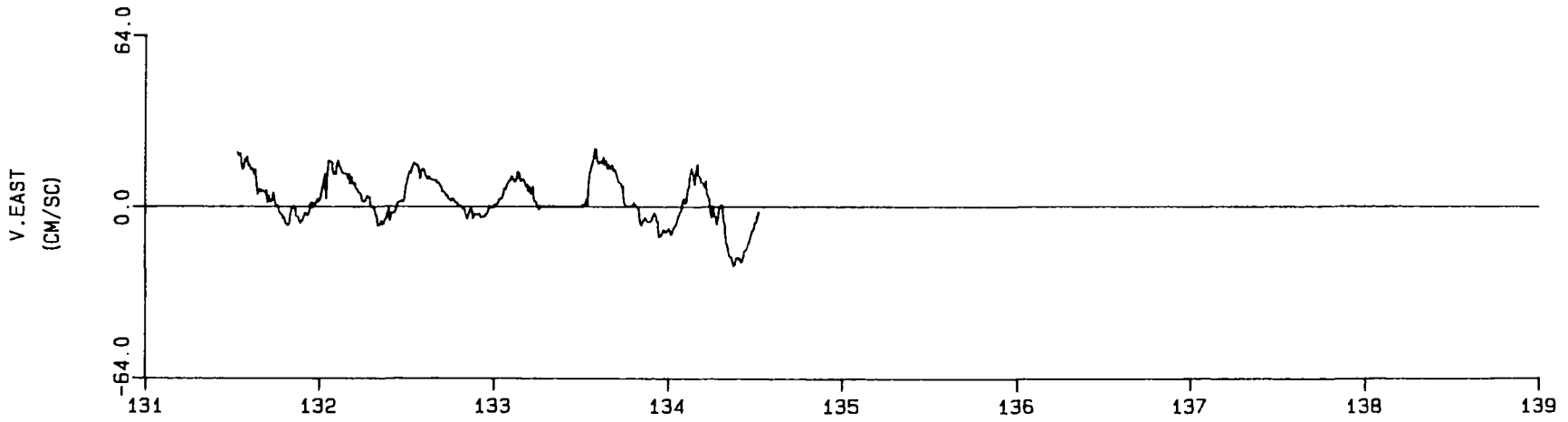
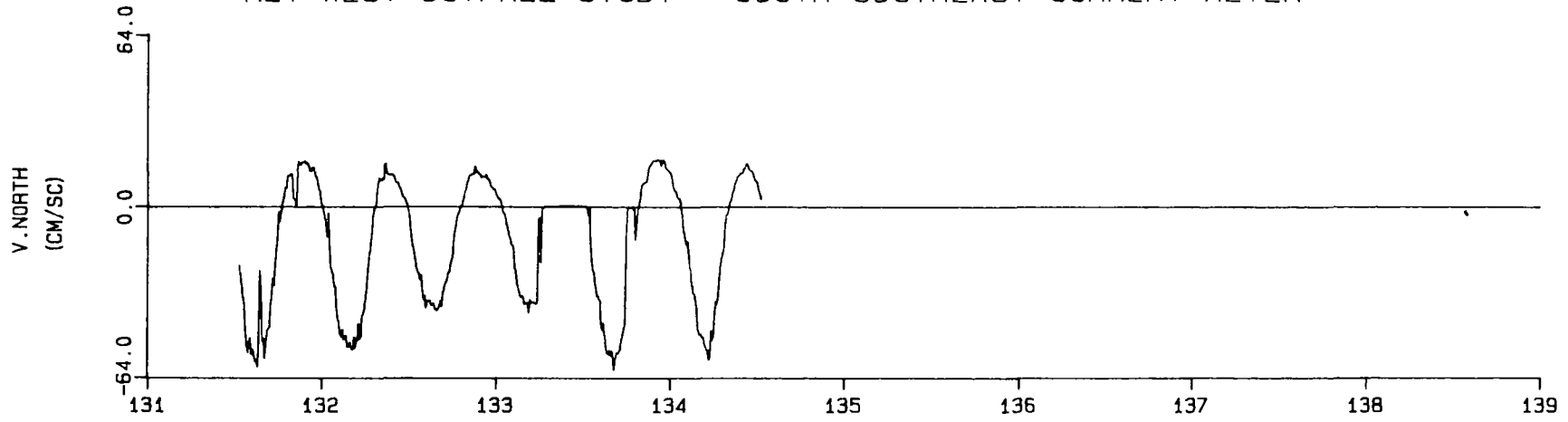
JULIAN DAYS

11-MAY-94 to 14-MAY-94

Endeco Type 174SSM Current Meter

Page: 1

KEY WEST OUTFALL STUDY - SOUTH-SOUTHEAST CURRENT METER



JULIAN DAYS

11-MAY-94 to 14-MAY-94



TOTAL	0	2	2	1	4	19	6	0	1	3		6
PERCENT	.00	3.64	3.64	1.82	7.27	34.55	10.91	.00	1.82	5.45	20.00	10.91

STATION AVERAGE = .242 (CM/SC)

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
12:30:00	29.89	137	27.16	56.31	35.70
12:40:00	31.65	143	27.16	56.46	35.81
12:50:00	33.66	145	27.55	56.78	35.74
13:00:00	36.93	147	27.45	56.62	35.70
13:10:00	38.43	154	27.55	56.62	35.63
13:20:00	40.19	159	27.84	57.09	35.73
13:30:00	48.22	162	27.84	57.09	35.73
13:40:00	55.00	161	28.04	57.09	35.59
13:50:00	57.52	162	28.04	57.09	35.59
14:00:00	54.26	159	28.14	57.25	35.62
14:10:00	51.74	162	28.33	57.41	35.59
14:20:00	57.77	164	28.33	57.41	35.59
14:30:00	55.51	165	28.43	57.57	35.62
14:40:00	57.77	165	28.43	57.57	35.62
14:50:00	59.52	167	28.53	57.72	35.66
15:00:00	59.28	168	28.53	57.72	35.66
15:10:00	61.79	167	28.72	57.88	35.62
15:20:00	54.75	169	28.82	58.04	35.66
15:30:00	24.37	169	28.92	58.04	35.58
15:40:00	32.65	169	29.21	58.67	35.80
15:50:00	51.24	172	29.21	58.51	35.69
16:00:00	49.73	174	29.51	58.82	35.69
16:10:00	57.52	174	29.51	58.82	35.69
16:20:00	52.75	174	29.70	59.14	35.76
16:30:00	46.97	174	29.90	59.29	35.72
16:40:00	46.47	172	29.70	59.14	35.76
16:50:00	44.96	178	30.00	59.45	35.75
17:00:00	37.93	174	29.90	59.14	35.61
17:10:00	33.15	176	29.80	59.14	35.68
17:20:00	27.38	176	29.80	59.14	35.68
17:30:00	29.89	175	29.90	59.45	35.83
17:40:00	23.10	167	29.51	58.98	35.79
17:50:00	16.82	171	29.02	58.19	35.62
18:00:00	12.31	176	29.12	58.51	35.76
18:10:00	2.01	178	29.02	58.35	35.73
18:20:00	6.28	178	28.82	58.04	35.66
18:30:00	2.51	228	28.72	58.04	35.73
18:40:00	3.27	302	28.72	58.04	35.73
18:50:00	4.77	318	28.82	58.19	35.77
19:00:00	8.29	325	28.82	58.19	35.77
19:10:00	7.79	328	28.92	58.04	35.58
19:20:00	12.56	331	28.92	58.19	35.69



19:30:00	3.31	330	28.82	58.19	35.77
19:40:00	3.56	327	28.92	58.04	35.58
19:50:00	13.81	331	28.92	58.19	35.69
20:00:00	10.55	332	28.92	58.04	35.58
20:10:00	2.51	338	28.82	58.04	35.66
20:20:00	2.51	344	28.72	58.04	35.73
20:30:00	.51	167	28.63	57.88	35.69
20:40:00	1.51	344	28.33	57.41	35.59
20:50:00	13.31	344	28.53	57.72	35.66
21:00:00	17.08	347	28.14	56.94	35.40
21:10:00	15.82	345	27.55	56.78	35.74
21:20:00	16.08	339	27.65	56.78	35.66

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
21:30:00	17.58	338	27.65	56.62	35.55
21:40:00	17.33	341	27.65	56.62	35.55
21:50:00	17.33	344	27.65	56.62	35.55
22:00:00	15.82	347	27.75	56.78	35.59
22:10:00	16.33	352	27.75	56.78	35.59
22:20:00	15.07	348	27.75	56.78	35.59
22:30:00	13.31	344	27.75	56.78	35.59
22:40:00	13.06	349	27.75	56.78	35.59
22:50:00	14.32	2	27.84	56.78	35.51
23:00:00	14.32	6	27.94	56.94	35.55
23:10:00	11.05	356	27.94	56.94	35.55
23:20:00	10.55	6	27.75	56.78	35.59
23:30:00	8.04	5	27.84	56.78	35.51
23:40:00	6.28	15	27.75	56.78	35.59
23:50:00	5.77	30	27.75	56.62	35.48
Means:			28.51	57.69	35.65

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:00:00	2.01	54	27.94	57.09	35.66
00:10:00	2.76	100	28.04	57.09	35.59
00:20:00	5.53	113	27.84	56.78	35.51
00:30:00	8.54	124	27.75	56.78	35.59
00:40:00	12.31	124	27.55	56.46	35.51
00:50:00	16.82	133	27.65	56.62	35.55
01:00:00	3.77	131	27.55	56.46	35.51
01:10:00	18.09	138	27.45	56.46	35.59
01:20:00	28.89	143	27.36	56.31	35.55
01:30:00	30.14	145	27.36	56.31	35.55
01:40:00	31.14	147	27.45	56.46	35.59
01:50:00	33.91	151	27.65	56.62	35.55
02:00:00	32.90	158	27.65	56.62	35.55
02:10:00	39.18	161	27.94	56.94	35.55
02:20:00	43.95	164	27.84	56.94	35.62
02:30:00	46.72	159	27.75	56.78	35.59
02:40:00	50.99	159	28.04	57.25	35.70
02:50:00	51.49	162	27.94	57.09	35.66
03:00:00	48.47	162	28.24	57.41	35.66
03:10:00	51.74	165	28.33	57.41	35.59
03:20:00	50.74	165	28.24	57.57	35.77
03:30:00	49.98	165	28.33	57.57	35.70
03:40:00	54.75	167	28.24	57.57	35.77
03:50:00	53.75	167	28.43	57.57	35.62
04:00:00	51.99	168	28.63	57.72	35.58
04:10:00	55.00	167	28.63	57.72	35.58
04:20:00	54.75	171	28.63	57.88	35.69
04:30:00	54.75	168	28.63	57.88	35.69
04:40:00	49.98	169	28.82	58.04	35.66
04:50:00	54.00	171	28.82	58.04	35.66
05:00:00	50.48	169	28.92	58.19	35.69
05:10:00	44.21	171	29.02	58.35	35.73
05:20:00	50.74	172	29.02	58.35	35.73
05:30:00	48.98	174	29.02	58.35	35.73
05:40:00	41.19	172	29.12	58.35	35.65
05:50:00	40.19	174	29.21	58.51	35.69
06:00:00	37.93	176	29.12	58.51	35.76
06:10:00	34.41	176	29.12	58.51	35.76
06:20:00	30.65	176	29.21	58.51	35.69
06:30:00	24.37	174	29.02	58.35	35.73
06:40:00	18.33	167	29.02	58.35	35.73
06:50:00	15.32	167	29.02	58.35	35.73

07:00:00	1.56	162	28.92	58.19	35.69
07:10:00	4.52	176	28.63	57.88	35.69
07:20:00	1.00	196	28.63	57.88	35.69
07:30:00	.25	168	28.63	58.04	35.80
07:40:00	2.01	334	28.63	58.04	35.80
07:50:00	8.54	341	28.63	57.88	35.69
08:00:00	11.30	339	28.43	57.72	35.73
08:10:00	11.81	323	28.43	57.72	35.73
08:20:00	11.56	323	28.43	57.57	35.62
08:30:00	12.31	328	28.43	57.57	35.62
08:40:00	10.80	331	28.43	57.72	35.73
08:50:00	16.58	335	28.33	57.41	35.59

Date: THU 12-MAY-1994

Julian date: 132

Magnetic Variation: 2.5

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:00:00	17.08	338	28.24	57.25	35.55
09:10:00	12.31	337	28.24	57.25	35.55
09:20:00	12.56	339	28.14	57.25	35.62
09:30:00	11.56	347	28.04	57.09	35.59
09:40:00	12.05	355	28.14	57.25	35.62
09:50:00	12.56	334	27.65	56.62	35.55
10:00:00	10.80	347	27.55	56.62	35.63
10:10:00	9.29	345	27.45	56.62	35.70
10:20:00	8.54	345	27.55	56.46	35.51
10:30:00	9.04	347	27.45	56.62	35.70
10:40:00	7.03	356	27.45	56.46	35.59
10:50:00	6.53	12	27.36	56.31	35.55
11:00:00	5.28	19	27.36	56.31	35.55
11:10:00	4.02	27	27.26	56.31	35.63
11:20:00	3.77	36	27.45	56.46	35.59
11:30:00	3.27	39	27.36	56.46	35.66
11:40:00	2.01	58	27.65	56.78	35.66
11:50:00	5.03	82	27.45	56.62	35.70
12:00:00	8.04	99	27.16	56.15	35.59
12:10:00	10.80	109	27.16	56.31	35.70
12:20:00	13.56	119	27.26	56.31	35.63
12:30:00	17.08	129	27.16	56.31	35.70
12:40:00	19.34	140	27.36	56.31	35.55
12:50:00	22.61	140	27.16	56.15	35.59
13:00:00	25.37	141	27.26	56.31	35.63
13:10:00	28.38	144	27.36	56.31	35.55
13:20:00	29.38	147	27.45	56.46	35.59
13:30:00	30.14	148	27.75	56.94	35.70
13:40:00	31.65	151	27.84	56.94	35.62
13:50:00	29.14	152	27.84	56.94	35.62
14:00:00	32.40	161	28.04	57.09	35.59
14:10:00	37.42	158	28.14	57.25	35.62
14:20:00	36.42	157	28.33	57.41	35.59
14:30:00	40.69	159	28.33	57.41	35.59
14:40:00	37.17	161	28.43	57.57	35.62
14:50:00	37.17	162	28.43	57.57	35.62
15:00:00	36.67	164	28.53	57.72	35.66
15:10:00	38.93	162	28.72	57.88	35.62
15:20:00	38.43	164	28.72	57.72	35.51
15:30:00	37.67	164	28.72	57.88	35.62
15:40:00	39.69	165	28.72	57.88	35.62
15:50:00	39.94	165	28.82	58.04	35.66

16:00:00	40.69	165	28.92	58.19	35.69
16:10:00	39.69	165	29.21	58.51	35.69
16:20:00	38.18	167	29.12	58.35	35.65
16:30:00	36.67	165	29.41	58.51	35.54
16:40:00	38.43	168	29.70	58.98	35.65
16:50:00	33.15	167	29.60	58.98	35.72
17:00:00	30.89	169	29.90	59.29	35.72
17:10:00	29.14	168	30.00	59.29	35.65
17:20:00	28.38	169	29.90	59.14	35.61
17:30:00	25.62	171	30.00	59.45	35.75
17:40:00	24.86	169	30.09	59.45	35.68
17:50:00	21.60	172	30.09	59.45	35.68

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
18:00:00	20.09	172	30.19	59.61	35.72
18:10:00	17.58	174	30.19	59.61	35.72
18:20:00	12.05	165	30.00	59.29	35.65
18:30:00	8.79	159	29.51	58.67	35.58
18:40:00	4.77	158	29.41	58.51	35.54
18:50:00	3.27	155	29.51	58.67	35.58
19:00:00	2.26	141	29.21	58.51	35.69
19:10:00	.00	131	29.12	58.35	35.65
19:20:00	.00	258	29.12	58.51	35.76
19:30:00	2.01	12	29.12	58.51	35.76
19:40:00	3.77	354	29.02	58.19	35.62
19:50:00	5.53	349	28.82	58.04	35.66
20:00:00	6.53	352	28.72	57.88	35.62
20:10:00	9.04	344	28.63	57.72	35.58
20:20:00	10.80	337	28.63	57.72	35.58
20:30:00	12.31	337	28.43	57.41	35.51
20:40:00	12.05	345	28.33	57.25	35.48
20:50:00	12.05	352	28.24	57.25	35.55
21:00:00	11.56	356	28.14	56.94	35.40
21:10:00	12.56	352	27.65	56.78	35.66
21:20:00	15.57	342	27.84	56.94	35.62
21:30:00	13.06	347	27.84	56.78	35.51
21:40:00	12.05	347	27.84	56.78	35.51
21:50:00	11.81	345	27.94	56.78	35.44
22:00:00	10.55	342	27.94	56.94	35.55
22:10:00	11.56	347	28.04	57.09	35.59
22:20:00	11.56	338	27.75	56.78	35.59
22:30:00	11.30	338	27.84	56.94	35.62
22:40:00	12.31	342	27.84	56.94	35.62
22:50:00	10.55	337	27.84	56.94	35.62
23:00:00	10.30	342	28.04	56.94	35.48
23:10:00	9.04	344	27.84	56.94	35.62
23:20:00	7.03	348	28.24	57.09	35.44
23:30:00	7.03	1	27.84	56.94	35.62
23:40:00	6.03	356	27.75	56.78	35.59
23:50:00	6.03	358	27.55	56.62	35.63
Means:			28.35	57.49	35.63

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:00:00	4.52	352	27.55	56.62	35.63
00:10:00	3.77	9	27.45	56.62	35.70
00:20:00	2.51	9	27.45	56.62	35.70
00:30:00	2.76	23	27.45	56.46	35.59
00:40:00	2.26	43	27.36	56.46	35.66
00:50:00	3.01	98	27.36	56.31	35.55
01:00:00	3.77	130	27.45	56.46	35.59
01:10:00	4.27	131	27.45	56.62	35.70
01:20:00	6.53	136	27.45	56.46	35.59
01:30:00	9.80	136	27.55	56.62	35.63
01:40:00	10.80	145	27.55	56.62	35.63
01:50:00	13.81	144	27.55	56.62	35.63
02:00:00	15.32	144	27.55	56.62	35.63
02:10:00	17.58	145	27.45	56.46	35.59
02:20:00	18.09	145	27.65	56.62	35.55
02:30:00	20.85	145	27.65	56.78	35.66
02:40:00	25.62	155	27.65	56.62	35.55
02:50:00	27.38	159	27.94	57.25	35.77
03:00:00	30.89	162	27.94	57.09	35.66
03:10:00	33.41	161	27.84	56.94	35.62
03:20:00	35.91	158	28.04	57.09	35.59
03:30:00	36.67	159	27.94	57.09	35.66
03:40:00	34.66	164	28.33	57.57	35.70
03:50:00	35.66	164	28.33	57.25	35.48
04:00:00	38.43	164	28.33	57.57	35.70
04:10:00	37.67	164	28.43	57.57	35.62
04:20:00	37.17	165	28.53	57.72	35.66
04:30:00	36.93	168	28.63	57.72	35.58
04:40:00	40.94	168	28.72	57.88	35.62
04:50:00	35.42	171	28.92	58.04	35.58
05:00:00	36.93	168	28.82	58.19	35.77
05:10:00	36.67	172	28.92	58.19	35.69
05:20:00	36.17	171	29.02	58.35	35.73
05:30:00	37.17	168	29.12	58.51	35.76
05:40:00	36.93	176	29.21	58.51	35.69
05:50:00	35.17	176	29.21	58.51	35.69
06:00:00	4.77	172	29.21	58.67	35.80
06:10:00	4.27	182	29.21	58.67	35.80
06:20:00	21.35	183	29.31	58.82	35.83
06:30:00	.51	181	29.31	58.67	35.73
06:40:00	.51	181	29.31	58.67	35.73
06:50:00	.00	176	29.21	58.51	35.69



07:00:00	.00	174	29.21	58.51	35.69
07:10:00	.00	169	29.02	58.19	35.62
07:20:00	.00	186	28.82	58.04	35.66
07:30:00	.00	171	28.53	57.72	35.66
07:40:00	.00	55	28.63	57.72	35.58
07:50:00	.00	157	28.63	57.72	35.58
08:00:00	.00	82	28.72	58.04	35.73
08:10:00	.00	292	28.82	58.04	35.66
08:20:00	.00	124	28.72	58.04	35.73
08:30:00	.00	300	28.82	58.04	35.66
08:40:00	.00	296	27.75	56.78	35.59
08:50:00	.51	302	27.75	56.78	35.59

