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GOVERNOR OF HAWAII



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BOARD OF LAND AND NATURAL RESOURCES

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STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
DIVISION OF BOATING AND OCEAN RECREATION  
333 QUEEN STREET, SUITE 300  
HONOLULU, HAWAII 96813

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OFC. OF ENVIRONMENTAL  
QUALITY CONTROL

April 13, 1994

BOR 0459.94

Dr. Bruce S. Anderson, Acting Director  
Office of Environmental Quality Control  
220 South King Street, 4th Floor  
Honolulu, Hawaii 96813

Dear Dr. Anderson:

Subject: Negative Declaration for the Statewide System  
of Day-Use Moorings

The Department of Land and Natural Resources, Division of Boating and Ocean Recreation has reviewed the comments received during the 30-day public comment period which began on December 3, 1993. We have determined that this project will not have significant environmental effect and have issued a negative declaration. The potential secondary effects associated with changes in boat traffic density and patterns as requested in Mr. Brian J. J. Choy's letter of November 26, 1993, and other pertinent public comments, have been addressed in the the Final Environmental Assessment. Please publish this notice in the April 27, 1994 OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the Final Environmental Assessment.

Very truly yours,

A handwritten signature in cursive script that reads "David E. Parsons".

David E. Parsons  
State Boating Administrator

Enc.

c: Ms. Patricia Tummons

1994-04-23-ST-~~FEA~~-Statewide  
System of Day-Use Moorings

APR 23 1994

**ENVIRONMENTAL ASSESSMENT**

**STATEWIDE SYSTEM OF  
DAY-USE MOORINGS**

**State of Hawaii  
Department of Land and Natural Resources  
Division of Boating and Ocean Recreation  
Honolulu, Hawaii**

**March 1994**

## **ENVIRONMENTAL ASSESSMENT**

### **STATEWIDE SYSTEM OF DAY-USE MOORINGS**

#### **INTRODUCTION—APPLICABILITY AND PROCEDURE**

This environmental assessment is prepared pursuant to Chapter 343, H.R.S., as amended, and Title 11, Chapter 200, Department of Health, Environmental Impact Statement Rules. The proposed statewide system of day-use moorings is considered to be an "Agency Action" under §11-200-5, Subchapter 5, because implementation of the proposed action would involve the use of submerged state lands, as well as state funds. The purpose of this environmental assessment is to evaluate the significance of potential environmental impacts resulting from the proposed day-use moorings, and to determine whether an environmental impact statement is required. This assessment will assist the state Board of Land and Natural Resources in its review of the proposed action.

Pursuant to Act 241, SLH 1992, this draft environmental assessment was made available for review during a 30-day period following publication of its availability in the OEQC Bulletin. The DLNR Division of Boating and Ocean Recreation has determined that an environmental impact statement is not required for this proposed action.

#### **PROPOSING AGENCY**

The proposing agency is the state Department of Land and Natural Resources (DLNR), Division of Boating and Ocean Recreation (DOBOR), the agency now responsible for the approval, installation, regulation, operation, and maintenance of moorings in state waters.

#### **AGENCIES CONSULTED IN MAKING ASSESSMENT**

In the planning phase of the statewide system of day-use moorings, DOBOR has consulted the state DLNR Division of Aquatic Resources, state Department of Business, Economic Development, & Tourism (DBEDT), Ocean Resources Branch, U.S. National Marine Fisheries Service (NMFS), the University of Hawaii Sea Grant Extension Service, and The Ocean Recreation Council of Hawaii (TORCH). An advisory committee, which includes all these parties, initially formed under the state Department of Transportation Harbors Division and now under DOBOR, provided recommendations regarding locations, designs, and environmental concerns. In addition, the City and County of Honolulu Water Safety Division (Department of Parks & Recreation) was consulted regarding potential conflicts between surfers and divers at selected sites on Oahu.

A statewide workshop was held in December 1992 by DBEDT Ocean Resources Branch, UH Sea Grant Extension Service, TORCH, and Malama Kai (a nonprofit foundation) to review current technology, designs, regulation, planning concerns, and environmental issues. The information and input from participants were considered in the formulation of the proposed day-use mooring system. Finally, TORCH chapters coordinated with ocean recreation

industry representatives from various islands to identify sites, specify locations, and develop site descriptions. All recommended sites are currently being used by both commercial and recreational boaters. UH Sea Grant and DBEDT Ocean Resources Branch assisted in the final compilation of site descriptions.

### GENERAL DESCRIPTION OF THE PROPOSED ACTION AND OBJECTIVES

A total of 281 day-use moorings are proposed for installation statewide: Kauai - 33 sites; Oahu - 31 sites, Maui County - 123 sites (*six sites off of Kahoolawe have been eliminated from consideration*); and West Hawaii - 94 sites. The total installation cost for materials is estimated to be \$84,000, plus about \$9,000 for equipment and \$30,000 annually for replacing parts as necessary. Much of the needed funds for installation and maintenance would be raised by TORCH, Malama Kai Foundation, and other user groups; in addition, they would contribute labor, boat time, use of dive equipment, and air refills. The moorings would be installed incrementally as funds are made available.

Day-use moorings are designed to reduce or prevent anchor damage caused by recreational and commercial boaters at sites popular for diving and snorkeling. The primary purpose is to protect stony corals and their associated habitats. Access to coral reefs is currently unrestricted (*except in marine life conservation districts, natural area reserves, and fishery management areas*), yet resource managers are responsible for both preserving reef resources and accommodating public use. Mooring buoys are an on-site management tool for allowing access to reefs while substantially reducing (or eliminating) anchor damage. In areas with low coral cover, but nevertheless popular dive sites, moorings still serve a valuable purpose in eliminating anchor damage to the bottom, especially geological features such as lava formations. The moorings would also provide a safe means of securing vessels at predetermined distances from each other; this would offer safer conditions for boats, as well as for divers and snorkelers. As already practiced in Florida's National Marine Sanctuaries, day-use moorings can also be used as a management tool to disperse divers away from popular, overused areas to other selected sites determined to be more suitable. ] NEW

The day-use moorings are intended for temporary use on a first-come first-served basis by any boater; overnight use is not authorized. In selected areas, where there is need to ensure access by recreational users, a few buoys may be reserved for non-commercial users. Anchoring within a defined radius of each day-use mooring will be prohibited by special DLNR rules<sup>1</sup>. In marine life conservation districts (MLCDs) and other selected high-use areas

<sup>1</sup>See DLNR Division of Boating and Ocean Recreation, proposed amendments to Title 13, Subtitle 11, Part 3, Ocean Waters, Navigable Streams and Beaches, Chapter 257 (Day Use Mooring Rules), September 16, 1993 draft. Proposed language in §13-257-5: "Anchoring restrictions. Anchoring is prohibited within 500 yards of any day use mooring buoy, except as otherwise provided in these rules. Anchoring elsewhere in a day use mooring zone is permitted in areas of sand, rock, rubble bottom types where no live corals exist."

with fragile environments, additional anchoring may be limited or eliminated once moorings are installed.

Now  
Hawaii's proposed system is based on a technique developed at National Marine Sanctuaries in Florida, and subsequently in a number of Caribbean countries. Day-use moorings eliminate the need to anchor by providing a simple, inexpensive, environmentally benign, and safe means of securing a recreational vessel without conventional anchors. The mooring system for hard bottoms has two components: (1) a stainless steel eyebolt for a single mooring pin (or two pins with a bridle for a two-point system) that is inserted into a 1-inch diameter hole drilled into solid bottom; (2) a line extending toward the ocean surface and attached to either a surface or subsurface buoy. For areas with sand patches that may be available as mooring sites, an alternative mooring system such as Manta Ray® sand anchors, will be considered and installed. Depending on local conditions and desires of users, a pickup line may or may not be attached to the buoy. (See Appendix D for illustrations of typical systems)

#### Technical Considerations

reduced from 287  
The 281 sites described in this environmental assessment identify the general locations of individual moorings as accurately as possible<sup>2</sup>. Before actual installation, the areas will be carefully surveyed to identify specific locations for individual pins; as much as possible, sites will be selected where there is solid substrate and where there is no live coral immediately surrounding the site. These sites will be marked with a nail and tagged for the installation team. Whenever possible, sites selected for installation will be reviewed with the DLNR Division of Aquatic Resources and affected communities to ensure that installation will cause minimal environmental and social impact.

Each mooring will require the drilling of a hole approximately 1 inch in diameter and 18 inches deep (for a two-point mooring, two holes are required). The holes are drilled using an underwater hydraulic drilling unit that consists of an onboard portable hydraulic unit, hydraulic line, and an underwater drilling unit. The underwater team consists of one person handling the drilling unit and the other as an alternate operator and dive buddy. After the holes are drilled, pressurized air is injected into the hole to clear out debris. A suitable underwater grout, such as Quikcrete®, will be inserted into the hole; a threaded stainless steel eyebolt, approximately 7/8-inch in diameter, will be implanted and left for about 24 hours to properly set. After sufficient time for the grout to cure, a testing team will pull-test the pin by applying at least 5000 pounds of vertical force. Following successful testing, a mooring line and buoy (either surface or subsurface) will be attached. A pickup line (to facilitate a boat securing itself to the mooring) may or may not be included. Users will be advised to visually inspect moorings after hooking up to ensure that all parts are in working order.

<sup>2</sup>GPS instruments and navigation charts were used to locate individual proposed mooring sites as accurately as possible for the purpose of this environmental assessment.

### Economic Considerations

The concept of day-use moorings was initiated by commercial dive operators who wanted to protect the marine environment that they relied upon for their livelihood. A 1987 study of the recreational dive industry in Hawaii (Tabata, 1992) revealed that dive businesses generated nearly \$20 million in revenues, much of it from dive tours. An update conducted for the calendar year 1990 shows that the industry now generates over \$27 million in revenues (Tabata, in press). In 1990, the ocean recreation industry generated over \$500 million in total revenues—making it a major component of Hawaii's economy. The long-term sustainable use of our nearshore environment calls for preventing reef damage caused by anchors. Day-use moorings offer an alternative method of securing vessels in an environmentally benign manner.

In terms of the cost of installing the moorings, it is estimated that each mooring will cost about \$300<sup>3</sup>. If the entire system of 281 proposed moorings is installed, the total installation cost for materials would be \$84,000 (281 x \$300) plus \$9,000 for equipment (*hydraulic power unit, underwater drill/hosing, and drill bits*). Annual maintenance for the entire proposed system would be about \$30,000 (100 per year @ \$300/mooring). The implementation of the statewide system will take place in increments as funds from public and private sources become available.

### Social Considerations

Dive operators, the initiators of the day-use mooring system, will benefit from ensuring the viability of nearshore marine environments. However, as the moorings will be open to all users on a first-come, first-served basis, other users such as recreational fishermen will gain from the protection of habitats. The day-use moorings are planned for moderate depths, mostly 20-90 feet deep for snorkeling or diving, and not intended for use by certain commercial ocean recreation businesses that need a place to secure vessels at the shoreline within swimming distance to shore (such as wilderness cruises and kayakers). The day-use moorings are also not designed for overnight use, nor for securing recreational vessels offshore from resorts and hotels. The maximum proposed use allowed at any mooring is 2.5 hours when another vessel is waiting.

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<sup>3</sup>Estimated wholesale cost of materials per mooring is based on: \$300 per mooring including eyebolts, stainless steel bridle, fittings, nylon line, buoy, and grout. Replacement of materials over a three-year period is estimated to cost about \$300 per mooring, not including eyebolts. These estimates do not include donated labor, air refills, and equipment rental estimated at up to \$200 per installation (or periodic replacement of materials). Additional costs will include the purchase of at least one additional hydraulic drill system (est. \$7,000) and necessary installation equipment for Manta Ray® anchors (est. \$2,000).

In the majority of sites listed, the moorings are located in areas where no other activities occur. In a few of the locations, buoys are planned in areas that are also favorite surfing sites. It is anticipated that no major conflict between these activities will occur because the sites are not used for diving during surfing season, and vice versa. Discussions with the surfing community have begun for one site at Makaha and will continue for other identified areas throughout the installation phase. Buoys and lines will probably be removed during surfing season to avoid possible entanglement of surfers in buoy lines.

As with any new technology, education of users will be a major component of the statewide system of day-use moorings. Potential conflicts between users can be avoided mainly by education. The majority of the mooring sites are in relatively shallow water—not in areas frequented by recreational fishermen in boats. They are also far enough from the shore to avoid any conflict with shore fishermen. If a particular site becomes popular with both divers and fishermen, it will be possible to establish Fishery Management Areas around these sites through DLNR administrative rule-making procedures.

### **Environmental Considerations**

The primary purpose of day-use moorings is to prevent anchor damage to stony coral environments. Site selection and installation will be carried out in a manner that will minimize any damage to reef areas. Compared to conventional anchors with chains dragging around in a "watch circle" for many feet in radius, moorings will require one or two holes having a total area of only 1-2 square inches of reef surface. Day-use moorings will facilitate the non-consumptive use of nearshore areas by dive and snorkel businesses while ensuring long-term productivity. In areas damaged by hurricane storm surge, coral recovery seems to be enhanced by elimination of anchoring.

Although the installation of moorings at a site can potentially increase vessel use of that area, recent studies by a graduate student in Florida have shown that not installing the buoys results in much greater damage to corals (Hocevar, 1993). As indicated earlier, all recommended sites are already being used; not installing moorings will result in greater damage. Establishing rules to prohibit anchoring in the area around the buoy will prevent damage from additional boaters. Additional buoys can be installed if the need arises.

Day-use moorings are not expected to create new beach landing sites as it is illegal for commercial operators to load and unload passengers without a permit. To operate, commercial vessels are required to have a commercial permit, issued by DOBOR; these permits are issued mainly for use of boat ramps and small boat harbors. In addition, most recreational vessels are launched from boat ramps and small boat harbors—not beaches.

As for Molokini, DLNR is in the process of developing administrative rules for the management of the Molokini Shoals MLCD. These rules will be based on allocation of permits to use the day-use moorings at Molokini. Similar permit requirements already exist at the Old Kona Airport and Kealahou MLCDs. Additional rules may be promulgated as needed at

other marine life conservation districts. Placing moorings in MLCDs can potentially: (1) limit access or use; and (2) stop anchor damage presently occurring.

## **DESCRIPTION OF THE AFFECTED ENVIRONMENT**

General descriptions are provided by island/county for the proposed mooring pins and associated marine environments. When appropriate, environmental descriptions are provided for clusters of pins when the affected environment is identical or similar. *See Appendix A for site listings, locations and general descriptions, Appendix B for supplemental descriptions, and Appendix C for location maps.*

## **SUMMARY OF POTENTIAL IMPACTS AND THEIR SIGNIFICANCE**

There will be three distinct phases relating to the installation and use of the moorings: pre-installation, installation, and post-installation. In the pre-installation phase, the only anticipated environmental impact will result from inserting a marker nail or pin in the substrate to identify the precise location of individual moorings. These markers will be carefully placed in areas with little or no live corals to facilitate installation later. Therefore, there should be minimal damage to live corals.

During the installation of mooring pins, the actual drilling will affect about 1-2 square inches of reef or rock surface; as mooring sites will be selected on the basis of having adequate working area around each pin location, there will be minimal physical damage to live coral around each mooring. The drilling will temporarily release fine sediment into the water column, a maximum volume of about 18 cubic inches of drilled materials; the sediment will disperse with prevailing currents. There is a possibility of minimal amounts of hydraulic oil being released into the ocean in the event of a failure in the hydraulic line. The final step in the installation phase involves attachment of the mooring line, buoy, and fittings; this step will have no environmental impact.

In the post-installation phase, there will be cumulative environmental impacts on the reef areas surrounding each of the moorings; however, the moorings will considerably reduce the overall environmental damage that would have resulted from anchors. There is also concern expressed by NMFS about possible humpback whale entanglement in the mooring lines and disturbance of green sea turtles in resting and foraging habitats in certain areas. NMFS has expressed concerns about whale entanglement at Maui sites 51 (Marriott Reef) through 71 (Olowalu), especially concerning calves in shallow water; however, most moorings will be in less than 100 feet depth in areas not known to be frequented by calves.

A number of sites listed for the various islands have also been identified by NMFS as high green turtle activity areas:

Sheraton Caverns, Kauai (sites 1-6)  
Turtle Bluffs, Kauai (site 14)  
Nualolo Kai, Kauai (sites 18-27)  
Makua Beach (Tunnels), Kauai (sites 28-31)

Maunalua Bay, Oahu (sites 22-27)  
Kaneohe Bay, Oahu (sites 28-29)

Turtle Haven, Lanai (sites 1-2)

Olowalu, Maui (sites 69-71)

Anaehoomalu Bay, Hawaii (sites 16-17)  
Kiholo Bay, Hawaii (sites 22-28)  
Turtle Pinnacle, Hawaii (sites 40-41)

## **ALTERNATIVES CONSIDERED**

There are basically three alternatives: (1) no action; (2) alternative mooring methods; and (3) day-use moorings. The "no action" alternative would allow the continued use of anchors to secure recreational and commercial vessels at popular reef areas. Most of the proposed mooring sites are currently used by dive and snorkel operators, as well as the boating and fishing public. Years of use have resulted in anchor damage; the "no action" alternative would do nothing to mitigate or eliminate the continuing physical damage to the marine environment.

Alternative mooring methods currently used in Hawaii include the use of heavy concrete blocks, heavy chains wrapped around rock formations, or engine blocks and other debris. These are generally unacceptable as they are visually unaesthetic and potentially damaging to corals (i.e., lifting and dropping of weights act like a "hammer" upon the reef).

The third alternative is the most preferred as day-use moorings are designed and engineered to be safe, secure, and environmentally benign. Day-use mooring configurations are also flexible to accommodate specific local conditions (e.g., surface vs. subsurface, one-point vs. two-point mooring, with or without pick-up line, etc.). Deactivation of a particular mooring would be simple as only removal of all riggings would be needed. The system is also designed for installation with portable equipment that can be done by volunteers.

## **PROPOSED MITIGATION MEASURES**

Special care in installation and operation will be exercised in marine life conservation districts by closely coordinating with DLNR Division of Aquatic Resources. Also, designs and

**APPENDIX A**  
**DESCRIPTIONS OF PROPOSED SITES**

PROPOSED KAUAI DAY-USE MOORING PIN LOCATIONS

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
1	SHERATON CAVERNS	21-52.39	159-27.97	38'	LAVA ROCK	Six buoys south of Koloa Landing, and west of Makahuena Point
2		21-52.41	159-27.96	36'		
3		21-52.45	159-27.91	24'		
4		21-52.41	159-27.94	40'		
5		21-52.39	159-27.90	47'		
6		21-52.42	159-27.90	26'		
7	KOLOA LANDING	21-52.85	159-28.25	25'	ROCK AND SAND	Just west of Nahuaalo Point
8	ARTIFICIAL REEF	21-52.85	159-29.48	80'	LAVA ROCK	Two buoys at proposed artificial reef site located between Fast Lanes and Beachhouse Arch
9		21-52.90	159-29.50			
10	ARTIFICIAL REEF	21-53.00	159-29.00	52'	BOULDERS	Two buoys at proposed artificial reef site located dire south of Sculptured Reef
11		21-53.02	159-29.02			
12	OASIS REEF, or KALANIPUAO ROCK	21-52.71	159-31.34	34'	LAVA ROCK	Two buoys at Kalanipua Rock
13		21-52.76	159-31.38	28'		

placements will be reviewed with DLNR Division of Aquatic Resources and NMFS in areas identified as important areas for green sea turtles and humpback whales. The UH Sea Grant Extension Service, TORCH, and Malama Kai Foundation—with recommendations from the mooring buoy advisory committee—will cooperate in a public education program that will teach users about how to properly use the moorings, as well as obeying laws relating to marine conservation and endangered/threatened species.

### **DETERMINATION**

The DLNR Division of Boating and Ocean Recreation determines that an environmental impact statement is not needed as provided in Chapter 343, HRS. The DLNR/DOBOR finds that the proposed project will have insignificant environmental impacts and that alternatives to day-use moorings, including the alternative of "no action" are less preferable in reducing or eliminating damage to reefs caused by anchors. Furthermore, the proposed action will benefit all ocean users who rely on healthy nearshore reefs, including fishermen, snorkelers, and divers. The proposed moorings will significantly reduce anchor damage while ensuring long-term productivity, sustainable use of reef areas, and enjoyment of marine environments by both residents and visitors.

