DRAFT
ENVIRONMENTAL IMPACT STATEMENT
FOR
ONEKAHAKAHA BEACH PARK IMPROVEMENT

Keaukaha, South Hilo, Hawaii

January 1974

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KEAUKAHA, SOUTH HILO, HAWAII

(Pursuant to Governor's Executive Order Dated August 23, 1971)

By

Department of Parks and Recreation

County of Hawaii

January 1974

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KEAUKAHA, SOUTH HILO, HAWAII

DEPARTMENT OF PARKS AND RECREATION

COUNTY OF HAWAII

INTRODUCTION

Onekahakaha Beach Park, formerly known as Lihikai, is the only developed park in the Hilo area with a sandy beach. Use of this park exceeds all other County of Hawaii beach parks. This is mainly due to the concentration of population in the Hilo area, the preference of both residents and visitors for ocean-oriented recreation, and the scarcity of accessible and sandy beaches on the windward side of the geologically young island of Hawaii.

In order to more fully utilize the park site and to better accommodate existing and anticipated demand for recreational facilities, the County of Hawaii has planned to undertake several improvements at Onekahakaha. These proposed improvements particularly consider the needs of younger children.

PARK DESCRIPTION

Located on the southeastern shore of Hilo Bay, the County of Hawaii's Onekahakaha Beach Park is a regional park used primarily by the residents of the greater Hilo area. It is roughly 3½ miles, or a 10-minute drive, from the center of the city. The area of the park which is developed encourages picnicking, swimming and wading, camping, shoreline fishing, snorkeling, and nature study. A unique feature of the park is its sheltered, shallow swimming and wading area which makes the park especially well suited for beginning swimmers and family groups with young children. The park area has long been a popular recreational area.

The first 20+ acres of the Onekahakaha Beach Park site were established by executive order in 1931. Subsequently, additional areas of State land were included in the park and the site now covers almost 34 acres. Improvements have altered much of the park area from the conditions which existed in 1931.

Such improvements include sea walls, a breakwater, groins, shoreline paths, filled swamps, dredged tidal pools, and the emplacement of imported sand and fill material. In addition, restrooms, pavilions, parking lots and other supportive facilities have been constructed. The park has also been landscaped.

Although the park site consists of almost 34 acres, only about one-third of the area is improved and heavily used for recreation. This is the eastern end of the site. In addition to the improved swimming area at that end of the site, park facilities include 8 pavilions; a stage-pavilion; about 70 picnic tables, both on the grass and in the pavilions; restrooms, outdoor showers; electricity; telephone; parking areas; a

temporary children's zoo; and a camping area. Uses and facilities are designated on the map labeled Appendix "B".

Picnicking is one of the dominant activities at Onekahakaha Beach Park. Large groups use the pavilions for picnics, meetings, and social gatherings, while small family groups tend to picnic on the grass. Use permits are issued for the pavilions and records kept by the Department of Parks and Recreation show an increase in the number of persons covered by such permits from 38,222 in 1969 to 51,733 in 1971.

Most swimming at Onekahakaha is within the shallow improved swimming basin which is less than three-quarters of an acre in size and which is protected by a small breakwater. Although this basin offers little challenge to experienced swimmers who prefer open coastal waters such as those at nearby parks, it is ideal for young children. During higher tides, some swimming and snorkeling is possible in the tidal areas west of the basin. The tidepools are also used for nature study. Nearshore waters are used for pole and net fishing by a number of fishermen.[1]

Camping is permitted in a small area along the coast to the east of the swamp. Most campers use tents, but camper vehicles are also permitted. In 1971, a total of 11,554 camping permits were issued by the County Department of Parks and Recreation for Onekahakaha Beach Park. Park officials estimate that about 75% of the camping permits issued are to non-residents. The remaining permits were issued to local residents, mainly during the summer. Camping may be a limited experience in its present location because of the sparse landscaping and the proximity of the camping area to the park access road and pavilions. Although not designated as a camping area, some camping also takes place along the coast to the west of the swamp.

In 1969 a small children's zoo was established by the County and temporarily located at Onekahakaha. Approximately 130,000 persons visited the zoo in 1970, most of them local residents. Within the next five years, the zoo will be moved to a permanent location to the south of the city in Panaewa.

There are three restrooms in the park. The two smaller ones are served by cesspools while the newer and larger restroom-shower facility has a self-contained sewage treatment unit. Outdoor showers are also located near the improved swimming area. The park is connected to the County's water system.

Two asphalt paved parking areas accommodate a total of 79 cars. The larger parking area has a capacity of 61 cars while the smaller one is marked for 18 cars. When pavilions are used, however, cars are usually parked informally wherever is convenient and wherever space is available. Seaward of the zoo, there is another parking area which is a former swamp filled with lava rock. This provides a graded parking area for approximately 100 cars. It is used primarily by zoo visitors. The fill area presents an expanse of bare rock and soil with little vegetation which is not especially aesthetically compatible with the park's landscape.

PLANNED IMPROVEMENTS

The following improvements, which are depicted in Appendix "D", are planned for Onekahakaha Beach Park:

1. An additional swimming and picnicking area will be developed in a nine-acre swamp area.

2. The existing swimming area will be improved and better drainage provided for the adjacent land area.

3. Protective structures will be constructed to reduce inundation of the park area by high seas.

4. Additional parking areas will be constructed and landscaped.

5. Camping activities will be eventually eliminated to allow more area for picnicking and other day uses. This will be done as facilities are provided for camping at other nearby parks.

Swimming Lagoon

A new swimming lagoon will be constructed to provide additional area for water activities. This is being designed especially for younger children. Approximately two acres of the central swamp area will be dredged and all organic material will be removed from the swimming and channel areas. To prevent injury and accident, sand and fill will be used to cover the rough pahoehoe lava substrate and to eliminate deep holes. A coarse granular fill will be placed to bring the bottom elevation to grade prior to placing an imported, medium coarse-grained coral sand. The sand will extend from 3 feet below to 4 feet above mean sea level (MSL). It will vary in thickness from one foot at the toe to 2.5 feet at the upper elevation.

To provide better water circulation, the lagoon will be connected to the ocean by two new channels. These will be approximately 300 feet long with widths varying from 10 to 40 feet. Their depths will be 3 feet above MSL except at the lagoon end which will be 4 and 5 feet. The channel bottoms will be natural pahoehoe as not exists or as after excavation. The channel slopes will also be natural pahoehoe, except in areas of organic material where revetment of two layers of a minimum of 500-pound stone will be placed for stability. These will be placed to a minimum elevation of 2 feet above MSL along the outer portions of the channel and central island.

The channels meet as they enter the ocean. This area will be cleared to a depth of two feet below MSL over an area of about 60 feet by 80 feet. The inner section of the island created by the channels will be raised to three feet above MSL over an area of about 25 feet by 100 feet. This height will provide additional protection to the new beach from storm waves.

Small rock shoals will be removed from between the groin and the large rock island. A small circulation channel west of the breakwater will be deepened about one foot and a channel to the east will be opened by increasing its depth by approximately two feet. This limited deepening will increase circulation in the swimming area during low tide. Any increased wave energy resulting from such deepening and reaching the shoreline would be less than a few inches during high sea conditions as wave height in the area is controlled by the offshore reef and land masses. In addition, rock outcrops occur immediately shoreward of both circulation channels.

Landward of the seawall a drainage system will be installed to remove water resulting from rain, bathing showers, and high waves.

Parking Areas

Two parking areas will be constructed. The larger one will be located on the fill area adjacent to the zoo and will have a capacity for approximately 50 cars. The parking area will follow a curved linear motif to minimize the visual impact of an expansive parking area. It will also be screened off from adjacent areas through landscaping. Provision is made for future expansion.

The smaller parking area will have a capacity for about 25 cars and 4 buses and will be about 300 feet landward of the seawall. The existing small parking lot adjacent to the seawall will be removed and the area landscaped.

Shoreline Protection

The areas adjacent to the pavilions at the seawall and to the west of it are subject to inundation by high seas. To reduce overtopping these areas will be raised about two feet and reveted. Revetment will conform to the natural conditions and be landscaped as much as practicable.

In addition to the above improvements, a program will be initiated which will include water lines; the relocation of restrooms to provide sewer connections; landscaping; picnic facilities; and the placement of all utility lines underground. These improvements will be completed within three years.