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:00:00	.00	311	27.65	56.78	35.66
09:10:00	.00	320	27.65	56.78	35.66
09:20:00	.25	317	27.55	56.62	35.63
09:30:00	.00	323	27.55	56.62	35.63
09:40:00	.00	314	28.33	57.57	35.70
09:50:00	.00	61	28.53	57.88	35.77
10:00:00	.00	335	28.53	57.72	35.66
10:10:00	.00	342	28.43	57.72	35.73
10:20:00	.00	359	28.33	57.57	35.70
10:30:00	.00	344	27.94	57.09	35.66
10:40:00	.00	325	27.55	56.62	35.63
10:50:00	.00	321	27.55	56.62	35.63
11:00:00	.00	325	27.55	56.62	35.63
11:10:00	.00	55	27.55	56.62	35.63
11:20:00	.00	154	27.65	56.78	35.66
11:30:00	.00	158	27.65	56.78	35.66
11:40:00	.00	158	27.65	56.78	35.66
11:50:00	.00	162	27.75	56.78	35.59
12:00:00	.00	175	27.75	56.78	35.59
12:10:00	.25	189	27.65	56.78	35.66
12:20:00	.75	100	27.65	56.78	35.66
12:30:00	.00	296	27.65	56.78	35.66
12:40:00	1.25	143	27.65	56.62	35.55
12:50:00	4.52	145	27.65	56.78	35.66
13:00:00	.25	150	27.65	56.62	35.55
13:10:00	16.08	150	27.65	56.78	35.66
13:20:00	23.61	147	27.55	56.62	35.63
13:30:00	28.38	148	27.65	56.78	35.66
13:40:00	30.65	147	27.75	56.78	35.59
13:50:00	35.17	148	27.75	56.94	35.70
14:00:00	39.69	147	28.04	57.25	35.70
14:10:00	40.94	148	27.75	56.94	35.70
14:20:00	39.43	154	27.94	57.09	35.66
14:30:00	45.71	159	28.24	57.41	35.66
14:40:00	49.73	159	28.24	57.41	35.66
14:50:00	46.97	158	28.33	57.41	35.59
15:00:00	50.74	161	28.53	57.72	35.66
15:10:00	54.26	159	28.53	57.57	35.55
15:20:00	57.02	164	28.63	57.72	35.58
15:30:00	58.27	162	28.72	57.88	35.62
15:40:00	55.76	165	28.63	57.88	35.69
15:50:00	58.52	164	28.82	57.88	35.55

16:00:00	56.01	165	28.82	58.04	35.66
16:10:00	58.78	165	28.82	58.04	35.66
16:20:00	63.55	165	28.92	58.19	35.69
16:30:00	58.78	167	29.02	58.19	35.62
16:40:00	56.76	165	29.21	58.35	35.58
16:50:00	56.76	167	29.41	58.67	35.65
17:00:00	55.51	168	29.31	58.51	35.62
17:10:00	54.51	169	29.51	58.98	35.79
17:20:00	50.99	169	29.51	58.67	35.58
17:30:00	48.73	169	29.60	58.98	35.72
17:40:00	46.22	171	29.80	59.14	35.68
17:50:00	43.95	169	29.60	58.82	35.61

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
18:00:00	9.54	171	29.70	58.98	35.65
18:10:00	.51	169	29.80	59.14	35.68
18:20:00	.25	172	29.70	58.98	35.65
18:30:00	.51	174	29.60	58.98	35.72
18:40:00	.51	174	29.80	58.98	35.58
18:50:00	.75	172	29.60	58.82	35.61
19:00:00	2.01	174	29.51	58.82	35.69
19:10:00	.25	178	29.70	59.14	35.76
19:20:00	13.06	172	29.70	59.14	35.76
19:30:00	6.78	174	29.31	58.67	35.73
19:40:00	.75	181	29.21	58.67	35.80
19:50:00	1.25	341	29.21	58.51	35.69
20:00:00	4.27	352	29.12	58.35	35.65
20:10:00	8.29	337	28.82	58.04	35.66
20:20:00	10.80	321	28.82	58.19	35.77
20:30:00	11.30	320	28.82	58.04	35.66
20:40:00	10.30	330	28.82	58.04	35.66
20:50:00	10.55	332	28.72	58.04	35.73
21:00:00	12.81	341	28.72	57.88	35.62
21:10:00	14.82	338	28.72	58.04	35.73
21:20:00	16.33	338	28.53	57.72	35.66
21:30:00	16.58	339	28.63	57.88	35.69
21:40:00	17.33	341	28.43	57.41	35.51
21:50:00	17.84	344	28.24	57.25	35.55
22:00:00	17.33	348	28.14	57.09	35.51
22:10:00	16.58	352	28.04	56.94	35.48
22:20:00	17.58	349	28.14	57.09	35.51
22:30:00	18.09	342	28.04	57.09	35.59
22:40:00	17.84	341	27.84	57.09	35.73
22:50:00	18.58	321	27.84	56.94	35.62
23:00:00	20.34	327	27.84	56.94	35.62
23:10:00	20.09	328	27.75	56.78	35.59
23:20:00	18.33	331	27.75	56.94	35.70
23:30:00	16.33	328	27.75	56.78	35.59
23:40:00	16.58	324	27.84	56.94	35.62
23:50:00	16.08	323	27.84	57.09	35.73

Means : 28.39 57.57 35.65

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:00:00	15.07	324	27.84	57.09	35.73
00:10:00	14.32	325	27.84	56.94	35.62
00:20:00	13.31	316	27.84	56.94	35.62
00:30:00	12.81	302	27.75	56.78	35.59
00:40:00	11.05	300	27.75	56.94	35.70
00:50:00	9.54	303	27.75	56.94	35.70
01:00:00	8.29	296	27.75	56.94	35.70
01:10:00	7.28	290	27.75	56.94	35.70
01:20:00	6.03	297	27.94	56.94	35.55
01:30:00	4.02	287	27.75	56.94	35.70
01:40:00	3.52	226	27.75	56.94	35.70
01:50:00	6.03	196	27.75	56.94	35.70
02:00:00	10.05	181	27.75	56.94	35.70
02:10:00	13.06	168	27.75	56.94	35.70
02:20:00	14.82	168	27.84	56.94	35.62
02:30:00	13.31	175	27.94	57.09	35.66
02:40:00	17.84	172	27.84	56.94	35.62
02:50:00	23.86	164	27.84	56.94	35.62
03:00:00	26.62	162	28.04	57.25	35.70
03:10:00	32.15	157	27.94	57.09	35.66
03:20:00	35.66	155	27.75	56.78	35.59
03:30:00	35.66	158	27.84	57.09	35.73
03:40:00	37.93	164	27.94	57.09	35.66
03:50:00	39.94	168	28.04	57.09	35.59
04:00:00	48.47	164	27.84	56.94	35.62
04:10:00	50.74	161	28.04	57.25	35.70
04:20:00	49.23	167	28.24	57.41	35.66
04:30:00	50.74	167	28.33	57.41	35.59
04:40:00	49.98	169	28.24	57.41	35.66
04:50:00	52.24	169	28.33	57.57	35.70
05:00:00	53.50	171	28.24	57.41	35.66
05:10:00	54.51	172	28.33	57.57	35.70
05:20:00	55.00	169	28.24	57.57	35.77
05:30:00	58.02	175	28.43	57.72	35.73
05:40:00	56.51	176	28.43	57.72	35.73
05:50:00	46.72	176	28.43	57.72	35.73
06:00:00	50.48	182	28.53	57.88	35.77
06:10:00	47.98	185	28.63	57.88	35.69
06:20:00	39.43	179	28.63	57.88	35.69
06:30:00	35.66	185	28.72	58.04	35.73
06:40:00	33.91	186	28.72	58.04	35.73
06:50:00	29.14	193	28.53	57.72	35.66

07:00:00	13.36	189	28.43	57.72	35.73
07:10:00	19.34	182	28.63	58.04	35.80
07:20:00	17.33	179	28.72	58.04	35.73
07:30:00	15.57	176	28.53	57.88	35.77
07:40:00	7.53	186	28.33	57.57	35.70
07:50:00	6.78	238	28.33	57.57	35.70
08:00:00	8.79	252	28.24	57.41	35.66
08:10:00	13.81	269	27.94	57.09	35.66
08:20:00	15.32	276	27.94	56.94	35.55
08:30:00	18.33	278	27.94	56.94	35.55
08:40:00	19.84	285	27.94	57.09	35.66
08:50:00	19.60	287	27.94	56.94	35.55

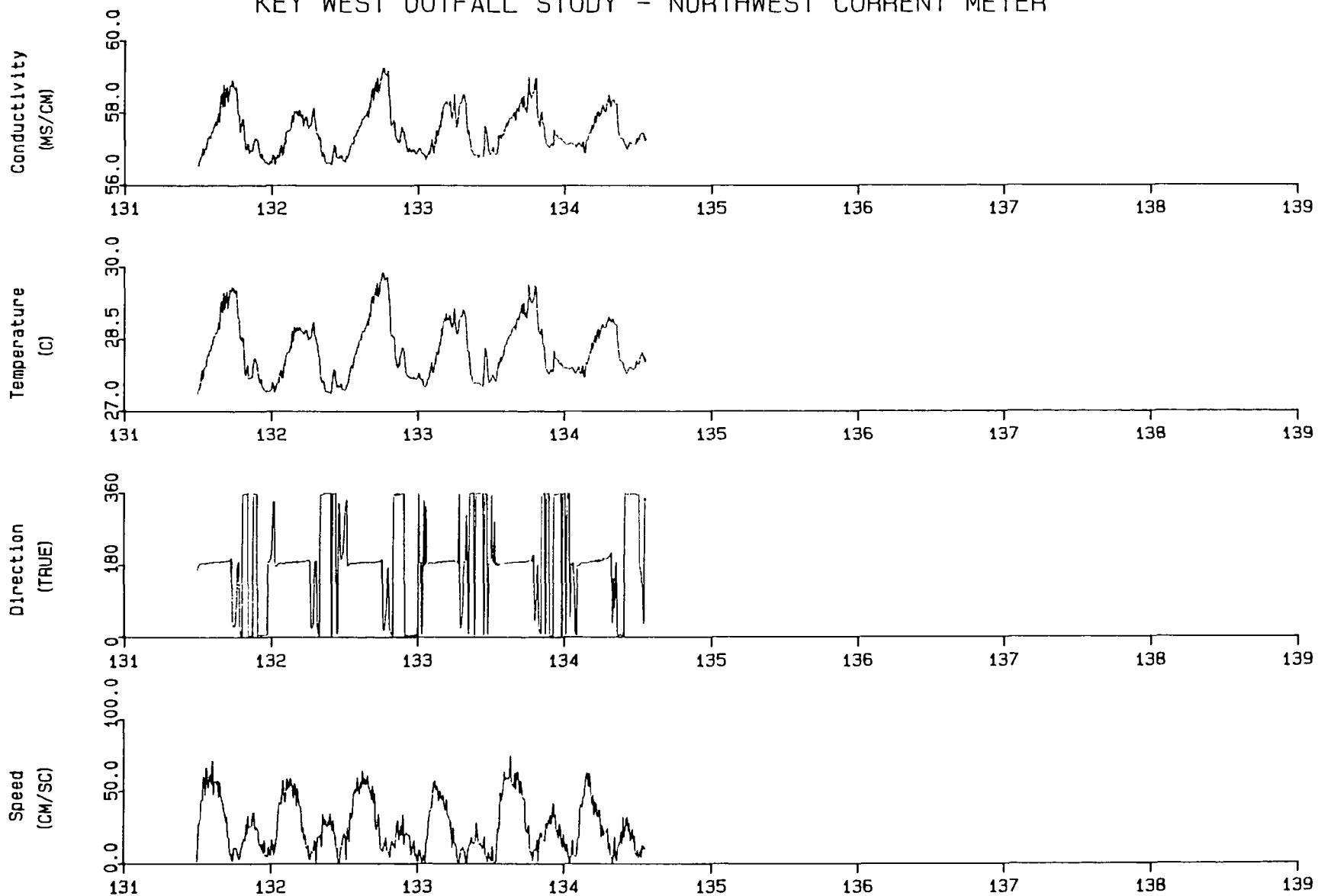
TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:00:00	22.36	292	27.94	56.94	35.55
09:10:00	24.61	292	27.94	57.09	35.66
09:20:00	24.37	296	27.94	57.09	35.66
09:30:00	22.36	300	27.94	57.09	35.66
09:40:00	22.36	302	27.94	57.09	35.66
09:50:00	23.61	302	27.94	57.09	35.66
10:00:00	22.61	302	27.94	57.09	35.66
10:10:00	24.61	302	27.84	57.09	35.73
10:20:00	25.37	303	27.94	57.09	35.66
10:30:00	23.86	306	27.94	57.25	35.77
10:40:00	22.86	313	28.04	57.25	35.70
10:50:00	22.61	314	28.04	57.25	35.70
11:00:00	21.60	311	27.94	57.09	35.66
11:10:00	19.60	311	27.94	57.09	35.66
11:20:00	18.84	313	27.94	57.09	35.66
11:30:00	17.33	316	27.94	57.09	35.66
11:40:00	14.82	316	27.94	57.09	35.66
11:50:00	12.81	316	27.94	57.25	35.77
12:00:00	12.56	317	27.94	57.09	35.66
12:10:00	10.05	323	27.94	57.09	35.66
12:20:00	8.29	314	27.94	57.09	35.66
12:30:00	5.77	318	27.94	57.09	35.66
12:40:00	3.01	323	27.94	57.09	35.66
12:50:00	.75	321	27.94	57.09	35.66
13:00:00	.25	138	27.94	57.09	35.66
Means:			28.06	57.24	35.67

# APPENDIX A

**\* NORTH CURRENT METER DATA \***



# KEY WEST OUTFALL STUDY - NORTHWEST CURRENT METER



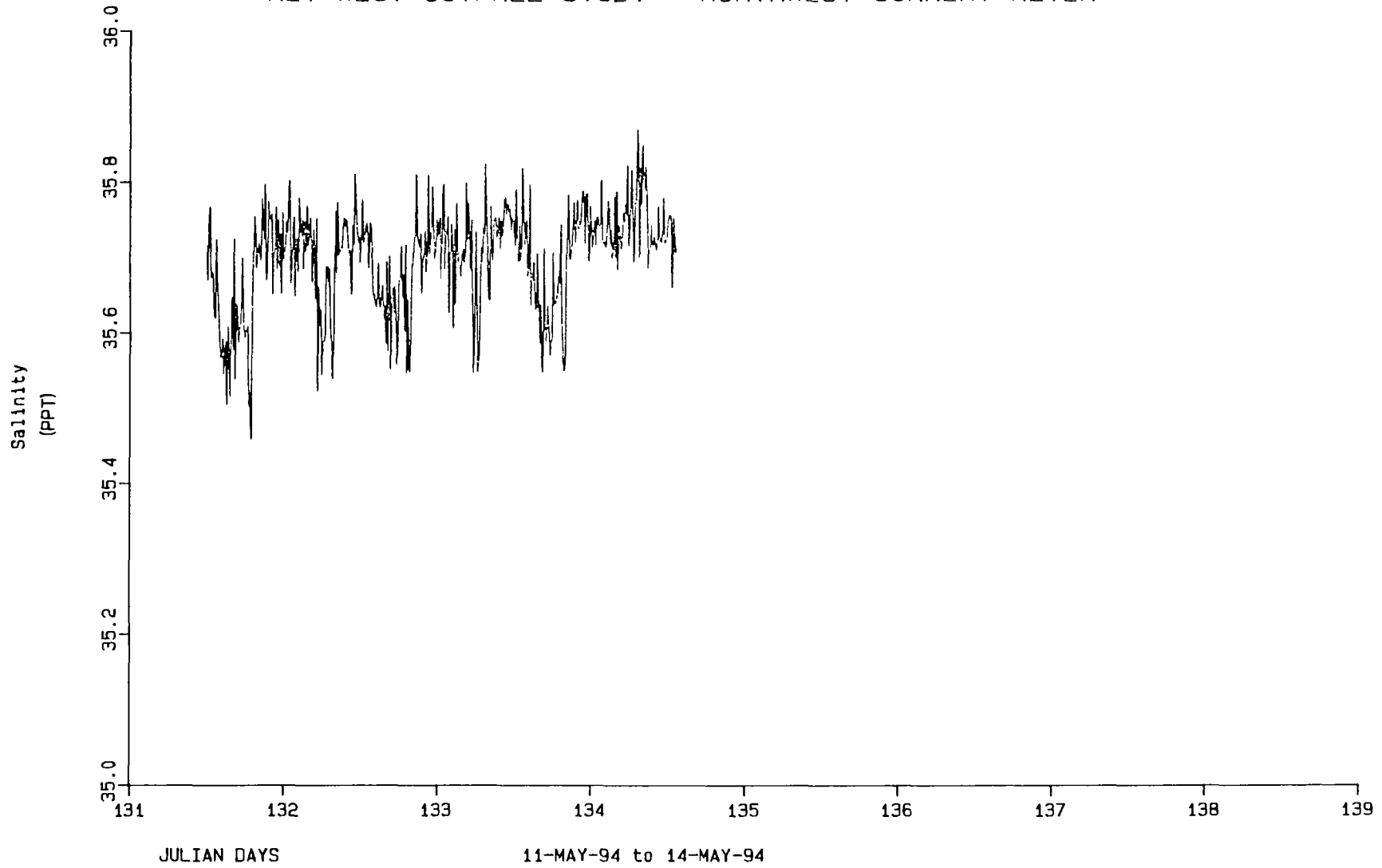
JULIAN DAYS

11-MAY-94 to 14-MAY-94

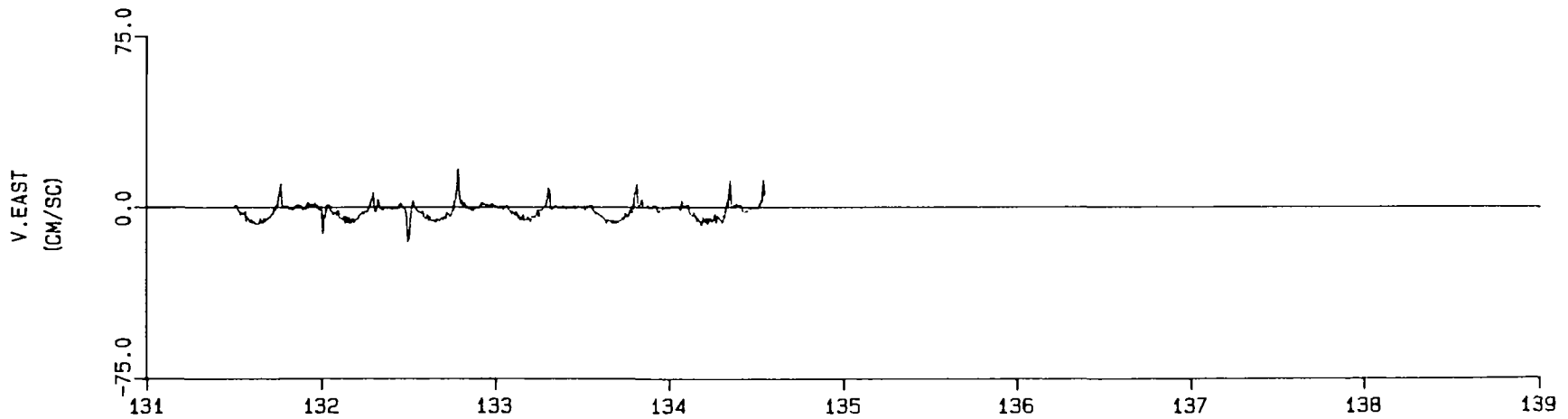
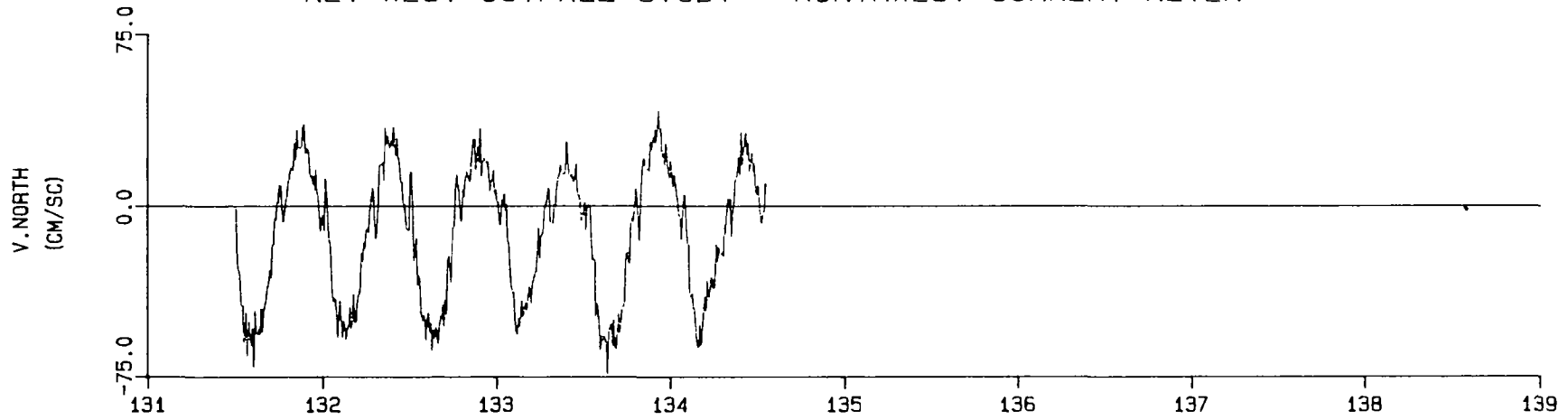
Endeco Type 174SSM Current Meter

