

FIRST QUARTERLY PROGRESS REPORT
CRYSTAL RIVER STUDIES
OCTOBER 3, 1983

Contractor
Stone & Webster Engineering Corporation

Subcontractor
Mote Marine Laboratory

Prepared for
Florida Power Corporation
P. O. Box 14042
St. Petersburg, FL 33733

8401100309 840105
PDR ADOCK 05000302
R PDR

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1.0 INTRODUCTION

In response to the requirements of Part III-H, NPDES Permit No. FL0000159 dated July 9, 1979 for Crystal River Units 1, 2, and 3, Florida Power Corporation prepared an ecological monitoring program for the area adjacent to the Crystal River power plant site. The ecological monitoring program is designed to address the objectives of a 316 demonstration as set forth in: "Interagency 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Power Facilities Environmental Impact Statements" and "Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92-500."

Comparisons of data (control versus effected areas) will be made within the proposed study and with previous studies, where appropriate. The coastal area west of the power plant is characterized by salt marsh dominated by Juncus roemarianus with narrow bands of Spartina alterniflora near the water's edge. The bottom in the adjacent coastal marine area is comprised of sand, mud, shell hash (oyster bars), and exposed lime rock with scattered patches of seagrass, attached benthic algae, and attached benthic invertebrates.

The sampling program was designed to address the following impacts:

1. Thermal impacts from the operation of the power plant (316 (a)).
2. Intake effects in the form of larval entrainment and adult impingement (316 (b)).

The Crystal River monitoring program is summarized in Table 1-1. This table indicates the types of sampling, number of sampling stations, number of replicates, frequency of sampling, total number of samples, and the overall duration of sampling. Each element of the program falls under one of four major headings: Benthos, Impingement and Entrainment, Fisheries, and Physical Studies.

TABLE 1-1
SUMMARY OF ECOLOGICAL PROGRAM
CRYSTAL RIVER STUDIES

<u>Study Component</u>	<u>No. of Stations</u>	<u>No. of Rep.</u>	<u>Frequency</u>	<u>Total No. Samples</u>	<u>Study Period</u>
I. Benthos					
A. Benthic core	20	6(+2)	Quarterly	600	15 mos
	20	6(+2)	6 wks	1200	15 mos
B. Macrophyte mapping	50	10	Quarterly + 1 Preliminary	3000	15 mos
	9(intens.)	10	6 wks	900	15 mos
	9(intens.)	5	6 wks	450	15 mos
C. Aerial photographs	1	1	3 times	3	15 mos
D. Oyster reef	9	90	Monthly & Bimonthly	14580	12 mos
E. Salt marsh program	8	24	6 wks	1920	15 mos
F. Physical					
a. Chlorophyll 'a'	8	2 depths	Weekly	1040	15 mos
b. Sediment	40	3	Quarterly	1200	15 mos
c. Photometry	40	1 profile	Weekly	2600	15 mos
d. Turbidity, D.O., pH, Salinity, Temperature	40	multiple depth	Weekly	5200	15 mos
e. Sediment Temp- erature, Eh	40	1 depth	Quarterly	200	15 mos
	20	1 depth	6 wks	200	15 mos
II. Impingement and Entrainment					
A. Impingement	3	4	Weekly + 3 times	660	12 mos
B. Entrainment	15	3	Biweekly day/night	2880	15 mos
III. Fisheries					
A. Trawl	9	7	Monthly (night)	756	12 mos
B. Seines	4	2	Monthly	96	12 mos
C. Drop net	2	2	Monthly	48	12 mos

TABLE 1-1 (Cont)

<u>Study Component</u>	<u>No. of Stations</u>	<u>No. of Rep.</u>	<u>Frequency</u>	<u>Total No. Samples</u>	<u>Study Period</u>
D. Creek trawls	4	7	Monthly (day)	336	12 mos
E. Crab traps	120	1	17 times	2040	4 mos
F. Crab impingement	1	1	17 times	17	4 mos
IV. Physical Studies					
A. Suspended loads	40	4 analyses	Biweekly	5120	15 mos
B. Bathymetry	-	-	-	1 survey	-
C. Short-term	16	1	-	Variable	2 mos
D. Long-Term	51	1 or 2	Continuous	Variable	12 mos
E. Meteorology	1	1	Continuous	Variable	15 mos
F. Temperature profiles	Variable	2	Variable	Variable	2 mos

2.0 PROGRAM MODIFICATIONS

Every effort has been made to conduct the Crystal River study as previously planned and approved by agency personnel. At the same time, it is understood that assumptions were made during the planning process concerning conditions which would be encountered and the appropriate sampling methods to be used at the site. The results of initial sampling and other experience gained at Crystal River have been used to evaluate these assumptions. In several instances, changes to the program have been warranted. In each case, approval has been sought and obtained from Florida Power Corporation prior to instituting the change. The following material summarizes changes, by program component, made since field sampling was initiated.

The changes noted are intended to provide data of equal or better quality than would have been provided by the earlier designs to fulfill the needs of the program. Each element of the field program has been carefully reviewed as it was initiated and changes made if needed. All components have now been conducted at least once so few, if any, additional changes are anticipated.

Figures 2-1, 2-2, and 2-3 are provided to show revised sampling locations for crab traps, entrainment sampling, and seining.

2.1 BENTHOS

2.1.1 Aerial Photographs

It has been proven impossible to obtain aerial photographs under summer weather conditions, primarily due to consistent haze. Similar problems are anticipated for next year, and the macrophyte program, which uses the photographs, needs only photographs taken in early fall and spring. Thus, program requirements have been reduced to three photographs to be taken between August 1983 and April-May 1984. This level of effort better reflects site conditions.

2.1.2 Oyster Reef

No adequate means could be found to clean oyster clumps for studies of associated fauna or to identify, weigh, and measure individual oysters within clumps for mortality and growth studies. Thus, individual oysters are used for the latter studies. These are placed in small wire trays - 10 in each tray, 9 trays for each station. Associated fauna is defined by harvesting three clumps of naturally occurring oysters at each station. These changes provide the desired information while overcoming the logistical problems.

2.1.3 Physical Parameters

Weekly temperature and conductivity data is to be collected within 90 minutes centered on a high or low tide. For several weeks, the attempt was made to cover 40 stations within this time frame, but while most stations were satisfactorily sampled, some were sampled too late. These delays also affected the collection of other water quality parameters within the four hour time frame for photometry, sometimes causing the longer period to be exceeded. Since the prime objective of the temperature data collection involves monitoring the thermal discharge area, the problems were corrected by reducing the number of stations at which temperature and conductivity must be measured within the 90 minute period from 40 to 27 (Stations 4 through 30). The stations remaining encompass all stations between the intake spoil and the barge canal. The program has successfully met its goals since the change.

2.2 IMPINGEMENT AND ENTRAINMENT

2.2.1 Entrainment Stations

Station B was intended to be a thermally-affected station, but review of temperature data collected in June indicated the station was too far north and west. The depth of water at low tide (about 3 feet) also made sampling impossible. Therefore, the station was moved south and east to coincide with benthic core station 20 to provide adequate water depth and exposure to the thermal discharge. Stations I and K represent control stations, but they were located beyond the area to be modeled and in an area observed to have different water quality conditions than elsewhere within the study area. To better reflect "control" stations and to permit the data to be used as input to source water body analyses, the stations were moved north and slightly west.

2.2.2 Entrainment Sampling in Creeks

Towed net samples had been planned for Cutoff and Salt Creeks, however, irregular bottom contours and limiting water depths precluded this technique. To obtain samples representative of organisms moving in and out of the creeks, samples are now being taken at the height of ebb or flood tides using a stationary plankton sled. The sled is the same one used to collect grassbed samples.

2.3 FISHERIES

2.3.1 Offshore Seines

Bottom conditions precluded seining on either the north or south shores of the intake spoil. Feasible sampling locations were found at Demory Gap and at Doghead Gap. These stations should

also be more representative of thermal discharge conditions than previously planned locations.

2.3.2 Block and Creek Seining

Initial efforts to conduct this type of sampling was unsuccessful due to creek size, topography, and bottom conditions. Alternative methods were considered at length but many were precluded by local conditions or by the need to provide a fairly representative sample of fish and macroinvertebrates in the creeks. While no gear would precisely substitute for seining, trawling proved to be feasible and will provide appropriate samples.

2.3.3 Crab Tagging

On advice from local fishermen and the Department of Natural Resources (DNR), the crab traps are baited with shad rather than cat food. To be consistent with DNR and to reduce manpower requirements, traps are left in place for seven days rather than five. To facilitate analysis and to provide information on crabs just south of the intake spoil, the four transects are now equal in length and Transect B has been relocated south of the intake spoil.

2.4 PHYSICAL STUDIES

2.4.1 Current Profiling

A change was made in this component by reallocating the effort. In each of the five channels being sampled (intake, discharge, Crystal and Withlacoochee Rivers, Barge Canal), a transect with five stations is occupied rather than a single station. The effort at the eleven offshore stations will be reduced; each station will be sampled two rather than four times each month. The resulting data is sufficient for modeling, and overall, this change will enhance model input data.

