PARTMENT OF GENERAL PLANNI
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

DONALD A. CLEGG
CHIEF PLANNING OFFICER

MM/DGP 10/89-3825

November 24, 1989

Honorable Marvin T. Miura, Director
Office of Environmental Quality Control
State of Hawaii
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Final Environmental Impact Statement (FEIS)
for the Lanikai Flood Control Project, Phase I
Tax Map Key: 4-3-03 thru 05

We are notifying you of our acceptance of the above EIS in fulfillment of the requirements of Chapter 343, HRS, and the EIS Rules.

According to the Department of Public Works, City and County of Honolulu, a Supplemental Environmental Impact Statement will be prepared for Phases 2, 3 and, 4.

Sincerely,

Betsy Kim Marcinkus
for DONALD A. CLEGG
Chief Planning Officer

DAC:gmy

Attach.

DEPARTMENT OF GENERAL PLANNING (DGP)

ACCEPTANCE REPORT: CHAPTER 343, HRS
ENVIRONMENTAL IMPACT STATEMENT (EIS)
LANIKAI FLOOD CONTROL PROJECT
(PHASE I CONSTRUCTION)
DEPARTMENT OF PUBLIC WORKS, DIVISION
OF ENGINEERING, C&C OF HONOLULU
KAILUA, KOOLAUPOKO, OAHU
TAX MAP KEY 4-3-03 THRU 05

A. Background

The Department of Public Works of the City and County of Honolulu is proposing to construct drainage improvements in Lanikai. Lanikai is a residential community situated on the windward coast of Oahu between Kailua Beach and Waimanalo, approximately 14 miles from downtown Honolulu.

The drainage project will be constructed in four phases:

1. PHASE 1:

   Construction of overflow swales in the four existing beach rights-of-ways from Mokulua Drive to the seaward boundary.

2. PHASE 2:

   Construction of a concrete drainage channel along the entire length of the "Lanipo Ditch". The channel would extend into the ocean to eliminate the sand blockage problem presently being experienced at the channel outlet.

3. PHASE 3:

   Reconstruction of Mokulua Drive with adequate longitudinal and tranverse slopes for drainage, concrete curbs and gutters and an undergound drainage collection system. Included in Phase 3 is the extension of the drain outlet into the ocean to eliminate the sand blockage problem presently being experienced at the outlet.

4. PHASE 4:

Construction of concrete curbs and gutters at strategic locations on Aalapapa Drive, Mokolea Drive, Kehaulani Drive and Poopoo Drive to collect and convey the runoff to a new underground drainage pipe system.

The Final Environmental Impact Statement is for Phase 1 only. A Supplemental Environmental Impact Statement will be prepared for Phases 2, 3, and 4.

The existing drainage system is unable to handle the runoff from major storms and the resultant flooding has caused extensive property damage. The proposed Phase I improvements will relieve the problem along Mokulua Drive.

This project will generate short-term construction-related impacts such as increase in traffic, dust, and noise. Mitigation measures will be implemented to minimize these impacts. During excavation, there is a possibility of encountering archaeological burial sites, therefore, an archaeological subsurface survey and testing will be performed prior to construction to determine if significant historic sites are present and, if so, to then develop and execute an acceptable mitigation plan.

Phase 1 of the project is estimated to cost $200,000.00 and is tentatively scheduled for construction in April 1990.

B. Procedures

1. An EIS Preparation Notice for the proposed project appeared in the September 23, 1988 Office of Environmental Quality Control (OEQC) Bulletin. Copies of this notice were distributed to interested Federal, State, and City and County agencies, as well as community interest groups.

2. Comments from consulted parties were received until October 24, 1988, allowing all parties the required 30-day minimum consultation period. Eighteen parties submitted written comments during this period, which were responded to in writing by the applicant.

3. The Draft EIS was received by the OEQC on March 20, 1989. The deadline for public review was then set for May 8, 1989.

4. Eighteen parties responded to the request for comments on the Draft EIS. Two of these eighteen replies were postmarked or received after the deadline for public review.

5. Both the Assessment and Draft EIS included Phases 2 thru 4. The comments received focussed mainly on these phases rather than Phase I which has the least significant environmental impacts.

C. Content

The Final EIS for the proposed Phase I of the Lanikai Flood Control Project adequately addresses the content requirements specified in Sections 11-200-17 and 11-200-18 of the EIS Rules.

D. Responses to Comments

The applicant provided adequate point-by-point responses to all comments received within the 45-day review period established for the Draft EIS, concerning Phase I of the subject project.

E. Unresolved Issues

The unresolved issues involve Phases 2 thru 4 which will be addressed by a Supplemental Environmental Impact Statement.

F. Determination

The Final EIS is determined to be acceptable under the procedures and requirements established in Chapter 343, HRS, and the State "EIS Rules" for Phase I.

for Betsy Ross Marcinkus
DONALD A. CLEGG
Chief Planning Officer

LANIKAI FLOOD CONTROL PROJECT

KAILUA, KOOLAUPOKO, OAHU

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

FINAL

ENVIRONMENTAL IMPACT STATEMENT

(PHASE 1 CONSTRUCTION)

KWOCK ASSOCIATES, INC.
CONSULTING ENGINEERS
1100 WARD AVENUE
HONOLULU, HAWAII 96814

FINAL

ENVIRONMENTAL IMPACT STATEMENT

FOR

LANIKAI FLOOD CONTROL PROJECT, PHASE 1
(CONSTRUCTION OF OVERFLOW SWALES)

Kailua, Koolaupoko, Oahu
TMK: 4-3-01 thru 05

Proposing Agency
Department of Public Works
Division of Engineering
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Submitted Pursuant to Chapter 343, HRS

Responsible Official: _____ Date 9-29-89
SAM CALLEJO
Director and Chief Engineer

Prepared By
KWOCK ASSOCIATES, INC.
1100 WARD AVENUE, SUITE 920
HONOLULU, HAWAII 96814

SEPTEMBER 1989

C O N T E N T S

I. SUMMARY

The Department of Public Works of the City and County of Honolulu is proposing to construct drainage improvements in the community of Lanikai. Lanikai is a residential community situated on the windward coast of Oahu between Kailua Beach and Waimanalo, approximately 14 miles from downtown Honolulu.

The drainage project will constructed in four phases:

1. **PHASE 1:**

   Construction of overflow swales in the four existing beach rights-of-ways from Mokulua Drive to the seaward boundry.

2. **PHASE 2:**

   Construction of a concrete drainage channel along the entire length of the "Lanipo Ditch". The channel would extend into the ocean to eliminate the sand blockage problem presently being experienced at the channel outlet.

3. **PHASE 3:**

   Reconstruction of Mokulua Drive with adequate longitudinal and tranverse slopes for drainage, concrete curbs and gutters and an underground drainage collection system. Included in Phase 3 is the extension of the drain outlet into the ocean to eliminate the sand blockage problem presently being experienced at the outlet.

4. **PHASE 4:**

   Construction of concrete curbs and gutters at strategic locations on Aalapapa Drive, Mokolea Drive, Kehaulani Drive and Poopoo Drive to collect and convey the runoff to a new underground drainage pipe system.

The Final Environmental Impact Statement is for Phase 1 only. A Supplemental Environmental Impact Statement will be prepared for Phases 2, 3, and 4.

The existing drainage system is unable to handle the runoff from major storms and the resultant flooding has caused extensive property damage. The proposed drainage improvements are intended to reduce this flooding and prevent property damage. The proposed open channel and pipe outlet extensions into the ocean are required to minimize sand blockage problems.

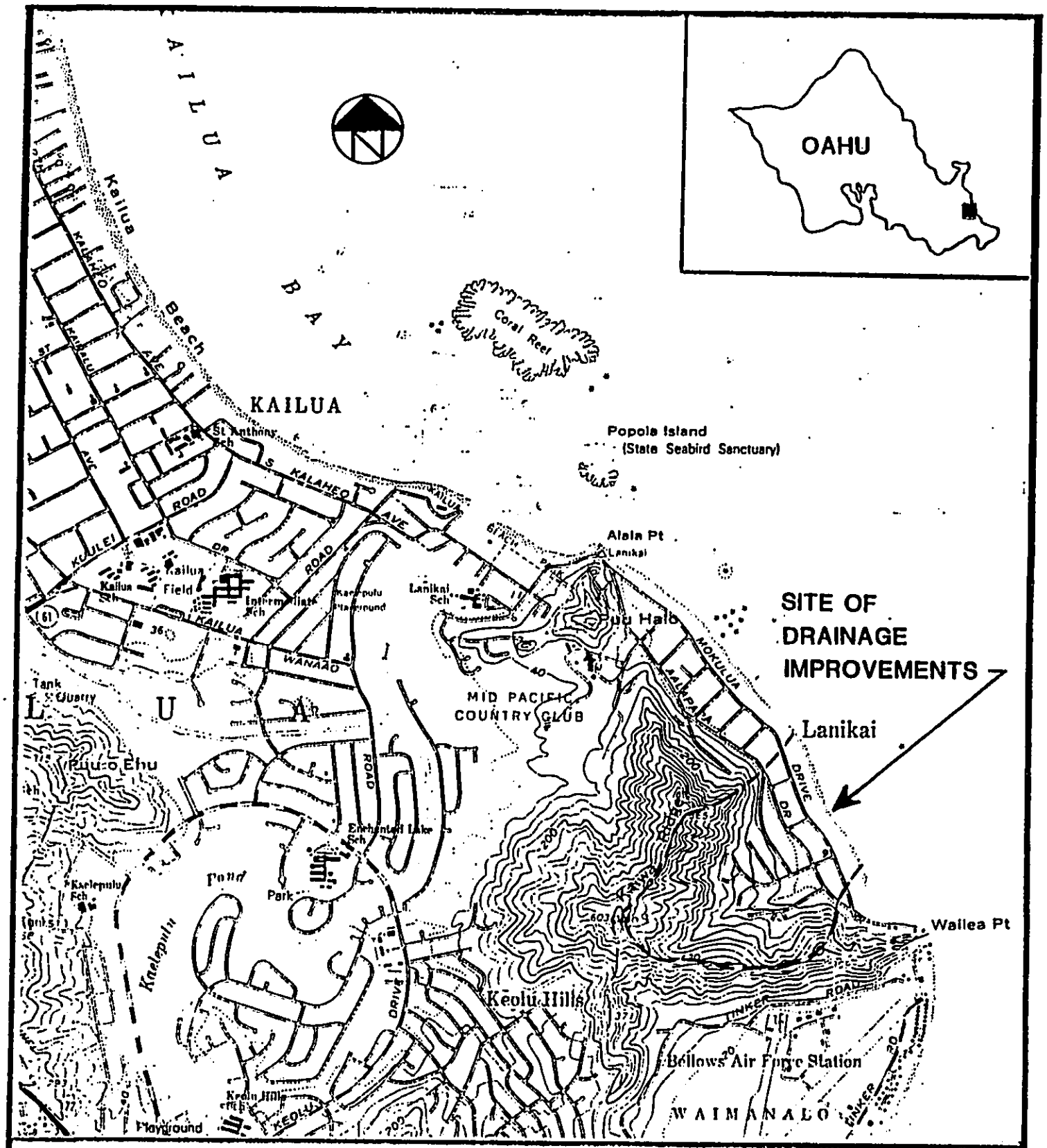
This project will generate short-term construction-related impacts such as road closures and an increase in traffic, dust, and noise. Mitigation measures will be implemented to minimize these impacts. In addition, flora and fauna may be temporarily disturbed by construction occurring around and within the stream. During excavation makai of Aalapapa Drive there is a possibility of encountering archaeological burial sites, therefore, an archaeological subsurface survey and testing will be performed prior to construction to determine if signidicant historic sitos are present and, if so, to then develop and execute an acceptable mitigation plan. The green sea turtle which frequents the outer edge of the shallow reef off Lanikai Beach is the only endangered species in the area.

The primary long term impact associated with the project will be the aesthetic and recreational effect of the open channel extension into the ocean. Another long term impact resulting from the project is the loss of parking spaces on the mauka side of the Mokulua Drive available to homeowners and beach goers.

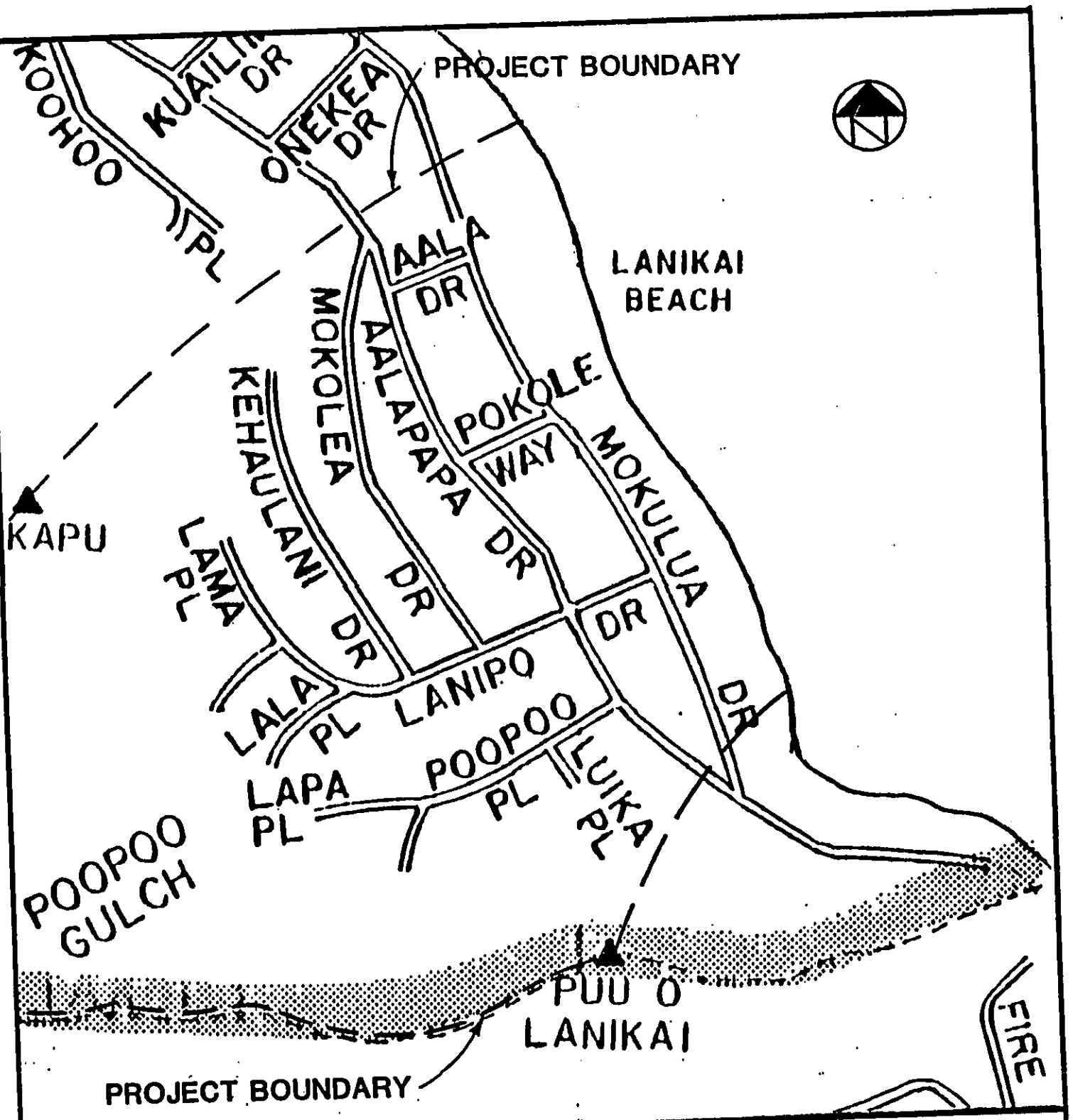
The benefit to the Lanikai community of the reduced chance of flood damage to property far outweighs any potential adverse impacts. An additional benefit is that the maintenance of the new drainage system will be the responsibility of the City and County of Honolulu, not the homeowner.

Other alternatives considered included (1) no action, (2) no open channel extension, (3) storm water detention, (4) open channel replaced with a pipe or box culvert and (5) repair existing structures and line the natural channel. In alternative (1) no action, potential property damage and injury to residents would still exist. In alternative (2) no open channel outlet, the sand blockage problem will still exist. Alternative (3), storm water detention will not work because the large area required to construct a detention basin is not available. Alternative (4), replace the open channel with a pipe or box culvert offers no advantage to the proposed plan because a visible groin extension would still be required. The existing drainage system is inadequate, therefore alternative (5) repairing the existing system would not solve the flooding problem.

The proposed project is estimated to cost $5,700,000 and will be constructed in four phases over 5 years. Phase 1 construction would begin in Fiscal Year 1990 and take four months to complete. The construction materials, public funds, energy and labor involved in this project will be irreversibly and irretrievably committed. Land will be committed for the life of the flood controls, however, the implementation of this project will reduce the chance of recurring flood damage, a great economic benefit to the residents of Lanikai.



LANIKAI FLOOD CONTROL PROJECT
FIGURE 1
LOCATION MAP
SCALE 1" = 2000'



LANIKAI FLOOD CONTROL PROJECT

FIGURE 2

STREET MAP

SCALE 1" = 500'

II. DESCRIPTION OF THE PROPOSED PROJECT

A. PURPOSE OF PROJECT

The Department of Public Works of the City and County of Honolulu is proposing to construct drainage improvements in the community of Lanikai (Figure 1). This project will be constructed in the southern portion of Lanikai (Figure 2) and will provide the area with an improved drainage system that will reduce flooding problems in the subdivision.

During major storms, the existing drainage system has been unable to handle all the runoff produced. Two storms occurring on November 26, 1984 and February 14, 1985 caused damages totaling more than $826,000. Reportedly the residents in this area had also sustained major damages from numerous storms prior to 1984.

The major reasons why flooding occurs are listed below:

1. The existing drainage system was designed based on standards existing at the time the subdivision was constructed and is undersized and inadequate to handle all the runoff generated by rainfall of a ten year duration based on the current standards. During a storm of any magnitude, there would be overflow from the system due to the insufficient capacity.

2. The existing main drainage channel above Aalapapa Drive is unimproved and is vulnerable to erosion. During periods of heavy runoff, the bottom and banks of this dirt channel erode carrying mud and silt downstream. The mud and silt clog downstream drainage structures reducing their capacity.

3. Sand blockage at the ocean outlets do not allow the water to drain into the ocean. The water backs up, overflows the channel, and causes major damages to homes along Mokulua Drive.

4. In some areas, grading and development have changed drainage flow patterns. Certain surface flows do not follow the natural water course or flow into the drainage structures designed to receive them. Homes in higher areas have no provisions to intercept runoff from the hillside that flows directly onto properties.

5. Maintenance of the existing drainage channel

between Mokuloa Drive and the outlet and "Lanipo Ditch above Aalapapa Drive is the responsibility of the home owners and is inadequate. Each home owner is responsible to maintain that portion of the drainage ditch that passes through their property. Erosion of the unlined ditch produces silt which is carried downstream. Debris and trash also accumulates in the drainage ditch and reduces the capacity of the channel. The type of drain inlets used within the roadways are susceptible to clogging.

The purpose of this project is to improve the existing drainage system of Lanikai in order to reduce the flood damage that occurs during heavy rainfall and to bring the drainage system up to the standards of the City and County of Honolulu so that they can assume responsibility for maintenance of the system.

B. EXISTING DRAINAGE SYSTEM

At the time Lanikai Development was constructed, the standards for subdivision improvements permitted drainage runoff to flow overland from the hillside, across the roadways and lots and into the ocean. Inlets with headwalls and culverts were installed across the roadways so that the runoff from defined drainage swales or ditches could cross the roads without damaging the pavement. The roads in the area do not have curbs to contain the runoff within the road prism. Runoff flows overland through private property down to the lowest point, Mokulua Drive.

In 1953 the City and County of Honolulu prepared construction plans for the Lanikai Flood Control Project to install a pipe system that discharged onto the beach through the beach right of way near the intersection of Aala Drive and Mokulua Drive. The pipe system extended up through Aala Drive to pick up flows from four catchbasins situated near the intersection of Aala Drive and Aalapapa Drive. In addition, a small pipe system was constructed on Aalapapa Drive near Lanipo Drive to collect the flow from two catchbasins at the intersection of Poopoo Place and Aalapapa Drive and two grated inlets on Aalapapa Drive. This system discharges into the open channel at Lanipo Drive.

The bulk of the drainage runoff from Lanikai is collected and discharged into the open channel that runs along Lanipo Drive from the ocean to the hillside above the development. From the ocean to a point

mauka of Aalapapa Drive, the rectangular channel is constructed of cement rubble masonry with the rocks having a flat cut surface. The improved channel is approximately 8'-6" wide and 4'-6" deep. Above Aalapapa Drive the channel is unimproved and has an alignment that meanders. The width of the unimproved channel varies. This is probably the result of erosion of the channel banks from flows over a period of time. The open channel also receives discharge from collection systems from Poopoo Place and Lama Place. In addition, pipe systems from Lanipo Drive, Kehaulani Drive, and Aalapapa Drive also discharge into the open channel.

Most of the pipe systems are undersized according to today's standards and not adequate to handle all of the runoff generated by rainfall of a ten year intensity. During a storm of any magnitude, there would be overflow from the system due to the insufficient capacity. The majority of the catch basins are the grated inlet type with limited inlet capacity and prone to clogging because of the small spacing of the grating openings. The grated inlets located on the shoulder of Aalapapa Drive are constructed flush with the pavement and have limited inlet capacity unless a head is permitted to build. Most of the grated inlets and catch basins are located on the mauka side of the roads and once the runoff crosses the street, there is nothing to prevent it from traveling through the lots on the makai side of the street.

Mokulua Drive is the lowest point in the subdivision. Yet there is no drainage system on Mokulua Drive from Lanipo Drive to Aala Drive to collect and transport the runoff for disposal. All of the area makai of Aalapapa Drive drains down to Mokulua Drive. In storms of high intensity, the overflow from the upper streets also end up on Mokulua Drive. During the storms of November 1984 and February 1985, this part of Lanikai suffered the most damages due to flooding of the area.

C. <u>PROBLEM AREAS</u>:

Lanikai was constructed at a period of time when subdivision standards were lower. This contributes much to the country or rural character of the neighborhood. The streets are narrow in width with the major roads having a 40 foot right-of-way with about eighteen feet of pavement. The minor streets have a 30 foot right-of-way with about fifteen feet of

pavement. The streets have no curbs making it difficult to collect the runoff in any kind of drainage system. The original subdivision improvements did not provide an adequate drainage system to collect and dispose of the runoff. Drainage improvements were constructed at a later date and are inadequate to handle the runoff. The following are the major problem areas:

1. Both the open drainage channel and the pipe system are undersized and incapable of carrying the runoff generated during storms of ten year intensity. The open channel has a runoff area of 125.44 acres and a flow of 384.91 cfs for a ten year storm. The 24" pipe system has a runoff area of 27.65 acres and a flow of 50.67 cfs for a ten year storm. An additional 21.99 acres with a runoff of 44.49 cfs flow overland to Mokulua Drive and is not picked up by any drainage system.

2. Sand blockage of both the open channel outlet and the pipe system outlet is a major problem. The pipe outlet is especially bad because the outlet is completely buried up to the top of the headwall. Unless the sand buildup at the outlet is cleared, flow is restricted through the system. The sand blockage at the channel outlet causes water to back up into the channel. Once the water level in the channel builds up higher than the sand however, the runoff will flow to the ocean. This reduces the capacity of the channel to carry the storm flow.

   Sand buildup is a result of sediment transport along the shore caused by wave action. In this process called littoral drift, wave-induced long shore currents erode or accrete the beach by moving sand up or down the shore. Sand is deposited at both outlets of the open channel and pipe system effectively blocking them.

   The problems with sand blockage of the channel and pipe outlets are discussed in detail in a report titled "Oceanographic Design Considerations for Drainage Discharge Structures" dated May 1987 prepared by Edward K. Noda and Associates, Oceanographic Consultants. This report can be found in Appendix A.

3. The erosion of the unimproved main channel above

Aalapapa Drive causes mud and silt to be carried downstream. During the storms of November 1984 and February 1985, the eroded mud and silt blocked the culvert at Aalapapa Drive causing the channel to overflow.

4. There is a general lack of understanding of ownership of easements and responsibility for maintenance. Until ownership of easements and responsibility for maintenance is resolved and understood by all concerned, maintenance will be a major problem. The unlined natural channel runs through private property and the property line is the centerline of the channel. It is the responsibility of the land owner to maintain the drainage system within his property. Besides the major drainage open channel that runs parallel to Lanipo Drive, there are several smaller drainage ditches that are located in private property including the drainage ditch between Lama Place and Kehaulani Drive, the drainage ditch between Kehaulani Drive and Mokolea Drive, the drainage ditch between Mokolea Drive and Aalapapa Drive and the drainage ditch between Lala Place and the major drainage channel running parallel to Lanipo Drive.

5. One of the reasons for Lanipo open channel overflowing was the silt and debris in the channel at the time the storm of November 1984 and February 1985 occurred. The debris blocked the culvert at Aalapapa Drive causing the flow in the channel to overflow into private property and the roadways. The City and County of Honolulu has an easement for only that portion of the channel between Mokulua Drive and Aalapapa Drive. The rest of the unimproved channel belongs to the adjoining property owners who are responsible for its maintenance.

6. The lack of an adequate drainage collection system and curbs on the roads to intercept the runoff from the hillside lots and roadways parallel to Mokulua Drive will cause ponding on Mokulua Drive because of its sump condition. The high sand dune along the beach prevent the runoff reaching Mokulua Drive to drain into the ocean. Mokulua Drive does not have an adequate drainage collection system to dispose of the runoff waters. Mokulua Drive is very flat and does not have adequate slope to eliminate puddles and ponding.