EXISTING ENVIRONMENTAL CONDITIONS

Topography and Geology

The park is generally of low elevation and relief which makes the area susceptible to inundation during high sea conditions that occur most often during winter months.

The natural coastline is dark pahoehoe from a prehistoric Mauna Loa flow. There are pockets of coarse coral sand and waterworn lava rubble along the shoreline. Lava underlies a shallow layer of imported fill and natural soil. The lava is highly porous and permits the subsurface interchange of water between the ponds and the ocean. Fresh groundwater is discharged into the brackish swamp ponds. Groundwater also seeps directly into the ocean along the coastline.

The lava forms a coastal shelf which drops abruptly to deep water from between 250 to 500 feet offshore. This underwater shelf and associated outcrops of lava rock protect the coast from the full impact of ocean waves while creating an expanse of calm, shallow nearshore tidepools.

Soils

Natural soil is very shallow except in the swamp area where a buildup of organic material has occurred. The texture of the organic material in the swamp ranges from fibrous peat to mud, with average depth being 2 to 3 feet and the deepest probe exceeding 9 feet. Near the shoreline there is some mixture of this material with coraline sand and boulders. Bagasse, or sugar cane trash, washing in from the sea has contributed to the accumulation of organic material in the swamp.

Waves and Currents

The prevailing offshore currents along the windward shore of the island set northwestward following the tradewinds. Occasionally, however, currents are found moving against the prevailing wind pattern. Outside of the Hilo Bay breakwater currents tend to eddy and often flow counter to the prevalent northwest current.

Water in the existing swimming area at Onekahakaha Beach Park freely interchanges with coastal waters through the breakwater. Circulation here is generally good, especially during high tide conditions. Shallow channels to the east and west aid in the water circulation of the swimming area.

The tidepool area is unique in that prevailing offshore waves pump water into the ponds at a faster rate than into the adjacent swimming area. Under both rising and ebb tide conditions water typically flows from the tidepool area into the swimming area then generally through the porous breakwater back to the sea. This circulation pattern is probably responsible for keeping sediments from the swimming area out of the tidepools.

The currents in the semi-enclosed basin immediately offshore of the swamp area result from surging wave action and are in-and-out through the entrance to the small basin. Tidal current patterns are similar but minimal in comparison to wave-generated currents. Beyond the lava shelf, offshore conditions are characterized by rough seas and associated strong currents generated by waves along the shoreline..

The swamp area is a marsh with a shallow water lagoon and isolated ponds. Under normal conditions there is no surface channel to the sea.[2] High seas or extreme high tides pump water into the swamp over the low protective shoreline section. Currents in the swamp are negligible except during periods of high wave runup. The waters within the swamp rise and fall freely with tidal fluctuations. The pond waters appear to maintain a level slightly above that of the nearby ocean for both rising and ebbing tides.

High sea conditions often pump water into the beach and pond areas west of the swamp with the direction of flow being from west to east. During extreme conditions, a high velocity current flows through the area. The shallow ponds here interchange freely with the offshore waters under normal tide and sea conditions.

Onekahakaha Beach Park is subject to wave attack from severe storms which originate to the north. Such wave conditions cause the inundation of the local shoreline, flooding much of the park area.[3]

Tides

The normal tidal range is small, averaging a little more than two feet. During lower tides, the existing swimming area and the adjacent shallow tidepools are much reduced in size. Lower tides permit access to coastal tidepools and afford the best opportunities for nature study. Rocky outcrops along the outer lava shelf can also be reached for fishing during lower tides and calm seas.

Tsunami

The entire park area is subject to tsunami inundation. Both the 1946 and the 1960 tsunamis hit this area of the coast and caused some changes in the local shoreline configuration. These events also probably contributed sediments and rock rubble to the swamp area and former outlet channels.

Water Quality

The coastal waters of Onekahakaha Beach are designated Class A by the State Public Health Regulation, Chapter 37-A. Water uses allowed by this classification are "recreational, including fishing, swimming, bathing and other water-contact sports and aesthetic enjoyment."

The existing swimming area and adjacent tidepools and offshore waters meet the standard for natural bathing places. Water samples taken from the swamp area, however, far exceed the permissible total coliform level.[4] Water quality samples are attached in Appendix F. A total coliform count does not distinguish between coliform sources, i.e., whether from decaying vegetation or from animal fecal wastes. Within the swamp, decaying vegetation probably contributes considerably to the total coliform count. It is the fecal coliform which are of concern to public health, particularly if they can be traced to human sources.

High fecal coliform counts of 4600 fecal/100 ml. and 1100 fecal/100 ml. were derived from test samples adjacent to the zoo and below the adjacent residential housing, respectively. Surface and subsurface drainage from the zoo and possible seepage from adjacent residential cesspools may be entering the swamp area and contributing to the high fecal coliform count. Existing poor water circulation within the swamp area is also probably responsible for the existing low quality of the swamp water for recreational use.

Salinity of the coastal water samples is similar to sea water. Some variation occurs depending upon the location and volume of fresh water seepage along the coast. Within the swamp, salinity in samples of the brackish water varied from 3.2 to 30.9 parts per thousand.

Fresh groundwater is generally colder than the nearshore ocean water. As with salinity, temperature gradients within the swamp and along the coast depend largely upon the rate and location of fresh water outflow, tide conditions, extent of mixing by winds or currents, and the water depth.

Biological Characteristics

A detailed biological survey of the park area, swamp and coastal waters is not available. A general assessment of the park biota, however, has been made.

Vegetation in the park consists largely of exotic and common native species including false kamani (Terminalia catappa), coconut, ironwood, pandanus, wild plum, Norfolk pine, kiawe (Prosopis pallida), mango, hau (Hibiscus tiliaceus), milo (Thespesia populnea), and Christmas berry. Along the shoreline grow the native rush grass manienie 'aki-'aki (Sporobolus virginicus), beach morning glory, and the indigenous naupaka-kahakai (Scaevola taccada). Reeds, sedges, Bermuda grass and floating mats of algae are found in the swamp area.

As far as is known, the swamp area is not presently used by migratory or native waterfowl which are regularly observed in nearby large open ponds such as Waiakea and Lokoaka.

Within the various tidepools are found a common assortment of small reef fish and invertebrates. It is not known if there are any rare or endangered species in the coastal waters, but it does not appear that there is an unusual abundance of marine life. In the existing swimming area marine life is sparse compared to the adjacent tidepools. This is possibly related to the murky conditions of the water during heavy use and the fine sediments from imported sand.

The swamp is evolving from an area of open water lagoons and ponds to a wetland marsh as organic sediments and vegetation gradually fill the ponds. Bagasse and material deposited from tsunami and storm waves may have speeded up the natural eutrophication process. The remaining open water can be expected to fill with sediments and vegetation in time, and the variety and abundance of existing biota would change with the loss of open pond water.

Swamp water biota would include species tolerant of brackish water with salinity and temperature fluctuating widely with the tide cycles. Small mosquito fish are abundant and tadpoles are seen in isolated ponds.

LAND USE

The County has zoned the park area "open" and has designated it for recreational uses in the County General Plan. The land adjacent to the park is designated for resort use. In addition to hotels and accessory commercial uses, single-family residential, duplex, and apartment uses are permitted.

Around the park are about 34 single-family woodframe houses, a few of which are quite old and in poor condition. Two apartment structures have been built with a total of 22 units and a 28-unit apartment is under construction. The neighborhood is in transition from a low density urban area characterized by single-family residences to a more dense use, such as apartments. The number of persons in the area can be expected to increase rapidly with the continuation of this trend.

The County sewer line has recently been extended along Kalanianaole Street. Older homes near the park, however, still use cesspools. All new apartments in this area will be required to connect with the sewer line or be provided with an approved private self-contained treatment unit.[5] Better sewage treatment should improve the quality of the swamp water if the sources of coliform are found to be cesspools.

ENVIRONMENTAL IMPACT

The proposed improvements for Onekahakaha Beach Park will have some impact on areas not heavily used by the public at the present time. Adequate support facilities and maintenance will be provided to prevent environmental degradation.

The greatest impact will occur in the swamp area as the succession of the swamp from open ponds to wetland marsh will be reversed. Open lagoons and channels which are more similar to a marine environment than a fresh water one will replace the existing brackish water swamp. Existing biota which are intolerant of these changes will be replaced by other species moving into the lagoon once the channels to the sea are opened.

Existing reeds, grasses, algae and other such vegetation in the spoils area (see Appendix D) will disappear as these areas are filled and eventually landscaped for recreational use. No large trees should be affected by the swamp improvements.