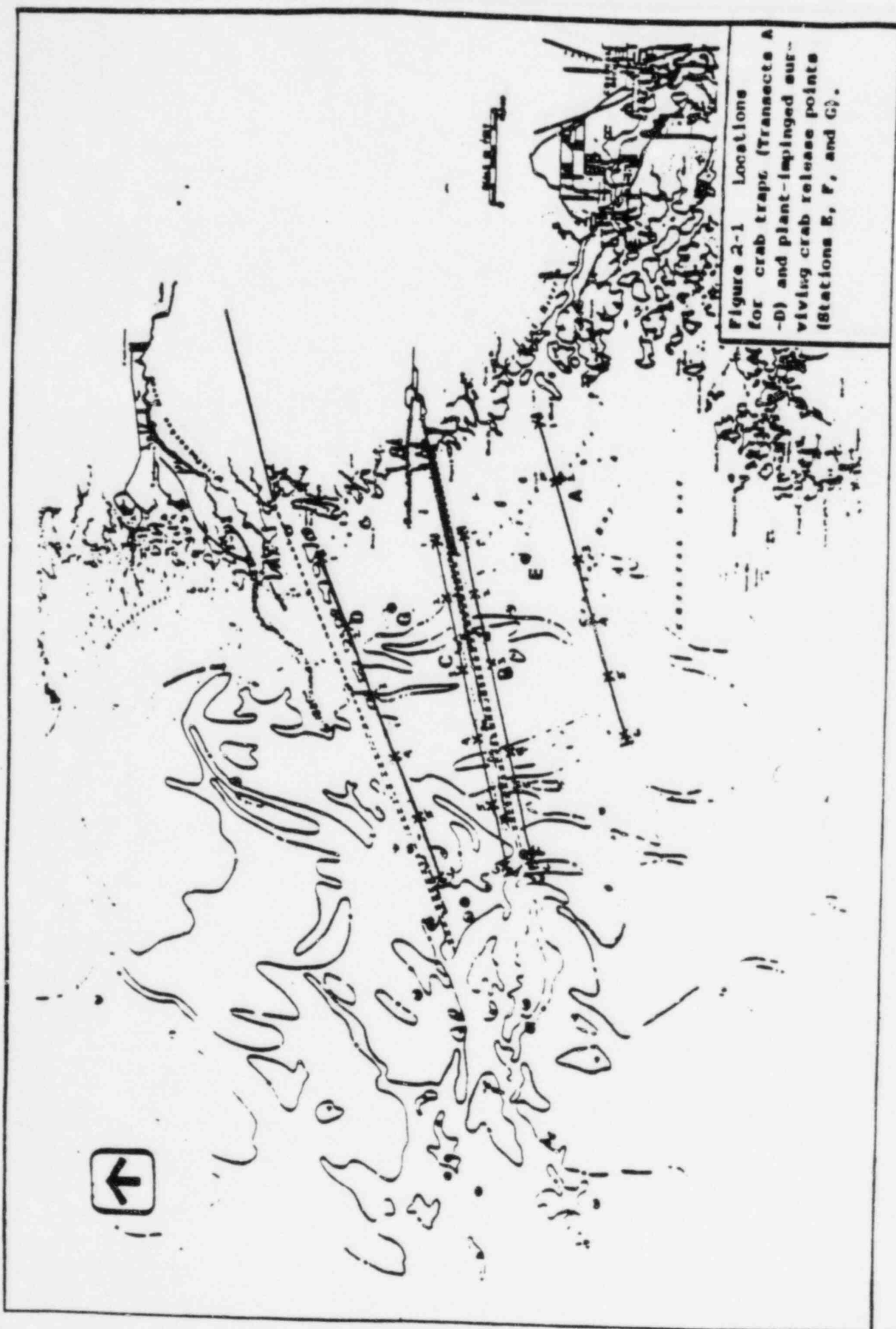
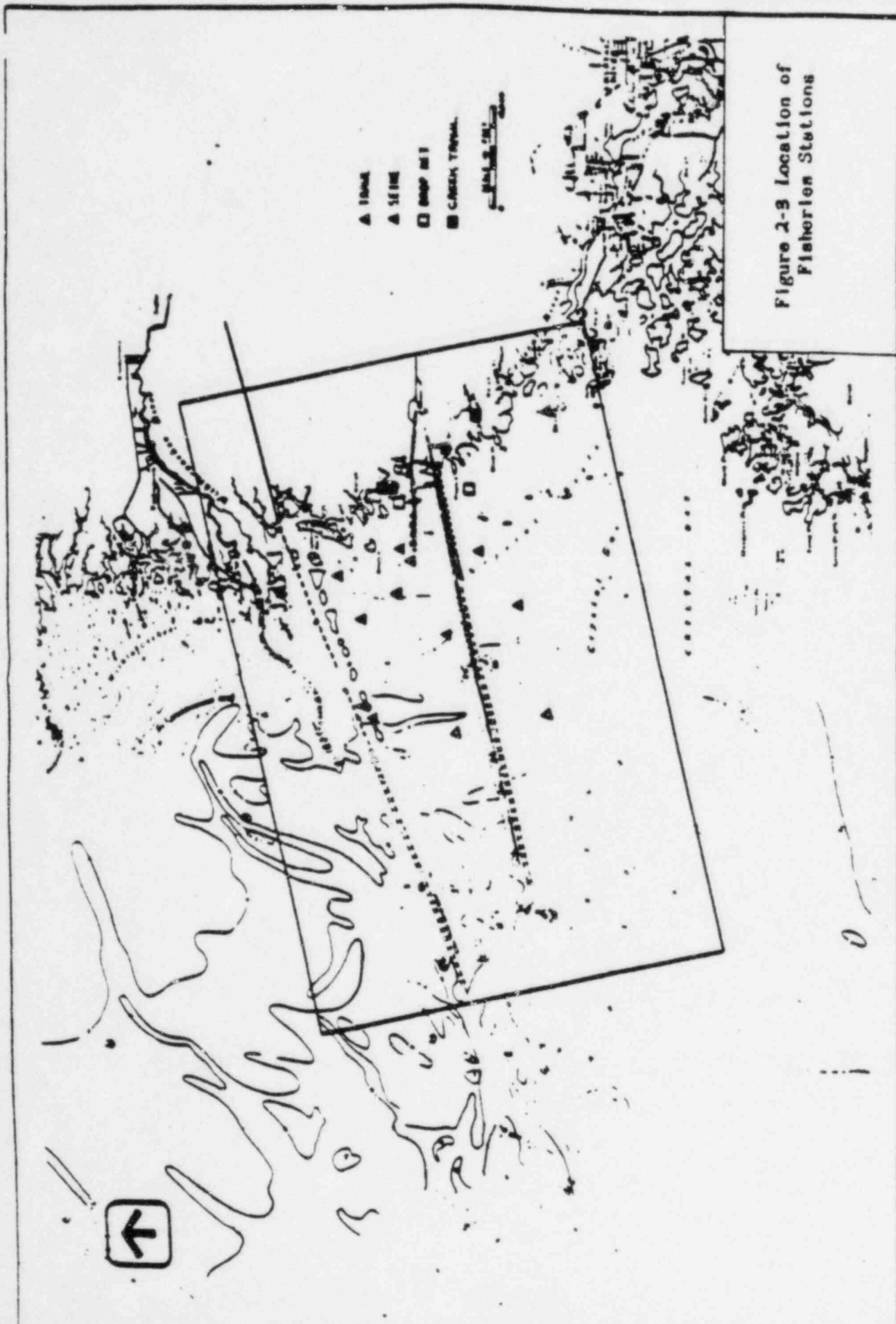


Figure 2-1 Locations
for crab traps (Transects A
-D) and plant-impinged sur-
viving crab release points
(Stations E, F, and G).



Scale 1:100,000

Figure 2-2 Location of
Plankton Stations
STATIONS A-K: towed nets
STATIONS L&M: sled
STATIONS N&P: channel net



3.0 SUMMARY OF PROGRESS

3.1 MOBILIZATION

Mobilization for the program was completed on June 3, 1983, according to schedule. Mobilization activities completed were:

- Set up of physical facilities on site, i.e., laboratory trailers, docks, meteorological station, etc.
- Purchase of all equipment and supplies necessary to commence the project.
- Reconnaissance surveys and deployment of marker buoys.

3.2 FIELD COLLECTIONS

All field collections were made according to schedule. No major problems were encountered. A summary of the field collections made during the first quarter is shown in Table 3-1.

3.3 LABORATORY ANALYSES

Laboratory analyses of samples collected in the various components of the program is progressing smoothly. As expected, meroplankton (entrainment) samples are heavy at this time (spawning season) and, therefore, laboratory analysis is lagging well behind the field collections. However, we expect to be caught up before March 1984 (during winter). All other components are progressing according to schedule. A summary of the status of laboratory analysis is shown in Table 3-2.

3.4 DATA COMPUTERIZATION

3.4.1 Input

Acquisition of suitable computer hardware to ensure compatibility between MML (input) and SWEC (processing) and placing the equipment on line occupied much of the first quarter. Establishment of standard data formats and initial input of various types of data took place primarily during August.

To date, machine compatibility has been firmly established, but problems have arisen in the development of standard formats for the many types of data. The philosophy has been to use input formats closely resembling or identical with field log records. Development of these new formats, rather than using existing ones, and incorporating the formats into the activities of each program component have taken a considerable amount of time. This effort has also been accomplished in parallel with field collections and laboratory analyses. Problems have both delayed input of some types of data and necessitated reentry of data sets.

The problems now have been solved and we expect to be on schedule before the end of October 1983. Data has been entered (to date) for the following samples:

- a. Benthic core samples from July 25 (1983) sampling.
- b. Oyster reef samples from the first retrieval sampling (August 8 and 9, 1983).
- c. Salt marsh samples from the first sampling (June 13 through 17, 1983).
- d. Macrophyte samples from the first sampling (June 20 through 30, 1983).
- e. Photometry, temperature, salinity, and pH measurements from the first eight samplings (June 9 through July 26, 1983).
- f. Turbidity and chlorophyll "a" samples from the first eight samplings (June 9 through July 26, 1983).
- g. Impingement samples from the first eight samplings (June 6 through July 26, 1983).
- h. Entrainment samples from the first sampling (June 23 through 25, 1983).
- i. Fisheries samples from the first two samplings (June and July 1983).
- j. Suspended solids samples from the first four samplings (June 9 through July 20, 83).

3.4.2 Processing

Data files are received by SWEC on diskettes, logged in, and read into the SWEC computer. To date, files referenced in Section 3.4.1, as well as species codes and scientific names, have been received. Data for crab trapping and recapture, as well as data on length-weight, fecundity, and parasitism of selected fish and invertebrate species are not scheduled until the second quarter.

The data files received by SWEC were checked for completeness and accuracy with the aid of a computerized summary and variable range review. Data of almost all types have been checked. Problems have been identified as have the means to resolve them. At this writing, revised data sets are being produced to conform to agreed upon formats.

3.5 PHYSICAL MODELING

The primary objective during this quarter has been to effect modifications to the finite element model in order to better simulate critical features at the Crystal River site. The modifications considered characteristically avoid changes within the central computational scheme, thus preserving the model's qualification derived from its wide use within the scientific community.

The original model provided open-water boundary input of current or tide height in the form of a sinusoidal function. The modifications are now complete which allow tabular input of current and/or tide height around the open boundaries. The model can, therefore, be driven by any periodic function which is derived from the field data collection program.

Modifications to better simulate the hydrodynamic behavior near oyster bars is in progress. In the presently favored scheme, the sides of elements are to be locally aligned with the axis of the oyster bars. Nodal values are assigned on each side in order to allow discrete longitudinal current and tide heights to be simulated on each side. Of course, the lateral current across the oyster bar applies to elements on both sides and is calculated by a function describing flow through openings and overtopping, all controlled by the tide height on each side of the oyster bar. To date, 16 simplified finite element grid arrangements have been employed in an effort to systematically explore the properties of this scheme.

Another scheme is under consideration at this time wherein a flow restriction through the element side is effected by employing a single line of nodes along the axis of the oyster bars. This scheme does not permit the discrete changes in longitudinal currents and tide heights available in the previous scheme, and this loss would have to be evaluated. Lateral currents would be simulated in either case. Such a scheme is commonly employed in finite difference models.

The bathymetry data collected has been reduced, and three separate source maps can be employed in determining local depths. All maps have been reproduced on mylar to the same scale in preparation for grid construction for the site.

A primary purpose for the August short term surveys was plume delineation in the near field. Although the data have not been reduced, preliminary results of the August 13 survey have been prepared and included as Figures 4-1 through 4-8. The tide condition at that time was semidiurnal and plant conditions showed three units in operation.

TABLE 3-1
FIRST QUARTER FIELD COLLECTIONS, CRYSTAL RIVER STUDIES

Task	Collection Dates	No. of Stations Sampled	No. of Samples Collected	Comments	
I.A.	Benthic Core	06/13-14/83 07/25/83	40 26	320 160	No problems No problems
I.B.	Oyster Reef	07/11-15/83 08/08-09/83 08/08-09/83	9 9 9	5670 810 810	Deployed Deployed Retrieved
I.C.	Salt Marsh	06/13-17/83 07/24-29/83	8 8	192 192	No problems No problems
I.D.	Macrophytes				
	1. Ground truthing	06/20-24/83	50	500	No problems
	2. Insensitive monitoring	06/27-30/83	8	40	Unable to find 3 seagrass bed stations in thermal area
	3. Seagrass growth	08/01-05/83 06/27-30/83 07/11-15/83 08/01-05/83 08/15-19/83	9 8 8 9 8	45 8 8 9 8	No problems Clipped Retrieved Clipped Retrieved (1 sta. lost)
I.E.	Aerial Photography	08/27/83	1	1	No photography during May-July because of ground haze
I.F.	Photometry				
	1. Light, temp., sal., pH	06/09/83	40	-	Light window not met
		06/15/83	40	-	Window not met
		06/22/83	40	-	Window not met
		06/30/83	40	-	Window met
		07/07/83	40	-	Window met
		07/12/83	40	-	Window met
		07/20/83	40	-	Window met
		07/26/83	40	-	Window met
		08/03/83	40	-	Window met
		08/10/83	40	-	Window met
		08/19/83	40	-	Window met
		08/24/83	40	-	Window met
		08/30/83	40	-	Window met

TABLE 3-1 (Cont)

Task	Collection Dates	No. of Stations Sampled	No. of Samples Collected	Comments	
2. Turbidity	06/09/83	40	73	No problems	
	06/15/83	40	73	No problems	
	06/22/83	40	78	No problems	
	06/30/83	40	71	No problems	
	07/07/83	40	78	No problems	
	07/12/83	40	74	No problems	
	07/20/83	40	81	No problems	
	07/26/83	40	76	No problems	
	08/03/83	40	77	No problems	
	08/10/83	40	75	No problems	
	08/19/83	40	85	No problems	
	08/24/83	40	93	No problems	
	08/30/83	40	66	No problems	
	3. Chlorophyll "a"	06/09/83	8	15	No problems
		06/15/83	8	17	No problems
		06/22/83	8	16	No problems
		06/30/83	8	15	No problems
		07/07/83	8	15	No problems
		07/12/83	8	16	No problems
07/20/83		8	15	No problems	
07/26/83		8	17	No problems	
08/03/83		8	15	No problems	
08/10/83		8	16	No problems	
08/19/83		8	20	No problems	
08/24/83		8	14	No problems	
08/30/83		8	16	No problems	
I.G. Sediments					
	1. IOC and granulometry	06/13-17/83	40	120	No problems
		09/05-09/83	40	120	No problems
	2. Sulfides	06/13-21/83	40	120	No problems
		08/29-09/02/83	40	120	No problems
3. Temp., Eh	06/13-14/83	40	40	No problems	
	07/25/83	20	20	No problems	
II.A. Impingement					
	06/06-07/83	2	8	No problems	
	06/13-14/83	2	8	No problems	
	06/23-24/83	1	4	Basket broke	
	07/01-02/83	2	8	No problems	
	07/05-06/83	2	8	No problems	
	07/14-15/83	2	8	No problems	
	07/19-20/83	3	10	No problems	
	07/25-26/83	3	12	No problems	
	08/04-05/83	3	12	No problems	
	08/09-10/83	3	10	Operator error	
	08/15-16/83	3	12	No problems	