7. The lack of curbs and gutters on the streets to collect and channel the runoff to catch basins and inlets is a problem. During rainfall of high intensity, the runoff will bypass the catch basins and inlets and overflow into the makai properties. The grated inlets are not effective because its limited inlet capacity. Capacity of the grated inlet is dependent on the depth of water that is allowed to build up above the grating. Without curbs and gutters, this water build up cannot take place. It has been shown that in areas where the City's Division of Road Maintenance has constructed asphaltic concrete curbs on the makai side of the street, the curbs has helped to prevent runoff flow from entering private property and causing damages to the home. However, when these asphaltic concrete curb are constructed indiscriminately, the result is usually additional problems elsewhere because the runoff is concentrated in another location.

8. The homes on the hillside have water from large runoff areas draining through the property. Many of the homeowners have built cut off ditches to divert the runoff around the houses. These diversion ditches however, are not adequate to handle the runoff from high intensity storms. The homeowners must continue to monitor, maintain and improve the diversion measures to channel the flow around the building to prevent storm damages.

9. Many of the homes were built without consideration for draining runoff away from the structure. Some of the houses have the ground sloping directly to the house allowing runoff on the property to flow into the house. Some of the houses on Mokulua Drive have their slab elevation below the elevation of Mokulua Drive. These homes will be subject to flooding during storms due to the sump condition of Mokulua Drive. Some of the homes are built flush with the ground without any step up to the house slab.

10. In many areas structures are built over drainage pipes. There is a building situated over the open channel makai of Mokulua Drive which interferes with capacity of the system and makes maintenance difficult.

11. The open ditch from Lala Place built of hollow block tile has been severely damaged and in many

places has failed. The walls have collapsed and the bottom slab washed away. Runoff that previously flowed in the lined ditch is now flowing uncontrolled and unrestricted and eroding the ground causing much mud and silt to be carried downstream.

12. Mokulua Drive is susceptible to flooding because the mauka parallel roads, Aalapapa Drive, Mokolea Drive and Kehaulani Drive do not have curbs to intercept and prevent the runoff from reaching Mokulua Drive. Mokulua Drive is the lowest point in the subdivision and all of the runoff flow will accumulate there because the upper roads do not have an adequate drainage system.

D. PROPOSED DRAINAGE SYSTEM

The existing Lanikai drainage system is unable to handle the amount of runoff produced by major storms which have caused extensive flood damage in the subdivision. Modifications and additions will have to be made to this drainage system in order to reduce the flooding. The sand blockage problem of the ocean outlets will have to be eliminated by constructing a system that will either prevent the buildup, bypass, or erode the sand berms to allow water to drain into the ocean.

The proposed drainage improvements are shown in Figure 3 and are scheduled to be constructed in four phases. A description of these phases are listed below:

Phase 1

1. Construct concrete paved pedestrian walkways sloping toward the beach which would perform as overflow swales through the four beach right of ways located on Mokulua Drive. Split face cement masonry units will be used for the retaining walls and the in place material invert will be graded to flow toward the beach. A typical section is shown in Figure 4. Barriers will be constructed to prevent cars from entering the beach through these walkways.

Phase 2

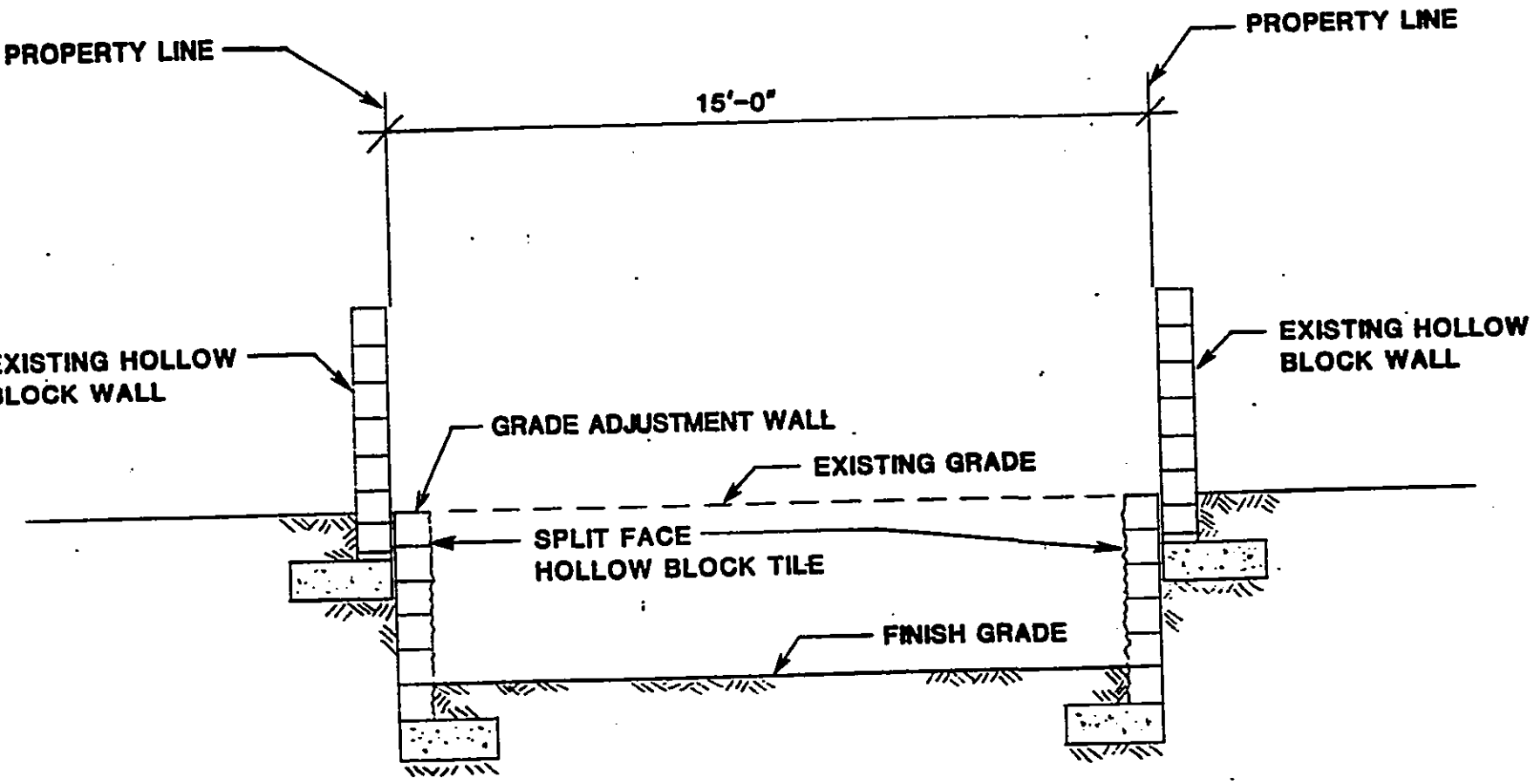
1. Construct a new concrete lined open channel alongthe entire length of the open ditch that runs parallel to Lanipo Drive. Typical channel

LANIKAI FLOOD CONTROL PROJECT
KAILUA, KOOLAUPOKO, OAHU

PROPOSED IMPROVEMENTS

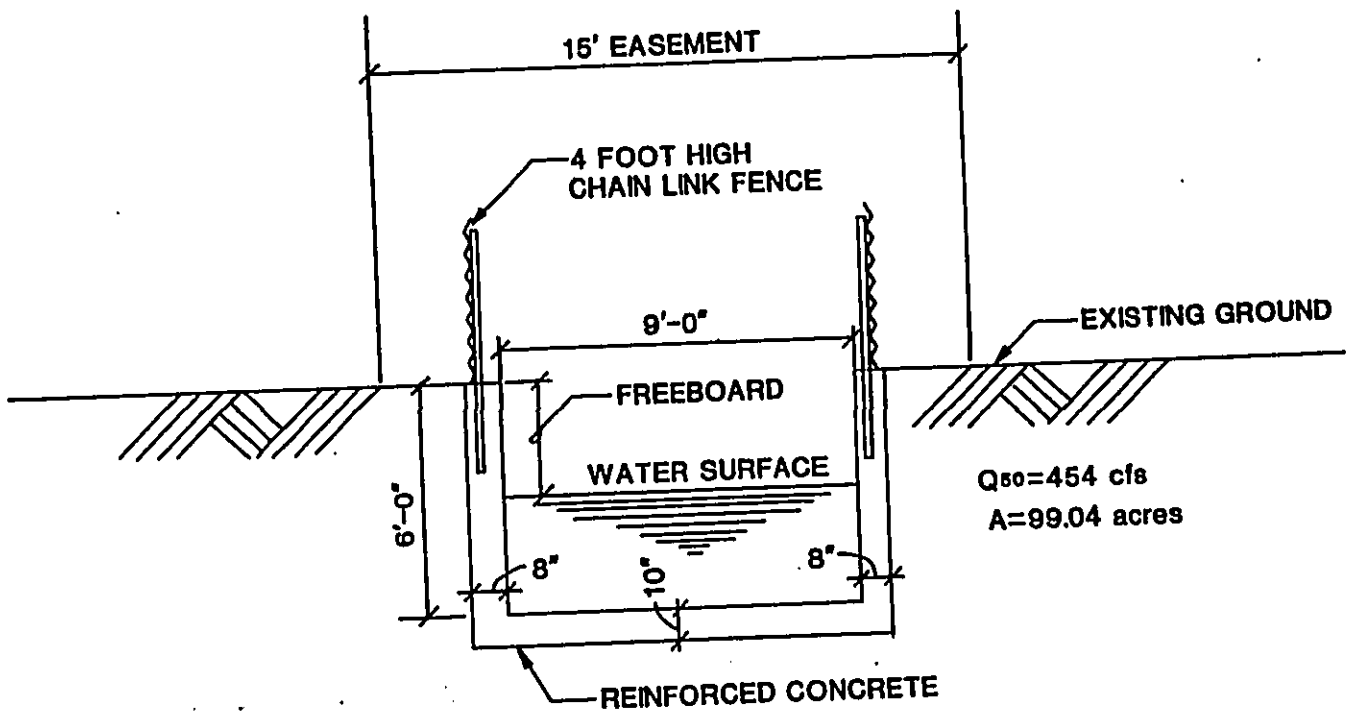
FIGURE 3

166-051



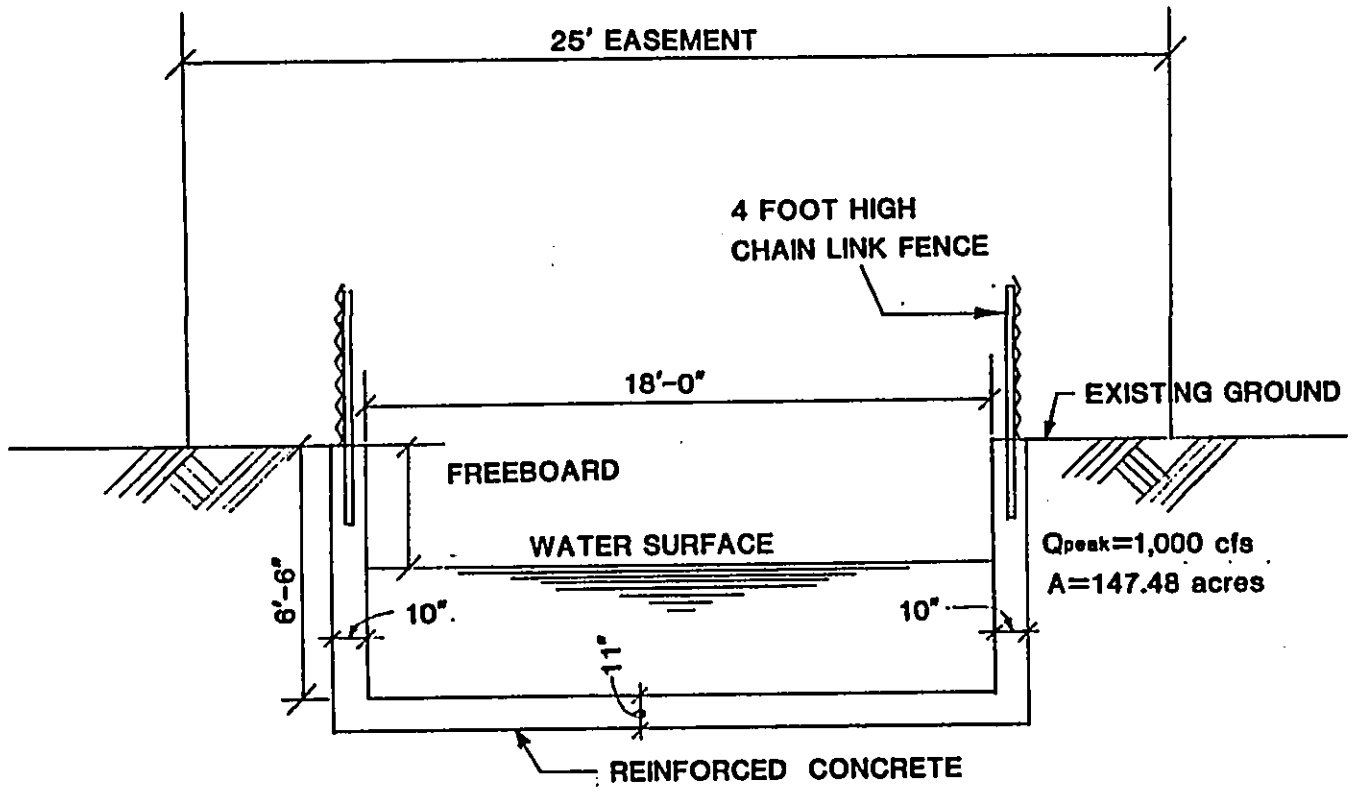
TYPICAL OVERFLOW SWALE AT
BEACH RIGHT OF WAY

FIGURE 4



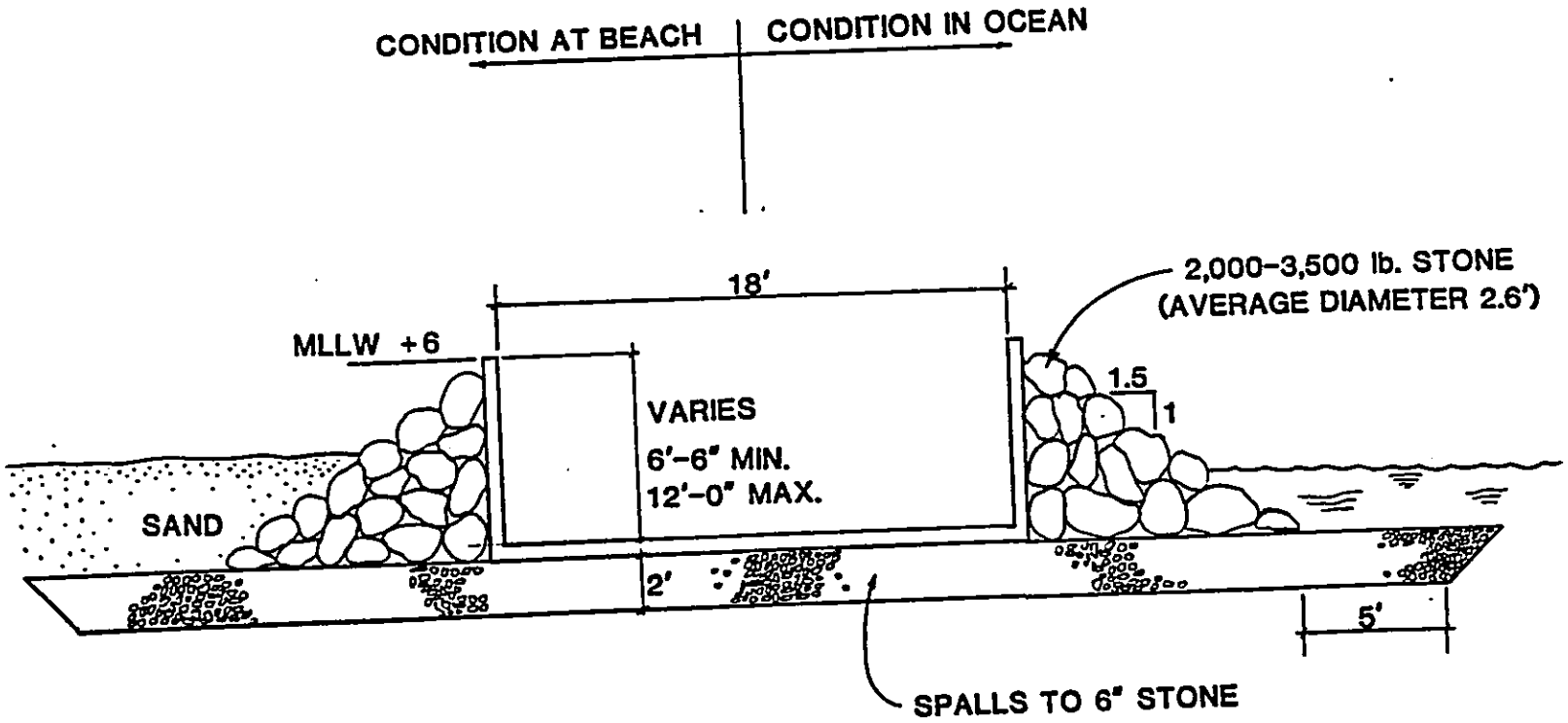
TYPICAL CHANNEL SECTION
ABOVE AALAPAPA DRIVE

FIGURE 5



TYPICAL CHANNEL SECTION
AALAPAPA DRIVE TO OUTLET

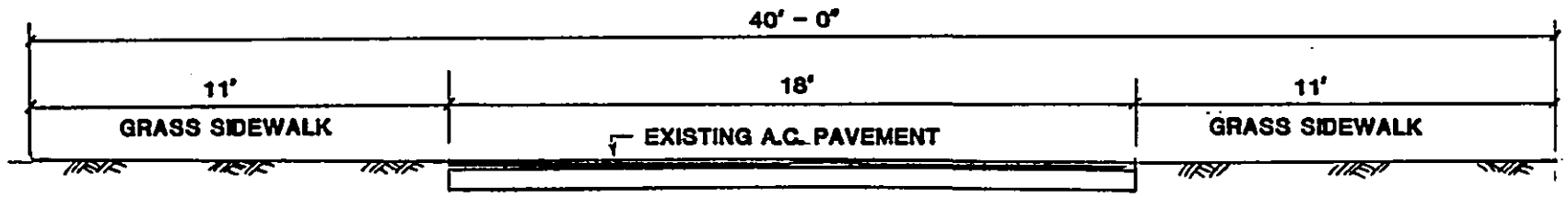
FIGURE 6



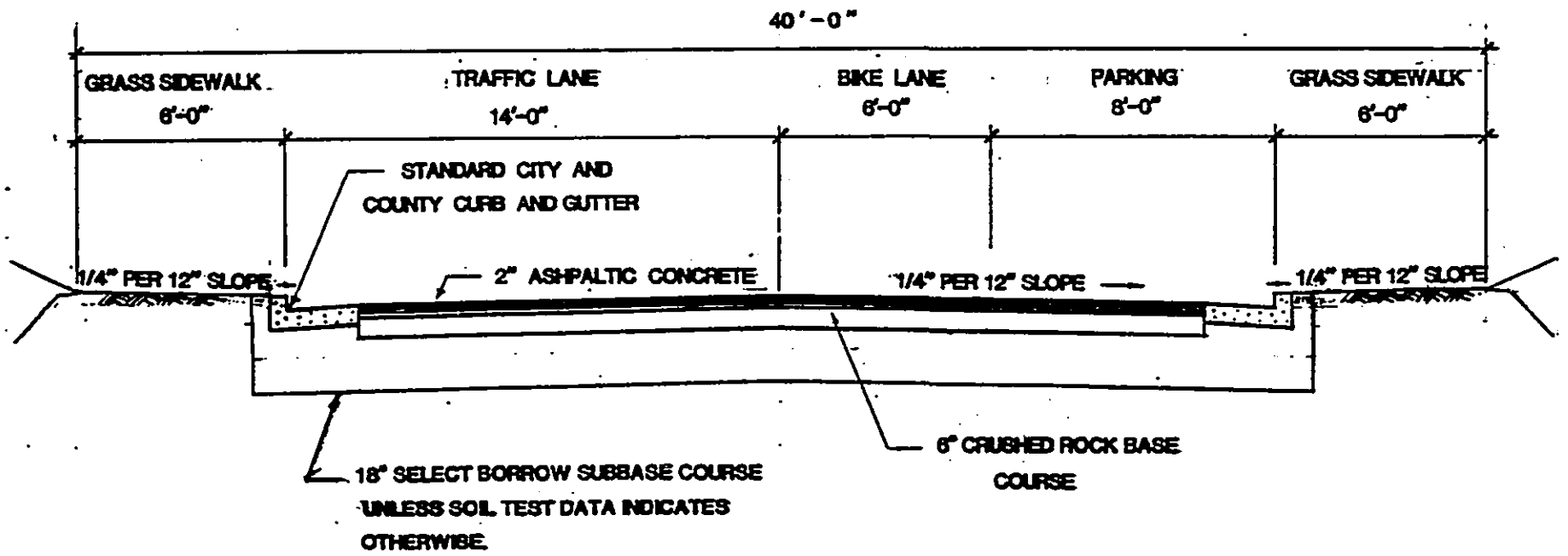
SECTION–OPEN CHANNEL EXTENSION

SCALE: 1" = 6.0'

FIGURE 7



MOKULUA DRIVE
EXISTING ROAD SECTION



MOKULUA DRIVE
(ONE WAY TRAFFIC)

PROPOSED ROAD SECTION

FIGURE 8

sections above and below Aalapapa Drive are shown in Figures 5 and 6, respectively. The channel would be designed to meet the City and County of Honolulu standards and would be maintained by the City. New box culverts would be provided at the Mokulua Drive and Aalapapa Drive crossings.

2. Extend the channel outlet in accordance with the recommendations of Edward K. Noda and Associates to eliminate the sand blockage problems.

The solution for keeping the channel opening clear from sand is to extend the channel beyond the maximum estimated beach zone limit. To achieve this, the open channel will have to be extended seaward from the existing seawall 170 feet. The open channel extension would consist of a vertical-wall, open concrete channel, with exterior facing of stone. A cross section of the open channel extension is shown in Figure 7. The side wall elevation will be 5 feet above mean sea level for the entire length of the channel in order to maintain the channel opening through the beach zone. This open channel extension would act as a groin effectively blocking both northward and southward littoral drifts. This would possibly increase the beach width on both sides of the channel. A 10 foot wide pedestrian bridge will be built across the concrete channel to maintain access to the beach.

Phase 3

1. Reconstruct Mokulua Drive with concrete curbs and gutters with the width adequate to provide one lane of traffic, a bike lane, and parking on the makai side (Figure 8). The sidewalk areas would remain grassed. Adequate slopes would be provided to drain the road and a drainage collection system would be provided.

Phase 4

1. Construct new pipe systems within the roadways to collect and transport the runoff for disposal. This would require approximately 9,000 linear feet of pipe.

2. Replace the existing pipe system that drains through the beach right of way near Aala Drive with one of adequate capacity.

3. Extend the pipe outlet into the ocean in accordance with the recommendations of Edward K. Noda and Associates to eliminate the sand blockage problems. This solution is similar to the open channel extension described in Phase 2. To extend the pipe outlet beyond the maximum estimated beach zone, the pipe end will have to be 150 feet seaward of the existing seawall and will end well short of the existing coral heads.

   The pipe outfall would be buried through much of the beach to minimize the aesthetic impacts and any potential littoral transport. The pipe outlet will be above the sandy offshore bottom to minimize sand infill. Armor stones or concrete supports will be used to provide lateral support.

4. Relocate the pipes running under structures on Poopoo Place and Lala Place to the road right-of-way so that they can be maintained by the City.

5. Flow from the existing open ditches on Aalapapa Drive, Mokolea Drive, Kehaulani Drive, Lama Place, Lala Place, Poopoo Place would be intercepted by City-owned drainage pipe systems within the roadway. The advantage of this would be to eliminate the overland flow through private property and to convey the runoff in a City-owned and maintained drainage system.

6. Construct a new catch basin on the makai side of Luika Place at the intersection of Poopoo Place.

7. On Aalapapa Drive, Mokolea Drive, Kehaulani Drive and Poopoo Drive, concrete curbs and gutters would be provided on the makai side of the street to intercept and convey the runoff to catchbasins. There would be no changes in road widths or traffic patterns.

E. FUNDING SCHEMES

The total estimated construction cost is $5,700,000. Phase 1 (Overflow Swales) and Phase 2 (Lanipo Channel) will be funded by the City as part of a capital improvement project (CIP). This cost is estimated to be $132,000 for Phase 1 and $2,979,000 for Phase 2. Phase 3 (Mokulua Drive Reconstruction) and Phase 4 (Drainage Pipe System) will be funded under an Improvement District process where the

Property Owners and the City will share the improvement cost under a formula to be set by the City Council. Phases 3 and 4 are estimated to cost $941,000 and $1,648,000, respectively.

Construction is contingent on the City receiving funds for Phases 1 and 2 and Property Owner's approval for an Improvement District to fund Phases 3 and 4.

F. SCHEDULE

Phase 1 is scheduled to commence construction in fiscal year 1990-1991 and construction is estimated to take four months.

Phase 2 is scheduled to commence construction in fiscal year 1991-1992 and construction is estimated to take one year.

Phases 3 and 4 would require more time due to the lengthy Improvement District process and construction would probably not commence until fiscal year 1993-1994 with a construction period of two years.

III. DESCRIPTION OF THE ENVIRONMENTAL SETTINGS

A. LOCATION

The project is located in Lanikai which is the residential community situated on the windward coast of Oahu between Kailua Beach and Waimanalo, approximately 14 miles from downtown Honolulu. Lanikai is part of the district of Kailua in the Judicial District of Koolaupoko. Housing consists of single family residences in a subdivision originally developed around 1929. Clark (The Beaches of O'ahu, 1977) describes Lanikai as an excellent, close-knit community. The drainage improvements are proposed in the southern portion of Lanikai extending from the ocean to the Kaiwa Ridge line bordered by Onekea Drive on the west to a line just short of the Aalapapa and Mokulua Drive intersection on the east. The area is currently zoned R-10, Residential District.

