

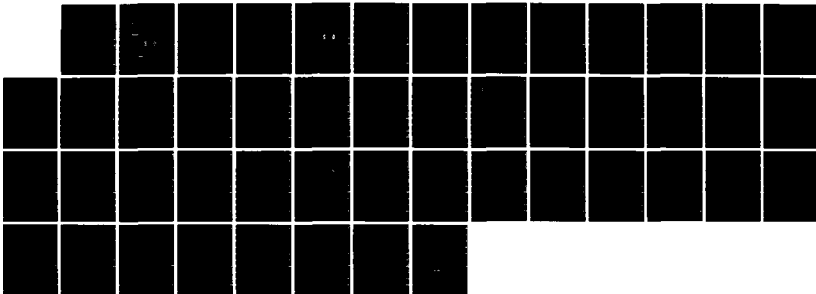
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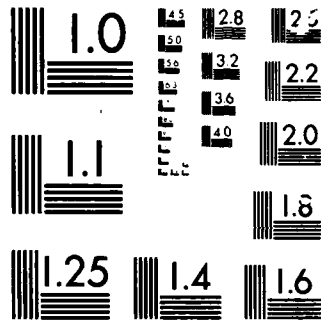
INDIAN ISLAND MOORINGS PROJECT EXECUTION PLAN(U) NAVAL 1/1  
FACILITIES ENGINEERING COMMAND WASHINGTON DC CHESAPEAKE  
DIV 15 JAN 79 CHES/NAVFAC-FPO-7909.5

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NATIONAL INLAND MODELING  
 PROJECT EXECUTION PLAN  
 15 January 1979

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The Officer in Charge of Construction (OICC), Naval Facilities Engineering Command, TRIDENT has the requirement to procure and install three fleet moorings at Indian Island, Washington. These moorings are part of a facility of fleet moorings that will be used by the Naval Underwater Weapons (Con't)

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Engineering Station (NUWES) to secure YC and YFN ammunition barges.  
CHESNAVFACENGCOM has been assigned the responsibility to design and install  
moorings Numbers 1,2, and 6.

①

INDIAN ISLAND MOORINGS

PROJECT EXECUTION PLAN

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15 JANUARY 1979

Commanding Officer, Chesapeake Division  
Naval Facilities Engineering Command  
Building 57, Washington Navy Yard  
Washington, D. C. 20374

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## 1.0 PROJECT DESCRIPTION

### 1.1 BACKGROUND

The Officer in Charge of Construction (OICC), Naval Facilities Engineering Command, TRIDENT has the requirement to procure and install three fleet moorings at Indian Island, Washington. These moorings are part of a facility of fleet moorings that will be used by the Naval Underwater Weapons Engineering Station (NUWES) to secure YC and YFN ammunition barges. CHESNAVFACENGCOM has been assigned the responsibility to design and install moorings Number 1, 2, and 6 (see Figure 1-1).

### 1.2 WORK SCOPE

The moorings to be installed will use refurbished Class C components that were procured by OICC, TRIDENT based on an original design by NUWES, Keyport. Subsequently, CHESNAVFACENGCOM modified this design to comply with the site characteristics and performance requirements. Basically, the moorings will be the free-swinging, riser-type with the ground ring 50 ft above the bottom (see Figure 1-2). The water depth for these moorings is 80-90 feet MLLW. Appendix B presents a more detailed discussion of the performance requirements and mooring design.

Installation of these moorings will be completed in the January-February 1979 timeframe. The sequence of installation will be mooring Number 6, 2, and 1. A Facility Acceptance Test has been prepared and incorporated into this construction plan.

### 1.3 PROJECT TASKING

CHESNAVFACENGCOM was initially requested by OICC, TRIDENT to perform a design review of the three fleet moorings to be installed at Indian Island, reference (a). (References are listed in Appendix A). In response, CHESNAVFACENGCOM submitted a plan of action, reference (b), and a revised plan of action reference (c), for the design and construction of these moorings in the January-February 1979 period. OICC, TRIDENT concurred with the revised plan of action by means of references (d) and (e).

Subsequently, the construction team was assembled as follows:

Watercraft Support Maintenance Center (WSMC)  
Washington Army National Guard  
Tacoma, Washington

Reference (f) requested a crane barge and tugs with crews for the construction period. WSMC accepted by reference (g).

Navy Public Works Center (PWC)  
San Diego, California



Reference (h) requested assistance with the rigging for installation. PWC accepted by reference (i)

Civil Engineering Laboratory (CEL)  
Port Hueneme, California

Reference (j) requested diving locker services for installation. CEL accepted by reference (k).

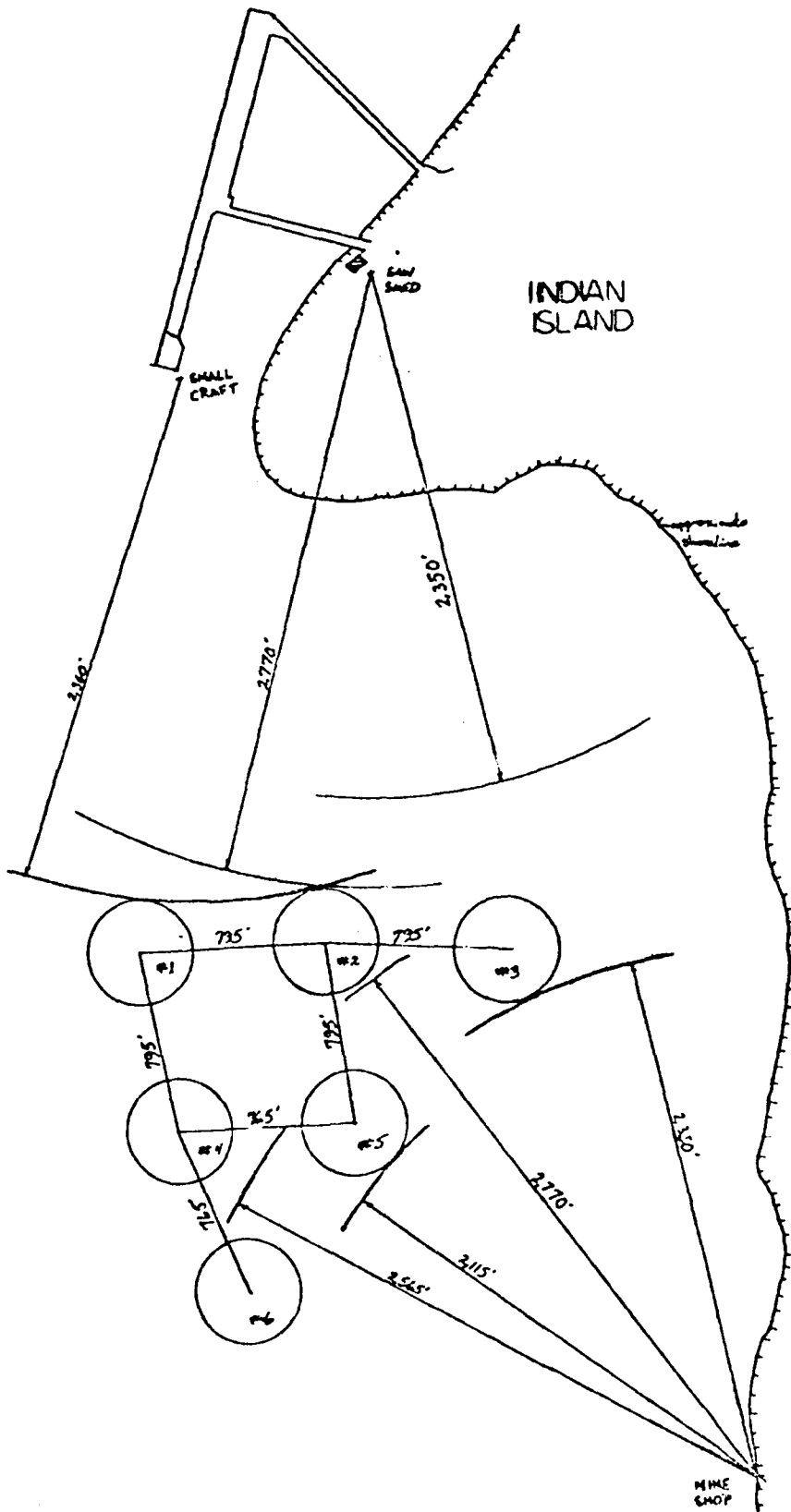
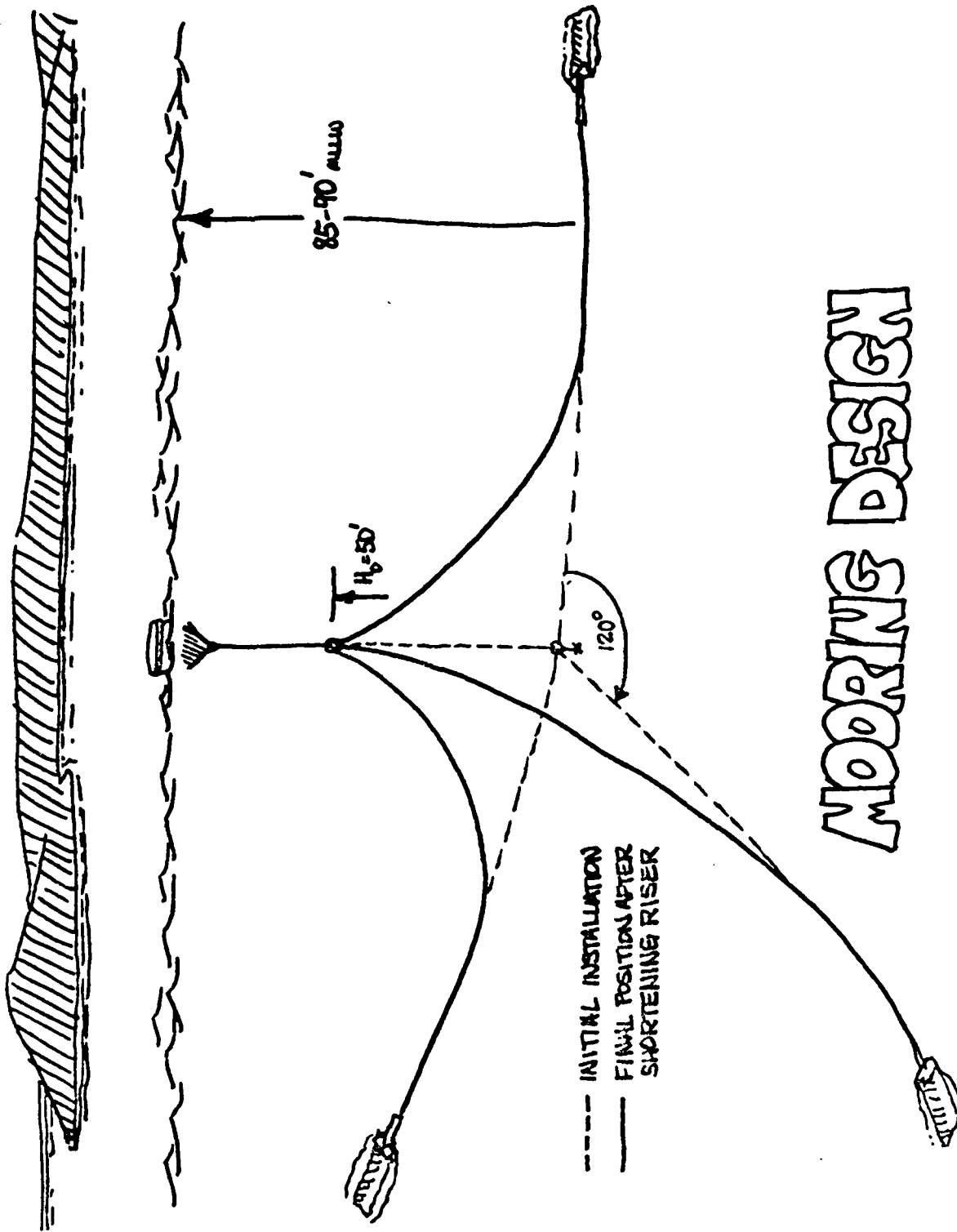


FIGURE 1-1



# MOORING DESIGN

FIGURE 1-2

## 2.0 PROJECT RESPONSIBILITIES

### 2.1 CHESNAVFACENGCOM

- Provide overall project direction for mooring design and installation.
- Coordinate project execution with OICC Trident and construction operations with the ROICC, Indian Island.
- Develop design criteria based on user performance requirements and anticipated environmental loading.
- Develop a mooring design using components of a Class C, Free-Swinging, Riser-Type Mooring provided by OICC Trident.
- Identify/coordinate assembly of construction platforms, equipment and personnel.
- Provide for project logistics, planning and engineering support.
- Provide for construction quality control and define/execute a "Facility Acceptance Test."
- Provide the following additional project equipment/services in support of construction operations:
  - Mini-Ranger navigation equipment and services.
  - Video-Tape recording equipment to document construction operations.
  - In-the-field engineering/design support.
- Prepare a Project Execution Plan
- Prepare a Project Completion Report and As-Built drawings.

### 2.2 WSMC, Tacoma, WA

- Provide a 60-ton crane barge with two tugs and crews required for construction operations.
- Provide for the safety of all personnel and equipment aboard these platforms during the construction mobilization period.
- Perform all necessary modification/outfitting of these platforms to make ready for construction operations.

## 2.2 WSMC, Tacoma, WA (Continued)

- Receive project equipment and make ready for transport to and from Indian Island aboard the WSMC barge or tugs.
- Provide the following additional project equipment/services in support of construction operations:
  - Platform maneuvering and station-keeping
  - Crane operator
  - On-load mooring components and assist with rigging
  - All communications equipment and services
  - Oxyacetylene cutting torch and extra gas cylinders
  - Fathometer aboard the 100-ft tug
  - Batteries for Mini-Ranger transponders
  - Standby tug to be used as a dive boat
- Coordinate with CHESNAVFACENCOM for WSMC supplied platforms, equipment and services

## 2.3 PWC, San Diego, CA

- Provide two mooring riggers and a Foreman to supervise all deck operations, including rigging and mooring installations.
- Provide for the safety of all personnel and equipment on deck during rigging and installation operations.
- Identify and fabricate, or provide for, all rigging hardware, tools and equipment necessary for installing the three moorings using the WSMC crane barge.
- Coordinate with CEL for the transport of all PWC supplied project equipment to WSMC, Tacoma.
- Fabricate deck padeyes and ship to WSMC for attachment to crane barge prior to construction mobilization.
- Coordinate with CHESNAVFACENCOM for PWC supplied equipment and services.