TABLE 3-1 (Cont)

<u>Task</u>	<u>Collection Dates</u>	<u>No. of Stations Sampled</u>	<u>No. of Samples Collected</u>	<u>Comments</u>
Impingement (3 mm)	08/25-26/83	3	12	No problems
	07/01/83	2	2	No problems
	07/25/83	3	3	No problems
	08/26/83	3	3	No problems
II.B. Eutainment	06/23-25/83	15	120	No problems
	07/06-08/83	15	120	No problems
	07/21-22/83	15	120	No problems
	08/01-02/83	15	120	No problems
	08/15-17/83	15	120	No problems
	08/31-09/01/83	15	120	No problems
III. Fisheries	1. Trawl			
	06/27-30/83	9	63	No problems
	07/26-27/83	9	63	No problems
	08/23-24/83	9	63	No problems
	2. Seines			
	06/28-07/07/83	4	8	No problems
	07/26-28/83	4	8	No problems
	08/22-23/83	4	8	No problems
	3. Drop net			
	07/05-06/83	2	4	No problems
	07/27-28/83	2	4	No problems
	08/22-23/83	2	4	No problems
	4. Creek trawls			
	07/26-27/83	4	28	No problems
	08/22-24/83	4	28	No problems
IV.A.1. Bathymetry	06/06-07/83	1 survey	-	Weather problems
	06/13-14/83	1 survey	-	Half complete
	06/28-30/83	1 survey	-	All complete
IV.A.2. Short Term	1. Tide gauges			
	08/01-30/83	16	16	75 percent data recovery
	2. Current meters			
	08/01-30/83	16	16	95 percent data recovery
	3. Vertical profiles			
4. Stream cross sections	08/01-30/83	64	64	No problems
	08/01-30/83	4	4	No problems
IV.A.3. Long Term	06/06-10/83	51	72	Deployed
	07/04-08/83	49	69	Retrieved
				(3 lost)
	07/04-08/83	51	72	Deployed
	08/01-05/83	43	60	Retrieved
				(12 lost)
	08/01-05/83	43	60	Deployed
	08/08-12/83	5	7	Deployed

TABLE 3-1 (Cont)

<u>Task</u>	<u>Collection Dates</u>	<u>No. of Stations Sampled</u>	<u>No. of Samples Collected</u>	<u>Comments</u>
	08/15-16/83	3	5	Deployed
IV.B. Suspended Load	06/09/83	40	74	No problems
	06/22/83	40	79	No problems
	07/07/83	40	80	No problems
	07/20/83	40	83	No problems
	08/03/83	40	77	No problems
	08/19/83	40	85	No problems
	08/30/83	40	70	No problems
IV.C. Meteorology	Station fully operational except for the period 08/05-25/83 when lightning struck and damaged the system.			

TABLE 3-2
STATUS OF LABORATORY ANALYSES TO DATE (09/26/83)
CRYSTAL RIVER STUDIES

<u>Task</u>	<u>Samples Collected to Date</u>	<u>Samples to be Analyzed</u>	<u>Samples Analyzed to Date</u>	<u>Comments</u>
I.A. Benthic Core				
1. Rough sorting	800	600	360	No problems
2. Identifications	800	600	300	No problems
I.B. Oyster Reef				
1. Oysters	10,620	10,620	10,620	No problems
2. Associated fauna	54	54	27	(clumps)
I.C. Salt Marsh	576	576	384	No problems
I.D. Macrophytes				
1. Ground truthing	1,000	1,000	1,000	No problems
2. Intensive monitoring	130	130	85	No problems
3. Seagrass growth	16	16	16	No problems
I.F. Photometry				
1. Turbidity	1,220	1,220	1,220	No problems
2. Chlorophyll "a"	251	251	251	No problems
I.G. Sediments				
1. TOC and granulometry	240	240	120	No problems
2. Sulfides	240	240	240	No problems
II.A. Impingement				
1. Regular	166	166	122	No problems
2. 3 mm	8	8	8	No problems
II.B. Entrainment	840	630	180	No problems
III. Fisheries				
1. Trawl	252	252	126	No problems
2. Seines	32	32	24	No problems
3. Drop net	16	16	12	No problems
4. Creek trawls	84	84	28	No problems
IV.B. Suspended Solids				
1. TSS	616	616	616	No problems
2. VSS	616	616	616	No problems

4.0 DATA TABLES

4.1 INTRODUCTION

Production of summary data tables has been delayed by problems noted in Section 3, however, it is intended that future quarterly reports will contain tables in the formats displayed in subsequent sections. These will be computer generated and are meant to provide summaries of all significant program elements rather than to display all data collected. Data manipulation will be minimal to permit examination of basic information. For example, while replicates at a station will be averaged, stations would not be combined to look at thermal versus control areas. Such analysis will occur after completion of the field effort.

4.2 BENTHOS

BENTHOS
DENSITY
JUNE
STATIONS

SPECIES

1

2

3

4

5

6

7

8

9

10 . . . 40

BENTHOS
MACROPHYTE GROUND TRUTHING
PERCENT COVER

JUNE
DOMINANT SPECIES

STATION

S

T

U

1

2

3

4

5

.

.

.

50

BENTHOS
MACROPHYTE INTENSIVE SAMPLING
VARIATION WITH LOCATION

JULY
STATION

1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---

SP. X

Percent Cover

Biomass

Density

Growth

SP. Y

Percent Cover

Biomass

Density

Growth

SP. Z

Percent Cover

Biomass

Density

Growth

BENTHOS
SPARTINA MARSH DENSITY, BIOMASS AND HEIGHT

JUNE

STATION

LOCATIONS	DAVIS ISLAND	FENCE	THERMAL	MIDWAY	CONTROL	UPPER SALT CK	LOWER SALT CK
-----------	-----------------	-------	---------	--------	---------	------------------	------------------

1

LH
LW
LD
DW

2

LH
LW
LD
DW

3

LH
LW
LD
DW

4

LH
LW
LD
DW

LH Live Height

LW Live Weight

LD Live Density

DW Dead Weight

BENTHOS
OYSTER MORTALITY - MONTHLY SAMPLES

STATION	MONTH					
	July		August		September	
	No. Live	No. Dead	No. Live	No. Dead	No. Live	No. Dead
1						
2						
3						
4						
5						
6						
7						
8						
9						

BENTHOS
WEEKLY TEMPERATURE MEASUREMENTS
JUNE
WEEK

STATION	1		2		3		4	
	S	B	S	B	S	B	S	B
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
.								
.								
.								
40								

BENTHOS
WEEKLY CONDUCTIVITY MEASUREMENTS
JUNE
WEEK

STATION	1		2		3		4	
	S	B	S	B	S	B	S	B
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
.								
.								
.								
40								

4.3 IMPINGEMENT AND ENTRAINMENT

IMPINGEMENT
SUMMARY

SPECIES

TOTAL NUMBER COLLECTED

ENTRAINMENT
DENSITY BY STATION

JUNE _____

STATION

SPECIES

A | B | C | D | E | F | G | H | I | J | K |

ENTRAINMENT
DENSITY BY STATION

JUNE _____

SPECIES

L

M

N

P

4.4 FISHERIES

FISHERIES
NUMBER AND WEIGHT BY GEAR
TRAWL
JUNE
STATION

SPECIES

T1

T2

T3

T4

T5

T6

T7

T8

T9

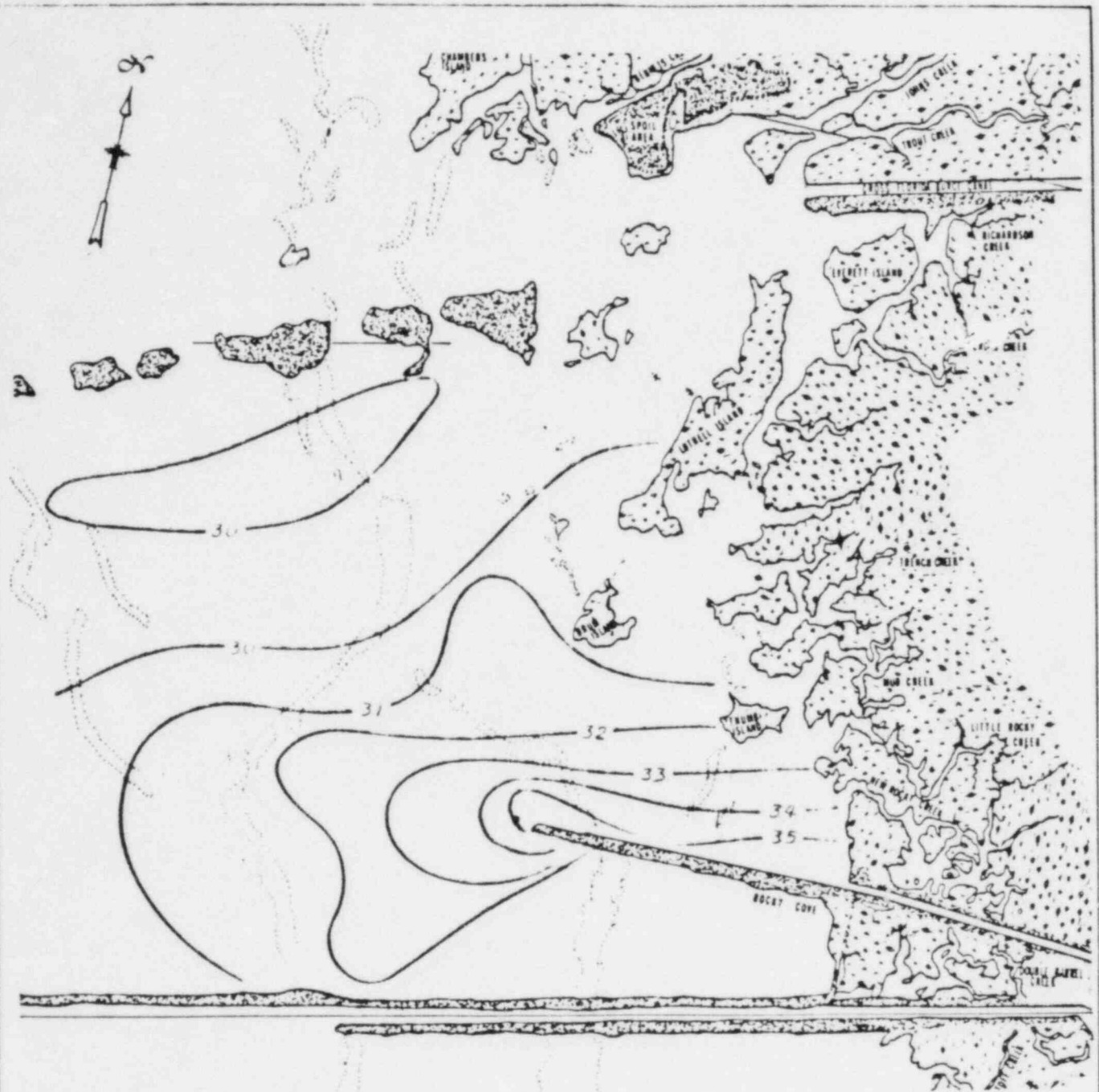
No. (wt.)