Landscaping of the large parking area seaward of the zoo will substantially improve the aesthetic appearance and environment of this area of the park. The removal and landscaping the existing small parking area next to the seawall will provide more area for recreation.

The protective shoreline structures along the coast are designed to be aesthetically compatible with the existing landscape as well as to reduce inundation of recreational areas and to prevent damage to park facilities. These protective structures will also reduce wave energy and currents within the swimming lagoon during winter storms, thereby reducing the possibility of sand moving out of the lagoon into adjacent coastal waters. Roots of trees adjacent and seaward of the protective structure west of the swamp, however, may require protection from possible increased soil erosion.

In the existing swimming area, the replacement of fine sand with coarser sand material should eliminate the undesirable murky condition of the water during heavy use and possibly improve the area as a marine habitat. Removal of certain rocks from the swimming area may also reduce injury to swimmers. The slight deepening of the channels may improve water circulation during low tide conditions.

ADVERSE ENVIRONMENTAL EFFECTS

The existing swamp habitat would be severely altered by the proposed improvements with adverse impact on existing swamp biota intolerant of the changes which will occur. The open water lagoon and ponds, however, would be more compatible with the recreational use of the area. Moreover, the newly created open waters will provide opportunities for nature study activities once new species become established.

Ponds used as settlement basins during construction and percolation ponds receiving surface drainage may experience a decline in water quality and an accelerated eutrophication. Should these ponds also become used for swimming, high coliform may pose a public health problem. The natural subsurface interchange of waters between the isolated ponds and the swimming lagoon would be restricted by the proposed impermeable barrier surrounding the lagoon and the channels which are required to improve the water quality of the swimming area. Once the organic material is removed from the bottom of these ponds, however, improved percolation may somewhat increase the water circulation.

Development of the lagoon swimming area may accelerate plans to relocate the zoo. The relocation is advisable, however, since the present zoo area is subject to tsunami and is limited in size.

The eventual loss of camping opportunity at the park could adversely affect persons enjoying this type of recreation. The elimination of camping, however, will not occur until facilities are available at Leleiwi and Lehia Beach Parks in the same area. (See Appendix A)

The destruction of marine and tidepool habitats may occur if imported sand, clay, cinder, or fine sediments accidentally migrate into coastal waters during construction or following completion of the project. There is also danger of dispersal of imported material by winter storm waves. Of particular concern would be fine sediments within imported

materials or material which readily abrades into fines. Close inspection and control during construction is necessary to avoid damage. In addition, construction details include the following provisions:

1. The use of medium, coarse-grained imported sand with all fines removed.

2. The removal of fine materials from the swamp and swimming area with hydraulic pumping into settling basins following excavation and before channels are opened to the sea.

3. The construction of protective structures to reduce wave energy and currents in the lagoon.

4. Revetment of side slopes of the channels and landscaping of sloped land fill areas for erosion control.

Unavoidable inconvenience will be experienced by park users during the construction phase. This would include noise, dust, aesthetic problems, possible smell from dredged materials, and temporary loss of areas for recreation. These inconveniences would be limited to less than one month in the existing swimming area and to about 4 to 5 months in the swamp area. To minimize the impact on park users, construction contracts will include requirements for dust control, site cleanup, and similar measures (refer to Department of Public Work's General Requirements and Covenants). In addition, the projects will be scheduled for off-peak seasons.

PROJECT ALTERNATIVES

As stated earlier, the major environmental impact will be in the swamp area. An alternative to the swimming lagoon would be to preserve the swamp ecosystem as it exists and to forego the proposed development. The swamp is not static, however, and natural processes will gradually alter the biota as organic debris accumulates and vegetation fills the remaining open water areas. The swamp does not afford recreational use in its present condition. Leaving the swamp as it is will continue to conentrate use at the developed park area.

Swamp improvements could be limited to the dredging of accumulated organic material and the clearing of channels to the ocean without the emplacement of imported sand and fill into the lagoons. This would be a less costly alternative but it will not reduce hazard associated with the rough lava surface of the bottom or deep water holes.

Alternative swimming areas could be developed by deepening the coastal tidepools. This, however, would eliminate nature study areas and would tend to continue to concentrate use along the coast.

The possible decline in water quality of isolated percolation ponds which may result from this project might be avoided if all ponds were connected by open channels to the main lagoon swimming area and/or if the impervious barrier around the lagoon was eliminated. This alternative design would provide better water circulation for the total pond-lagoon system of the swamp, but more extensive dredging would be required to provide connecting channels. In addition, the connection of these ponds directly to the lagoon may not improve the water quality of the swimming lagoon enough to permit swimming.

To further reduce the possibility of accidental siltation of coastal waters, plastic sheeting might be substituted for the impervious silty clay barrier around the swimming lagoon and channels.

RELATIONSHIP BETWEEN SHORT-TERM AND LONG-TERM PRODUCTIVITY

Both the short-term and long-term productivity of Onekahakaha Beach Park is for public recreation. This use is well established and will intensify with regional and local population growth. It is unlikely that future development of nearby parks will substantially reduce the use of Onekahakaha because of the park's unique suitability for young children. Proposed improvements are intended to improve the recreational experience within the park for present and future residents and visitors, but most especially for children.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The commitment of resources required to accomplish the proposed improvements include the materials and public funds necessary for construction. There is also an implied commitment of resources for the extension of park facilities to serve the new recreation areas created by this project. Park maintenance must also be extended.

ECONOMIC AND SOCIAL COSTS

The cost of the proposed improvements is estimated to be approximately $700,000. The proposed improvements will benefit present and future residents of immediate park area, the greater Hilo, and the various districts of the County. Although major park users are now residents, the proportion of visitors enjoying the park may increase with nearby local resort development. Most importantly, the planned improvements will be to the benefit and enjoyment of young children and their families.

FOOTNOTES

1 Little data are available regarding the number of persons utilizing the near-shore waters for wading and swimming. Recent observations by lifeguards indicate that between 80 and 120 persons are in the water at any given time during peak use periods and about 30 during normal weekdays. During June and July, however, the County's Summer Fun program brings approximately 800 children between the ages of 6 and 13 to the park each week. A different group of about 200 children are taken to visit the park during the morning from Mondays through Thursdays.

2 Rubble-filled areas at the narrow bar at the mouth of the swamp may indicate former channels.

3 Major deepwater storm wave data for this area show the following high wave conditions:

Date	Wave Height	Period	Direction
Jan., 1947	14.5 ft.	17.3 sec.	N
Mar., 1954	22.9 ft.	17.2 sec.	N
Nov., 1956	8.2 ft.	15.5 sec.	N
Nov., 1958	14.6 ft.	14.3 sec.	N

4 Public Health Regulation, Chapter 1, establishes a standard for natural bathing places of an average total coliform index of less than 1000 per 100 ml.