### **NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)**

The proposed day-use moorings are subject to NEPA (Public Law 91-190, as amended) as approval by the U.S. Army Corps of Engineers under a general permit is needed. Additionally, review by the U.S. National Marine Fisheries Service pursuant to the Endangered Species Act and Marine Mammal Protection Act is also required. Finally, a federal consistency review will be conducted by the Hawaii Coastal Zone Management Program under the federal Coastal Zone Management Act. The State Division of Boating and Ocean Recreation will coordinate with these federal agencies and the Hawaii CZM Program to ensure that NEPA requirements are fulfilled.

### **REFERENCES**

Hocevar, J.D. 1993. A survey of the stony coral community composition of Pompano Ledge, Broward County, Florida, with a preliminary evaluation of the effectiveness of mooring buoys in reducing coral damage. M.S. Thesis, Nova University, Florida.

Tabata, R.S. 1992. *Hawaii's recreational dive industry and use of nearshore dive sites*. University of Hawaii Sea Grant College Program and Hawaii Department of Planning, Economic Development, and Tourism, UNIH-SEA GRANT-CR-92-02 and Contribution 98, Ocean Resources Branch, DBEDT. Honolulu, Hawaii.

Tabata, R.S. and Elizabeth Reynolds (in press). *Hawaii's recreational dive industry, 1990 update*. Sea Grant Marine Economics Report, UH Sea Grant College Program. Contribution, Ocean Resources Branch, DBEDT. Honolulu, Hawaii.

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
14	TURTLE BLUFFS	21-52.55	159-31.43	4'	LAVA ROCK	Southwest off Makaokahai Point
15	GENERAL STORE	21-52.60	159-31.57	54'	LAVA ROCK	Just off Makaokahai Point
16	"L" BUOY	22-74.85	159-46.10	12'	LAVA ROCK	North of Polihale, fronting Halemanu River mouth
17	MILOLII	22-09.50	159-43.28	34'	LAVA ROCK	On Na Pali side of Milolii
18	NUALOLO KAI	22-09.61	159-42.09	35'	LAVA ROCK	Ten buoys east of Alapii Point off Nualolo Stream
19		22-09.66	159-42.12			
20		22-09.65	159-42.08			
21		22-09.62	159-42.10			
22		22-09.63	159-42.10			
23		22-09.66	159-42.07			
24		22-09.68	159-42.08			
25		22-09.65	159-42.14			
26		22-09.64	159-42.13			
27		22-09.66	159-42.09			

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
28	MAKUA BEACH, or TUNNELS	22-13.50	159-34.50	25'	LAVA ROCK	Four buoys off Haena Point
29		22-14.48	159-34.50	30'		
30		22-13.41	159-33.64	20'		
31		22-13.50	159-33.77	18'		
32	KIPU KAI	21-55.42	159-21.88	28'	SAND AND ROCK	Two buoys northeast of Kaweliko Point
33		21-54.68	159-23.48	28'		

PROPOSED OAHU DAY-USE MOORING PIN LOCATIONS

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
1	KEAAU, or STARS	21-29.10	158-14.10	30'-35'	CORAL ROCK WITH SOME LAVA ROCK	Off beach park
2	LAND OF OZ, or OUTER MAKAHA	21-28.35	158-13.43	25'-30'	CORAL ROCK WITH SOME LAVA ROCK	Two buoys west of Kepuhi Point
3						
4						
5	MAKAHA CAVERNS	21-28.35	158-13.32	20'-30'	CORAL ROCK WITH SOME LAVA ROCK	Six buoys south of Kepuhi Point
6						
7						
8						
9						
10	BIG MOUTH CAVE, or ULUA CAVE	21-27.35	158-13.20	80'-90'	CORAL ROCK WITH SOME LAVA ROCK	West of Lahilahi Point
11						
12	AMMO REEF	21-26.42	158-12.00	30'-40'	CORAL ROCK WITH SOME LAVA ROCK	Four buoys placed southwest of Waianae Small Boat Harbor
13						
14						

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES			
15	RAINBOW REEF	21-16.47	157-50.52	30'-35'	CORAL ROCK WITH SOME LAVA ROCK	Two buoys west of Ala Wai Small Boat Harbor entrance			
16									
17	CANYONS REEF	21-16.12	157-50.52	30'-35'	CORAL ROCK WITH SOME LAVA ROCK	Five buoys east/southeast of Ala Wai Small Boat Harbor entrance			
18									
19									
20									
21									
22	MAUNALUA BAY	21-16.35	157-43.45	20'-40'	CORAL ROCK WITH SOME LAVA ROCK	Six buoys west of Koko Head in Maunalua Bay			
23									
24									
25									
26									
27									
28	KANEIOHE BAY	21-28.38	157-49.22	5'-10'	LIVE CORAL WITH CORAL ROCK AND CORAL MOUNDS, SOME SAND	Four surface buoys requested so as to mark shallow water area also			
29							21-28.47	157-49.43	5'-10'
30							21-28.47	157-48.06	5'-10'
31							21-27.32	157-48.03	5'-10'

## PROPOSED MAUI COUNTY DAY-USE MOORING PIN LOCATIONS

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
1	TURTLE HAVEN 1	20-49.90 N	156-48.50 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	LANAI
2	TURTLE HAVEN 2	20-49.90 N	156-48.50 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	LANAI
3	SARGENT MINOR	20-45.263 N	156-50.772 W	50'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
4	SARGENT MAJOR 1	20-45.282 N	156-50.715 W	50'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
5	SARGENT MAJOR 2	20-45.282 N	156-50.715 W	50'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
6	ARMCHAIR 1	20-45.043 N	156-50.887 W	30'-40'	75/25% LAVA ROCK W/SAND CHANNELS	LANAI
7	ARMCHAIR 2	20-45.043 N	156-50.887 W	30'-40'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
8	ARMCHAIR 3	20-45.043 N	156-50.887 W	30'-40'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
9	FISH ROCK 1	20-44.409 N	156-52.729 W	50'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
10	FISH ROCK 2	20-44.409 N	156-52.729 W	50'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
11	OUTSIDE MANELE	20-44.476 N	156-53.140 W	30'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
12	CATTLE CHUTE	20-44.390 N	156-53.166 W	40'	75/25% LAVA ROCK W/SAND CHANNELS	LANAI
13	FIRST CATHEDRAL 1	20-44.004 N	156-53.333 W	65'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
14	FIRST CATHEDRAL 2	20-44.004 N	156-53.333 W	65'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
15	FIRST CATHEDRAL 3	20-43.948 N	156-54.320 W	50'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
16	RIVERS RUN	20-44.089 N	156-54.418 W	50'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
17	EMERALD CITY	20-44.119 N	156-54.514 W	40'	50/50% LAVA ROCK W/SAND CHANNELS	LANAI
18	KNOB HILL	20-44.030 N	156-55.413 W	50'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
19	SECOND CATHEDRAL 1	20-44.030 N	156-55.413 W	65'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI
20	SECOND CATHEDRAL 2	20-44.030 N	156-55.413 W	50'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI
21	LOBSTER ROCK	20-44.027 N	156-55.619 W	50'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
22	WASH ROCK	20-44.030 N	156-55.789 W	55'	50/50% LAVA ROCK W/SAND CHANNELS	LANAI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
23	WHITE ROCK	20-44.033 N	156-56.407 W	50'	50/50% LAVA ROCK W/SAND CHANNELS	LANAI
24	NO NAME PARADISE	20-44.033 N	156-56.440 W	50'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI
25	MENPACHI CAVES	20-44.015 N	156-56.456 W	50'	75/25% LAVA ROCK W/SAND CHANNELS	LANAI
26	TAAPE RIDGE	20-44.008 N	156-56.423 W	50'	50/50% LAVA ROCK W/SAND CHANNELS	LANAI
27	MONOLITH	20-44.980 N	156-56.520 W	40'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI
28	GRAND CANYON	20-43.836 N	156-57.661 W	60'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI
29	LIGHTHOUSE 1	20-44.013 N	156-57.966 W	60'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
30	LIGHTHOUSE 2	20-44.013 N	156-57.966 W	50'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
31	LIGHTHOUSE 3	20-44.013 N	156-57.966 W	40'	80/20% LAVA ROCK W/SAND CHANNELS	LANAI
32	SHARK FIN 1	20-44.241 N	156-58.101W	65'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI
33	SHARK FIN 2	20-44.241 N	156-58.101W	50'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI

Draft Environmental Assessment: Day-Use Moorings

Appendix A - Descriptions of Proposed Sites

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
34	SHARK FIN 3	20-44.241 N	156-58.101W	40'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI
35	BARGE HARBOR	20-47.10 N	156-59.35 W	35'	90/10% LAVA ROCK W/SAND CHANNELS	LANAI
36	NEEDLES 1	20-49.50 N	156-48.50W	45'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI -NANAHOA
37	NEEDLES 2	20-49.50 N	156-48.50W	45'	60/40% LAVA ROCK W/SAND CHANNELS	LANAI -NANAHOA
38	MOKUHOONIKI 1 TABLE TOP	21-08.160 N	156-42.499 W	40'	80/20% LAVA ROCK W/SAND CHANNELS	MOLOKAI
39	MOKUHOONIKI 2 HOLE	21-08.016 N	156-42.563 W	50'	80/20% LAVA ROCK W/SAND CHANNELS	MOLOKAI
40	MOKUHOONIKI 3 CRATER	21-08.032 N	156-42.372 W	50'	80/20% LAVA ROCK W/SAND CHANNELS	MOLOKAI
41	HONOLUA BAY 1	21-01.501 N	156-38.470 W	40'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
42	HONOLUA BAY 2	21-01.501 N	156-38.470 W	40'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
43	HONOLUA BAY 3	21-01.501 N	156-38.470 W	40'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
44	HONOLUA BAY 4	21-01.501 N	156-38.470 W	40'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
45	HONOLUA BAY 5	21-01.501 N	156-38.470 W	40'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
46	CLIFFHOUSE 1	21-00.001 N	156-40.005 W	40'	60/40% LAVA ROCK W/SAND CHANNELS	MAUI
47	CLIFFHOUSE 2	21-00.001 N	156-40.005 W	40'	60/40% LAVA ROCK W/SAND CHANNELS	MAUI
48	AIRPORT 1	20-56.393 N	156-41.724 W	40'	40/60% LAVA ROCK W/SAND CHANNELS	MAUI
49	AIRPORT 2	20-56.393 N	156-41.724 W	40'	40/60% LAVA ROCK W/SAND CHANNELS	MAUI
50	AIRPORT 3	20-56.393 N	156-41.724 W	40'	40/60% LAVA ROCK W/SAND CHANNELS	MAUI
51	MARRIOTT REEF 1	20-54.282 N	156-41.104 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
52	MARRIOTT REEF 2	20-54.282 N	156-41.104 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
53	MARRIOTT REEF 3	20-54.282 N	156-41.104 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
54	HYATT REEF 1	20-53.620 N	156-41.104 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
55	HYATT REEF 2	20-53.620 N	156-41.104 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
56	HYATT REEF 3	20-53.620 N	156-41.104 W	30'	50/50% LAVA ROCK W/SAND CHANNELS	MAUI
57	MALA WHARF 1	20-53.130 N	156-41.300 W	35'	20/80% LAVA ROCK W/SAND CHANNELS	MAUI
58	PUUNOA POINT 1	20-53.810 N	156-41.356 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
59	PUUNOA POINT 2	20-53.810 N	156-41.356 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
60	PUUNOA POINT 3	20-53.810 N	156-41.356 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
61	LAHAINA SHORES	20-51.202 N	156-40.621 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI
62	A FRAME	20-41.499 N	156-40.621 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
63	SWIMMING POOL	20-51.443 N	156-40.621 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
64	PUAMANA PARK	20-51.438 N	156-40.617 W	40'	LAVA ROCK W/SAND CHANNELS	MAUI
65	LAUNIUPOKO PARK 1	20-50.804 N	156-39.431 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI
66	LAUNIUPOKO PARK 2	20-50.804 N	156-39.431 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
67	LAUNIUKO PARK 3	20-50.804 N	156-39.431 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI
68	TRANSFORMER	20-50.001 N	156-39.010 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI
69	OLOWALU 1	20-48.395 N	156-39.930 W	25'	LAVA ROCK W/SAND CHANNELS	MAUI
70	OLOWALU 2	20-48.395 N	156-39.930 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
71	OLOWALU 3	20-48.395 N	156-39.930 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI
72	PAPAWAI 1	20-46.374 N	156-33.265 W	25'	LAVA ROCK W/SAND CHANNELS	MAUI
73	PAPAWAI 2	20-46.374 N	156-33.265 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
74	PAPAWAI 3	20-46.374 N	156-33.265 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI
75	MCGREGOR POINT 1	20-46.690 N	156-31.299 W	25'	LAVA ROCK W/SAND CHANNELS	MAUI
76	MCGREGOR POINT 2	20-46.690 N	156-31.299 W	30'	LAVA ROCK W/SAND CHANNELS	MAUI
77	MCGREGOR POINT 3	20-46.690 N	156-31.299 W	35'	LAVA ROCK W/SAND CHANNELS	MAUI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
78	MOLOKINI OUTER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
79	MOLOKINI OUTER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
80	MOLOKINI OUTER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
81	MOLOKINI OUTER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
82	MOLOKINI MID CRATER	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
83	MOLOKINI MID CRATER	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
84	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
85	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
86	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
87	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
88	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
89	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
90	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
91	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
92	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
93	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
94	MOLOKINI INNER REEF	20-38.00 N	156-29.80 W	30'-90'	LAVA ROCK W/SAND CHANNELS	MOLOKINI
95	RED HILL 1	20-38.281 N	156-27.226 W	30'-40'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
96	RED HILL 2	20-38.281 N	156-27.199W	30'-40'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
97	RED HILL 3	20-38.329 N	1156-27.140 W	30'-40'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
98	MARTY'S REEF	20-30.418 N	156-26.866 W	50'-60'	30/70% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
99	BANYAN TREE REEF	20-39.382 N	156-26.916 W	60'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
100	JODY'S BACK YARD	20-39.068 N	156-26.887 W	50'	40/60% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
101	FIVE GRAVES 1	20-39.320 N	156-26.648 W	20'-30'	60/40% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
102	FIVE GRAVES 2	20-39.350 N	156-26.710 W	20'-30'	60/40% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
103	FIVE GRAVES 3	20-39.387 N	156-26.733 W	20'-30'	60/40% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
104	FERRARI'S POINT	20-40.040 N	156-26.729 W	20'-30'	70/30% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
105	POLO BEACH	20-40.346 N	156-26.790 W	20'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
106	WAILEA POINT 1	20-40.840 N	156-26.813 W	20'-30'	70/30% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
107	WAILEA POINT 2	20-40.860 N	156-26.853 W	20'-30'	70/30% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
108	MENEHUNE REEF	20-45.603 N	156-28.135 W	20'-30'	60/40% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
109	KALAMA PARK	20-44.055 N	156-27.605 W	20'-30'	40/60% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
110	LA PEROUSE PINNACLE 1	20-35.516 N	156-25.222 W	30'	100/0% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
111	LA PEROUSE PINNACLE 2	20-35.488 N	156-25.246 W	30'	100/0% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
112	SPLIT REEF	20-34.793 N	156-24.708 W	30'	70/30% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
113	PINNACLE POINT 1	20-34.701 N	156-24.117 W	20'-30'	80/20% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
114	PINNACLE POINT 2	20-34.636 N	156-23.026 W	40'-50'	80/20% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
115	PINNACLE POINT 3	20-34.694 N	156-23.986 W	20'-30'	80/20% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
116	PARROT REEF	20-34.688 N	156-23.219 W	35'	60/40% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
117	GOLDEN ARCHES 1	20-34.409 N	156-22.416 W	45'	80/20% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
118	GOLDEN ARCHES 2	20-34.441 N	156-22.348 W	20'-30'	80/20% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
119	DRAGON REEF	20-34.525 N	156-21.986 W	20'	80/20% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
120	TAAPE REEF	20-38.437N	156-27.398W	72'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
121	HAWAIIAN REEF	20-38.446N	156-27.436W	85'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI

NO.	SITE NAME	LATITUDE	LONGITUDE	DEPTH	BOTTOM CONDITION	NOTES
122	APARTMENTS	20-38.418N	156-27.707W	95'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI
123	BATTLESHIP	20-38.404N	156-27.730W	95'	50/50% LAVA ROCK W/SAND CHANNELS	SOUTH MAUI

## PROPOSED HAWAII ISLAND DAY-USE MOORING PIN LOCATIONS

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
1	Keawanui Point	20-07.01	155-53.02	35'-40'	Rock with coral heads	N. of Black Point
2	Red Hill	20-05.05	155-52.06	40'	Rock, coral heads, sand	Kohala
3	North Kei Kei	20-05.01	155-52.04	40'	Rock, coral heads, sand	Kohala
4	Waiakele Bay	20-04.03	155-51.07	40'	Rock with coral heads	Kohala
5	South Frog Rock	20-03.08	155-51.02	40'-45'	Rock with coral heads	Kohala
6	Pioneer Reef	20-02.06	155-50.05	40'-45'	Coral, rock outcropping	N of Kawaihae Harbor
7	Puako Bay South	19-58.22	155-50.85	35'	rock, sand, off reef flat	North Puako Reef area
8	Puako Reef	19-58.20	155-50.94	35'-40'	rock, sand, off reef flat	Off public access
9	Puako Reef	19-58.18	155-50.97	35'-40'	rock, sand, coral, by reef	Off public access
10	Puako Reef	19-58.07	155-51.27	35'-40'	rock, sand, coral, by reef	Off public access
11	Puako Reef	19-58.00	155-51.38	40'	rock, sand, coral, by reef	Off public access
12	Puako Reef	19-57.79	155-51.54	40'	rock, sand, coral, by reef	Off public access
13	Puako Reef	19-57.50	155-51.64	35'-40'	rock, sand, coral, by reef	Pauoa Bay
14	Puako Reef	19-56.36	155-52.74	40'	rock, sand, coral, by reef	Pauoa Bay
15	Honokaope Bay	19-56.50	155-52.80	40'-45'	coral, rock, sand areas	S. of Waawaa Pt.
16	Anaehoomalu Bay	19-54.98	155-53.96	40'-45'	coral, rock, sand areas	South Anaehoomalu Bay
17	Anaehoomalu Bay	19-54.74	155-54.92	35'	coral, rock, sand areas	South Anaehoomalu Bay

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
18	Anaehoomalu Bay	19-54.67	155-53.94	30'-35'	coral, rock, sand areas	South Anaehoomalu Bay
19	Kapalaoa	19-54.16	155-54.21	30'	coral, rock, sand areas	South Kapalaoa Bay
20	Keawaiki Bay	19-53.39	155-54.44	35'-40'	coral, rock, sand areas	N of Kaiwi Point
21	Keawaiki Bay	19-53.30	155-54.61	30'	coral, rock, sand areas	N of Kaiwi Point
22	North Kiholo Bay	19-51.97	155-55.51	40'	rock, coral heads, sand	S of Hou Point
23	North Kiholo Bay	19-51.95	155-55.48	45'	rock, coral heads, sand	S of Hou Point
24	South Kiholo Bay	19-51.20	155-56.55	40'-45'	rock, coral heads, sand areas	Near Nawaikulua Pt.
25	South Kiholo Bay	19-51.27	155-56.65	40'-45'	coral, rock, sand areas	Near Nawaikulua Pt.
26	South Kiholo Bay	19-51.36	155-56.83	40'-45'	coral, rock, sand areas	Near Nawaikulua Pt.
27	South Kiholo Bay	19-51.30	155-56.99	45'	coral, rock, sand areas	South of Nawaikulua Pt.
28	South Kiholo Bay	19-51.21	155-57.10	40'	coral, rock, sand areas	Near Mano Point
29	Kaupulehu	19-50.00	155-59.50	40'-45'	coral, rock, sand areas	South Kahuwai Bay
30	Kukio	19-49.50	156-05.00	35'	coral, rock, sand areas	N of Kikaua Pt.
31	Kua Bay	19-48.50	156-01.00	35'	coral, rock, sand areas	Just N of Kua Bay
32	Kua Bay	19-48.30	156-01.00	40'	rock, coral, sand areas	Kua Bay area
33	Awakee	19-48.00	156-01.50	40'-45'	coral, rock, sand areas	South of Puu Kuili
34	Makalawena	19-47.50	156-02.00	40'	rock, coral, sand areas	S. of Kahoiawa Pt.
35	Mahauiula	19-46.80	156-03.00	40'-45'	rock, coral, sand areas	Off State Park