## 2.4 CEL, Port Hueneme, CA

- Provide a Navy dive team and services for underwater inspections and other construction operations.
- Provide for the safety of all personnel and equipment used for diving operations, including medical evacuation and use of a recompression chamber.
- Provide CEL dive locker/equipment and a zodiac to be used as a standby dive boat.
- Provide a truck with drivers to transport project equipment. Prepare for transport and coordinate movement and delivery of project equipment from PWC, San Diego to CEL, Port Hueneme to WSMC, Tacoma and return.
- Provide vibracorer equipment and services at sites selected by CEL/CHESDIV.
- Provide diver operated soil sampling/testing equipment and services at sites selected by CEL/CHESDIV.
- Provide photographic equipment and personnel to document construction operations.
- Provide the following additional project equipment/services in support of construction operations:
  - Calibrated load cell and rigging necessary for the pull-test
  - Portable arc welder and associated hardware/equipment and personnel.
  - Rigging for marker buoy moorings
  - Wire cutters for use by divers
  - Additional oxyacetelene bottles
  - Assist with on-site logistics
  - Assist with navigation setup and other construction operations
- Coordinate with CHESNAVFACECOM for CEL supplies equipment and services.

### 3.0 CONSTRUCTION SCHEDULE

The following lists the daily sequence of events scheduled for the construction period, 22-31 January 1979. This plan calls for a total of 10 days mobilization plus an additional three days (1-3 February 1979) contingency in the event of heavy weather or unforeseen conditions. This schedule is subject to revision during the construction period.

#### 3.1 PREPARATION/ASSEMBLY OF PROJECT EQUIPMENT (PRIOR TO 18 JAN 79)

- |                   |   |
|-------------------|---|
| PWC, San Diego    | <ul style="list-style-type: none"><li>● Fabricate and/or assemble all rigging hardware for project execution.</li><li>● Fabricate padeyes and ship to WSMC, Tacoma for attachment to barge deck.</li></ul>  |
| CEL, Port Hueneme | <ul style="list-style-type: none"><li>● Prepare Mini-Ranger and Vibracoring equipments located at PWC, San Diego for transport to CEL.</li><li>● Provide a truck with drivers for transport of rigging hardware and other equipment from PWC, San Diego to CEL, Port Hueneme.</li><li>● Prepare dive locker and other hardware/equipment in support of project for transport to WSMC, Tacoma.</li></ul> |
| WSMC, Tacoma      | <ul style="list-style-type: none"><li>● Attach padeyes and prepare barge deck for project.</li><li>● Continue preparations for receiving equipment and transit of barge/tug to Indian Island.</li><li>● Assemble hardware/equipment in support of project.</li></ul>  |

#### 3.2 TRANSPORT OF PROJECT EQUIPMENT (18-21 JAN 79)

- CEL provide a truck with drivers/mechanic for transport of assembled hardware/equipment from CEL, Port Hueneme to WSMC, Tacoma.
- Remainder of construction team make final preparation for mobilization.

### 3.3 TRANSIT TO INDIAN ISLAND (22 JAN 79)

- On-load equipment from truck to barge; barge/tugs transit to Indian Island.
- Remainder of construction team transit to Port Townsend.
- On-site inspection and conference between CHESDIV/PWC/CEL/WSMC.

### 3.4 PRE-RIGGING AND PREPARATIONS (23-24(AM) JAN 79)

- Set up Mini-Ranger Navigation.
- Weld flukes on anchors and other pre-rigging of mooring components and crane barge.
- Diver inspection of existing mooring on site to determine condition.
- Obtain vibracorer samples in mooring area at locations selected by CEL/CHESDIV.

### 3.5 MOORING INSTALLATIONS (24(PM)-30(AM) JAN 79)

- Each mooring installation and acceptance test is scheduled to be completed within 48 hours, but conducted over a three-day period. See "Typical Mooring Installation Sequence" for a more detailed discussion.

### 3.6 CLEAN-UP AND TRANSIT HOME (30(PM)-31 JAN 79)

- After the three moorings have been installed and the acceptance tests completed, all project equipment will be assembled and prepared for transport. All equipment will remain on the barge for transit to Tacoma.
- Upon reaching Tacoma, all equipment will be transferred to the truck provided by CEL for transport to CEL, Port Hueneme, and PWC, San Diego.



#### 4.0 TYPICAL MOORING INSTALLATION

The following describes the various operations planned for the installation and test of each mooring. The schedule/duration of each operation must be considered "typical" since they will depend on the experience gained and the conditions encountered during each installation.

Typically, the installation and test of each mooring is planned to be completed within 48 hours and conducted over a three-day period.

#### 4.1 DAY NUMBER ONE (PM)

- **RIG FOR MOORING INSTALLATION.** The crane barge will be positioned at the West end of the pier with its stern alongside the two storage barges. Operating over its stern, the crane barge will on-load the components for the mooring and lay them out on deck. The components will be assembled and stoppered off on deck as shown in Figure 4-1. All preparations will be made for executing installation for the following morning.

- **INSTALL MARKER BUOYS.** The Mini-Ranger will be located on the 100-ft tug used to maneuver the crane barge. Concurrent with the rigging operations, the tug will be maneuvered to the location specified for each marker buoy and the buoys deployed. The mooring of these buoys is designed to maintain constant tension on the line, while accommodating a tidal variation of -2 to +10 ft in water depth. The intent is to provide a marker buoy that will tend directly over its anchor and not be submerged during high tide conditions (see Figure 4-2).

A total of six buoys will be deployed, two location buoys and two pairs of range-bearing buoys (see Figure 4-3). The two location buoys will mark the sites of the mooring buoy (center of the mooring) and the anchor for Leg No. 1. The two pairs of range-bearing buoys will indicate the direction/bearing in which Leg No. 2 and Leg No. 3 are to be laid. These buoys will be positioned approximately 300 ft out from the anchor sites so as to provide room for the barge/tugs to maneuver.

#### 4.2 DAY NUMBER TWO (AM)

- **INSTALL THE MOORING.** It is preferred to start each installation in the morning so as to allow the maximum number of daylight hours to solve any problems, should they arise. The complete installation will be executed in two stages. The first stage will consist of installing the mooring on location with the ground ring approximately 10 ft above the bottom. This is to keep as much of the ground tackle on bottom and thus help maintain the mooring buoy on location during subsequent operations. The second stage will consist of lifting the mooring buoy and stoppering off the riser on deck. The riser will then be shortened so as to leave the ground ring at the design height of 50 ft above the bottom at MLLW.

The initial installation will proceed as follows:

- All components must be overboarded off the port side as the boom will not reach over the bow. All laying operations will be performed over the port bow.
- The anchor for Leg No. 1 will be lowered and positioned on bottom at the marker buoy. Leg No. 1 will then be layed as the tug(s) maneuver the crane barge back to the center marker buoy.
- Once at the center marker buoy, the mooring buoy and two throw-off legs will be put in the water (see Figure 4-4).
- The barge will then be maneuvered for recovery of the pick-up line for throw-off Leg No. 2. The bitter end of Leg No. 2 will be stoppered off on deck and the remainder of Leg No. 2 assembled.
- Laying of Leg No. 2 will proceed away from the center of the mooring using the range-bearing buoys for positioning. It is anticipated that a displacement of the mooring buoy will result from this operation (see Figure 4-5).
- Position control for placing the anchor of Leg No. 2 will be by means of a plot board using the range-information from the Mini-Ranger. Prior to reaching the desired anchor location, the anchor will be lowered to the bottom and then dragged onto location using the crown line.
- Upon recovery and assembly of anchor Leg No. 3, the mooring buoy will be pulled back onto location using Leg No. 3 (see Figure 4-6). While laying Leg No. 3, a constant visual determination of the location of the mooring buoy relative to the center marker buoy will be conducted. The barge will be maneuvered using the range-bearing buoys. The anchor will be lowered and positioned in the same manner as Leg No. 2.

After completion of the first stage of installation, the final position of the mooring buoy will be adjusted, if necessary, to bring it on location at the center marker buoy. This will be accomplished by picking up on the crown line and repositioning selected anchors.

● DIVER INSPECTION. Upon completion of the first stage of installation and adjusting the position of the mooring buoy, divers will perform an underwater inspection of the mooring. See "Facility Acceptance Test" for further discussion.

#### 4.3 DAY NUMBER TWO (PM)

- **SECOND STAGE OF INSTALLATION.** Upon satisfactory completion of the diver inspection, the mooring buoy will be lifted onto the deck of the crane barge and the riser stoppered off. The riser will then be cut and shortened so as to provide the design height of the ground ring at 50 ft above the bottom at MLLW. The purpose of this design is to create large catenaries in the anchor legs and thus reduce the watch circle of the mooring. To complete the initial lift of the mooring buoy, the anchors must be pulled in towards the center, for a drag distance of approximately 30 ft. Should one or more of the anchors fail to move the proper distance, a shift in the location of the mooring buoy will result. Depending on the magnitude of this relocation, selected anchors may be repositioned so as to bring the mooring buoy back on location.

#### 4.4 DAY NUMBER THREE (AM)

- **PULL-TEST.** The pull-test on the mooring, to determine its displacement under maximum design loads, is an integral part of the "Facilities Acceptance Test." Refer to this section for further discussion.

- **RECOVERY OF CROWN LINES.** Upon successful completion of the Facilities Acceptance Test, the crown lines will be recovered. Divers will descend on each line and disconnect the line, via a shackle, from the anchor. In the event the shackle is not accessible, due to anchor penetration into the bottom, the divers will be equipped with wire cutters to part the line at the mud line.

This completes the sequence of a typical mooring installation, except for the recovery and relocation of the marker buoys for the next installation. This is scheduled to occur during the afternoon while the crane barge is rigging for the next installation.