FISHERIES

NUMBER AND WEIGHT OF CRABS TRAPPED

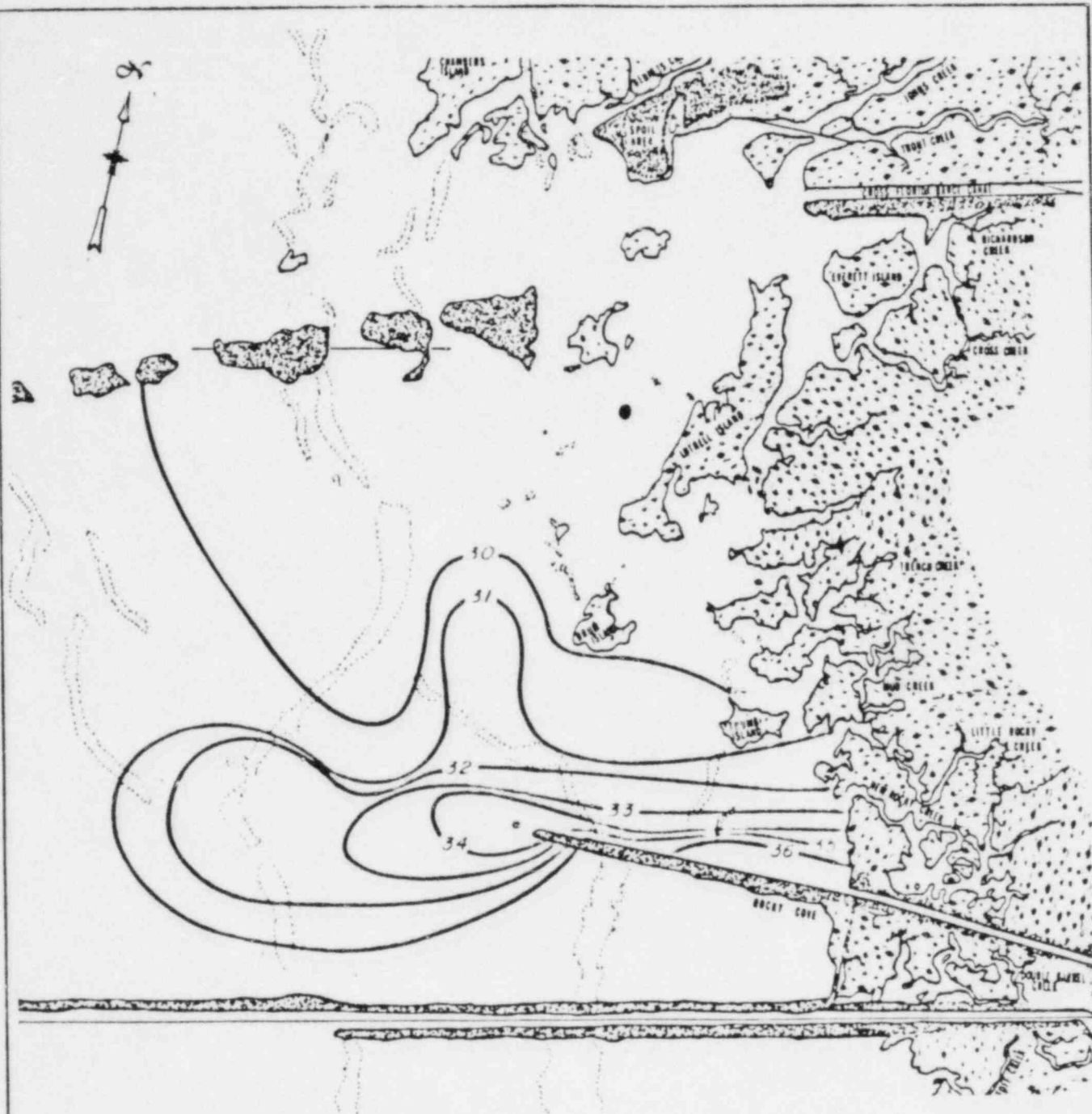
STATION	Blue Crab		Stone Crab	
	No.	Width	No.	Width
1				
2				
3				
4				
5				
.				
.				
.				

4.5 PHYSICAL DATA



NOTE
TEMPERATURE IN °C

FIGURE 4-2
BOTTOM TEMPERATURES
MID EBB (0846-0946)
AUGUST 13, 1983
FLORDIA POWER CORPORATION
CRYSTAL RIVER NPDES STUDIES



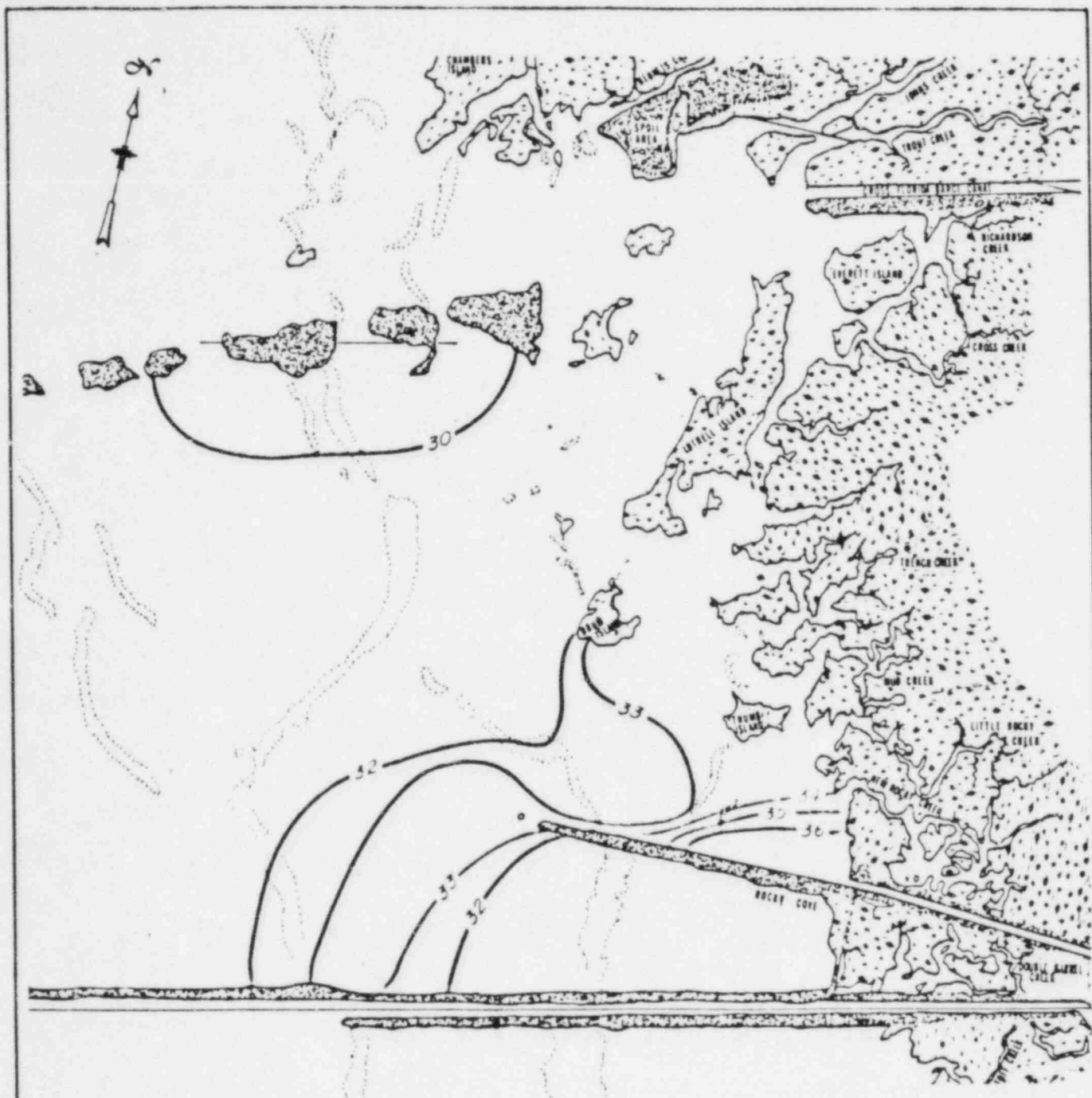
NOTE
TEMPERATURE IN °C

FIGURE 4-4
BOTTOM TEMPERATURES
LOW WATER SLACK (1216-1316)
AUGUST 13, 1983
FLORDIA POWER CORPORATION
CRYSTAL RIVER NPDES STUDIES



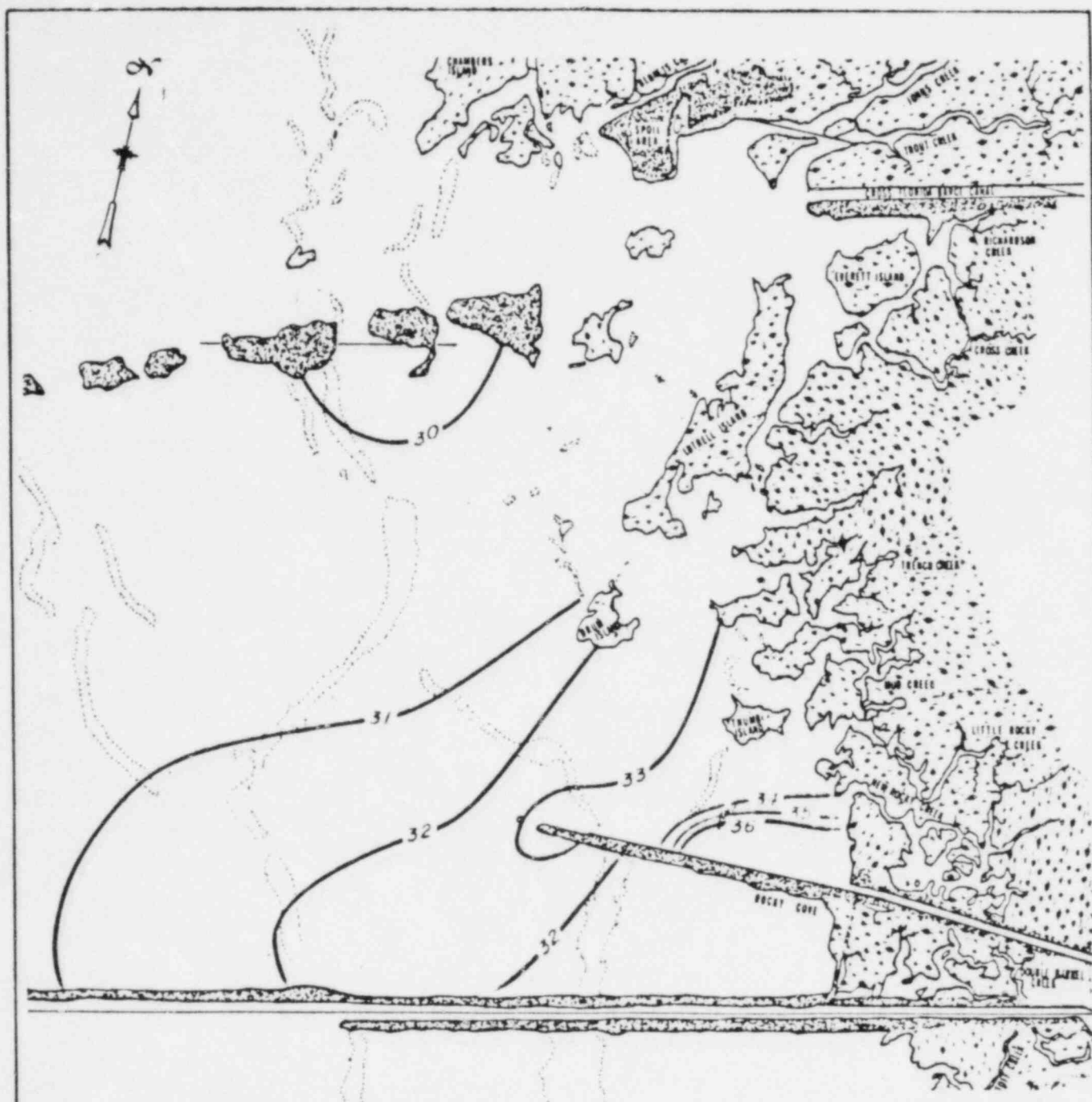
NOTE
TEMPERATURE IN °C

FIGURE 4-5
SURFACE TEMPERATURES
MID FLOOD (1458-1558)
AUGUST 13, 1983
FLORDIA POWER CORPORATION
CRYSTAL RIVER NPDES STUDIES