Page: 1

KEY WEST OUTFALL STUDY - NORTHWEST CURRENT METER



KEY WEST OUTFALL STUDY - NORTHWEST CURRENT METER



JULIAN DAYS

11-MAY-94 to 14-MAY-94

Endeco Type 174SSM Current Meter

Page: 1



S U M M A R Y

DATA POINTS USED	SEGMENT LENGTH	NO. SEGMENTS	DEG. OF FREEDOM	DECIMATION FACTOR	FREQ. RESOLUTION	NYQU
442	512	1	2	1	.036	



S U M M A R Y

DATA POINTS USED	SEGMENT LENGTH	NO. SEGMENTS	DEG. OF FREEDOM	DECIMATION FACTOR	FREQ. RESOLUTION	NYQU
442	512	1	2	1	.036	

Date: WED 11-MAY-1994

Julian date: 131

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
12:00:00	-1	0
12:10:00	-8	1
12:20:00	-27	0
12:30:00	-29	-1
12:40:00	-32	-2
12:50:00	-44	-4
13:00:00	-44	-3
13:10:00	-61	-3
13:20:00	-57	-3
13:30:00	-47	-2
13:40:00	-67	-6
13:50:00	-57	-4
14:00:00	-51	-5
14:10:00	-60	-6
14:20:00	-61	-7
14:30:00	-54	-6
14:40:00	-71	-7
14:50:00	-46	-6
15:00:00	-56	-8
15:10:00	-57	-7
15:20:00	-54	-7
15:30:00	-57	-8
15:40:00	-45	-5
15:50:00	-56	-7
16:00:00	-46	-7
16:10:00	-43	-5
16:20:00	-40	-6
16:30:00	-35	-5
16:40:00	-34	-5
16:50:00	-29	-4
17:00:00	-32	-5
17:10:00	-17	-3
17:20:00	-17	-3
17:30:00	-6	-1
17:40:00	-6	-2
17:50:00	1	1
18:00:00	1	1
18:10:00	9	4
18:20:00	8	7
18:30:00	1	10
18:40:00	-7	0
18:50:00	-4	-1



19:00:00	2	1
19:10:00	5	0
19:20:00	10	0
19:30:00	12	-1
19:40:00	17	-1
19:50:00	16	0
20:00:00	15	-1
20:10:00	27	-2
20:20:00	20	0
20:30:00	33	0
20:40:00	24	1
20:50:00	26	0

Date: WED 11-MAY-1994

Julian date: 131

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
21:00:00	26	1
21:10:00	26	0
21:20:00	35	0
21:30:00	36	-2
21:40:00	23	-1
21:50:00	25	-1
22:00:00	24	1
22:10:00	21	2
22:20:00	12	1
22:30:00	13	1
22:40:00	9	1
22:50:00	13	1
23:00:00	6	0
23:10:00	16	2
23:20:00	5	0
23:30:00	4	0
23:40:00	-4	-1
23:50:00	-11	-2

Date: THU 12-MAY-1994

Julian date: 132

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
00:00:00	-6	-1
00:10:00	-4	-1
00:20:00	-11	-12
00:30:00	12	-5
00:40:00	5	-2
00:50:00	-8	1
01:00:00	-16	1
01:10:00	-19	0
01:20:00	-31	-2
01:30:00	-42	-2
01:40:00	-40	-4
01:50:00	-41	-2
02:00:00	-48	-2
02:10:00	-58	-4
02:20:00	-48	-2
02:30:00	-42	-5
02:40:00	-50	-5
02:50:00	-58	-5
03:00:00	-51	-6
03:10:00	-53	-4
03:20:00	-59	-7
03:30:00	-54	-4
03:40:00	-51	-7
03:50:00	-45	-5
04:00:00	-55	-8
04:10:00	-49	-6
04:20:00	-38	-5
04:30:00	-51	-7
04:40:00	-45	-6
04:50:00	-40	-5
05:00:00	-38	-5
05:10:00	-35	-4
05:20:00	-21	-3
05:30:00	-25	-3
05:40:00	-16	-2
05:50:00	-19	-3
06:00:00	-10	-2
06:10:00	-10	-2
06:20:00	-12	-2
06:30:00	-2	0
06:40:00	2	1
06:50:00	8	3

07:00:00	6	4
07:10:00	-7	6
07:20:00	-15	-2
07:30:00	-11	-2
07:40:00	0	0
07:50:00	17	3
08:00:00	18	0
08:10:00	19	-1
08:20:00	19	-2
08:30:00	10	-1
08:40:00	34	-1
08:50:00	27	0

TIME	V(N) (CM/SC)	V(E) (CM/SC)
09:00:00	30	0
09:10:00	27	-1
09:20:00	25	-1
09:30:00	28	0
09:40:00	26	-1
09:50:00	34	-1
10:00:00	27	0
10:10:00	22	-1
10:20:00	30	-1
10:30:00	20	-1
10:40:00	18	0
10:50:00	10	1
11:00:00	10	1
11:10:00	1	0
11:20:00	0	0
11:30:00	-5	-1
11:40:00	-10	-2
11:50:00	-11	-6
12:00:00	-10	-15
12:10:00	15	-14
12:20:00	14	-6
12:30:00	1	0
12:40:00	-25	3
12:50:00	-18	0
13:00:00	-14	-1
13:10:00	-35	-1
13:20:00	-31	-3
13:30:00	-33	-2
13:40:00	-47	-3
13:50:00	-51	-3
14:00:00	-48	-2
14:10:00	-50	-4
14:20:00	-59	-5
14:30:00	-50	-5
14:40:00	-47	-4
14:50:00	-55	-6
15:00:00	-52	-4
15:10:00	-64	-6
15:20:00	-54	-6
15:30:00	-59	-6
15:40:00	-53	-6
15:50:00	-56	-7

16:00:00	-61	-5
16:10:00	-52	-6
16:20:00	-49	-6
16:30:00	-50	-5
16:40:00	-43	-5
16:50:00	-53	-6
17:00:00	-41	-5
17:10:00	-48	-5
17:20:00	-24	-3
17:30:00	-22	-3
17:40:00	-28	-4
17:50:00	-34	-4

Date: THU 12-MAY-1994

Julian date: 132

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
18:00:00	-19	-3
18:10:00	-9	-2
18:20:00	-8	-2
18:30:00	8	2
18:40:00	13	4
18:50:00	9	8
19:00:00	5	17
19:10:00	-7	6
19:20:00	-7	1
19:30:00	7	2
19:40:00	4	1
19:50:00	12	2
20:00:00	15	0
20:10:00	13	-1
20:20:00	11	-1
20:30:00	10	-1
20:40:00	18	-1
20:50:00	26	-1
21:00:00	29	-2
21:10:00	15	-1
21:20:00	19	-1
21:30:00	26	-1
21:40:00	19	0
21:50:00	34	-1
22:00:00	12	0
22:10:00	19	1
22:20:00	21	2
22:30:00	19	1
22:40:00	19	1
22:50:00	20	1
23:00:00	14	1
23:10:00	6	0
23:20:00	10	1
23:30:00	12	0
23:40:00	15	2
23:50:00	5	0

Date: FRI 13-MAY-1994

Julian date: 133

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
00:00:00	7	0
00:10:00	1	0
00:20:00	1	0
00:30:00	-9	-1
00:40:00	-8	0
00:50:00	3	0
01:00:00	0	0
01:10:00	5	-2
01:20:00	-2	0
01:30:00	0	0
01:40:00	-16	0
01:50:00	-17	0
02:00:00	-28	-2
02:10:00	-35	-2
02:20:00	-38	-4
02:30:00	-38	-2
02:40:00	-49	-3
02:50:00	-56	-4
03:00:00	-57	-2
03:10:00	-50	-5
03:20:00	-53	-4
03:30:00	-49	-6
03:40:00	-42	-4
03:50:00	-49	-6
04:00:00	-45	-4
04:10:00	-43	-6
04:20:00	-46	-6
04:30:00	-41	-6
04:40:00	-36	-4
04:50:00	-39	-5
05:00:00	-43	-7
05:10:00	-33	-4
05:20:00	-32	-4
05:30:00	-29	-5
05:40:00	-29	-4
05:50:00	-19	-3
06:00:00	-10	-1
06:10:00	-24	-5
06:20:00	-13	-1
06:30:00	-12	-1
06:40:00	-9	-1
06:50:00	-1	0



07:00:00	0	0
07:10:00	4	1
07:20:00	8	4
07:30:00	5	8
07:40:00	-9	7
07:50:00	-8	-1
08:00:00	-8	-2
08:10:00	0	0
08:20:00	0	0
08:30:00	9	1
08:40:00	12	0
08:50:00	13	-1

Date: FRI 13-MAY-1994

Julian date: 133

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
09:00:00	18	0
09:10:00	14	0
09:20:00	13	-1
09:30:00	13	0
09:40:00	16	0
09:50:00	28	-1
10:00:00	22	-1
10:10:00	13	-1
10:20:00	12	0
10:30:00	13	-1
10:40:00	10	0
10:50:00	10	0
11:00:00	14	0
11:10:00	18	-1
11:20:00	4	0
11:30:00	4	0
11:40:00	1	0
11:50:00	-7	0
12:00:00	-4	-1
12:10:00	-2	0
12:20:00	1	0
12:30:00	-11	-2
12:40:00	-1	0
12:50:00	0	0
13:00:00	-1	0
13:10:00	-2	0
13:20:00	-16	0
13:30:00	-24	0
13:40:00	-24	-1
13:50:00	-49	-2
14:00:00	-43	-4
14:10:00	-46	-2
14:20:00	-53	-3
14:30:00	-64	-3
14:40:00	-57	-5
14:50:00	-59	-4
15:00:00	-57	-5
15:10:00	-59	-5
15:20:00	-61	-6
15:30:00	-74	-8
15:40:00	-54	-6
15:50:00	-52	-6

16:00:00	-52	-6
16:10:00	-62	-8
16:20:00	-50	-6
16:30:00	-63	-8
16:40:00	-63	-6
16:50:00	-55	-7
17:00:00	-47	-6
17:10:00	-56	-7
17:20:00	-51	-6
17:30:00	-44	-6
17:40:00	-44	-5
17:50:00	-42	-6

Date: FRI 13-MAY-1994

Julian date: 133

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
18:00:00	-21	-3
18:10:00	-20	-3
18:20:00	-25	-5
18:30:00	-26	-4
18:40:00	-8	-1
18:50:00	-6	-1
19:00:00	-7	-3
19:10:00	-1	-1
19:20:00	7	5
19:30:00	3	8
19:40:00	-5	10
19:50:00	-16	-1
20:00:00	0	0
20:10:00	13	2
20:20:00	21	3
20:30:00	21	0
20:40:00	16	-1
20:50:00	16	0
21:00:00	16	0
21:10:00	14	1
21:20:00	28	-1
21:30:00	24	-1
21:40:00	30	0
21:50:00	27	1
22:00:00	33	1
22:10:00	27	1
22:20:00	34	0
22:30:00	42	-3
22:40:00	32	-2
22:50:00	34	-3
23:00:00	21	-1
23:10:00	23	-1
23:20:00	17	-1
23:30:00	27	-1
23:40:00	23	0
23:50:00	13	0

Date: SAT 14-MAY-1994

Julian date: 134

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
00:00:00	10	0
00:10:00	20	0
00:20:00	14	0
00:30:00	8	0
00:40:00	13	0
00:50:00	10	0
01:00:00	4	0
01:10:00	0	0
01:20:00	-4	0
01:30:00	-6	0
01:40:00	-16	-2
01:50:00	-4	2
02:00:00	5	1
02:10:00	4	0
02:20:00	-7	0
02:30:00	-17	0
02:40:00	-18	1
02:50:00	-40	-2
03:00:00	-40	-3
03:10:00	-38	-4
03:20:00	-45	-4
03:30:00	-47	-3
03:40:00	-56	-4
03:50:00	-63	-6
04:00:00	-62	-5
04:10:00	-52	-6
04:20:00	-62	-7
04:30:00	-55	-8
04:40:00	-45	-4
04:50:00	-40	-6
05:00:00	-47	-7
05:10:00	-33	-5
05:20:00	-42	-8
05:30:00	-40	-5
05:40:00	-31	-5
05:50:00	-32	-6
06:00:00	-36	-6
06:10:00	-31	-5
06:20:00	-17	-3
06:30:00	-25	-8
06:40:00	-18	-4
06:50:00	-22	-5

07:00:00	-20	-6
07:10:00	-21	-6
07:20:00	-23	-7
07:30:00	-9	-4
07:40:00	-13	-5
07:50:00	-3	-2
08:00:00	3	2
08:10:00	0	0
08:20:00	3	7
08:30:00	-14	11
08:40:00	-3	0
08:50:00	1	0

Date: SAT 14-MAY-1994

Julian date: 134

Magnetic Variation: 2.5

TIME	V(N) (CM/SC)	V(E) (CM/SC)
09:00:00	11	1
09:10:00	12	1
09:20:00	16	1
09:30:00	21	1
09:40:00	13	1
09:50:00	32	1
10:00:00	17	0
10:10:00	22	-2
10:20:00	31	-3
10:30:00	32	-3
10:40:00	22	-2
10:50:00	28	-2
11:00:00	14	-1
11:10:00	20	-1
11:20:00	23	-1
11:30:00	15	-1
11:40:00	19	-1
11:50:00	6	-1
12:00:00	4	-1
12:10:00	9	-1
12:20:00	3	0
12:30:00	-6	1
12:40:00	-8	3
12:50:00	-3	2
13:00:00	-3	12
13:10:00	9	5
13:20:00	10	-3
13:30:00	-1	0





TOTAL	6	2	0	0	1	4	6	0	0	1		5
PERCENT	21.43	7.14	.00	.00	3.57	14.29	21.43	.00	.00	3.57	10.71	17.86

STATION AVERAGE = .825 (CM/SC)

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
12:00:00	1.26	168	27.36	56.51	35.71
12:10:00	8.33	175	27.42	56.54	35.67
12:20:00	26.76	178	27.46	56.67	35.75
12:30:00	29.13	182	27.51	56.73	35.77
12:40:00	32.05	183	27.65	56.82	35.67
12:50:00	43.94	184	27.85	57.01	35.68
13:00:00	44.05	183	27.67	56.82	35.68
13:10:00	60.61	183	27.88	56.98	35.62
13:20:00	56.61	182	27.92	56.98	35.62
13:30:00	47.01	182	27.94	57.13	35.72
13:40:00	66.89	185	28.14	57.29	35.67
13:50:00	56.81	184	28.16	57.29	35.63
14:00:00	51.33	185	28.26	57.35	35.59
14:10:00	60.33	185	28.26	57.29	35.56
14:20:00	61.78	186	28.35	57.45	35.56
14:30:00	54.40	185	28.39	57.48	35.59
14:40:00	71.47	185	28.55	57.57	35.54
14:50:00	46.77	187	28.55	57.66	35.57
15:00:00	56.65	187	28.63	57.76	35.59
15:10:00	57.21	187	28.63	57.63	35.50
15:20:00	54.78	187	28.68	57.76	35.61
15:30:00	57.39	187	28.84	57.97	35.57
15:40:00	45.56	186	28.70	57.72	35.51
15:50:00	56.21	186	29.23	58.47	35.60
16:00:00	46.47	188	29.29	58.53	35.64
16:10:00	43.14	186	29.03	58.13	35.57
16:20:00	40.84	189	29.46	58.78	35.72
16:30:00	35.81	188	29.09	58.13	35.53
16:40:00	34.19	189	29.39	58.65	35.64
16:50:00	28.86	188	29.48	58.72	35.63
17:00:00	31.99	188	29.11	58.25	35.58
17:10:00	17.67	190	29.31	58.50	35.60
17:20:00	16.91	191	29.52	58.75	35.61
17:30:00	5.63	189	29.48	58.75	35.64
17:40:00	6.63	196	29.58	58.90	35.70
17:50:00	1.38	23	29.56	58.75	35.61
18:00:00	1.49	28	29.46	58.65	35.59
18:10:00	10.06	25	29.46	58.65	35.60
18:20:00	11.03	41	29.52	58.72	35.60
18:30:00	9.95	86	29.31	58.47	35.61
18:40:00	7.43	176	28.94	57.94	35.50
18:50:00	3.81	187	28.88	57.91	35.52

19:00:00	2.12	15	28.51	57.45	35.46
19:10:00	4.59	2	28.47	57.63	35.63
19:20:00	10.30	1	28.55	57.82	35.69
19:30:00	12.01	356	28.51	57.82	35.75
19:40:00	16.67	355	28.26	57.51	35.73
19:50:00	16.27	358	27.75	56.95	35.68
20:00:00	14.86	355	27.73	56.95	35.70
20:10:00	27.42	356	27.90	57.13	35.72
20:20:00	20.06	359	27.96	57.13	35.70
20:30:00	33.33	0	27.67	56.86	35.69
20:40:00	24.51	2	27.67	56.95	35.78
20:50:00	25.52	1	27.69	56.92	35.75

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
21:00:00	25.51	1	27.71	56.95	35.72
21:10:00	26.47	0	27.81	57.13	35.80
21:20:00	34.65	359	28.06	57.23	35.67
21:30:00	35.56	357	28.10	57.29	35.68
21:40:00	22.71	357	28.00	57.29	35.77
21:50:00	25.26	357	27.96	57.20	35.75
22:00:00	24.21	1	27.77	57.01	35.75
22:10:00	21.24	4	27.61	56.82	35.76
22:20:00	12.24	3	27.59	56.73	35.65
22:30:00	13.09	4	27.67	56.86	35.70
22:40:00	9.29	5	27.50	56.70	35.71
22:50:00	12.90	4	27.48	56.70	35.77
23:00:00	6.42	4	27.42	56.61	35.68
23:10:00	15.87	5	27.40	56.61	35.75
23:20:00	5.38	4	27.44	56.61	35.69
23:30:00	3.67	6	27.38	56.54	35.73
23:40:00	4.52	187	27.40	56.54	35.65
23:50:00	11.39	188	27.40	56.64	35.76
Means :			28.31	57.48	35.65

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:00:00	5.74	193	27.42	56.58	35.69
00:10:00	4.49	197	27.44	56.61	35.69
00:20:00	16.38	226	27.59	56.82	35.72
00:30:00	12.86	339	27.53	56.76	35.75
00:40:00	5.53	338	27.38	56.54	35.73
00:50:00	7.69	175	27.46	56.73	35.78
01:00:00	15.68	176	27.55	56.82	35.80
01:10:00	18.53	179	27.59	56.73	35.66
01:20:00	31.14	183	27.59	56.76	35.68
01:30:00	42.39	183	27.77	56.98	35.74
01:40:00	40.63	184	27.85	57.10	35.75
01:50:00	41.14	183	27.67	56.79	35.64
02:00:00	48.12	182	27.69	56.89	35.72
02:10:00	58.06	183	27.96	57.17	35.72
02:20:00	48.32	181	27.94	57.13	35.68
02:30:00	41.99	186	28.14	57.45	35.78
02:40:00	50.33	185	28.20	57.48	35.74
02:50:00	58.56	185	28.22	57.51	35.73
03:00:00	51.13	186	28.22	57.48	35.75
03:10:00	52.78	184	28.33	57.54	35.68
03:20:00	59.10	187	28.29	57.60	35.75
03:30:00	54.49	184	28.66	57.91	35.70
03:40:00	51.66	187	28.43	57.72	35.77
03:50:00	44.95	186	28.74	58.03	35.71
04:00:00	55.06	187	28.63	57.97	35.73
04:10:00	49.83	186	28.68	58.03	35.75
04:20:00	38.66	187	28.74	58.00	35.71
04:30:00	51.34	187	28.68	57.91	35.67
04:40:00	45.56	187	28.74	58.07	35.74
04:50:00	40.04	187	28.70	57.94	35.71
05:00:00	38.77	187	28.64	57.85	35.64
05:10:00	35.56	186	28.64	57.94	35.75
05:20:00	21.04	188	28.59	57.60	35.52
05:30:00	24.89	187	28.61	57.79	35.66
05:40:00	16.32	187	28.68	57.88	35.61
05:50:00	19.38	189	28.68	57.88	35.63
06:00:00	10.50	190	28.59	57.66	35.54
06:10:00	10.09	191	28.47	57.54	35.59
06:20:00	12.26	190	28.53	57.63	35.59
06:30:00	2.08	187	28.51	57.63	35.60
06:40:00	2.35	17	28.59	57.76	35.69
06:50:00	8.21	22	28.78	58.00	35.69

07:00:00	6.75	32	28.84	58.13	35.67
07:10:00	9.21	136	28.57	57.79	35.68
07:20:00	15.40	188	28.51	57.63	35.60
07:30:00	11.69	190	28.39	57.41	35.58
07:40:00	.16	32	28.33	57.38	35.54
07:50:00	17.63	9	28.14	57.26	35.60
08:00:00	18.16	0	28.06	57.32	35.69
08:10:00	18.62	356	27.69	56.92	35.76
08:20:00	19.24	355	27.59	56.76	35.68
08:30:00	10.40	353	27.63	56.89	35.77
08:40:00	34.31	358	27.59	56.79	35.70
08:50:00	26.55	359	27.48	56.64	35.71