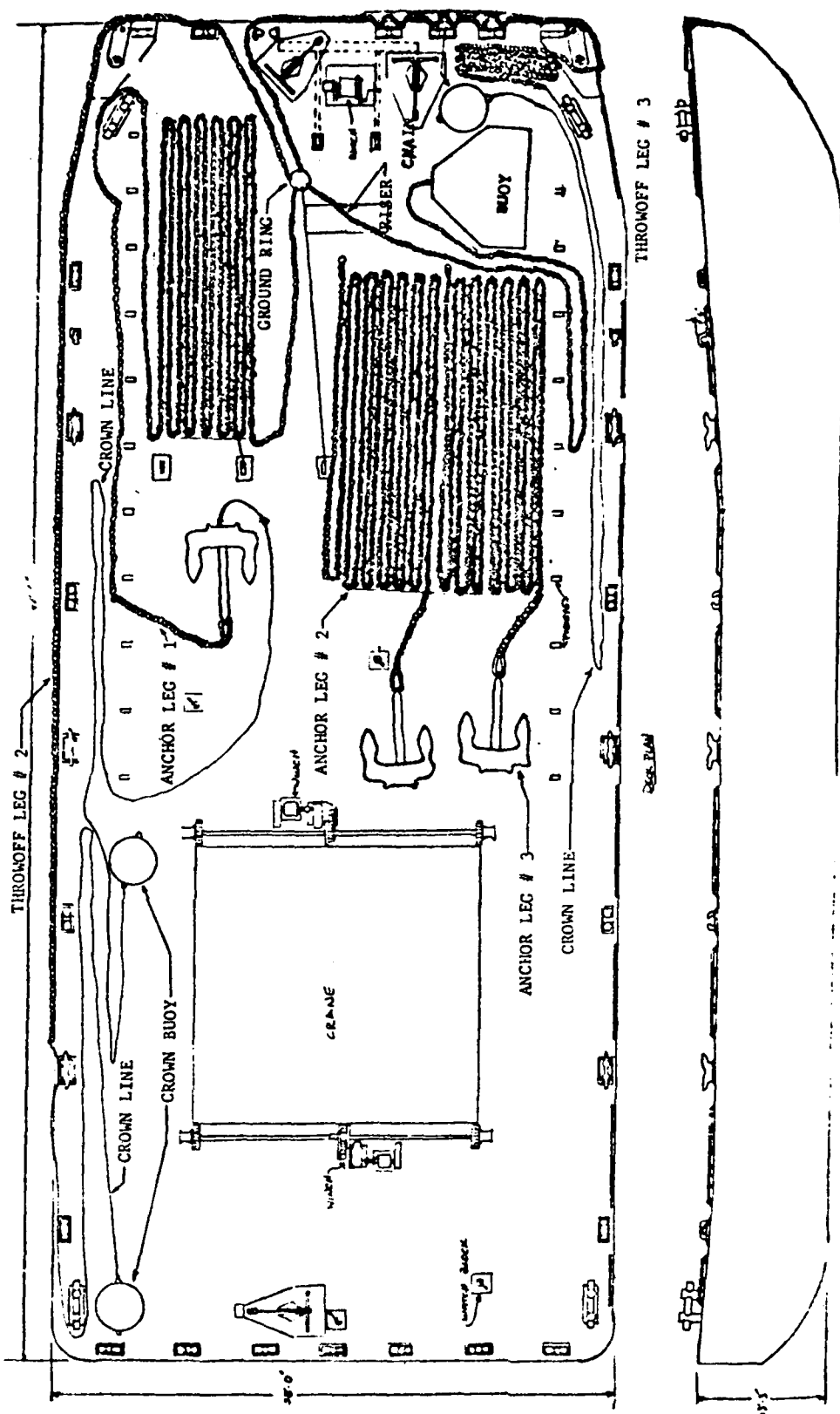


FIGURE 4-1

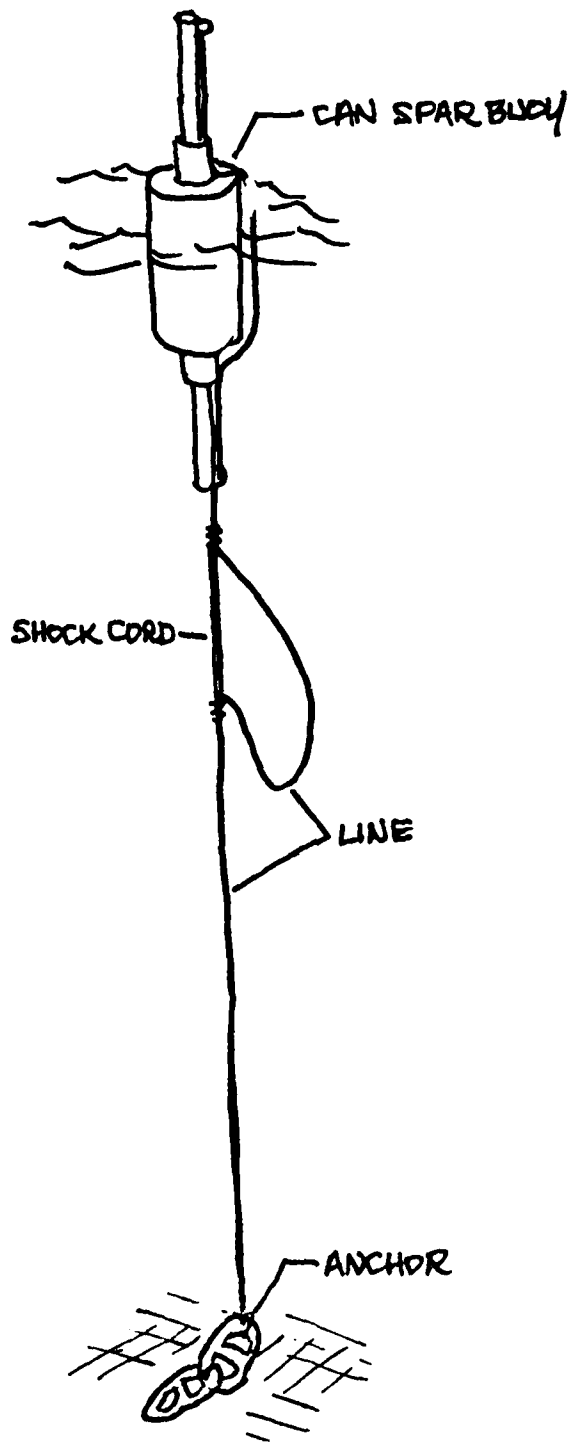
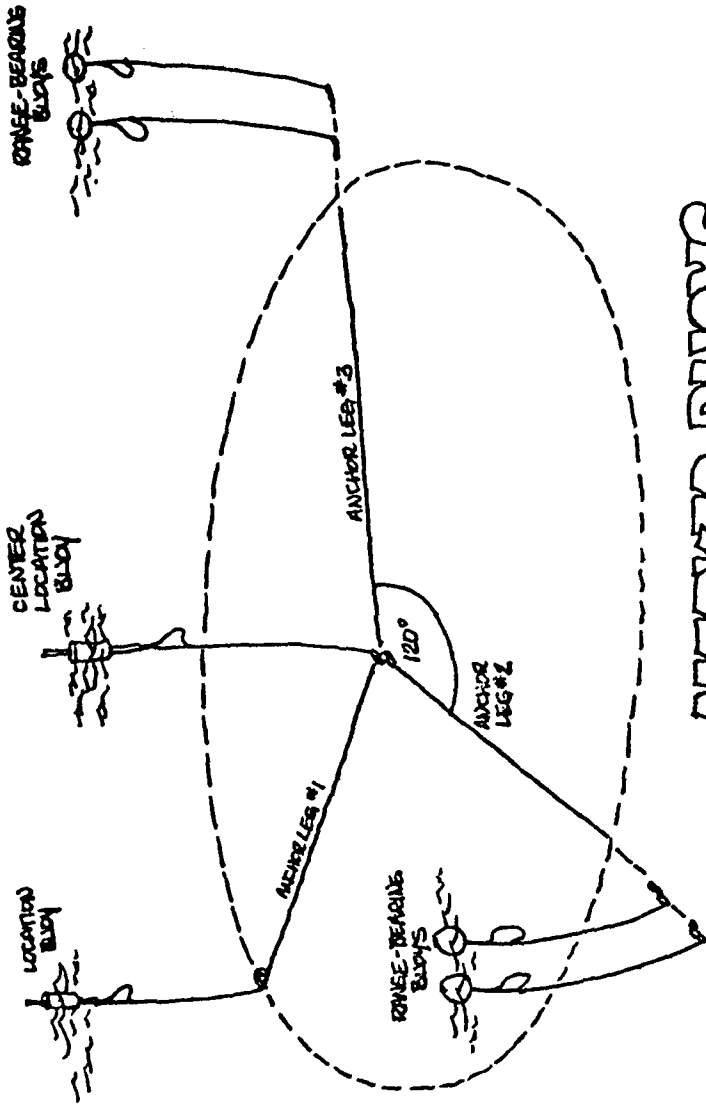