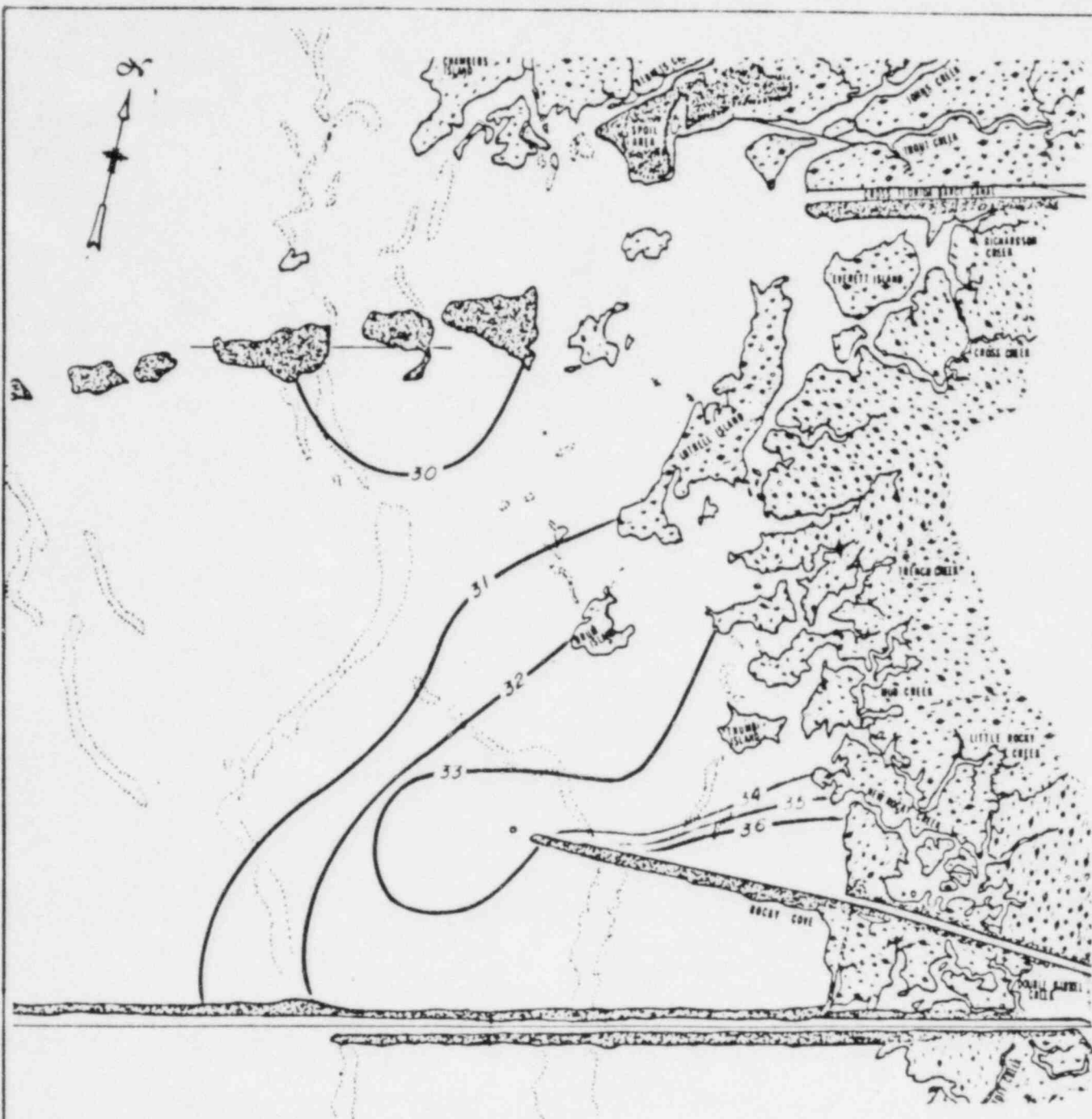
NOTE
TEMPERATURE IN °C

FIGURE 4-6
BOTTOM TEMPERATURES
MID FLOOD (1458-1558)
AUGUST 13, 1983
FLORDIA POWER CORPORATION
CRYSTAL RIVER NPDES STUDIES



NOTE
TEMPERATURE IN °C

FIGURE 4-7
SURFACE TEMPERATURES
HIGH WATER SLACK (1740-1840)
AUGUST 13, 1983
FLORDIA POWER CORPORATION
CRYSTAL RIVER NPDES STUDIES



NOTE
TEMPERATURE IN °C

FIGURE 4-8
BOTTOM TEMPERATURES
HIGH WATER SLACK (1740-1840)
AUGUST 13, 1983
FLORDIA POWER CORPORATION
CRYSTAL RIVER NPDES STUDIES



**Florida
Power**
CORPORATION

October 21, 1983

Mr. Paul J. Traina, Director
Water Management Division
U. S. Environmental Protection Agency
345 Courtland Street NE
Atlanta, GA 30365

Subject: Crystal River 316 Study

Dear Mr. Traina:

One aspect of the Crystal River 316 Study includes the quarterly analysis of fish stomach contents from seine and trawl samples collected in control and thermal areas. Discussions with EPA and FDER biologists suggest that the usefulness of the stomach content data in addressing specific 316 a and b objectives is questionable. Therefore, Florida Power plans to delete this analysis from the fisheries program.

Sincerely,

William S. O'Brien

William S. O'Brien

WSO/md

cc: Mr. D. B. Hicks
Mr. J. P. Subramani
Mr. L. A. Olsen
Mr. D. Farrell



December 7, 1983

Mr. Paul J. Traina, Director
Water Management Division
U. S. Environmental Protection Agency
345 Courtland Street
Atlanta, Georgia 30365

Subject: Crystal River 316 Study

Dear Mr. Traina:

During the first quarterly progress meeting for the Crystal River 316 Study, Agency representatives expressed the desire to increase the period between quarterly report submittal and the progress meetings. This would allow more complete review of the information submitted in the Reports. Accordingly, Florida Power has revised the reports/meeting schedule as follows:

<u>Quarter</u>	<u>Report</u>	<u>Meeting</u>
2	1-11	02/02/84
3	4-11	05/03/84
4	7-11	08/02/84
5(Final)	1-31	

Unless otherwise noted, future progress meetings will be held at Florida Power's General Office Complex, St. Petersburg. Questions concerning this schedule should be addressed to Mr. Paul Behrens at (813) 866-5521.

Sincerely,

William S. O'Brien

William S. O'Brien
Director
Environmental & Licensing Affairs

WSO/gr

cc: Mr. C. H. Kaplan, EPA
Mr. Del Hicks, EPA
Mr. J. P. Subramani, FDER
Dr. L. A. Olsen, FDER
Dr. Dan Williams, FDER
Mr. Doug Farrell, FDER



December 12, 1983

Mr. Paul J. Traina, Director
Water Management Division
U. S. Environmental Protection Agency
345 Courtland Street
Atlanta, Georgia 30365

Subject: Crystal River 316 Study

Dear Mr. Traina:

The first quarterly progress meeting for the Crystal River 316 Study was held on October 27, 1983. Minutes of this meeting are attached for your review. During the progress meeting EPA representatives expressed interest in having FPC conduct discharge-side sampling at Units 1,2, and 3 as a possible source of plankton density data to evaluate entrainment effects. Apparently, data has recently become available which suggest that discharge sampling provides a better estimate of plankton entrainment densities than intake sampling due to lower avoidance in the discharge.

Florida Power will address the EPA concerns regarding entrainment sampling and plans to approach the question in two phases. In the first phase, a single station will be added in the discharge to collect oblique tows with the same gear and methods currently employed at existing deep water stations (Figure 1). The station will be located at a point where the discharges from Unit 3 and Units 1 and 2 have turned, mixed, and are flowing westward in the canal, but east of the point where the blowdown discharge for Unit 4 enters the canal. While other locations, using other gears have been considered, the need is to compare discharge and intake samples. This necessitates using the same sampling techniques presently employed. Sampling will be initiated before the start of the 1984 spawning season, probably February 1 to be conservative, and continue in parallel with the existing program.

The results of the sampling will be carefully monitored. If the densities in the discharge samples are not significantly higher than in intake samples, no additional sampling would take place. If densities are significantly higher, a short-term study would be initiated to address the relationship between the densities at the new station, in the discharges and in the intake canal.

Mr. Paul J. Traina
December 12, 1983
Page 2

Florida Power intends to finalize plans to implement this sampling in the near future. We would appreciate Agency comments on this proposed plan no later than January 5, 1984. Comments should be addressed to Mr. Paul Behrens at (813) 866-5521.

Sincerely,

William S. O'Brien

William S. O'Brien
Director
Environmental & Licensing Affairs

WSO/gr

Attachment

cc: Mr. C. H. Kaplan, EPA, w/attachment
Mr. Del Hicks, EPA, w/attachment
Mr. J. P. Subramani, FDER, w/attachment
Dr. L. A. Olsen, FDER, w/attachment
Dr. Doug Farrell, FDER, w/attachment

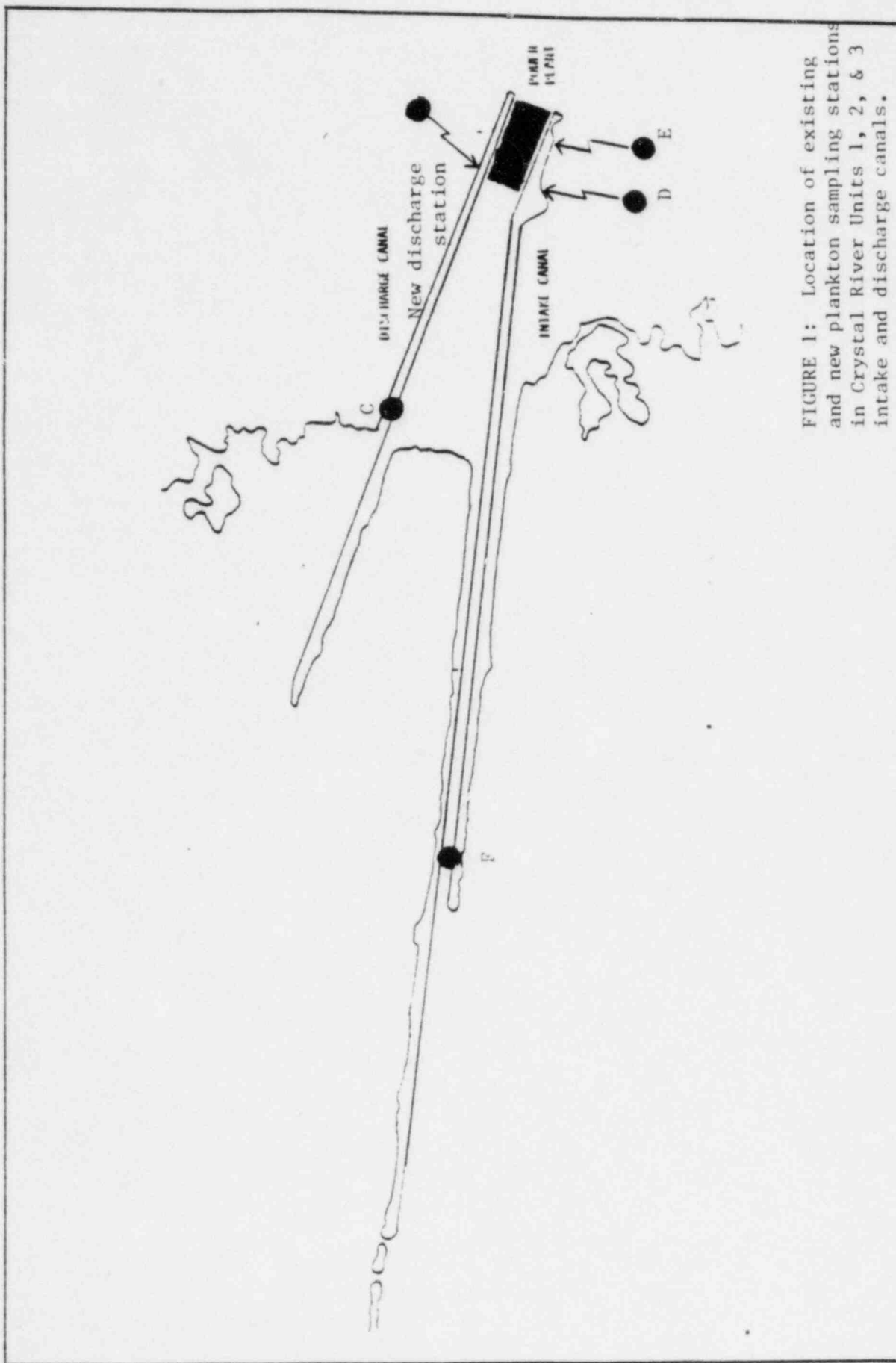


FIGURE 1: Location of existing and new plankton sampling stations in Crystal River Units 1, 2, & 3 intake and discharge canals.