B. BEACH SETTING AND USE

Lanikai Beach is a sandy beach which stretches for more than a mile along the coast between Wailea Point and Aala Point. Lanikai Beach is well protected by the shallow outer reef margin and offshore islands. The bottom slopes gently offshore and safe swimming is possible year round (Clark, 1977). The beach is used

extensively by sunbathers, swimmers, wind surfers and small sailing crafts. Access to the beach is by several right-of-ways which are owned by the Lanikai Association. Beachfront lots border it's entire length with beach widths varying between 20 and 100 feet.

Beach widths are continuously changing due to the process of littoral drift. Littoral drift is the process where wave-induced long shore currents erode or accrete the beach. This is the reason that the beach width in the area of the open channel has decreased from about 100 feet in 1969 to less than 20 feet today.

The ocean bottom just offshore of Lanikai consist of sand, coral rubble, and eroded coral blocks. Shifting sand keeps inshore waters fairly murky at the Wailea Point end of the beach. The reef flat is consolidated limestone of low relief or limestone rubble, in either case with a considerable admixture of sand (AECOS, Oahu Coral Reef Inventory, 1979).

C. SOIL

The Lanikai area is classified by the United States Soil Conservative Service as being in the Kaena-Waialua Association. This association, or soil type, is described as fine grained soils that have a fine-texture to coarse-texture subsoil or underlying material, depending on the slope in which the association lies. The surface soil in Lanikai varies from Jaucas Sand (0 to 15% slopes) between the beach and Aalapapa Drive, Mokuleia clay loam just mauka of Aalapapa Drive and Kokokahi clay (6 to 12% slopes) and Papaa clay (35 to 70% slopes) in the higher areas. All of these soil types are described in the U.S. Agriculture Soil Conservation Service Soil Conservation Report.

D. CLIMATE

Lanikai is located on the windward side of Oahu which is subject to moisture laden northeast tradewinds 75% of the year. A reverse of wind pattern, the so called Kona Winds from the south to southwest occur about seven percent of the year. The average annual temperature is 75 degrees fahrenheit and humidities range from 70 to 80 percent throughout the year. Average annual rainfall is 25 inches along the coast. The air quality of the Lanikai area is generally excellent.

E. DRAINAGE

The project area consist of the valley in the southern portion of Lanikai between Puu O Lanikai and Kaiwa Ridge which has a total drainage area of 184 acres. Rain falling in the area enters the existing drainage system and is discharged into the ocean at one of two locations. The main drainage channel in this valley is called "Lanipo Auwai" by residents. It runs parallel to Lanipo Drive and collects the runoff from the majority of the area. A hydrologic study was performed that determined parts of the existing drainage system are inadequate to handle a major storm.

According to the Flood Insurance Study for the City and County of Honolulu, the area abutting Lanikai Beach (makai of Mokulua Drive) has a base flood elevation of 5 feet above mean sea level.

F. ARCHAEOLOGY AND CULTURAL SIGNIFICANCE

The alignment of the flood control drain and subdrains is completely located in the fully developed Lanikai subdivision. The drains do not cross any virgin or undeveloped land. Sites of Oahu (Sterling and Summers, 1978) indicate no archaeological sites on the project alignment. Also, there are no known sites listed in the Hawaii Registry of Historical Places, nor any eligible sites for inclusion on the National Registry of Historical Places in the project area (DLNR, 1987). However, a recent watermain installation in Lanikai has uncovered some ancient burial sites. In sand substrate areas (areas makai of Aalapapa Drive) more burial sites may be expected.

G. FLORA AND FAUNA

Existing vegetation around the stream portion of the drain consists of Haole Koa, Kiawe, California Grass and Christmas Berry Trees. Vegetation at other locations are ornamental plants which are part of homeowner's landscaped yards. The subdivision development has probably displaced any native flora in the vicinity of the project. None of the flora are endangered. Animal life in the neighborhood consists of mongoose, rats and feral cats and dogs. Bird life are made up of common, introduced birds such as Myna, Barred Dove, and Spotted Dove. Residents have also reported seeing Sparrows, Linnets, Thrushes, Cardinals, Finches, and Bulbuls.

The only endangered marine plant or animal specimens in the waters off Lanikai is the green sea turtle (Chelonia Mydas), which frequents the outer edge of the shallow barrier reef off Lanikai Beach. This species is listed as threatened and receives Federal protection under the Endangered Species Act. Fish are extremely sparse from the shore seaward to where the reef heads are exposed. This is due to the wave surge force and periodic transport of sand into the reef creating a relatively flat reef causing a lack of habitat (Russo, Benthic Ecosystem and Fish Population off Mokapu Outfall, 1980).

H. UTILITIES

Utilities in the Lanikai area are provided by the following agencies: Board of Water Supply (water), Hawaiian Telephone Company (telephone), Hawaiian Electric Company (electricity), and City and County of Honolulu Department of Public Works (sewer and refuse disposal). There is no natural gas service in the area. The water and sewer lines are underground while the telephone and electrical lines are on overhead poles.

IV. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURE

A. CONSTRUCTION RELATED IMPACTS

1. ECONOMIC

The cost of this drainage project is estimated to be $5,700,000. City and County funds will cover a portion of the construction cost. The City and County will explore the use of an improvement district process where cost of the project is shared between the City and owners of properties benefiting from the improvements to fund the remaining portion of the project.

2. AIR QUALITY

There will be an increase in dust and vehicular exhaust emissions in the immediate working area during construction. The dust generated should not occur at significant levels. Appropriate water sprinkling methods will be used to reduce dust if it becomes a problem. Exhaust emissions should not have any significant affect on the area because prevailing winds should disperse any exhaust gas concentrations.

3. WATER QUALITY

Problems with water quality during construction will be minimal because this drain is normally dry. Only during a heavy rainfall is there a possibility of any runoff. Construction could be scheduled during the dry season to minimize excess sediment loading of near shore waters. There will be some turbidity and sediment in the waters off Lanikai caused by construction of the offshore drainage system. The Contractor will take precautions to prevent debris, construction materials, petroleum products, and other contaminants from entering the drainage system and coastal waters. These impacts will be temporary and have no long-term adverse effects.

The overflow of cesspools and sanitary sewer lines during storm flooding will have an impact on the pollution of the coastal water with raw sewage being transported directly to the shoreline. The coastal water quality will be protected with the construction of this project.

4. EROSION

During heavy rain some erosion will occur in areas which were cleared for construction and equipment access. Clearing of areas will be minimized by using existing roadways whenever practical. Runoff will be diverted from areas susceptible to erosion with temporary diversion ditches whenever possible. Flora in the area should return shortly and prevent any future erosion.

5. TRAFFIC

Portions of Mokulua and Aalapapa Drives will have to be closed during the construction of the drainage ditch road crossings. Other streets will be partially blocked off during the construction of the street drainage system. A traffic plan and appropriate traffic control measures will be implemented to ease congestion in the construction areas. Traffic control measures include warning signs, barricades, and a special duty police officer to direct traffic. Times of road closure will be restricted to non-peak hours. Homeowners will be advised of the traffic plan prior to start of construction.

There will be a slight increase in traffic due to construction workers in the area. The amount of street parking in construction areas will be reduced.

6. NOISE

There will be an increase in noise from the construction area. Any disruption to the community can be minimized by restricting the hours of heavy equipment operation. All noise regulations established by the State Department of Health will be met. (Chapter 43 - Community Noise Control for Oahu, State Department of Health, 1981). The Contractor must obtain a noise permit if noise levels from the construction activities are expected to exceed the allowable levels of the regulations. The Contractor must comply with the conditional use of this permit as specified in the rules and conditions issued with the permit. Construction equipment and on-site vehicles requiring an exhaust of gas or air will be equipped with mufflers. Traffic noise from heavy vehicles traveling to and from the construction site will be minimized and must comply with the provisions of Title 11, Administrative Rule, Chapter 42, Vehicular Noise Control for Oahu. Barriers or berms will be constructed around the baseyard or any stock-piles to reduce the noise from these areas and a contingency plan will be developed in the event that complaints are made regarding noise emanating from these areas.

7. BIOLOGICAL

There are no rare or endangered flora or fauna in the area. Any vegetation along the existing drain will be removed but will return after construction is completed. Vegetation will be removed from the four beach right-of-ways where the overflow swales are constructed.

Construction of the pipe outfall near Aala Street and open channel extension will be reduced from the 200 feet recommended by Edward K. Noda and Associates, Inc. to 150 feet to minimize any adverse effects on the coral community and related ecosystems which described by AECOS in their report Biolgical Reconnaissance Surveys of the Lanikai Fringing Reef off the Project Area. Marine life inside project area is extremely

sparse due to a lack of habitat (flat sandy reef). This is caused by the wave surge force coupled with the periodic transport of sand onto the reef. If warranted, a silt curtain will be used during excavation and construction of both drains.

8. ARCHAEOLOGICAL

There is a possibility of encountering burial sites during construction of the open channel makai of Aalapapa Drive. Archaeological subsurface survey and testing will be performed prior to construction to determine is significant historic sites are present and, if so, to then develop and execute an acceptable mitigation plan.

9. BEACH USE

Construction of the ocean outlets and overflow swales will require closing of the public right of way and portions of the beach. While it is not possible to quantify effects on beach use during construction, it is likely that many beach goers will choose to avoid this area and use another portion of the beach. Contractor will be allowed to close only one beach right-of-way at any given time to minimize the inconvenience to the public.

B. LONG TERM IMPACTS

1. DRAINAGE

The proposed drainage improvements will substantially reduce flooding in the South Lanikai area. The two ocean outlets will allow water to drain into the ocean bypassing the sand buildup on the beaches. The capacity of the drains and channels will be increased to handle more runoff. The construction of additional drainage structures will help convey the water to the main drains and channels. Overflow swales constructed in four beach right-of-ways will meet City design standards. These modifications will reduce flooding in the subdivision without changing the character of the community. Concrete curbs and gutters would be installed only where necessary to convey runoff to catch basins. Right of way acquisition will be kept to a minimum. The City will be responsible for the

maintenance of all new drainage structures eliminating the homeowner's responsibility of maintaining the drainage system in his property. This will greatly reduce flooding due to debris clogging drainage structures.

2. ECONOMIC

The drainage improvement will have great economic benefits to the Lanikai residents. The implementation of this project will reduce the chance of recurring flood damage. This includes the cost of cleaning, repairing and replacing damaged items, and the cost of family disruption and relocation. There is also an increase in the community's sense of cohesiveness and confidence knowing that they are better protected from flooding.

The improvement district (I.D.) process is being investigated by the City to have residents share in the cost of the project. The reasoning behind an I.D. project is that Lanikai residents would benefit economically from this project, and therefore should share with the cost.

3. WATER QUALITY

The drainage system will affect water quality only during heavy rainfall. Discharge of storm waters is not a new but a continuing impact. The proposed drainage system will service the same drainage area as the existing system. There will be a slight increase of pollutants entering the ocean due to the increase in the amount of water being discharged into the ocean. The increase in discharge is due to the improved drainage system that collects water more efficiently. There will also be an increase in the rate that the pollutants reach the ocean because of the increase in the rate of runoff reaching the ocean.

4. EROSION

The proposed drainage improvement will decrease the amount of erosion that occurs during storms. The proposed concrete drain channel will not erode and will be sized so that it will not overflow, reducing any possible erosion along the stream or channel bank. The additional drainage structures will direct the water off the street

and properties to the channels or drain. Debris basins will be constructed to receive any rocks and silt coming from the slopes at the upstream end of the channel.

5. NOISE

No significant change in noise is anticipated.

6. AIR QUALITY

Ambient air quality should not be significantly affected by the project.

7. TRAFFIC

There will be no impact to traffic flow due to the drainage improvements. All areas where street excavation will occur will be resurfaced to match previous conditions. One way traffic on Aalapapa Drive and Mokulua Drive would be maintained. The reconstruction of Mokulua Drive will eliminate approximately 20 parking spaces on mauka side of the street. The lost spaces will made up by providing parking on the makai side of the street. Presently many of the homeowners have planted trees or placed rocks to prevent parking in front of their homes on the makai side fo the street. Additional parking is available on side streets and the lost of 20 parking spaces should not have have an adverse impact on the beach activities.

8. BIOLOGICAL

The project area does not contain any endangered species of plant or animals. Displaced flora and fauna would be able to return following construction. Long-term adverse impacts are not anticipated from the proposed drainage improvement.

This drain is usually dry so there is no reason to believe that there would be any significant effect on marine life. AECOS in their report Biological Reconnaissance Surveys of the Lanikai Fringing Reef off the Project Area discusses the presence of the green sea turtles in the area and reported no adverse impacts due to the construction of the project. During intense rain the discharge of storm waters from

drainage improvements would not be a new but a continuing impact. There would only be a slight increase of pollutants entering the ocean with the drainage improvements. The project will reduce the mosquito population in the area by eliminating standing water in the drain.

9. ARCHAEOLOGICAL

There is a possibility of encountering archaeological remains during the excavation for the open channel in areas makai of Aalapapa Drive. Archaeological subsurface survey and testing prior to construction to determine if signifcant historic sites are present and, if so, to then develop and execute an acceptable mitigation plan. This will ensure that all excavations will be properly monitored and any archaeological findings are preserved or removed.

10. UTILITIES

There are no anticipated impacts on existing utilities in the Lanikai area. All buried lines (water and sewer) will be modified or relocated in the areas where there is a conflict with the new drains. Potable groundwater resources will not be impacted.

11. BEACH MODIFICATIONS

Both the open channel and pipe outfall will be located at the same beach locations as the existing channel and pipe outlets. The pipe outfall will be buried through much of the beach area, minimizing any aesthetic impacts. The open channel extension will extend 170 feet seaward from the existing seawall. The open channel extension will look like a rock wall extending into the ocean similar to other drainage outfalls located around Oahu. The top of the groin will be level at 5 feet above mean sea level for it's entire length. This extension would possibly lead to an accretion in the beach width on both sides of the channel (Edward K. Noda and Associates, 1987). This beach accretion will reduce the distance that the channel extends into the water minimizing the aesthetic impact of the groin. Edward K. Noda & Associates discusess the matter further in their Assessment of Impacts Related to Offshore Extension of Drain Pipe and Open Channel which may be found in Appendix B.

12. RECREATIONAL EFFECT

The pipe outfall will be buried through much of the beach area and will be sufficiently deep so not to affect swimming and boating in the area. The pipe outfall will extend out 150 feet from the existing seawall. The existing beach in this area is approximately 60 feet wide and the pipe outlet will extend 90 feet in the water. A permanent visual marker can be placed at the seaward end of the pipe to ensure that water users who launch/beach small craft in this area do not run over the pipe.

The channel extension will extend out 170 feet from the existing seawall and since the existing beach is approximately 20 feet wide, the channel will extend 150 feet into the water. Swimmers and sailboats will have to go out past the channel outlet to cross to the other side of the groin. The potential increase in the beach width will decrease the length of channel in the water.

On the beach, a bridge will be built to allow beach goers to cross the channel and a four-foot fence on each channel wall will prevent beach goers from falling into the channel.

C. UNAVOIDABLE ADVERSE IMPACTS

Construction related noise, dust, and inconvenience are unavoidable. Aesthetic and beach impacts are also unavoidable. The reduction of parking spaces on Mokulua Drive and destruction of foliage are unavoidable.

D. COMMITMENT OF RESOURCES, FUTURE OPTIONS, AND LONG-TERM PRODUCTIVITY

Construction of a storm drain commits the City and County to maintenance of the drainage system and open channel, clearing of sand clogging, and removal of debris snagged by the drains. The shorewaters occupied by the open channel and pipe outlet extensions would be permanently unavailable for recreation.

E. GOVERNMENTAL POLICIES OFF SETTING ADVERSE IMPACTS

Since Lanikai is a residential area that has suffered extensive property damage from flooding,

improvements in drainage system are felt to offset potential adverse impacts.

V. SUMMARY OF UNRESOLVED ISSUES

1. Funding is available for only a portion of Phase 2. Funding of drainage improvements for Phases 3 and 4 is not resolved at this time.

2. It is unknown if archaeological burial sites will be encountered during excavation.

VI. ALTERNATIVE TO PROPOSED ACTION

A. NO PROJECT

There will be no direct cost or environmental impact from doing nothing. However, Lanikai will continue to flood and suffer property damages during heavy rainfall.

B. NO OPEN CHANNEL OUTLET EXTENSION

Improvements to the open channel will stop at the beach if no channel extension is constructed. This alternative will eliminate the aesthetic and recreational impacts of the channel extension. However, this does not solve the sand blockage problem of the open channel. Sand will continue to block the mouth of the open channel preventing the runoff from reaching the ocean. To prevent flooding, the sand berm will have to be removed before every storm or flooding may occur. Removal of the sand berm at the outlet may be a problem especially if the storm occurs at night. Personnel and equipment may not be available to open the channel mouth. This alternative is very risky and in the long run probably very expensive.

C. STORM WATER DETENTION

Storm water detention consist of constructing detention basins which collect runoff delaying the discharge of runoff into drainage structures. This eliminates the need to enlarge downstream drainage structures due to the decreased runoff rate. The major problem with this alternative is that there are no suitable areas large enough to construct the detention basin with adequate storage capacity needed for the amount of runoff produced in Lanikai.

D. OPEN CHANNEL OCEAN OUTLET REPLACED WITH A PIPE OR BOX CULVERT

A large diameter pipe or box culvert can be used to handle the flow draining into the ocean from the open channel. However, both pipe and box culvert will be large enough to require a visible groin extending into the ocean, similar to the groin for the open channel ocean extension. Maintenance for both alternatives will be difficult and expensive because of limited access. The pipe or box culvert alternative offers no advantages over the proposed open channel extension with maintenance being one major disadvantage. The open channel designed with freeboard would be able to carry the runoff from a storm of greater intensity than the design storm.

E. REPAIR EXISTING STRUCTURES, LINE NATURAL CHANNELS AND INSTALL A NEW DITCH ON MOKULUA DRIVE

Hydrologic and hydraulic calculations show that the existing drainage system is inadequate and undersized to handle all the runoff produced in Lanikai. Therefore, repairing the existing drainage structures will not solve the flooding problems. Lining of the natural channels will reduce erosion but will not increase the capacity of the channels downstream. A new ditch on Mokulua Drive accomplishes the same thing as the proposed pipe system on Mokulua Drive. These alternatives do not completely solve the flooding problems. Lanikai will continue to flood and suffer property damages during heavy rainfall.

VII. PROJECT RELATIONSHIP TO LAND USE PLANS, POLICIES AND CONTROLS

Proposed drainage improvements are neither clearly required nor prohibited by adopted public land use plans and policies. Selection among project alternatives and impact mitigation measures is more a matter of judgement than one of law. Regulatory authority over the project is shared by 9 different public agencies. As indicated in Chapter VII, as many as 10 different permits and approvals would be necessary to construct the Lanikai Flood Control Project.

A. FEDERAL LAND USE CONTROLS

The U.S. Army Corps of Engineers regulates dredging and construction makai of the mean higher high water mark. The Corps is responsible

to protect the public interest in navigation, economic development, recreation, flood mitigation, and environmental quality. Generally, the Corps accepts the advice of the U.S. Fish and Wildlife Service concerning environmental matters and the advice of the U.S. Coast Guard concerning navigation. The Corps is responsible to consider economics as well as environmental impacts when selecting among proposed drainage alternatives.

Because the State Coastal Zone Management (CZM) Program has been approved by the U.S. Department of Commerce, Corps permits cannot be given without prior approval of the State Department of Business and Economic Development (DBED). DBED review is based on the objectives and policies of Chapter 205A, Hawaii Revised Statutes (HRS). Relevant policies include the following:

Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas. (Section 205A-2(c)(1)(B)(i), HRS).

Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites and sandy beaches, when such resources will be unavoidably be damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable. (Section 205A-2(c)(1)(B)(ii), HRS).

Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline. (Section 205A-2(c)(3)(B), HRS).

Preserve valuable coastal ecosystems of significant biological or economic importance. (Section 205A-2(c)(4)(B), HRS).

Direct the location and expansion of coastal dependent development to area presently designated and used for such developments (Section 205A-2(c)(5)(C) HRS).

B. STATE LAND USE CONTROLS

The policies of the State Plan (Chapter 226, HRS) and the State CZM Law (Chapter 205A, HRS) by law are binding on permits and approvals by State agencies. Theoretically, this is supposed to prevent myopic decision making. In practice, no State agency has amended its regulations to specifically incorporate the policies of the State Plan or State CZM Law. Relevant policies of Chapter 205A have been previously discussed. In addition, one policy of Chapter 226 is pertinent:

> Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimal. (Section 226-104(c)(4), HRS).

As indicated in this EIS, mitigation measures will be employed to minimize environmental impacts, regardless of which drainage alternative is selected.

Pursuant to Chapter 205, HRS, and the State Land Use District Regulations of the State Land Use Commissions, lands mauka of the shoreline are in the Urban District and subject to County regulation while lands makai of the shoreline are in the Conservation District and subject to regulation by the Department of Land and Natural Resources (DLNR). Permit applications for development in shoreline areas must be accompanied by a recent shoreline survey certified by the Department of Land and Natural Resources. A shoreline survey meeting State requirements will be conducted following final approval of this EIS. The standard usually used for identifying the "shoreline" is the makai edge of vegetation.

The DLNR controls disposition of State property at Lanikai. To varying degrees, all proposed drainage alternatives would require permanent drainage easements across State land and authorization for temporary use of State land during construction. The only laws which provide policy guidance concerning County use of State land are the State Plan and the State CZM Law.

The State Department of Transportation (DOT) Harbors Division regulates dredging and construction on shores and shorewaters "... belonging to or controlled by the State of Hawaii ..." (DOT Harbors Division Rules and Regulations and Tariff No. 4, paragraph 3801). The only laws which provide policy guidance concerning DOT Shore and Shorewaters

Construction permits are the State Plan and State CZM Law.

The State Department of Health regulates marine dredging and construction which may "... degrade marine bottoms ..." (Public Health Regulations Chapter 37-A Section 3.4 (B)). From the standpoint of water quality, DOH preference is to diffuse potential storm water impacts on marine ecosystems by use of multiple small drainage outfalls. Given the degraded quality of the bottom off Lanikai, DOH Regulations do not provide a firm basis for selecting among proposed drainage alternatives.

C. COUNTY LAND USE CONTROLS

A special management area use (SMA) permit would be needed from the Honolulu City Council before any other State or County permit could be given to construct proposed drainage improvements. State CZM Law guidelines require the City Council to impose conditions on SMA permits to minimize adverse impacts from developments. Also SMA permits cannot be granted unless the City Council finds:

(A) That the development will not have any substantial adverse environmental or ecological effect, except as such effect is minimized to the extent practicable and clearly outweighed by public health, safety, or compelling public interest ...

(B) That the development is consistent with the ... policies ... of this chapter ...

(C) That the development is consistent with the county general plan ... (Section 205A-26(2), HRS)

Relevant policies of the 1977 County General Plan Objectives and Policies include the following:

> Design surface drainage and flood-control systems in a manner which would help preserve their natural settings. (Natural Environment Objective A Policy 5).
>
> Protect the natural environment from damaging levels of air, water, and noise pollution. (Natural Environment Objective A Policy 6).

The State Shoreline Setback Law requires that two public hearings by held before a public agency decides to undertake construction or development within a 40 foot strip mauka of the shoreline. Before building the proposed drainage alternatives, the Department of Public Works (DPW) will need to hold two public hearings.

DPW grading/grubbing permits and Building Department building permits set performance standards for construction methods. They do not authorize agency selection of the drainage project.

VIII. NECESSARY APPROVALS

Approval	Agency	Public Hearings
Approval of Shoreline Survey	DLNR	
Shoreline Setback Approval	DLU	2 hearings
Special Management Area Permit	City Council	1 hearing
Grading/Grubbing Permit	DPW	
Conservation District Use Permit	DLNR	
Easement for Permanent Use of State Land	DLNR	
Right of Entry for Temporary Use of State Land	DLNR	
Shore and Shorewaters Construction Permit	DOT	
Approval of Drainage Outfall	DOH	
Permits for Structures and Fill Material in Navigable Waters	DBED/COE	Op. COE Hearing

****

DPW	County Department of Public Works
BD	County Building Department
DAGS	State Department of Accounting & General Services Survey Division
DLNR	State Department of Land and Natural Resources
DOT	State Department of Transportation Harbors Division
DOH	State Department of Health Pollution Technical Review Branch
DBED	State Department of Business & Economic Development Coastal Zone Management Branch
COE	U.S. Army Corps of Engineers

Approvals required for Phase 1 construction include Shoreline Survey, Shoreline Setback Variance, Special Management Area Permit, and Grading Permit. No work will be performed within the conservation area administered by the Department of Land and Natural Resources.

IX. AGENCIES AND PERSONS CONSULTED

A. LIST OF CONSULTED PARTIES

1. Federal Government

*Department of Agriculture, Soil Conservation Service
*Department of the Navy, Commander, Naval Base Pearl Harbor
*U.S. Army Corps of Engineers, Honolulu District Engineer
*U.S. Fish and Wildlife Service
U.S. Coast Guard, Fourteenth Coast Guard District

2. State Government

*D.A.G.S, Division of Public Works
*Department of Business and Economic Development
*Department of Defense, Office of the Adjutant General
*Department of Health
*Department of Land and Natural Resources
*Department of Transportation
*State Office of Environmental Quality Control
*University of Hawaii Environmental Center
University of Hawaii Water Resources Center
State Senator Mary George
State Representative Cam Cavasso

3. County Government

*Department of Land Utilization
*Department of Transportation Services
*Department of Parks and Recreation
Department of General Planning
Police Department
*Board of Water Supply
City Councilman David Kahanu
Kailua Neighborhood Board No. 31

4. Private

*The Lanikai Association
The Lani-Kailua Outdoor Circle
Kailua Community Council
*Hawaiian Electric Co., Inc.
Hawaiian Telephone Co.
Pacific Resources Inc. (Gasco, Inc.)