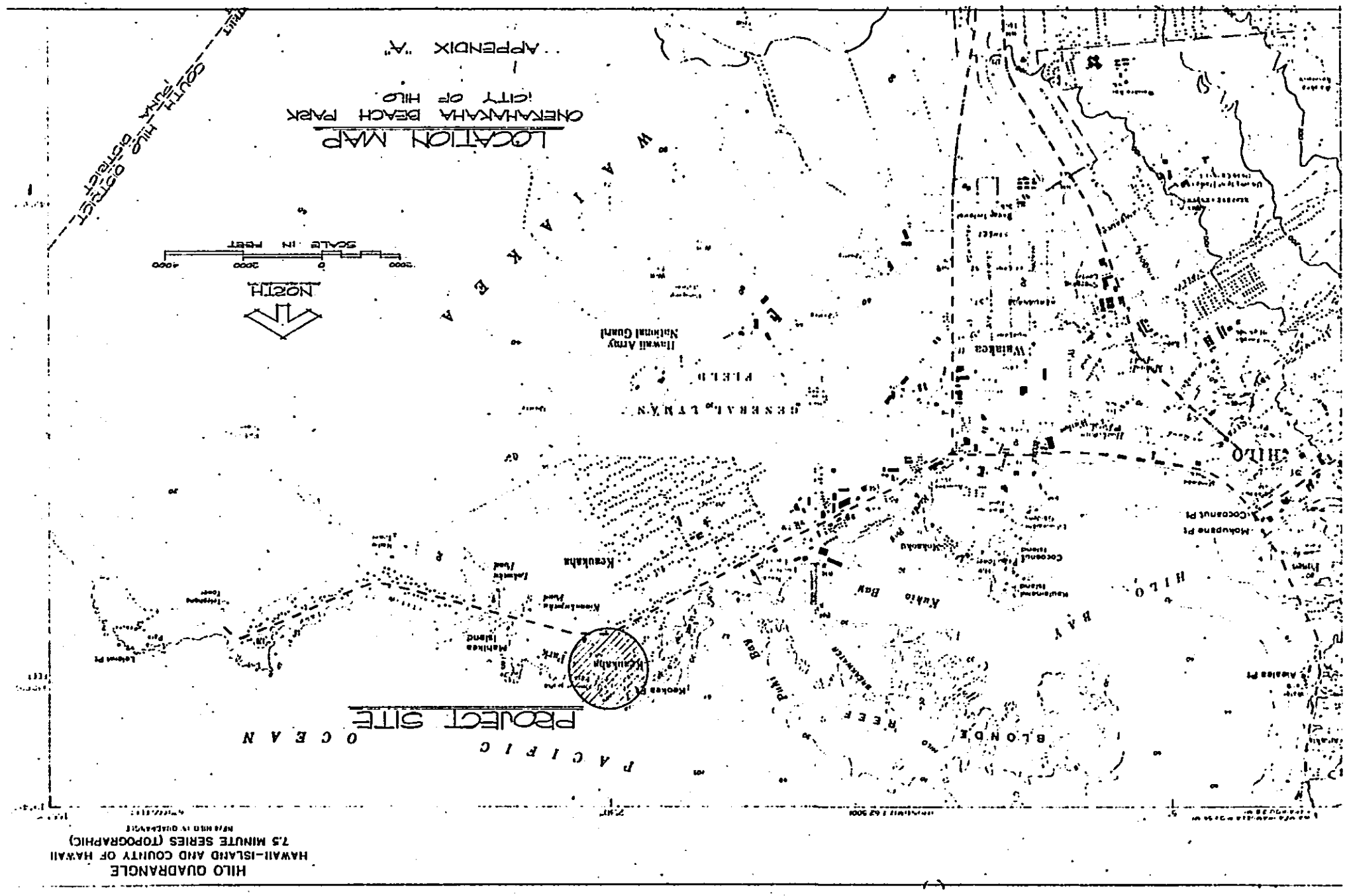
5 One apartment building constructed prior to the extension of the sewer line has a self-contained sewage treatment unit. The other two apartment buildings are connected to the County sewer line.

A P P E N D I X

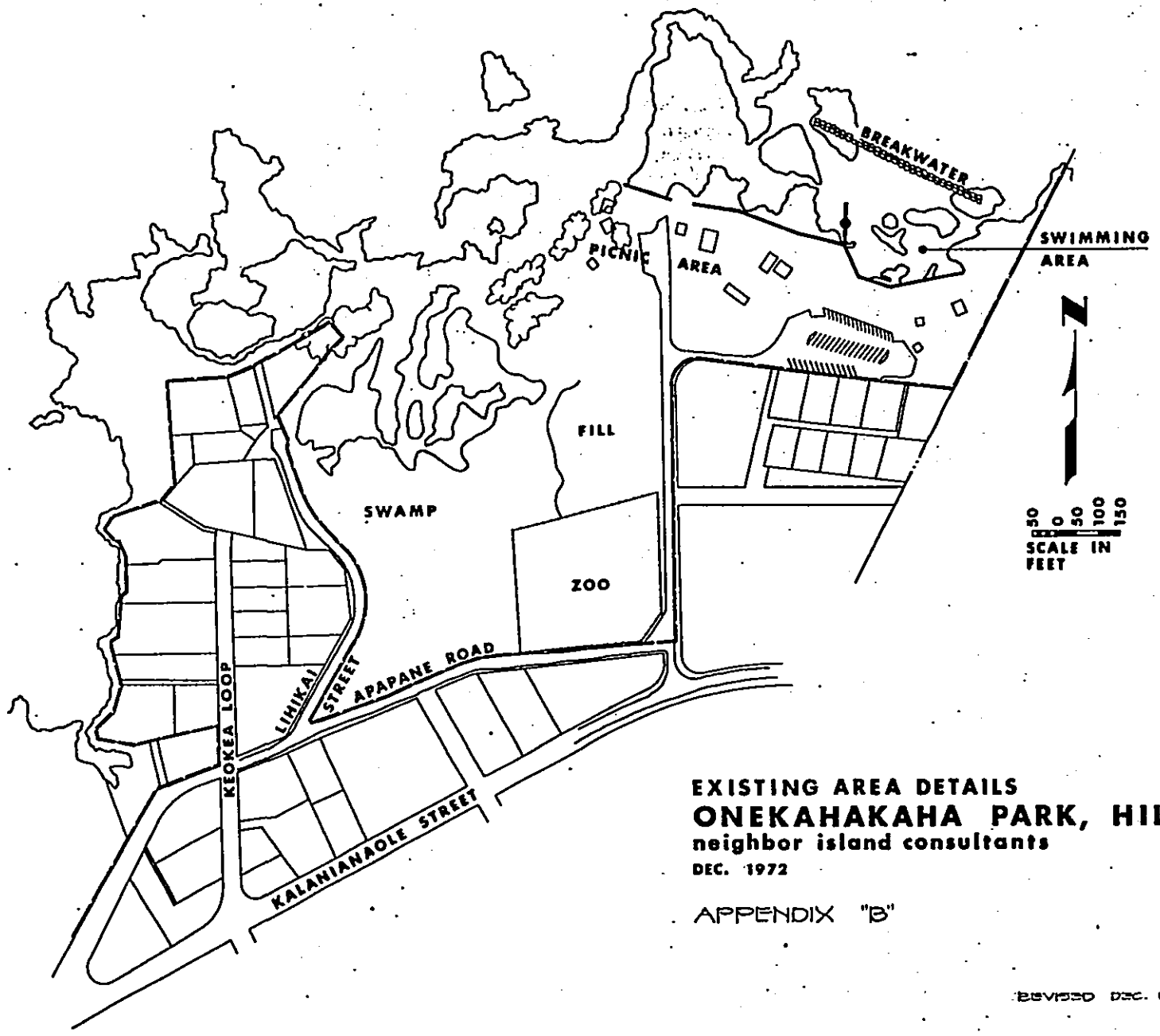
A P P E N D I X

APPENDIX "A"

LOCATION MAP
ONEHAKAHA BEACH PARK
CITY OF HILO



HILO QUADRANGLE
HAWAII-ISLAND AND COUNTY OF HAWAII
7.5 MINUTE SERIES (TOPOGRAPHIC)