Drift Environmental Assessment: Day-Use Moorings

Appendix A - Descriptions of Proposed Sites

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
36	Airplane wreck	19-57.00	156-03.10	70'	rock ledge, corals	Wreck is close to ledge
37	Keahole Pt.	19-44.05	156-03.50	45'-50'	rock ledge, corals	Just N of Keahole Pt.
38	Black Hole	19-43.20	156-03.00	60'	rock areas with coral	South of Keahole Pt.
39	Dottie's Reef	19-43.00	156-03.00	45'	coral, rock arches	N. of Golden Arches
40	Turtle Pinnacle	19-41.00	156-02.00	30'-35'	rock, coral with sand areas	N. of Honokohau Hrbr, need NPS and Pai OK
41	Turtle Pinnacle	19-41.00	156-02.10	40'	rock, coral with sand areas	N. of Honokohau Hrbr, need NPS and Pai OK
42	Manta Ray Beach	19-40.50	156-01.55	30'	rock, coral with sand areas	S. of Honokohau Hrbr, need NPS and Pai OK
43	Keahuolu Pt.	19-39.00	156-01.50	35'-40'	coral, rock with sand	N of Keahuolu Pt.
44	Keahuolu Pt.	19-38.80	156-01.80	40'	rock, coral and sand areas	Nearby Keahuolu Pt.
45	Old Airport MLCD	19-38.10	156-01.30	40'	rock, coral, and sand areas	Community ok req.
46	Old Airport MLCD	19-38.20	156-01.40	40'	rock, coral, and sand areas	Community ok req.
47	Alii Villas	19-37.50	155-59.20	40'-45'	rock, coral and sand areas	Off Alii Drive
48	Kona Makai	19-37.40	155-59.18	40'-45'	rock, coral, and sand areas	Off Alii Drive

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
49	Royal Seacliff	19-37.35	155-59.15	40'-45'	rock, coral, and sand areas	Off Alii Drive
50	Laaloa Lava Tube	19-36.50	155-59.00	35'-40'	rock, coral, and sand areas	Off Mile #4 Marker
51	Kanaloa	19-34.05	155-58.05	40'	coral, rocks, sand areas	Just N. of Keauhou Bay
52	Kona Surf	19-33.35	155-57.55	40'-45'	rock, coral and sand areas	Just S. of Keauhou Bay
53	Kealakekua Bay North	19-29.10	155-57.00	45'	coral, rocks and sand patches	Out of MLCD boundary
54	Kealakekua Bay North	19-29.07	155-56.50	45'	coral, rocks and sand patches	Out of MLCD boundary
55	Kealakekua Bay North	19-29.05	155-56.40	45'-50'	coral, rocks and sand patches	Out of MLCD boundary
56	Kealakekua Bay MLCD	19-29.00	155-56.00	50'-55'	coral, sand, rocks	Community OK req'd.
57	Kealakekua Bay MLCD	19-29.00	155-56.00	50'-55'	coral, sand, rocks	Community OK req'd.
58	Kealakekua Bay South	19-28.00	155-56.50	45'-50'	coral, rocks and sand areas	Out of MLCD boundary
59	Keomo Point	19-27.05	155-55.30	40'-45'	coral, rocks and sand areas	South Kona
60	Honaunau Bay	19-25.40	155-55.20	40'	rock and sand areas	South of Pelehoni Point, must get NPS ok

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
61	Lepeamea Rock	19-20.00	155-53.70	50'-55'	rock and sand areas	S. of Pali Kaholo
62	Ka'u Loa Point	19-19.00	155-53.80	50'-55'	rock and sand areas	Kaula Pt.
63	Au'au Point	19-18.00	155-53.80	50'-55'	rock and sand areas	South Kona
64	Kalaepa'akai Point	19-17.00	155-53.90	50'	rock and sand areas	Off Opihihale
65	Laeokamimi Point	19-12.10	155-53.10	50'	rock and sand areas	N. of Papa Bay
66	Alika Bay	19-11.90	155-53.10	55'	rock and sand areas	N. of Papa Bay
67	Papa Bay	19-11.80	155-53.20	55'	rock, coral sand areas	South Kona
68	Makahiki Point	19-11.80	155-53.30	55'	rock, coral and sand areas	Off Ho'opuloa
69	Milolii	19-11.00	155-53.40	50'	rock and coral	Milolii Bay
70	Kapulau Point	19-10.20	155-53.60	50'-55'	rock and coral areas	S. of Omaka'a Bay
71	Okoe Bay	19-09.00	155-54.50	55'	rock and coral	S. of Hanamalo Pt.
72	Manuka Bay	19-04.20	155-54.50	55'	rock and coral	S. of Kamoi Pt.
73	Kaulanamauna Cove	19-03.00	155-54.00	55'-60'	rock and coral areas	Kau
74	Manuka South	19-02.50	155-54.00	55'-60'	rock and coral areas	N. of Kauna Pt.
75	Kauna Point North	19-02.30	155-53.80	55'	rock and coral areas	Just N. of Kauna Pt.
76	Kauna Point South	19-02.20	155-53.80	60'	rock and coral areas	Just S. of Kauna Pt.
77	Keawaiiki	19-01.70	155-52.10	55'	rock and coral areas	N. of Awili Pt.
78	Pohue Bay	19-00.50	155-47.50	55'	rock and coral	W. of Hosaka Pt.

NO.	NAME	LATITUDE (N)	LONGITUDE (W)	DEPTH	BOTTOM CONDITIONS	NOTES
79	Kepuhi o Kahio Pt.	18-58.00	155-43.50	60'	rock and coral areas	Near Puu Kaimuuwala
80	Ka'iiki'i	18-57.20	155-42.50	60'	rock and coral areas	Kaikiiki Shoal
81	Wai'ahukini	18-57.10	155-42.30	60'	rock and coral areas	Off Pali o Kulani
82	Wai'ahukini South	18-57.10	155-42.30	65'	rock and coral areas	Off Pali o Kulani
83	Kamaoa	18-56.00	155-41.50	65'	rock and coral areas	N. of Kalukupoko
84	Kamaoa	18-55.90	155-41.40	65'-70'	rock and coral areas	Just N. of Kalukupoko
85	Pali Ha'u'uke'uke	18-55.00	155-41.45	65'-70'	rock and coral areas	Ka Lae
86	South Point	18-54.86	155-41.26	50'	pahoehoe lava flow, boulders	Six surface buoys on the Kona side of Ka Lae
87		18-54.85	155-41.26			
88		18-54.84	155-41.26			
89		18-54.83	155-41.25			
90		18-54.82	155-41.25			
91		18-54.80	155-41.25			
92		Kaulana Bay	18-55.00			
93	Mahana Bay	18-56.00	155-38.00	40'-45'	rock and coral areas	Green sand beach
94	Ka'alu'alu Bay	18-57.80	155-36.50	45'-50'	rock and coral areas	Inside of bay

**APPENDIX B**  
**SUPPLEMENTAL DESCRIPTIONS**  
**OF AFFECTED ENVIRONMENTS**

## KAUAI

Sites 1-6 are all located around the perimeter of the dive site named "Sheraton Caverns." The bottom environment is lava rock with several species of coral. There is a scattering of sand patches with approximately two-foot relief in elevation. The main diving area is a V-shaped lava tube with an archway system. This area has no moorings as it contains the largest concentration of corals. The corals seen are *Leptastrea purpurea*, *Porites lobata*, *Pocillopora meandrina* and *P. eydouxi*.

Site 7 is at Koloa Landing. This is a U-shaped cove where the slopes of the cove are boulders and the middle is a sand environment. The mooring location is placed on a fairly level large boulder. Between the boulders is hardpack. There is a little coral in the area.

Sites 8 and 9 are in a flat hardpack area. There is a boulder field to the north and a sand environment to the south.

Sites 10-11 are also positioned in a barren area as a proposed artificial reef site. This particular area is lava rock with a boulder field and little coral.

Sites 12-13 are located to the east and to the west of Kalanipua Rock. The rock is a lava pinnacle that rises up to a depth of 4-5 feet. The pinnacle is covered with *Leptastrea purpurea*, *Porites lobata*, *Pocillopora meandrina*, and *P. eydouxi*. The mooring locations are approximately 80-100 feet to the east and to the west of the pinnacle. Since this area has a regular tidal current, this will allow a vessel to tie up to a mooring and then adjust scope appropriately to be near the pinnacle. The environment at the locations of the moorings is flat lava rock with hardpack and sand. There is no coral except on the pinnacle.

Site 14 is located on flat lava rock with hardpack surrounding it. There is little coral for about 60 feet. Approximately 60 feet away is a lava bluff which is a turtle resting ground. At the top of this lava rise there is some *Pocillopora meandrina*.

Site 15 is located in a flat lava rock area surrounded by hardpack. There is little coral around the location of the mooring. However, approximately 40 feet away is a U-shaped cove with several lava tubes entering it providing nice topography and relief.

Site 16 is located on flat lava rock with shallow ledge lines. There are coral heads in the area, mostly *Pocillopora meandrina* and *P. eydouxi*. (Note: this position was taken off a NOAA chart and not read by GPS.)

Site 17 (also taken off a NOAA chart) is located on flat lava rock surrounded by hardpack. The coral habitat present is *Pocillopora meandrina*, and is scattered about.

Sites 18-27 (positions taken by GPS) follows a lava ledge line on the perimeter of Nualolo Kai Bay. The top of the ledge had *Pocillopora meandrina* and *Porites lobata* prior to Hurricane Iniki.

Sites 28-29 are located on a ledge line which runs perpendicular to shore. The ledge line is lava rock with *Porites lobata*, *Pocillopora meandrina*, and *P. eydouxi*. The ledge line drops to a thick sand environment (Coordinates taken from NOAA chart).

Sites 30 and 31 (coordinates by GPS) are on a lava rock ledge line which runs parallel to shore. The top of the ledge line used to have much coral, mainly *Porites lobata*, *Pocillopora meandrina*, and *P. eydouxi*. There has been coral damage from Hurricane Iniki.

Sites 32 and 33 (coordinates taken from NOAA chart) are in an area of flat lava rock covered with fine sand. Close by is the perimeter of the bay with *Leptastrea purpurea*, *Porites lobata*, *Pocillopora meandrina* and *P. eydouxi* covering the boulders.

## OAHU

Site 1 (Keaau or Stars) is off Keaau Beach Park and has a nice ledge which starts at about 30 feet and drops to approximately 60-70 feet. It contains an abundance of lava tubes and canyons with a small but diverse amount of marine life. Coral coverage on the ledge is abundant with evidence of damage due to anchoring. This site is used on a regular basis by dive charters.

Sites 2 and 3 (Land of Oz or Outer Makaha) is just off Kepuhi Point and is used frequently by dive charters. Coral damage is heavy, yet not extensive, as anchoring occurs in the same general area. This site starts as a shelf in about 25-30 feet and follows a lava ravine down to about 60-70 feet. Coral coverage is about 50% with the remainder made up of rubble and sand.

Sites 4 to 9 (Makaha Caverns) is probably the most heavily used dive destination in the area, although it may be used sparingly during the winter months. From April to November, it gets heavy boat traffic. This site contains various lava formations, from tubes and arches, to valleys and canyons. There is approximately 65-70% coral coverage with the remainder sand and lava. An abundant variety of marine life, including many green sea turtles are sighted often. Because of the heavy use, coral damage is quite extensive.

Site 10 (Big Mouth Cave, or Ulua Cove) is just off Lahilahi Point and is a shelf in approximately 50 feet of water which overhangs a cavern-like structure in about 80-90 feet. Coral coverage on top of the shelf is about 50%. The bottom consists of about 40% coral with the remainder rubble and sand, with some lava rock.

Sites 11 to 14 (Ammo Reef) is just outside the Waianae Boat Harbor and is heavily used, especially during the winter months. This area consists of small lava shelves, with approximately 60% coral coverage. The remainder is sand and lava rock. There is quite a bit of marine life in this area, which earns the nickname for this area -- "Aquarium Reef." Due to its heavy use, anchor damage is extensive.

Sites 15 and 16 (Rainbow Reef) is just west of the Ala Wai Boat Harbor entrance and is a spur-and-groove reef structure with about 50% coral coverage. The remainder is sand and coral rock. Green sea turtles are often sighted in this area. Anchor damage is moderate.

Sites 17 to 21 (Canyons Reef) is a spur-and-groove reef structure and is heavily used dive site east/southeast of the Ala Wai Small Boat Harbor. It has a coral coverage of approximately 50% with the remainder sand and coral rock. There is abundant marine life in this area, including many green sea turtles. Anchor damage is extensive.

Sites 22 to 27 (Maunalua Bay) includes a couple of different dive sites, known locally as "Turtle Canyons" and "Anglers Reef". These sites have good three-dimensional topography with up to 75% coral coverage. The remainder is sand and lava rock. Abundant marine life and green sea turtles make these popular choices for dive charters. Anchor damage is extensive.

Sites 28 and 29 (Kaneohe Bay) consist of coral mounds used by divers, snorkelers, and others. They are relatively shallow and as such, boaters throw their anchors on top and drift back to the lee of the mound. Sites 30 and 31 (also Kaneohe Bay) are just offshore of Kapapa Island. There is a nice fringing reef in approximately 15-25 feet of water. All four of these sites have coral damage, but not serious.

## **MAUI COUNTY**

The following are brief benthic/biological descriptions of the proposed pin sites for Maui County.

Type I. These areas are primarily sand channels with ridges of lava covered with corals. The corals are primarily finger corals (*Porites compressa*), lobed coral (*Porites lobata*) and cauliflower coral (*Pocillopora meandrina*). Species of butterflyfishes (*Chaetodon spp.*), wrasses (*Labridae*), hawkfishes and triggerfishes (*Rhinocanthus spp.*) are the most common fish in the area. These areas are frequented by green sea turtles (*Chelonia mydas*) at times.

Type II. These areas contain lava fingers or pinnacles with intermittent areas of cauliflower coral. There are occurrences of vine corals as these areas have 10-30 foot drops along the lava faces. The fish life includes taape (*Lutjanus kasmira*), triggerfishes, wrasses, mu (*Monotaxis sp.*), and an occasional ulua (*Caranx spp.*). These areas have numerous crevices which contain a variety of marine life.

Type III. These areas are isolated formations surrounded by sand. These usually have a base of lava rock covered by sparse coral. Corals are usually limited to cauliflower and lobed corals. The fish life includes taape, surgeonfish (*Acanthurus spp.*), triggerfish, butterflyfish, and wrasses. These areas are isolated "oases" in the oceanic "desert" and contain a variety of marine life in relatively small localities.

The areas located around the island of Lanai (Sites 1-37) contain both types I and II areas. Type I areas are found at Sites 1, 2, 9-21, 17, 20, 21, 24, 28, 32, and 34. Type II areas are found at Sites 3-10, 13-21, 23 and 37.

The areas located around Molokai (Sites 38-40) contain both types I and II areas. Type I areas are found at Sites 39 and 40. Type II areas are found at Sites 38, 39, and 40.

The areas located around the island of Maui (Sites 41-123) contain all three types. Type I areas are found at Sites 41-97, 101-103, 106-108, and 110. Type II areas are found at Sites 46, 47, 75, and 119. Type III areas are found at sites 120-123.

## **HAWAII (BIG ISLAND)**

The following provides general descriptions of the zones (clusters of sites) within which mooring pins are proposed. The area extends along the Kohala, Kona and Kau coastal waters, beginning near Keawanui Bay on the north boundary, and extending southward for approximately 150 miles to Ka'alu'alu Bay east of Ka Lae (South Point). The sites selected are within the 70' depth curve and within one-half mile of the shoreline. The ocean floor is composed of the bottom types as follow:

- (a) a solid or hard bottom or a massive rock surface;
- (b) Submerged field of large to massive boulders;
- (c) Cobbles or small boulders;
- (d) Hard bottom with sand pockets, the latter comprising generally less than 60% of the area of the designated formation;
- (e) Hard bottom with sand pockets comprising 60% or more of the formation; or, hard bottom with sand veneer; or sand bottom with numerous scattered rock boulders; and
- (f) Complex reef bottom consisting of mostly sand, but with limestone outcrops or boulders.

Each zone represents a heavily used diving and snorkeling site visited by public and commercial divers on a daily basis. Zones are described below with the site numbers of proposed mooring pins:

**Zone 1 (Proposed Site 1).** This area is known as Black Point and has an abundance of lava tubes and canyons with good three-dimensional topography and Christmas tree shaped coral pinnacles. It contains *Porites compressa* (finger coral), *P. lobata* (yellow-lobed coral), *Pocillopora*

*eydouxi* (giant finger coral), several types of *Montipora*, and *Pocillopora meandrina* (cauliflower coral).

**Zone 2 (Proposed Sites 2-6).** This area is known as "Kohala Estates". These sites have many coral formations similar to Zone 1, including a dome of plate coral (*Montipora verrucosa*). Dive sites in this area include "Red Hill," "North Kei," "Waiakailio Bay," "South Frog Rock," and "Pioneer Reef." The bottom is hard bottom with sand pockets comprising generally less than 60% of the area.

**Zone 3 (Proposed Sites 7-14).** This site is called Puako Reef. Puako Reef is a fringing reef extending 100-250 yds offshore at which point, the reef flat drops to a bottom of about 35', gradually sloping to a depth of 70' and deeper. The bottom is a complex reef bottom consisting of mostly sand, but with limestone outcrops or boulders. The reef is bounded in the north by Puako Bay (Proposed buoy 7) and in the south by Pauoa Bay (Proposed buoys 13 and 14).

**Zone 4 (Proposed Site 15).** This area is known as Honokaope Bay, just south of Mauna Lani Resort. The bottom is characterized by a hard bottom with sand pockets, which comprise generally less than 60% of the area. The area has some coral formations, including *Porites compressa* (finger coral), and *P. lobata* (yellow-lobed coral). The bottom slopes gradually from 30' to 60', then more rapidly outside the bay to 80' + with more sand flats.

**Zone 5 (Proposed Sites 16-19).** This area is locally known as "A Bay" and "Pentagon." It has one of the most interesting lava tube formations on the Kona Coast. The bottom is flat with underlying, interconnected lava tubes.

**Zone 6 (Proposed Sites 20-21).** This area is known as Keawaiki Bay. The bay has a bottom averaging 35' depth with a hard bottom with sand veneer and numerous scattered rock boulders.

**Zone 7 (Proposed Sites 22-28).** This area is known as Kiholo or "Turtle Bay." Kiholo Bay is a large bay with shoreline cliffs at the northern boundary and 30' waters close to shore, sandy bottom on a pahoehoe veneer with boulders (Buoys 22-23); inner lagoon area, shallow with sandy bottom where turtles frequent (no buoys in shallow areas); and a southern section (Buoys 24-28) with a hard bottom with sand pockets comprising 60% or more of the area with a few scattered boulders. Corals include *Porites compressa* (finger coral), and *P. lobata* (yellow-lobed coral).

**Zone 8 (Proposed Site 29).** This area is known as Kaupulehu or Kona Village. The reef flat is relatively shallow here (25-35'), extending perhaps 1000 yds. offshore. It is a rocky hard bottom, with numerous holes and small tubes. Corals include *Porites compressa* (finger coral), *P. lobata* (yellow-lobed coral), *Montipora* (bracket or plate coral), and *Pocillopora meandrina* (cauliflower coral).