* Parties commenting on the Draft Environmental Impact Statement

COMMENTS AND RESPONSES TO THE ENVIRONMENTAL ASSESSMENT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P. O. BOX 50167
HONOLULU, HAWAII 96850

ENVGR 88-327

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TO Room 6307

MAY 24 1988

Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Re: Environmental Assessment for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii

Dear Mr. Thiede:

We have reviewed the subject document and offer the following comments for your consideration. Contrary to statements made in the document, the green sea turtle (Chelonia mydas) frequents the outer edge of the shallow barrier reef off Lanikai Beach. This species is listed as threatened and receives Federal protection under the Endangered Species Act. Provided that care is taken during construction to minimize soil erosion and retain suspended fine sediments within the immediate project area, we do not anticipate that the project will affect this listed species.

40

We appreciate this opportunity to comment.

Sincerely yours,

Ernest Kosaka

Ernest Kosaka, Field Supervisor
Office of Environmental Services
Pacific Islands Office

cc: Kwock Associates, Inc.

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0506

July 25, 1988

Mr. Ernest Kosaka, Field Supervisor
Office of Environmental Services
Fish and Wildlife Service
United States Department of the Interior
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Subject: Your Letter of May 24, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project

We appreciate your comments and will incorporate suggested impact mitigation measures in our construction plans if the proposed project is implemented. In order to adequately address the public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

Maine T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

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STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

IN REPLY, PLEASE REFER TO:
EPHSD

SF.3814
ENV 14
12/14 ENGR

June 9, 1988

MEMORANDUM

To: Mr. Alfred J. Thiede, Director and Chief Engineer
Department of Public Works, City & County of Honolulu

From: Deputy Director for Environmental Health

Subject: Environmental Assessment (EA) for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, Tax Map Key 4-3-01 thru 05

Thank you for allowing us to review and comment on the subject EA. We provide the following comments:

Noise

1. Construction activity must comply with Title 11, Administrative Rules, Chapter 43, Community Noise Control for Oahu. The following conditions should also be included.

   a. The contractor must obtain a noise permit if the noise levels from the construction activities are expected to exceed the allowable levels of the rules.

   b. Construction equipment and on-site vehicles requiring an exhaust of gas or air must be equipped with mufflers.

   c. The contractor must comply with the conditional use of the permit as specified in the rules and conditions issued with the permit.

2. Traffic noise from heavy vehicles travelling to and from the construction site must be minimized near existing residential areas and must comply with the provisions of Title 11, Administrative Rules, Chapter 42, Vehicular Noise Control for Oahu.

3. Should there be a baseyard or stockpile located adjacent to residences, precautions to reduce the noise in these areas, such as barriers or berms, must be implemented and contingency plans must be developed in the event that complaints are received regarding noise emanating from these areas.

Vector Control

We support the proposed project since it will enhance our mosquito control efforts for this community through the elimintion or reduction of standing water.

BRUCE S. ANDERSON, Ph.D.

41

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0508

July 25, 1988

Mr. Bruce S. Anderson, PhD.
Deputy Director for Environmental Health
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Anderson:

Subject: Your Memorandum of June 9, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project

We appreciate your comments and will incorporate suggested impact mitigation measures in our construction plans if the proposed project is implemented. In order to adequately address additional public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

Maria T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

JOHN WAIHEE
GOVERNOR OF HAWAII

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LIBERT K. LANDGRAF
DEPUTY

AGRICULTURAL DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
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WATER AND LAND DEVELOPMENT

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DOC.: 3817E
FILE: 88-552

JUL 22 1988

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CITY & COUNTY OF HONOLULU
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Jul 26 2 51 PM '88

The Honorable Alfred J. Thiede
Director and Chief Engineer
DEPARTMENT OF PUBLIC WORKS
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

SUBJECT: Environmental Assessment for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii
Tax Map Key: 4-3-01 thru 05

42

Dear Mr. Thiede:

Thank you for giving our Department the opportunity to comment on this matter.

We have reviewed the materials you submitted and have the same comments offered in our earlier letter to Mr. Donald A. Clegg, dated May 27, 1988, a copy of which was sent to you by Mr. E. B. Connell of the Department of General Planning on June 3, 1988, according to our records. An additional copy is enclosed for your convenience.

In addition, we currently have the following comments and concerns.

Aquatic Resources:

The action proposed may have some impact on aquatic resources from turbidity and sediment caused by construction and the offshore drainage system modifications. Various benthic aquatic organisms in the vicinity of the proposed ocean channel extension may be displaced; however, impacts adverse to biological resources are expected to be temporary, and no long-term effects are anticipated.

We suggest that construction take place during the dry season to mitigate excess sediment loading of nearshore waters. Also, precautions should be taken to prevent debris, construction materials, petroleum products and other contaminants from entering the drainage system and coastal waters.

Historic Sites:

The subject Environmental Assessment states on Page 24 that the proposed drains do not cross any virgin or undeveloped land, and that there are no known sites of historical significance in the project alignment.

This is no longer true. The recent Board of Water Supply installation of an 8" main in Lanikai impacted human burials (Site 80-11-3738).. In sand substrate areas in Lanikai, as with all coastal areas on the Windward side of O'ahu, more burials may be expected. The entire project area makai from Mokulua Drive is sand. Further, Site 80-11-3738 is on Aalapapa Drive, where the sand substrate is buried under one meter of alluvium. Thus, the depth of trenching for the proposed Phase 2 channel also becomes an issue.

We believe, therefore, that this project has the potential to adversely affect significant historic sites. We recommend that the Department of Public Works retain a professional archaeologist to design and implement a monitoring plan based on construction design. This plan should be submitted to the Historic Sites Section for review prior to project implementation.

Recreation:

We are concerned, too, about the potential impact of the project on the sand beach and the swimming area: Lanikai Beach is one of the best swimming beaches in the State and it is also a scenic resource. The environmental impacts and mitigation measures did not address visual resources and inadequately addressed the impact on the sand beach and the swimming area. The environmental assessment (EA) stated: "This extension could possibly lead to an accretion in the beach width on both sides of the channel." Based on our observations of groins and other extensions into the water, we note that it also could lead to a severe beach erosion problem. The statement in the EA suggests that the long-term impact on the sand beach and the swimming area is unknown and that it could possibly lead to the erosion of the sand beach, thus adversely impacting its outdoor recreation value.

We conclude that an Environmental Impact Statement is warranted for this project.

Thank you again for your cooperation in this matter. Please feel free to call me or Jay Lembeck of our Office of Conservation and Environmental Affairs, at 548-7837, if you have any questions.

Very truly yours,

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

Enclosure

43

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0532

August 3, 1988

Mr. William W. Paty, Chairperson
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Your Letter of July 22, 1988 (Doc. No. 3817E) Concerning the Environmental Assessment for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii. TMK: 4-3-01 thru 05

We appreciate your comments and will incorporate suggested impact mitigation measures in our construction plans if the proposed project is implemented. In order to adequately address additional public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. THe Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

For ALFRED J. THIEDE
Director and Chief Engineer

MT:CPC:tc
cc: Kwock Associates, Inc.

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR
LESLIE S. MATSUBARA
DEPUTY DIRECTOR

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

KAMAMALU BUILDING, 250 SOUTH KING ST., HONOLULU, HAWAII
MAILING ADDRESS: P.O. BOX 2359, HONOLULU, HAWAII 96804 TELEX: 723610 HIDPED

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Ref. No. P-8450

June 8, 1988

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The Honorable Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

Subject: Environmental Assessment (EA) for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii TMK: 4-3-01 thru 05 (Ref. No. 12-0349)

We have reviewed the subject assessment relative to Hawaii's Coastal Zone Management (CZM) objectives and policies and offer the following comments.

There may be significant CZM related impacts associated with the flood control project. Therefore, we recommend that an environmental impact statement (EIS) be prepared to address the probable impacts. The EIS should include a discussion of relevant objectives and policies of the Hawaii CZM Program, as specified in Chapter 205A, Hawaii Revised Statutes. As part of the discussion, special attention should be given to the following areas of concern.

Recreational Resources

CZM policy calls for the provision of adequate, accessible and diverse recreational opportunities in the CZM area by protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas, and by providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value. The proposed development includes an open drainage channel and pipe outfall both of which cross the beach and extend into the sea. The effect of these developments on the use of the beach and offshore recreational area (surfing, beach walking, swimming and boating) is not addressed in the EA and should be evaluated in the EIS.

Coastal Ecosystems

One of the objectives of the Hawaii CZM Program is to protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems. The proposed development calls for the construction of concrete walkways in the existing public beach access right-of-ways for use as overflow swales. We are concerned that such development may adversely affect the strand ecosystem. Alternatives for handling overflows and their consequences relative to the coastal ecosystem are not discussed in the EA and should be evaluated.

Another significant ecosystem likely to be adversely affected is the coral reef community. We are concerned that the proposed channel outlet and pipe outfall may have adverse effects in two ways. Because coral ecosystems can be adversely affected by an increase in fresh water, appropriate mitigation measures are warranted. We suggest that a survey be done to determine the densities of coral in the area. This information should then be used to determine the area which would be least affected by fresh water input, and thus the area for placement of the drainage outfalls. The other concern involves the impact to the coral ecosystem which may result from an increase in sediment transport into the ocean carried by the drainage system. The potential for this impact needs to be assessed, and the inclusion of a desilting basin near the makai end of the system considered.

Additionally, the impacts on nearby endangered species, notably sea turtles, should be discussed.

Coastal Hazards

An objective of the CZM Program is to reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence. The construction of the channel outlet and the pipe outfall across the beach and into the ocean will affect the natural shore processes in this area. The environmental assessment indicates that this may result in accretion on both sides of the channel outlet. However, we believe this matter should be investigated further due to the structures' potential to also cause erosion in the immediate or adjacent areas. According to the report entitled Beach Changes on Oahu as Revealed by Aerial Photographs (Hwang, 1981), Lanikai Beach experiences significant patterns of accretion and erosion. The outfall structures have the potential to disrupt this natural cycle.

In addition, we suggest that all alternatives to the structures be considered, especially those that will not interrupt the natural littoral transport. For example, periodic maintenance of the existing channel opening may adequately reach the goals of this project and concurrently involve the least amount of adverse impacts. Another alternative, suggested for other drainage systems, involves designing the channel and pipe outlets to end in a buried revetment mauka of the shoreline. The revetment protects the outlets

from erosion while allowing for the continuation of natural shore processes. These and other alternatives should be evaluated for their applicability at the Lanikai site.

On the basis of the potential impacts discussed above, we believe that an EIS should be prepared for this project. The EA does not address these significant impacts. Thank you for the opportunity to comment.

Sincerely,

Roger A. Ulveling

cc: Office of Environmental Quality Control

45

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0511

July 26, 1988

Mr. Roger A. Ulveling, Director
Department of Business and
Economic Development
State of Hawaii
P. O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Ulveling:

Subject: Your Letter of June 8, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

We appreciate your comments on the proposed project. In order to adequately address the public concerns about alternative drainage structures, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

LIBERT K. LANDGRAF
DEPUTY

AGRICULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

DOC. NO.: 3493E
FILE NO.: 88-469

MAY 27 1988

Honorable Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Clegg,

SUBJECT: Lanikai Flood Control Project. TMK: 4-3-1 thru 5

We have reviewed the project cited above and have the following comments to offer.

Our records indicate that no archaeological survey or testing has taken place in the Lanikai area. As the flood control trenches follow road right-of-ways in the development part of Lanikai, we would not expect to encounter any surface archaeological sites. However, we would expect to encounter subsurface archaeological deposits in areas of Lanikai where ground disturbance has not been great. In the beach areas, burials are likely to be encountered.

The current action is a Development Plan amendment, and as such, will have no impact on significant historic sites. However, the construction of the flood control system can be anticipated to have an adverse effect. Planning should therefore include allocation of funds to provide for archaeological subsurface survey.

Thank you for the opportunity to comment on this project.

Very truly yours,

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

46

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0512

July 25, 1988

Mr. William W. Paty, Chairperson
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Your Letter of May 27, 1988 (Doc. No. 3493E)
Concerning the Environmental Assessment for the
Lanikai Flood Control Project, Kailua, Oahu, Hawaii,
TMK: 4-3-01 thru 05

We appreciate your comments and will incorporate your recommendations made to the Department of General Planning if the proposed project is implemented. In order to adequately address additional public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

JOHN WAIHEE
GOVERNOR

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN K. LICHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO:
STP 8.3004

Engr.
88.4659

July 20, 1988

Mr. Alfred Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

Environmental Assessment for the
Lanikai Flood Control Project
Kailua, Oahu

47

The drainage outlet to the ocean should be located and designed so that the structure will not pose a safety hazard to near shore users in the area.

Thank you for this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

FRANK F. FASI
MAYOR

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0534

August 4, 1988

Mr. Edward Y. Hirata, Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hirata:

Subject: Your Letter of July 20, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

We appreciate your comments on the proposed project. In order to adequately address additional public concerns, we will be preparing an Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

for ALFRED J. THIEDE
Director and Chief Engineer

MT:CPC:tc
cc: Kwook Associates, Inc.

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

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REPLY TO ATTENTION OF

June 2, 1988

ENGR 88-5587

Planning Branch

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Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

Thank you for the opportunity to review the Environmental Assessment (EA) for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii. The following comments are offered:

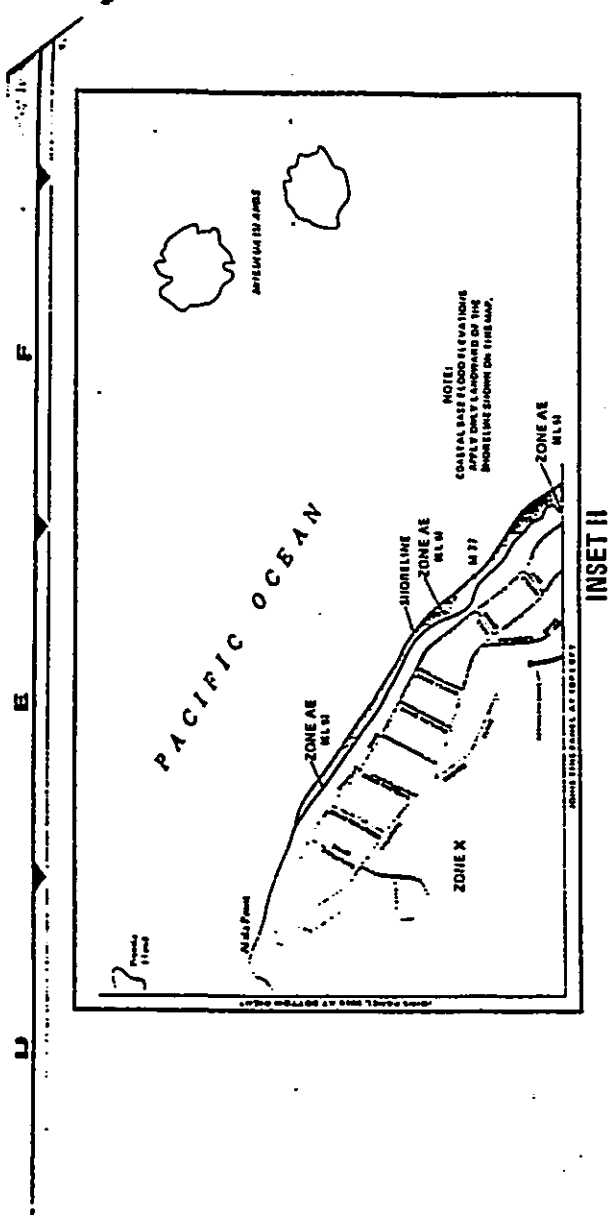
a. Department of the Army permits will be needed for fills and structures in waters of the United States, as noted on page 48 of the EA. Please contact Operations Branch (telephone 438-9258).

b. According to the Flood Insurance Study for the City and County of Honolulu (copy of map enclosed), portions of the project are situated outside of the 500-year flood plain (Zone X, unshaded). Portions of the site abbutting Lanikai Beach at Aala Drive and Pokole Way are in Zone AE with a base flood elevation of 5 feet above mean sea level.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Enclosure



PACIFIC

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University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

June 17, 1988
RN:0192

Mr. Alfred J. Thiede
Director and Chief Engineer
Division of Wastewater Management
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

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JUN 23 11 08 AM '88
HIST. OF ENGINEERING

Dear Mr. Thiede:

Environmental Assessment
Lanikai Flood Control Project
Kailua, Oahu

In response to your request, we have reviewed the Environmental Assessment (EA) for the above cited project with the assistance of William Coulbourn, Geology and Geophysics; and Belinda Tilley, Environmental Center. We offer the following comments relevant to the determination as to whether or not an Environmental Impact Statement (EIS) should be required.

The Lanikai Flood Control Project involves construction of new paved pedestrian walkways to serve as overflow swales along four beach right-of-ways; a new concrete lined open channel along the entire length of the open ditch that runs parallel to Lanipo Drive; an extension of the channel outlet seaward 170 feet from the existing seawall; a reconstruction of Mokulua Drive with concrete curbs and gutters to improve drainage; new pipe systems within roadways to improve collection and transport of runoff; a replacement of the existing inadequate pipe system through the beach right of way near Aala Drive; an extension of the pipe outlet 200 feet seaward of the existing seawall for these pipe systems; a relocation of drainage pipes under structures; and an interceptor system to eliminate existing open ditches on private property and provide a connection with the new City-owned and maintained drainage system.

General Comments:

In evaluating the potential environmental effects of this project, it is important to recognize that the primary purpose of the project is to initiate significant environmental changes in the drainage characteristics

49

of the Lanikai area. Therefore, if the environmental impacts of the project were not significant, the project would not be undertaken. The open channel will require major construction in the shoreline region, an environmentally sensitive area. It will require an irrevocable commitment of the natural coastal resource area that it traverses. It will certainly have a substantial impact on public drainage facilities. There will be significant short term impacts to coastal water quality and, finally, the discharge pipes will have significant impacts to the shoreline and coastal sand transport. Therefore, in accordance with the EIS Rules 11-200-12, the criteria for determining whether an action may have a significant effect on the environment are clearly met. Furthermore, HRS 343 states that, "An [Environmental Impact] statement shall be required if the agency finds that the proposed action may have a significant effect on the environment." It is our conclusion that in accordance with applicable statutes of the State of Hawaii, an EIS is required for this project.

Specific Comments:

One of the most significant potential impacts of this project will be reflected in modifications to the sand beach shoreline at Lanikai. These modifications are not likely to be confined to the immediate area of the excavations and construction, but can be reflected in considerable erosion or accretion of sandy coastal areas extending several hundred yards or more on either side of the erected coastal structure or dredged channel. Unfortunately, there are no long term studies of the longshore transport of sand at Lanikai. Dennis Hwang's study of, "Beach Changes on Oahu as Revealed by Aerial Photographs," (1981) addressed the long term changes in the width of the beach and concluded that the pattern of erosion and accretion of Lanikai beach is determined by the direction of sand transport along the shoreline. However no data are presented to objectively support or quantify this supposition. Thus, studies of longshore sand transport are needed so that the design of the open channel and discharge pipe(s) can be developed to minimize impacts to the coastal sand beach resources.

Page 15, Paragraph 2: The proposed open channel plan states that, "the solution for keeping the channel opening clear from sand is to extend the channel beyond the maximum estimated beach zone limit." In order to accomplish this, it is proposed that vertical walls with exterior stone facings will be required, and that this structure would act as a "groin." Our reviewers have suggested that the correct term to describe the open channel extension is "jetty." An expanded discussion that supports this suggestion can be found in the discussion of the characteristics and functions of Jetys and Groins presented in the Corps of Engineers' Shore Protection Manuals, 1977. In simplest terms, a jetty borders a channel and serves to prevent or restrict shoaling of the channel by littoral material. A groin is generally constructed to reduce longshore transport and thereby build or widen a beach by trapping littoral drift. We do not concur with the opinion expressed that the proposed "groin"

[jetty], "would possibly increase the beach width on both sides of the channel," (emphasis added). It would be just as likely that the beach width would be reduced on both sides. It should be noted that in virtually all cases where impermeable structures have been constructed perpendicular to a sandy shoreline in the coastal environmental, accretion results on one side of the structure and erosion on the other. It should be further noted that at such time as the accreted area reaches the end of the structure, the impoundment of sand will stop and sand will be transported seaward to depths beyond the groin or breakwater, or be deposited at the mouth of the channel.

Page 17, Figure 4: Figure 4 shows a cross section of the open channel extension and we note that a vertical drop of six feet to a concrete channel floor is indicated. Considering that this will be present across a public sand beach area, we believe that this structure represents a significant safety hazard, especially to children. With the vertical concrete walls proposed, great difficulty would be experienced in climbing out of the channel if one fell in, not to mention the danger of the fall itself. Fencing will be required unless some other method of enclosing the channel is proposed. Visual impacts of the solutions to this safety problem should be considered particularly since the activity will take place in a sensitive coastal recreational area.

Pages 14 and 15: The document refers again to a possible accretion of the beach width on both sides of the channel allowing for more recreational activities to take place in the area. We believe this suggestion is in error and is not supported by observations.

Page 16: In the discussion of the alternatives to the proposed action, the potential for risk and expense is cited under the "No Open Channel Outlet." It should be recognized that construction of the Open Channel Outlet also carries a high risk and potential expense component. The likelihood for beach erosion of adjacent or nearby properties due to the open channel is extremely high. We believe that the potential for subsequent litigation by property owners against the City for damages resulting from beach erosion is similarly high. Therefore special attention needs to be given to alternative modes of construction including possible additional buried pipes to carry the drainage load instead of the open channel. The pipe outfalls could be buried through much of the beach to minimize the aesthetic impacts and reduce potential littoral transport problems.

Appendix, Page 15: The discussion of the "blocking" effects of the seaward extension of the open channel on northward and southward sediment transport is likely correct. However, we take exception to the supposition that the beach would accrete on both sides of the channel. If sand is blocked and held from one direction, the downside shore will erode.

We suggest that an EIS be prepared to address these and related issues pertinent to this project. Thank you for the opportunity to comment on this EA.

Yours truly,

Jacqualin Miller
Associate Environmental Coordinator

cc: OPQC
L. Stephen Lau
William Coulbourn
Belinda Tilley

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0510

July 25, 1988

Mr. Kisuk Cheung, Chief
Engineering Division
Department of the Army
U. S. Army Engineer District, Honolulu
Fort Shaftar, Hawaii 96858

Dear Mr. Cheung:

Subject: Your Letter of June 2, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project

We appreciate your comments on the proposed project. In order to adequately address additional public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin. Following acceptance of the EIS by the Governor, we will be applying for all necessary Department of Army permits.

Very truly yours,

Maria T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

51

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0509

July 25, 1988

Ms. Jacquelin Miller
Associate Environmental Coordinator
Environmental Center
University of Hawaii at Manoa
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Ms. Miller:

Subject: Your Letter of June 27, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project

We appreciate your comments on the proposed drainage project. In order to adequately address the public and Environmental Center's concerns about other drainage alternatives and beach processes, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

Maria T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

RECEIVED
DEPT OF PUBLIC WORKS
Jun 20 | 38 PM '88

TO

JOHN E. WHITTEN
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

FRANK F. FASI
MAYOR

TE-3321
PLL.1137

June 15, 1988

MEMORANDUM

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: JOSEPH M. MAGALDI, JR., ACTING DIRECTOR

SUBJECT: LANIKAI FLOOD CONTROL PROJECT
ENVIRONMENTAL ASSESSMENT
TMK: 4-3-01 THRU 05

This is in response to your memorandum of May 13, 1988 requesting our comments on the subject project.

We have no objections to the Lanikai Flood Control Project in Kailua. However, to mitigate traffic concerns with regard to this project, the following should be considered:

1. Parking prohibitions in conjunction with the construction of this project should be addressed.

2. Adequate traffic control measures should be implemented to allow access into all areas which should include the hiring of police officers, warning signs, barricades, etc.

3. Continued coordination of this project with affected property owners to minimize any adverse impacts.

If you have any questions, please contact Kenneth Hirata of my staff at 527-5031.

JOSEPH M. MAGALDI, JR.

52

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0504

July 25, 1988

MEMORANDUM

TO: JOSEPH M. MAGALDI, JR., ACTING DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JUNE 15, 1988 CONCERNING THE ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII,
TMK: 4-3-01 THRU 05

We appreciate your comments and will incorporate suggested impact mitigation measures in our construction plans if the proposed project is implemented. In order to adequately address additional public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Maria T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, HONOLULU, HAWAII 96813 • (808) 523-4137

FRANK F. FASI
MAYOR

JOHN P. WHALEN
DIRECTOR

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JUN 17 1 37 PM '88

DGR
88-382

LUS/88-3951(RF)

June 16, 1988

MEMORANDUM

TO: ALFRED J. THIEDE, DIRECTOR & CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: JOHN P. WHALEN, DIRECTOR

SUBJECT: ENVIRONMENTAL ASSESSMENT (EA) FOR LANIKAI FLOOD CONTROL PROJECT; KAILUA; TAX MAP KEY 4-3-01 THROUGH 05

Having reviewed the subject EA, we offer the following comments:

1. The oceanographic analysis should be expanded to include a thorough study of littoral transport processes. The report acknowledges that the extended open channel outlet structure would act as a groin, "effectively blocking both northward and southward littoral drifts"; the tentative conclusion that this would lead to accretion on either side of the channel is not adequately supported. Further study is needed to substantiate this optimistic forecast and to evaluate the potential that the outlet structure and/or the proposed drain pipe extension could exacerbate erosion along Lanikai Beach.