EXISTING AREA DETAILS

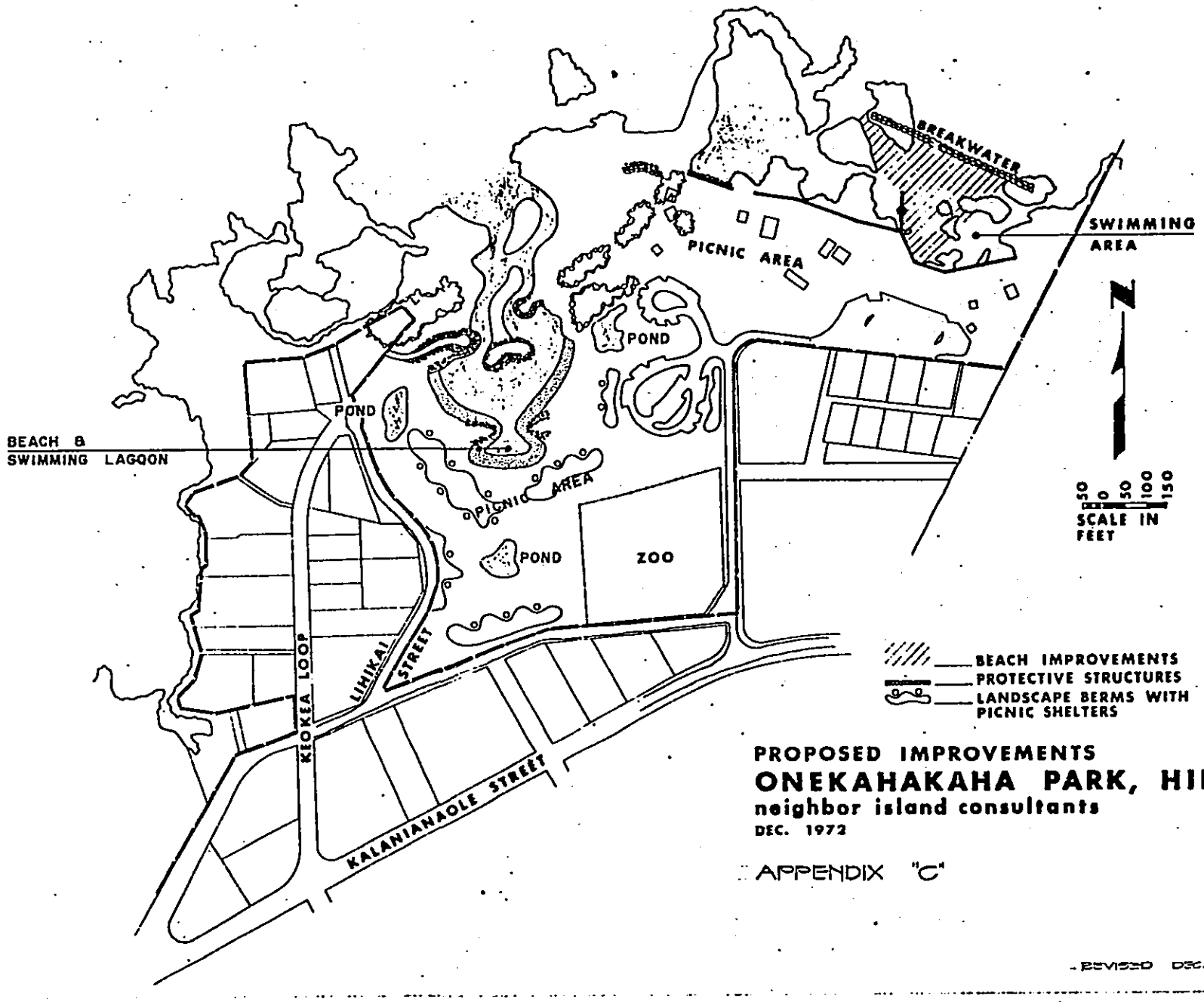
ONEKAHAKAHA PARK, HILO

neighbor island consultants

DEC. 1972

APPENDIX "B"

REVISED DEC. 1973



PROPOSED IMPROVEMENTS

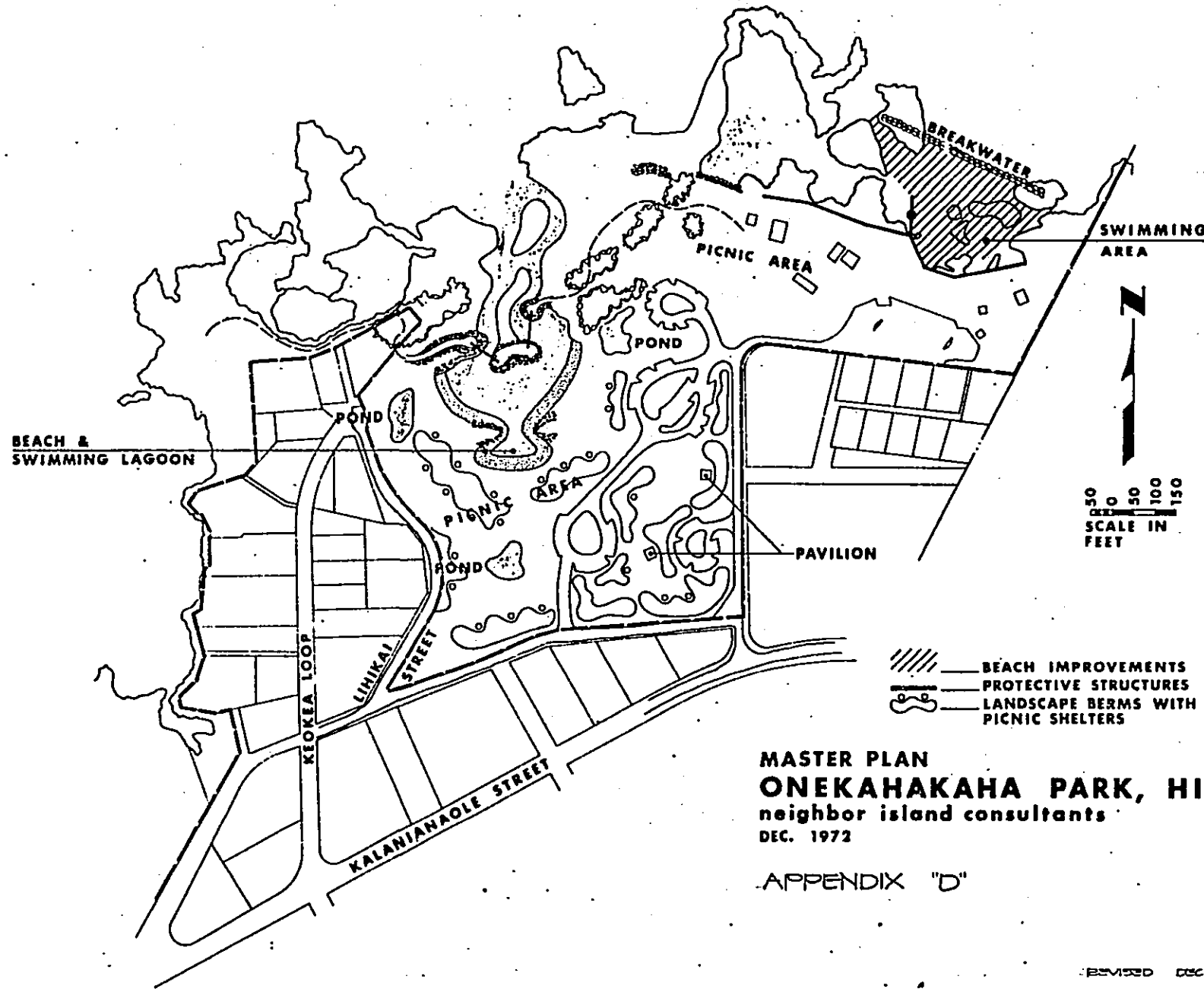
ONEKAHAKAHA PARK, HILO

neighbor island consultants

DEC. 1972

APPENDIX "C"