**Zone 9 (Proposed Sites 30-35).** This area has similar bottom characteristics, so they are grouped together. The bays are known as Kukio, Kua, Awakee, Makalawena and Mahaiula. The bottom is shallow 30'-40' deep gradually dropping to 60'-70', then steeper dropoff into deeper waters with sandy bottom. It is a rocky hard bottom, with numerous pukas and small tubes. Corals include *Porites compressa* (finger coral), *P. lobata* (yellow-lobed coral), and *Pocillopora meandrina* (cauliflower coral).

**Zone 10 (Proposed Site 36).** This area is known as "Airplane Wreck." It lies in 70' of water with rock ledges, overhangs and a variety of corals including *Porites compressa* (finger coral), *P. lobata* (yellow-lobed coral), *Montipora* (bracket or plate coral), and *Pocillopora meandrina* (cauliflower coral). The bottom drops off steeply to great depths just out from the wreck.

**Zone 11 (Proposed Sites 37-38).** This area is known as Keahole Point. The bottom drops rather steeply from the shore to 80' + deep water with a narrow shelf at about 45'. There are rock ledges, boulders, and rocky bottom with some corals. At the proposed site for 37, there are pinnacles and boulders with many heads of *Pocillopora meandrina* (cauliflower coral), and encrusting corals. The depth ranges from 15'-50' with a radical dropoff from 50' to 100'+. At the site for 38, there are boulders, crevices, encrusting corals and a sand spit starting at about 20' depth, running to over 100' depth. There is a garden eel colony at about 40' (this is possibly the shallowest garden eel colony known in Hawaii).

**Zone 12 (Proposed Site 39).** This area is known as "Golden Arches." The specific site is called "Dottie's Reef." With a bottom depth of about 45', dropping rather rapidly to 80'+, there are numerous rock ledges and boulders in the narrow shelf close to shore. There are lava tube canyons, arches, steep pinnacles, dropoffs, and an abundance of corals and fish.

**Zone 13 (Proposed Sites 40-42).** This area is known as Honokohau with sites on the north called "Turtle Pinnacle" and on the south of the Bay known as "Manta Ray Beach." This area is outside the entrance to Honokohau Harbor with a bottom of hard pahoehoe covered with some sand and boulders. There are some shallow reef flat dropping into 35' waters which have some pinnacles surrounded by sandy areas. The northern area is directly offshore the Kaloko Honokohau National Historical Park.

**Zone 14 (Proposed Sites 43-46).** The northern part of this zone is known as "Kaiwi Point" and the southern part is known as "Old Airport." These sites area characterized by abundant types of coral, lava tubes, arches, pinnacles, and dramatic dropoffs. Note that Buoys 45-46 are proposed for the area now designated as the Old Kona Airport Marine Life Conservation District.

**Zone 15 (Proposed Sites 47-50).** This zone consists of the coastal waters just off Alii Drive. The individual sites are "Alii Villas," "Kona Makai," "Royal Seacliff," and "Laaloa Lava Tube." This area consists of a sandy bottom, caves, arches, lava formations, and a shallow ledge dropping off rapidly to 80'+. There is lush coral growth with *Tubastraea coccinea* (soft corals), *Porites compressa* (finger coral), *P. lobata* (yellow-lobed coral), *Montipora* (bracket or plate coral), and *Pocillopora meandrina* (cauliflower coral).

**Zone 16 (Proposed Sites 51-52).** This area is known as Keauhou Bay. The northern site (Buoy 51) is characterized by huge mushroom coral heads (*Fungia scutaria*) on a sandy bottom gradually going from about 30' to 80', after which point it drops off steeply. There is a manta ray cleaning stations here. At the southern part of the bay, off the Kona Surf Hotel, it is a hard bottom with scattered large boulders and some pinnacles. The bottom slopes gradually from 10'-30' close to shore for 50 yds, then drops gradually from 30' to 80', then rapidly drops off to deeper waters.

**Zone 17 (Proposed Sites 53-58).** This area is known as Kealakekua Bay. Buoys 56-57 are proposed within the Kealakekua Bay Marine Life Conservation District. Buoys 53-57 are along the northern part of the bay around Cook Point. There is a narrow shelf close to shore at about 35-50' deep. There are abundant corals and fish on a hard bottom with a few scattered boulders. The dropoff is spectacular in the exceptionally pristine waters of the Bay to depths of over 200'. There are encrusting coral, caves, crevices and ledges in waters up to about 45' deep. On the southern part of the bay, (Buoy 58), there is a narrow shelf with the tips of long pahoehoe lava flows. There is encrusting corals in the shallower waters up to about 35' with some pinnacles and canyons and a spectacular dropoff.

**Zone 18 (Proposed Site 59).** This is an area known as Keei [or Mokuakae] Bay, just north of Keomo Pt. There is a narrow shelf close to shore with the tips of long pahoehoe lava flows. There is encrusting corals in the shallower waters up to about 35' with some pinnacles and canyons and a steep dropoff to 80'+.

**Zone 19 (Proposed Site 60).** This is an area known as Honaunau. The bay is has a shallow shelf close to shore with the tips of long pahoehoe lava flows. There is encrusting corals in the shallower waters up to about 35' with some pinnacles and canyons. In these areas, other corals flourish. The bottom of the bay is sandy with some boulders scattered. Note that the buoy should be submerged so there is no visual impact on the Pu'uhonua o Honaunau National Historical Park.

**Zone 20 (Proposed Sites 61-62).** This is an area known as the "First Lava Flow." There is a narrow shelf close to shore with the tips of long pahoehoe lava flows. There is encrusting corals in the shallower waters up to about 40' with some pinnacles and canyons and a steep dropoff to 80'-100'+. Corals such as *Porites lobata* (yellow-lobed coral), *Montipora* (bracket or plate coral), and *Pocillopora meandrina* (cauliflower coral) are found here.

**Zone 21 (Proposed Sites 63-64).** This is an area south of the Second Lava Flow, and north of the Third Lava Flow, in an area known as Opihihale. Dive sites are sometimes called "Pinnacles." This environment is very similar to Zone 20 with larger pinnacles and canyons.

**Zone 22 (Proposed Sites 65-71).** This is the area north and south of Miloli'i. Buoys 65-66 are located in Papa Bay, with encrusting corals in the shallower waters up to about 35' where there are some pinnacles and canyons. In these areas, other corals flourish. The bottom of the bay is sandy with some boulders scattered. The areas further south, fronting the Miloli'i area

(Buoys 67-69), and continuing to Honomalino (Buoy 70) and in Okoe Bay (Buoy 71) are similar in bottom environmental characteristics.

**Zone 23 (Proposed Sites 72-74).** This is an area known as Manuka and is characterized by a narrow coastal shelf with pahoehoe flows, terminating with dropoffs to 40'. On the faces and in the canyons, corals abound, including *Porites lobata* (yellow-lobed coral), *Montipora* (bracket or plate coral), and *Pocillopora meandrina* (cauliflower coral). The bottom, which is a hard bottom with some sand, and boulders with some corals growth, drops gradually to 80' and then rapidly to 100'+.

**Zone 24 (Proposed Sites 75-76).** This area is known as Kauna Point. The pinnacles in this area are prominent, just out from a narrow pahoehoe coastal shelf with canyons, tubes, and arches. The bottom is hard lava veneer with some sand that drops off quickly to 100'+.

**Zone 25 (Proposed Site 77).** This is an area known as Keawaiki and is characterized by a narrow coastal shelf with pahoehoe flows, terminating with dropoffs to 45'. On the faces and in the canyons, corals abound, including *Porites lobata* (yellow-lobed coral), *Montipora* (bracket or plate coral), and *Pocillopora meandrina* (cauliflower coral). The bottom, which is a hard bottom with some sand, and boulders with some corals growth, drops gradually to 80' and then rapidly to 100'+.

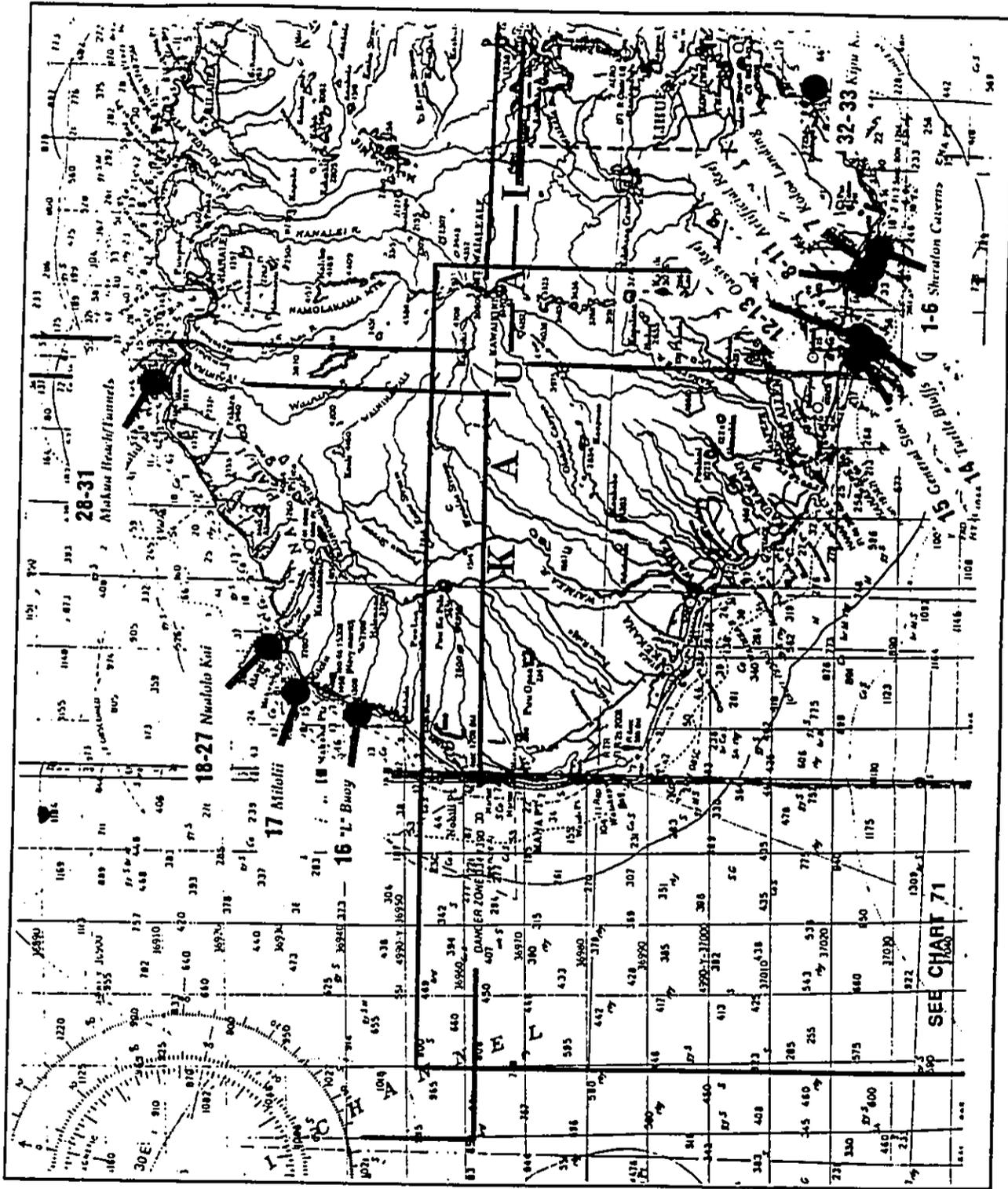
**Zone 26 (Proposed sites 78-82).** This is an area known as Kahuku. The pinnacles in this area are prominent, just out from a narrow pahoehoe coastal shelf with canyons, tubes, and arches. The bottom is hard lava veneer with some sand that drops off quickly to 100'+.

**Zone 27 (Proposed Sites 83-91).** This is an area known as Ka Lae, or South Point. There is a very narrow pahoehoe shelf adjacent to shore with lava tubes, caves, arches and canyons. There is some coral growth in protected areas including *Porites lobata* (yellow-lobed coral) and some *Montipora* (bracket or plate coral). At the extreme southern tip of Ka Lae, Buoys 86-91 are all close to the fish ladders.

**Zone 28 (Proposed Sites 92-94).** This is an area also known as Ka Lae, or South Point. This area differs from Zone 27 due to the fact it is the windward side of the point with higher surf, therefore less coral growth. However in these three bays, Kaulana Bay, Mahana Bay, and Ka'alu'alu Bay, there is some protection. The narrow coastal pahoehoe shelf has some tubes and canyons. This drops down to 40' on a hard bottom with some sand, and boulders with some corals growth. This in turn drops gradually to 80' and then rapidly to 100'+.

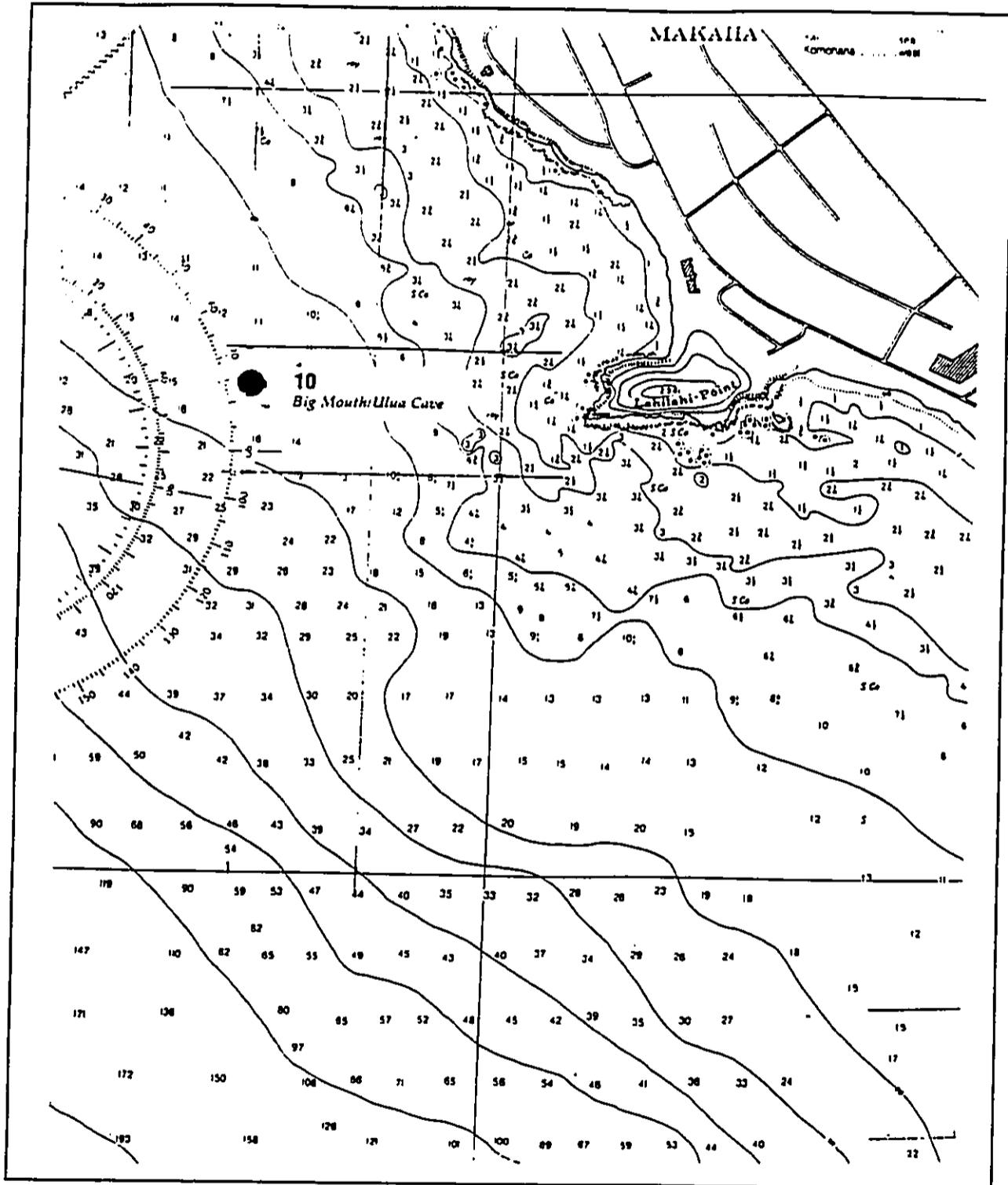
**APPENDIX C**  
**LOCATION MAPS**

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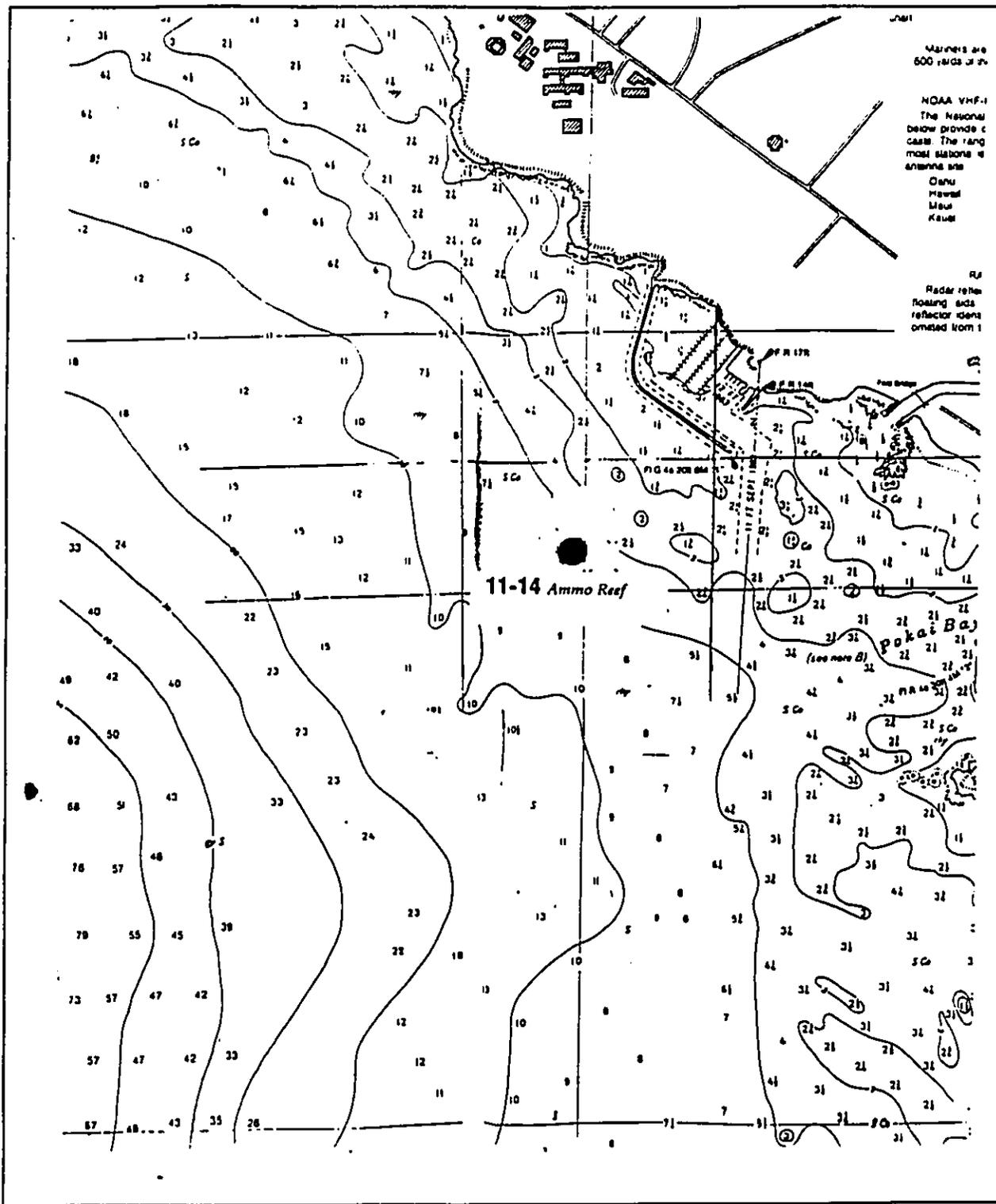