FIGURE 4-2



# MARKER BUOYS

FIGURE 4-3

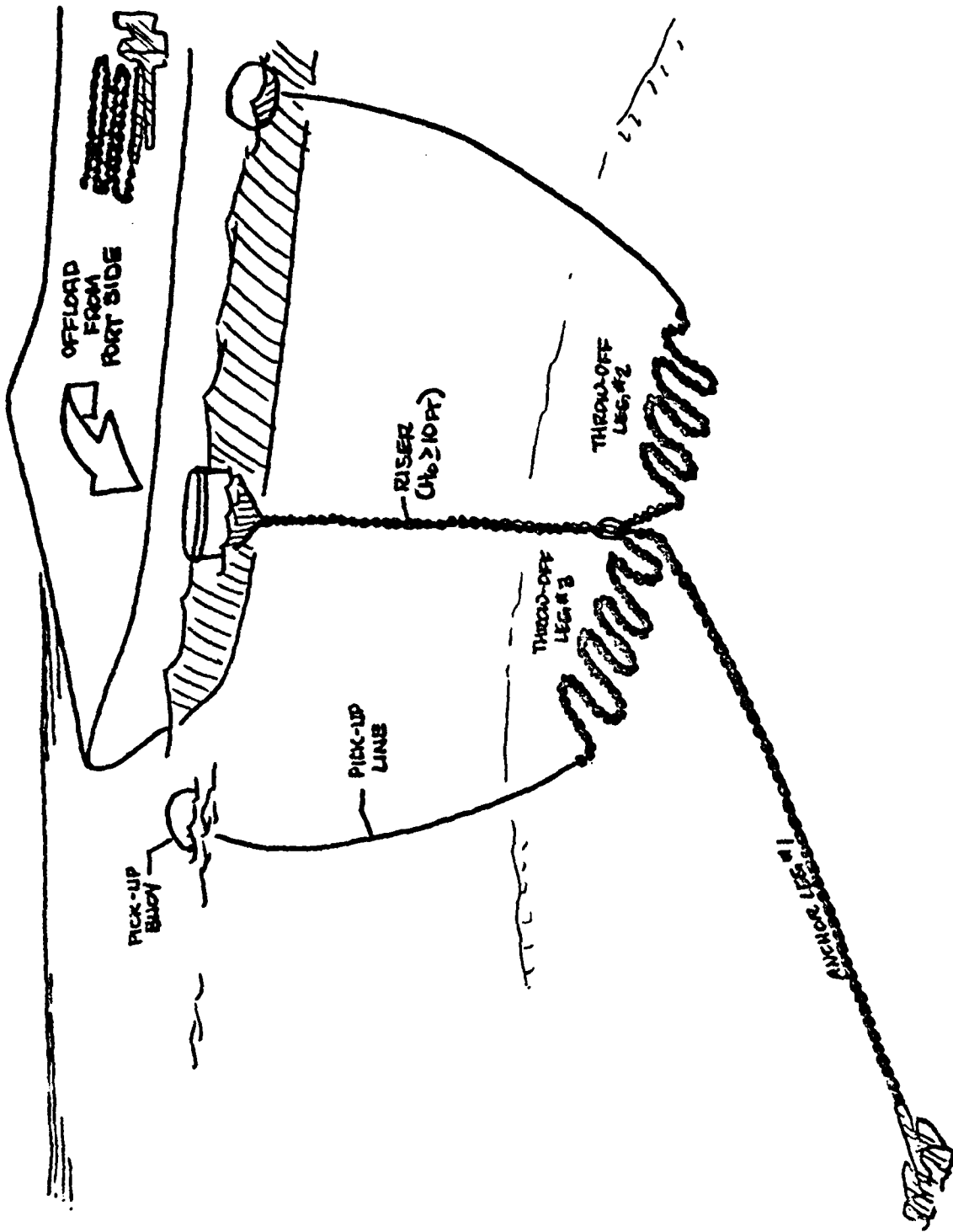


FIGURE 4-4

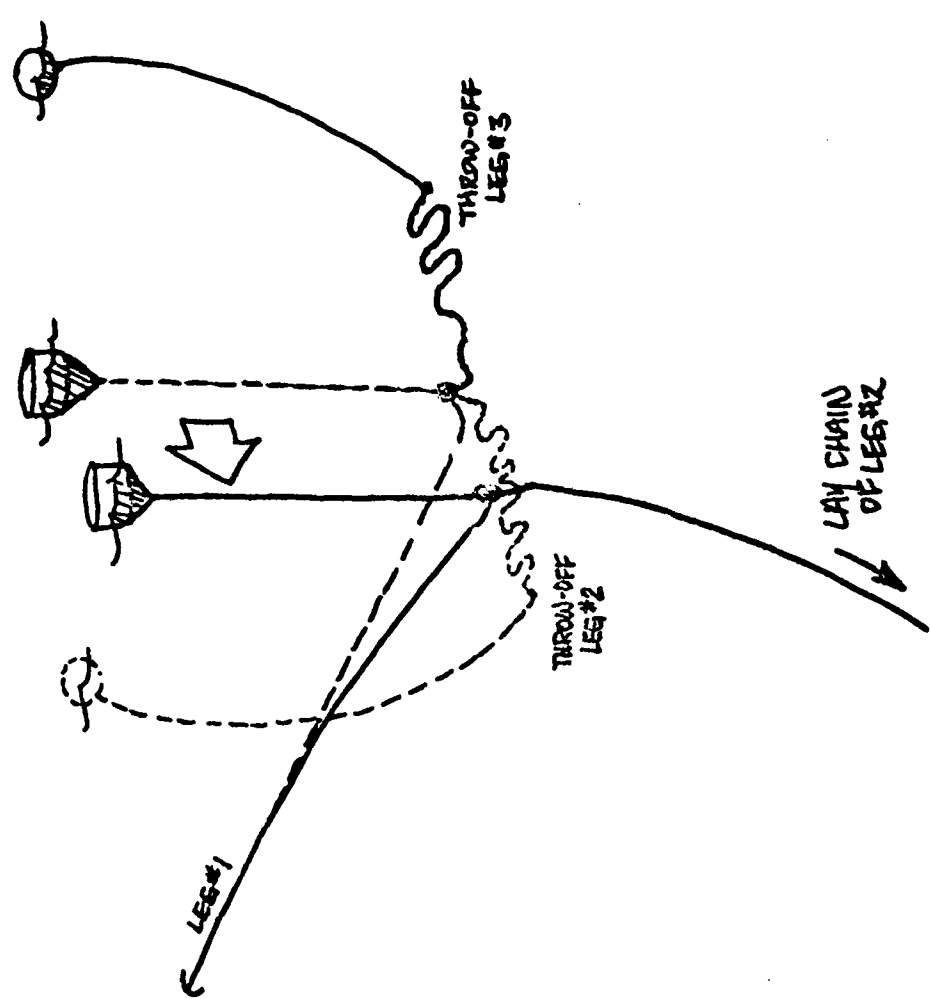


FIGURE 4-5



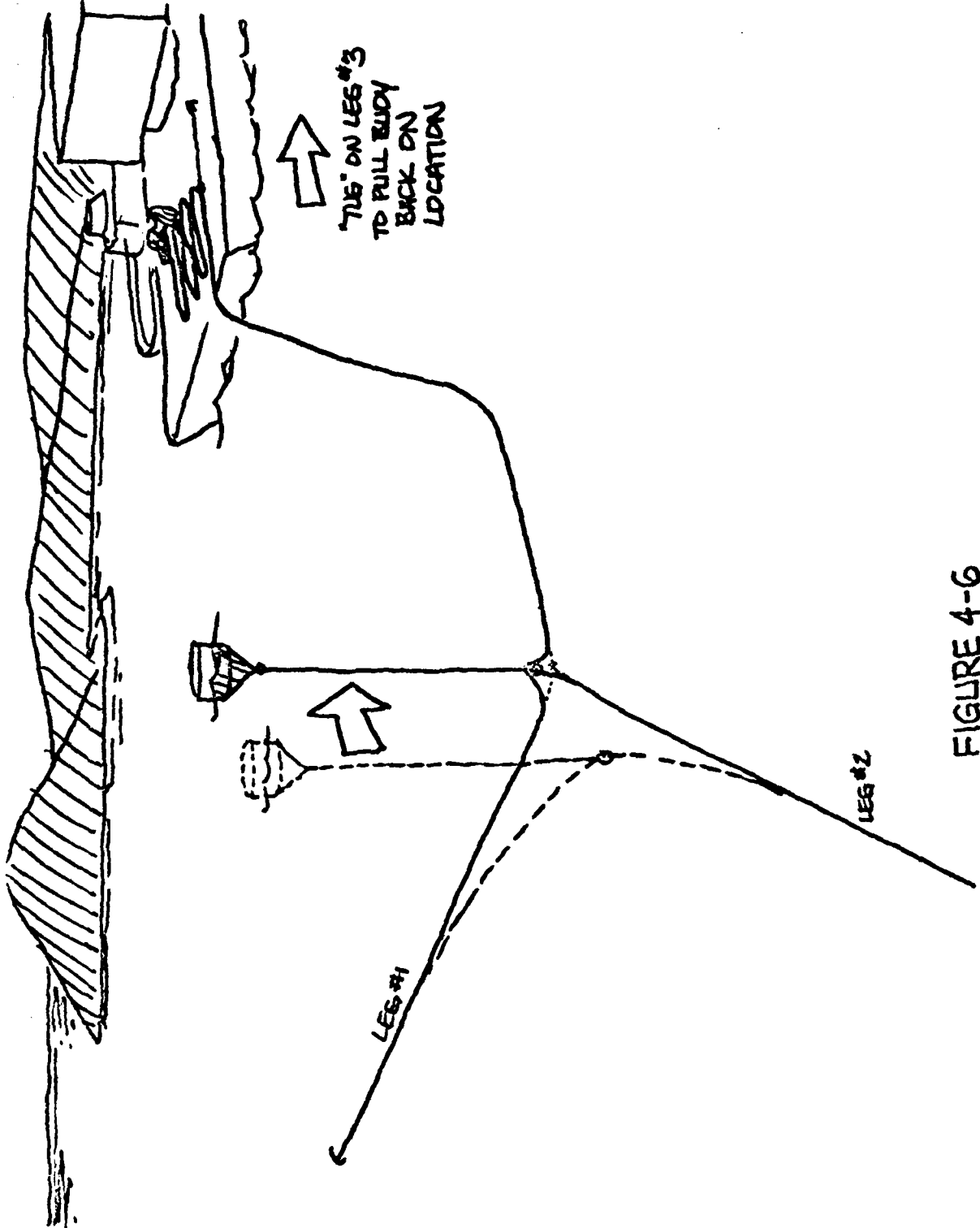


FIGURE 4-6

## 5.0 FACILITY ACCEPTANCE TEST

The purpose of a Facility Acceptance Test is to demonstrate that the constructed facility will meet a defined set of performance criteria. For the Indian Island Moorings, the performance criteria is defined in terms of a maximum mooring watch circle that maintains the barge separations specified in Table 1-1. The coordinates of each mooring were determined by assuming a mooring watch circle of 235 feet. This is based on a buoy displacement of 50 ft under maximum design load, a bridle length of 75 ft and a barge length of 110 feet. In addition, a circle of error for mooring location of  $\pm 20$  ft was provided.

For the three moorings being installed, the facility "acceptance" criteria has been defined as a maximum mooring watch circle that lies within a 70 ft radius of the desired mooring coordinates. This is based on the 20 ft location tolerance and the 50 ft buoy watch circle under full load (12 kips). Thus the cumulative error in mooring location and measured buoy displacement under a 12 kip horizontal load should not be greater than 70 ft from the specified mooring coordinates.

A Facility Acceptance Test will be conducted for each mooring during its installation that will consist of three separate operations.

### 5.1 DIVER INSPECTION

Immediately upon completion of the initial installation and prior to shortening the riser, a diver inspection will be performed. This will determine whether the anchors have been deployed with the flukes down, the anchor legs are laid out (no "balls" of chain) on the bottom and the anchor legs do not cross those of an adjacent mooring. In the event of an unacceptable condition, corrective action will be taken prior to proceeding with the installation.

### 5.2 VERIFICATION OF MOORING LOCATION

During the final stages of the installation a constant visual determination of the location of the mooring buoy relative to the center marker buoy will be conducted. The purpose of verifying the location of the mooring is to assure the center marker buoy has not been displaced during the installation. This will be accomplished by maneuvering the tug with the Mini-Ranger up to the mooring buoy and obtaining a "fix". In the event the location of the buoy is found to be further than 20 feet from the desired location, no action will be taken until completion of the Pull-Test and determination of the maximum mooring watch circle.

### 5.3 PULL-TEST

The purpose of a Pull-Test is to determine the displacement of the mooring buoy under maximum design load. The test will consist of the crane pulling on the mooring buoy, using a stern anchor off the barge (see Figure 5-1). A digital load cell provided by CEL will be used to measure the horizontal load being generated. A small boat will be positioned at the center marker buoy with a tape measure attached to the mooring buoy. The test will proceed by slowly applying a horizontal load to the mooring buoy until the design load of 12 kips is reached. At this time the Pull-Test will be terminated and the resulting displacement of the buoy, as determined from the tape measure, will be radioed to the barge.

Successful completion of the Acceptance Test has been defined as a maximum mooring watch circle lying within a radius of 70 feet about the mooring coordinates. In the event the mooring watch circle is found to extend beyond the 70 feet radius, one or more anchors may be repositioned to either tighten up the buoy watch circle or reposition the buoy, or both.

In-the-field engineering design/judgment will be used to determine the appropriate course of action.

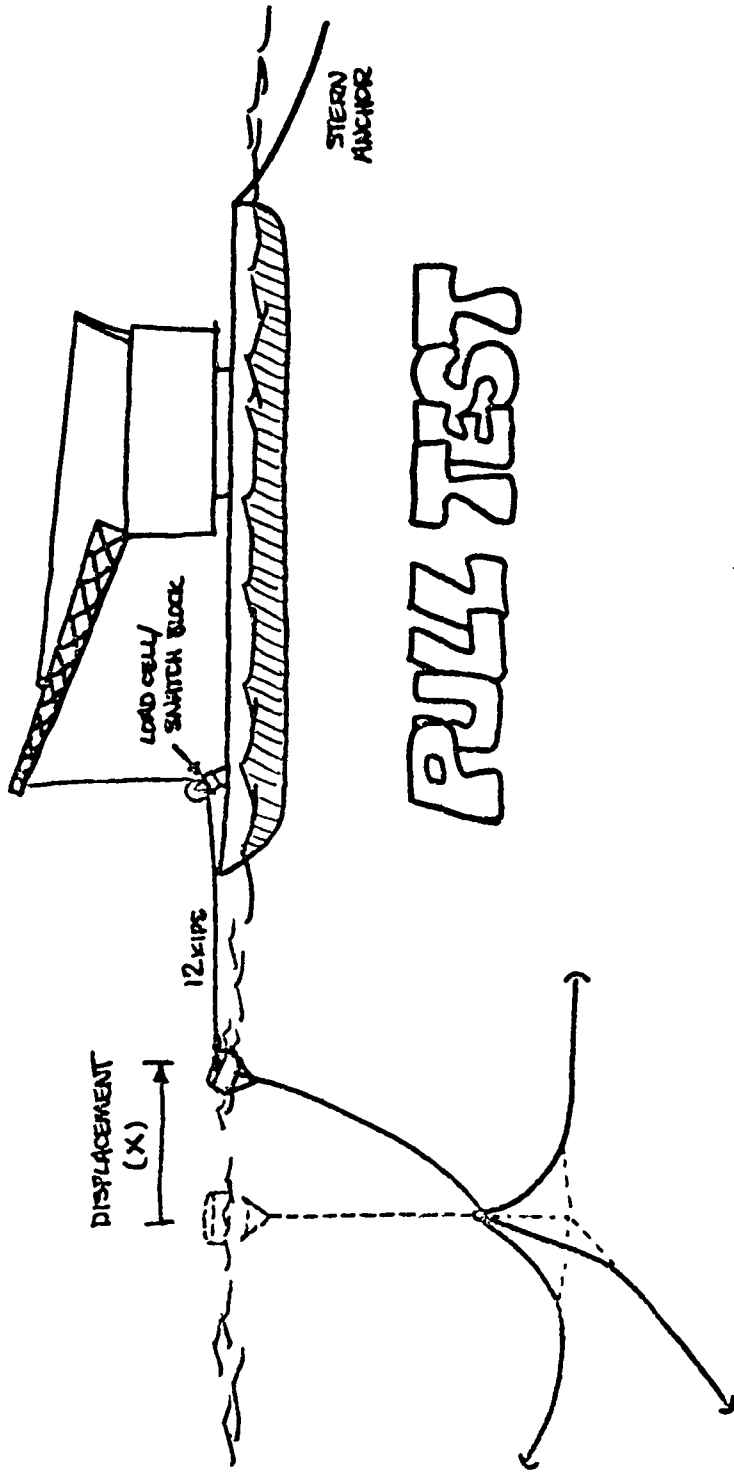


FIGURE 5-1

APPENDIX A. REFERENCES

- a. OICC, TRIDENT, Bremerton, Washington Msg 200238Z Jun 78
- b. CHESNAVFACENCOM, Washington, DC ltr 11410, 28 Jul 78
- c. CHESNAVFACENCOM, Washington, DC ltr 11000, 24 Nov 78
- d. OICC, TRIDENT, Bremerton, Washington Spdltr 09A232/DAC/d1 7302, 1 Sep 78
- e. OICC, TRIDENT, Bremerton, Washington Msg 291810Z Nov 78
- f. CHESNAVFACENCOM, Washington, DC Msg 072153Z Dec 78
- g. Phone Conversation btwn A. Kurtz (CHESDIV) and LTC J. Johnston (WSNG), 7 Dec 78
- h. CHESNAVFACENCOM, Washington, DC Msg 111928Z Dec 78
- i. PWC, San Diego, California Msg 031643Z Jan 79
- j. CHESNAVFACENCOM, Washington, DC Msg 131946Z Oct 78
- k. CIVENGLAB, Port Hueneme, California Msg 190137Z Oct 78

## APPENDIX B

### DESIGN

BACKGROUND - The moorings will be used to secure YC or YFN type barges. These barges will hold ammunition offloaded from various ships at the Indian Island Annex Pier. The highest class of mooring required by DM-26 for these barge types is Class-E, in an environment of 100 mph wind and 2-knot current. Prior to the initiation of this project, all components for three-point free-swinging, riser-type moorings were delivered to the site. These components are refurbished, Class-C type hardware. The design consisted of utilizing this hardware in a free-swinging riser type mooring based on the specified performance and design criteria.

PERFORMANCE CRITERIA - The quantity of explosives each barge holds governs the minimum separation between the stern of that barge and the bow of any other. For 200,000 pounds this separation is 645 feet. Combining the barge length of 110 feet, bridle length of 75 feet, and buoy watch circle of 50 feet gives a mooring circle radius of 235 feet. There exists a location tolerance of  $\pm 20$  feet at each site, increasing this radius to a maximum of 255 feet from the center X, Y coordinate. The center-to-center inter-magazine distance for 200,000 pounds of explosive is 795 feet. The coordinates and separation of all six moorings can be found in Table B.1 and Figure B.1.

DESIGN CRITERIA - The moorings were designed to meet the above performance criteria when subjected to a 100 mph wind and 2-knot current occurring at the same time at mean low low water. The survival tide is MLLW plus 15 feet for this environment. The design horizontal load on the mooring due to the barge is 12 kips. To maintain the equivalent of 18 inches of free board on the buoy, the maximum vertical load is 24 kips. With no horizontal load applied to the buoy, there can be no slack chain below the ground ring, and with the design load applied, the anchor shank shall not be lifted off of the bottom.

DESIGN RATIONALE - The allowable buoy displacement when under load, given in the performance criteria, can be achieved by having a short riser chain and a part of each ground leg held in a catenary.

Holding the ground ring 10 feet off the bottom in MLLW of 90 feet results in a watch circle radius greater than 65 feet. To achieve this however, the anchors must be placed with pinpoint accuracy to eliminate either excessive vertical load on the buoy or slack chain below ground ring. Raising the ground ring 50 feet off the bottom, at this water depth, allows the anchor be placed in a 12-foot wide band and still be at the desired distance from the ground ring. This will allow the 50-foot watch circle criteria to be met.

MOORING DESIGN - A summary of moorings 1, 2, and 6 design is tabulated below and a general configuration can be seen in Figure B.2.

Mooring Number	1	2	6
Water Depth (feet)	90	80	85
Height of Ground Ring (feet)	50	40	45
Riser Length (feet)	35	35	35
Length of Ground Chair (feet)	430	430	430
Distance from Anchor to Ground Ring (feet)	398 to 410	402 to 415	402 to 412
Buoy Displacement Under Load (feet)	50 to 39	50 to 37	50 to 35
Design Load on Buoy (kips)	12	12	12
Load on Anchor at Design Load (kips)	10.2 to 12.3	9.5 to 12.7	9.8 to 12
Pull-Test Load (kips)	12	12	12

The installation coordinates of all anchor and marker buoys in the Lambert Coordinate System, Washington North Zone can be found in Figures B.3, B.4, and B.5.

To: Adm. J. Kurtz  
 Code PPO-1  
 CHESDINWAFFACENCOM  
 TELEX: (201) 433-3881

Best available copy.