REVISED DEC. 1973



MASTER PLAN

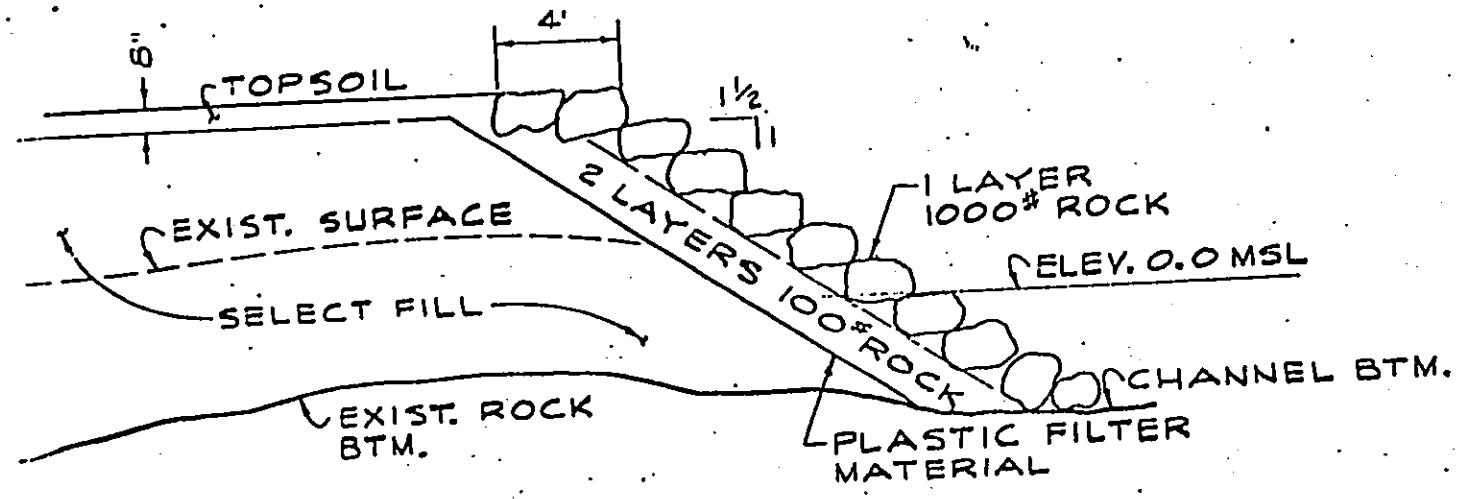
ONEKAHAKAHA PARK, HILO

neighbor island consultants

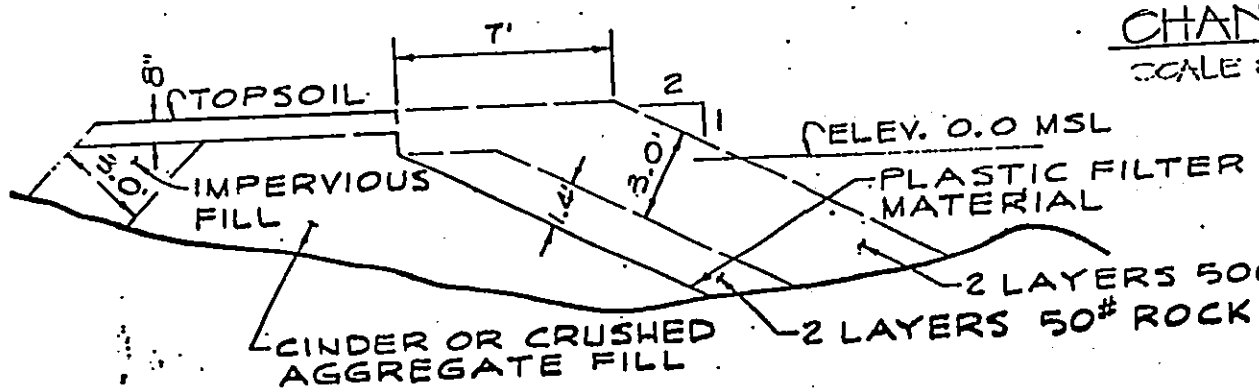
DEC. 1972

APPENDIX "D"

REVISED DEC. 1973

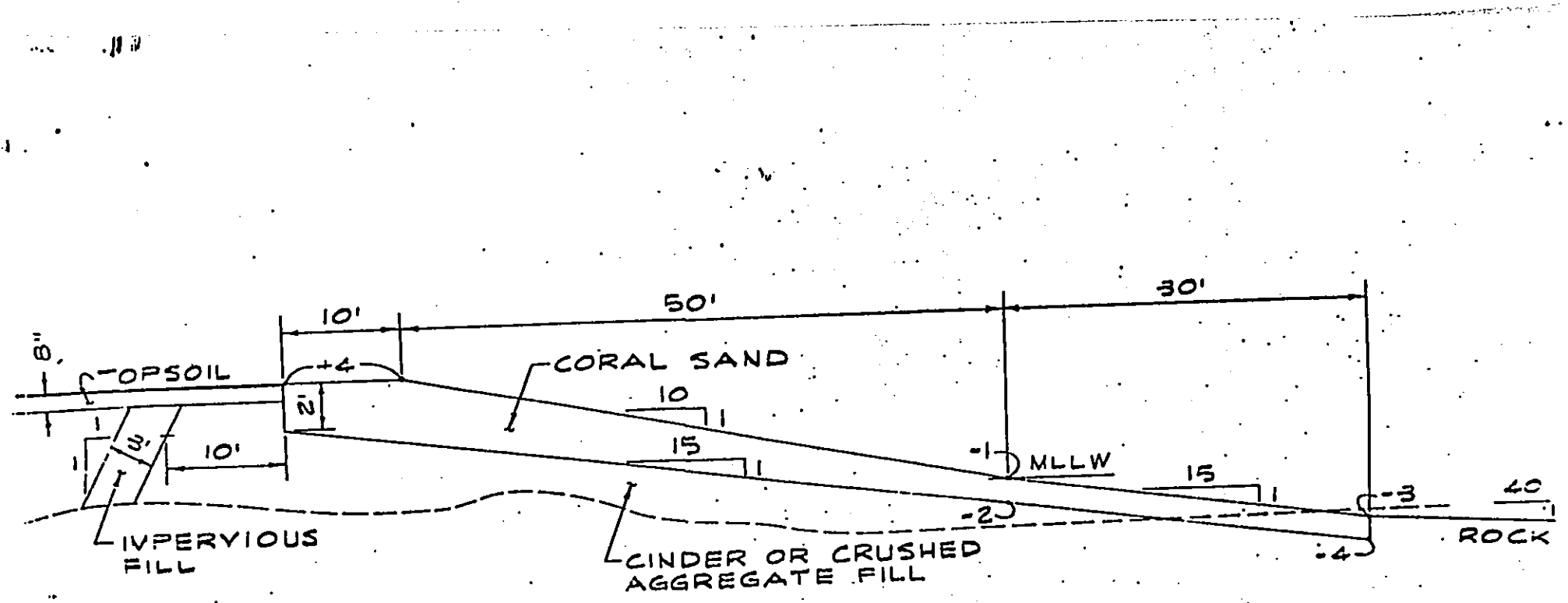


TYP. SECT. (A-A')
WEST STRUCTURE HEAD
SCALE: 1" = 5'



TYP. SECT. (B-B')
CHANNEL REVETMENT
SCALE: 1" = 5'

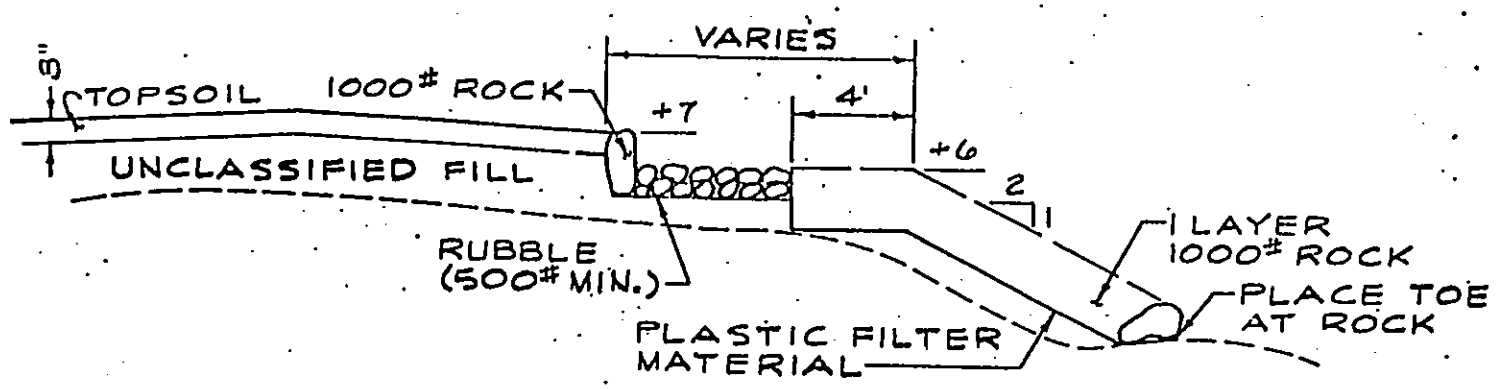
APPENDIX "E-1"



TYP. BEACH SECT. (C-C')

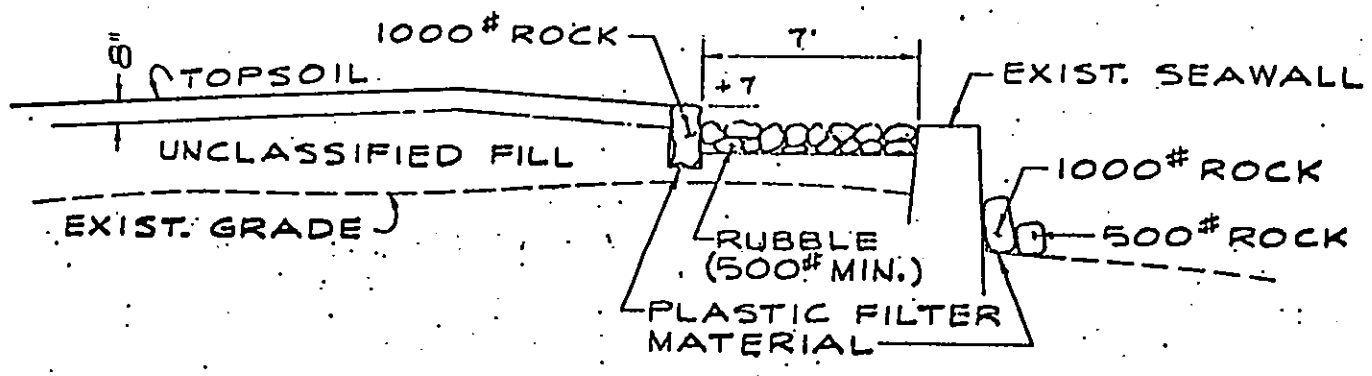
SCALES: VERT. 1" = 5'
HORIZ. 1" = 10'