2. How would pedestrians walking along the public beach cross the channel? Some provision should be made for lateral public beach access.

3. Installation of concrete curbs and gutters, as proposed, would interfere with parking for guests and for beach-users. Currently beach-users park on the shoulder of Mokulua Drive and intersecting streets. At the very least, the EA should quantify the amount of parking which would be displaced.

Thank you for the opportunity to comment. If you have any questions, please contact Mr. Robin Foster of our staff at 527-5027.

Loretta Chee
JOHN P. WHALEN
Director of Land Utilization

JPW:sl
1902B

cc: DPR

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0501

July 25, 1988

MEMORANDUM

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JUNE 16, 1988 CONCERNING THE ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TMK: 4-3-01 THRU 05

We appreciate your comments on the proposed project. In order to adequately address the public and the Department of Land Utilization's concerns about the beach processes, parking, and lateral beach access, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Main T. Fukiyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
DEPT OF PUBLIC WORKS 650 SOUTH KING STREET
HONOLULU, HAWAII 96813

JUN 6 3 22 PM '88

TO _____

FRANK F. FASI
MAYOR

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JUN 7 9 24 AM '88

ENGR DF-3593
DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

VW/DGP 5/88-2014

June 3, 1988

MEMORANDUM

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: E. B. CONNELL, ACTING CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: LANIKAI FLOOD CONTROL PROJECT,
TAX MAP KEY 4-3-1 THRU 5

54

Attached for your information is a copy of a letter from Mr. William W. Paty, Chairperson, Board of Land and Natural Resources, describing the Department of Land and Natural Resources' archaeological concerns about the subject project.

E. B. CONNELL
Acting Chief Planning Officer

Attachment

cc: Mr. William W. Paty, DLNR

MAY 27 1988

DOC. NO.: 3493E
FILE NO.: SE-469

Honorable Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Clegg,

SUBJECT: Lanikai Flood Control Project. TMK: 4-3-1 thru 5

We have reviewed the project cited above and have the following comments to offer.

Our records indicate that no archaeological survey or testing has taken place in the Lanikai area. As the flood control trenches follow road right-of-ways in the development part of Lanikai, we would not expect to encounter any surface archaeological sites. However, we would expect to encounter subsurface archaeological deposits in areas of Lanikai where ground disturbance has not been great. In the beach areas, burials are likely to be encountered.

The current action is a Development Plan amendment, and as such, will have no impact on significant historic sites. However, the construction of the flood control system can be anticipated to have an adverse effect. Planning should therefore include allocation of funds to provide for archaeological subsurface survey.

Thank you for the opportunity to comment on this project.

Very truly yours,

/S/ WILLIAM W. PATY

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

bcc: DAR, Historic Sites

DHirvin

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

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FRANK F. FASI, Mayor
DONNA B. GOTH, Chairman
ERNEST A. WATARI, Vice Chairman
MILTON J. AGADER
SISTER M. DAVILYN AH CHICK, O.S.F.
EDWARD Y. HIRATA
ALFRED J. THIEDE
JOHN K. TSUI
KAZU HAYASHIDA
Manager and Chief Engineer

ENVR 88-358

June 3, 1988

TO: MR. ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TMK: 4-3-01 THRU 05

Thank you for the opportunity to review the proposed flood control project in Lanikai.

The proposed project will not impact on potable groundwater resources in the area. However, in order to ensure that the proposed project will not impact on our water facilities, we request that the construction drawings be coordinated with us.

If you have any questions, please contact Lawrence Whang at 527-6138.

ES

Water ... man's greatest need - use it wisely

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DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0503

July 25, 1988

MEMORANDUM

TO: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JUNE 3, 1988 CONCERNING THE ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TMK: 4-3-01 THRU 05

We appreciate your comments on the proposed project. In order to adequately address additional public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin. Following the acceptance of the EIS by the Governor, we will send construction plans for your review and approval.

Marie T. Fukuzawa
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 • AREA CODE (808) 943-3111

DOUGLAS G. GIBB
CHIEF

WARREN FERREIRA
DEPUTY CHIEF

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MAYOR

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OUR REFERENCE SS-LK

June 3, 1988

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TAX MAP KEY: 4-3-01 THRU 05

56

We have reviewed the environmental assessment for the above project and have no objections to the proposed drainage improvements.

However, because Lanikai is a residential community and the project is scheduled to be completed over a period of several years, specific measures should be implemented to minimize interference with the daily traffic pattern and activities of the community. We recommend that there be a strict adherence to noise regulations, that adequate warning signs be posted, and that blinking barricades be set up (for hours of darkness) to insure the safety of pedestrians and residents. May we also suggest that a special duty officer be hired to ease and direct traffic during the initial stages of construction.

Thank you for the opportunity to provide comment.

for DOUGLAS G. GIBB
Chief of Police

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0505

July 25, 1988

MEMORANDUM

TO: DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JUNE 3, 1988 CONCERNING THE ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TMK: 4-3-01 THRU 05

We appreciate your comments and will incorporate suggested impact mitigation measures in our construction plans if the proposed project is implemented. In order to adequately address additional public concerns, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

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VW/DGP 5/88-1885

June 8, 1988

MEMORANDUM

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII.
TAX MAP KEY: 4-3-01: THROUGH 05

This is in response to your request for comments on the Environmental Assessment for the proposed Lanikai Flood Control Project. We have reviewed the Environmental Assessment (EA) and offer comments on these points:

1. Effects of Beach Modifications

   We are concerned about the potential impact of the proposed open channel and pipe outfall upon Lanikai Beach.

2. Funding Schemes for Proposed Project

   The property owners of the proposed I.D. funding for Phases 3 & 4 need to be informed to ascertain their willingness to participate in the project.

3. Archaeology and Cultural Significance

   We have received input that indicates a need for an archaeological subsurface survey. Planning should therefore include a further assessment of the need for this action.

4. Traffic Impact - Construction Period

   We are concerned about traffic congestion in Lanikai during the construction period - 1988 to 1994. We note that you plan to close portions of Mokuloa Drive and Aalapapa Drive, the major collector streets servicing Lanikai, during the construction of the drainage ditch road crossings. We suggest that the residents of Lanikai and public agencies and utilities be provided copies of your construction activities in advance.

Thank you for giving us an opportunity to comment upon this matter.

Donald A. Clegg

DONALD A. CLEGG
Chief Planning Officer

57

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

HIRAM K. KAMAKA
DIRECTOR

WALTER M. OZAWA
DEPUTY DIRECTOR

ENGR
AP-3444

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TO

May 25, 1988

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: HIRAM K. KAMAKA, DIRECTOR

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT
TAX MAP KEY 4-3-01 THRU 05

58

The environmental assessment for the Lanikai Flood Control Project has been reviewed and the following comments are offered.

The Department of Parks and Recreation has no public park in this area, but it has two public beach rights-of-way which will be impacted. For this reason we are concerned about how the drainage structures will affect the stability of the sand beach.

The project includes concrete-lined swales from Mokulua Drive to the beach within each of the four beach rights-of-way within the project boundaries. Two of these at the end of Lanipo Drive and just north of Aala Drive are public easements and no adverse comments are offered.

A 54-inch concrete drainage pipe will underlie the right-of-way near Aala Drive and will extend 200 feet into the ocean. In this case, there should be minimum effect on the littoral (long shore) sand drift because the pipe will be beneath the sand beach.

A new concrete channel 18 feet wide by 6-1/2 feet deep will lie along the beach right-of-way at the end of Lanipo Drive and exit across the beach and 170 feet into the ocean as an open channel that will prevent pedestrian traffic along the shoreline. It will also act as a groin that could cause severe shoreline erosion problems to the adjacent properties alternately on either one side or the other of the structure.

It is recommended that a cover be put on the concrete channel in the beach area both for safety and pedestrian purposes. It is also recommended that consideration be given to protecting adjacent properties by a revetment if the homeowners are not already protected.

Thank you for allowing us to comment on this project.

HIRAM K. KAMAKA, Director

HKK:ei

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Jun 13 2 32 PM '88

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TO

MARY GEORGE
HAWAII STATE SENATE
STATE CAPITOL
HONOLULU, HAWAII 96813

June 8, 1988

Mr. Alfred J. Thiede, Director
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

Thank you for making available to me a copy of the Environmental Assessment for the Lanikai Flood Control Project.

While I can't make any intelligent observations about the engineering aspects of the proposed improvements, I can perhaps raise my concern about the esthetic result of the plans outlined for phases 1 and 2.

If the concrete-paved walkways between Mokulua Drive and the beach are similar to the one I observed over several seasons at the beach end of Namala Place in Kailua, I would wonder if the whole informal character of the beach accesses would be altered. I can remember seeing great canyons in the sand at the end of Namala after heavy rains, and sometimes the beach level was way below the end of the paved swale. From the beach, the effect was less than agreeable. My very untechnical observation tells me that unpaved ground absorbs and disposes of runoff rather well, and that paving that ground simply serves to carry all of that runoff down to the beach.

Is there some way to pave only part of the walkway? A gutter system?

Is it absolutely necessary to extend the channel outlet into the ocean? The proposal would seem to behave like a groin, and I am wary about what such an extension would do to the accretion and the scouring of sand on either side. I understand there are very different opinions and theories about littoral drift (I think I remember reading that these theories haven't changed very much since Leonardo made his observations) but I would be surprised to learn that "this would possibly increase the beach width on both sides of the channel" as stated on page 16 of the Assessment.

My own guess is that the channel extension would result in buildup of sand on one side and erosion on the other. I would like to be shown an example of a groin which has resulted in the increase of beach width on both sides.

Have I missed something? How will beach walkers get across or around the channel extension?

Unless phases 1 and 2 depend on the subsequent completion of phases 3 and 4 of the project as described in the Assessment, I would like to defer comment on the latter. I am not sure about the acceptability of an improvement district to the residents who would be expected to pay a good part of the attendant costs.

Thank you for the opportunity to voice my reactions to the Assessment.

Sincerely,

Mary George

MARY GEORGE
Senate Minority Leader

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0502

July 25, 1988

MEMORANDUM

TO: HIRAM K. KAMAKA, DIRECTOR
DEPARTMENT OF PARKS AND RECREATION

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF MAY 25, 1988 CONCERNING THE ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TMK: 4-3-01 THRU 05

We appreciate your comments on the proposed project. In order to adequately address the public concerns about other drainage alternatives and the beach processes, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Maria T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0507

July 25, 1988

The Honorable Mary George
The Senate
State Capitol
Honolulu, Hawaii 96813

Dear Senator George:

Subject: Your Letter of June 8, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project

We appreciate your comments on the proposed project. In order to adequately address the public concerns about the channel outlet and beach access, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

Maria T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

KAILUA NEIGHBORHOOD BOARD NO. 31
c/o KAILUA SATELLITE CITY HALL
629A KAILUA ROAD
KAILUA, HAWAII 96734

July 18, 1988

Mr. Al Thiede
Director and Chief Engineer
650 South King Street
Honolulu, Hawaii 96813

Subject: Lanikai Flood Control Project

Dear Mr. Thiede:

At its regular meeting, July 7, 1988, the Kailua Neighborhood Board discussed the proposed Lanikai Flood Control Project and its potential impact upon our shoreline environment. We agreed that there is a distinct need for flood control in Lanikai, and this project seems to satisfy that need. Therefore, we support the request for amendment to the Koolaupoko Development Plan Public Facilities Map assuming the following concerns are addressed and resolved:

1. In regards to the paving of right-of-way swales to aid in runoff. We are concerned with the general appearance, potential safety problems for users, protection of abutting properties, and maintenance of the paved areas. Have any alternatives to paving been considered which might be used to the same effect?

2. In regards to the extension of drainage pipes beyond the sand line, we would like to know what effect this will have on sand buildup on either side of the groin. Could this action cause erosion to the shoreline in other areas of the beach; and does it present a potential safety problem for water users in the groin area?

3. We are concerned that the work done in Lanikai could adversely affect other shoreline areas from Waimanalo to Kailua, as a result of changes to currents or wave action. We feel this item in particular needs to be considered in depth prior to final approval of this project.

4. Lastly, we see the need for a regular schedule of maintenance for this project to be developed and provided by the Department of Public Works.

The Kailua Neighborhood Board believes that an Environmental Impact Statement is essential to address these and other concerns. We wish to thank you for this opportunity to comment on this project.

Sincerely,

Bonnie L. Heim

Bonnie L. Heim, Chair B.L.

cc: Lanikai Community Association
Environmental Committee
Kailua Neighborhood Board
Neighborhood Commission Office

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0500

July 25, 1988

MEMORANDUM

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR MEMORANDUM OF JUNE 8, 1988 CONCERNING THE ENVIRONMENTAL ASSESSMENT FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TMK: 4-3-01 THRU 05

62

We appreciate your comments on the proposed project. In order to adequately address the public and the Department of General Planning's concerns about the effects of beach modification, funding, traffic and archeological significance, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Maiu T. Fukuyama
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0533

August 4, 1988

Ms. Bonnie L. Heim, Chairperson
Kailua Neighborhood Board
629-A Kailua Road
Kailua, Hawaii 96734

Dear Ms. Heim:

Subject: Your Letter of July 18, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

We appreciate your comments on the proposed project. In order to adequately address additional public concerns, we will be preparing an Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

Frank J. Doyle
for ALFRED J. THIEDE
Director and Chief Engineer

MT:CPC:tc
cc: Kwock Associates, Inc.

THE LANIKAI ASSOCIATION • P. O. BOX 481 • KAILUA, OAHU 96734

June 16, 1988

88-3931 DEP GM ENGR

Councilmember David Kahanu
City Council
City Hall
Honolulu, Hawaii 96813

RE: Lanikai Flood Control Project
Environmental Assessment

Dear Councilman Kahanu:

On June 15, 1988, the Lanikai Flood Control Project (LFCP) Steering Committee, of the Lanikai Association, met. All members had studied the Environmental Assessment carefully and the consensus represented a unanimous opinion. We find the assessment completely acceptable and approve of it except in two (2) specific details, which have already been addressed. They are as follows:

63

1.) The design of graded Rights-of-way to the beach is not acceptable as proposed. We feel that alternative designs must be developed, evaluated and agreed upon by the Department of Engineering and the community.

2.) The plans for extending a drain pipe and open drainage channel beyond the high water marks at the Rights-of-way in question are not acceptable and this portion of the proposal and funding for it should be deleted from the proposal at this time.

We look forward to working with the City and County departments involved in the LFCP and with you in the solution of these problems.

Aloha pumehana,

1887

Dr. Phil Foti, Chairman
FLCP Steering Committee

CC: Mr. Alfred Thiede, Director and Chief Engineer, Department of Engineering
Mr. Ken Kwock, Kwock Associates, Inc.
The Lanikai Association, Barbara J. Smith, President

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0513

July 25, 1988

Dr. Phil Foti, Chairman
LFCP Steering Committee
The Lanikai Association
P. O. Box 481
Kailua, Hawaii 96734

Dear Dr. Foti:

Subject: Your Letter of June 16, 1988 Concerning the Environmental Assessment for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

We appreciate your comments on the proposed project. In order to adequately address the public concerns about the drainage alternatives, we will be preparing a draft Environmental Impact Statement (EIS) on the proposed flood control project. The Environmental Assessment that you reviewed will become the basis of an EIS Preparation Notice and will be submitted to the Office of Environmental Quality Control (OEQC) for publication in the OEQC Bulletin.

Very truly yours,

Main T. Fukagawa
for ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock & Associates, Inc.

COMMENTS AND RESPONSES TO THE
ENVIRONMOMETAL IMPACT STATEMENT PREPARATION NOTICE

DEPT OF PUBLIC WORKS
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OCT 13 10 30 AM '88

E,ISE
88-6270

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
LIBERT K. LANDGRAF
HARUKO TAKAHASHI
RUSSELL K. FURUMOTO

AGRICULTURE DEVELOPMENT PROGRAM
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CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

OCT 17 1988

DOC. NO.: 4448E
FILE NO.: 89-147

The Honorable Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

RECEIVED
DEPT. OF PUBLIC WORKS
Oct 20 9 57 AM '88

SUBJECT: Environmental Impact Statement Preparation Notice (EISPN) for the Proposed Lanikai Flood Control Project, Kailua, Koolaupoko, Oahu, Hawaii. TMK: 4-3-01 thru 05. (refer to: 12-0615)

Dear Mr. Thiede:

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the materials you submitted and have the following additional comments.

Our Department's Division of Aquatic Resources notes that the City and County notice states that some impacts may occur from this project. However, many of the expected impacts have not been fully described, including the effects of cesspool and subdivision overflows during storm flooding. Under these circumstances, sewage could be transported directly out to the shoreline.

We suggest that the DEIS discuss the potential impacts identified in the Environmental Assessment and the impacts outlined by our previous comments. Mitigation measures should be proposed whereby adverse impacts could be avoided, controlled, or compensated for, through offsetting benefits.

Our Department's Historic Sites Section does not have any additional comments to make at this time. Our comments on the Environmental Assessment, in which we asked for archaeological subsurface survey and testing, are still applicable.

Please feel free to call me or Roy Schaefer of our Office of Conservation and Environmental Affairs, at 548-7837, if you have any questions.

Very truly yours,

WILLIAM W. PATY, Chairperson
Board of Land and Natural Resources

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0803

December 6, 1988

Mr. William Paty, Chairperson
Board of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Your Letter of October 17, 1988 (Doc. No. 4448E) concerning the Environmental Impact Statement Preparation Notice for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

We appreciate your comments and will address the impact of cesspool and subdivision overflows during storm flooding and the potential for sewage to be transported directly out to the shoreline in the draft Environmental Impact Statement. Other impacts previously identified will also be discussed and mitigation measures will be proposed where appropriate.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock Associates, Inc.

99

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

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Engr
FF-6101

FRANK F. FASI, Mayor
DONNA B. GOTH, Chairman
JOHN K. TSUI, Vice Chairman
SISTER M. DAVILYN AH CHICK, O.S.F.
EDWARD Y. HIRATA
ALFRED J. THIEDE
ERNEST A. WATARI
MAURICE H. YAMASATO

KAZU HAYASHIDA
Manager and Chief Engineer

TO: October 5, 1988

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: FOR KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WTER SUPPLY

SUBJECT: YOUR MEMORANDUM OF SEPTEMBER 12, 1988 ON THE ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR THE PROPOSED LANIKAI FLOOD CONTROL PROJECT, KAILUA, KOOLAUPOKO, OAHU, HAWAII (TMK: 4-3-01: THROUGH 05)

The proposed project is not anticipated to impact our groundwater resource in the area. The construction plans should be submitted to us for review and approval to assure the protection of our facilities in the area.

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Pure Water... man's greatest need - use it wisely

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE

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ES
Room G307

SEP 16 1988

Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Re: Environmental Impact Statement Preparation Notice, Lanikai Flood Control Project, Kailua, Oahu

Dear Mr. Thiede:

We have reviewed the referenced document and offer the following comments for your consideration.

In addition to the concerns described in the Service's May 24, 1988 letter, the Draft Environmental Impact Statement should also discuss potential changes to coastal water quality from the discharge of stormwater run-off from the proposed flood control project.

We appreciate the opportunity to comment.

Sincerely,

for Ernest Kosaka
Field Supervisor
Office of Environmental Services

67

1

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0804

December 6, 1988

Mr. Ernest Kosaka, Field Supervisor
Office of Environmental Services
Fish and Wildlife Service
United States Department of the Interior
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Subject: Your Letter of September 15, 1988 concerning the Environmental Impact Statement Preparation Notice for Lanikai Flood Control Project, Kailua, Oahu

We appreciate your comments and will address the potential changes to coastal water quality from the discharge of stormwater runoff from the proposed flood control project in the draft Environmental Impact Statement.

Very truly yours,

ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock Associates, Inc.

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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DEPT OF PUBLIC WORKS
SEP 27 3 36 PM '88

TO _____

HIRAM K. KAMAKA
DIRECTOR

WALTER M. OZAWA
DEPUTY DIRECTOR

FRANK F. FASI
MAYOR

88-5932

September 23, 1988

RECEIVED
DEPT. OF ENGINEERING
Sep 28 10 40 AM '88

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: HIRAM K. KAMAKA, DIRECTOR

SUBJECT: PREPARATION NOTICE FOR ENVIRONMENTAL IMPACT STATEMENT FOR THE LANIKAI FLOOD CONTROL PROJECT (TMK: 4-3-01 THRU 05)

Our comments on this project were forwarded to you when we reviewed the Environmental Assessment for the proposed Lanikai Flood Control design.

Our primary concern is summarized in the last two paragraphs of our May 25, 1988 memorandum which concerns the uncovered 18-foot wide channel across the beach near the end of Lanipo Drive which would prevent pedestrian traffic along the shoreline.

HIRAM K. KAMAKA, Director

HKK:ei

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
12-0802

December 6, 1988

MEMORANDUM

TO: MR. HIRAM K. KAMAKA, DIRECTOR
DEPARTMENT OF PARKS AND RECREATION

FROM: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER

SUBJECT: YOUR MEMORANDUM OF SEPTEMBER 23, 1988 CONCERNING ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE FOR THE LANIKAI FLOOD CONTROL PROJECT, KAILUA, OAHU, HAWAII, TMK: 4-3-01 THRU 05

We appreciate your comments and will address your concern for pedestrian traffic along the shoreline at the drainage channel near the end of Lanipo Drive in the draft Environmental Impact Statement.

FOR ALFRED J. THIEDE
Director and Chief Engineer

cc: Kwock Associates, Inc.

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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OCT 17 10 59 AM '88

Engr 88-623

FRANK F. FASI
MAYOR

JOHN E. WHITE
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

TO _____

TE-6146
PL1.1288

October 13, 1988

MEMORANDUM

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: JOSEPH M. MAGALDI, JR., DEPUTY DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT
PREPARATION NOTICE (EISPN)
LANIKAI FLOOD CONTROL PROJECT
TMK: 4-3-01: THRU 05

69

This is in response to your memorandum dated September 12, 1988 requesting our comments on the subject project.

We have no objections to the proposed Lanikai Flood Control Project in Kailua. However, our department should be notified if any construction work on Aalapapa Drive and Mokulua Drive will affect our existing bikeway facility.

If you have any questions, please contact Thomas Baba of my staff at Local 5009.

JOSEPH M. MAGALDI, JR.

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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EPW. 11
9/30 Engr
88-573

FRANK F. FASI
MAYOR

DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

TO _____

PM/DGP 9/88-3309

September 28, 1988

MEMORANDUM

TO: ALFRED J. THIEDE, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR THE PROPOSED LANIKAI FLOOD CONTROL PROJECT, KAILUA, KOOLAUPOKO, OAHU (TMK: 4-3-01: THRU 05)

Thank you for providing us with a copy of the subject EISPN. At this time, we have no additional comments to offer. We anticipate that our previously transmitted concerns regarding beach modification, funding, traffic and archaeological significance will be addressed in the environmental impact statement.

We appreciate your providing this opportunity for additional comments and look forward to reviewing the draft environmental impact statement.

DONALD A. CLEGG
Chief Planning Officer

DAC:js

Engr 88-602E

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STATE OF HAWAII
DEPARTMENT OF HEALTH

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CITY & COUNTY OF HONOLULU
OCT 4 3 05 PM '88

September 26, 1988

MEMORANDUM

To: Mr. Alfred J. Thiede, Director and Chief Engineer
Department of Public Works

From: Deputy Director for Environmental Health

Subject: Environmental Impact Statement Preparation Notice (EISPN) for Proposed Lanikai Flood Control Project, Kailua, Koolaupoko, Oahu, Hawaii (Tax Map Key 4-3-01 thru 05)

Thank you for allowing us to review and comment on the subject EISPN. A 401 water quality certification may be required if the Corps of Engineers issues a Section 404 permit.

BRUCE S. ANDERSON, Ph.D.

70

DEPARTMENT OF THE ARMY
HONOLULU ENGINEER DISTRICT, CORPS OF ENGINEERS
BUILDING 230
FORT SHAFTER, HAWAII 96858-5440

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CITY & COUNTY OF HONOLULU
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Engr 88-C182

REPLY TO ATTENTION OF:

October 6, 1988

Planning Branch

Mr. Alfred J. Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

Thank you for the opportunity to review the Environmental Impact Statement Preparation Notice (EISPN) for the Lanikai Flood Control Project, Kailua, Koolaupoko, Oahu, Hawaii. Our previous review comments on the Environmental Assessment for this project (letter dated June 2, 1988) are applicable to the EISPN. We have no additional comments on the EISPN.

Sincerely,

Clarence Fujii
Acting Chief
Engineering Division

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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

EDWARD Y. HIRATA
DIRECTOR
DEPUTY DIRECTORS
JOHN E. LICHIMA
RONALD N. HIRANO
DAN T. KOCHI
JEANNE K. SCHULTZ

IN REPLY REFER TO:
STP 8.3177

Env'al
Af 6.129 Engr

October 4, 1988

Mr. Alfred Thiede
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

Environmental Impact Statement Preparation Notice
Proposed Lanikai Flood Control Project
Kailua, Oahu

We have no objection to the proposed Lanikai flood control project.

Thank you for this opportunity to provide comments.

Very truly yours,

Edward Y. Hirata
Director of Transportation

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71

COMMENTS AND RESPONSES TO THE
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Engrg

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:

April 10, 1989

Planning Branch

Dr. Marvin Miura
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for the proposed Lanikai Flood Control Project, Kailua, Koolaupoko, Oahu. Our review comments on the EIS Preparation Notice (letter dated June 2, 1988) have been incorporated into the DEIS (page 46). We have no additional comments.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Copy Furnished:

Mr. Chew Lun Lau
City and County of Honolulu
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

73

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 113
PEARL HARBOR HAWAII 96860-5020

Env cel
-Engrg (kj)

IN REPLY REFER TO

5090 (1338)
Ser 032/845
29 Mar 1989

Dr. Marvin T. Miura
Office of Environmental Quality Control
465 S. King St., Room 104
Honolulu, HI 96813

Dear Dr. Miura:

LANIKAI FLOOD CONTROL PROJECT

The Draft Environmental Impact Statement (DEIS) for Lanikai Flood Control Project, Kailua, Koolaupoko, Oahu, has been reviewed, and we have no comments to offer. Since we have no further use for the DEIS, it is being returned.