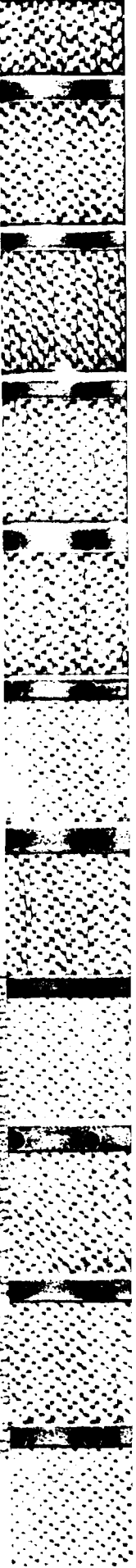
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**TABLE B.1**  
 EXPLOSIVE SAFETY QUANTITY DISTANCE  
 IN FEET

Source/ BOM in Grounds	Small Craft	Saw Shed	Misc Shed	Targets						Coordinates (Lambert Coordinate System, Washington North Zone.)	
				Buoy 1	Buoy 2	Buoy 3	Buoy 4	Buoy 5	Buoy 6		
	K=10 5-20(3)	K=10 5-4(3)	K=10 5-4(3)	K=11 5-10(9)	K=11 5-10(9)	K=11 5-10(9)	K=11 5-10(9)	K=11 5-10(9)	K=11 5-10(9)	North	East
Buoy 1 200,000	-	-	-	(500) 795	(500) 795	-	(797) 795	(1186) 795	-	394,545	1,531,6
Buoy 2 200,000	-	2770	2770	(500) 795	-	(796) 795	(1045) 795	(795) 795	-	394,570	1,532,4
Buoy 3 150,000	-	2350	2350	-	(796) 795	-	-	(1012) 735	-	394,525	1,533,2
Buoy 4 175,000	-	-	2565	(797) 795	(1045) 795	-	-	(768) 765	(766) 765	393,760	1,531,79
Buoy 5 125,000	-	-	2115	(1186) 795	(795) 795	(1012) 735	(768) 765	-	(871) 700	393,782	1,532,5
Buoy 6 125,000	-	-	2115	-	-	-	(766) 765	(871) 700	-	393,052	1,532,0

(Computed Distances)

NOTE: The mortar circle radius of 235' is based on buoy location tolerance  $\pm 20'$ , watch circle radius 50',  
 brittle length 75' and base length 110'. The center to center inter-magnetic distance of 795' for 100,000  
 pounds is based on the above parameters applied to the table value of 643'. ESQ's for the other quantities,  
 the distance of 235' is based on the above parameters applied to the table value of 643'.