Mr. Kaplan expressed concern that no one document described the entire program being conducted and contained figures showing finalized locations of sampling. Mr. Behrens will prepare a single summary document describing the program. Now that all types of sampling have been initiated few changes in the program are expected. Mr. Kaplan stressed that the NPDES study conducted must be approved by EPA and that he will be the lead person responsible for this project within EPA. He will review thoroughly any future proposed changes.

Changes which have been made in the program since the start of field work were summarized in the quarterly report (previously submitted) and discussed in the meeting. Mr. Kaplan expressed disappointment in changes made in the aerial photography portions of the study. Drs. Mahadevan and Biffar explained that changes simply reflected local conditions which precluded the summer photography. In addition, late fall and early spring photos would be sufficient to support the macrophyte program. Mr Raschke suggested that Dr. Mahadevan contact EPA personnel at Las Vegas who use special films for photographing on hazy days. Dr. Mahadevan will do so. After reviewing the base map produced by using a February aerial photograph, some members of the group questioned inclusion of all the possible grass beds in the vicinity of the discharge. It was agreed that the field sampling team would be questioned on this matter and any action necessary would be taken to document macrophytes not directly sampled at present sampling locations.

Dr. Biffar then explained the changes that have been made in the oyster reef program and in the weekly water quality sampling. Mr. Kaplan emphasized the need for information to define background temperature. Mr. Raschke was also concerned that the sampling locations chosen include controls not affected by the plant. He also wants to be assured that reentrainment of organisms or heat is not an issue at this plant. Dr. Biffar explained that based on plots of June and July temperature sampling, the plume measured to +2°C was well within the area sampled and did not extend to Fisherman's Pass. No formal designation of thermal control stations has yet been made, but the extensive study area should provide many possibilities among the stations being sampled.

Changes in the oyster reef program were acceptable, but Mr. Raschke believes there will be more "noise" in the caged oyster data since the oysters used come from a potentially different population near the Withlacoochee River. He acknowledged that no suitable alternative was available, since one reason for revising the POS involved avoiding destructive sampling.

Dr. Biffar continued the discussion with a review of changes in the entrainment sampling program. Mr. Raschke suggested that Station B could be sampled with alternative methods. Dr. Biffar noted that one criterion applied when stations were moved was maintaining the same gear at each station and thus collecting comparable data.

Mr. Raschke also would like to see more plankton entrainment effort in the discharge since net avoidance there might be less of a problem than on the intake side. Mr. Behrens said the question of number of replicates had been discussed extensively but he agreed to talk with Mr. Del Hicks about the adequacy of the existing plan.

NOTES OF CONFERENCE
FLORIDA POWER CORPORATION

J.O.No. 14498

Held in the Offices of
Florida Power Corporation
Crystal River, FL
October 27, 1983

Present for:

Florida Power Corporation (FPC)

David Voigts
Paul Behrens
Ron Fuller*

U.S. Environmental Protection
Agency (EPA)

Jim Patrick
Ron Raschke
Charles Kaplan

Florida Department of Environ-
mental Resources (DER)

Lawrence Olsen

Mote Marine Laboratory (MML)

Kumar Mahadevan

Stone & Webster Engineering
Corporation (SWEC)

Tom Eiffar
David McDougall
Tom Folger
John Downing

*Part time

PURPOSE

The meeting constituted the First Quarterly Progress Meeting for the Crystal River NPDES 316(A) and (B) studies.

DISCUSSION

Attachments 1 and 2 provide the meeting agenda and the attendance list. Mr. Behrens opened the meeting with a brief overview of the project. The development of the original Plan of Study (POS) in 1979 was reviewed, as were subsequent discussions of alternatives with the agencies. In 1982, the POS was revised by MML and early this year the revised program was reviewed and approved by the EPA and Florida DER. The new program included 15 months of sampling. Further changes were made in the program as a result of the bidding process; these changes primarily involve modeling efforts and were submitted to the agencies for approval.

Dr. Biffar noted the change in entrainment sampling whereby Stations I and J were moved inside the modeled area to improve the utility of the data in modeling and to avoid sampling very different water conditions. Mr. Olsen stated that Station I was intended to provide a characterization of potential "source water" from the south. Dr. Biffar agreed this could be interesting information but could not be directly applied to describing impacts of the plant. A similar discussion continued over the movement of Station B, which is presently assumed to represent a thermally affected area. Mr. Kaplan was unsure if this station was intended to be a "thermal" station but thought this station was intended to sample the effect of the barge canal. It was noted that physical conditions precluded sampling at the previous station as water depth is frequently 3 ft or less.

Dr. Biffar described changes in the plankton pushnet and fisheries inshore block net and offshore seining programs. Mr. Rashke was concerned about net avoidance for the stationary creek nets. It was noted that the pushnet was not feasible, that the stationary nets could obtain samples which are comparable among themselves, and that efforts were being made to sample the periods of greatest tidal flow to minimize avoidance. Relative to offshore seining, Mr. Kaplan believed it was intended to seine along the intake dikes to determine the contribution of the indigenous spawning populations to the entrained plankton. No one could confirm this intent. Mr. Behrens will discuss this with Mr. Hicks. Dr. Biffar explained that the changes were made only because it was impossible to sample the original locations and because at least one of the stations was intended to be thermally affected. Therefore, locations near the discharge were sought.

Most of the changes made in the crab tagging program were made to make the program similar to the existing DNR crab tagging program. Mr. Olsen commented that the biologist in his department, Mr. Dave Farrell, was very pleased with the changes made to date.

Dr. Biffar also explained that the current profiling had been modified to obtain five profiles spaced across the channels instead of one, and that the number of profiles performed at open water stations had been reduced from four to two in each month. Mr. McDougall assured the group that the two originally proposed models could still be driven with this data.

Dr. Mahadevan then summarized the results of the field and laboratory efforts of the program. Mr. Rashke asked if copies of the historical records of aerial photography at the site are available. Mr. Behrens indicated that FPC has aerial photos going back to the 1960's. Mr. Rashke expects much concern on the extent of the damage to macrophytes and that these photos would be very useful. Mr. Voigts noted that the supplement to the EIS (final) contains a macrophyte map of unknown origin and dubious date. There are indications that the map is wrong and may have been inappropriately inserted into the document. Mr. Kaplan would like the page number where that map appears in the EIS. Dr. Mahadevan noted that there had been some initial difficulty encountered in finding the necessary number of macrophyte beds in the discharge zone but that the problem has been resolved. Mr. Kaplan was concerned that the macrophyte discharge stations are so far from the discharge. It was explained that these are the closest beds to the discharge. Dr. Mahadevan discussed the photometry and tide window temperature sampling programs. Mr. Kaplan wanted to know the date of

the change in the latter program. Dr. Mahadevan said this occurred after the third week of sampling. Dr. Mahadevan described progress of sampling in the chlorophyll "A", sediment and impingement programs.

Mr. Kaplan asked when it would be known if sampling from two of the four screens of each unit would be sufficient to obtain accurate estimates of impingement, since he would like to request a change in scope trade off for a study of the value of fine mesh screening. Messrs. Behrens and Voigts said they were not authorized to discuss fine mesh screening. They also noted that the impingement data does not allow distinction of impingement by screen. Mr. Kaplan said he would redirect this question of study of fine mesh screening studies to the appropriate people at FPC.

Dr. Mahadevan completed discussing the results of field sampling for entrainment, fisheries, crab trapping, bathymetry, and short term studies. Mr. Kaplan wanted to know details of what data were missing by station for the short term studies. Mr. McDougall said since the models can be driven by either the tide or the current data some options are available to accommodate missing data. Mr. Kaplan wants a new figure in the revised plan of study to reflect the true sampling locations for current meters and tide gauges. Mr. Kaplan said he also wanted to know what data is missing for thermograph samples by station and day. Dr. Biffar showed Mr. Kaplan the record by station through late September. Dr. Mahadevan said he expects an improvement in recovery of thermograph data since now many crab traps are located in the vicinity of the thermographs thereby camouflaging them. Mr. Kaplan commented that the benthos and thermograph stations are not the same. Dr. Mahadevan explained that the original thermograph program only included 21 stations. There are now 51 thermograph and 40 benthos sampling stations and the existing program now has "about 21" stations where thermograph data is collected in the vicinity of benthos stations.

Dr. Mahadevan completed his summary with explanations of results of suspended load and meteorology sampling without further discussion.

Mr. McDougall summarized results of the hydrologic modeling efforts to date. Mr. Kaplan asked if the short term data indicate plume bottom detachment or surface hugging. Mr. McDougall replied that there is no evidence of either effect in the data collected to date.

Mr. Behrens asked the group if there were any additional information they would like to see in the summary data tables for future quarterly reports. Mr. Raschke asked that measures of variance be provided as well as means. Mr. Kaplan would like to see weekly Wt's presented by station on a figure of the sample areas along with contours of acreage by degree Wt with time of tide on the legend. Dr. Biffar noted that such contouring of weekly data is not anticipated. Messrs. Downing, Biffar, Mahadevan, and Behrens did not understand how this weekly contouring and measuring acreage could be completed without some modeling of the plume. Mr. Behrens also questioned the utility of some 65 weekly figures depicting Wt by station. Mr. Kaplan thought that this information was to be produced according to the approved program. It was resolved that this would require some modeling and subjective contour plotting and that the magnitude of effort required for information obtained was not worthwhile. Mr. Kaplan said he would also like to see plots of weekly max-min-average by station for thermograph data, or

at least for the station at the POD. Such plots, on a daily or weekly basis, are feasible after the charts are digitized.

Mr. Olsen said that he has always been pleased with Dr. Mahadevan's approach and would be pleased to see summaries with his standard approach with limited statistical comparisons and more graphs.

Mr. Behrens and Mr. Kaplan agreed that the date for the next quarterly meeting would allow two weeks for EPA review of the report. Future mailings to EPA should be directed to or separately copied to Mr. Kaplan to assure rapid delivery.

JDowning:LRR

AGENDA

FIRST QUARTERLY PROGRESS MEETING

CRYSTAL RIVER NPDES STUDIES

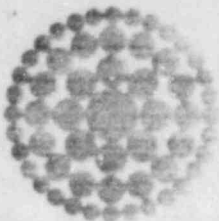
1. Introduction - P. Behrens
 - Requirement for the study
 - Development of the Plan of Study
 - Present participants
 - Schedule
 - Field work
 - Final report submittal
 - Purpose for quarterly meetings
2. Program Changes - T. Biffar
3. Field Work and Laboratory Analysis - S. Mahadevan
4. Hydrodynamic and Hydrothermal Modeling - D. McDougall
5. Displays and Data Tables
6. Tour of Study Area and Laboratory

ATTACHMENT 2

Crystal River 316 Progress Meeting

10-27-83

Paul Berrens	FPC	813 866 5521
Ron Fuller	FPC	904 995 3802
David Voigt	FPC	813 866 5160
JOHN A. DOWNING	Stone & Webster	617 589-2776
Kumar Mahadevan	MML	813-338-4471
Ken Roserko	EPA	404/546-1000
Charles F. ...	EPA	404-55-7500
T.A. Folger	Stone & Webster	(609) 482-3222
David H. McDougall	SWEC	(617) 589-2707
Jim Patrick	EPA	404 891 1012
Tom ...	SWEC	617-589-2707
Louise ...	SWEC	617-589-2707



**Florida
Power**
CORPORATION

December 22, 1983

Mr. Paul J. Traina, Director
Water Management Division
U. S. Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365

Subject: Crystal River 316 Study
Thermograph data retrieval

During the first quarterly progress meeting for the Crystal River 316 Study, Mr. Kaplan requested that Florida Power provide the enclosed summary of thermograph data collected as part of the program. Data are presented by month and station for the first six months of the program.