Date: THU 12-MAY-1994

Julian date: 132

Magnetic Variation: 2.5

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:00:00	30.44	359	27.38	56.58	35.71
09:10:00	26.52	358	27.38	56.61	35.71
09:20:00	24.86	358	27.40	56.61	35.74
09:30:00	28.27	359	27.38	56.61	35.75
09:40:00	26.12	358	27.36	56.58	35.74
09:50:00	34.36	357	27.36	56.54	35.75
10:00:00	26.67	0	27.50	56.73	35.73
10:10:00	22.00	358	27.69	56.92	35.70
10:20:00	29.53	357	27.87	57.10	35.71
10:30:00	20.49	357	27.83	57.01	35.70
10:40:00	18.22	359	27.63	56.76	35.65
10:50:00	9.85	5	27.50	56.73	35.74
11:00:00	10.05	7	27.53	56.73	35.71
11:10:00	.68	335	27.50	56.79	35.81
11:20:00	.35	310	27.50	56.73	35.77
11:30:00	4.96	190	27.57	56.82	35.74
11:40:00	10.30	193	27.46	56.67	35.72
11:50:00	12.82	208	27.44	56.67	35.73
12:00:00	18.61	235	27.44	56.61	35.69
12:10:00	20.46	316	27.42	56.64	35.72
12:20:00	15.70	335	27.48	56.79	35.78
12:30:00	1.50	342	27.53	56.73	35.72
12:40:00	25.16	174	27.59	56.82	35.73
12:50:00	17.96	179	27.73	56.95	35.74
13:00:00	14.46	183	27.83	57.04	35.74
13:10:00	35.10	182	27.94	57.17	35.72
13:20:00	30.88	185	27.92	57.13	35.68
13:30:00	33.14	183	27.88	57.13	35.74
13:40:00	46.95	183	28.08	57.32	35.74
13:50:00	50.88	182	28.18	57.35	35.71
14:00:00	48.41	182	28.20	57.38	35.65
14:10:00	50.47	184	28.31	57.51	35.65
14:20:00	59.51	185	28.33	57.48	35.63
14:30:00	50.43	185	28.45	57.60	35.63
14:40:00	47.34	184	28.49	57.63	35.65
14:50:00	55.69	186	28.49	57.69	35.69
15:00:00	51.84	184	28.66	57.82	35.63
15:10:00	64.45	185	28.64	57.82	35.63
15:20:00	54.74	186	28.66	57.88	35.65
15:30:00	59.00	186	28.72	57.91	35.66
15:40:00	53.75	186	28.78	57.94	35.62
15:50:00	56.46	187	28.86	58.03	35.63

16:00:00	0.74	184	28.78	57.85	35.58
16:10:00	2.58	186	29.01	58.25	35.69
16:20:00	49.06	187	28.96	58.13	35.57
16:30:00	50.23	186	29.37	58.59	35.63
16:40:00	43.69	186	29.39	58.69	35.70
16:50:00	53.70	186	29.21	58.31	35.55
17:00:00	41.49	186	29.42	58.69	35.64
17:10:00	48.12	186	29.56	58.84	35.66
17:20:00	23.96	186	29.39	58.56	35.62
17:30:00	22.39	187	29.66	58.96	35.66
17:40:00	28.12	187	29.37	58.53	35.63
17:50:00	34.18	187	29.44	58.62	35.55



TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
18:00:00	19.59	190	29.68	58.90	35.60
18:10:00	9.54	191	29.74	59.06	35.67
18:20:00	8.64	193	29.87	59.21	35.67
18:30:00	7.81	14	29.87	59.24	35.71
18:40:00	13.91	15	29.72	59.03	35.64
18:50:00	12.23	43	29.76	59.06	35.68
19:00:00	17.32	74	29.77	59.03	35.60
19:10:00	9.00	138	29.77	59.15	35.72
19:20:00	7.40	172	29.40	58.53	35.54
19:30:00	7.13	20	29.17	58.31	35.64
19:40:00	3.57	10	28.55	57.60	35.55
19:50:00	12.36	7	28.59	57.66	35.55
20:00:00	14.86	1	28.53	57.72	35.62
20:10:00	12.75	357	28.55	57.79	35.68
20:20:00	11.30	355	28.43	57.69	35.69
20:30:00	9.88	354	28.08	57.35	35.73
20:40:00	17.73	356	27.96	57.26	35.73
20:50:00	25.62	358	27.88	57.20	35.81
21:00:00	28.93	356	27.96	57.20	35.73
21:10:00	15.02	356	28.12	57.32	35.71
21:20:00	18.93	357	28.20	57.45	35.72
21:30:00	25.87	357	28.31	57.60	35.73
21:40:00	18.73	358	28.29	57.48	35.65
21:50:00	34.00	358	28.22	57.48	35.69
22:00:00	11.87	0	28.04	57.26	35.70
22:10:00	19.34	4	27.81	57.07	35.73
22:20:00	21.19	4	27.73	56.92	35.68
22:30:00	19.38	2	27.73	56.92	35.70
22:40:00	18.93	2	27.69	57.01	35.81
22:50:00	19.54	2	27.71	56.95	35.70
23:00:00	14.47	2	27.67	56.89	35.71
23:10:00	5.73	3	27.69	56.95	35.74
23:20:00	10.50	3	27.67	56.98	35.79
23:30:00	12.39	1	27.71	56.92	35.72
23:40:00	15.52	5	27.65	56.82	35.70
23:50:00	5.18	2	27.65	56.86	35.71
Means :			28.26	57.48	35.69

Date: FRI 13-MAY-1994

Julian date: 133

Magnetic Variation: 2.5

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:00:00	6.62	4	27.67	56.92	35.75
00:10:00	1.17	1	27.71	56.98	35.73
00:20:00	1.42	358	27.79	57.01	35.74
00:30:00	8.99	184	27.67	56.95	35.75
00:40:00	8.44	183	27.65	56.86	35.67
00:50:00	2.57	6	27.65	56.86	35.72
01:00:00	.00	150	27.53	56.82	35.78
01:10:00	5.31	341	27.50	56.79	35.80
01:20:00	2.12	174	27.50	56.67	35.68
01:30:00	.51	326	27.53	56.76	35.73
01:40:00	16.02	178	27.63	56.82	35.73
01:50:00	17.01	180	27.67	56.92	35.75
02:00:00	28.06	183	27.71	56.82	35.62
02:10:00	35.51	183	27.88	57.07	35.69
02:20:00	38.32	185	28.00	57.26	35.74
02:30:00	38.16	183	27.81	57.01	35.73
02:40:00	49.06	183	27.79	56.86	35.60
02:50:00	55.75	183	27.98	57.20	35.74
03:00:00	57.00	182	27.96	57.13	35.63
03:10:00	49.87	185	28.22	57.51	35.77
03:20:00	53.24	184	28.16	57.35	35.69
03:30:00	49.73	187	28.16	57.38	35.71
03:40:00	41.87	186	28.41	57.63	35.68
03:50:00	49.50	187	28.35	57.57	35.67
04:00:00	45.46	184	28.72	58.00	35.70
04:10:00	43.04	188	28.57	57.82	35.71
04:20:00	46.75	186	28.84	58.13	35.69
04:30:00	41.83	187	28.92	58.22	35.70
04:40:00	35.91	187	28.86	58.25	35.80
04:50:00	39.23	187	29.01	58.31	35.72
05:00:00	43.55	188	28.84	58.22	35.77
05:10:00	33.45	187	28.90	58.19	35.73
05:20:00	32.00	187	29.00	58.25	35.68
05:30:00	29.59	190	28.96	58.31	35.75
05:40:00	29.22	188	28.72	57.85	35.65
05:50:00	18.82	189	28.72	57.82	35.54
06:00:00	9.72	187	28.88	58.07	35.60
06:10:00	24.54	190	29.13	58.53	35.73
06:20:00	13.32	186	28.82	58.00	35.68
06:30:00	12.40	186	28.59	57.57	35.54
06:40:00	9.50	187	28.61	57.69	35.56
06:50:00	.82	181	28.74	57.94	35.63

07:00:00	.42	358	28.94	58.25	35.71
07:10:00	3.90	16	28.96	58.25	35.69
07:20:00	8.93	29	28.96	58.34	35.74
07:30:00	9.27	59	29.11	58.50	35.73
07:40:00	11.04	143	29.07	58.50	35.82
07:50:00	7.74	187	28.98	58.31	35.75
08:00:00	8.00	193	28.92	58.25	35.71
08:10:00	.30	306	28.55	57.72	35.64
08:20:00	.23	204	28.24	57.41	35.64
08:30:00	8.54	3	28.22	57.51	35.77
08:40:00	12.25	358	28.00	57.26	35.71
08:50:00	13.06	357	27.75	56.95	35.69

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:00:00	17.98	359	27.69	56.92	35.75
09:10:00	13.81	359	27.57	56.82	35.75
09:20:00	13.51	356	27.57	56.82	35.75
09:30:00	13.36	0	27.57	56.79	35.72
09:40:00	15.81	359	27.59	56.82	35.74
09:50:00	28.27	357	27.57	56.82	35.75
10:00:00	22.29	358	27.57	56.73	35.71
10:10:00	13.04	357	27.57	56.82	35.75
10:20:00	12.44	358	27.55	56.79	35.73
10:30:00	13.51	357	27.51	56.76	35.74
10:40:00	10.29	357	27.50	56.76	35.78
10:50:00	9.78	357	27.51	56.76	35.78
11:00:00	14.37	1	27.83	57.13	35.76
11:10:00	18.37	356	28.31	57.63	35.77
11:20:00	4.32	358	28.22	57.51	35.76
11:30:00	4.12	353	28.06	57.35	35.76
11:40:00	.81	2	27.75	56.98	35.73
11:50:00	7.42	181	27.57	56.82	35.75
12:00:00	3.92	188	27.61	56.82	35.73
12:10:00	1.54	189	27.65	56.89	35.75
12:20:00	1.33	355	27.73	56.95	35.71
12:30:00	11.51	189	27.75	57.04	35.79
12:40:00	1.18	183	27.69	56.89	35.72
12:50:00	.26	289	27.63	56.82	35.69
13:00:00	.51	179	27.61	56.82	35.74
13:10:00	1.67	183	27.71	56.89	35.69
13:20:00	15.71	178	27.88	57.10	35.71
13:30:00	23.96	180	28.00	57.35	35.82
13:40:00	24.09	183	28.12	57.38	35.77
13:50:00	49.03	182	28.02	57.26	35.71
14:00:00	43.02	184	28.10	57.38	35.74
14:10:00	46.21	183	28.16	57.41	35.75
14:20:00	52.74	183	28.31	57.51	35.67
14:30:00	64.05	183	28.37	57.60	35.68
14:40:00	57.50	184	28.39	57.72	35.80
14:50:00	59.58	183	28.49	57.63	35.63
15:00:00	57.61	185	28.53	57.76	35.68
15:10:00	59.05	185	28.59	57.85	35.67
15:20:00	61.48	185	28.57	57.82	35.69
15:30:00	74.78	185	28.64	57.85	35.62
15:40:00	54.75	186	28.74	57.91	35.63
15:50:00	52.40	186	28.74	58.00	35.70

16:00:00	52.33	186	28.78	58.00	35.64
16:10:00	52.59	186	28.68	57.76	35.58
16:20:00	50.12	186	28.90	58.13	35.64
16:30:00	63.14	186	28.94	58.10	35.56
16:40:00	63.63	185	28.88	58.00	35.54
16:50:00	55.86	187	29.03	58.25	35.71
17:00:00	47.67	187	29.11	58.31	35.61
17:10:00	56.91	187	29.21	58.41	35.58
17:20:00	51.49	186	29.00	58.13	35.60
17:30:00	44.80	187	29.25	58.47	35.63
17:40:00	44.50	186	28.96	58.07	35.61
17:50:00	42.14	188	29.03	58.13	35.57

Date: FRI 13-MAY-1994

Julian date: 133

Magnetic Variation: 2.5

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
18:00:00	21.73	188	28.90	57.97	35.59
18:10:00	20.75	189	29.19	58.44	35.59
18:20:00	25.45	191	29.64	59.00	35.71
18:30:00	26.25	189	29.35	58.53	35.63
18:40:00	7.69	189	29.23	58.38	35.64
18:50:00	5.73	190	29.23	58.47	35.64
19:00:00	7.92	200	29.31	58.56	35.65
19:10:00	1.19	204	29.40	58.65	35.67
19:20:00	9.17	36	29.62	58.93	35.66
19:30:00	8.54	66	29.58	58.96	35.74
19:40:00	11.55	118	29.07	58.16	35.61
19:50:00	15.99	181	28.74	57.79	35.57
20:00:00	.51	18	28.59	57.60	35.55
20:10:00	13.21	7	28.61	57.63	35.55
20:20:00	21.17	8	28.70	57.94	35.68
20:30:00	20.59	358	28.70	58.03	35.74
20:40:00	16.17	358	28.39	57.72	35.78
20:50:00	15.88	359	28.33	57.60	35.70
21:00:00	15.62	359	28.18	57.41	35.69
21:10:00	14.41	2	27.88	57.13	35.71
21:20:00	28.27	358	27.85	57.10	35.75
21:30:00	24.09	358	27.77	57.04	35.77
21:40:00	29.88	359	27.77	57.01	35.72
21:50:00	27.22	1	27.83	57.10	35.74
22:00:00	33.40	1	27.87	57.17	35.78
22:10:00	27.07	1	27.81	57.04	35.73
22:20:00	34.30	0	27.83	57.10	35.75
22:30:00	41.64	355	28.26	57.54	35.74
22:40:00	32.15	356	28.10	57.38	35.77
22:50:00	33.85	355	28.08	57.38	35.79
23:00:00	21.39	356	28.06	57.38	35.78
23:10:00	22.96	357	28.04	57.29	35.72
23:20:00	17.33	358	27.98	57.29	35.78
23:30:00	27.51	357	27.96	57.29	35.78
23:40:00	22.86	359	28.00	57.29	35.73
23:50:00	13.46	0	27.94	57.20	35.69
Means:			28.32	57.55	35.70

Date: SAT 14-MAY-1994

Julian date: 134

Magnetic Variation: 2.5

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:00:00	10.34	357	27.88	57.20	35.77
00:10:00	19.93	359	27.88	57.17	35.75
00:20:00	14.03	358	27.88	57.10	35.71
00:30:00	7.73	1	27.88	57.10	35.73
00:40:00	13.20	359	27.87	57.13	35.75
00:50:00	9.67	359	27.88	57.13	35.71
01:00:00	4.09	356	27.87	57.17	35.75
01:10:00	.28	46	27.87	57.17	35.75
01:20:00	4.33	183	27.90	57.13	35.74
01:30:00	6.33	179	27.88	57.13	35.74
01:40:00	15.81	186	27.85	57.10	35.74
01:50:00	4.65	148	27.79	57.10	35.80
02:00:00	5.15	5	27.77	57.01	35.72
02:10:00	4.26	3	27.83	57.10	35.72
02:20:00	6.57	177	27.87	57.17	35.71
02:30:00	17.17	178	27.92	57.17	35.71
02:40:00	17.81	177	27.79	57.07	35.73
02:50:00	40.37	182	27.75	57.01	35.77
03:00:00	39.83	184	27.87	57.13	35.76
03:10:00	38.62	185	27.94	57.20	35.71
03:20:00	45.32	185	27.71	56.89	35.74
03:30:00	47.07	183	27.67	56.86	35.69
03:40:00	56.60	183	28.00	57.26	35.71
03:50:00	63.09	185	27.96	57.23	35.78
04:00:00	62.19	184	28.06	57.29	35.70
04:10:00	52.62	186	28.14	57.45	35.79
04:20:00	62.22	186	28.22	57.45	35.68
04:30:00	55.50	188	28.18	57.45	35.74
04:40:00	45.34	185	28.41	57.66	35.73
04:50:00	40.47	187	28.27	57.54	35.71
05:00:00	47.09	188	28.45	57.72	35.72
05:10:00	33.10	188	28.57	57.91	35.76
05:20:00	42.49	191	28.39	57.69	35.74
05:30:00	40.49	187	28.63	57.97	35.77
05:40:00	31.40	189	28.70	58.03	35.75
05:50:00	32.84	190	28.49	57.88	35.82
06:00:00	36.57	189	28.66	57.97	35.71
06:10:00	30.89	189	28.78	58.10	35.74
06:20:00	17.18	190	28.80	58.22	35.78
06:30:00	26.23	196	28.72	58.13	35.82
06:40:00	18.89	192	28.70	58.00	35.72
06:50:00	22.50	192	28.74	58.00	35.69

07:00:00	1.12	195	28.84	58.22	35.77
07:10:00	22.23	195	28.88	58.31	35.77
07:20:00	24.28	197	28.96	58.50	35.87
07:30:00	9.31	202	28.90	58.38	35.84
07:40:00	13.72	202	28.82	58.13	35.70
07:50:00	3.99	210	28.86	58.31	35.82
08:00:00	3.61	30	28.92	58.34	35.77
08:10:00	.27	147	28.84	58.34	35.85
08:20:00	7.66	67	28.78	58.22	35.80
08:30:00	17.92	140	28.80	58.22	35.79
08:40:00	3.28	186	28.78	58.25	35.82
08:50:00	1.00	0	28.43	57.76	35.78



Date: SAT 14-MAY-1994

Julian date: 134

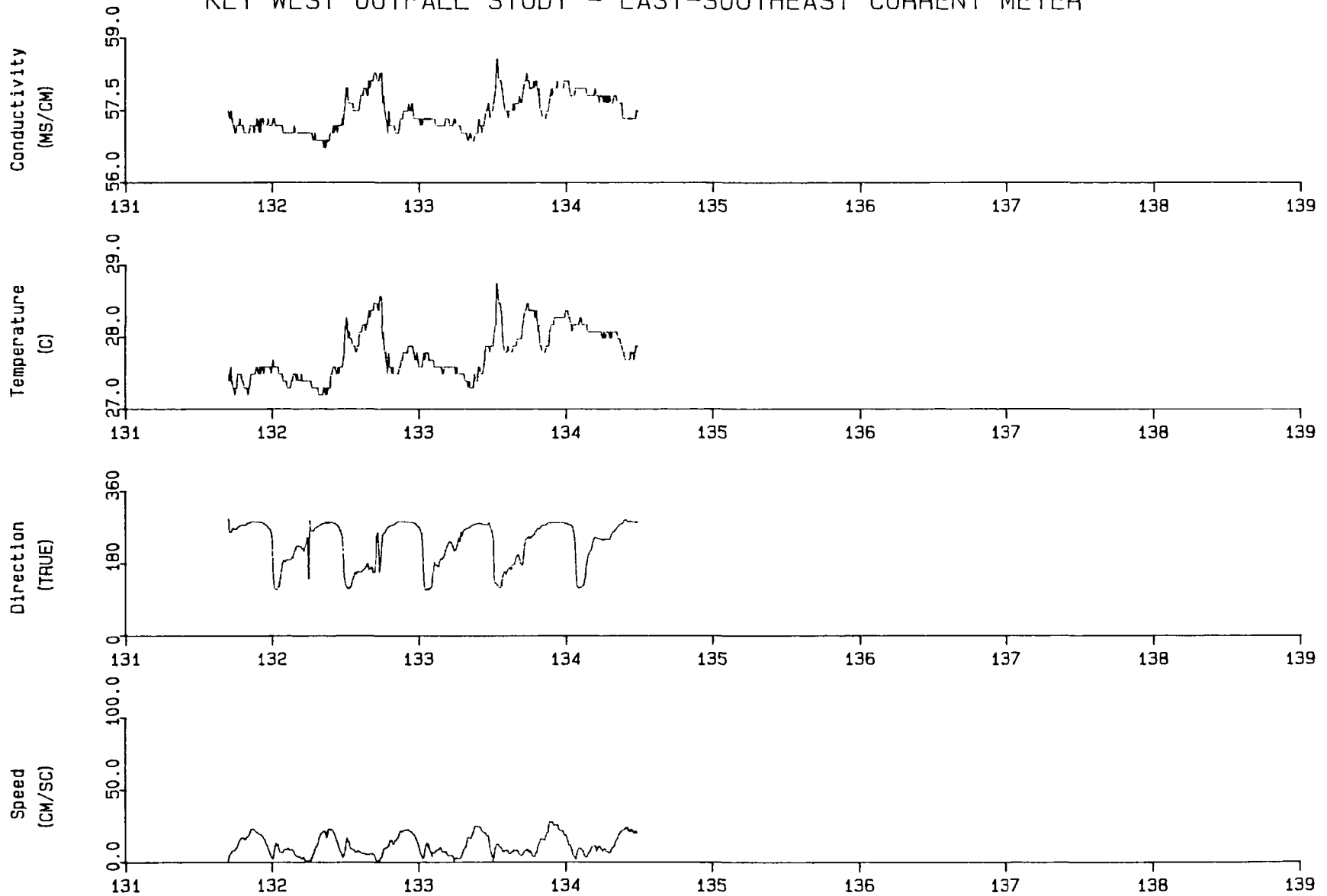
Magnetic Variation: 2.5

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:00:00	11.21	3	28.24	57.45	35.68
09:10:00	12.40	2	28.04	57.29	35.71
09:20:00	16.26	4	28.04	57.29	35.71
09:30:00	21.23	2	28.00	57.29	35.74
09:40:00	12.74	2	27.98	57.23	35.71
09:50:00	32.44	1	27.88	57.13	35.71
10:00:00	17.20	359	27.85	57.10	35.73
10:10:00	22.54	355	27.77	56.98	35.71
10:20:00	30.84	355	27.79	56.98	35.71
10:30:00	32.09	355	27.85	57.07	35.72
10:40:00	22.20	355	27.90	57.20	35.77
10:50:00	27.66	355	27.90	57.17	35.72
11:00:00	14.47	356	27.90	57.13	35.72
11:10:00	19.68	356	27.85	57.10	35.72
11:20:00	23.40	357	27.87	57.10	35.74
11:30:00	14.56	357	27.87	57.13	35.78
11:40:00	18.89	357	27.90	57.13	35.72
11:50:00	6.16	354	28.04	57.29	35.73
12:00:00	4.53	352	27.96	57.20	35.73
12:10:00	8.95	355	27.98	57.29	35.75
12:20:00	3.16	352	27.96	57.26	35.75
12:30:00	5.77	173	28.10	57.38	35.75
12:40:00	8.83	162	28.16	57.45	35.74
12:50:00	3.16	145	28.22	57.41	35.66
13:00:00	12.22	102	28.14	57.45	35.75
13:10:00	10.80	29	28.10	57.35	35.73
13:20:00	10.20	345	28.02	57.23	35.70
13:30:00	.87	157	27.98	57.26	35.71
Means :			28.18	57.47	35.74