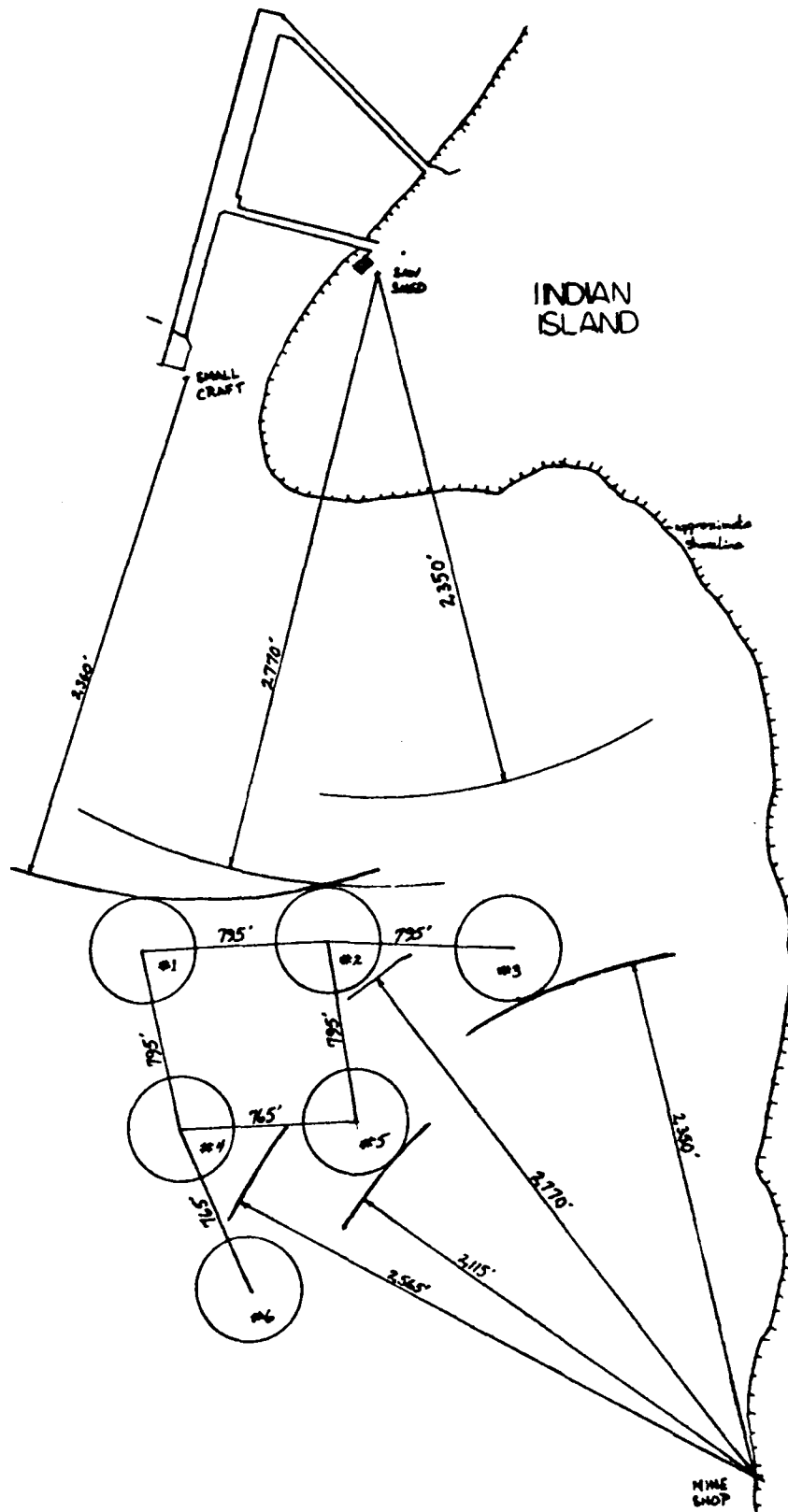


FIGURE B.1

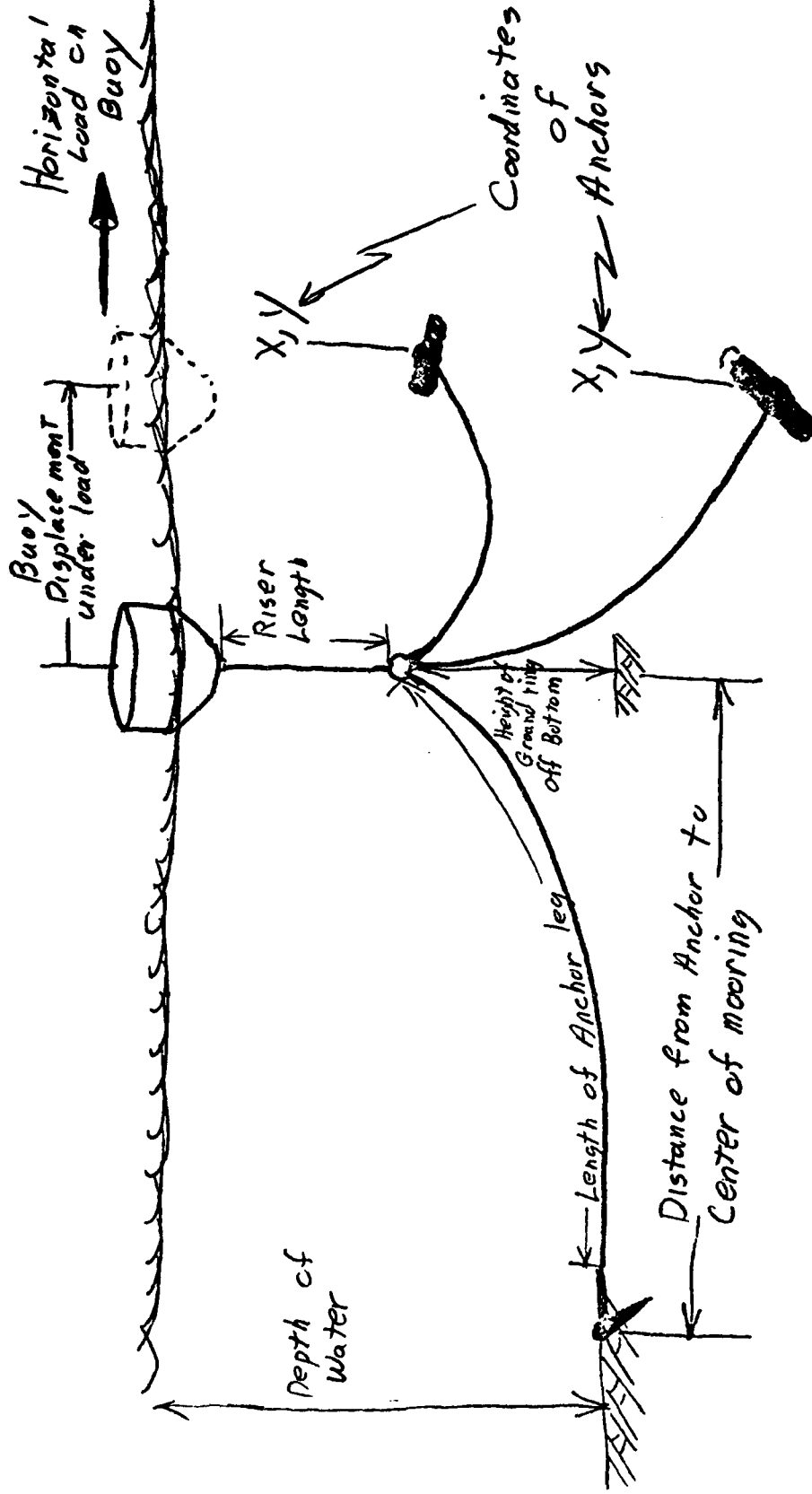


FIGURE B.2 MOORING CONFIGURATION

FIGURE B.3

MOORING #1 INSTALLATION COORDINATES

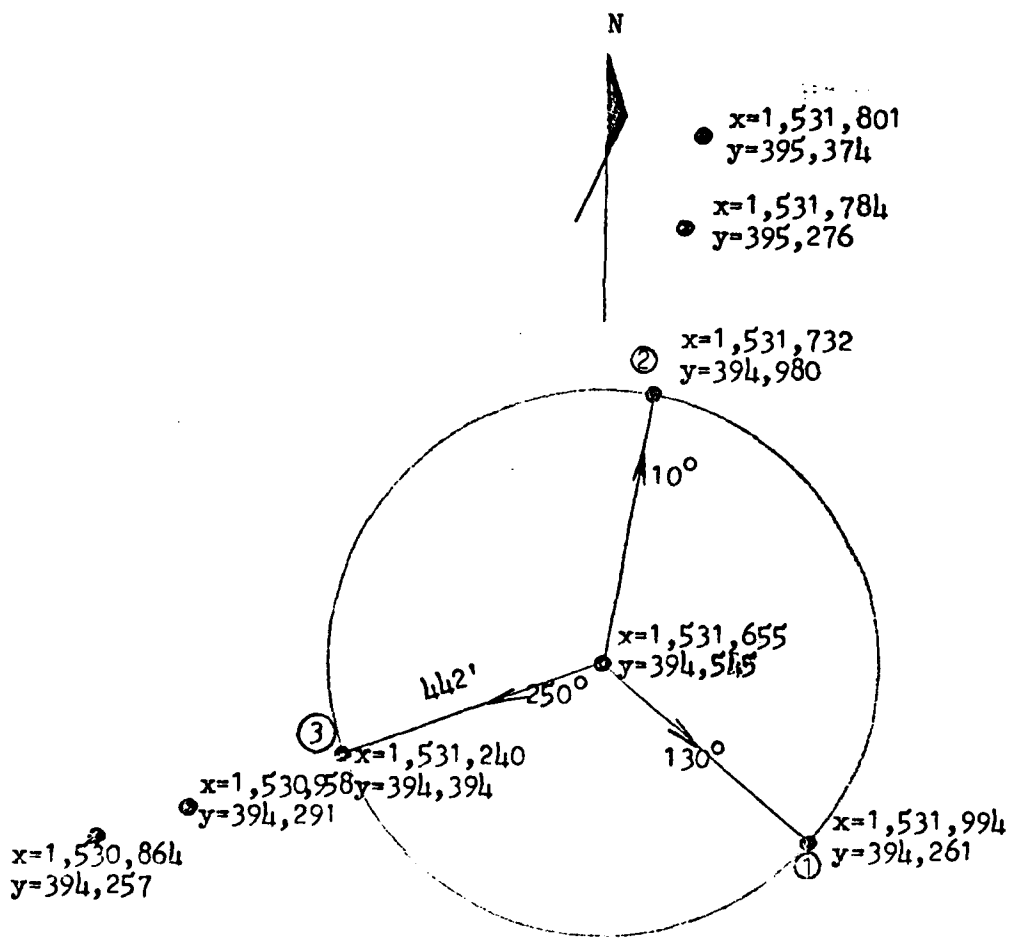


FIGURE B.4  
MOORING #2 INSTALLATION COORDINATES

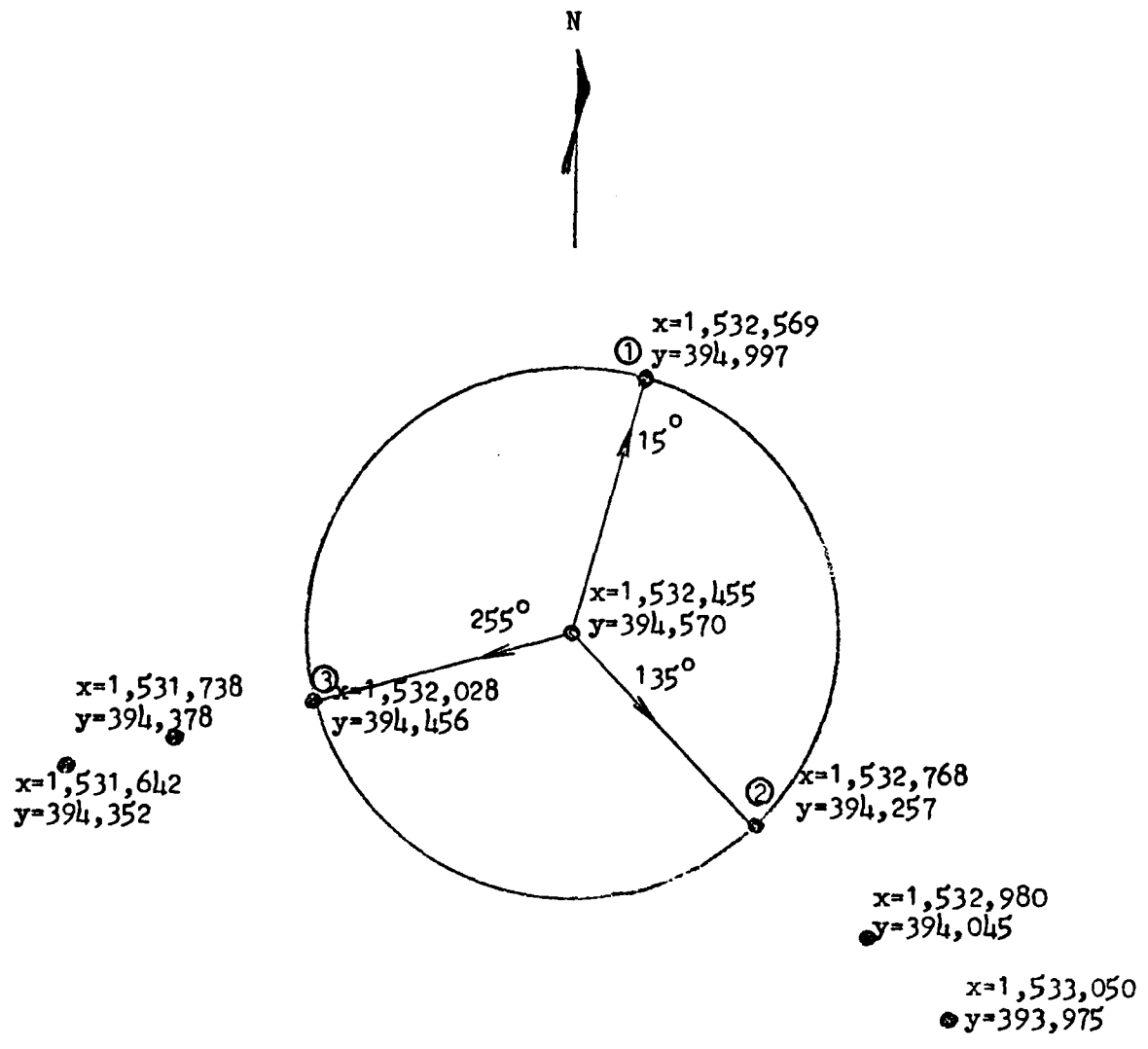
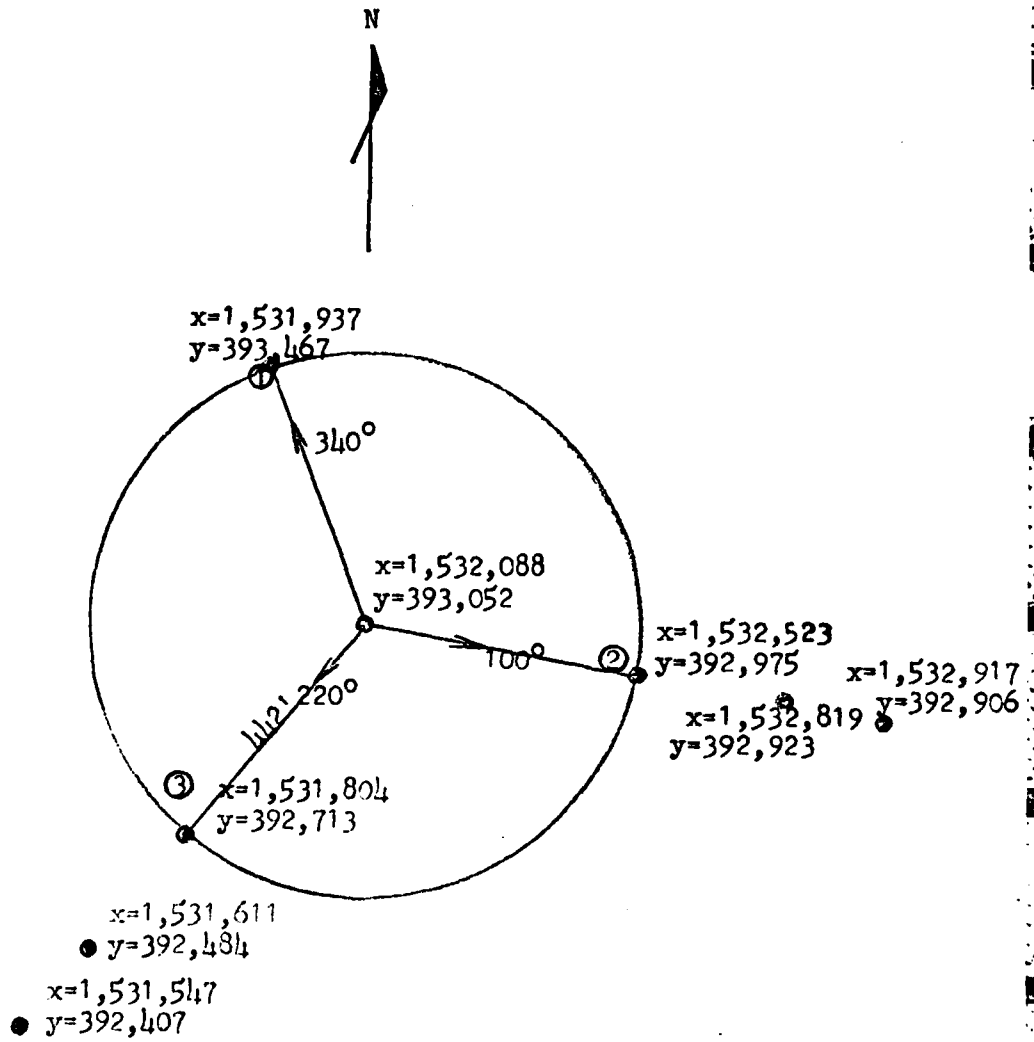


FIGURE B.5

MOORING #6 INSTALLATION COORDINATES



## APPENDIX C. NAVIGATION

Mini-Ranger shore sites will be set up at Kala Point and Crane Point (see Figure C.1). Both transponder locations are marked by survey monuments.

### KALA POINT

The Kala Point monument is located approximately 30 feet northwest of the U. S. Coast Guard Light. The monument consists of a concrete pile which protrudes approximately 8 inches above the berm of the beach. A plate on top of the pile bears the following inscription: "KUHN, USE, No. 1, 1920."

Access to Kala Point entails traveling through a private housing development, requiring use of a coded magnetic card for entry. Arrangements have been made with the property manager to acquire a temporary card for use during the construction period. There is a public telephone available at the gate with a notice attached giving the name and telephone number of the property manager. In an emergency, a small boat may be beached at Kala Point, weather permitting.

### CRANE POINT

The Crane Point monument is located at the southwest edge of the Point. It consists of a plate mounted flush with the ground and bears the inscription "NAVY". Access to the Point may be made by vehicle.

The Mini-Ranger processor will be placed aboard the 100-foot tug used to maneuver the crane barge. Its transponder will be mounted on the mast, aft of the deck house, using hose clamps. All transponders will be mounted as so to assure direct line-of-sight between them.

Coordinates for the two shore sites in the Lambert Coordinate System, Washington North Zone, are as follows:

Kala Point N391,817.13	E 1,527,584.39
Crane Point N388,342.49	E 1,533,550.72

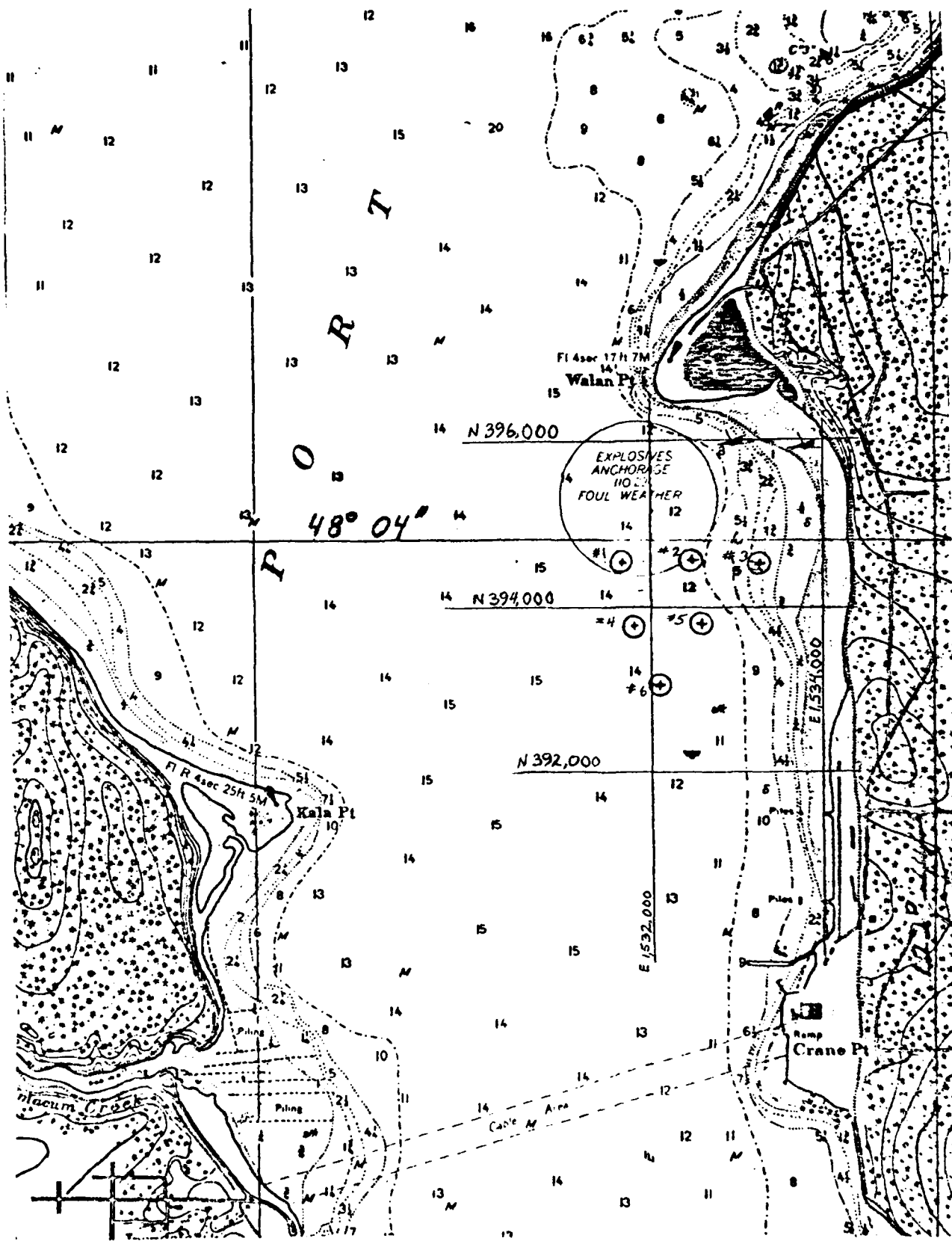


FIGURE C.1

APPENDIX D. METEOROLOGICAL DATA

22 Jan - 18 Feb 1979

WINDS

Winds are mainly out of the Southeast to Southwest quadrants. Local topography and proximity to maritime effects influence the prevailing southerly winds. However, circulation patterns are uncertain at the eastern end of the straight of Juan de Fuca lying just north of the Point Wilson Light Station due to the interaction of the east-west flow through the straight with the southerly flow through Pudget Sound. Intense storms can generate sustained winds of 40 knots with 50 knot gusts. Mean wind speeds for January are 10.4 SSW and for February are 10.0 SW.

<u>Whidbey Island</u> NAS				<u>Seattle</u>	
% freq winds 17 kts		% freq winds 28 kts		% freq winds 34 kts	
<u>Jan</u>	<u>Feb</u>	<u>Jan</u>	<u>Feb</u>	<u>Jan</u>	<u>Feb</u>
20.0	16.7	1.6	0.8	4.3	3.3

PRECIPITATION

Precipitation in the area is usually in the form of a drizzle or light rain, rarely snow or heavy rain. The warmer southerly flow brings cloudiness, drizzle and some fog with measurable precipitation on 17 to 22 days. The frequency of drizzle is normally 5% to 8% but combined drizzle and fog can persist for better than a week, if an intense storm should stall in the Gulf of Alaska. The average monthly precipitation in Port Townsend for January is 2.20 in. and for February is 1.66 in. The mean monthly accumulation of snow at Port Townsend is 3.5 in. in January and 3.0 in. in February.

Mean number of days on which precipitation occurs.

	<u>Port Townsend</u>	
	<u>Jan</u>	<u>Feb</u>
0.1"	9	6
0.5"	1	1



The monthly accumulation of snow at Port Townsend is 3.5" in January and 3.0" in February while the mean number of days per month that snowfall exceeds 1.5" (at Whiddey Island NAS) .9" in January and .7" in February.

#### VISIBILITY

Fog banks and morning cloudiness are quite common in the area. If a stagnant weather condition occurs at the same time, fog can hang around for several days. Visibilities are lowered to less than  $\frac{1}{2}$  mile on two to three days per month, but at Point Wilson the fog signal blows 8 percent to 15 percent at the time.

In addition, a large pulp mill is located about two miles south of Port Townsend and emits a continuous whitish smoke. This can act like a fog but is more persistent. On occasion, this smoke has reduced visibility to  $\frac{1}{2}$  mile.

#### TEMPERATURES

Throughout the year, the moderating influence of airflow over the surrounding waters tempers the main daily temperature ranges to within a range of 10° to 15°F. The mean monthly temperatures for Port Townsend are 39.2°F in January and 41.4°F in February while the mean minimum and maximum temperatures are for January 35.1°F and 43.3° and for February 36.3°F and 46.4°F. The dampness, however, gives an increased sensation of coldness.

Very infrequently do cold snaps occur. Most likely they occur with the outbreak of arctic air from the interior of Canada. Cold snaps are accompanied by crisp northeasterly winds and usually persist for five to ten days. At Port Townsend, the mean number of days that the temperature is below 32°F is eight days in January and seven days in February.