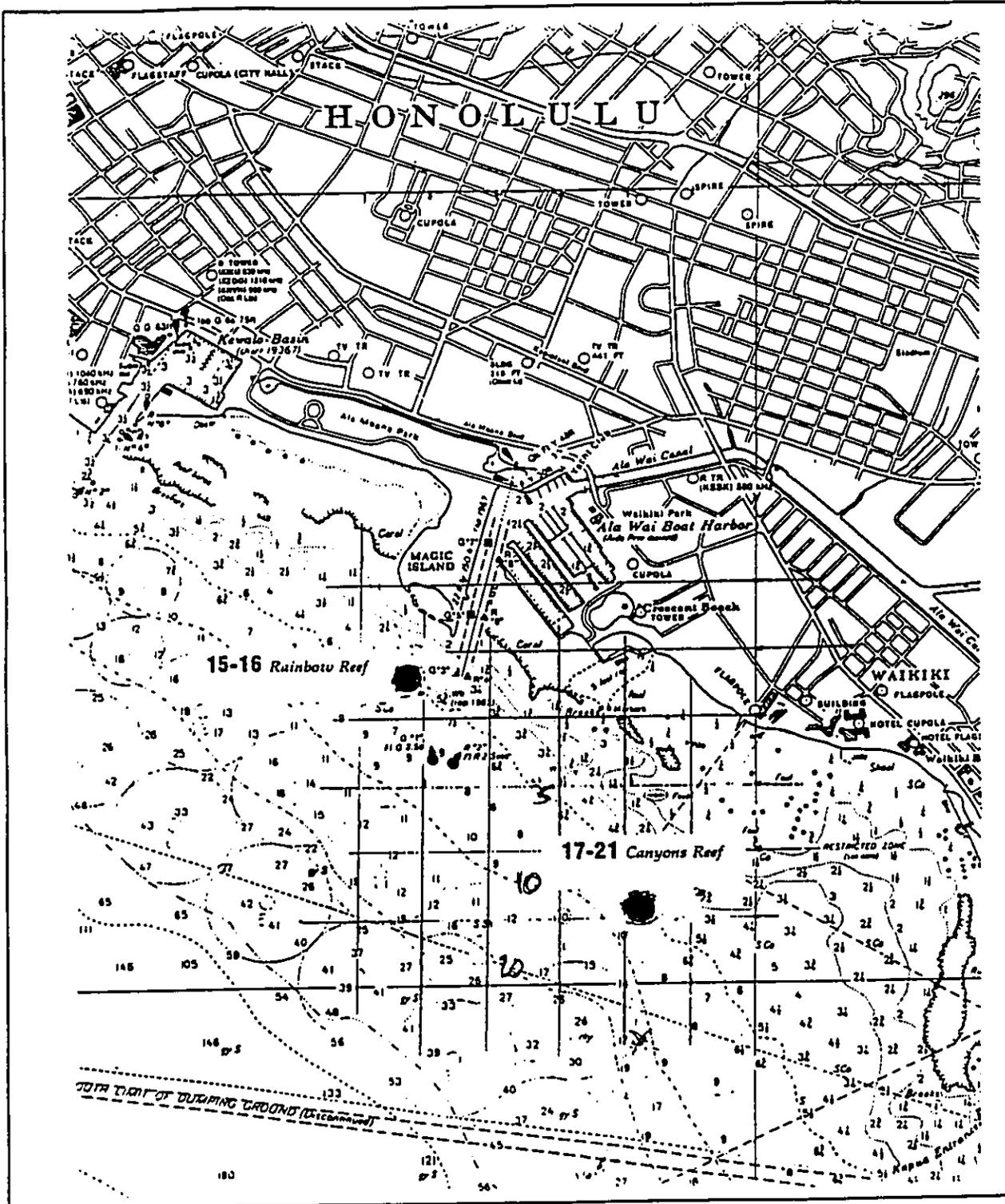


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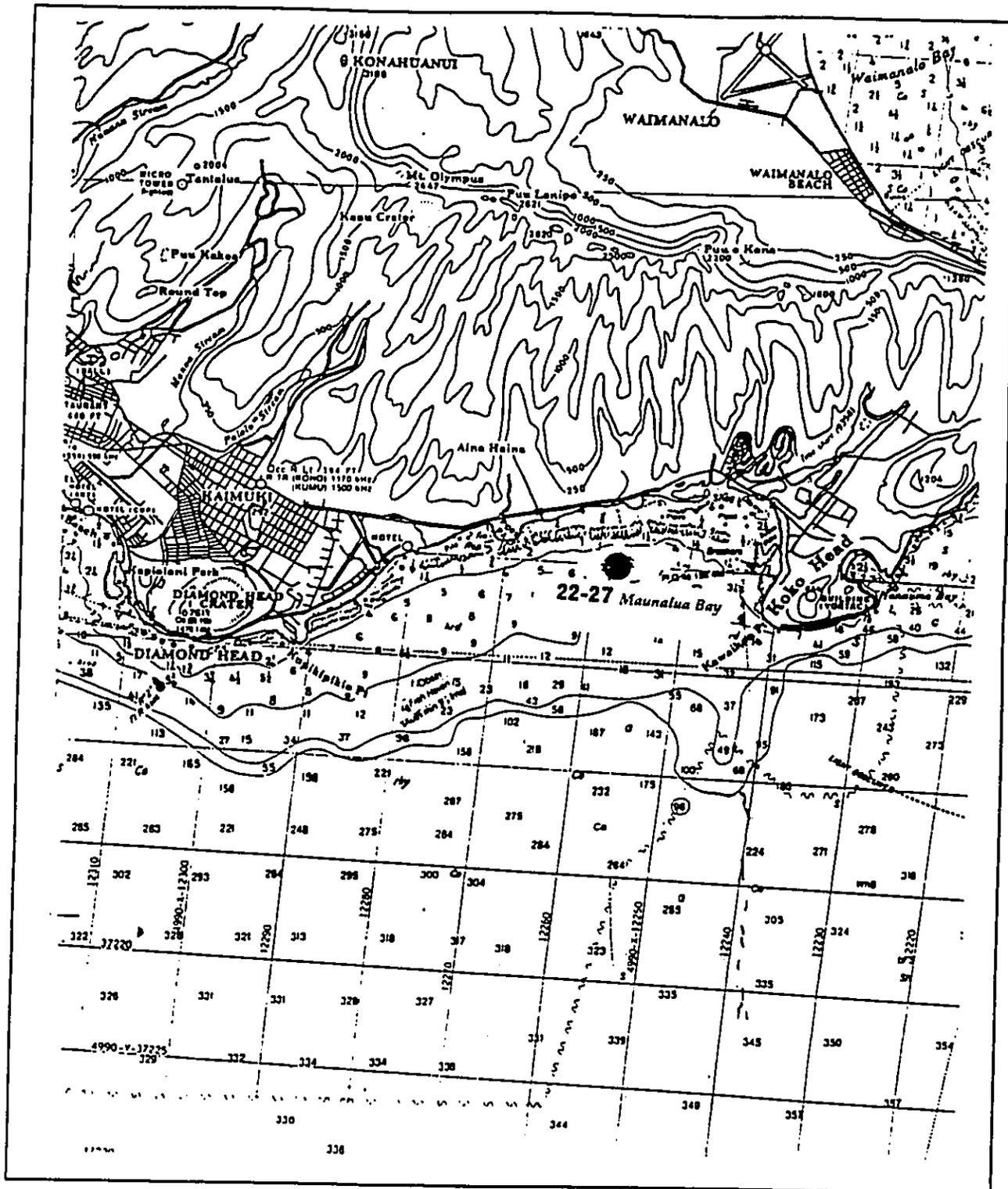


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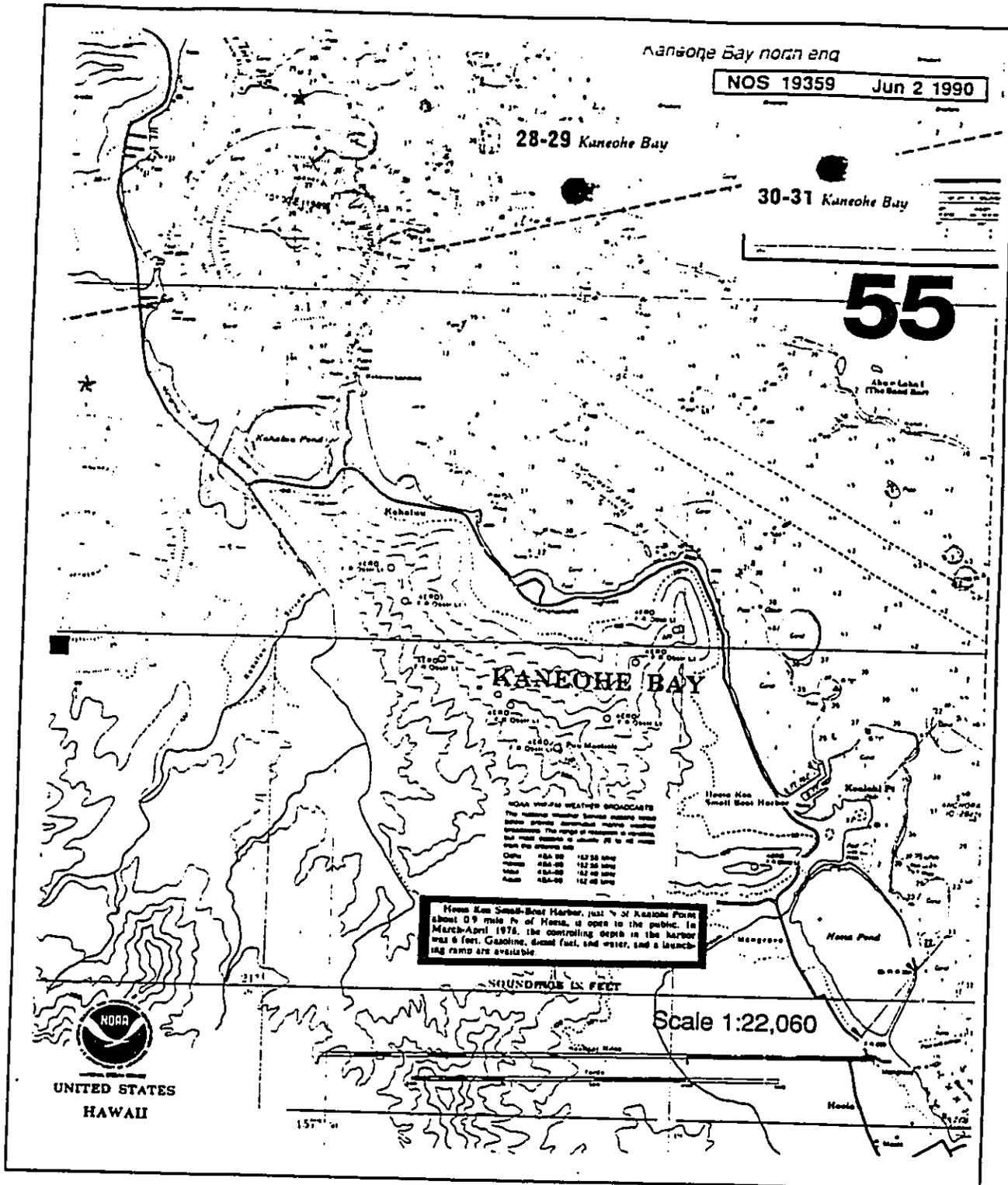




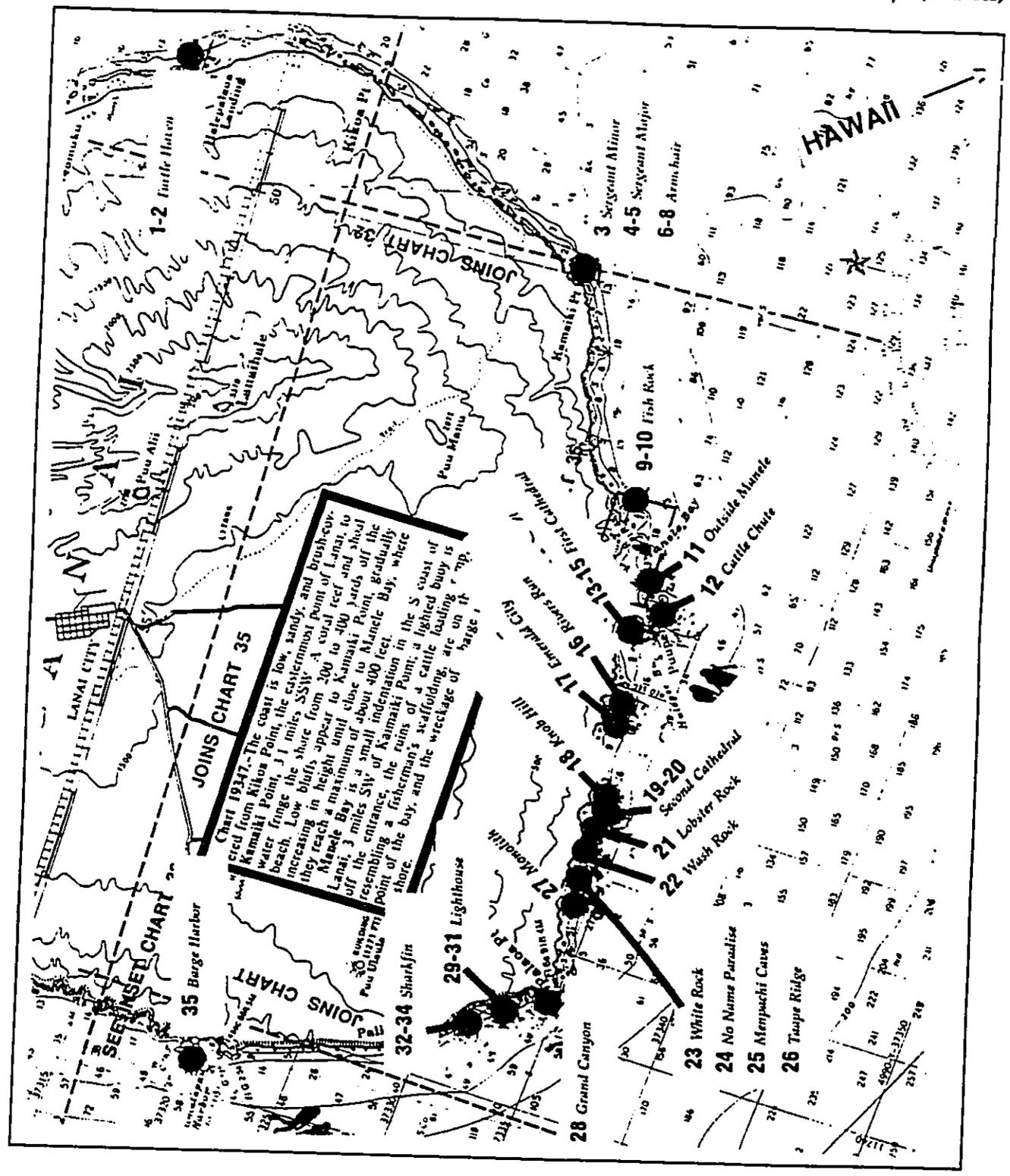
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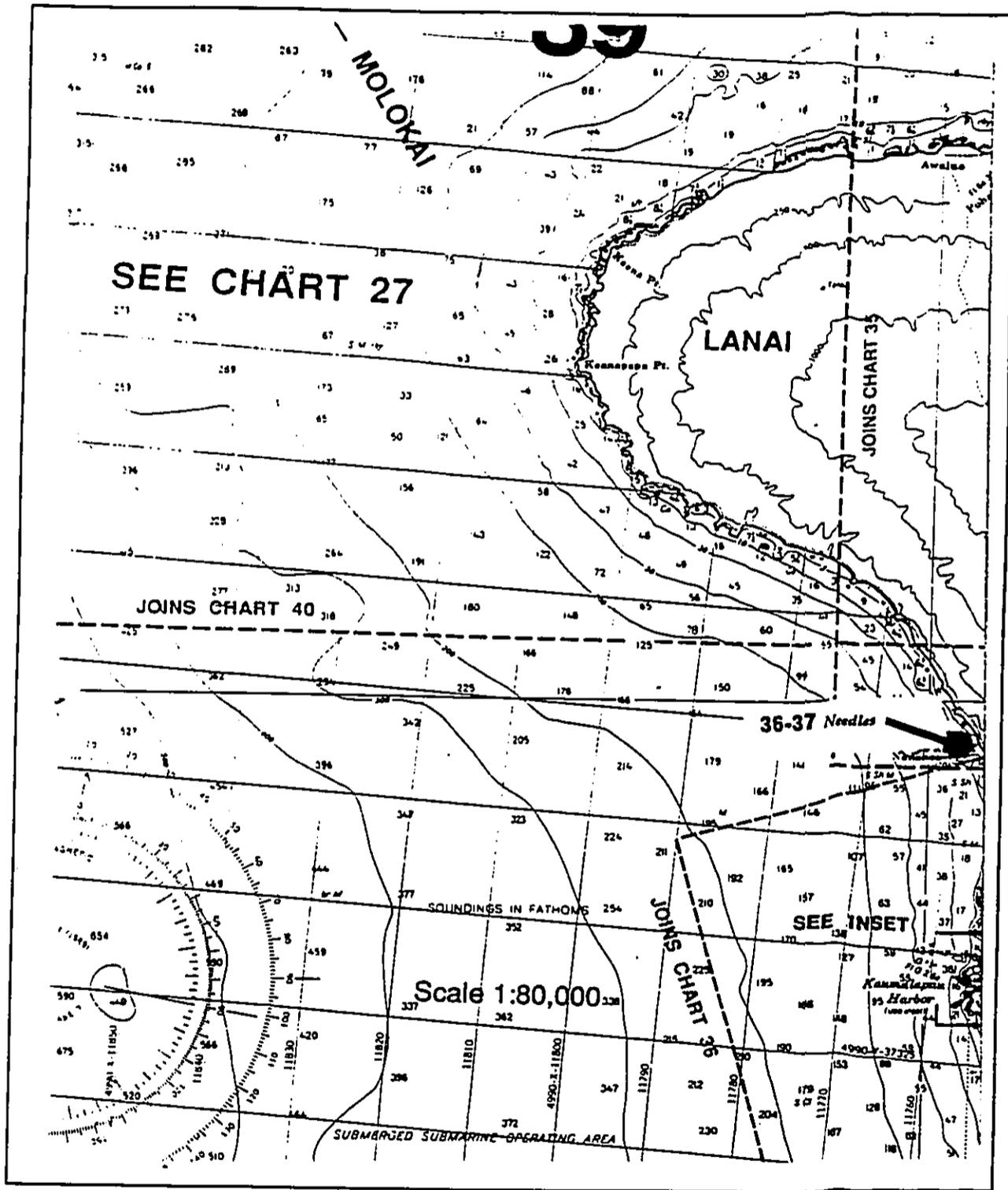
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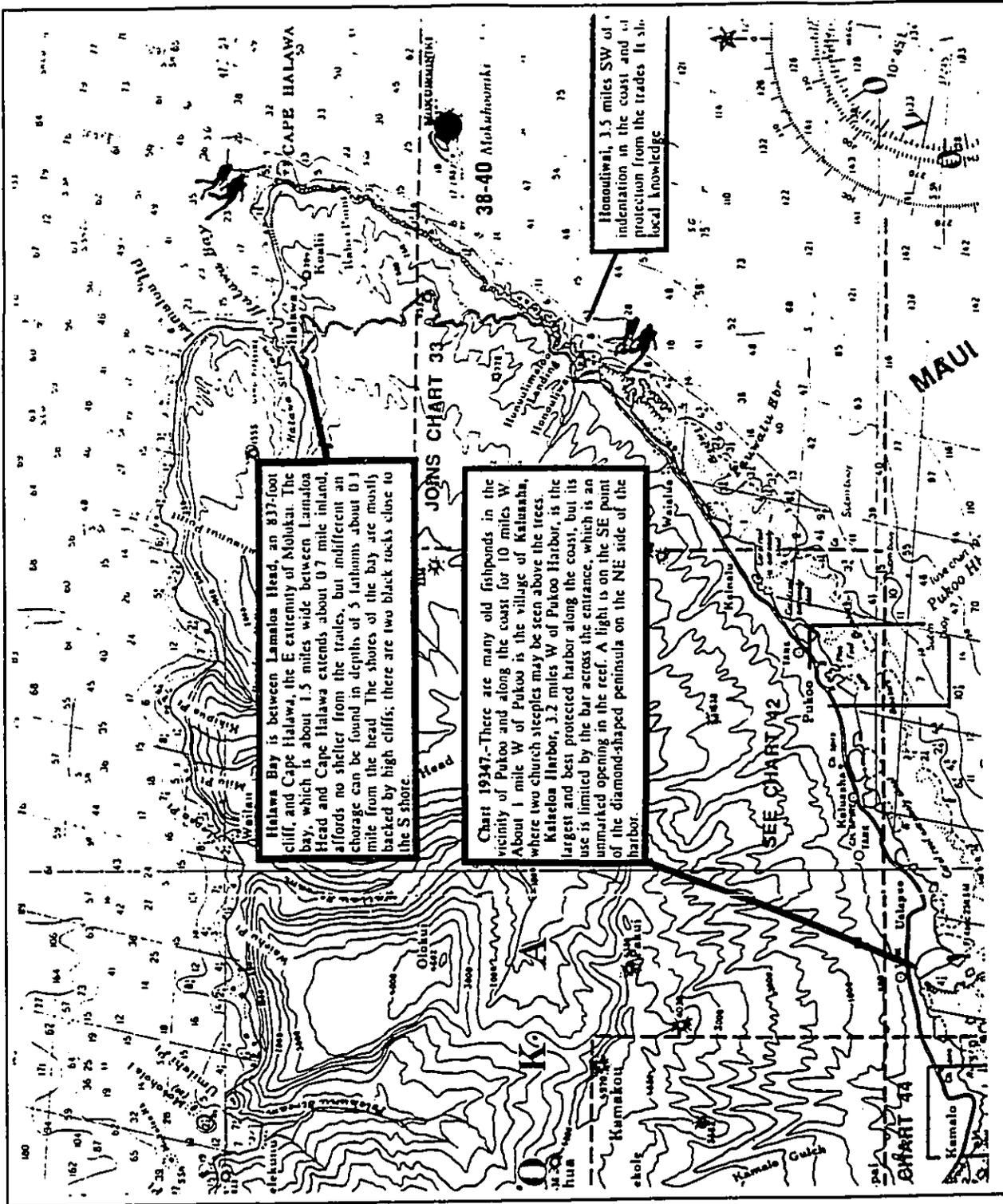