# APPENDIX A

**\* EAST CURRENT METER DATA \***

KEY WEST OUTFALL STUDY - EAST-SOUTHEAST CURRENT METER



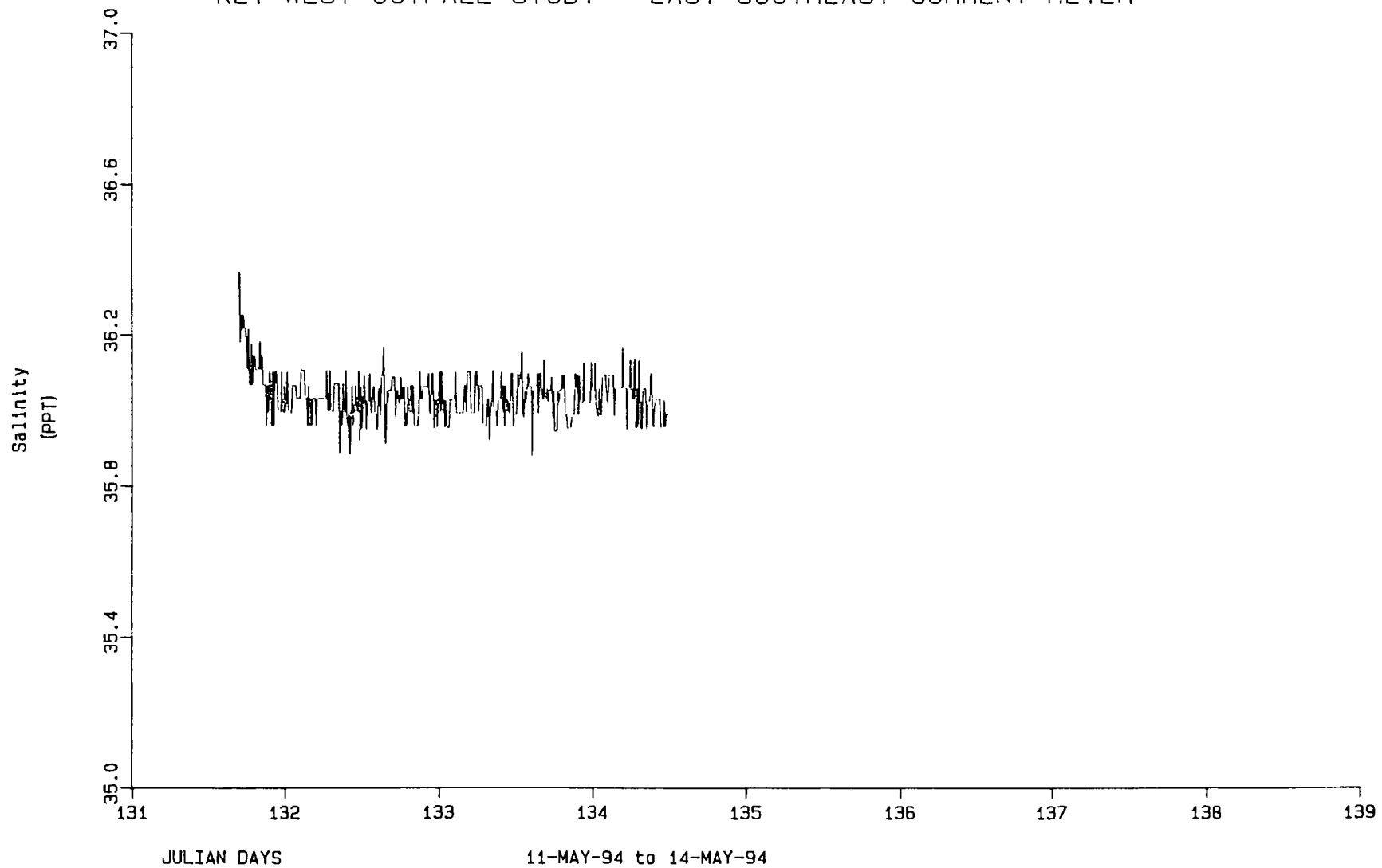
JULIAN DAYS

11-MAY-94 to 14-MAY-94

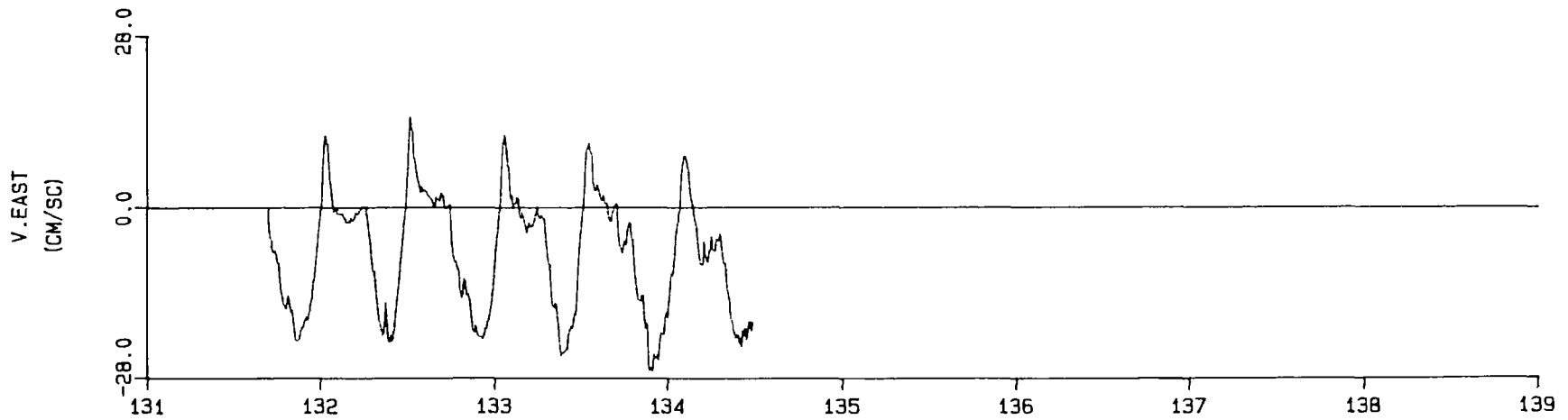
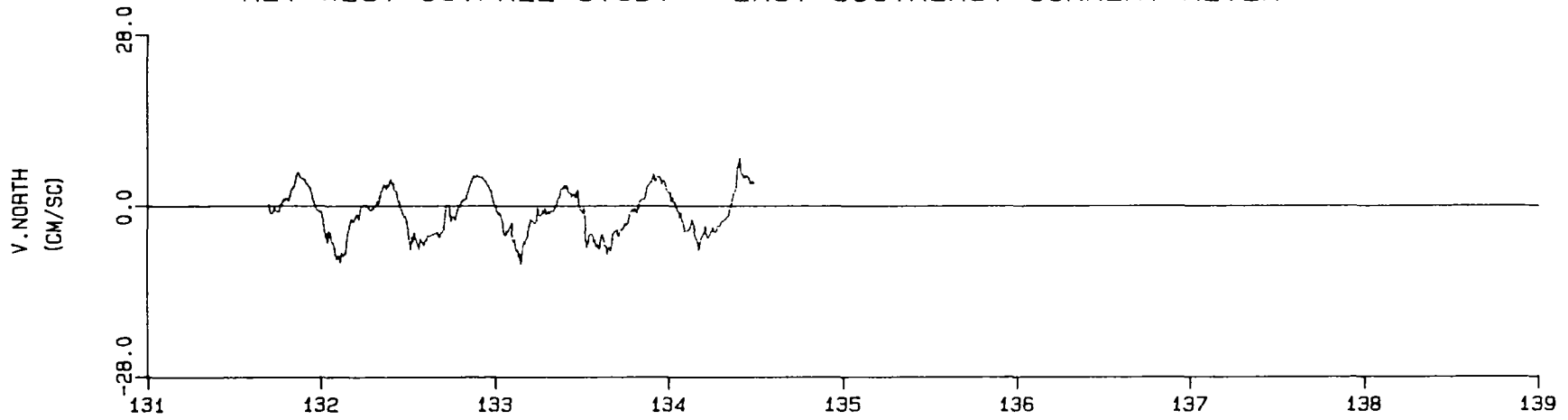
Endeco Type 174SSM Current Meter

Page: 1

KEY WEST OUTFALL STUDY - EAST-SOUTHEAST CURRENT METER



KEY WEST OUTFALL STUDY - EAST-SOUTHEAST CURRENT METER



JULIAN DAYS

11-MAY-94 to 14-MAY-94

Endeco Type 174SSM Current Meter

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TOTAL	0	0	0	0	1	2	1	8	5	2	—	0
PERCENT	.00	.00	.00	.00	5.26	10.53	5.26	42.11	26.32	10.53	.00	.00

STATION AVERAGE = .741 (CM/SC)

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
16:45:00	.51	290	27.38	57.47	36.36
16:55:00	3.27	255	27.48	57.32	36.18
17:05:00	5.28	254	27.38	57.32	36.25
17:15:00	5.77	257	27.57	57.47	36.21
17:25:00	7.53	262	27.38	57.32	36.25
17:35:00	7.28	266	27.28	57.16	36.22
17:45:00	7.28	262	27.28	57.16	36.22
17:55:00	8.04	262	27.18	57.01	36.18
18:05:00	9.29	264	27.28	57.01	36.10
18:15:00	9.29	264	27.28	57.16	36.22
18:25:00	11.30	269	27.48	57.16	36.06
18:35:00	13.56	271	27.48	57.16	36.06
18:45:00	14.82	272	27.48	57.32	36.18
18:55:00	16.08	273	27.48	57.16	36.06
19:05:00	16.33	272	27.38	57.16	36.14
19:15:00	16.82	273	27.38	57.16	36.14
19:25:00	15.82	273	27.28	57.01	36.10
19:35:00	14.57	272	27.28	57.01	36.10
19:45:00	15.82	275	27.28	57.01	36.10
19:55:00	17.33	278	27.28	57.01	36.10
20:05:00	17.08	279	27.18	57.01	36.18
20:15:00	18.58	279	27.28	57.01	36.10
20:25:00	20.34	280	27.38	57.16	36.14
20:35:00	22.36	282	27.48	57.16	36.06
20:45:00	22.61	283	27.48	57.16	36.06
20:55:00	22.61	283	27.48	57.16	36.06
21:05:00	22.10	282	27.48	57.01	35.95
21:15:00	20.85	282	27.48	57.16	36.06
21:25:00	20.34	282	27.57	57.16	35.99
21:35:00	20.09	282	27.57	57.32	36.10
21:45:00	19.34	282	27.48	57.16	36.06
21:55:00	18.84	280	27.48	57.01	35.95
22:05:00	18.33	280	27.57	57.32	36.10
22:15:00	18.84	279	27.48	57.01	35.95
22:25:00	17.84	279	27.57	57.32	36.10
22:35:00	17.08	278	27.57	57.32	36.10
22:45:00	15.57	276	27.48	57.16	36.06
22:55:00	15.07	273	27.57	57.16	35.99
23:05:00	12.31	272	27.57	57.16	35.99
23:15:00	11.30	269	27.57	57.16	35.99
23:25:00	9.29	265	27.57	57.32	36.10
23:35:00	7.53	264	27.57	57.16	35.99



23:45:00	5.28	259	27.57	57.16	35.99
23:55:00	3.52	252	27.48	57.16	36.06
Means:			27.44	57.17	36.10

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:05:00	1.76	234	27.57	57.16	35.99
00:15:00	2.01	151	27.67	57.32	36.03
00:25:00	7.03	116	27.57	57.32	36.10
00:35:00	10.80	112	27.57	57.16	35.99
00:45:00	12.81	113	27.57	57.16	35.99
00:55:00	11.30	113	27.57	57.16	35.99
01:05:00	12.05	120	27.57	57.16	35.99
01:15:00	8.29	120	27.48	57.16	36.06
01:25:00	6.03	140	27.48	57.16	36.06
01:35:00	6.53	158	27.48	57.16	36.06
01:45:00	6.03	176	27.48	57.16	36.06
01:55:00	6.78	188	27.38	57.01	36.03
02:05:00	8.04	182	27.38	57.01	36.03
02:15:00	8.79	182	27.38	57.01	36.03
02:25:00	8.29	188	27.38	57.01	36.03
02:35:00	8.29	188	27.28	57.01	36.10
02:45:00	9.54	186	27.28	57.01	36.10
02:55:00	7.79	188	27.28	57.01	36.10
03:05:00	8.29	188	27.28	57.01	36.10
03:15:00	8.29	192	27.38	57.01	36.03
03:25:00	8.04	193	27.38	57.01	36.03
03:35:00	7.28	202	27.48	57.01	35.95
03:45:00	5.53	207	27.48	57.16	36.06
03:55:00	4.27	216	27.48	57.01	35.95
04:05:00	3.77	224	27.38	57.01	36.03
04:15:00	2.76	220	27.48	57.01	35.95
04:25:00	3.52	221	27.38	57.01	36.03
04:35:00	3.52	220	27.38	57.01	36.03
04:45:00	2.76	220	27.38	57.01	36.03
04:55:00	1.76	212	27.48	57.01	35.95
05:05:00	2.01	216	27.38	57.01	36.03
05:15:00	2.76	206	27.38	57.01	36.03
05:25:00	1.25	217	27.38	57.01	36.03
05:35:00	.25	224	27.38	57.01	36.03
05:45:00	.25	242	27.38	57.01	36.03
05:55:00	.00	238	27.38	57.01	36.03
06:05:00	.00	138	27.38	57.01	36.03
06:15:00	.00	287	27.38	57.01	36.03
06:25:00	1.25	258	27.38	57.01	36.03
06:35:00	2.51	258	27.28	57.01	36.10
06:45:00	4.27	258	27.28	56.85	35.99
06:55:00	5.77	261	27.28	56.85	35.99

07:05:00	8.29	266	27.28	57.01	36.10
07:15:00	0.55	266	27.28	56.85	35.99
07:25:00	10.55	269	27.28	56.85	35.99
07:35:00	12.05	269	27.28	56.85	35.99
07:45:00	14.57	272	27.18	56.85	36.07
07:55:00	16.58	271	27.18	56.85	36.07
08:05:00	18.58	273	27.18	56.85	36.07
08:15:00	19.60	276	27.18	56.85	36.07
08:25:00	20.34	276	27.18	56.85	36.07
08:35:00	21.35	278	27.28	56.69	35.88
08:45:00	20.85	279	27.28	56.85	35.99
08:55:00	19.09	279	27.18	56.69	35.96

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:05:00	15.82	279	27.18	56.85	36.07
09:15:00	19.84	279	27.28	56.85	35.99
09:25:00	22.36	279	27.28	56.85	35.99
09:35:00	22.61	280	27.28	57.01	36.10
09:45:00	21.35	279	27.48	57.01	35.95
09:55:00	22.36	279	27.48	57.01	35.95
10:05:00	20.85	276	27.57	57.16	35.99
10:15:00	19.84	276	27.57	57.01	35.88
10:25:00	18.09	276	27.57	57.16	35.99
10:35:00	16.08	272	27.48	57.16	36.06
10:45:00	14.06	272	27.48	57.01	35.95
10:55:00	12.31	268	27.57	57.16	35.99
11:05:00	9.80	265	27.48	57.16	36.06
11:15:00	7.53	258	27.57	57.16	35.99
11:25:00	6.03	249	27.57	57.16	35.99
11:35:00	3.77	241	27.57	57.32	36.10
11:45:00	2.51	200	27.67	57.16	35.91
11:55:00	4.52	143	27.77	57.47	36.06
12:05:00	7.53	124	28.06	57.63	35.95
12:15:00	12.56	119	28.26	57.94	36.02
12:25:00	16.58	116	28.16	57.94	36.09
12:35:00	13.81	112	27.96	57.63	36.02
12:45:00	13.56	116	28.06	57.63	35.95
12:55:00	9.04	119	27.96	57.63	36.02
13:05:00	9.04	126	27.96	57.63	36.02
13:15:00	8.29	137	27.87	57.63	36.10
13:25:00	7.79	145	27.87	57.47	35.99
13:35:00	8.04	154	27.87	57.47	35.99
13:45:00	6.03	157	27.77	57.47	36.06
13:55:00	6.78	151	27.77	57.47	36.06
14:05:00	6.53	158	27.87	57.47	35.99
14:15:00	7.28	157	27.87	57.47	35.99
14:25:00	6.28	155	28.06	57.63	35.95
14:35:00	6.28	157	28.06	57.78	36.06
14:45:00	5.28	158	28.06	57.78	36.06
14:55:00	5.28	161	28.16	57.78	35.98
15:05:00	5.28	164	28.16	57.94	36.09
15:15:00	5.03	165	28.16	57.94	36.09
15:25:00	4.77	169	28.06	57.94	36.17
15:35:00	4.77	178	28.16	57.78	35.98
15:45:00	4.52	178	28.26	57.78	35.91
15:55:00	4.77	161	28.35	58.10	36.05

16:05:00	4.52	165	28.26	57.94	36.02
16:15:00	5.28	168	28.35	58.10	36.05
16:25:00	5.28	169	28.35	58.10	36.05
16:35:00	5.03	152	28.35	58.10	36.05
16:45:00	4.77	157	28.45	58.25	36.09
16:55:00	4.27	157	28.45	58.25	36.09
17:05:00	2.26	179	28.45	58.25	36.09
17:15:00	.51	247	28.45	58.10	35.98
17:25:00	.00	255	28.35	58.10	36.05
17:35:00	.00	223	28.35	58.10	36.05
17:45:00	.75	154	28.55	58.25	36.01
17:55:00	2.76	175	28.55	58.25	36.01

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
18:05:00	2.51	221	28.45	58.25	36.09
18:15:00	5.53	249	27.96	57.63	36.02
18:25:00	8.29	255	28.06	57.78	36.06
18:35:00	9.29	254	27.77	57.47	36.06
18:45:00	9.04	261	27.77	57.32	35.95
18:55:00	9.80	265	27.57	57.16	35.99
19:05:00	10.30	269	27.48	57.01	35.95
19:15:00	10.80	268	27.77	57.47	36.06
19:25:00	14.06	272	27.57	57.16	35.99
19:35:00	15.07	272	27.57	57.16	35.99
19:45:00	14.32	273	27.48	57.16	36.06
19:55:00	11.81	273	27.57	57.16	35.99
20:05:00	12.31	275	27.48	57.16	36.06
20:15:00	14.57	278	27.48	57.01	35.95
20:25:00	14.57	280	27.48	57.01	35.95
20:35:00	15.57	282	27.48	57.01	35.95
20:45:00	16.58	283	27.48	57.01	35.95
20:55:00	18.58	283	27.57	57.16	35.99
21:05:00	20.85	283	27.57	57.32	36.10
21:15:00	21.10	282	27.67	57.32	36.03
21:25:00	20.09	283	27.67	57.32	36.03
21:35:00	21.10	283	27.77	57.47	36.06
21:45:00	21.60	282	27.77	57.47	36.06
21:55:00	21.85	282	27.77	57.47	36.06
22:05:00	21.85	282	27.77	57.47	36.06
22:15:00	21.85	282	27.77	57.47	36.06
22:25:00	22.10	280	27.87	57.63	36.10
22:35:00	21.35	280	27.87	57.47	35.99
22:45:00	20.34	280	27.87	57.47	35.99
22:55:00	20.34	279	27.87	57.63	36.10
23:05:00	19.09	279	27.87	57.63	36.10
23:15:00	18.58	278	27.77	57.32	35.95
23:25:00	17.33	278	27.67	57.32	36.03
23:35:00	16.08	275	27.67	57.32	36.03
23:45:00	14.57	272	27.77	57.32	35.95
23:55:00	12.81	269	27.67	57.32	36.03
Means:			27.67	57.32	36.02