APPENDIX "E-2"



TYP. SHORE LINE FILL SECT. (D-D')

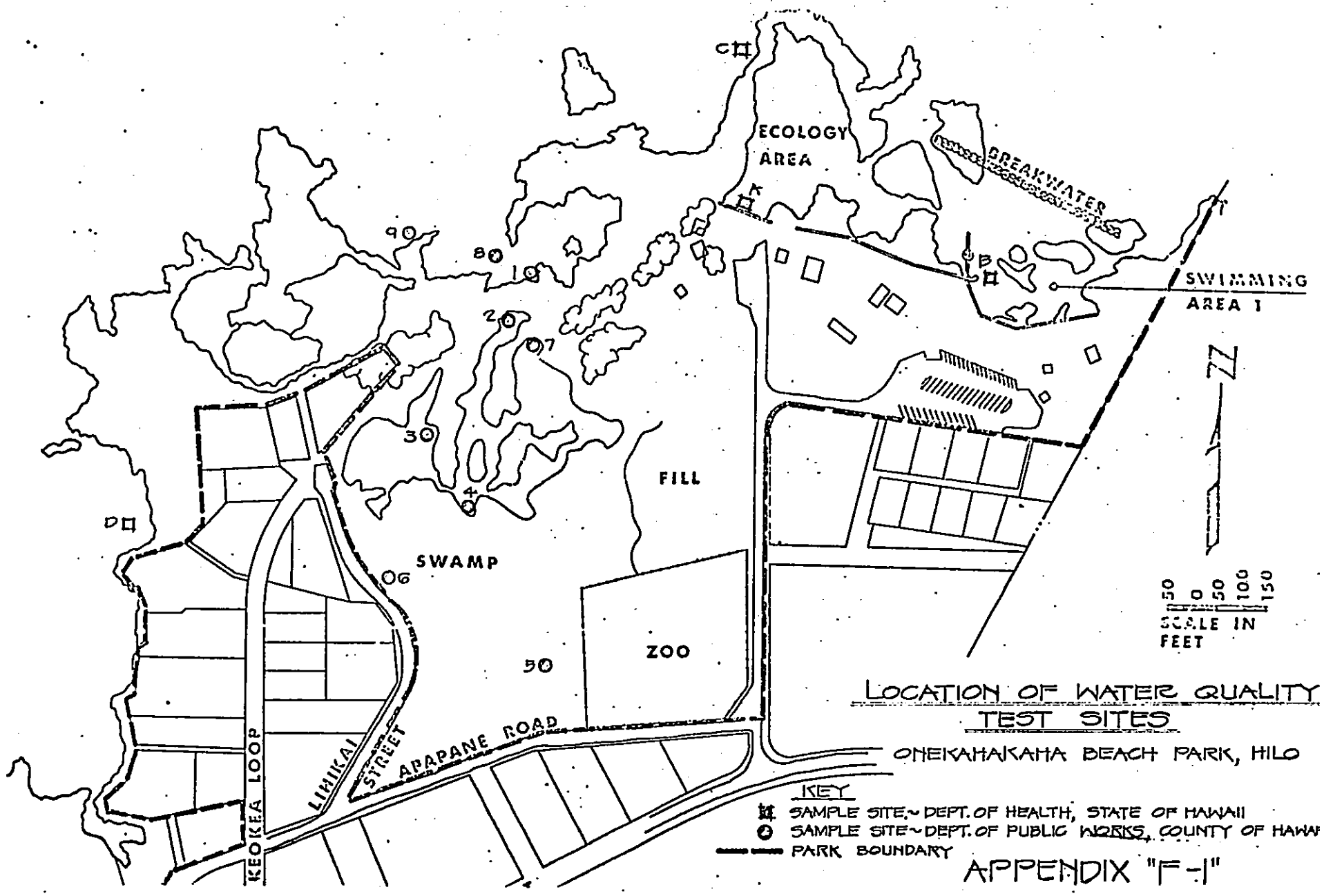
SCALE: 1" = 5'



TYP. SEAWALL SECT. (E-E')

SCALE: 1" = 5'

APPENDIX "E-3"



LOCATION OF WATER QUALITY TEST SITES

ONEKAHAKAHA BEACH PARK, HILO

KEY

- SAMPLE SITE ~ DEPT. OF HEALTH, STATE OF HAWAII
- SAMPLE SITE ~ DEPT. OF PUBLIC WORKS, COUNTY OF HAWAII
- PARK BOUNDARY

APPENDIX "F-1"

SWAMP AREA

WATER QUALITY DATA —ONEKAHAKAHA BEACH PARK * (Dept. of Public Works; County of Hawaii)

Site No.	Sampling Date (1972)	Approx. Time	Tide Condition	Coliform Test (MF/100 ml) Total	Fecal	PH	Temp. F°	Nitrogen (Ammonia mg/l)	Phosphate (mg/l)	Chloride (mg/l)	Salinity (%)	Hydrogen Sulfide (mg/l)
1	4/12	3:00pm	high slack	650		8.2	76	<0.16	0.013	18,700	3.32	
	5/2	11:40am	low slack	200								
	6/30	2:30pm	low rising	1,100	15							
	7/5	2:00pm	high slack	220		7.5	77	nil	0.01	16,600	2.97	nil
2	4/12	3:00pm	high slack	5,600		7.3	74	0.33	0.005	3,160	.57	nil
	5/2	11:40am	low slack	1,450		7.5	77.5	<0.33	0.10	1,700	1.69	0
	6/30	2:30pm	low rising	2,100	43							
	7/5	2:00pm	high slack	4,370		6.6	77	0.01	0 .01	2,620	0.47	nil
3	4/12	3:00pm	high slack	19,800		6.9	80	5.10	1.58	9,950	1.76	4.0
	5/2	11:40am	low slack	3,440		7.3	75	<0.33	0.12	3,100	3.09	2.0
	6/30	2:30pm	low rising	2,400	93							
	7/5	2:00pm	high slack	8,130		6.6	76	0.23	0.03	1,930	0.35	nil
4	4/12	3:00pm	high slack	74,200		7.2	69		0.19	2,670	0.48	nil
	5/2	11:40am	low slack	2,200		6.7	78	0.66	0.18	1,370	1.06	0
	6/30	2:30pm	low rising	1,500	240							
	7/5	2:00pm	high slack	8,500		6.2	78	0.28	0.10	1,750	0.32	nil
5	4/12	3:00pm	high slack	30,800		7.1	68	6.60	1.47	2,430	0.44	
	6/30	2:30pm	low rising	11,000	4,600							
6	4/12	3:00pm	high slack	18,000		7.0	68		0.26	1,940	0.35	
	6/30	2:30pm	low rising	24,000	1,100							
7	5/2	11:40am	low slack	3,100		7.0	77	<0.33	0.08	1,740	1.73	0.2
	6/30	2:30pm	low rising	24,000	240							
	7/5	2:00pm	high slack	6,500		6.6	76	0.15	0.08	2,050	0.37	nil
8	6/30	2:30pm	low rising	150	43							
9	6/30	2:30pm	low rising	9	<3							
	7/5	2:00pm	high slack	15		8.1	78	nil	<0.01	20,600	3.64	nil

* Samples taken approximately 1 foot below water surface.

APPENDIX "F-2"

WATER QUALITY- ONEKAHAKAHA BEACH PARK

Summary of Coliform Tests of Water Samples taken by State Dept. of Health, Jan. through May, 1972.