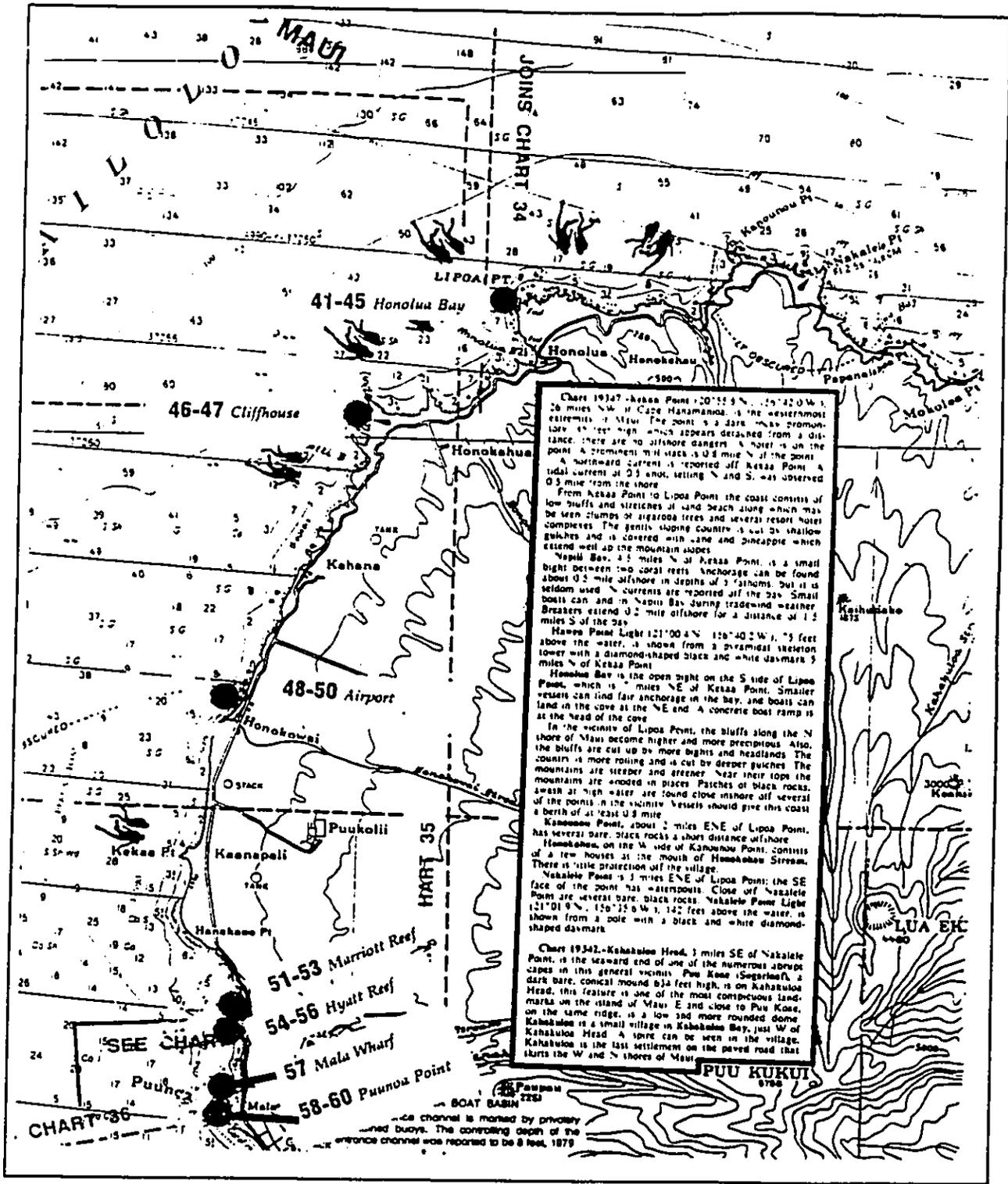
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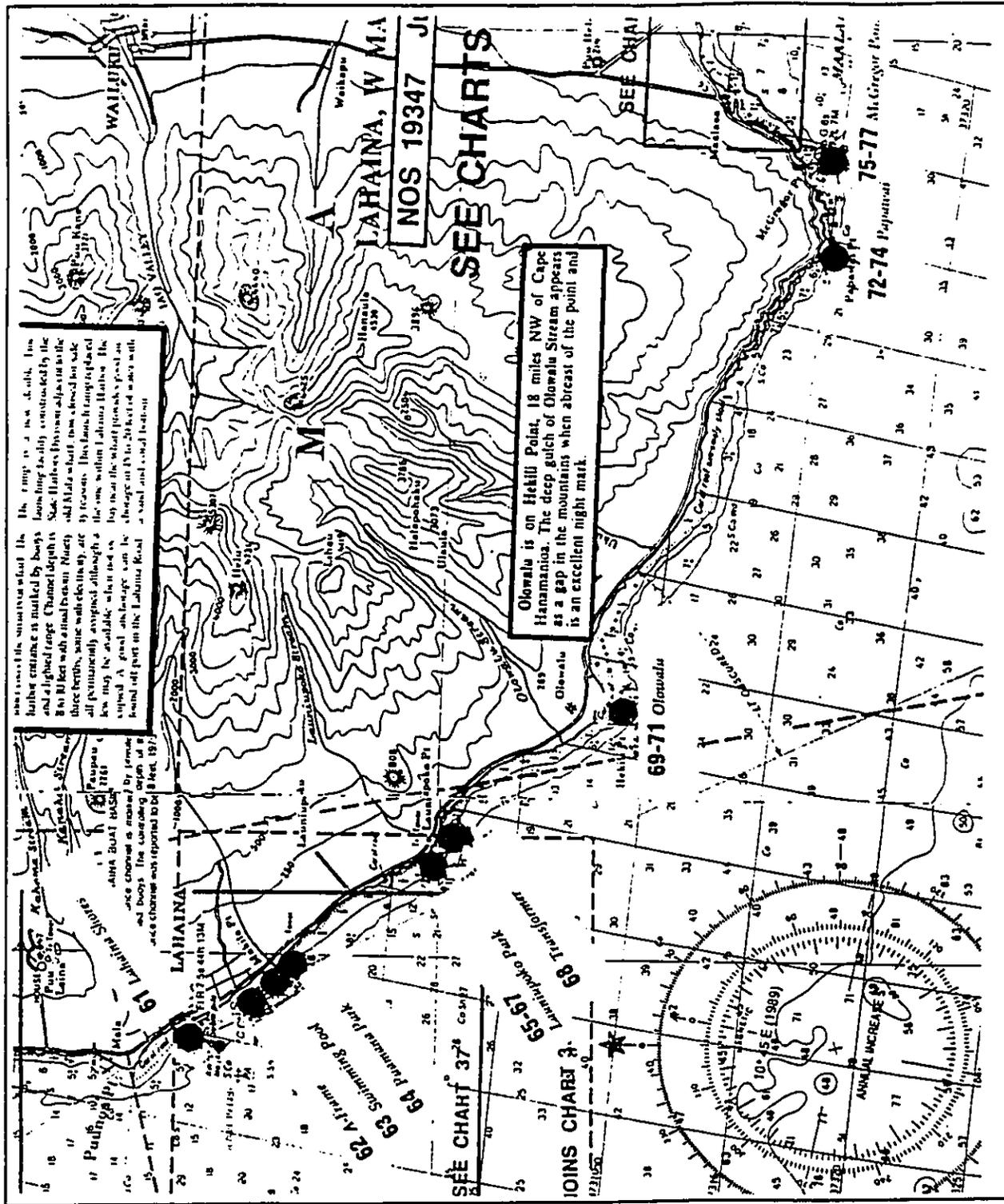
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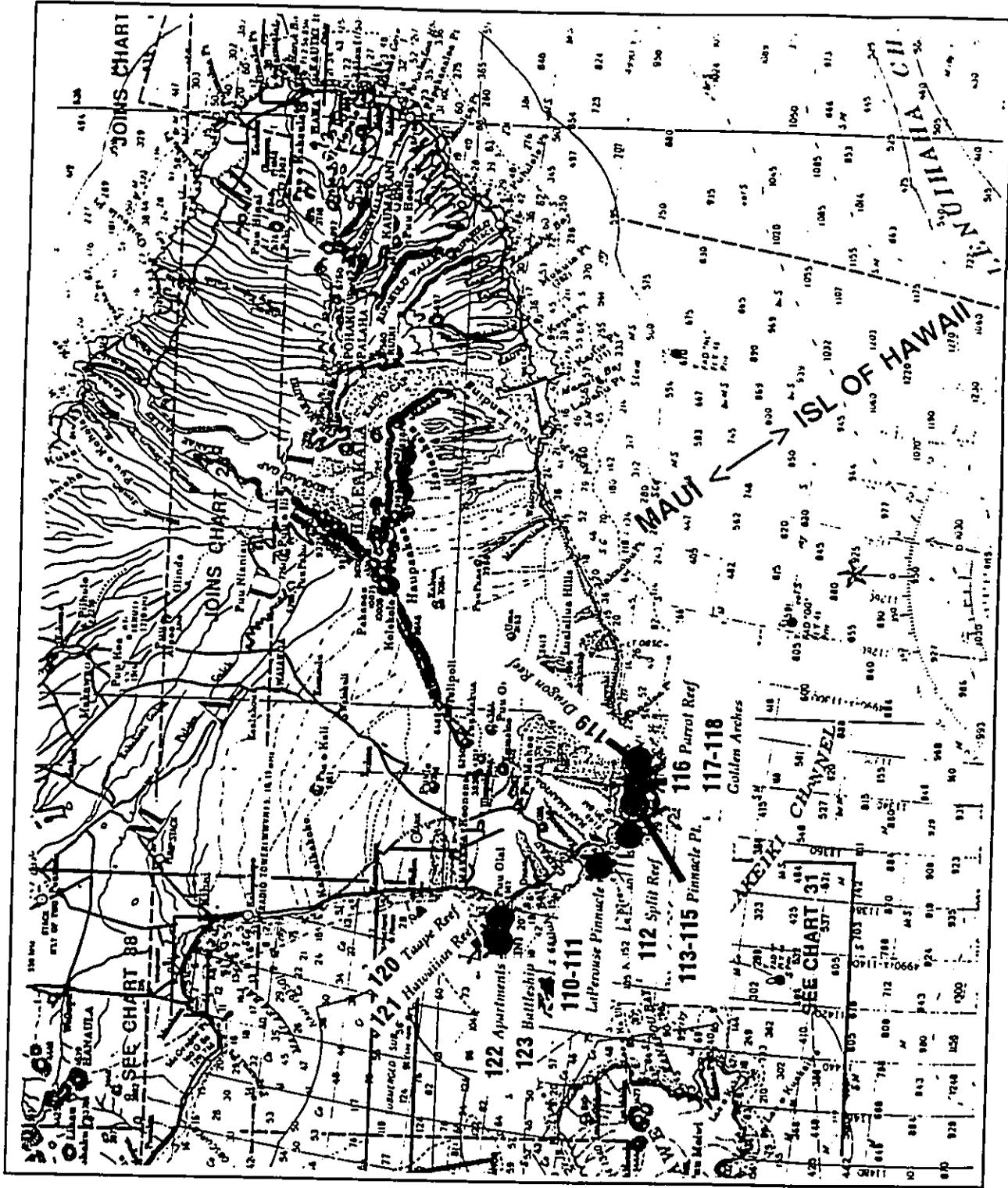






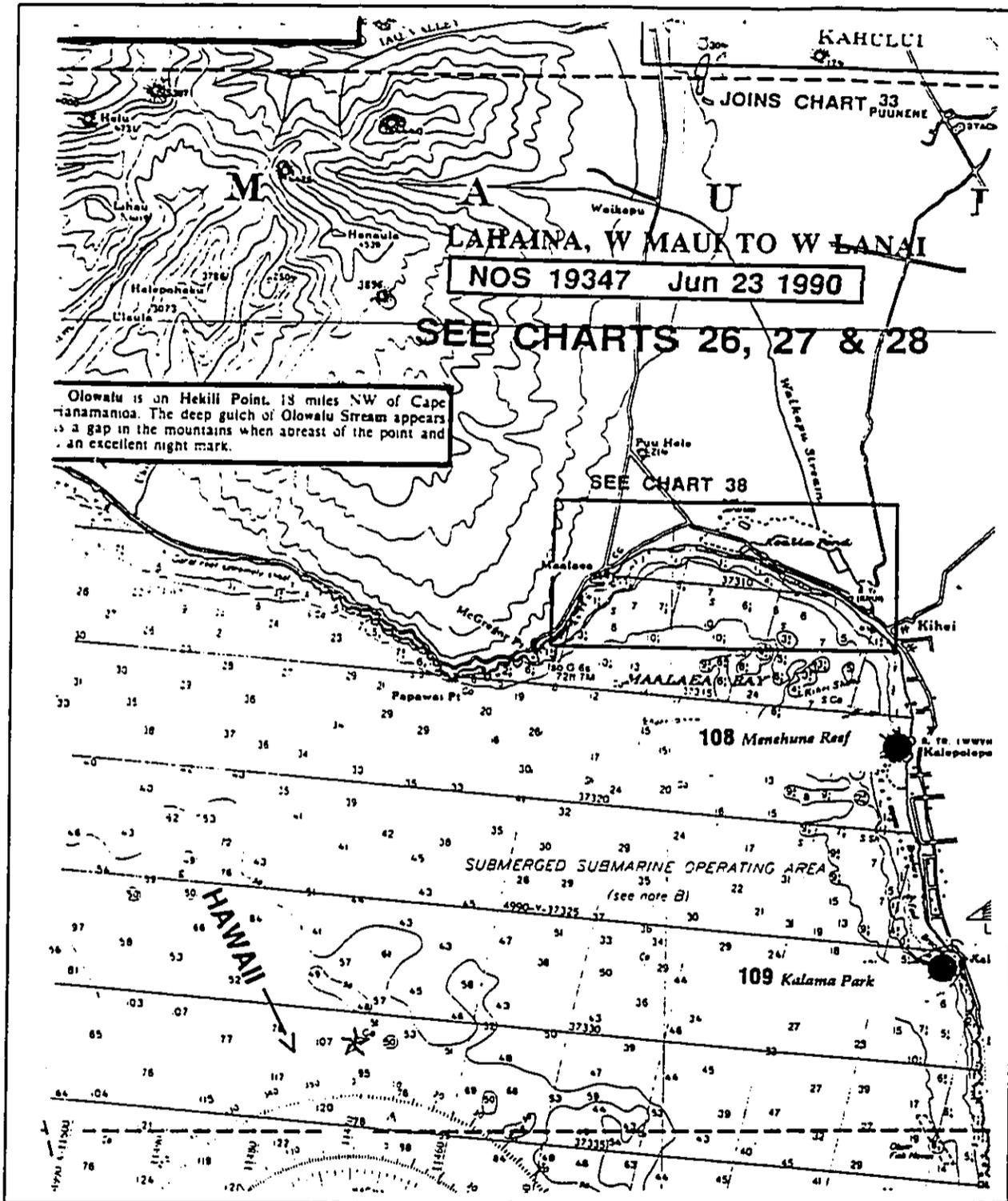
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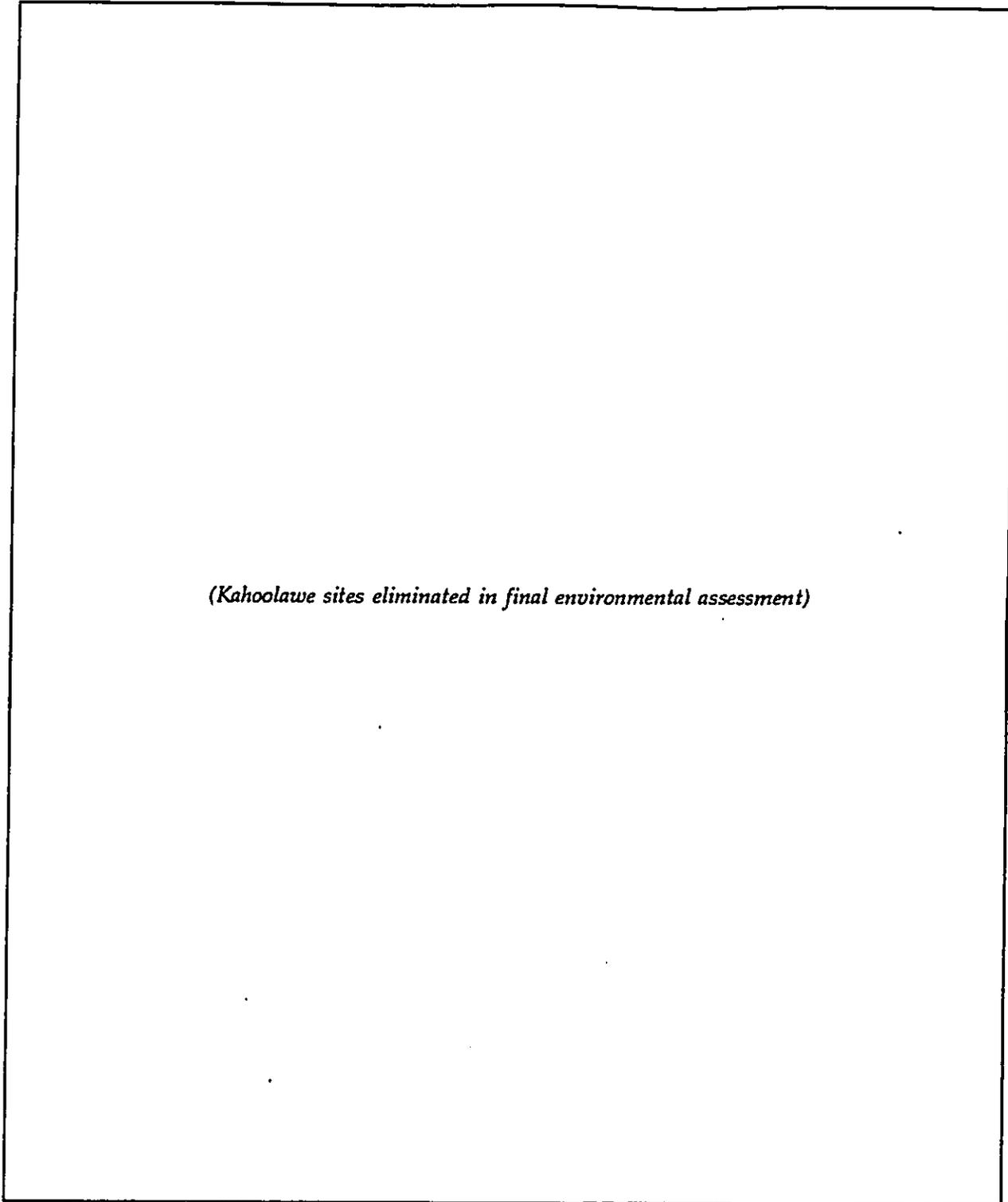