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:05:00	10.55	268	27.57	57.32	36.10
00:15:00	7.79	262	27.57	57.16	35.99
00:25:00	5.28	252	27.57	57.32	36.10
00:35:00	3.77	252	27.57	57.16	35.99
00:45:00	1.76	210	27.67	57.32	36.03
00:55:00	3.01	140	27.77	57.32	35.95
01:05:00	7.03	112	27.67	57.32	36.03
01:15:00	11.30	112	27.77	57.32	35.95
01:25:00	12.81	112	27.77	57.32	35.95
01:35:00	12.05	113	27.77	57.32	35.95
01:45:00	9.80	114	27.67	57.32	36.03
01:55:00	7.53	117	27.67	57.32	36.03
02:05:00	6.28	122	27.67	57.32	36.03
02:15:00	3.01	155	27.67	57.32	36.03
02:25:00	6.03	161	27.67	57.32	36.03
02:35:00	6.03	182	27.57	57.32	36.10
02:45:00	5.53	174	27.57	57.16	35.99
02:55:00	7.53	175	27.57	57.16	35.99
03:05:00	7.28	168	27.57	57.16	35.99
03:15:00	8.29	171	27.57	57.16	35.99
03:25:00	7.79	182	27.57	57.16	35.99
03:35:00	9.80	189	27.57	57.16	35.99
03:45:00	9.29	192	27.57	57.16	35.99
03:55:00	6.78	188	27.48	57.16	36.06
04:05:00	6.03	195	27.48	57.16	36.06
04:15:00	6.78	200	27.57	57.16	35.99
04:25:00	6.28	210	27.57	57.32	36.10
04:35:00	6.78	220	27.57	57.32	36.10
04:45:00	4.77	224	27.57	57.32	36.10
04:55:00	3.52	230	27.57	57.32	36.10
05:05:00	4.27	234	27.57	57.16	35.99
05:15:00	4.27	230	27.57	57.16	35.99
05:25:00	4.27	226	27.57	57.16	35.99
05:35:00	3.77	220	27.57	57.16	35.99
05:45:00	2.76	209	27.57	57.32	36.10
05:55:00	.51	207	27.57	57.32	36.10
06:05:00	2.01	213	27.48	57.16	36.06
06:15:00	2.51	221	27.57	57.16	35.99
06:25:00	2.51	233	27.48	57.16	36.06
06:35:00	1.51	242	27.48	57.16	36.06
06:45:00	2.26	231	27.48	57.16	36.06
06:55:00	2.01	257	27.48	57.01	35.95

07:05:00	3.77	245	27.48	57.01	35.95
07:15:00	5.77	257	27.48	57.01	35.95
07:25:00	7.79	262	27.48	57.01	35.95
07:35:00	9.54	261	27.38	57.01	36.03
07:45:00	9.54	265	27.38	57.01	36.03
07:55:00	13.31	265	27.38	56.85	35.92
08:05:00	16.33	266	27.28	56.85	35.99
08:15:00	16.58	268	27.38	57.01	36.03
08:25:00	15.82	269	27.28	57.01	36.10
08:35:00	16.08	272	27.28	56.85	35.99
08:45:00	18.09	273	27.28	56.85	35.99
08:55:00	19.84	273	27.28	56.85	35.99



TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:05:00	22.86	276	27.48	57.01	35.95
09:15:00	24.61	276	27.38	57.01	36.03
09:25:00	24.12	276	27.38	57.01	36.03
09:35:00	24.12	278	27.38	57.01	36.03
09:45:00	23.86	276	27.57	57.32	36.10
09:55:00	23.61	278	27.57	57.16	35.99
10:05:00	23.36	275	27.48	57.16	36.06
10:15:00	21.10	275	27.48	57.01	35.95
10:25:00	20.34	275	27.48	57.16	36.06
10:35:00	19.60	273	27.57	57.16	35.99
10:45:00	20.09	275	27.67	57.32	36.03
10:55:00	19.09	275	27.87	57.47	35.99
11:05:00	17.58	273	27.87	57.47	35.99
11:15:00	17.84	276	27.87	57.63	36.10
11:25:00	15.57	279	27.87	57.63	36.10
11:35:00	10.80	269	27.77	57.32	35.95
11:45:00	7.53	264	27.87	57.47	35.99
11:55:00	5.28	259	27.87	57.47	35.99
12:05:00	3.52	247	27.87	57.47	35.99
12:15:00	.75	233	27.87	57.63	36.10
12:25:00	3.01	129	28.06	57.78	36.06
12:35:00	8.79	127	28.16	57.94	36.09
12:45:00	11.81	126	28.74	58.56	36.08
12:55:00	11.56	122	28.65	58.56	36.15
13:05:00	11.56	114	28.45	58.10	35.98
13:15:00	10.05	117	28.45	58.10	35.98
13:25:00	9.80	117	28.35	58.10	36.05
13:35:00	9.29	122	28.26	57.94	36.02
13:45:00	7.03	147	28.06	57.78	36.06
13:55:00	6.03	157	27.87	57.63	36.10
14:05:00	7.28	158	27.77	57.47	36.06
14:15:00	7.28	150	27.77	57.47	36.06
14:25:00	7.79	158	27.77	57.47	36.06
14:35:00	7.28	164	27.87	57.32	35.88
14:45:00	5.28	168	27.77	57.47	36.06
14:55:00	4.77	168	27.77	57.47	36.06
15:05:00	5.77	161	27.77	57.47	36.06
15:15:00	6.53	175	27.77	57.47	36.06
15:25:00	6.78	174	27.87	57.63	36.10
15:35:00	8.04	176	27.87	57.47	35.99
15:45:00	7.03	186	27.87	57.63	36.10
15:55:00	7.03	195	27.87	57.63	36.10

16:05:00	8.04	199	27.96	57.63	36.02
16:15:00	6.78	200	27.96	57.63	36.02
16:25:00	4.77	190	27.96	57.78	36.13
16:35:00	4.27	179	27.96	57.63	36.02
16:45:00	4.02	174	27.96	57.63	36.02
16:55:00	4.02	172	28.06	57.78	36.06
17:05:00	5.28	190	28.26	57.94	36.02
17:15:00	6.78	223	28.35	58.10	36.05
17:25:00	7.53	238	28.35	58.10	36.05
17:35:00	8.04	240	28.45	58.25	36.09
17:45:00	8.54	244	28.45	58.10	35.98
17:55:00	7.03	244	28.35	58.10	36.05

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
18:05:00	6.53	240	28.35	57.94	35.94
18:15:00	6.78	244	28.35	57.94	35.94
18:25:00	5.28	247	28.35	57.94	35.94
18:35:00	3.52	251	28.35	58.10	36.05
18:45:00	2.76	248	28.26	57.94	36.02
18:55:00	3.01	258	28.35	58.10	36.05
19:05:00	5.53	258	28.35	58.10	36.05
19:15:00	5.53	265	28.16	57.94	36.09
19:25:00	9.29	265	28.06	57.78	36.06
19:35:00	11.56	262	28.16	57.94	36.09
19:45:00	13.31	268	27.87	57.47	35.99
19:55:00	15.32	272	27.87	57.47	35.99
20:05:00	15.32	272	27.77	57.32	35.95
20:15:00	15.57	273	27.77	57.32	35.95
20:25:00	14.57	273	27.77	57.32	35.95
20:35:00	14.57	273	27.77	57.32	35.95
20:45:00	17.33	275	27.87	57.47	35.99
20:55:00	20.09	278	27.87	57.47	35.99
21:05:00	19.34	279	27.87	57.47	35.99
21:15:00	20.85	279	27.87	57.63	36.10
21:25:00	27.38	278	28.06	57.78	36.06
21:35:00	26.62	278	28.16	57.94	36.09
21:45:00	27.38	279	28.16	57.78	35.98
21:55:00	27.38	280	28.16	57.94	36.09
22:05:00	24.37	279	28.26	57.94	36.02
22:15:00	25.12	279	28.26	57.94	36.02
22:25:00	25.12	280	28.26	57.94	36.02
22:35:00	24.61	280	28.26	58.10	36.13
22:45:00	25.62	280	28.26	57.94	36.02
22:55:00	22.36	280	28.26	57.94	36.02
23:05:00	20.85	279	28.26	57.94	36.02
23:15:00	21.35	280	28.26	57.94	36.02
23:25:00	21.10	280	28.26	57.94	36.02
23:35:00	21.35	279	28.26	57.94	36.02
23:45:00	18.33	278	28.26	58.10	36.13
23:55:00	17.58	276	28.35	58.10	36.05
Means:			27.83	57.49	36.03

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
00:05:00	18.33	276	28.35	58.10	36.05
00:15:00	16.08	278	28.35	58.10	36.05
00:25:00	13.81	272	28.26	58.10	36.13
00:35:00	11.05	276	28.26	57.94	36.02
00:45:00	11.30	272	28.16	57.78	35.98
00:55:00	9.80	272	28.16	57.78	35.98
01:05:00	7.79	268	28.06	57.78	36.06
01:15:00	4.52	258	28.16	57.78	35.98
01:25:00	3.27	249	28.16	57.78	35.98
01:35:00	3.01	228	28.16	57.94	36.09
01:45:00	1.25	161	28.16	57.94	36.09
01:55:00	5.03	119	28.16	57.94	36.09
02:05:00	7.53	114	28.16	57.94	36.09
02:15:00	9.29	117	28.26	57.94	36.02
02:25:00	9.29	116	28.26	57.94	36.02
02:35:00	8.54	119	28.16	57.94	36.09
02:45:00	7.53	122	28.16	57.94	36.09
02:55:00	6.78	123	28.16	57.94	36.09
03:05:00	4.27	136	28.16	57.94	36.09
03:15:00	2.51	152	28.16	57.94	36.09
03:25:00	3.01	175	28.16	57.78	35.98
03:35:00	3.52	193	28.06	57.78	36.06
03:45:00	5.53	202	28.06	57.78	36.06
03:55:00	6.28	207	28.06	57.78	36.06
04:05:00	7.03	210	28.06	57.78	36.06
04:15:00	9.54	219	28.06	57.78	36.06
04:25:00	10.05	231	28.06	57.78	36.06
04:35:00	10.80	240	28.06	57.78	36.06
04:45:00	10.80	242	28.06	57.94	36.17
04:55:00	10.55	244	28.06	57.78	36.06
05:05:00	6.53	238	28.06	57.78	36.06
05:15:00	9.29	240	28.06	57.78	36.06
05:25:00	10.55	238	28.06	57.63	35.95
05:35:00	10.55	240	28.06	57.78	36.06
05:45:00	8.79	237	28.06	57.78	36.06
05:55:00	7.79	237	27.96	57.78	36.13
06:05:00	6.03	234	27.96	57.63	36.02
06:15:00	8.29	238	28.06	57.78	36.06
06:25:00	8.54	238	27.96	57.63	36.02
06:35:00	8.54	238	27.96	57.78	36.13
06:45:00	6.28	237	28.06	57.63	35.95
06:55:00	6.53	238	28.06	57.78	36.06

07:05:00	6.53	238	28.06	57.63	35.95
07:15:00	5.28	237	27.96	57.78	36.13
07:25:00	6.28	245	28.06	57.63	35.95
07:35:00	8.04	251	27.96	57.63	36.02
07:45:00	9.54	255	28.06	57.63	35.95
07:55:00	9.54	257	28.06	57.78	36.06
08:05:00	10.55	259	28.06	57.78	36.06
08:15:00	13.81	262	28.06	57.78	36.06
08:25:00	14.82	266	28.06	57.63	35.95
08:35:00	15.82	269	27.96	57.63	36.02
08:45:00	18.58	272	27.96	57.63	36.02
08:55:00	18.84	275	27.96	57.63	36.02

TIME	SPEED (CM/SC)	DIR (TRU)	TEMP (C)	COND (MS/CM)	SALN (PPT)
09:05:00	20.34	276	27.87	57.63	36.10
09:15:00	20.85	276	27.87	57.63	36.10
09:25:00	21.85	278	27.77	57.32	35.95
09:35:00	21.85	286	27.77	57.32	35.95
09:45:00	22.10	287	27.67	57.32	36.03
09:55:00	23.61	289	27.67	57.32	36.03
10:05:00	22.10	283	27.67	57.32	36.03
10:15:00	23.61	282	27.67	57.32	36.03
10:25:00	20.85	282	27.67	57.32	36.03
10:35:00	21.60	282	27.67	57.32	36.03
10:45:00	20.60	283	27.77	57.32	35.95
10:55:00	22.36	282	27.77	57.32	35.95
11:05:00	21.35	282	27.77	57.32	35.95
11:15:00	19.34	280	27.67	57.32	36.03
11:25:00	19.09	280	27.77	57.32	35.95
11:35:00	20.85	280	27.87	57.47	35.99
11:45:00	19.34	280	27.87	57.47	35.99
11:55:00	17.08	279	28.06	57.78	36.06
12:05:00	15.07	275	27.96	57.63	36.02
Means:			28.01	57.70	36.03

## APPENDIX B

\* CORMIX MODEL RUN \*









X	Y	Z	S	C	B
.00	.00	.50	1.0	.925E+03	.31

I MOD101: DISCHARGE MODULE

BEGIN MOD111: WEAKLY DEFLECTED JET IN CROSSFLOW

CO-FLOWING DISCHARGE

Profile definitions:

B = Gaussian 1/e (37%) half-width, normal to trajectory

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	B
.00	.00	.50	1.0	.925E+03	.34
.01	.00	.51	1.0	.922E+03	.34
.02	.00	.52	1.0	.919E+03	.34
.03	.00	.53	1.0	.916E+03	.34
.04	.00	.54	1.0	.913E+03	.34
.05	.00	.55	1.0	.910E+03	.34
.06	.00	.56	1.0	.908E+03	.34
.07	.00	.57	1.0	.905E+03	.34
.08	.00	.58	1.0	.902E+03	.34
.09	.00	.59	1.0	.899E+03	.35
.10	.00	.60	1.0	.896E+03	.35
.11	.00	.61	1.0	.893E+03	.35
.12	.00	.62	1.0	.891E+03	.35
.13	.00	.63	1.0	.888E+03	.35
.14	.00	.64	1.0	.885E+03	.35
.15	.00	.65	1.0	.883E+03	.35
.16	.00	.66	1.1	.880E+03	.35
.17	.00	.67	1.1	.877E+03	.35
.18	.00	.68	1.1	.874E+03	.36
.19	.00	.69	1.1	.872E+03	.36
.20	.00	.70	1.1	.869E+03	.36
.21	.00	.71	1.1	.867E+03	.36
.22	.00	.73	1.1	.864E+03	.36
.23	.00	.74	1.1	.861E+03	.36
.24	.00	.75	1.1	.859E+03	.36
.24	.00	.76	1.1	.856E+03	.36
.25	.00	.77	1.1	.854E+03	.36
.26	.00	.78	1.1	.851E+03	.36
.27	.00	.79	1.1	.849E+03	.37
.28	.00	.80	1.1	.846E+03	.37
.29	.00	.81	1.1	.844E+03	.37
.30	.00	.83	1.1	.841E+03	.37
.31	.00	.84	1.1	.839E+03	.37
.32	.00	.85	1.1	.836E+03	.37
.33	.00	.86	1.1	.834E+03	.37
.34	.00	.87	1.1	.832E+03	.37
.35	.00	.88	1.1	.829E+03	.37
.36	.00	.90	1.1	.827E+03	.38
.37	.00	.91	1.1	.824E+03	.38
.38	.00	.92	1.1	.822E+03	.38
.39	.00	.93	1.1	.820E+03	.38
.40	.00	.95	1.1	.817E+03	.38
.41	.00	.96	1.1	.815E+03	.38

.42	.00	.97	1.1	.813E+03	.38
.43	.00	.98	1.1	.811E+03	.38
.44	.00	.99	1.1	.808E+03	.38
.45	.00	1.01	1.1	.806E+03	.39
.46	.00	1.02	1.2	.804E+03	.39
.47	.00	1.03	1.2	.802E+03	.39
.48	.00	1.05	1.2	.799E+03	.39
.49	.00	1.06	1.2	.797E+03	.39

Cumulative travel time = 0. sec

END OF MOD111: WEAKLY DEFLECTED JET IN CROSSFLOW

BEGIN MOD121: WEAKLY DEFLECTED PLUME IN CROSSFLOW

Profile definitions:

B = Gaussian 1/e (37%) half-width, normal to trajectory

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	B
.49	.00	1.06	1.2	.797E+03	.38
.61	.00	1.13	1.2	.769E+03	.39
.73	.00	1.21	1.2	.742E+03	.40
.84	.00	1.29	1.3	.717E+03	.41
.96	.00	1.37	1.3	.693E+03	.42
1.07	.00	1.44	1.4	.670E+03	.43
1.19	.00	1.52	1.4	.648E+03	.43
1.30	.00	1.60	1.5	.628E+03	.44
1.41	.00	1.67	1.5	.608E+03	.45
1.51	.00	1.75	1.6	.590E+03	.46
1.62	.00	1.83	1.6	.572E+03	.47
1.73	.00	1.90	1.7	.555E+03	.48
1.84	.00	1.98	1.7	.539E+03	.49
1.94	.00	2.06	1.8	.524E+03	.49
2.04	.00	2.13	1.8	.510E+03	.50
2.15	.00	2.21	1.9	.496E+03	.51
2.25	.00	2.29	1.9	.482E+03	.52
2.35	.00	2.36	2.0	.469E+03	.53
2.45	.00	2.44	2.0	.457E+03	.54
2.55	.00	2.52	2.1	.445E+03	.54
2.65	.00	2.59	2.1	.434E+03	.55
2.75	.00	2.67	2.2	.423E+03	.56
2.85	.00	2.75	2.2	.413E+03	.57
2.95	.00	2.83	2.3	.403E+03	.58
3.04	.00	2.90	2.4	.393E+03	.59
3.14	.00	2.98	2.4	.384E+03	.60
3.24	.00	3.06	2.5	.375E+03	.60
3.33	.00	3.13	2.5	.366E+03	.61
3.43	.00	3.21	2.6	.358E+03	.62
3.52	.00	3.29	2.6	.350E+03	.63
3.62	.00	3.36	2.7	.343E+03	.64
3.71	.00	3.44	2.8	.335E+03	.65
3.81	.00	3.52	2.8	.328E+03	.65
3.90	.00	3.59	2.9	.321E+03	.66
3.99	.00	3.67	2.9	.314E+03	.67
4.08	.00	3.75	3.0	.308E+03	.68
4.18	.00	3.82	3.1	.302E+03	.69
4.27	.00	3.90	3.1	.295E+03	.70
4.36	.00	3.98	3.2	.290E+03	.71

4.45	.00	4.05	3.3	.284E+03	.71
4.54	.00	4.13	3.3	.278E+03	.72
4.64	.00	4.21	3.4	.273E+03	.73
4.73	.00	4.29	3.5	.268E+03	.74
4.82	.00	4.36	3.5	.263E+03	.75
4.91	.00	4.44	3.6	.258E+03	.76
5.00	.00	4.52	3.7	.253E+03	.76
5.09	.00	4.59	3.7	.249E+03	.77
5.18	.00	4.67	3.8	.244E+03	.78
5.27	.00	4.75	3.9	.240E+03	.79
5.36	.00	4.82	3.9	.236E+03	.80
5.45	.00	4.90	4.0	.231E+03	.81

Cumulative travel time = 2. sec

END OF MOD121: WEAKLY DEFLECTED PLUME IN CROSSFLOW

BEGIN MOD132: LAYER BOUNDARY IMPINGEMENT/UPSTREAM SPREADING

Vertical angle of layer/boundary impingement = 40.71 deg  
Horizontal angle of layer/boundary impingement = .00 deg

UPSTREAM INTRUSION PROPERTIES:

Upstream intrusion length = 2.89 m  
X-position of upstream stagnation point = 2.56 m  
Thickness in intrusion region = .58 m  
Half-width at downstream end = 7.50 m  
Thickness at downstream end = .58 m

Plume width as a function of position:

	2.56	3.51	4.46	5.40	6.35	7.30	8.25	9.20
:	.00	2.84	4.01	4.91	5.67	6.34	6.95	7.50

Profile definitions:

BV = top-hat thickness, measured vertically  
BH = top-hat half-width, measured horizontally in Y-direction  
ZU = upper plume boundary (Z-coordinate)  
ZL = lower plume boundary (Z-coordinate)  
S = hydrodynamic average (bulk) dilution  
C = average (bulk) concentration (includes reaction effects, if any)

Control volume inflow:

X	Y	Z	S	C	B
5.45	.00	4.90	4.0	.231E+03	.81

Control volume outflow:

X	Y	Z	S	C	BV	BH	ZU	ZL
9.20	.00	6.00	6.8	.136E+03	.58	7.50	6.00	5.42

Cumulative travel time = 21. sec

END OF MOD132: LAYER BOUNDARY IMPINGEMENT/UPSTREAM SPREADING

\*\* End of NEAR-FIELD REGION (NFR) \*\*

BEGIN MOD141: BUOYANT AMBIENT SPREADING

Profile definitions:

BV = top-hat thickness, measured vertically  
BH = top-hat half-width, measured horizontally in Y-direction  
ZU = upper plume boundary (Z-coordinate)  
ZL = lower plume boundary (Z-coordinate)

S = hydrodynamic average (bulk) dilution

C = average (bulk) concentration (includes reaction effects, if any)

e Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
9.20	.00	6.00	6.8	.136E+03	.58	7.50	6.00	5.42
49.01	.00	6.00	8.9	.105E+03	.27	20.80	6.00	5.73
88.83	.00	6.00	9.9	.930E+02	.21	30.40	6.00	5.79
128.65	.00	6.00	10.9	.849E+02	.18	38.50	6.00	5.82
168.46	.00	6.00	11.9	.778E+02	.17	45.68	6.00	5.83
208.28	.00	6.00	13.0	.713E+02	.16	52.24	6.00	5.84
248.09	.00	6.00	14.2	.652E+02	.16	58.32	6.00	5.84
287.91	.00	6.00	15.6	.594E+02	.16	64.04	6.00	5.84
327.73	.00	6.00	17.1	.540E+02	.16	69.47	6.00	5.84
367.54	.00	6.00	18.9	.490E+02	.16	74.66	6.00	5.84
407.36	.00	6.00	20.8	.444E+02	.17	79.66	6.00	5.83
447.17	.00	6.00	23.0	.403E+02	.17	84.48	6.00	5.83
486.99	.00	6.00	25.3	.365E+02	.18	89.17	6.00	5.82
526.81	.00	6.00	28.0	.331E+02	.19	93.73	6.00	5.81
566.62	.00	6.00	30.8	.300E+02	.20	98.19	6.00	5.80
606.44	.00	6.00	33.9	.273E+02	.21	102.55	6.00	5.79
646.25	.00	6.00	37.2	.249E+02	.22	106.82	6.00	5.78
686.07	.00	6.00	40.8	.227E+02	.24	111.02	6.00	5.76
725.89	.00	6.00	44.7	.207E+02	.25	115.15	6.00	5.75
765.70	.00	6.00	48.8	.190E+02	.26	119.21	6.00	5.74
805.52	.00	6.00	53.2	.174E+02	.28	123.21	6.00	5.72
845.33	.00	6.00	57.9	.160E+02	.29	127.16	6.00	5.71
885.15	.00	6.00	62.9	.147E+02	.31	131.06	6.00	5.69
924.97	.00	6.00	68.1	.136E+02	.32	134.91	6.00	5.68
64.78	.00	6.00	73.7	.126E+02	.34	138.72	6.00	5.66
04.60	.00	6.00	79.6	.116E+02	.36	142.48	6.00	5.64
1044.41	.00	6.00	85.7	.108E+02	.38	146.20	6.00	5.62
1084.23	.00	6.00	92.2	.100E+02	.40	149.89	6.00	5.60
1124.05	.00	6.00	99.0	.934E+01	.41	153.54	6.00	5.59
1163.86	.00	6.00	106.1	.871E+01	.43	157.15	6.00	5.57
1203.68	.00	6.00	113.6	.814E+01	.45	160.73	6.00	5.55
1243.49	.00	6.00	121.4	.762E+01	.47	164.28	6.00	5.53
1283.31	.00	6.00	129.5	.714E+01	.50	167.80	6.00	5.50
1323.13	.00	6.00	138.0	.670E+01	.52	171.29	6.00	5.48
1362.94	.00	6.00	146.8	.630E+01	.54	174.75	6.00	5.46
1402.76	.00	6.00	155.9	.593E+01	.56	178.18	6.00	5.44
1442.57	.00	6.00	165.4	.559E+01	.59	181.59	6.00	5.41
1482.39	.00	6.00	175.3	.528E+01	.61	184.97	6.00	5.39
1522.21	.00	6.00	185.5	.499E+01	.63	188.33	6.00	5.37
1562.02	.00	6.00	196.1	.472E+01	.66	191.66	6.00	5.34
1601.84	.00	6.00	207.1	.447E+01	.68	194.97	6.00	5.32
1641.65	.00	6.00	218.4	.423E+01	.71	198.26	6.00	5.29
1681.47	.00	6.00	230.2	.402E+01	.73	201.52	6.00	5.27
1721.29	.00	6.00	242.3	.382E+01	.76	204.76	6.00	5.24
1761.10	.00	6.00	254.7	.363E+01	.79	207.99	6.00	5.21
1800.92	.00	6.00	267.6	.346E+01	.81	211.19	6.00	5.19
1840.74	.00	6.00	280.9	.329E+01	.84	214.37	6.00	5.16
1880.55	.00	6.00	294.5	.314E+01	.87	217.54	6.00	5.13
1920.37	.00	6.00	308.6	.300E+01	.90	220.68	6.00	5.10
60.18	.00	6.00	323.0	.286E+01	.93	223.81	6.00	5.07
00.00	.00	6.00	337.9	.274E+01	.96	226.91	6.00	5.04

Cumulative travel time = 9975. sec

Simulation limit based on maximum specified distance = 2000.00 m.  
This is the REGION OF INTEREST limitation.

CORMIX SESSION REPORT:

XX

CORNELL MIXING ZONE EXPERT SYSTEM

nt system: CORMIX v.2.10 April 1993
SITE NAME/LABEL: KEY WEST OUTFALL - MAY 1994
ORIGINAL design case: FAR FIELD
ORIGINAL file name: FF4
Start of main session: 07/28/94--09:50:51

DESIGN ITERATION number: 2
NEW DESIGN CASE: FAR FIELD
NEW FILE NAME: FF6
Using subsystem CORMIX1: Submerged Single Port Discharges
(Version: CMX1 v.2.20 April 1993)
Start of iteration session: 07/28/94--11:25:29

\*\*\*\*\*
SUMMARY OF INPUT DATA:

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AMBIENT PARAMETERS:

Cross-section = unbounded
Average depth HA = 6 m
Depth at discharge HD = 6 m
Ambient velocity UA = .2 m/s
Darcy-Weisbach friction factor F = .0116
Wind velocity UW = 3 m/s
Stratification Type STRCND = U
Surface density RHOAS = 1016.8 kg/m^3
Bottom density RHOAB = 1016.8 kg/m^3

DISCHARGE PARAMETERS:

Submerged Single Port Discharge
Nearest bank = left
Distance to bank DISTB = 900 m
Port diameter DO = .62 m
Port cross-sectional area AO = 0.3018 m^2
Discharge velocity UO = 0.85 m/s
Discharge flowrate QO = .257 m^3/s
Discharge port height HO = .5 m
Vertical discharge angle THETA = 0 deg
Horizontal discharge angle SIGMA = 0 deg
Discharge temperature (freshwater) = 28 degC
Corresponding density RHO0 = 996.2337 kg/m^3
Density difference DRHO = 20.5662 kg/m^3
Buoyant acceleration GPO = .1984 m/s^2
Discharge concentration CO = 925 PPB
Surface heat exchange coeff. KS = 0 m/s
Coefficient of decay KD = 0 /s

DISCHARGE/ENVIRONMENT LENGTH SCALES:

LQ = 0.54 m Lm = 2.33 m Lb = 6.37 m
LM = 1.41 m Lm' = 99999.0 m Lb' = 99999.0 m

NON-DIMENSIONAL PARAMETERS:

Strat densimetric Froude number FR0 = 2.42
Velocity ratio R = 4.25

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge = no
Water quality standard specified = no
Regulatory mixing zone = no

Region of interest = 10000.00 m downstream

\*\*\*\*\*

HYDRODYNAMIC CLASSIFICATION:

-----\*  
FLOW CLASS = H3 |  
\*-----\*

This flow configuration applies to a layer corresponding to the full water depth at the discharge site.

Applicable layer depth = water depth = 6 m

\*\*\*\*\*

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-----

X-Y-Z Coordinate system:

Origin is located at the bottom below the port center:  
900 m from the left bank/shore.

-----

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at edge of NFR = 136.1576 PPB

Dilution at edge of NFR = 6.7

NFR Location: x = 9.19 m

(centerline coordinates) y = .00 m

z = 6.00 m

NFR plume dimensions: half-width = 7.49 m

thickness = .58 m

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buoyancy assessment:

The effluent density is less than the surrounding ambient water density at the discharge level.

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

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UPSTREAM INTRUSION SUMMARY:

Plume exhibits upstream intrusion due to low ambient velocity or strong discharge buoyancy.

Intrusion length = 2.88 m

Intrusion stagnation point = 2.56 m

Intrusion thickness = .58 m

Intrusion half width at impingement = 7.49 m

Intrusion half thickness at impingement = .58 m

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FAR-FIELD MIXING SUMMARY:

Plume becomes vertically fully mixed at 6203.16 m downstream.

\*\*\*\*\* TOXIC DILUTION ZONE SUMMARY \*\*\*\*\*

No TDZ was specified for this simulation.

\*\*\*\*\* REGULATORY MIXING ZONE SUMMARY \*\*\*\*\*

No RMZ and no ambient water quality standard have been specified.

\*\*\*\*\* FINAL DESIGN ADVICE AND COMMENTS \*\*\*\*\*

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.

Comparative comparison with field and laboratory data has shown that the MIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +/-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.





X	Y	Z	S	C	B
.00	.00	.50	1.0	.925E+03	.31

OF MOD101: DISCHARGE MODULE

-----  
 BEGIN MOD111: WEAKLY DEFLECTED JET IN CROSSFLOW

CO-FLOWING DISCHARGE

Profile definitions:

- B = Gaussian 1/e (37%) half-width, normal to trajectory
- S = hydrodynamic centerline dilution
- C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	B
.00	.00	.50	1.0	.925E+03	.34
.02	.00	.52	1.0	.918E+03	.34
.05	.00	.55	1.0	.910E+03	.34
.07	.00	.57	1.0	.903E+03	.34
.10	.00	.60	1.0	.896E+03	.35
.12	.00	.62	1.0	.889E+03	.35
.15	.00	.65	1.0	.883E+03	.35
.17	.00	.68	1.1	.876E+03	.35
.20	.00	.70	1.1	.869E+03	.36
.22	.00	.73	1.1	.863E+03	.36
.24	.00	.76	1.1	.856E+03	.36
.27	.00	.79	1.1	.850E+03	.37
.29	.00	.81	1.1	.844E+03	.37
.32	.00	.84	1.1	.838E+03	.37
.34	.00	.87	1.1	.832E+03	.37
.37	.00	.90	1.1	.826E+03	.38
.39	.00	.93	1.1	.820E+03	.38
.42	.00	.96	1.1	.814E+03	.38
.44	.00	.99	1.1	.808E+03	.38
.47	.00	1.03	1.2	.803E+03	.39
.49	.00	1.06	1.2	.797E+03	.39

Cumulative travel time = 0. sec

END OF MOD111: WEAKLY DEFLECTED JET IN CROSSFLOW

-----  
 BEGIN MOD121: WEAKLY DEFLECTED PLUME IN CROSSFLOW

Profile definitions:

- B = Gaussian 1/e (37%) half-width, normal to trajectory
- S = hydrodynamic centerline dilution
- C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	B
.49	.00	1.06	1.2	.797E+03	.38
.79	.00	1.25	1.3	.729E+03	.41
1.07	.00	1.44	1.4	.670E+03	.43
1.35	.00	1.63	1.5	.618E+03	.45
1.62	.00	1.83	1.6	.572E+03	.47
1.89	.00	2.02	1.7	.532E+03	.49
2.15	.00	2.21	1.9	.496E+03	.51
2.40	.00	2.40	2.0	.463E+03	.53
2.65	.00	2.59	2.1	.434E+03	.55

2.90	.00	2.79	2.3	.408E+03	.57
3.14	.00	2.98	2.4	.384E+03	.60
3.38	.00	3.17	2.6	.362E+03	.62
3.62	.00	3.36	2.7	.343E+03	.64
3.85	.00	3.56	2.9	.324E+03	.66
4.08	.00	3.75	3.0	.308E+03	.68
4.32	.00	3.94	3.2	.292E+03	.70
4.54	.00	4.13	3.3	.278E+03	.72
4.77	.00	4.32	3.5	.265E+03	.74
5.00	.00	4.52	3.7	.253E+03	.76
5.22	.00	4.71	3.8	.242E+03	.79
5.45	.00	4.90	4.0	.231E+03	.81

Cumulative travel time = 2. sec

END OF MOD121: WEAKLY DEFLECTED PLUME IN CROSSFLOW

BEGIN MOD132: LAYER BOUNDARY IMPINGEMENT/UPSTREAM SPREADING

Vertical angle of layer/boundary impingement = 40.67 deg  
Horizontal angle of layer/boundary impingement = .00 deg

UPSTREAM INTRUSION PROPERTIES:

Upstream intrusion length	=	2.88 m
X-position of upstream stagnation point	=	2.56 m
Thickness in intrusion region	=	.58 m
Half-width at downstream end	=	7.49 m
Thickness at downstream end	=	.58 m

me width as a function of position:

	2.56	3.51	4.46	5.40	6.35	7.30	8.25	9.19
Y:	.00	2.83	4.01	4.91	5.66	6.33	6.94	7.49

Profile definitions:

BV = top-hat thickness, measured vertically  
BH = top-hat half-width, measured horizontally in Y-direction  
ZU = upper plume boundary (Z-coordinate)  
ZL = lower plume boundary (Z-coordinate)  
S = hydrodynamic average (bulk) dilution  
C = average (bulk) concentration (includes reaction effects, if any)

Control volume inflow:

X	Y	Z	S	C	B
5.45	.00	4.90	4.0	.231E+03	.81

Control volume outflow:

X	Y	Z	S	C	BV	BH	ZU	ZL
9.19	.00	6.00	6.8	.136E+03	.58	7.49	6.00	5.42

Cumulative travel time = 21. sec

END OF MOD132: LAYER BOUNDARY IMPINGEMENT/UPSTREAM SPREADING

\*\* End of NEAR-FIELD REGION (NFR) \*\*

MOD141: BUOYANT AMBIENT SPREADING

Profile definitions:

BV = top-hat thickness, measured vertically  
BH = top-hat half-width, measured horizontally in Y-direction  
ZU = upper plume boundary (Z-coordinate)  
ZL = lower plume boundary (Z-coordinate)

S = hydrodynamic average (bulk) dilution  
 C = average (bulk) concentration (includes reaction effects, if any)

ne Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
9.19	.00	6.00	6.8	.136E+03	.58	7.49	6.00	5.42
318.89	.00	6.00	16.8	.552E+02	.16	68.29	6.00	5.84
628.59	.00	6.00	35.7	.259E+02	.22	104.93	6.00	5.78
938.29	.00	6.00	70.0	.132E+02	.33	136.19	6.00	5.67
1247.99	.00	6.00	122.3	.756E+01	.48	164.68	6.00	5.52
1557.68	.00	6.00	195.0	.474E+01	.65	191.30	6.00	5.35
1867.38	.00	6.00	290.0	.319E+01	.86	216.49	6.00	5.14
2177.08	.00	6.00	409.0	.226E+01	1.09	240.53	6.00	4.91
2486.78	.00	6.00	553.5	.167E+01	1.35	263.61	6.00	4.65
2796.48	.00	6.00	725.0	.128E+01	1.63	285.85	6.00	4.37
3106.18	.00	6.00	924.7	.100E+01	1.93	307.38	6.00	4.07
3415.88	.00	6.00	1153.9	.802E+00	2.26	328.27	6.00	3.74
3725.57	.00	6.00	1413.6	.654E+00	2.60	348.59	6.00	3.40
4035.27	.00	6.00	1704.8	.543E+00	2.97	368.40	6.00	3.03
4344.97	.00	6.00	2028.6	.456E+00	3.36	387.75	6.00	2.64
4654.67	.00	6.00	2385.8	.388E+00	3.77	406.67	6.00	2.23
4964.37	.00	6.00	2777.5	.333E+00	4.20	425.19	6.00	1.80
5274.07	.00	6.00	3204.3	.289E+00	4.64	443.36	6.00	1.36
5583.76	.00	6.00	3667.1	.252E+00	5.11	461.20	6.00	.89
5893.46	.00	6.00	4166.7	.222E+00	5.59	478.72	6.00	.41
6203.16	.00	6.00	4703.9	.197E+00	6.00	495.95	6.00	.00

Cumulative travel time = 30991. sec

MOD141: BUOYANT AMBIENT SPREADING

BEGIN MOD161: PASSIVE AMBIENT MIXING IN UNIFORM AMBIENT

Vertical diffusivity (initial value) = .940E-02 m<sup>2</sup>/s  
 Horizontal diffusivity (initial value) = .589E+01 m<sup>2</sup>/s

The passive diffusion plume is VERTICALLY FULLY MIXED at beginning of region.

Profile definitions:

- BV = Gaussian s.d.\*sqrt(pi/2) (46%) thickness, measured vertically  
 = or equal to layer depth, if fully mixed
- BH = Gaussian s.d.\*sqrt(pi/2) (46%) half-width,  
 measured horizontally in Y-direction
- ZU = upper plume boundary (Z-coordinate)
- ZL = lower plume boundary (Z-coordinate)
- S = hydrodynamic centerline dilution
- C = centerline concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
6203.16	.00	6.00	4703.9	.197E+00	6.00	495.95	6.00	.00
6393.00	.00	6.00	4872.8	.190E+00	6.00	513.76	6.00	.00
6582.84	.00	6.00	5043.7	.183E+00	6.00	531.77	6.00	.00
6772.69	.00	6.00	5216.5	.177E+00	6.00	550.00	6.00	.00
6962.53	.00	6.00	5391.3	.172E+00	6.00	568.42	6.00	.00
7152.37	.00	6.00	5567.9	.166E+00	6.00	587.05	6.00	.00
7342.21	.00	6.00	5746.5	.161E+00	6.00	605.87	6.00	.00
7532.05	.00	6.00	5926.9	.156E+00	6.00	624.90	6.00	.00
7721.90	.00	6.00	6109.2	.151E+00	6.00	644.12	6.00	.00
7911.74	.00	6.00	6293.3	.147E+00	6.00	663.53	6.00	.00



CORMIX SESSION REPORT:

XX

CORNELL MIXING ZONE EXPERT SYSTEM

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  it system:                CORMIX v.2.10          April 1993
  SITE NAME/LABEL:         KEY WEST OUTFALL
  DESIGN CASE:             WITH 25 METER DIFFUSER WITH 6 PORTS
  FILE NAME:              DIF1
  Using subsystem CORMIX2: Submerged Multiport Diffuser Discharges
                           (Version: CMX2 v.2.20          April 1993)
  Start of session:       07/29/94--13:09:53

```

\*\*\*\*\*  
SUMMARY OF INPUT DATA:  
-----

AMBIENT PARAMETERS:

```

Cross-section              = unbounded
Average depth              HA = 6 m
Depth at discharge        HD = 6 m
Ambient velocity          UA = .2 m/s
Darcy-Weisbach friction  F  = .0116
Wind velocity             UW = 3 m/s
Stratification Type       STRCND = U
Surface density           RHOAS = 1016.8 kg/m^3
Bottom density            RHOAB = 1016.8 kg/m^3

```

DISCHARGE PARAMETERS:

```

Submerged Multiport Diffuser Discharge
Diffuser type             DITYPE = alternating perpendicular
Diffuser length          LD = 25 m
  arest bank              = left
  ffuser endpoints       YB1 = 885 m; YB2 = 910 m
  umber of openings      NOPEN = 6
Spacing between risers/openings SPAC = 5 m
Port/Nozzle diameter     DO = .25 m
Equivalent slot width    BO = 0.0094 m
Total area of openings   AO = 0.0392 m^2
Discharge velocity       UO = 1.09 m/s
Total discharge          QO = .257 m^3/s
Discharge port height    HO = .5 m
Nozzle arrangement       BETYPE = near vertical discharge
Diffuser alignment angle GAMMA = 90 deg
Vertical discharge angle THETA = 90.0 deg
Horizontal discharge angle SIGMA = 0.0 deg
Relative orientation angle BETA = 90.0 deg
Discharge temperature (freshwater) = 28 degC
  Corresponding density  RHO0 = 996.2337 kg/m^3
Density difference       DRHO = 20.5662 kg/m^3
Buoyant acceleration    GP0 = .1984 m/s^2
Discharge concentration  C0 = 925 PPB
Surface heat exchange coeff. KS = 0 m/s
Coefficient of decay     KD = 0 /s

```

FLUX VARIABLES PER UNIT DIFFUSER LENGTH:

```

Discharge (volume flux)  q0 = 0.010280 m^2/s
Momentum flux           m0 = 0.011212 m^3/s^2
Buoyancy flux           j0 = 0.002039 m^3/s^3

```

DISCHARGE/ENVIRONMENT LENGTH SCALES :