Site	Total No. of Samples	Total Coliform (MPN/100cc)			Fecal Coliform (MPN/100cc)		
		Max.	Min.	Average	Max.	Min.	Average
A	17	1,100	<3	89	93	<3	20
B	11	240	<3	50	93	<3	19
C	10	240	4	67	93	<3	14
D	17	750	4	112	390	<3	28

APPENDIX "F-3"

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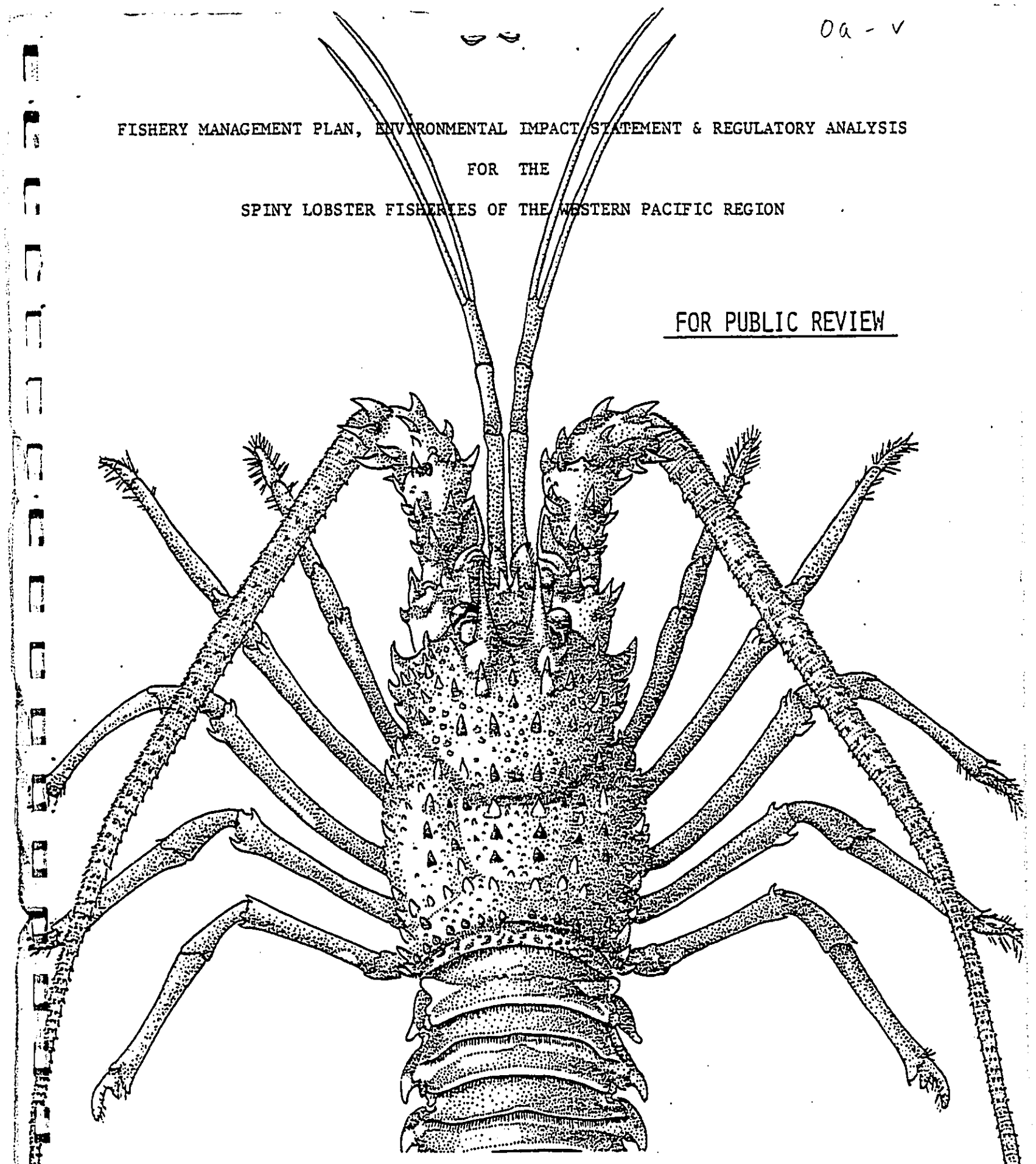
FISHERY MANAGEMENT PLAN, ENVIRONMENTAL IMPACT STATEMENT & REGULATORY ANALYSIS

FOR THE

SPINY LOBSTER FISHERIES OF THE WESTERN PACIFIC REGION

FOR PUBLIC REVIEW



WESTERN PACIFIC FISHERY MANAGEMENT COUNCIL

1164 Bishop Street, Suite 1608

Honolulu, Hawaii 96813

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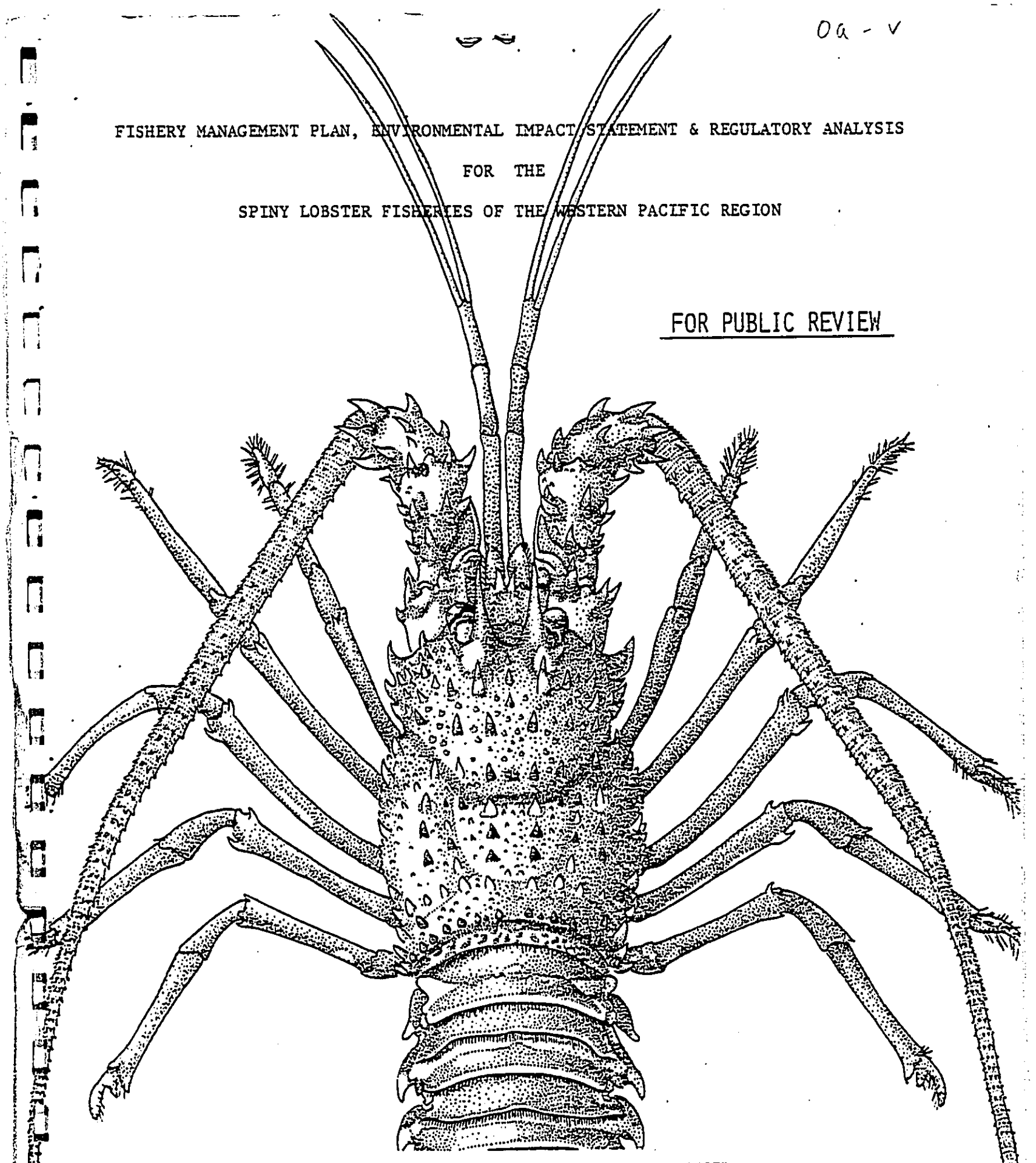
FISHERY MANAGEMENT PLAN, ENVIRONMENTAL IMPACT STATEMENT & REGULATORY ANALYSIS

FOR THE

SPINY LOBSTER FISHERIES OF THE WESTERN PACIFIC REGION

FOR PUBLIC REVIEW



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