As the figures indicate, a significant increase in data recovery was realized after the initial deployment period. This is due to weekly checking of the units for presence/absence and redeployment of the thermographs using a modified buoy system that resembles the one used in the blue crab tagging program. We fully expect that this improved data return rate will continue through the remainder of the study period.

Should you wish further discussion regarding this matter, please contact Mr. Paul Behrens at 813/866-5521.

Sincerely,

William S. O'Brien
Director
Environmental & Licensing Affairs

WSO/gr

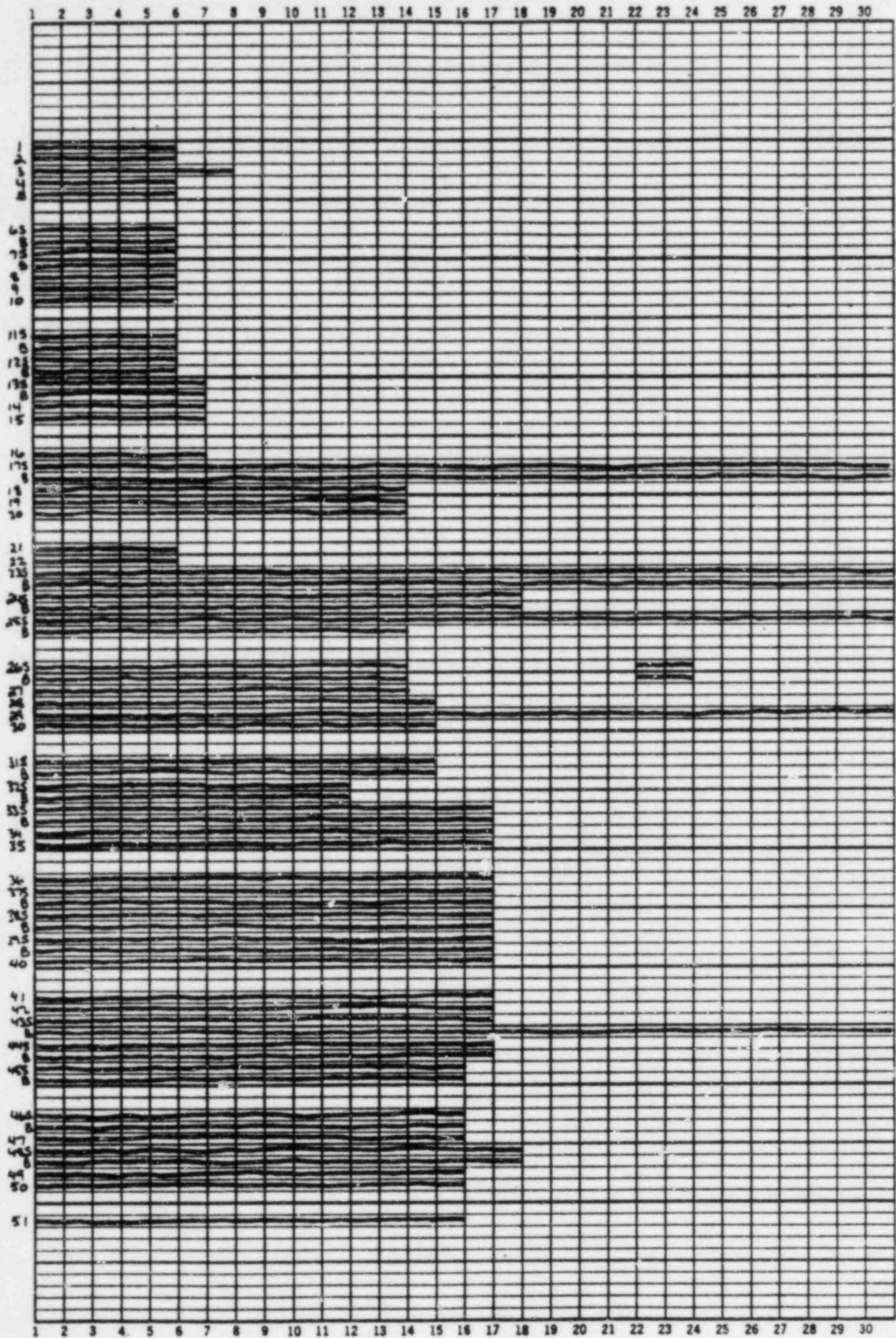
Enclosure

cc: C. H. Kaplan, EPA
D. Hicks, EPA
J. P. Subramani, FDER
L. A. Olsen, FDER
D. Farrell, FDER

AVAILABLE THERMOGRAPH CHARTS

(No data available on dates marked)

THERMOGRAPH STATIONS

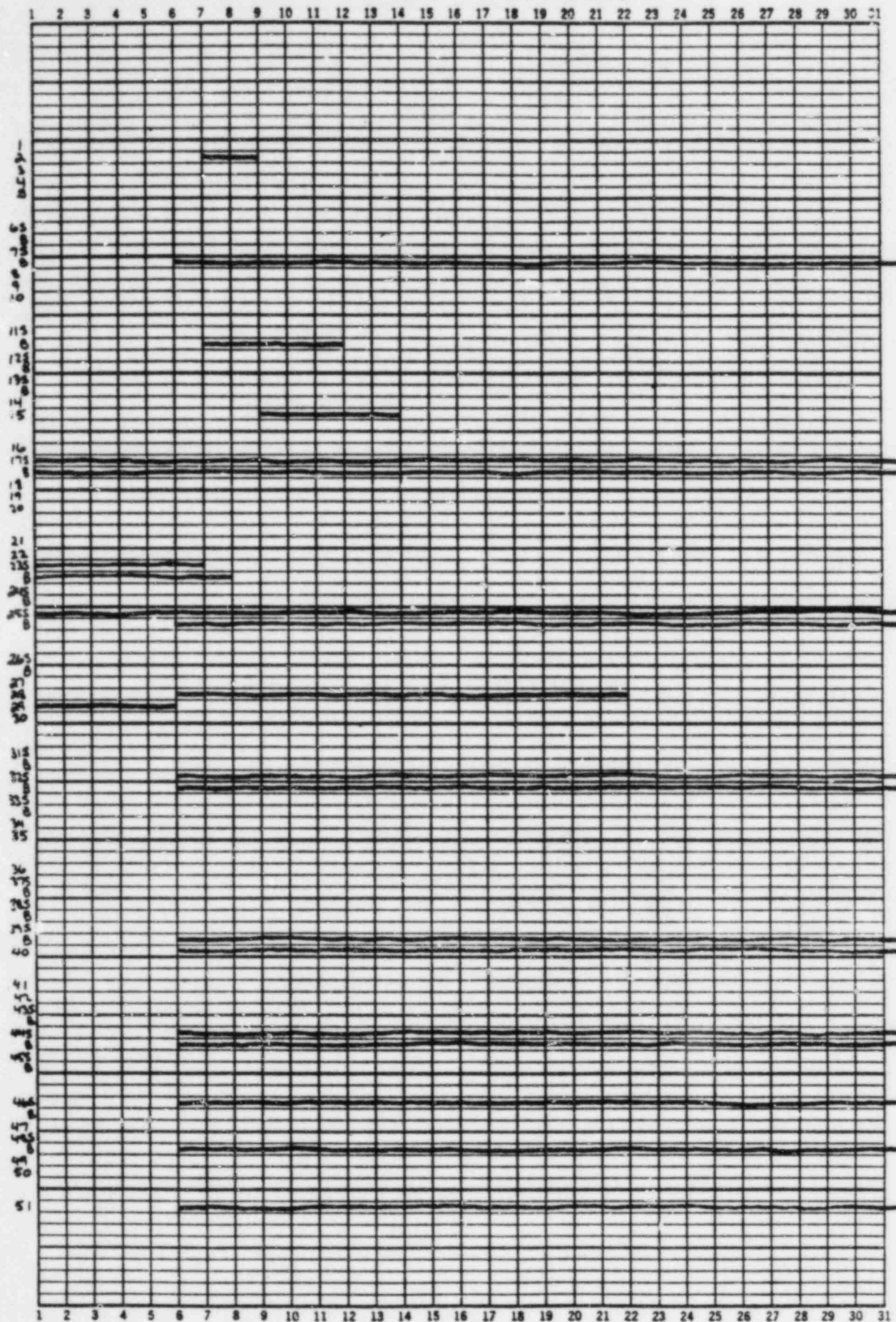


Month JUNE 1933

AVAILABLE THERMOGRAPH CHARTS

(No data available on dates marked)

THERMOGRAPH STATIONS

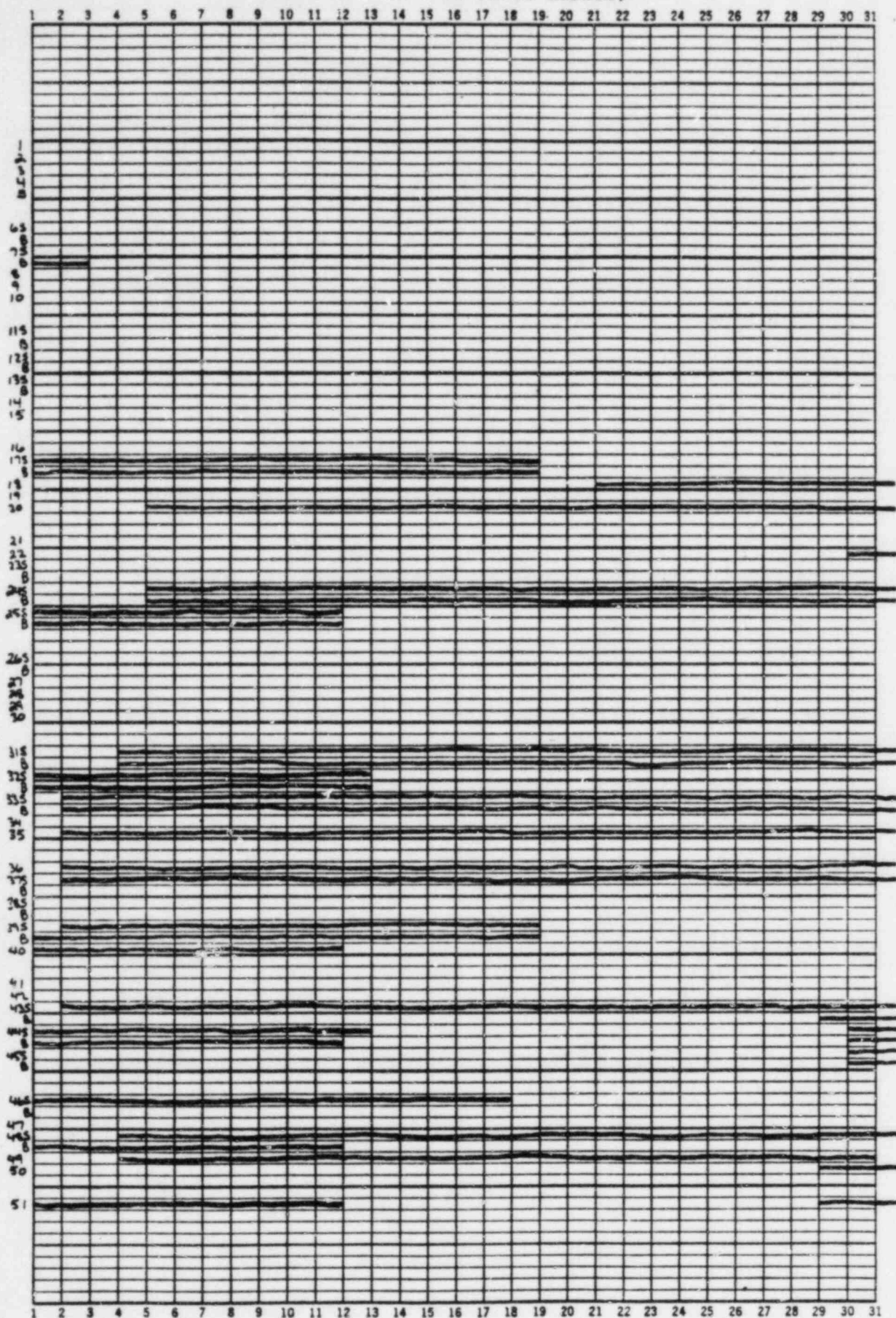


Month JULY 1983

AVAILABLE THERMOGRAPH CHARTS

(No data available on dates marked)