```

lq = 0.00 m          lm = 0.28 m          lM = 0.69 m
lm' = 99999.0 m     lb' = 99999.0 m         la = 99999.0 m
(These refer to the actual discharge/environment length scales.)

```

-----  
NON-DIMENSIONAL PARAMETERS:

Slot Froude number	FRO	=	25.22
port/nozzle Froude number	FRDO	=	4.89
velocity ratio	R	=	5.45

-----

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge	=	no
Water quality standard specified	=	no
Regulatory mixing zone	=	no
Region of interest	=	2000.00 m downstream

\*\*\*\*\*

HYDRODYNAMIC CLASSIFICATION:

\*-----\*  
| FLOW CLASS = MUIH |  
\*-----\*

This flow configuration applies to a layer corresponding to the full water depth at the discharge site.

Applicable layer depth = water depth = 6 m

\*\*\*\*\*

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

-----

X-Y-Z Coordinate system:

Origin is located at the bottom below the port center:  
897.50 m from the left bank/shore.

-----

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory application. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at edge of NFR	=	8.2932 PPB
Dilution at edge of NFR	=	111.5
NFR Location:	x =	31.43 m
(centerline coordinates)	y =	.00 m
	z =	6.00 m
NFR plume dimensions:	half-width =	16.65 m
	thickness =	4.30 m

-----

Buoyancy assessment:

The effluent density is less than the surrounding ambient water density at the discharge level.

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

\*\*\*\*\* TOXIC DILUTION ZONE SUMMARY \*\*\*\*\*

No TDZ was specified for this simulation.

\*\*\*\*\* REGULATORY MIXING ZONE SUMMARY \*\*\*\*\*

No RMZ and no ambient water quality standard have been specified.

\*\*\*\*\* FINAL DESIGN ADVICE AND COMMENTS \*\*\*\*\*

CORMIX2 uses the TWO-DIMENSIONAL SLOT DIFFUSER CONCEPT to represent the actual three-dimensional diffuser geometry. Thus, it approximates the details of the merging process of the individual jets from each port/nozzle.

In the present design, the spacing between adjacent ports/nozzles (or riser assemblies) is of the order of, or less than, the local water depth so that the slot diffuser approximation holds well.

Nevertheless, if this is a final design, the user is advised to use a final CORMIX1 (single port discharge) analysis, with discharge data for an individual diffuser jet/plume, in order to compare to the present near-field prediction.

-----  
REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known  
technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the  
CORMIX predictions on dilutions and concentrations (with associated  
plume geometries) are reliable for the majority of cases and are accurate  
to within about  $\pm 50\%$  (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges  
the design configuration as highly complex and uncertain for prediction.





REGMZ = 0  
XINT = 2000.00 XMAX = 2000.00

Z COORDINATE SYSTEM:

ORIGIN is located at the bottom and the diffuser mid-point:  
897.50 m from the LEFT bank/shore.

X-axis points downstream, Y-axis points to left, Z-axis points upward.

NSTEP = 50 display intervals per module

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-----  
BEGIN MOD201: DIFFUSER DISCHARGE MODULE

Profile definitions:

BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory

BH = top-hat half-width, in horizontal plane normal to trajectory

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	BV	BH
.00	.00	.50	1.0	.925E+03	.01	12.50

END OF MOD201: DIFFUSER DISCHARGE MODULE

-----  
-----  
BEGIN MOD211: WEAKLY DEFLECTED PLANE JET IN CROSSFLOW

CROSSFLOWING DISCHARGE

file definitions:

V = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory

BH = top-hat half-width, in horizontal plane normal to trajectory

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	BV	BH
.00	.00	.50	1.0	.925E+03	.01	12.51
.00	.00	.51	1.2	.755E+03	.01	12.51
.00	.00	.53	1.4	.654E+03	.01	12.51
.01	.00	.54	1.6	.585E+03	.01	12.51
.01	.00	.56	1.7	.534E+03	.01	12.51
.01	.00	.57	1.9	.494E+03	.01	12.51
.01	.00	.59	2.0	.462E+03	.01	12.51
.02	.00	.60	2.1	.436E+03	.02	12.52
.02	.00	.61	2.2	.414E+03	.02	12.52
.02	.00	.63	2.3	.394E+03	.02	12.52
.03	.00	.64	2.4	.378E+03	.02	12.52
.03	.00	.66	2.6	.363E+03	.02	12.52
.03	.00	.67	2.6	.350E+03	.03	12.53
.04	.00	.69	2.7	.338E+03	.03	12.53
.04	.00	.70	2.8	.327E+03	.03	12.53
.05	.00	.72	2.9	.317E+03	.03	12.53
.05	.00	.74	3.0	.308E+03	.03	12.53
.06	.00	.75	3.1	.300E+03	.03	12.53
.06	.00	.77	3.2	.292E+03	.04	12.54
.07	.00	.78	3.2	.285E+03	.04	12.54
.07	.00	.80	3.3	.279E+03	.04	12.54
.08	.00	.81	3.4	.273E+03	.04	12.54
.08	.00	.83	3.5	.267E+03	.04	12.54
.09	.00	.85	3.5	.262E+03	.05	12.55
.09	.00	.86	3.6	.256E+03	.05	12.55

.10	.00	.88	3.7	.252E+03	.05	12.55
.10	.00	.90	3.7	.247E+03	.05	12.55
.11	.00	.91	3.8	.243E+03	.05	12.55
.11	.00	.93	3.9	.239E+03	.05	12.55
.12	.00	.95	3.9	.235E+03	.06	12.56
.13	.00	.97	4.0	.231E+03	.06	12.56
.13	.00	.98	4.1	.228E+03	.06	12.56
.14	.00	1.00	4.1	.224E+03	.06	12.56
.14	.00	1.02	4.2	.221E+03	.06	12.56
.15	.00	1.04	4.2	.218E+03	.07	12.57
.16	.00	1.06	4.3	.215E+03	.07	12.57
.16	.00	1.08	4.4	.212E+03	.07	12.57
.17	.00	1.09	4.4	.209E+03	.07	12.57
.18	.00	1.11	4.5	.207E+03	.07	12.57
.18	.00	1.13	4.5	.204E+03	.07	12.57
.19	.00	1.15	4.6	.202E+03	.08	12.58
.20	.00	1.17	4.6	.199E+03	.08	12.58
.20	.00	1.19	4.7	.197E+03	.08	12.58
.21	.00	1.21	4.7	.195E+03	.08	12.58
.22	.00	1.23	4.8	.193E+03	.08	12.58
.22	.00	1.25	4.8	.191E+03	.09	12.59
.23	.00	1.27	4.9	.189E+03	.09	12.59
.24	.00	1.29	5.0	.187E+03	.09	12.59
.25	.00	1.31	5.0	.185E+03	.09	12.59
.25	.00	1.33	5.1	.183E+03	.09	12.59
.26	.00	1.36	5.1	.181E+03	.09	12.59

Cumulative travel time = 3. sec

OF MOD211: WEAKLY DEFLECTED PLANE JET IN CROSSFLOW

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BEGIN MOD222: STRONGLY DEFLECTED PLANE PLUME IN CROSSFLOW

Profile definitions:

BV = Gaussian 1/e (37%) half-width, in vertical plane normal to trajectory

BH = top-hat half-width, in horizontal plane normal to trajectory

S = hydrodynamic centerline dilution

C = centerline concentration (includes reaction effects, if any)

X	Y	Z	S	C	BV	BH
.26	.00	1.36	5.1	.181E+03	.14	12.59
.80	.00	1.42	6.6	.141E+03	.17	12.63
1.34	.00	1.49	8.1	.115E+03	.21	12.67
1.88	.00	1.55	9.5	.971E+02	.25	12.71
2.42	.00	1.62	11.0	.841E+02	.29	12.75
2.96	.00	1.68	12.5	.741E+02	.33	12.79
3.50	.00	1.75	14.0	.663E+02	.37	12.83
4.04	.00	1.81	15.4	.600E+02	.41	12.87
4.58	.00	1.88	16.9	.547E+02	.45	12.91
5.12	.00	1.94	18.4	.503E+02	.49	12.95
5.66	.00	2.01	19.9	.466E+02	.53	12.99
6.20	.00	2.08	21.3	.434E+02	.57	13.03
6.74	.00	2.14	22.8	.406E+02	.61	13.07
7.28	.00	2.21	24.3	.381E+02	.65	13.10
7.82	.00	2.27	25.8	.359E+02	.68	13.14
8.36	.00	2.34	27.2	.340E+02	.72	13.18
8.90	.00	2.40	28.7	.322E+02	.76	13.22
9.44	.00	2.47	30.2	.306E+02	.80	13.26
9.98	.00	2.53	31.7	.292E+02	.84	13.30
10.52	.00	2.60	33.1	.279E+02	.88	13.34

11.06	.00	2.66	34.6	.267E+02	.92	13.38
11.59	.00	2.73	36.1	.256E+02	.96	13.42
12.13	.00	2.79	37.6	.246E+02	1.00	13.46
12.67	.00	2.86	39.0	.237E+02	1.04	13.50
13.21	.00	2.93	40.5	.228E+02	1.08	13.54
13.75	.00	2.99	42.0	.220E+02	1.12	13.58
14.29	.00	3.06	43.5	.213E+02	1.16	13.61
14.83	.00	3.12	44.9	.206E+02	1.19	13.65
15.37	.00	3.19	46.4	.199E+02	1.23	13.69
15.91	.00	3.25	47.9	.193E+02	1.27	13.73
16.45	.00	3.32	49.4	.187E+02	1.31	13.77
16.99	.00	3.38	50.8	.182E+02	1.35	13.81
17.53	.00	3.45	52.3	.177E+02	1.39	13.85
18.07	.00	3.51	53.8	.172E+02	1.43	13.89
18.61	.00	3.58	55.3	.167E+02	1.47	13.93
19.15	.00	3.64	56.7	.163E+02	1.51	13.97
19.69	.00	3.71	58.2	.159E+02	1.55	14.01
20.23	.00	3.78	59.7	.155E+02	1.59	14.05
20.77	.00	3.84	61.2	.151E+02	1.63	14.09
21.31	.00	3.91	62.6	.148E+02	1.67	14.12
21.85	.00	3.97	64.1	.144E+02	1.70	14.16
22.39	.00	4.04	65.6	.141E+02	1.74	14.20
22.93	.00	4.10	67.1	.138E+02	1.78	14.24
23.47	.00	4.17	68.5	.135E+02	1.82	14.28
24.01	.00	4.23	70.0	.132E+02	1.86	14.32
24.55	.00	4.30	71.5	.129E+02	1.90	14.36
25.09	.00	4.36	73.0	.127E+02	1.94	14.40
25.63	.00	4.43	74.4	.124E+02	1.98	14.44
26.17	.00	4.49	75.9	.122E+02	2.02	14.48
26.71	.00	4.56	77.4	.120E+02	2.06	14.52
27.25	.00	4.63	78.9	.117E+02	2.10	14.56

Cumulative travel time = 138. sec

END OF MOD222: STRONGLY DEFLECTED PLANE PLUME IN CROSSFLOW

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 BEGIN MOD235: LAYER/BOUNDARY/TERMINAL LAYER APPROACH

Profile definitions:

BV = top-hat thickness, measured vertically  
 BH = top-hat half-width, measured horizontally in y-direction  
 ZU = upper plume boundary (Z-coordinate)  
 ZL = lower plume boundary (Z-coordinate)  
 S = hydrodynamic average (bulk) dilution  
 C = average (bulk) concentration (includes reaction effects, if any)

Control volume inflow:

X	Y	Z	S	C	BV	BH
27.25	.00	4.63	78.9	.117E+02	2.10	14.56

Control volume outflow:

X	Y	Z	S	C	BV	BH	ZU	ZL
31.44	.00	6.00	111.5	.829E+01	4.30	16.65	6.00	1.70

relative travel time = 159. sec

-----  
 END OF MOD235: LAYER/BOUNDARY/TERMINAL LAYER APPROACH

-----  
 \*\* End of NEAR-FIELD REGION (NFR) \*\*  
 -----

BEGIN MOD241: BUOYANT AMBIENT SPREADING

Profile definitions:

- BV = top-hat thickness, measured vertically
- I = top-hat half-width, measured horizontally in y-direction
- J = upper plume boundary (Z-coordinate)
- ZL = lower plume boundary (Z-coordinate)
- S = hydrodynamic average (bulk) dilution
- C = average (bulk) concentration (includes reaction effects, if any)

Plume Stage 1 (not bank attached):

X	Y	Z	S	C	BV	BH	ZU	ZL
31.44	.00	6.00	111.5	.829E+01	4.30	16.65	6.00	1.70
70.81	.00	6.00	126.3	.732E+01	2.98	27.26	6.00	3.02
110.18	.00	6.00	135.8	.681E+01	2.42	36.06	6.00	3.58
149.55	.00	6.00	143.1	.646E+01	2.09	43.88	6.00	3.91
188.92	.00	6.00	149.2	.620E+01	1.88	51.04	6.00	4.12
228.30	.00	6.00	154.7	.598E+01	1.72	57.71	6.00	4.28
267.67	.00	6.00	159.8	.579E+01	1.60	64.00	6.00	4.40
307.04	.00	6.00	164.7	.562E+01	1.51	69.99	6.00	4.49
346.41	.00	6.00	169.4	.546E+01	1.44	75.72	6.00	4.56
385.78	.00	6.00	174.1	.531E+01	1.38	81.23	6.00	4.62
425.15	.00	6.00	178.8	.517E+01	1.33	86.54	6.00	4.67
464.52	.00	6.00	183.6	.504E+01	1.29	91.69	6.00	4.71
503.89	.00	6.00	188.4	.491E+01	1.25	96.69	6.00	4.75
543.27	.00	6.00	193.4	.478E+01	1.22	101.55	6.00	4.78
582.64	.00	6.00	198.6	.466E+01	1.20	106.29	6.00	4.80
622.01	.00	6.00	203.9	.454E+01	1.18	110.92	6.00	4.82
661.38	.00	6.00	209.4	.442E+01	1.17	115.45	6.00	4.83
700.75	.00	6.00	215.2	.430E+01	1.15	119.88	6.00	4.85
740.12	.00	6.00	221.1	.418E+01	1.14	124.23	6.00	4.86
779.49	.00	6.00	227.3	.407E+01	1.14	128.50	6.00	4.86
818.86	.00	6.00	233.7	.396E+01	1.13	132.69	6.00	4.87
858.23	.00	6.00	240.4	.385E+01	1.13	136.81	6.00	4.87
897.61	.00	6.00	247.4	.374E+01	1.13	140.86	6.00	4.87
936.98	.00	6.00	254.6	.363E+01	1.13	144.85	6.00	4.87
976.35	.00	6.00	262.1	.353E+01	1.13	148.79	6.00	4.87
1015.72	.00	6.00	269.9	.343E+01	1.14	152.67	6.00	4.86
1055.09	.00	6.00	278.0	.333E+01	1.14	156.50	6.00	4.86
1094.46	.00	6.00	286.4	.323E+01	1.15	160.27	6.00	4.85
1133.83	.00	6.00	295.1	.313E+01	1.16	164.00	6.00	4.84
1173.20	.00	6.00	304.2	.304E+01	1.17	167.69	6.00	4.83
1212.58	.00	6.00	313.5	.295E+01	1.18	171.34	6.00	4.82
1251.95	.00	6.00	323.2	.286E+01	1.19	174.94	6.00	4.81
1291.32	.00	6.00	333.2	.278E+01	1.20	178.51	6.00	4.80
1330.69	.00	6.00	343.6	.269E+01	1.21	182.04	6.00	4.79
1370.06	.00	6.00	354.3	.261E+01	1.23	185.53	6.00	4.77
1409.43	.00	6.00	365.3	.253E+01	1.24	188.99	6.00	4.76
1448.80	.00	6.00	376.7	.246E+01	1.26	192.42	6.00	4.74
1488.17	.00	6.00	388.5	.238E+01	1.27	195.82	6.00	4.73
1527.55	.00	6.00	400.6	.231E+01	1.29	199.18	6.00	4.71
1566.92	.00	6.00	413.0	.224E+01	1.31	202.52	6.00	4.69
1606.29	.00	6.00	425.9	.217E+01	1.33	205.83	6.00	4.67
1645.66	.00	6.00	439.1	.211E+01	1.35	209.12	6.00	4.65
1685.03	.00	6.00	452.7	.204E+01	1.37	212.38	6.00	4.63
1724.40	.00	6.00	466.7	.198E+01	1.39	215.61	6.00	4.61
1763.77	.00	6.00	481.0	.192E+01	1.41	218.82	6.00	4.59
1803.14	.00	6.00	495.8	.187E+01	1.43	222.01	6.00	4.57
1842.52	.00	6.00	510.9	.181E+01	1.46	225.17	6.00	4.54
1881.89	.00	6.00	526.4	.176E+01	1.48	228.31	6.00	4.52
1921.26	.00	6.00	542.3	.171E+01	1.51	231.43	6.00	4.49



## APPENDIX C

\* AGPT LAB REPORT \*



# UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION  
ATHENS, GEORGIA 30613

JUN 13 1994

4ES-ES

## MEMORANDUM

**SUBJECT:** KEY WEST, FLORIDA ALGAL ASSAY

**FROM:** DON SCHULTZ *Don Schultz*

**TO:** TOM CAVINDER, CHIEF  
WATER QUALITY UNIT

Algal Growth Potential Tests (AGPT) were conducted with six salt water samples collected adjacent to the Key West municipal sewage treatment plant (STP) discharge on May 12, 1994. Sampling stations were located to provide an unimpacted control station 200 meters upcurrent from the discharge boil, a station from the STP discharge boil, and a station 200 meters down-current from the discharge boil. These stations were sampled on two separate tidal cycles and have been described as separate stations to identify them as separate time samples. Table 1. describes the separate station samples.

The AGPT were conducted with the marine test alga Dunaliella tertiolecta according to the method described in EPA's Marine Algal Assay Procedure (EPA, 1974), The test procedure consisted of utilizing non-treated samples to measure the productivity of the sample, plus separate treatments of the samples with nitrogen and phosphorus. The last treatments were to determine the algal nutrient limitation of samples. The salinity of the samples were all found to be uniformly 35 0/00. The test alga had been cultured to grow at this salinity prior to the tests.

While there are no published marine AGPT dry weight levels which are indicative of enriched conditions, personal communication with Florida Department of Environmental Regulation indicated that they consider a level of 10 mg/L as such. Accordingly, control stations KW-2 and KW-4 would be slightly enriched, boil stations Kw-1 and Kw-5 were grossly enriched and down-current stations KW-3 and KW-6 are moderately enriched, but being diluted (table 2).



Nutrient limitation of AGPT can normally provide an indication of the source of the sample since most STP discharges are nitrogen limited. However, most of Florida marine waters are naturally nitrogen limited (anonymous, 1976) and could confuse AGPT results. The AGPT nutrient limitation results indicated that the boil stations KW-1 and KW-5 and one down-current station, KW-6, were all strongly nitrogen limited (table 2). The remaining station nutrient limitation results were co-limiting to both nitrogen and phosphorus, meaning both nutrients were required to provide algal growths greater than the untreated samples.

#### LITERATURE CITED

EPA. 1974. Marine Algal Assay: Bottle Test. Environmental Protection Agency. Corvallis, Oregon.

Anonymous, 1976. A Review of the Need for Nutrient Regulation in Florida. Bureau of Water Quality. Department of Environmental Regulation. pp. 1-27.

TABLE 1.. KEY WEST, FLORIDA AGPT STATION LOCATION

<u>STATION</u>	<u>DESCRIPTION</u>	<u>SAMPLE TIME</u>
KW-1	Sewage plant discharge boil	1st tide
KW-2	200 meters up-current from boil	1st tide
KW-3	200 meters down-current from boil	1st tide
KW-4	200 meters up-current from boil	2nd tide
KW-5	Sewage plant discharge boil	2nd tide
KW-6	200 meters down-current from boil	2nd tide

TABLE 2. MAXIMUM STANDING CROP (MSC) OF DUNALIELLA TERTIOLECTA

DRY WEIGHT (mg/L)

SOURCE: Key West, Florida

DATE: May 12, 1994

<u>STATION/ LOG #</u>	<u>TREATMENT*</u>	<u>REP 1 HIGH</u>	<u>REP 2 LOW</u>	<u>REP 3</u>	<u>MEAN</u>	<u>RANGE</u>
KW-1	CONTROL	46.42	40.17	42.11	42.90	6.25
940501	C+N	100.47	91.12	91.68	94.42	9.35
	C+P	34.88	30.97	31.51	32.45	3.91
KW_-2	CONTROL	---	14.70	13.36	14.03	1.34
940502	C+N	14.65	16.02	13.05	14.57	2.97
	C+P	18.19	13.58	17.45	16.41	4.61
KW-3	CONTROL	20.28	14.88	17.75	17.64	5.40
940503	C+N	22.28	18.62	19.68	20.19	3.66
	C+P	22.34	18.04	19.74	20.04	4.30
KW-4	CONTROL	9.19	7.23	7.94	8.12	1.96
940504	C+N	11.33	9.71	10.55	10.53	1.62
	C+P	14.76	12.29	13.79	13.61	2.47
KW-5	CONTROL	24.89	21.48	22.93	23.10	3.41
940505	C+N	41.41	36.45	38.19	38.68	4.96
	C+P	28.55	21.86	24.7	25.04	6.69
KW-6	CONTROL	24.56	14.74	19.72	19.67	9.82
940506	C+N	31.87	25.29	27.94	28.37	6.58
	C+P	22.45	17.3	17.64	19.13	5.15

\*C+N = Control + Nitrogen

\*C+P = Control + Phosphorus