Thank you for the opportunity to review the draft.

Sincerely,

W. W. HU
Assistant Base Civil Engineer
By direction of the Commander

Encl
(1) DEIS

Copy to: (w/o encl)
Mr. Chew Lun Lau
City & County of Honolulu
Dept of Public Works

JOHN WAIHEE
GOVERNOR

RECEIVED
DEPT OF PUBL. WORKS
MAY 5 02 PM '89
TO

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
400 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

MARVIN T. MIURA, PH.D.
DIRECTOR
TELEPHONE NO.
548-6915

April 28, 1989

Mr. Chew Lun Lau
City & County of Honolulu
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

74

Dear Mr. Lau:

We have reviewed your EIS for the Lanikai Flood Control Project and offer the following comments for your consideration:

1. Since there have been some burial sites in the Lanikai area, we recommend that you contact the Department of Land and Natural Resources, State Historic Preservation Program and commence early discussion of steps that will be taken if other burials are found.

2. The construction of a silting basin to minimize the effects of soil run-off into the ocean should be considered as a mitigation measure.

3. The reef in that particular area of Lanikai is very shallow. If blasting of the reef is required in installing the ocean outfall, precautions to insure that the sea turtles are not harmed should be taken. Also, blasting should not coincide with the Humpback Whale migratory season.

Thank you for providing us this opportunity to review your EIS.

Sincerely,

MARVIN T. MIURA, PH.D.
Director, Office of Environmental Quality Control

ROY SAKAMOTO
Environmental Technical Specialist

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO:

89-12-0561

August 3, 1989

Dr. Marvin T. Miura, Ph.D
Director, Office of Environmental
Quality Control
State of Hawaii
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Your Letter, Dated April 28, 1989, Concerning the Draft EIS for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

75

Thank you for your comments on the draft EIS. The draft EIS will be revised to require an archeological subsurface survey prior to construction and an acceptable mitigation plan will be developed if required.

A silting basin is planned at the upstream end of the drainage channel to minimize the effects of the soil runoff into the ocean.

If blasting is require, adequate controls will be imposed to address your concerns.

Very truly yours,

FOR: SAM CALLEJO
Director and Chief Engineer

MT:tc
cc: Kwock Associates, Inc.

Egg-

UNITED STATES
DEPARTMENT OF
AGRICULTURE

SOIL
CONSERVATION
SERVICE

P. O. BOX 50004
HONOLULU, HAWAII
96850

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MAY 13 8 00 AM '89

May 16, 1989

Dr. Marvin T. Miura
Office of Environmental Quality Control
465 S. King Street, Rm. 104
Honolulu, HI 96813

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (DEIS) -
Lanikai Flood Control Project, Koolaupoko, Oahu

We have no comments to offer at this time; however, we would appreciate the opportunity to review the final EIS.

Sincerely,

WARREN H. LEE
State Conservationist

cc:
Mr. Chew Lun Lau, C & C of Honolulu, Dept. of Public Works,
650 S. King Street, Honolulu, HI 96813

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

CHAIRMAN

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

LAWRENCE H. MIKE
MANABU TAKAHASHI
RUSSELL S. KUMABE

AGRICULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REF: OCEA-vin

APR 24 1989

DOC. NO.: 5539E
FILE NO.: 89-527

MEMORANDUM

TO: The Honorable Marvin T. Miura, Director
Office of Environmental Quality Control

FROM: William W. Paty, Chairperson
Board of Land and Natural Resources

SUBJECT: Draft E. I. S. for Lanikai Flood Control Project
Kailua, Koolaupoko, Oahu, TMK: 4-3-01 thru 05

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the materials you submitted and have the following comments.

Our Department's Historic Sites Section states that in our comments on the EA for this project, we asked for archaeological subsurface survey and testing prior to construction to determine if significant historic sites were present and, if so, to then develop and execute an acceptable mitigation plan. In this draft EIS, the City and County specifies archaeological monitoring during construction. We believe that the probability that subsurface archaeological deposits and burials are present is high, and that monitoring during construction does not constitute an adequate historic preservation compliance or mitigative measure according to Chapter 6E HRS.

Our Aquatic Resources Division indicates that temporary, adverse impact including silt from the sand clearing and closing of the beach for construction purposes are expected. Appropriate mitigative measures should be taken to minimize silting, and petroleum derivatives, lumber, and other debris associated with construction activities should be prevented from entering Kailua Bay.

Please feel free to call me or Roy Schaefer of our Office of Conservation and Environmental Affairs, at 548-7837, if you have any questions.

WILLIAM W. PATY

cc: Mr. Chew Lun Lau
C & C of Honolulu/Dept. of Public Works

76

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO:
89-12-0563

August 2, 1989

Mr. William W. Paty, Chairperson
Board of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

Subject: Your Memorandum of April 24, 1989 (Doc. No. 5539E)
Concerning the Draft EIS for the Lanikai Flood
Control Project, Kailua, Oahu, Hawaii,
TMK: 4-3-01 thru 05

77

Thank you for your comments on the draft EIS. The draft EIS will be revised to require an archeological subsurface survey and testing prior to construction to determine if significant historic sites were present and, if so, to then develop and execute an acceptable mitigation plan.

The revised EIS will also address the concerns of your Aquatic Resources Division for appropriate mitigative measures to be taken to minimize silting, and to prevent petroleum derivatives, lumber, and other debris associated with construction from entering Kailua Bay.

Very truly yours,

Sam Callejo
SAM CALLEJO
Director and Chief Engineer

MT:tc
cc: Kwock Associates, Inc.

JOHN WAIHEE
GOVERNOR

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APR 27 12 59 PM '89

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

April 25, 1989

Dr. Marvin T. Miura
Director
Office of Environmental Quality
Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Draft Environmental Impact Statement for the
Proposed Lanikai Flood Control Project,
Kailua, Koolaupoko, Oahu; TMK: 4-3-01 through 05

Thank you for the opportunity to comment on the subject Draft EIS.

The subject Flood Control Project will not affect our State highway facilities.

Very truly yours,

Edward Y. Hirata
Director of Transportation

cc: Chew Lum Lau - C & C of Honolulu DPW

Copy

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
JOHN E. LIZCHIKA
RONALD M. HIRANO
DAN Y. KIDOKA
JEANNE R. SCHULTZ

IN REPLY REFER TO:
HWY-PS
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TO

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Engrg (5)
Mar 31 2 41 PM '89

(P)1276.9

MAR 29 1989

Dr. Marvin Miura
Director
Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Lanikai Flood Control Project
Draft Environmental Impact Statement

Thank you for the opportunity to review the subject document. We have no comments to offer.

Should there be any questions, please contact Mr. Cedric Takamoto of the Planning Branch at 548-5742.

Very truly yours,

T. Tominaga

TEUANE TOMINAGA
State Public Works Engineer

CT:jnt
cc: Mr. Chew Lun Lau

78

JOHN WAIHEE
GOVERNOR

RECEIVED
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'89 APR 5 8 35 AM

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

ALVIN T. LUM
ADJUTANT GENERAL

MYLES M. NAKATSU
DEPUTY ADJUTANT GENERAL

IV
E.N.I
Engrg (4)

April 3, 1989

Engineering Office

Dr. Marvin T. Miura, Director
State Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Lanikai Flood Control Project
Koolaupoko, Oahu

Thank you for providing us the opportunity to review the above subject project.

We have no comments to offer at this time regarding this project.

Sincerely,

Jerry M. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

cc:
Mr. Chew Lun Lau, Dept. of Public Works,
C&C of Honolulu

NATIONAL GUARD
Americans At Their Best

'89

April 7, 1989

MEMORANDUM

TO: Roger C. Evans, OCEA

FROM: Ralston H. Nagata, State Parks Administrator

SUBJECT: Review of draft EIS for Lanikai Flood Control Project
Kailua, Koolaupoko, O'ahu
TMK: 4-3-01 through 05

HISTORIC SITES SECTION CONCERNS:

In our comments on the EA for this project, we asked for archaeological subsurface survey and testing prior to construction to determine if significant historic sites were present and, if so, to then develop and execute an acceptable mitigation plan. In this draft EIS, the City and County specifies archaeological monitoring during construction. We believe that the probability that subsurface archaeological deposits and burials are present is high, and that monitoring during construction does not constitute an adequate historic preservation compliance or mitigative measure according to Chapter 6E HRS.

RALSTON H. NAGATA

bcc: Mr. Chew Lun Lau
Dept. of Public Works
City & County of Honolulu

79

DEPARTMENT OF BUSINESS
AND ECONOMIC DEVELOPMENT

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR
LESLIE MATSUBARA
DEPUTY DIRECTOR

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813 FAX: (808) 586-2536

March 23, 1989

REGISTERED
DEPT OF PUBLIC WORKS
89 APR 7 13 AM '89

Dr. Marvin T. Miura
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Lanikai Flood Control Project Draft Environmental Impact Statement, Koolaupoko, Oahu

Thank you for the opportunity to review the Draft EIS. We have no comments to offer at this time.

Sincerely,

MAURICE H. KATA
Energy Program Administrator

MHK/hk

cc: Mr. Chew Lun Lau

Engrg

JOHN WAIHEE
GOVERNOR OF HAWAII

RECEIVED
DEPT OF PLNG & WORK
APR 7 11 08 AM '89
TO _____

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

IN REPLY, REFER TO
EPHSD

April 6, 1989

MEMORANDUM

To: Dr. Marvin T. Miura, Director
Office of Environmental Quality Control

From: Deputy Director for Environmental Health

Subject: Draft Environmental Impact Statement for Lanikai Flood Control Project, Kailua, Koolaupoko, Oahu, Tax Map Key 4-3-01 thru 05

80 Thank you for allowing us to review and comment on the subject project. We do not have any comments at this time.

BRUCE S. ANDERSON, Ph.D.

cc: Mr. Chew Lun Lau, DPW

Engrg (KJ)

RECEIVED
DEPT OF PLNG & WORK
APR 10 6 01 PM '89
TO _____

89:PLNG/1300B JT

April 14, 1989

MEMORANDUM

TO: Dr. Marvin Miura, Director
Office of Environmental Quality Control

FROM: Joseph K. Conant

SUBJECT: Draft Environmental Impact Statement for the Lanikai Flood Control Project

Thank you for the opportunity to review the enclosed draft EIS for the subject project.

We have no comments to offer.

JOSEPH K. CONANT
Executive Director

cc: Mr. Chew Lun Lau,
Department of Public Works

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY
Enclosure
Engrg (cy)

April 4, 1989

Dr. Marvin T. Miura
Office of Environmental Quality Control
State of Hawaii
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Your Letter Received on March 22, 1989 on the Lanikai Flood Control Project Draft Environmental Impact Statement

Our previous comments on the environmental assessment for the project, which are shown on page 53 of the Draft EIS, are still applicable to the project.

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Chew Lun Lau
(Dept. of Public Works)

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

WALTER H. OZAWA
DIRECTOR

Wi
Engrg (cy)

April 5, 1989

Dr. Marvin T. Miura, Director
Office of Environmental Quality Control
485 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Lanikai Flood Control Project
Draft Environmental Impact Statement

The May 6, 1989 Draft Environmental Impact Statement for the proposed Lanikai Flood Control Project has been reviewed, and we have no further comments beyond those given in our May 25, 1988 letter, which is included in the report.

We are appreciative that a pedestrian bridge has been provided over the open concrete channel as it crosses the beach.

Sincerely,

WALTER H. OZAWA, Director

WHO:dh

cc: Mr. Chew Lun Lau, Department of Public Works

RECEIVED
'89 JUL 13 AM 8:

STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
1600 KAPIOLANI BLVD., SUITE 1500
HONOLULU, HAWAII 96814
[illegible]

RECEIVED
JUL 8 1989
KWOCK ASSOCIATES, INC.

June 23, 1989

C-L89-0074

Dr. Marvin T. Miura, Director
Office of Environmental Quality Control
465 S. King St. Room 104
Honolulu, Hawaii 96813

SUBJECT: Draft EIS: Lanikai Flood Control Project, Kailua, O'ahu

Dear Dr. Miura:

82

Human skeletal remains and buried archaeological sites have been discovered in Kailua and Lanikai during similar construction projects in the past. Consequently, a qualified archaeologist should be on hand to monitor ground disturbing activities, conduct salvage excavations if necessary, and to write a report on the fieldwork and findings. Copies of all archaeological reports should be sent to our office for review and comment. In addition, our office would like to be notified in the event that human skeletal remains are discovered during construction.

Sincerely,

Richard K. Paglinawan

Richard K. Paglinawan
Administrator

RKP:EN:klr

cc: Chew Lun Lau

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

89-12-0562

August 3, 1989

Office of Hawaiian Affairs
State of Hawaii
1600 Kapiolani Blvd., Suite 1500
Honolulu, Hawaii 96814

Attention: Mr. Richard K. Paglinawan
Administrator

Gentlemen:

Subject: Your Letter of June 23, 1989 (C-L89-0074) Concerning the Draft EIS for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

Thank you for your comments on the draft EIS. The draft EIS will be revised to require an archeological subsurface survey and testing prior to construction to determine if significant historic sites were present and, if so, to then develop and execute an acceptable mitigation plan.

As requested, we will provide your office with a copy of the archeological report and will notify your office in the event human skeletal remains are discovered during construction.

Very truly yours,

Marvin T. Fukuyama

for SAM CALLEJO
Director and Chief Engineer

MT:tc
cc: Kwock Associates, Inc.

ENGRG

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

May 8, 1989
RE:0532

Dr. Marvin T. Miura
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Draft Environmental Impact Statement
Lanikai Flood Control Project
Koolaupoko, Oahu

The Department of Public Works of the City and County of Honolulu proposes construction to improve drainage in the community of Lanikai, including enlarging the existing drainage channel, replacing the pipe drainage system in the subdivision, constructing overflow swales in four beach right-of-ways, reconstructing a portion of Mokulua Drive, and extending the open channel and pipe outlets into the ocean. Our review was prepared with the assistance of William Coulburn, Geology and Geophysics; Bion Griffin, Anthropology; George Taoka, Civil Engineering; Yu-Si Fok, Water Resources Research Center; and Randall Rush, Environmental Center.

General Comments

With the exception of additional supporting information in the appendices, the Draft Environmental Impact Statement (EIS) is not substantively different in content than the previously reviewed Environmental Assessment (EA) for this project. Hence, our earlier comments noted on page 47 of the Draft EIS remain largely applicable.

Coastal Circulation

Our reviewers take issue with the assessment of the project's interactions with long-shore drift. The statement that the extension of the open channel groin (or, more accurately, jetty) will "possibly lead to an accretion in beach width on both sides of the channel" is wishful thinking. Figure 1, Appendix B, apparently is interpreted to infer that an interference pattern in waves off-shore of the proposed open channel will mitigate long-shore drift. The statement that it is possible that the

channel extension will "lead to an accretion in the beach width on both sides of the channel" is misleading. Shoreline instability is characteristic of the area, as evidenced by historical photos as well as the proliferation of seawalls. In addition, there is no mention of the effects of tidal flushing across the reef, which also may influence shoreline processes.

Nearshore Biological Effects

An intended consequence of the project is to facilitate the delivery of runoff to coastal receiving waters, and reduction of percolation will increase the volume of water delivered. However, no consideration is given to the effects of the enhanced discharge on near-shore biota.

Aesthetic Considerations

Our comments on the EA called attention to the need for safety measures to insure that people do not accidentally fall into the channel. The Draft EIS proposes a four-foot chain link fence along the channel to mitigate safety hazards, with no apparent consideration of the visual impacts of such a structure. As our earlier comments noted, "[v]isual impacts of the solutions to this safety problem should be considered, particularlt since the activity will take place in a sensitive coastal recreational area."

In general, the visual aesthetics of the proposed beach modifications are less than optimal. Once completed, this structure will be a permanent eyesore in the midst of one of Oahu's most scenic beaches. The proposed alternatives fail to offer satisfactory solutions as well, but our reviewers feel that different, albeit more costly, solutions are available which would alleviate both the flooding and the aesthetic concerns. For instance, why not use additional access routes to install multiple buried pipe discharges? In view of the sensitivity of the Lanikai area, it behooves the State to creatively transport the runoff across the beach in a way that is effective, yet neither aesthetically nor functionally problematic.

Future Capacity

As shown in Figure 3, large areas within the project area are presently undeveloped, and contain potential future house lots which will have to be added to the drainage system. It is not clear from statements in the Draft EIS whether the proposed improved drainage system will be capable of handling additional drainage from future development.

Archaeology

The Draft EIS statement (page 28, section 9) that excavations will be monitored is entirely inappropriate. Human burials recently have been recovered in the area, including mauka of Aalapapa Drive. These burials were deeply placed and in old beach sands. Intensive sub-surface

excavations designed to remove any burials are the only appropriate procedure to follow. Monitoring would only result in machine destruction of the burials. Since we can be certain more burials, and perhaps occupation sites, are in the sand layer, test excavations as specified by the Historic Sites Section of Department of Land and Natural Resources should be performed.

We thank you for allowing us the opportunity to comment on this Draft EIS.

Yours truly,

John Harrison
Environmental Coordinator

cc: Chew Lun Lau ✓
L. Stephen Lau
William Coulbourn
Bion Griffin
George Taoka
Yu-Si Fok
Randall Rush

84

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO:

89-12-0564

August 3, 1989

Mr. John Harrison
Environmental Coordinator
Environmental Center
University of Hawaii at Manoa
Crawford 317, 2550 Campus Road
Honolulu, Hawaii 96822

Dear Mr. Harrison:

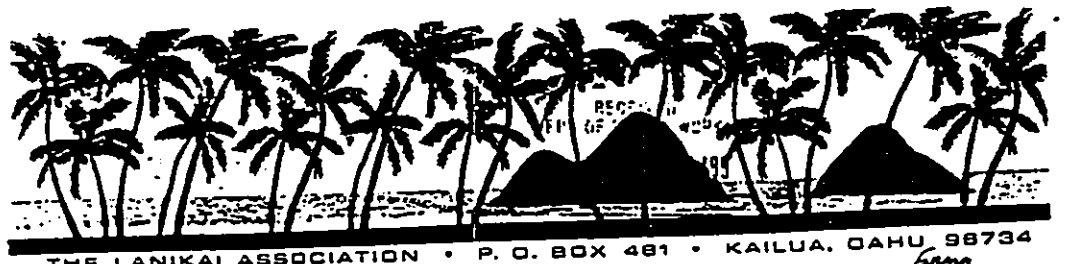
Subject: Your Letter, Dated May 8, 1989 (RE: 0532), Concerning the Draft EIS for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

Thank you for your comments on the draft EIS. A final EIS will be published for Phase I, Construction of Overflow Swales. A supplemental EIS will be prepared for Phases II, III and IV and will address your concerns.

Very truly yours,

SAM CALLEJO
Director and Chief Engineer

MT:tc
cc: Kwock Associates, Inc.



THE LANIKAI ASSOCIATION • P. O. BOX 481 • KAILUA, OAHU 96734

May 1989

Mr. Chew Lun Lau
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Lau:

Thank you for this opportunity to comment on the Environmental Impact Statement (EIS) for the Lanikai Flood Control Project (LFCP).

The Kailua Neighborhood Board No.31 letter of July 18, 1988 expressed concern about the general appearance of the swales, the effect of the groins (drain pipe and open channel extensions) and the need for regular maintenance. Mr. Foti, the previous Chair of the LFCP Steering Committee, in his letter of June 16, 1988 expressed a similar concern about the design of the swales and extension of the drain pipe and open channel beyond the high-water line. Mr. Thiede's response to both letters was that these concerns would be addressed in the EIS. The EIS does not address these issues adequately and as such our concern remains the same. Specifically, these concerns can be summarized as: (1) the design of the swales; (2) the affect on beach accretion and erosion by the construction of two groins; and (3) the affect on water quality and the coral community.

Figure 4 shows a "Typical Overflow Swale at Beach Right of Way". The swale is depicted as being constructed of monolithic walls and floor of reinforced concrete with a maximum wall height of 4'-6". This figure is incorrect in that, as designed, the maximum wall height is 7'. Nowhere in the EIS is the general appearance or alternate design of these swales discussed as Mr. Thiede's reply indicated they would. The EIS is deficient in this regard and the current design is unacceptable to the Lanikai community. It should be noted that a meeting was held on April 19, 1989 with Mr. Sam Callejo, Director, Department of Public Works, representative of Councilperson Kahanu's Office, Kwock Associates and representatives of the LFCP Steering Committee and the President of the Lanikai Community Association. At this meeting Mr. Callejo agreed to review the design of the swales in order to minimize their visual impact. It is therefore assumed the issue of swale design can be resolved by this cooperative effort.

The long term environmental impact of the open channel on beach modification is stated as being the "possible" accretion in beach width on both sides of the channel. No discussion of long term environmental impact on beach modification resulting from construction of the extended 5'-6" (not 24") diameter drain pipe. The statement as to the open channel is not supported by Appendix B, "Assessment of Impacts to Offshore Extension of Drain and Open Channel". This assessment notes that both groins are located in the general area of convergence of littoral transport. It further notes that the beach width at the drain pipe outlet has been stable from 1950 to 1982 but that there has been a great fluctuation in beach width in the area of the open channel. The language used to discuss

accretion, while imprecise, does lead to conclusions other than stated in the EIS. Accretion related to the open channel extension is stated as being "potential", whereas, when discussing no extension of the open channel, accretion is stated as being "likely". While choosing non-quantitative terminology, the writer clearly envisions an impact as the result of the open channel extension. Non-quantitative terminology is required due to the lack of adquate study of this impact. The potential for long term damage is too great to allow construction of these groins without further study. Until model or other studies are completed that can determine the accretion/erosion impact more definitively, construction of these groins is strongly opposed.

The EIS states that the drain pipe and open channel extensions will not adversely affect the coral community. Appendix C provides a "Biological Reconnaissance Surveys of the Lanikai Fringing Reef off the Project Area". This survey notes the existance of some "spectacular live coral heads" at the proposed terminus of the 5'-6" drain pipe (erroneously cited as being 24") which, over time, can be expected to kill all the coral in the vicinity of the discharge. This statement contradicts the conclusion of no adverse affect and lends further strength to the argument that inadequate data exists to allow proceeding with construction of either groin.

Lastly, the listing of alternatives is considered incomplete. In discussing the alternative of no open channel extension, it is noted that sand blockage would require removal prior to every storm. This is inferred as being an unacceptable alternative without further discussion. This is not necessarily a valid conclusion. As noted in the Kailua Neighborhood Board No.31 letter of July 18, 1988, the need for regularly scheduled maintenance of the drainage system (with or without improvement) is a continuing problem which is unaddressed in the EIS. Based on the unquantified impact of groin construction, it is possible that the preferred alternative is the improvement of the drainage system except for open channel and drain pipe extension, with regularly scheduled maintenance, not just of sand blockage, but of the entire drainage system.

I am available to discuss our continuing concerns with any of the parties involved in their resolution.

Sincerely,

Richard D. Eber
Chair, LFCP Steering Committee

cc: Sen. Mary George
Rep. C. Cavasso
Councilperson Kahanu
Kailua Neighbornood Board No.31
OEQC

85

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO:

89-12-0560

August 2, 1989

The Lanikai Association
P. O. 481
Kailua, Hawaii 96734

Attention: Mr. Richard D. Eber
Chair, LFCP Steering Committee

Gentlemen:

Subject: Your Letter, Dated May 4, 1989, Concerning the Draft EIS for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

Thank you for your comments on the draft EIS. A final EIS will be published covering the work under Phase I, Construction of Overflow Swales. A supplemental EIS will be prepared to cover the work under Phase II, III, and IV.

The design of the overflow swales has not been finalized. In a letter to the Lanikai Association dated June 15, 1989, an alternative design using split-faced CMU for the sidewalls and concrete with a standard sidewalk finish for the bottom slab was proposed.

Your concerns regarding the pipe outlet and channel extension are still under review and will be discussed in the supplemental EIS for Phases II, III and IV.

Very truly yours,

Sam Callejo

SAM CALLEJO
Director and Chief Engineer

MT:tc
cc: Councilmember David Kahanu
Kwock Associates, Inc.

86

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-00C

William A. Bonnet
Manager
Environmental Department

RECEIVED
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
'89 MAY 15 6 09 AM

Enjy

ENV 2-1
JA/G

May 10, 1989

Marvin T. Miura, Ph.D., Director
State of Hawaii
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (EIS) for Lanikai Flood Control Project

The proposed project will be in proximity to existing HECO electrical facilities (see Attachment 1, Figure 3 in the EIS). Our review shows that a number of possible conflicts with the project and HECO facilities may exist throughout the project area. Resolving these conflicts will require HECO engineering. The developer or his consultant is to complete the coordination of their work with HECO prior to finalizing the project design.

In addition, since HECO facilities are energized, the following construction notes shall be included in the EIS:

a. The Contractor is to exercise extreme caution when the excavation and construction cross or are in proximity to HECO overhead lines and is to maintain a minimum 13'-0" clearance for his equipment while working close to and/or under the overhead facilities.

b. The Contractor is to comply with the directions of the State of Hawaii Occupational Safety and Health Law (DOSH).

c. When trench excavation is adjacent to or beneath our existing HECO structures or facilities, the Contractor is responsible for:

   1. Sheeting and bracing the excavation to prevent slides, cave-ins, and settlements, and

   2. Protecting existing structures or facilities with beams, struts, or under-pinning.

d. If the Contractor requires pole bracing instructions, he should call the HECO District Construction Superintendent at HECO's Koolau office at 261-6084 a minimum of 72 hours in advance.

e. For verification of underground lines or for assistance in supporting and protecting these lines, the Contractor shall call HECO's Underground Division at 543-7395 a minimum of 72 hours in advance.

f. Any work required to relocate HECO facilities shall be done by HECO. The Contractor shall be responsible for all costs and coordination. In addition, should it become necessary for the Contractor to temporarily relocate any HECO facilities, these temporary locations will be done by HECO or by the Contractor under HECO supervision and all costs will be borne by the Contractor.

g. Any damage to HECO's facilities will be reported immediately to HECO's Trouble Dispatcher at 543-7838, The Contractor shall be liable for any damages to HECO's facilities.