THERMOGRAPH STATIONS

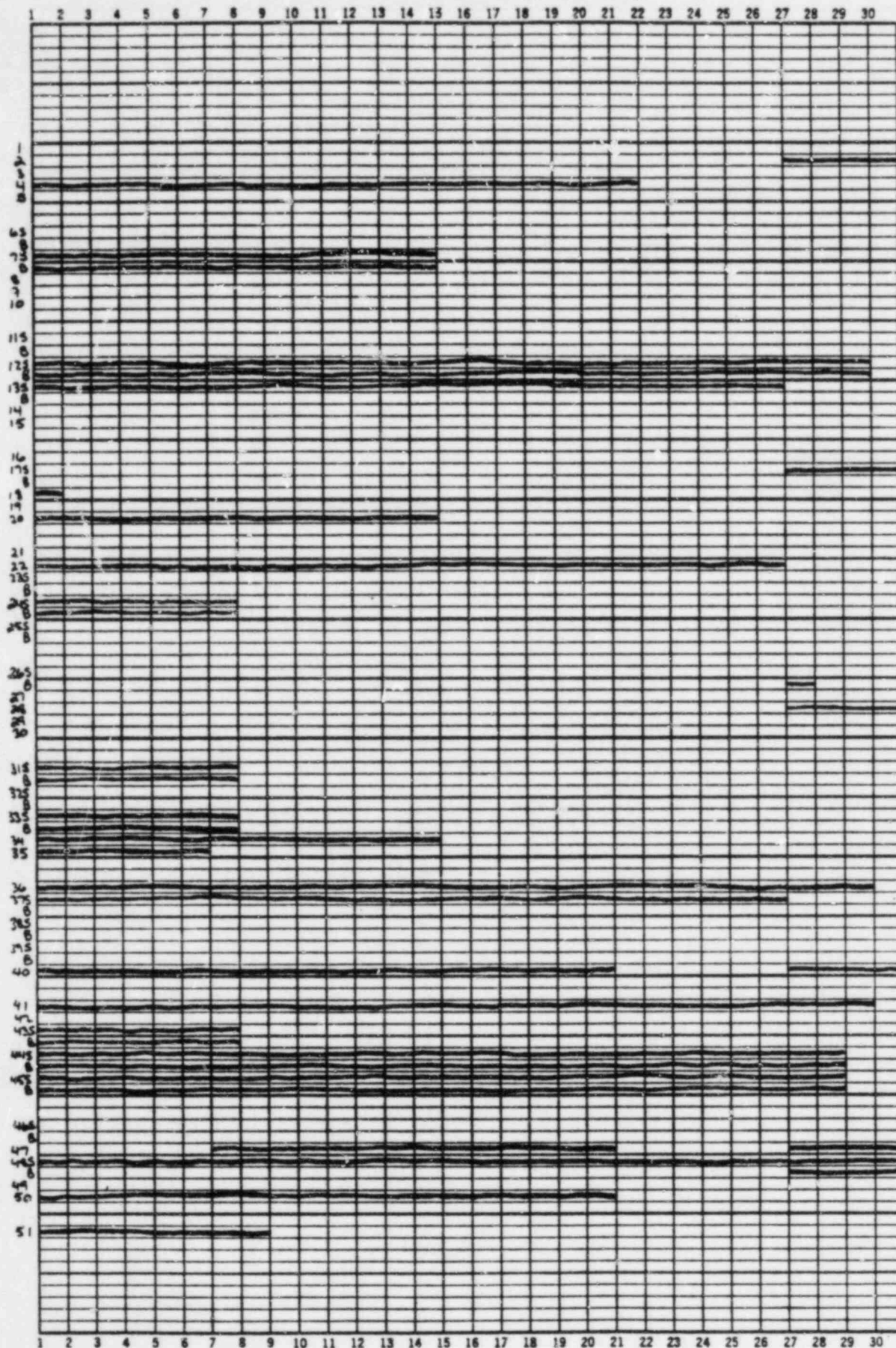


Month AUGUST 1983

AVAILABLE THERMOGRAPH CHARTS

(No data available on dates marked)

THERMOGRAPH STATIONS

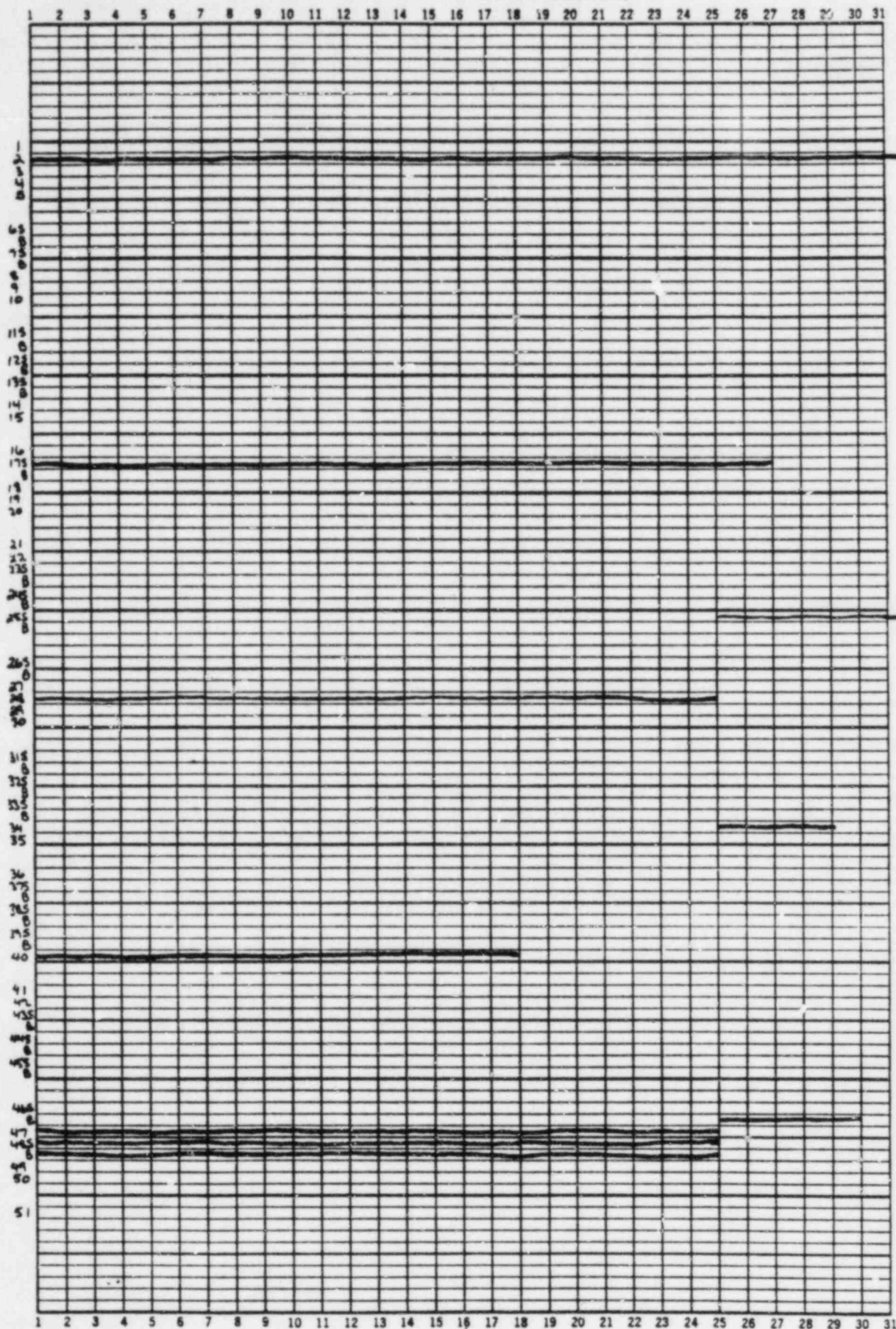


Month SEPTEMBER 1983

AVAILABLE THERMOGRAPH CHARTS

(No data available on dates marked)

THERMOGRAPH STATIONS

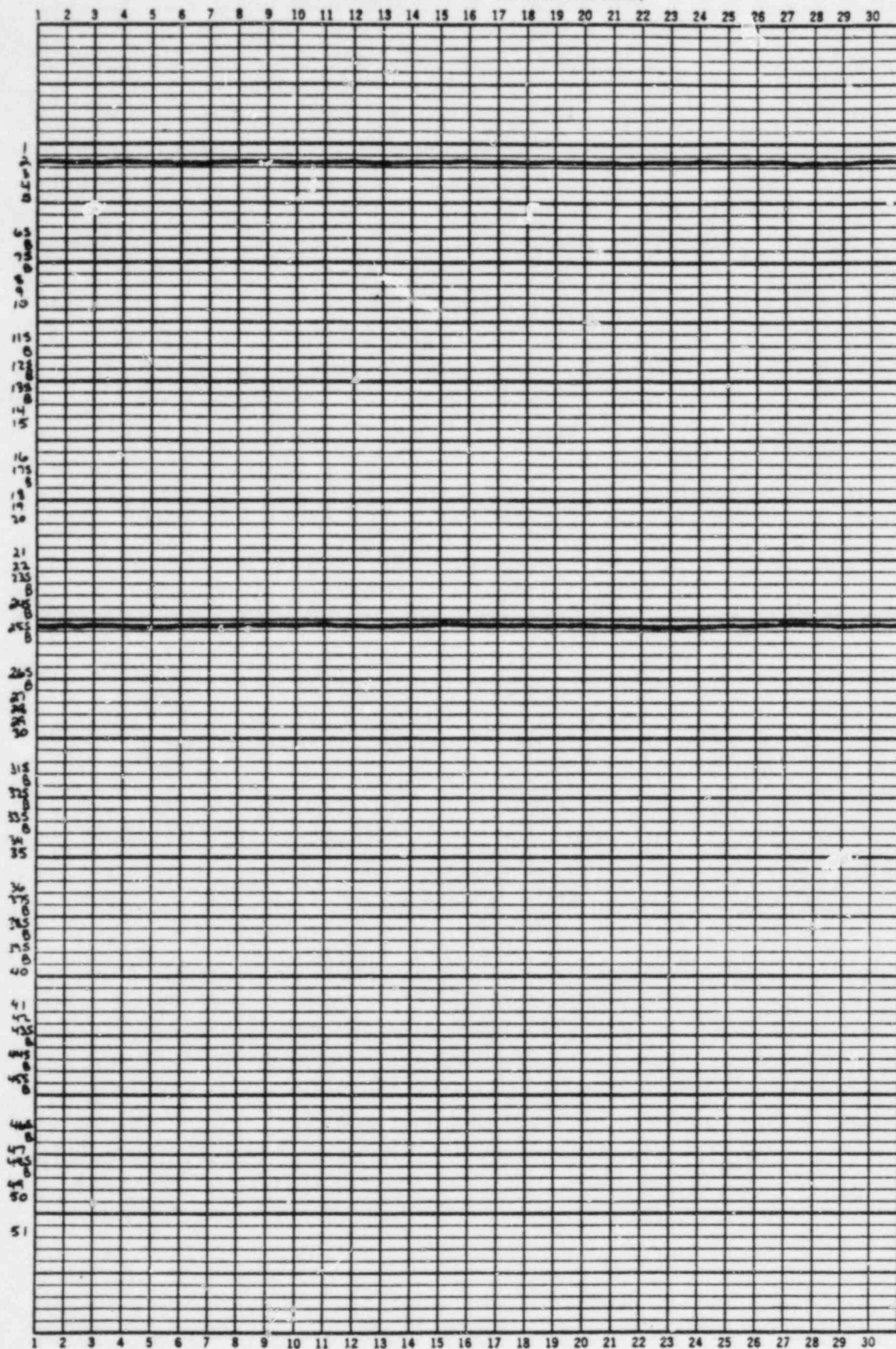


Month OCTOBER 1983

AVAILABLE THERMOGRAPH CHARTS

(No data available on dates marked)

THERMOGRAPH STATIONS



Month NOVEMBER 1923