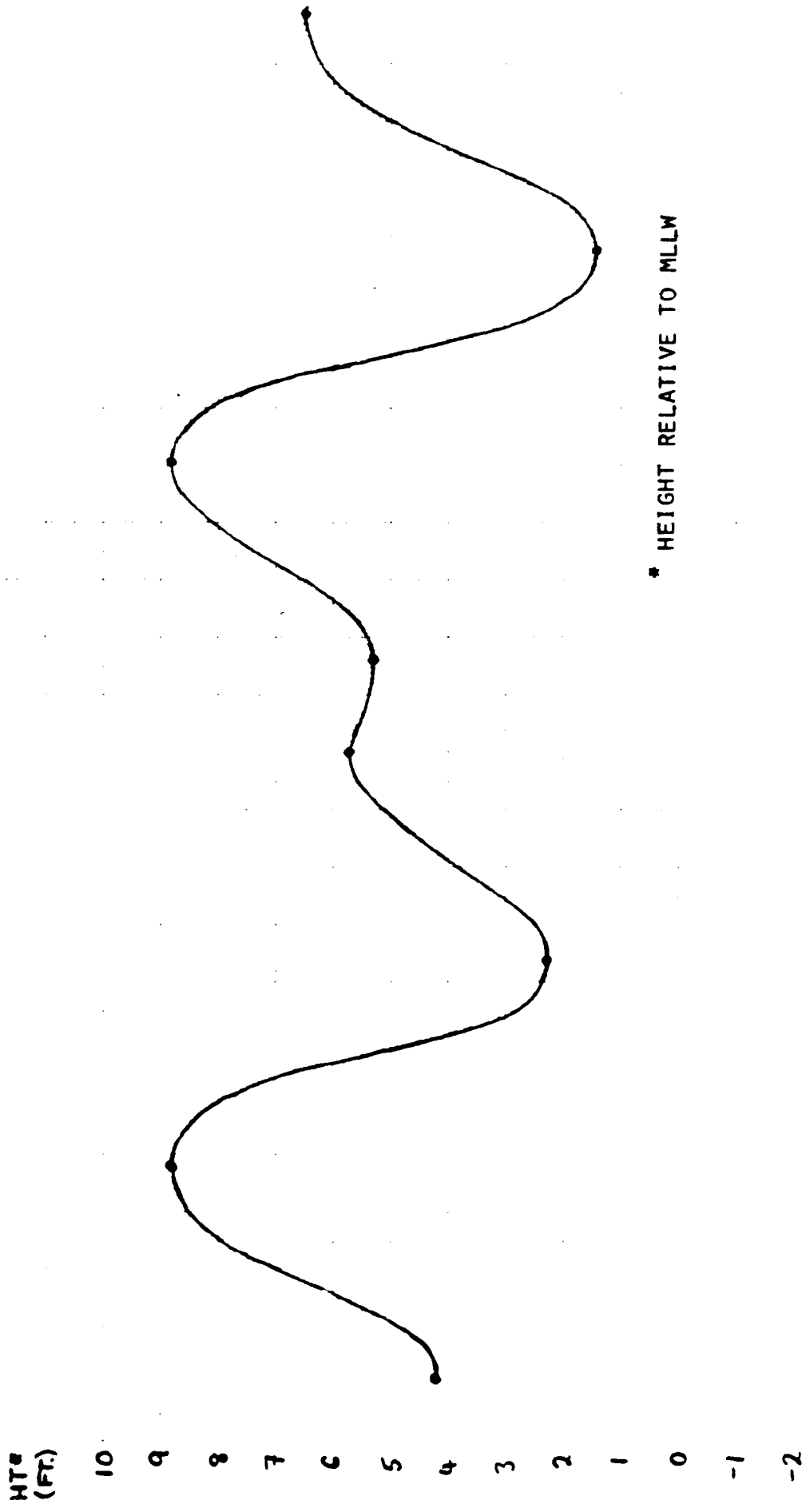
#### WAVE HEIGHTS

Due to the short fetch, the wind generated waves in Port Townsend Inlet are small. In January 66.7 percent of the waves are less than 2 ft while 100 percent are less than 6 ft. In February 72.7 percent are less than 2 ft and 81.8 percent are less than 4 ft.

#### TIDES

The mean range of the tide at Port Townsend is 5.2 ft but the maximum diurnal range between mean lower low water and mean higher high water is 11.8 ft on 28 and 29 January.

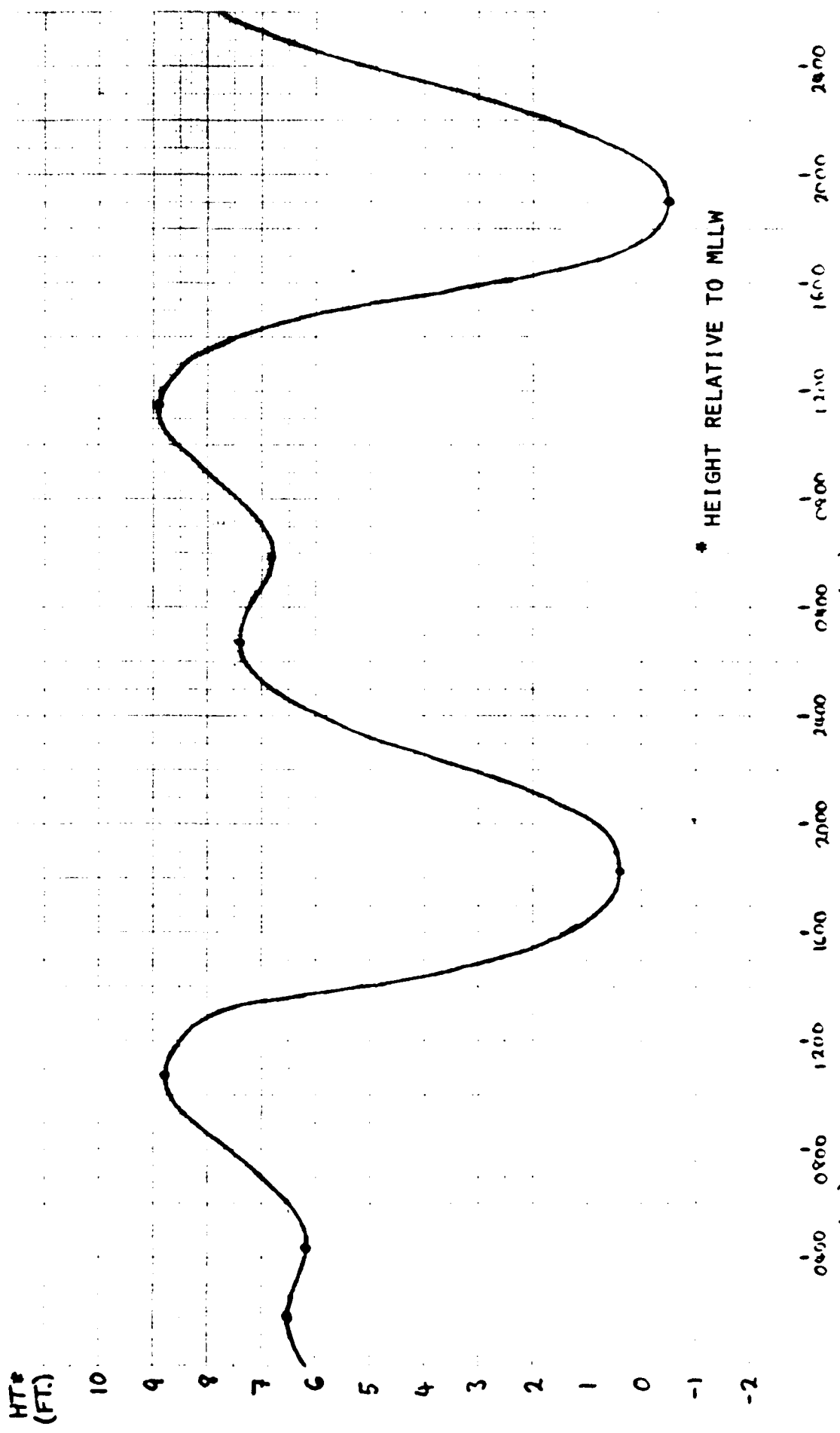
TIDE CYCLES FOR  
PORT TOWNESEND, WASHINGTON



\* HEIGHT RELATIVE TO MLLW

21 JAN (Su) 22 JAN (M)

TIDE CYCLES FOR  
PORT TOWNSEND, WASHINGTON



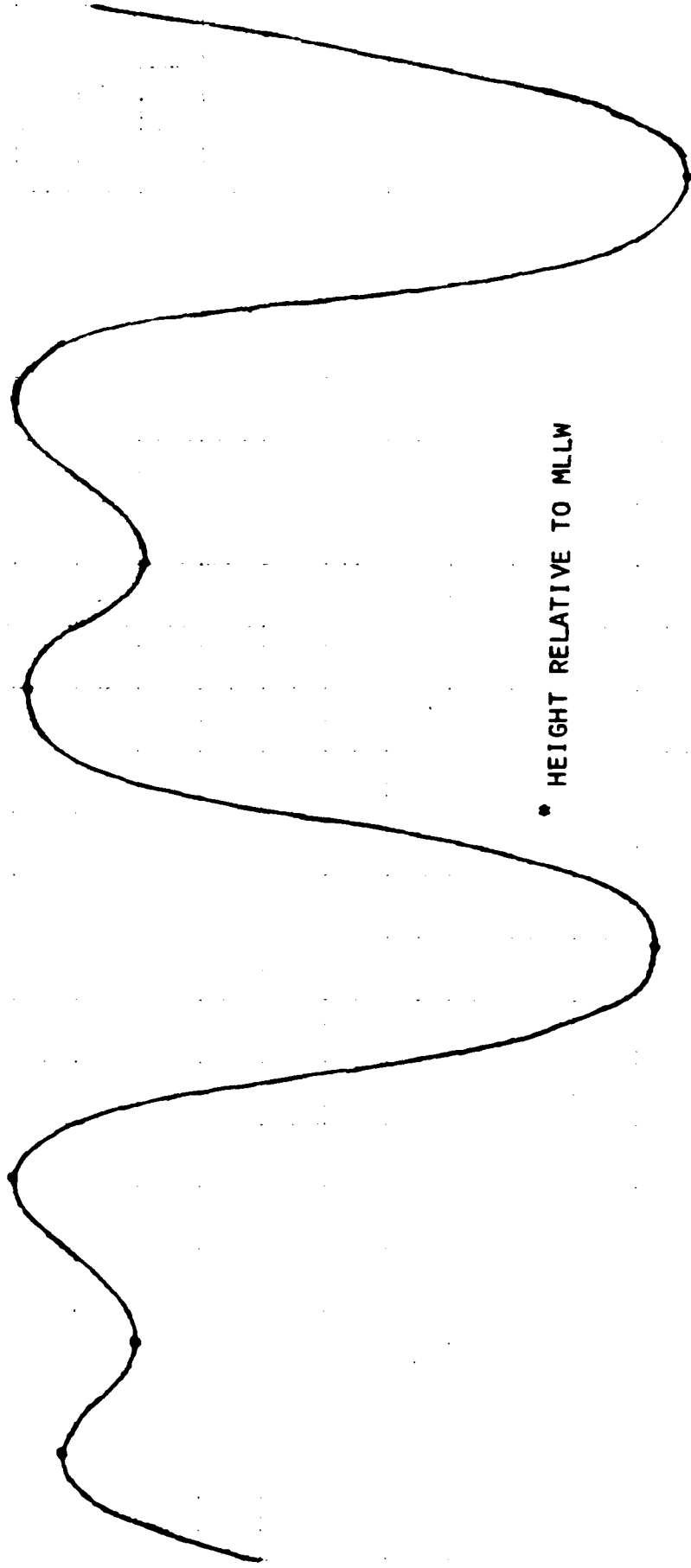
23 JAN (T) 24 JAN (W)

\* HEIGHT RELATIVE TO MLLW

TIDE CYCLES FOR  
PORT TOWNSEND, WASHINGTON

HT.  
(FT.)

10  
9  
8  
7  
6  
5  
4  
3  
2  
1  
0  
-1  
-2



\* HEIGHT RELATIVE TO MLLW

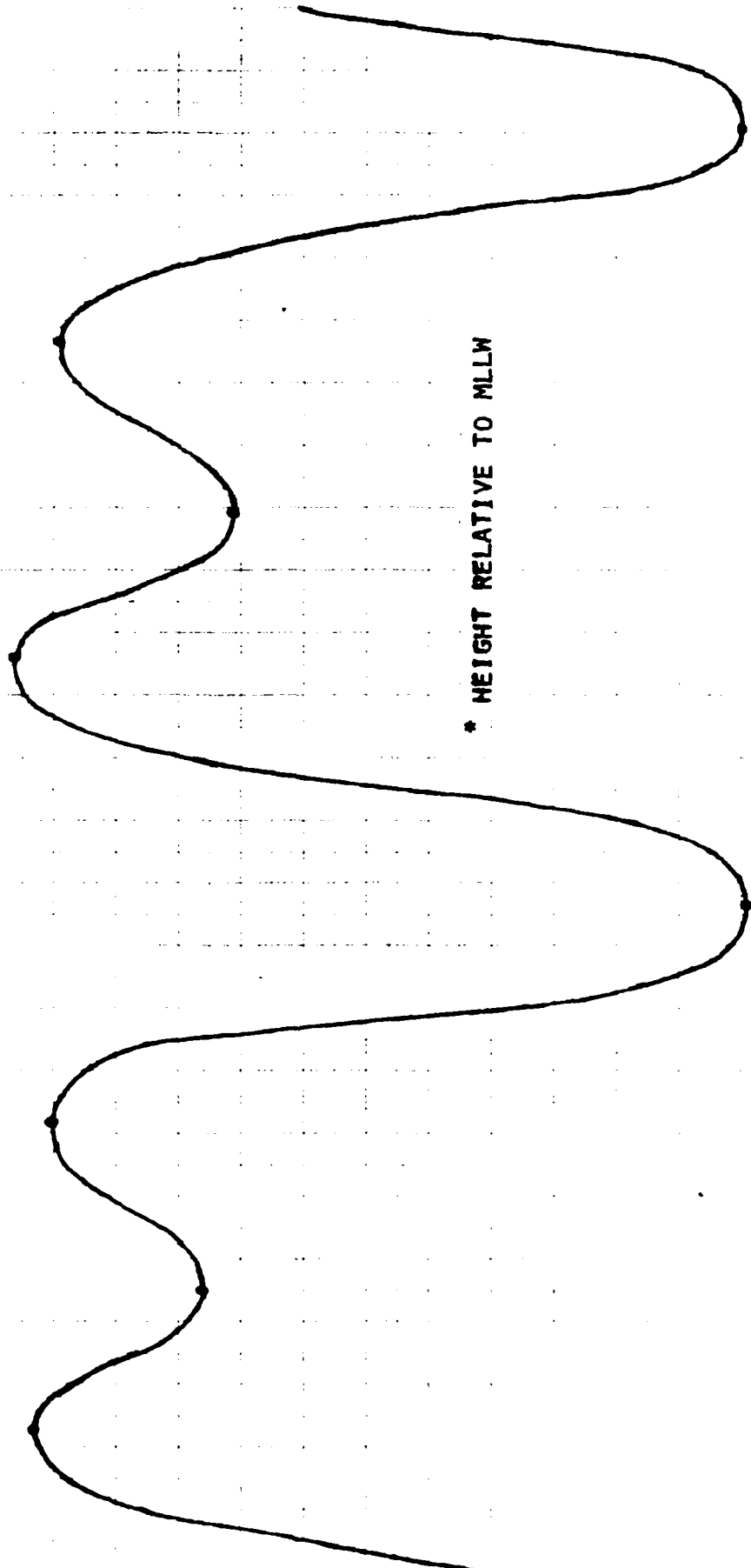
25 JAN (Th)

26 JAN (F)

TIDE CYCLES FOR  
PORT TOWNSEND, WASHINGTON

HT\*  
(FT.)