87

Sincerely,

Attachment

cc: Dr. Chew Lun Lau
C&C of Honolulu
Dept. of Public Works

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO:
89-12-0565

August 3, 1989

Mr. William Bonnet
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Mr. Bonnet:

Subject: Your Letter, Dated May 10, 1989, Concerning the Draft EIS for the Lanikai Flood Control Project, Kailua, Oahu, Hawaii, TMK: 4-3-01 thru 05

Thank you for your comments on the Draft EIS. Your concerns regarding conflicts of the proposed improvements with existing HECO electrical facilities can best be addressed during the design stage. The construction notes will be included in the plans and will be routed to HECO for review prior to construction.

Very truly yours,

FOR SAM CALLEJO
Director and Chief Engineer

MT:tc
cc: Kwock Associates, Inc.

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU

LU3/89-1667(RF)
88/EIS-7

May 8, 1989

RECEIVED
MAY 10 1989
KWOCK ASSOCIATES, INC.

MEMORANDUM

TO: SAM CALLEJO, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM: JOHN P. WHALEN, DIRECTOR

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)
LANIKAI FLOOD CONTROL PROJECT

We have reviewed the Draft EIS and offer the following comments:

1. Drainage Study: What is the anticipated discharge volume and flooding with and without the project for storms of varying duration? How much can the existing system handle? How much could it handle if maintenance were improved? Presumably the proposal is based upon a drainage study; this should be summarized in the text and appended to the EIS.

2. Coastal Water Quality: The discussion of potential impacts to coastal water quality and coastal biota is incomplete. The Biological Survey (Appendix C) reports large live coral heads near the terminus of the proposed 24-inch drain outlet and suggests that they may be killed due to long-term effects of the drainage. This should be reported in the EIS text. How much additional silt, organic materials and toxic materials is expected to reach coastal waters during storm events? What effects can be expected? These impacts should be quantified and reported in the EIS.

3. Impacts on the Sandy Beach: Based only upon analysis of aerial photographs and beach erosion trends, Appendix B states that the 170-foot open channel extension could result in "potential accretion" of the beach on either side of the structure. The statement in the EIS text is more positive (pp.28-29): The extension "would possibly lead to an accretion in the beach width on both sides of the channel." These predictions, however qualified, lack adequate factual basis. At the very least, the EIS should examine the impacts on the beach and adjacent residential properties should the channel extension cause erosion on either side.

4. Visual Impacts: How far seaward would the four-foot-high fence topping the channel walls extend? The EIS should discuss the long-term visual impacts of the open channel extension for users of Lanikai Beach. The discussion should include an elevation and a perspective rendering of the structure seen from the beach.

5. Parking Impacts: The Draft EIS states that removing all parking along the mauka edge of Mokulua Drive will result in the loss of 20 parking spaces (p. 27). Judging from the number of vehicles parked along Mokulua Drive on a busy Sunday afternoon, the figure appears low. This estimate should be substantiated. Will curbs and gutters also be installed on side streets, and would this add to the number of spaces lost?

6. Lanipo Drainage Channel: The proposal calls for enlarging and lining the open ditch which parallels Lanipo Drive. How will the City obtain access to maintain this channel. Even if it were not enlarged, could the City obtain access and assume responsibility for channel maintenance?

7. Alternatives: Alternative E appears to be a practical, low-impact proposal. In addition to those stated, could other low-impact improvements be included as part of this alternative? While it would not "completely solve the flooding problems," would such an alternative measurably reduce flooding hazards?

8. Other Comments:

a. Page 13: Would the beach right-of-way overflow swale extend seaward of the vegetation line? If so, how far into the public beach would it extend?

b. Page 17: The EIS should include a current cross-section of Mokulua Drive for comparison with the proposed cross-section.

c. Page 21: The EIS should include the Flood Insurance Rate Map (FIRM) for the project area, as well as maps of areas affected by recent flood events. Would the project lead to a revision in the FIRM?

d. Page 32: Will the U.S. Army Corps of Engineers require an EIS to be prepared under the National Environmental Protection Act for this project?

e. Appendixes: These should be labelled. Appendix B lacks a title page, and there is no indication of its author.

If you have questions concerning these comments, please contact Mr. Robin Foster of our Environmental Affairs Branch at 527-5027.

JOHN P. WHALEN
Director of Land Utilization

JPW:sl
0256W

cc: Kwock Associates, Inc.

89

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO
89-12-0694

October 5, 1989

MEMORANDUM

TO: MR. JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: SAM CALLEJO, DIRECTOR AND CHIEF ENGINEER

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)
LANIKAI FLOOD CONTROL PROJECT

Thank you for your comments to the draft EIS. Our responses to your comments are shown below and are in the same order as stated in your memorandum of May 8, 1989.

A final EIS will be published for Phase I, Construction of the Overflow Swales. A supplemental EIS will be prepared for Phases II, III, and IV.

1. Drainage Study

Based on the drainage study for the project, the capacities for the existing and proposed drainage systems are as follows:

a. Existing System

i.	Lanipo Ditch	385 cfs
ii.	24" Drain Outlet	22 cfs

b. Proposed Improvements

i.	Lanipo Ditch	1000 cfs
ii.	54" Drain Outlet	51 cfs

Lack of maintenance will reduce the capacity of the existing drainage systems. However, proper maintenance will only serve to restore the original capacity and not increase the capacity of the existing drainage systems.

2. Coastal Water Quality

Based on the biological survey, Edward K. Noda & Associates, Inc. is planning to shorten the drain outlet to minimize the impact on the existing coral. Organic and toxic materials are not permitted in the drainage system and should not have an impact on the coastal waters.

The environmental impacts to the coastal water quality will be addressed in the supplemental EIS.

3. Impacts on the Sandy Beach

There is presently little or no dry beach at the southeast side of the channel. The proposed open channel will have sloping rubble sides to dissipate wave energy and minimize wave reflection and potential scouring effects.

The environmental impacts to the beach will be addressed in the supplemental EIS.

4. Visual Impacts

The four-foot-high fence would end at the pedestrian overpass. Visual impact on the channel is lessened by the rubble sloping sidewalls.

The visual impacts of the project will be addressed in the supplemental EIS.

5. Parking Impacts

Many residents along Hokulua Drive at the present time do not allow parking in the sidewalk area fronting their residences by planting trees or placing boulders to prevent cars from parking. No curb and gutters will be installed on side streets except where necessary to intercept and convey runoff to catch basins.

The impact of the project on parking will be addressed in the supplemental EIS.

6. Lanipo Drainage Channel

The channel is wide enough that equipment can be used. Access will be available at intersections of streets. Also, the City will assume the responsibility for channel maintenance.

7. Alternatives

While Alternative E is low impact, it is also ineffective and does not improve the system. A better alternative is to do nothing and keep the

present drainage system. Residents must be prepared to accept periodic flooding and damages.

8. Other Comments

a. The overflow swales will not extend beyond the seaward boundary certified by DLNR.

b. A current cross-section of Hokulua Drive has been included in Figure 8, page 17 of the EIS document.

c. A Flood Insurance Rate Map (FIRM) for the project areas, as well as maps of areas affected by recent flood events will be included in the supplemental EIS. Possible revision to the FIRM should be evaluated upon completion of the project.

d. No EIS will be required under the National Environmental Protection Act.

e. The appropriate labels, titles and authors will be added to the appendices.

SAM CALLEJO
Director and Chief Engineer

cc: Kwock Associates, Inc.

89-1660 EMWith Encl

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

RECTIVED
DEPT OF PUBLIC WORKS
'89 MAR 3 12 46 PM

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TO

ES
Room 6307

MAR 3 1 1989

Dr. Marvin T. Miura
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Re: Draft Environmental Impact Statement, Lanikai Flood Control Project, Koolaupoko, Oahu

Dear Dr. Miura:

We have reviewed the referenced Environmental Impact Statement, and have no further comments to offer at this time.

We appreciate the opportunity to comment.

91

Sincerely yours,

Ernest Kosaka
Field Office Supervisor
Environmental Services

cc: Dept. of Public Works, C&C of Hnl

REFERENCES

1. AECOS. Oahu Coral Reef Inventory. U.S. Army Corp. of Engineer, Pacific Ocean Division, Fort Shafter, Hawaii, 1979.

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APPENDIX

A. *Oceanographic Design Considerations for Drainage Discharge Structures*, Edward K. Noda and Associates, Inc., August 1987.

B. Assessment of Impacts Related to Offshore Extension of Drain Pipe and Open Channel, Edward K. Noda and Associates, Inc., Undated.

C. Biological Reconnaissance Surveys of the Lanikai Fringing Reef Off the Project Area, AECOS, January 1989.

LANIKAI FLOOD CONTROL PROJECT

OCEANOGRAPHIC DESIGN CONSIDERATIONS FOR DRAINAGE DISCHARGE STRUCTURES

Prepared for:

Kwock Associates, Inc.
1100 Ward Avenue, Suite 920
Honolulu, Hawaii 96814

Prepared by:

Edward K. Noda and Associates
615 Piikoi Street, Suite 1000
Honolulu, Hawaii 96814

August 1987

TABLE OF CONTENTS

1. INTRODUCTION

The City and County of Honolulu has initiated plans to improve the drainage system for the Lanikai area, located between Kailua and Waimanalo on the windward coast of Oahu. The project limits are shown on Figure 1. The area is presently drained by an open channel which discharges at the shoreline in the vicinity of Lanipo Drive and a 24-inch drain pipe which terminates at the shore near Aala Street. The open channel has intermittent sand blockage problems at the mouth and the drain pipe exit is almost always completely buried by the beach and presently is completely ineffective.

As part of the design effort to improve the existing drainage system, the oceanographic aspects related to the drainage structures at the shoreline were evaluated to mitigate the potential sand blockage problems. This report summarizes the results of the oceanographic study and provides design criteria for stability considerations related to storm wave attack.

2. TYPICAL WAVE CLIMATE

The littoral transport characteristics which are manifest in the accretion or erosion of the beach is dependent on the typical open ocean wave characteristics, which in turn is a function of the meteorological parameters. Thus, the daily, seasonal, yearly, and long-term variability in the sediment transport characteristics is directly related to the variability of the weather patterns, both local and global.

The typical wave types which affect the Hawaiian Islands consist of locally-generated wind waves as well as long-period swell waves which are generated by storms or pressure centers in the distant Northwest Pacific or South Pacific regions and which travel a few thousand miles prior to reaching the islands. Figure 2 shows the typical wave types and deepwater approach

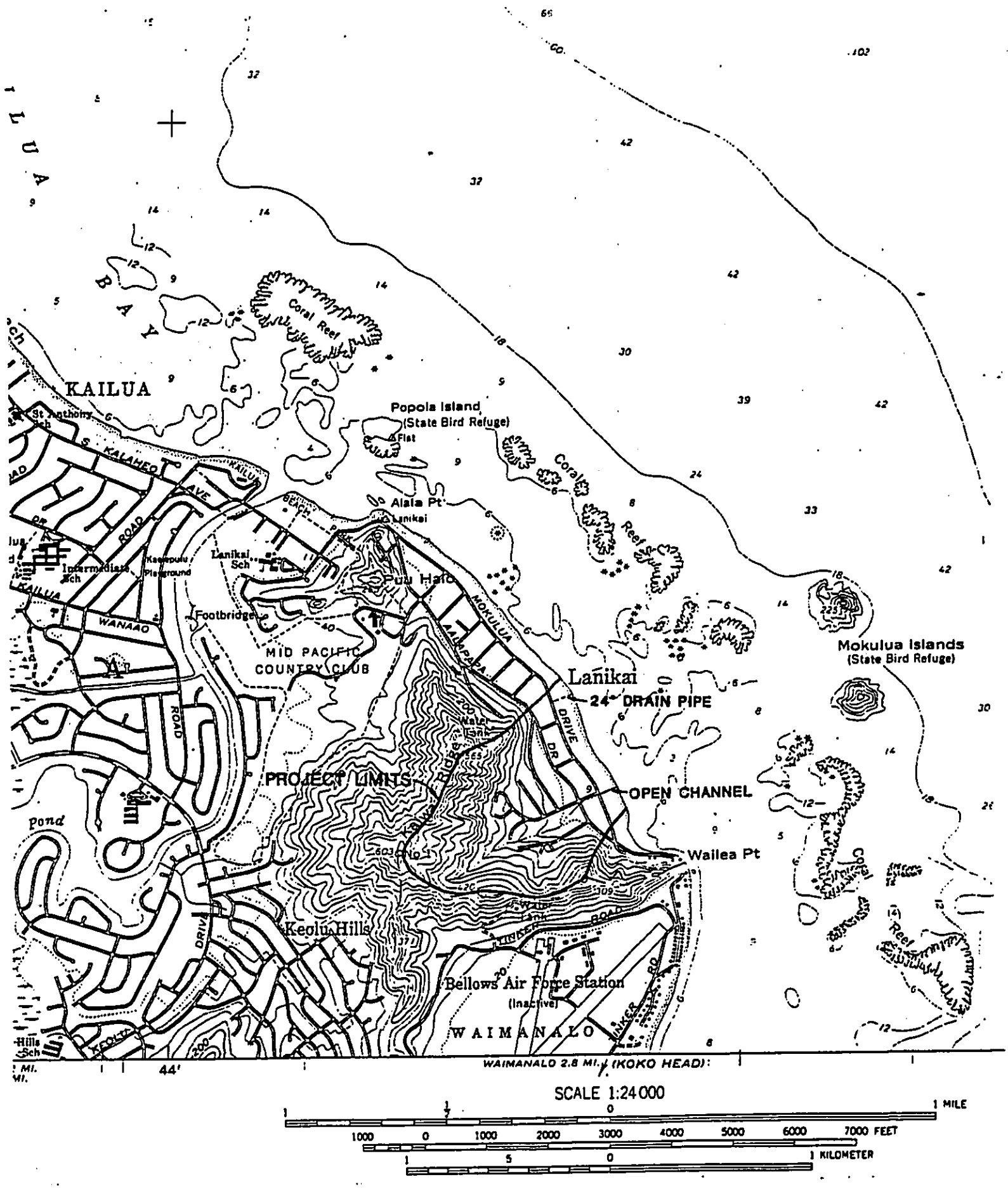


Figure 1. Lanikai Flood Control Project Limits.

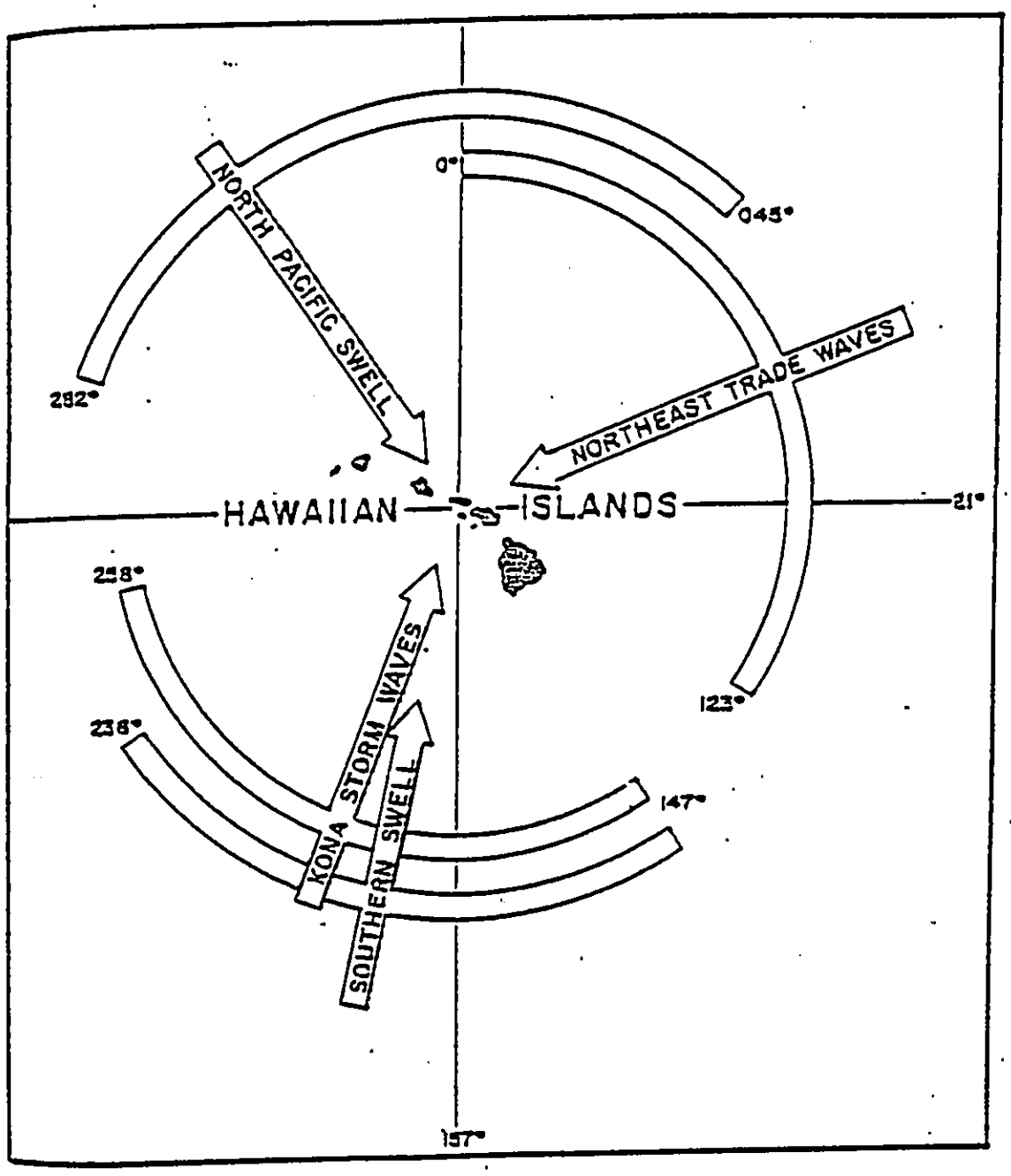


Figure 2. Typical Deepwater Wave Climate in Hawaiian Waters

directions.

Northeast Tradewind Waves: These waves are generated by the prevailing tradewinds and may be present throughout the year. However, they are largest and most dominant during the summer months when the tradewinds are strong and persistent. These waves typically have periods of 5 to 8 seconds and heights 4 to 8 feet.

North Pacific Swell: These waves are generated by severe winter storms in the North Pacific near the Aleutians or by mid-latitude low pressure systems. Hence, they are largest and most frequent during the winter months. These waves have relatively long periods (10 to 15 seconds) with large heights to 20 feet.

Southern Swell: These waves are generated by distant winter storms in the Southern Hemisphere, and hence are most frequent during the summer months, arriving as low, long-period swell. These waves typically have heights less than 5 feet with periods to 18 seconds.

Kona Storm Waves: These waves are generated by local fronts and extra-tropical storms, and hence are infrequent yearly events. These storm waves typically occur during the winter months with periods of 6 to 10 seconds and heights to 15 feet.

The Lanikai coastline is shielded by the island mass from most of the Southern swell and Kona Storm waves. Thus, the wave types which typically influence the sediment transport characteristics along this coast are the predominant Northeast tradewind-generated waves and the winter North Pacific swell. The seasonality of these wave types can be described by the frequency of occurrence statistics of deepwater wave characteristics derived from long-term data bases. One of these data bases was developed using a sophisticated wave hindcast model called the Spectral Ocean Wave Model (SOWM). This model utilized the

atmospheric pressure fields to determine the large-scale wind fields and subsequent wind-generated wave fields over a 13-year period from 1964 to 1977. The voluminous data are not available in published form but can be procured from the National Climatic Center, NOAA, on 9-track magnetic tape for specified grid point locations. The data for the Hawaiian Islands were acquired and summarized in monthly and annual tabulations of percent frequency of occurrence of significant wave height versus period for 8-point sectors of approach [1]. While the data set has shortcomings for definition of the wave climate in other coastal areas of the State, it is considered generally applicable for the Lanikai area. From the SOWM data, Table 1 summarizes the percent of time during which waves occur from the various sectors of approach on a monthly and yearly basis. Note the predominance of the northeasterly wave approach direction, and the relatively higher frequency of occurrence of northerly waves during the winter months as compared to the summer months.

Table 1. SOWM Percent Frequency of Deepwater Wave Approach Direction on a Monthly Basis

Month	N	NE	E	SE	S	SW	W	NW
Jan	19.2	39.0	14.0	3.5	8.5	7.5	7.3	0.8
Feb	20.3	46.7	17.8	4.3	3.4	2.3	5.2	0.1
Mar	25.0	51.1	16.4	2.0	1.8	1.9	1.6	0.2
Apr	15.1	65.8	17.6	0.9	0.6	0.0	0.0	0.0
May	6.3	75.5	15.6	2.2	0.1	0.2	0.0	0.0
Jun	3.1	68.6	26.8	1.1	0.4	0.1	0.0	0.0
Jul	3.7	78.3	17.4	0.5	0.0	0.0	0.0	0.0
Aug	4.3	79.8	15.8	0.0	0.0	0.0	0.2	0.0
Sep	8.0	71.0	17.9	1.6	0.2	0.0	1.3	0.0
Oct	17.9	60.3	18.4	1.8	0.4	0.8	0.3	0.0
Nov	19.0	55.9	18.3	2.2	2.7	0.8	0.9	0.1
Dec	18.9	49.1	19.8	4.9	4.1	1.4	1.2	0.5
Annual	13.4	61.7	18.0	2.1	1.9	1.3	1.5	0.1

As the deepwater waves approach shore, they are transformed by processes of wave refraction, diffraction, and shoaling. Along the Lanikai shoreline, these processes are very complicated due to the shallow offshore reefs and islands. The combined transformation processes result in much reduced wave heights at the shoreline and complicated nearshore wave approach patterns. The variable wave approach directions along this stretch of shoreline is evidenced by the irregular shape of the Lanikai shoreline between Alala Point and Wailea Point as compared to the very regular crescent-shaped shoreline within Kailua Bay.

While it is not within the scope of this study to characterize the exact nature of the littoral transport processes, suffice it to say that the sediment transport along the shore responds both seasonally and over long-term cycles to the dynamic wind and wave climate. The long-term changes in beach width were evaluated from aerial photos as described in Section 4.

The nearshore wave characteristics, in addition to providing the energy source for sediment transport along the shore, also shape the beach profile. The beach crest elevation typically reflects the maximum runup height of waves breaking on the beach face. Along the Lanikai shoreline, the beach crest elevation is rather low due to the typically small nearshore waves.

A comprehensive beach processes study was accomplished in 1977 [2] to evaluate the erosion problem at Kailua Beach Park. As part of this study, field measurements of winds, waves and longshore currents were accomplished at four shoreline locations between Kuulei Road and just Lanikai side of Alala Point. For the June 13-September 2, 1977 period of field measurements, the range, mean, and standard deviation of the measured parameters at Site D just Lanikai side of Alala Point are summarized in Table 2 below.

Table 2. Summary of Measured Parameters at Site D, Lanikai Side of Alala Point, June 13-September 2, 1977 [2]

Parameter Measured	Range	Mean	Standard Deviation
Wind speed (mph)	2-19	11.6	3.4
Wind direction (°T)	055-115	079	013
Longshore current (ft/min)*	-22 to +39	+6.3	8.6
Wave height (ft)	0.4-1.5	1.0	0.3
(Offshore wave height)	1.2-4.0	2.5	0.7
Wave period (sec)	4.5-9.2	7.0	1.1
(Offshore wave period)	6.5-10.3	8.5	0.9
Wave direction (°T)	036-076	045	007

* Plus sign denotes flow to the northwest; minus sign denotes flow to the southeast.

The offshore wave heights were measured on the reef adjacent to Flat Island. It was noted that these wave heights were considerably smaller than the typical deepwater tradewind wave heights due to the considerable refraction effects prior to reaching the outer reef area. The nearshore waves at the northwestern-most site towards Kailua Bay had the largest heights, with a mean value of 1.9 feet. The other sites to the southeast which were more protected by the offshore reef all had mean values of 1 foot or less.

The field measurements were accomplished during conditions typical of the summer season. Assuming that the measured wave heights at Site D are fairly representative of the entire Lanikai shoreline, then one would expect typical maximum nearshore heights of less than 2 feet. Section 4 describes the analysis of typical maximum beach crest elevation applicable to the evaluation of sand blockage in the open discharge channel and at the drain pipe.

3. EXTREME WAVE CONDITIONS

While storm wave attack along this coastline is very infrequent, the structural design of shoreline improvements to the drainage system should consider the maximum design wave conditions which can be expected to impact the discharge channel structure and drain pipe(s). Because of the shallow offshore reefs and nearshore bottom depths, the maximum wave heights which can impact the shore are depth-limited.

Large storm waves break seaward of the reef, dissipating a considerable portion of their energy. The remaining energy reforms as secondary waves which propagate to shore. The largest waves which can reach the shore are limited in height by the nearshore water depths. The largest wave height which can theoretically propagate over a flat bottom is approximately equal to 0.78 times the water depth. The large waves which break seaward of the shore cause a rise in water level called set-up. Thus, the increase in nearshore water depth due to the wave set-up allows larger than normal waves to reach shore. The increased water level also allows waves to attack the shoreline at higher elevations on the beach. This can result in considerable beach erosion and wave overtopping of the shoreline. The increased water levels at the drainage discharge structures will also change the discharge flow characteristics, and will need to be considered in the hydraulic design.