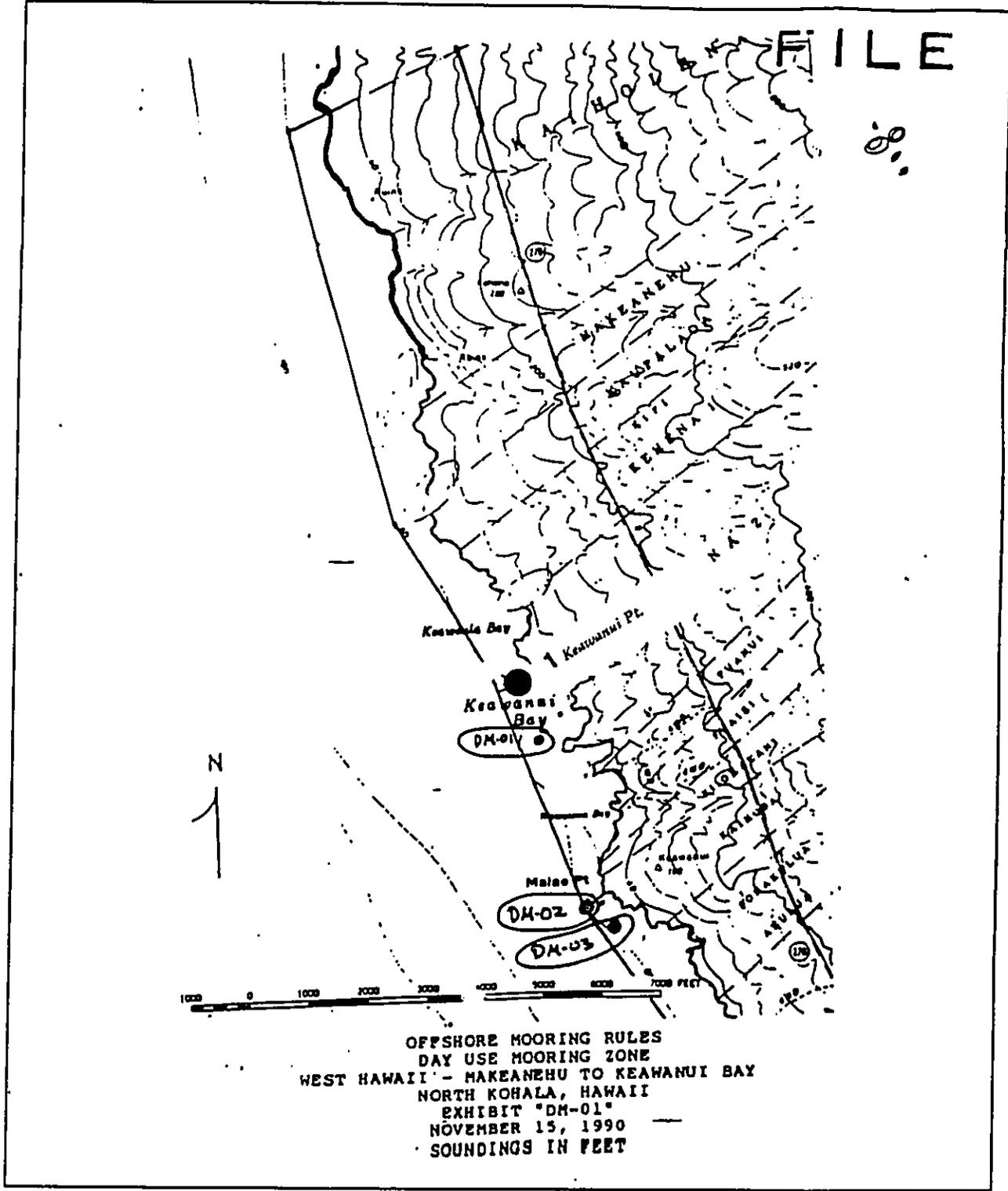


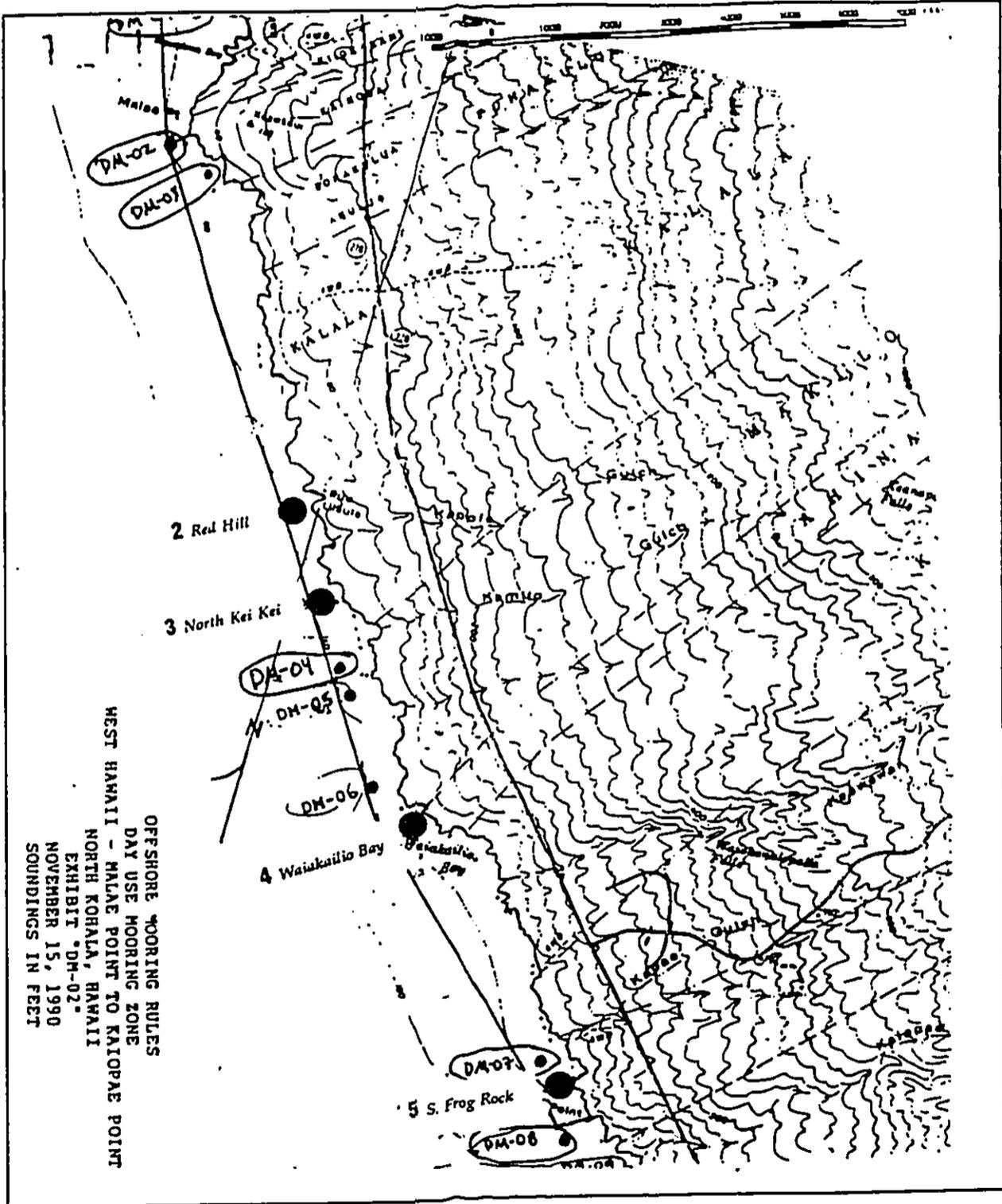


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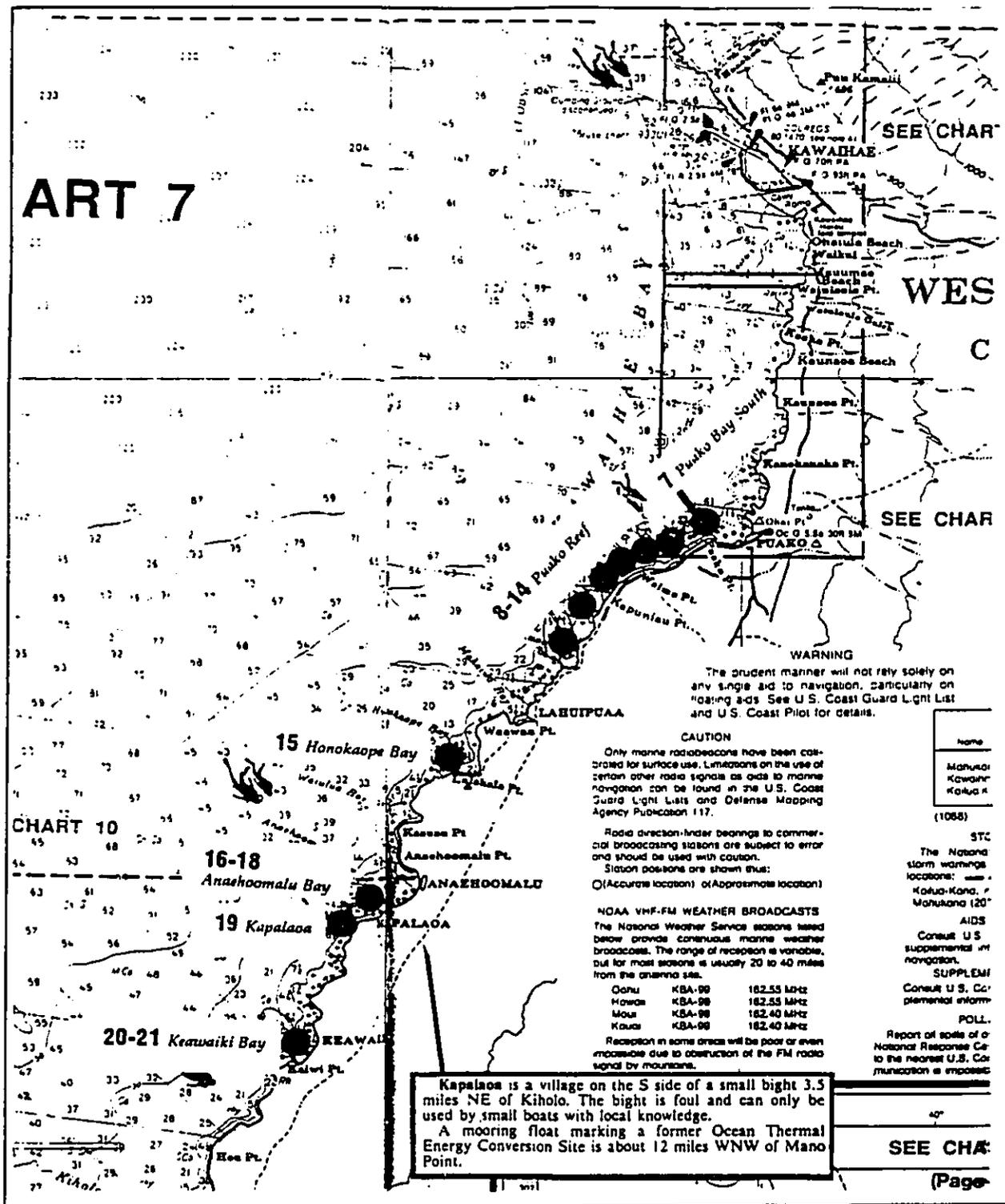