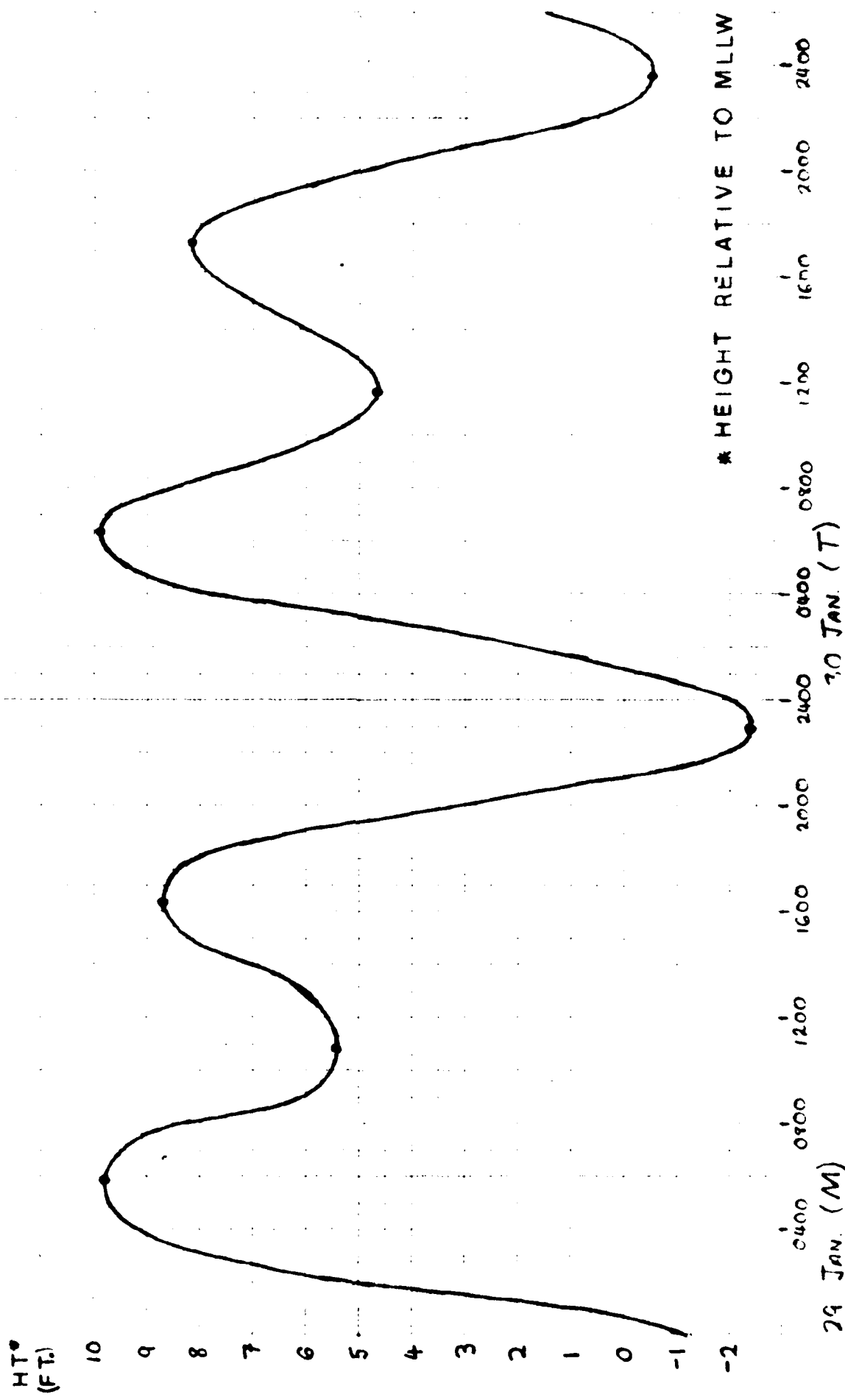
10  
9  
8  
7  
6  
5  
4  
3  
2  
1  
0  
-1  
-2



\* HEIGHT RELATIVE TO MLLW

0000 0800 1200 1600 2000 2400 2800  
27 JAN (Su) 28 JAN (Su)

# TIDE CYCLES FOR PORT TOWNSEND, WASHINGTON



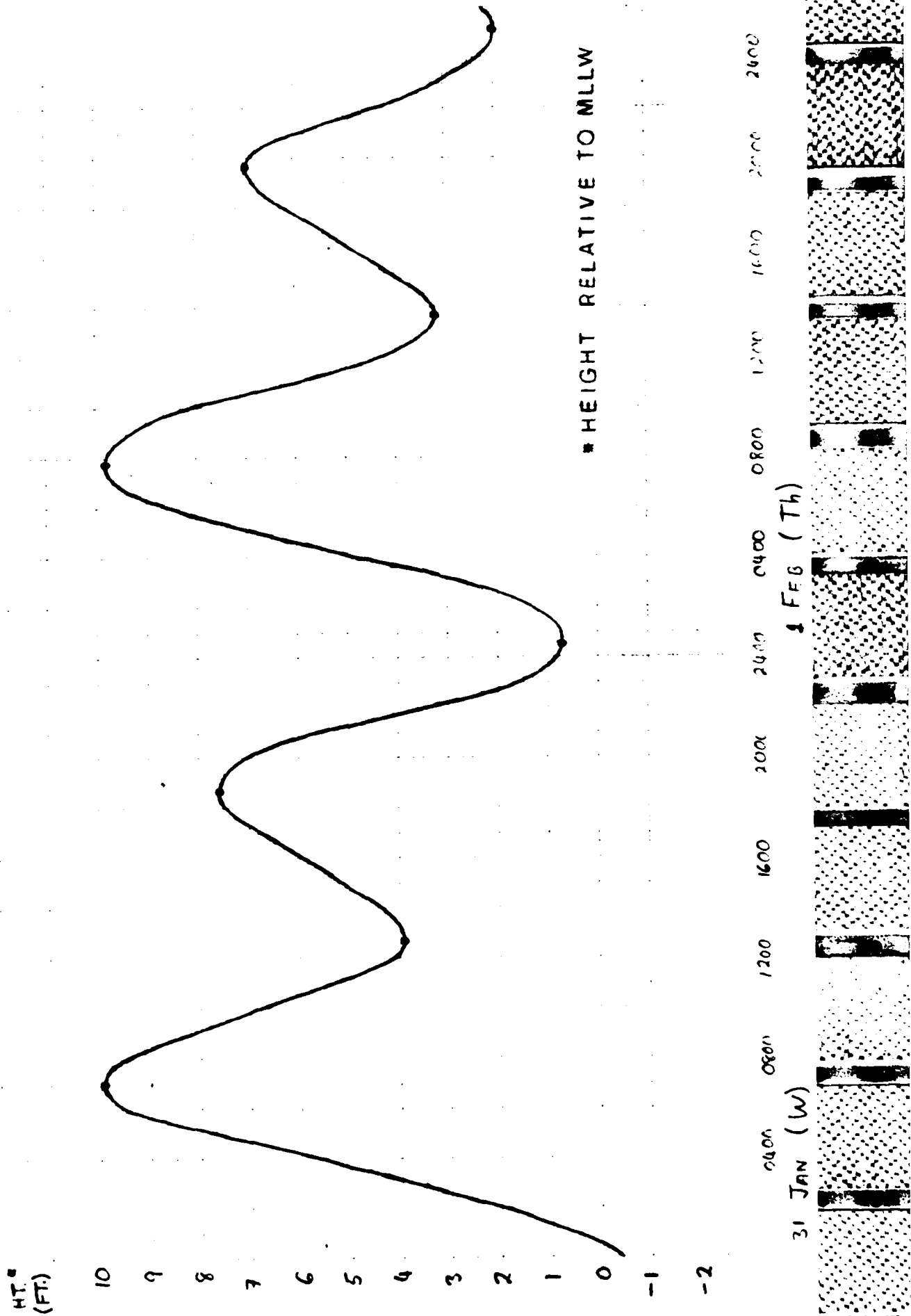
HT.  
(FT.)

\* HEIGHT RELATIVE TO MLLW

29 JAN. (M)

30 JAN. (T)

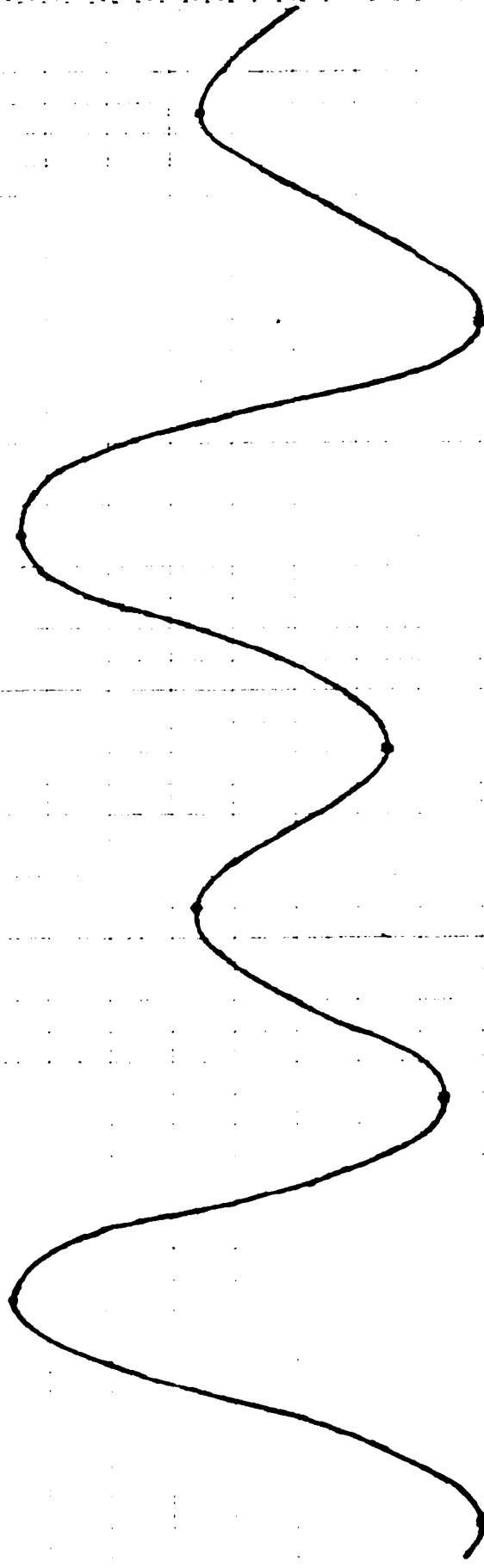
# TIDE CYCLES FOR PORT TOWNSEND, WASHINGTON



# TIDE CYCLES FOR PORT TOWNSEND, WASHINGTON

HT.  
(FT)

10  
9  
8  
7  
6  
5  
4  
3  
2  
1  
0  
-1  
-2



\* HEIGHT RELATIVE TO MLLW

2400 0800 1200 1600 2000 2400  
2 FEB (FRI) 3 FEB (SAT)



APPENDIX E. PROJECT PERSONNEL AND SUPPORT

OICC, TRIDENT, Bremerton, WA (A/V 439-2944)

Indian Island Moorings Project Manager, Mr. D. Clinkenbeard (206)478-2944

CHESNAVFACENCOM, Washington, DC (A/V 288-3881)

Project Manager	Mr. A. J. Kurtz	(202) 433-3881
Design Manager	Dr. S. C. Ling	433-3881
Design Engineer	Mr. T. J. O'Boyle	433-3881
Navigator	Mr. L. Mendlow	433-3881

WSMC, Tacoma, WA (A/V 355-7011, Pier 23)

Equipment Mechanical General Foreman	CW4 R. H. Bishop	(206) 593-2009
Boat Operator Foreman	CW4 F. Clifton	593-2009

PWC, San Diego, California (A/V 958-2804)

Moorings Rigger Foreman	Mr. D. Jockell	—
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CEL, Port Hueneme, California (A/V 360-5736)

Diving Locker Officer	LT W. F. Walker	—
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