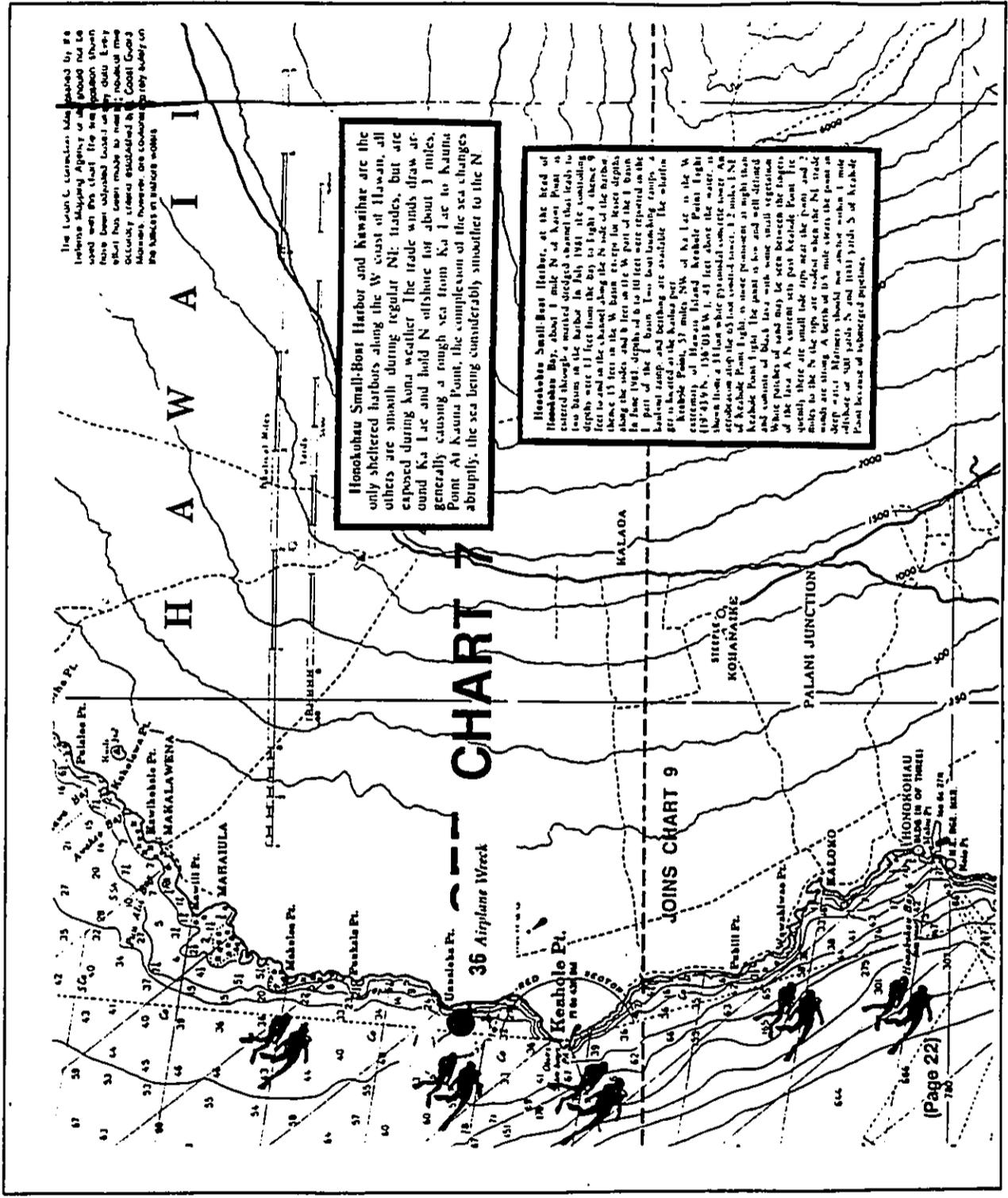










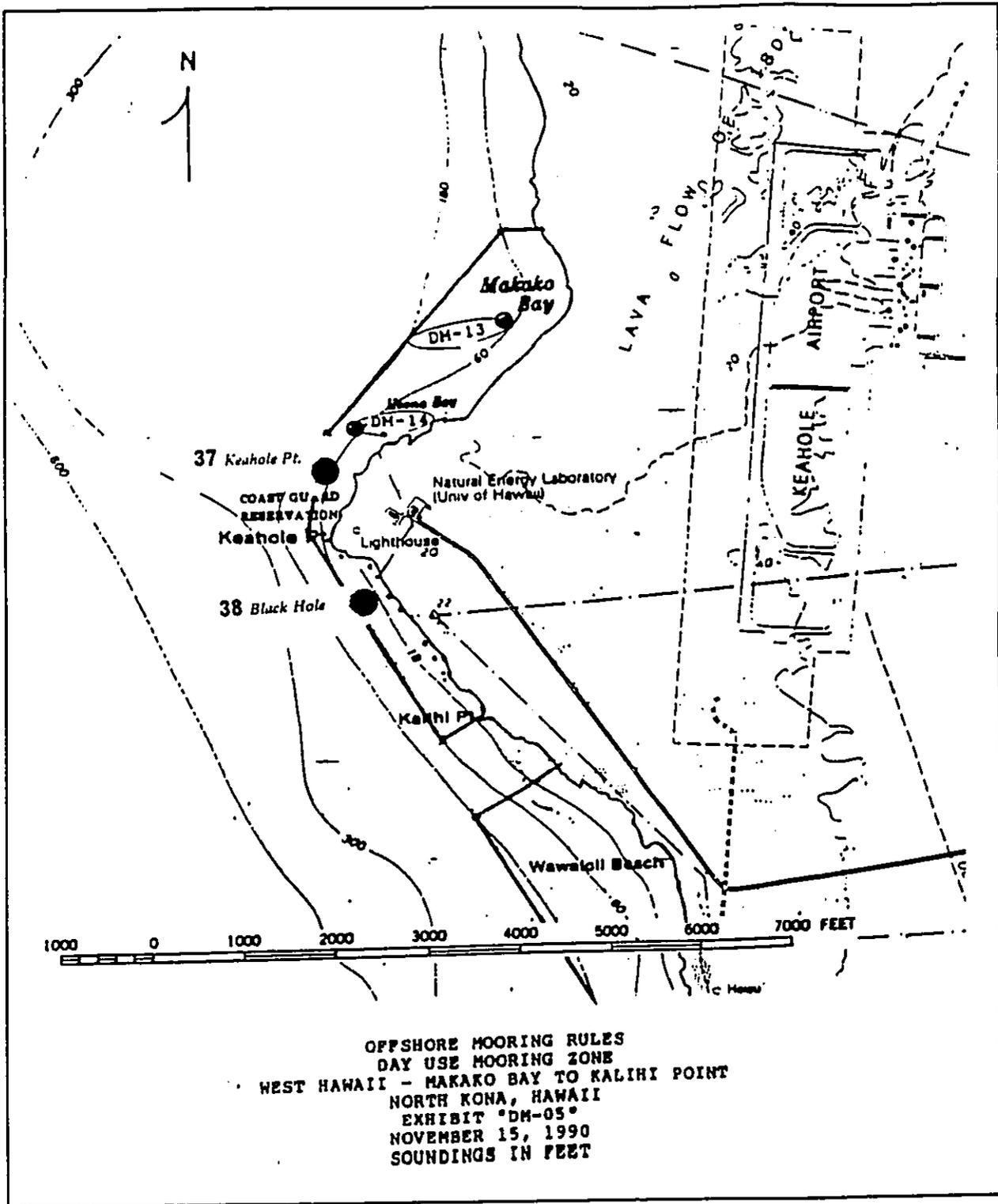


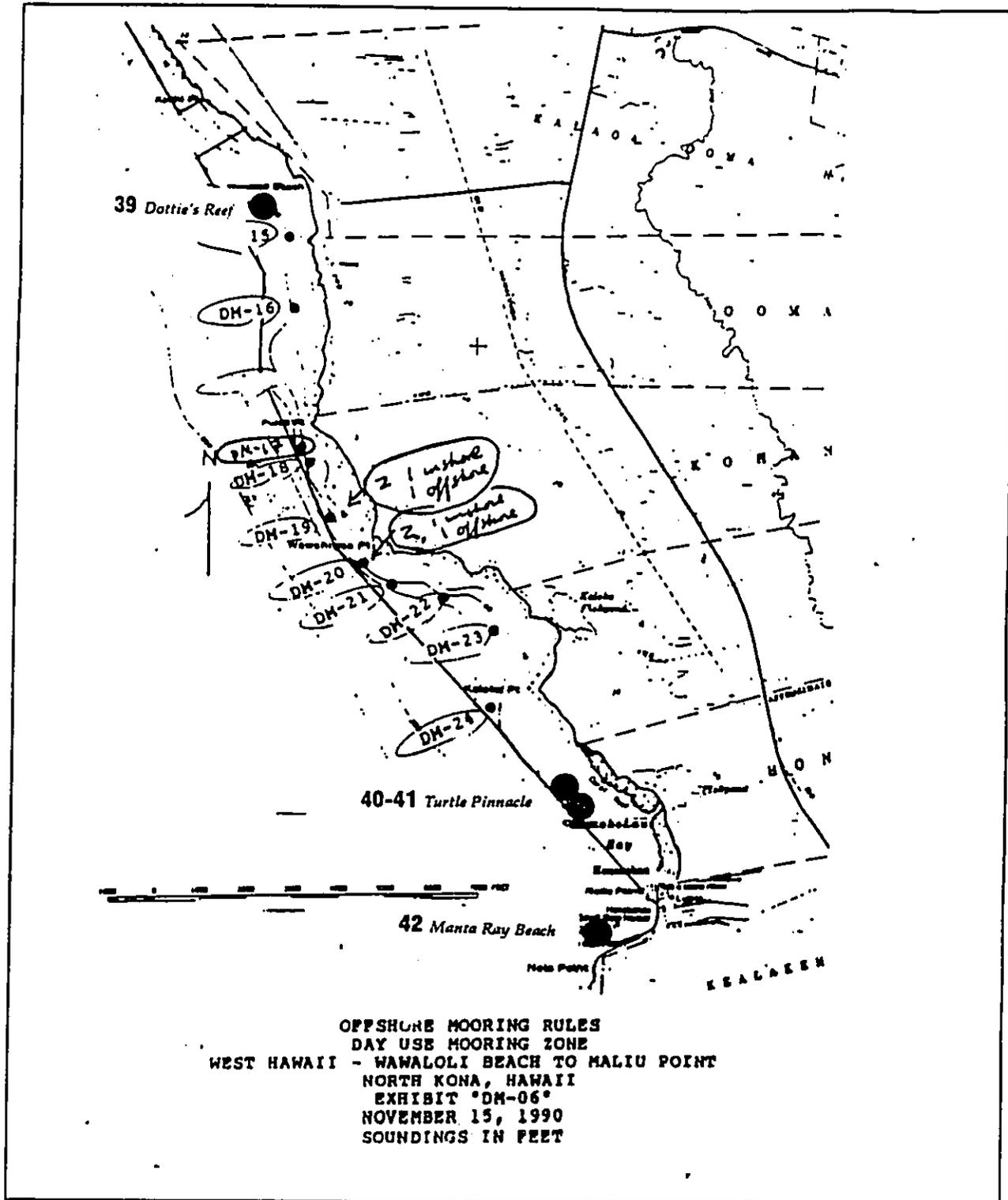
The Loran C. correction Map issued by the Hydrographic Agency of the United States has been updated based on the data from the Loran C. stations established in the Coast Guard Marine Survey. The Loran C. stations are shown on the map in various colors.

Honokohau Small Boat Harbor and Kawaihau are the only sheltered harbors along the W coast of Hawaii, all others are smooth during regular NE trades, but are exposed during kona weather. The trade winds draw around Ka Lae and hold N offshore for about 3 miles, generally causing a rough sea from Ka Lae to Kaunua Point. At Kaunua Point, the complexion of the sea changes abruptly, the sea being considerably smoother to the N.

Honokohau Small Boat Harbor, at the head of Honokohau Bay, about 1 mile N of Kawaihau Point is a marked dredged channel that leads to a bay about 1/2 mile long. The depth of the channel is 13 feet in the N part, 11 feet in the S part, and 8 feet in the W part. The harbor is about 1/2 mile long and 1/2 mile wide. The harbor is generally smooth during regular NE trades, but is exposed during kona weather. The trade winds draw around Ka Lae and hold N offshore for about 3 miles, generally causing a rough sea from Ka Lae to Kaunua Point. At Kaunua Point, the complexion of the sea changes abruptly, the sea being considerably smoother to the N.

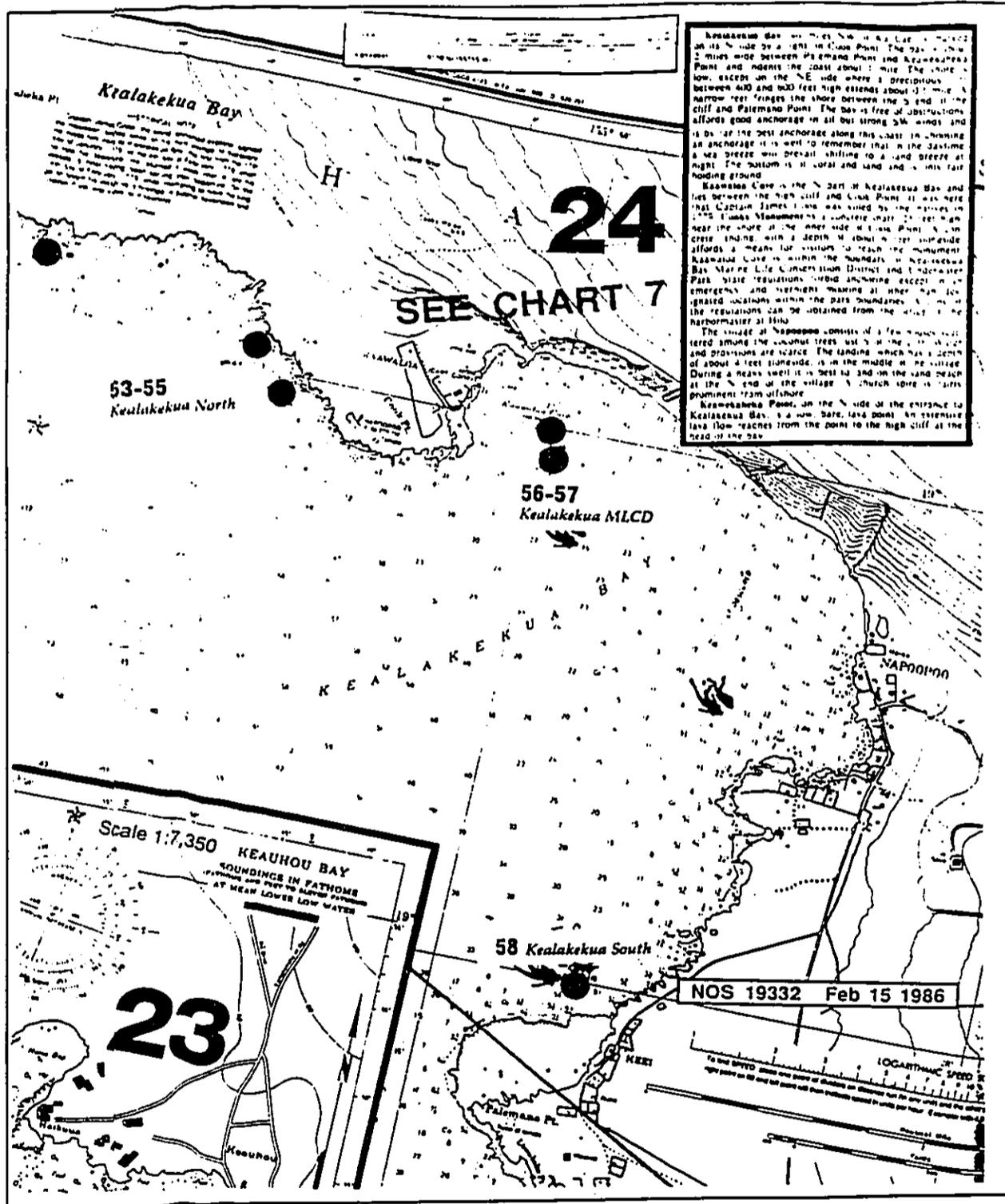
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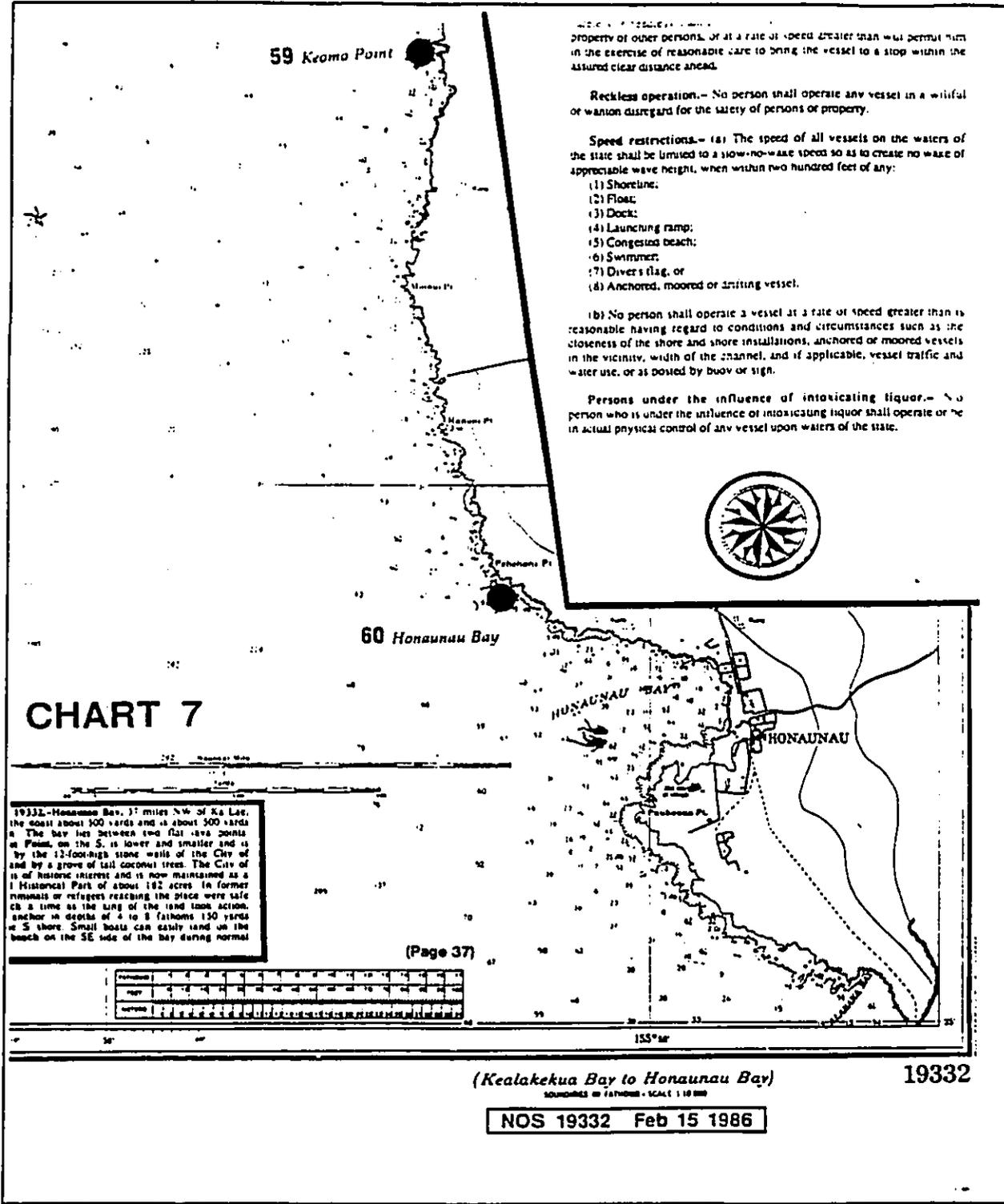


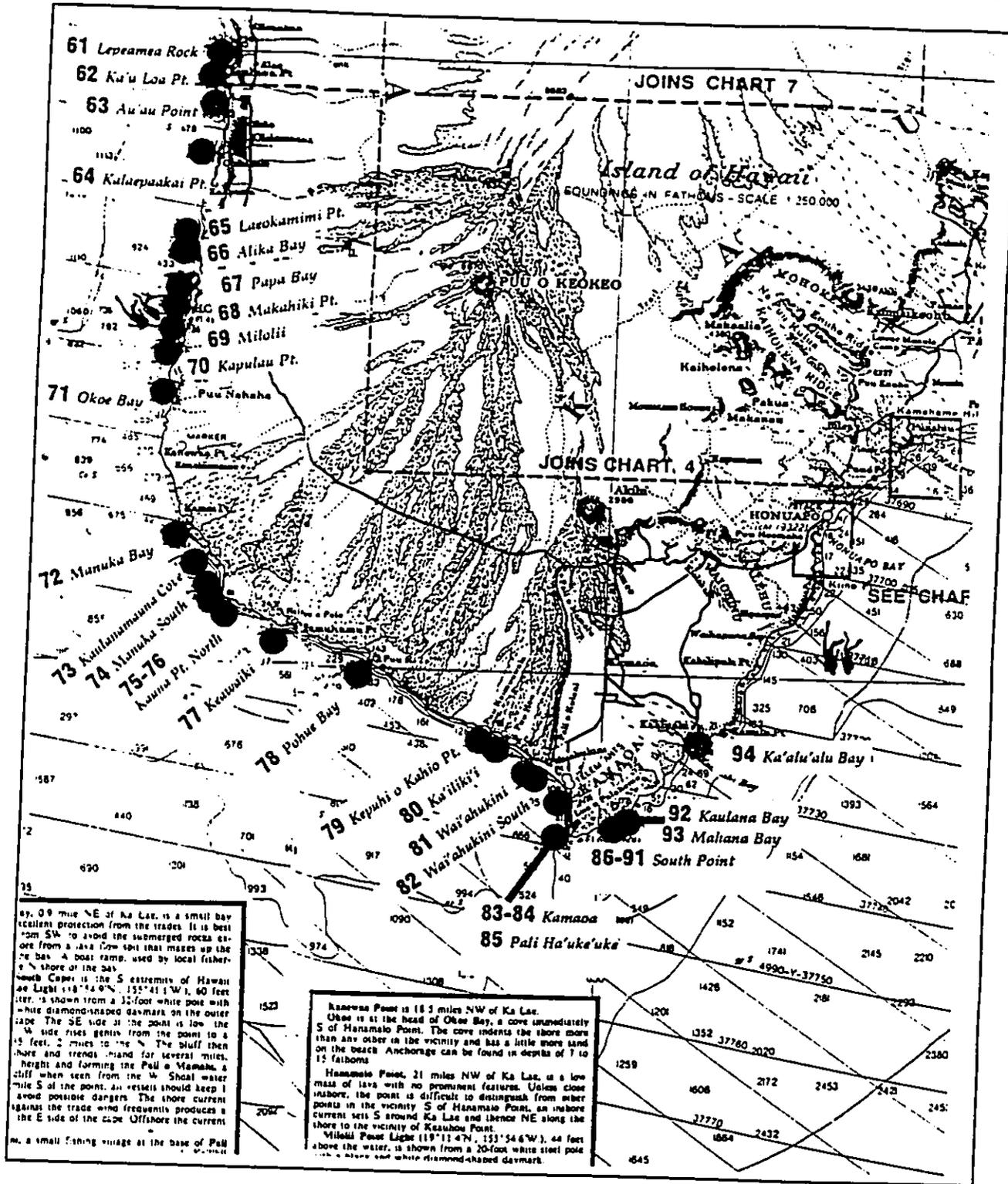






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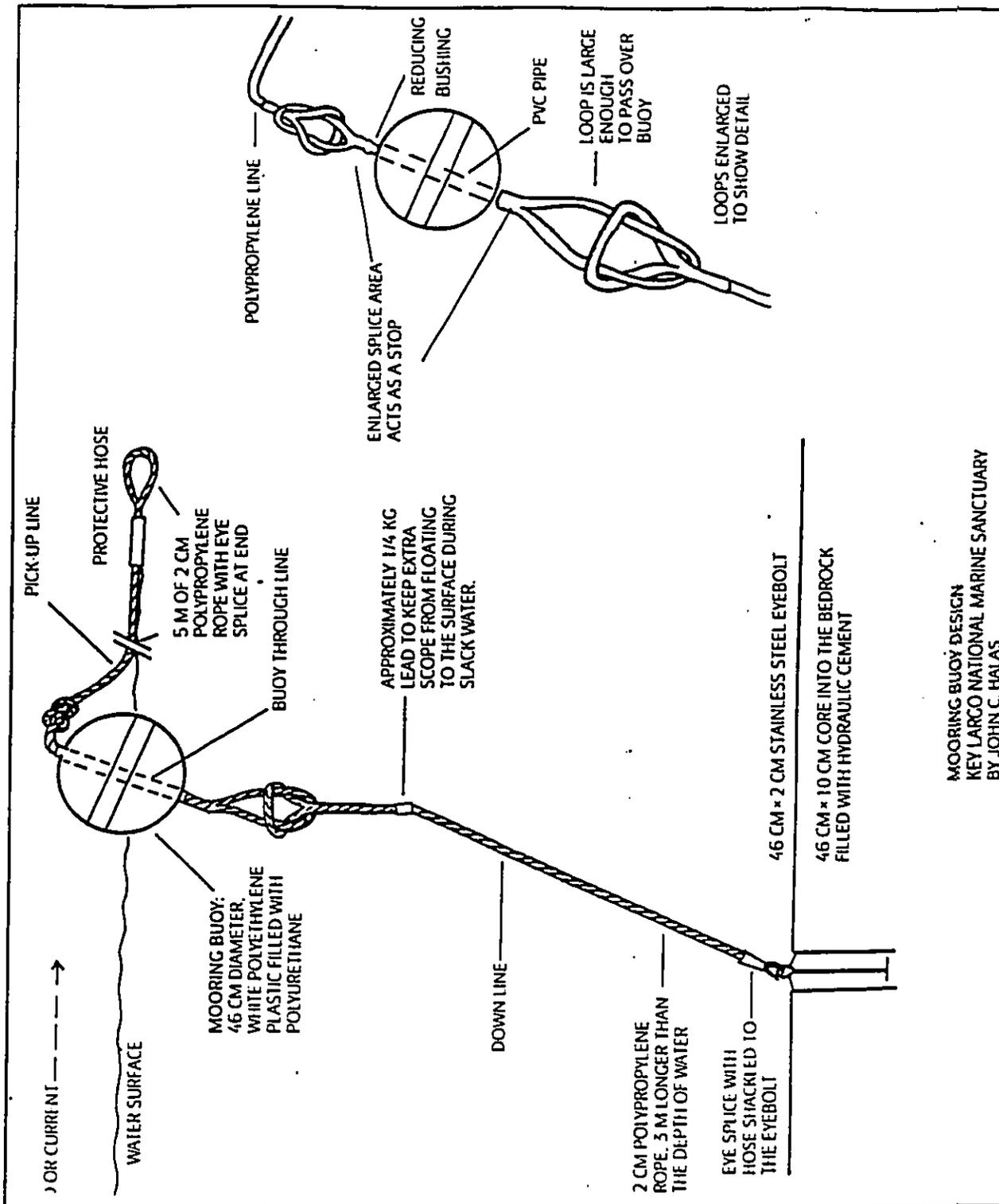


**APPENDIX D**

**SCHEMATIC DIAGRAMS OF  
TYPICAL MOORINGS**

**Single-Point Mooring**

**Manta Ray® Sand Anchor**



MOORING BUOY DESIGN  
KEY LARGO NATIONAL MARINE SANCTUARY  
BY JOHN C. HALAS