The phenomenon of wave set-up is related to the conversion of kinetic energy of wave motion to a quasi-steady potential energy. The theoretical definition of wave set-up is based on the rate of decrease of radiation stress in the surf zone. Radiation stress is defined as the excess flow of momentum due to the presence of waves. A singular numerical model was used to calculate the set-up at the locations of the open channel and drain pipe. Based on the bathymetry profile, the solution is obtained by a forward

finite-difference numerical scheme related to the decrease of wave height across the surf zone. Calculations were performed for two deepwater significant wave conditions as summarized in Table 3.

Case 1 is for the maximum recorded significant wave parameters from a Waverider Buoy located offshore Makapuu Point during the period October 1981-August 1986. This Waverider Buoy is exposed to similar deepwater wave conditions as would be expected offshore Lanikai, except that the buoy also experiences Southern Swell energy which cannot reach the Lanikai shore. The 19-foot wave height is assumed to approach directly onshore with no refraction effects. Case 2 is representative of hurricane wave conditions. From a recent study which evaluated the probable hurricane wave impacts along the south shore of Oahu [3], the wave parameters developed for a model scenario hurricane approaching from the southeast indicated significant heights of about 25 feet which could approach directly onshore at Lanikai.

Table 3. Wave Set-up Parameters and Results

Parameter	Open Channel	Drain Pipe
Case 1:		
H_s = 19 ft		
T = 10 sec		
Breaking height, H_b (ft)	19.6	19.6
Breaking depth, d_b (ft)	24.2	24.2
Wave Set-up (ft)	2.2	2.2
Case 2:		
H_s = 25 ft		
T = 11 sec		
Breaking height, H_b (ft)	26.1	25.1
Breaking depth, d_b (ft)	31.9	31.2
Wave Set-up (ft)	2.9	2.9

The results indicate no difference between the open channel and drain pipe locations, with maximum set-up of 2.2 feet for H_s = 19 feet and set-up of 2.9 feet for H_s = 25 feet.

The maximum nearshore water depth is the sum of the MLLW depth, wave set-up, MHHW tide, and negligible contribution due to storm surge effects. Table 4 summarizes the nearshore design water levels and depth-limited wave heights.

Table 4. Nearshore Design Water Levels and Maximum Wave Heights (MLLW datum)

Parameter	Case 1	Case 2
Wave Set-up (ft)	2.2	2.9
MHHW Tide (ft)	1.8	1.8
Design SWL Elevation (ft above MLLW)	4.0	4.7
Water Depth (ft)	4.0	4.0
Total Design Water Depth (ft)	8.0	8.7
Maximum Wave Height (ft)	6.2	6.8

The 6.2-6.8 feet theoretical maximum wave height is conservative and the actual heights will probably be somewhat less for the given deepwater design wave conditions. One reason is the transient nature of storm events, whereby the design deepwater wave conditions may not necessarily occur during high tide. For a MLLW tide condition, the theoretical maximum wave height is 4.8-5.4 feet. Another reason is the non-steady nature of the wave set-up phenomenon. Because the storm waves are not regular, consisting of a spectrum of wave heights and periods, the set-up can also be expected to fluctuate in response to the time-varying wave conditions as well as the spatial variability of breaking wave conditions along the coast. Since the nearshore wave heights will probably be less than 6.8 feet under the hurricane design wave conditions, a maximum wave height of 6.2 feet is used for design criteria evaluation of the shoreline structures with respect to stability considerations.

4. TYPICAL BEACH CREST ELEVATIONS AND BEACH WIDTH

The evaluation of potential sand blockage in the open discharge channel and at the drain pipe(s) requires the characterization of both the horizontal extent of potential beach accretion as well as the vertical height of the beach crest elevation.

The typical beach crest elevation can be estimated based on the typical nearshore wave climate and the existing beach profiles along the project reach. There is presently little or no dry beach at the southeast end of Lanikai in the vicinity of the open channel. However, when this reach is in a cycle of accretion, the beach will extend across the channel entrance and the maximum crest elevation of the berm within the channel will be similar to the beach crest elevation on the adjacent shores.

The beach crest elevation reflects the typical runup height of waves breaking on the beach face. For a beach slope of about 1V:5H, and wave height of 2 feet with period between 6 and 8 seconds, the calculated runup elevation on the beach is 4.6-5.8 feet above MLLW at low tide and 6.4-7.6 feet above MLLW at high tide. For a wave height of 1 foot, the runup elevation on the beach is 2.6-3.0 feet above MLLW at low tide and 4.4-4.8 feet above MLLW at high tide. Since the mean wave height is about 1 foot with typical maximum height less than 2 feet, the typical beach berm elevation within the open channel is expected to be about 5-6 feet above MLLW during an accreted beach state.

At the present drain pipe location, the discharge structure is completely buried by the beach. The beach crest elevation adjacent to the CRM wall and fence line is about 6 feet above MLLW, which correlates with the above estimated runup elevations. Any drain pipe which terminates within the beach zone will be plugged if the invert elevation is lower than the beach crest elevation. The maximum expected horizontal fluctuations of beach

width can be determined by analysis of historical aerial photos.

A series of 8 aerial photos spanning the period April 1950 to December 1982 were used to quantify the horizontal extent of beach changes along the Lanikai shoreline. The photos were enlarged to an approximate scale of 1 inch = 200 feet in order to resolve the typically narrow beach widths. The shoreline, characterized by the vegetation line and seawalls, as well as the seaward extent of the beach, characterized by the waterline, were digitized along with known landmarks from each photo and then computer-scaled. Figure 3 shows the portion of the shoreline from the vicinity of the drain pipe to the open channel, where the vegetation line and waterline are plotted from each photo with respect to a reference line. Note the long-term variability of the shoreline as well as the beach width, expecially in the vicinity of the open channel.

The shoreline and waterline from each photo were then overplotted to more easily distinguish the relative changes. Figure 4 shows the overplots with respect to the same reference line used in Figure 3.

At the drain pipe location, the shoreline and beach width has been relatively stable over the past 37 years. Minimum beach width has been about 60 feet and maximum width has been 90 feet. The present beach width is close to minimum.

In contrast to the drain pipe location, the shoreline in the vicinity of the open channel has fluctuated greatly over the past 37 years. The vegetation line in 1950 was about the same as in the 1980's, which was about the most receded shoreline limit. The vegetation line in 1969 was the most accreted, where the shoreline on the north side of the channel had moved seaward over 100 feet. The beach width was also maximum in 1969 at about 100 feet. The present shoreline and beach width is at the minimum, with the beach width typically less than 20 feet.

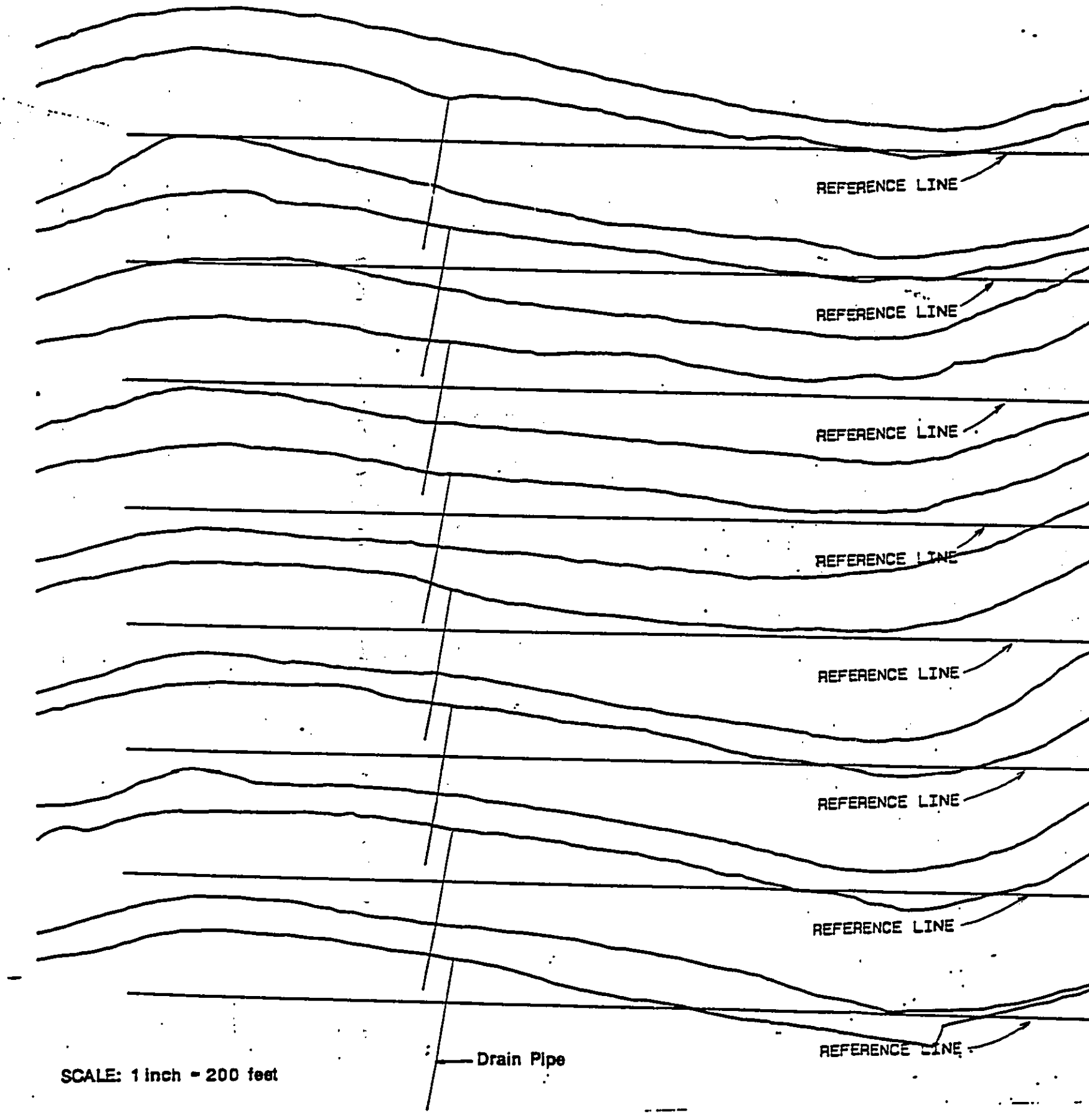
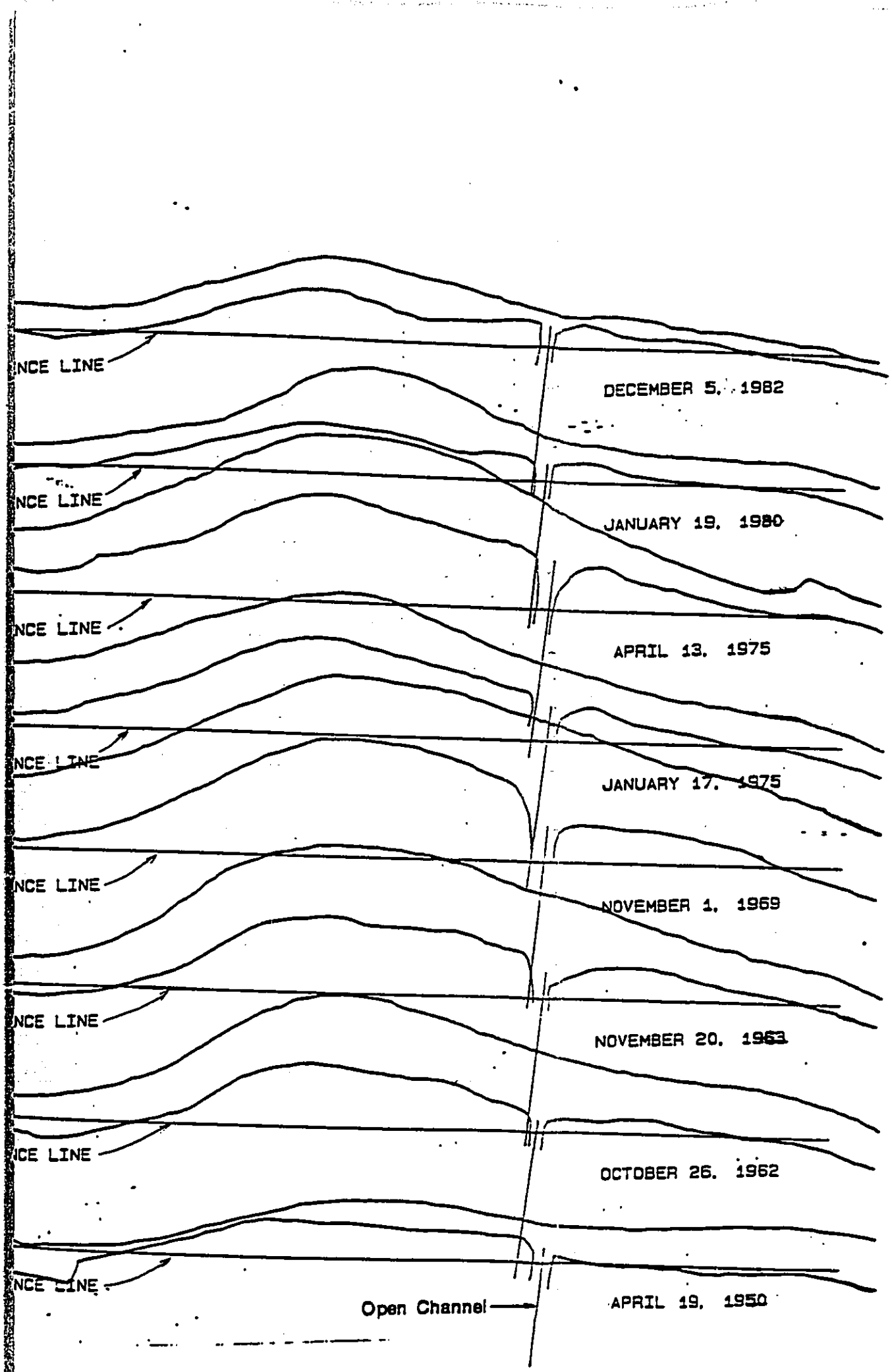
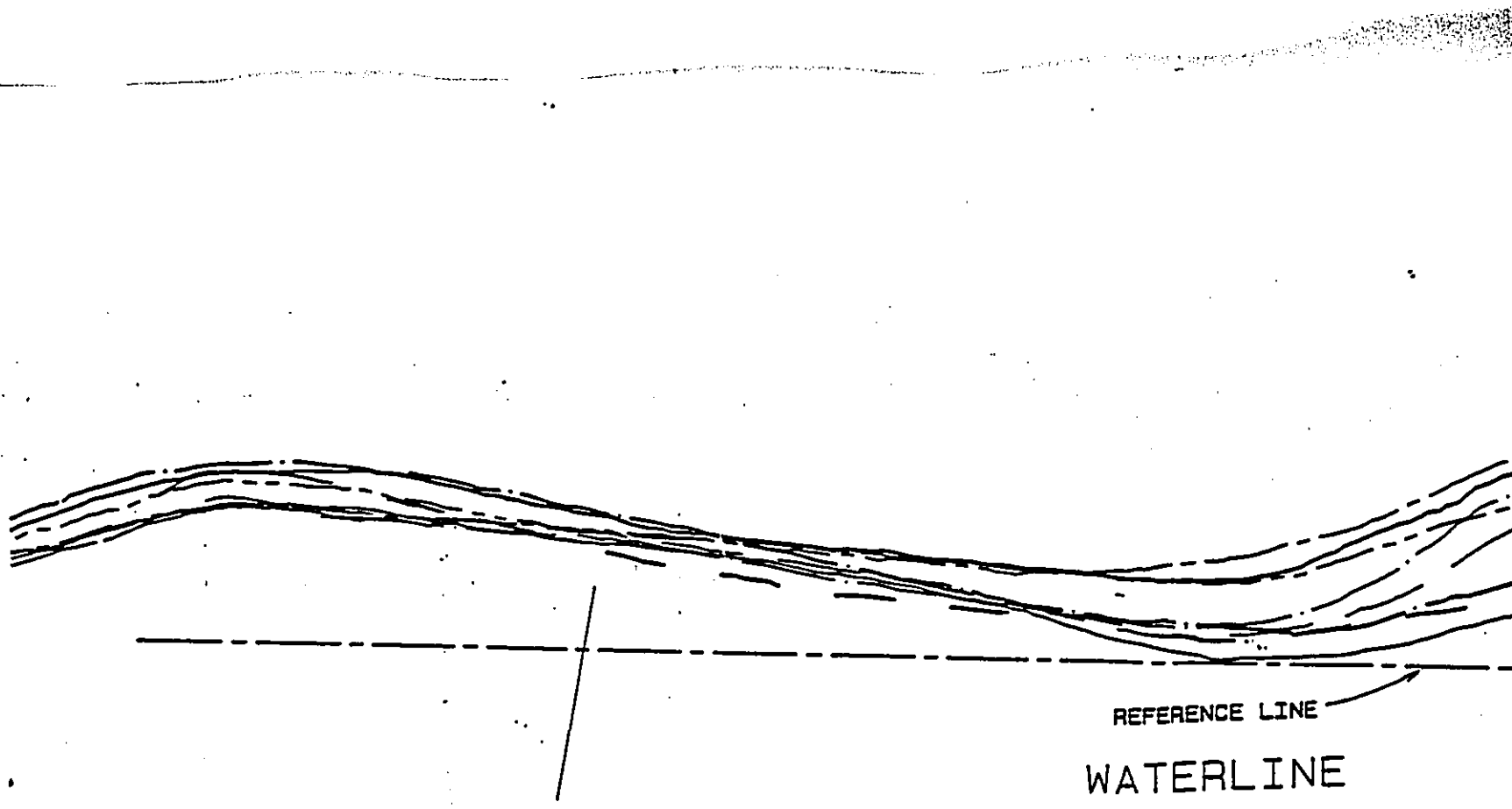
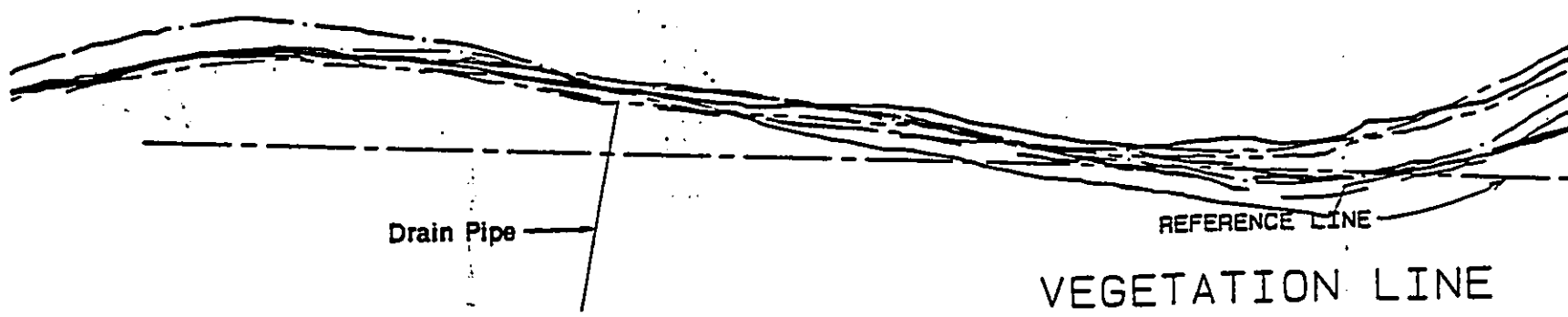


Figure 3. Shoreline and Waterline Along Project Reach



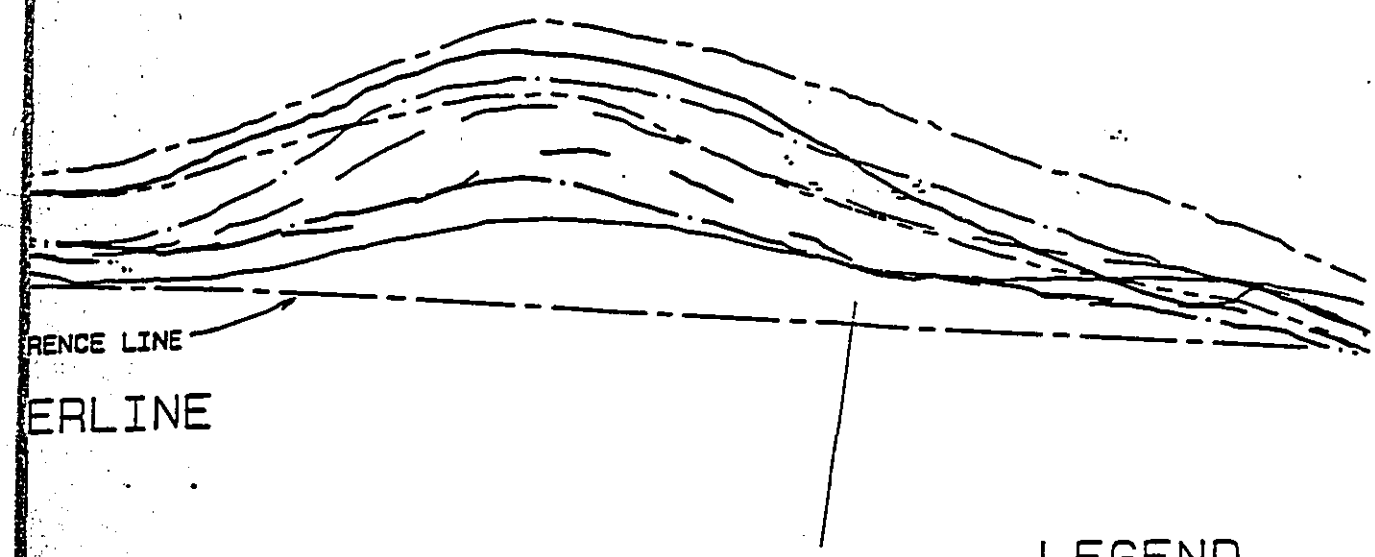
ng Project Reach from Aerial Photos.





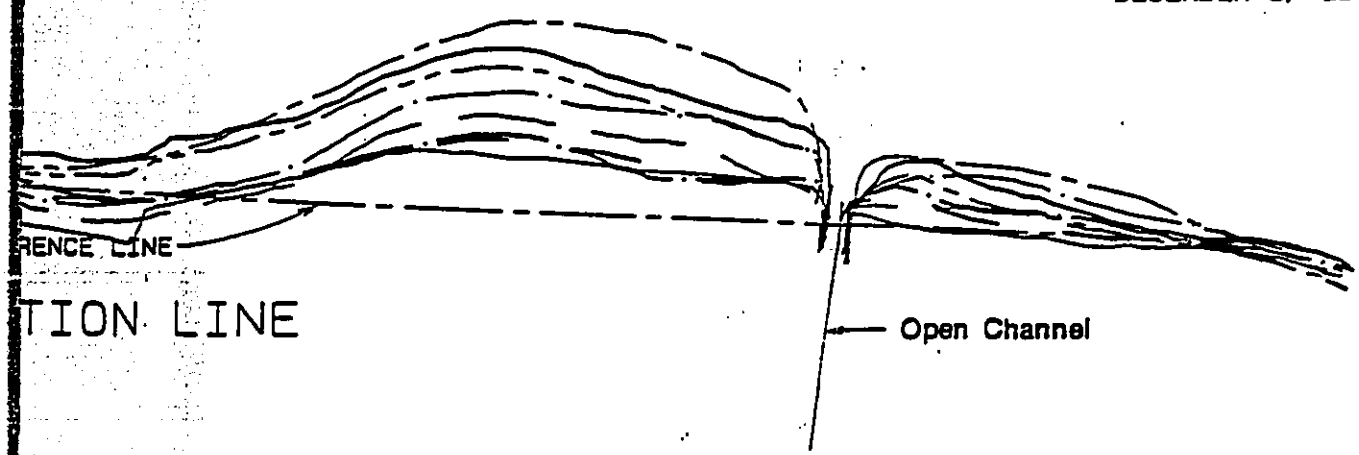
SCALE: 1 inch = 200 feet

Figure 4. Overplots of Shoreline and Waterline from A



LEGEND

APRIL 19, 1950
OCTOBER 26, 1962
NOVEMBER 20, 1963
NOVEMBER 1, 1969
JANUARY 17, 1975
APRIL 13, 1975
JANUARY 19, 1980
DECEMBER 5, 1982



and Waterline from Aerial Photos.

5. DESIGN CONSIDERATIONS FOR OPEN CHANNEL

The maximum shoreline accretion evidenced by the aerial photos occurred in 1969, where the vegetation line was about 90 feet seaward of the 1982 vegetation line at a point about 80 feet north of the channel, and the waterline was about 160 feet seaward of the 1982 waterline. The drainage channel in 1969 was presumably completely ineffective, having over 100 feet of beach berm blocking the channel exit.

The only semi-permanent solution for maintaining the channel opening is to extend the channel beyond the maximum estimated beach zone limits. It is postulated that the sand movement in the vicinity of the channel is predominantly longshore. Aerial photos and site investigation reveal a coral-rubble bottom directly offshore the channel, with predominantly sandy offshore areas to the south adjacent Wailea Point and to the north near the drain pipe. Diffraction of wave energy around the two offshore islands probably result in a convergence of northward and southward longshore transport in the vicinity of the channel, leading to potential accretion. Thus, a seaward extension of the channel would effectively block the northward and southward sediment transport. This would presumably stabilize the southern shoreline between Wailea Point and the channel by acting as a groin for the northward littoral drift, and resulting in potential accretion. The shoreline north of the channel could also potentially accrete since the channel would act as a groin for the southward littoral drift.

Figure 5 is a survey of the existing shoreline elevations and nearshore depths, depicting the proposed channel extension. Also shown are the vegetation line and waterline from the 1969 and 1982 aerial photos. The drainage channel is proposed to extend 170 feet seaward from the existing seawall, which is about the maximum historical seaward extent of the beach. The channel

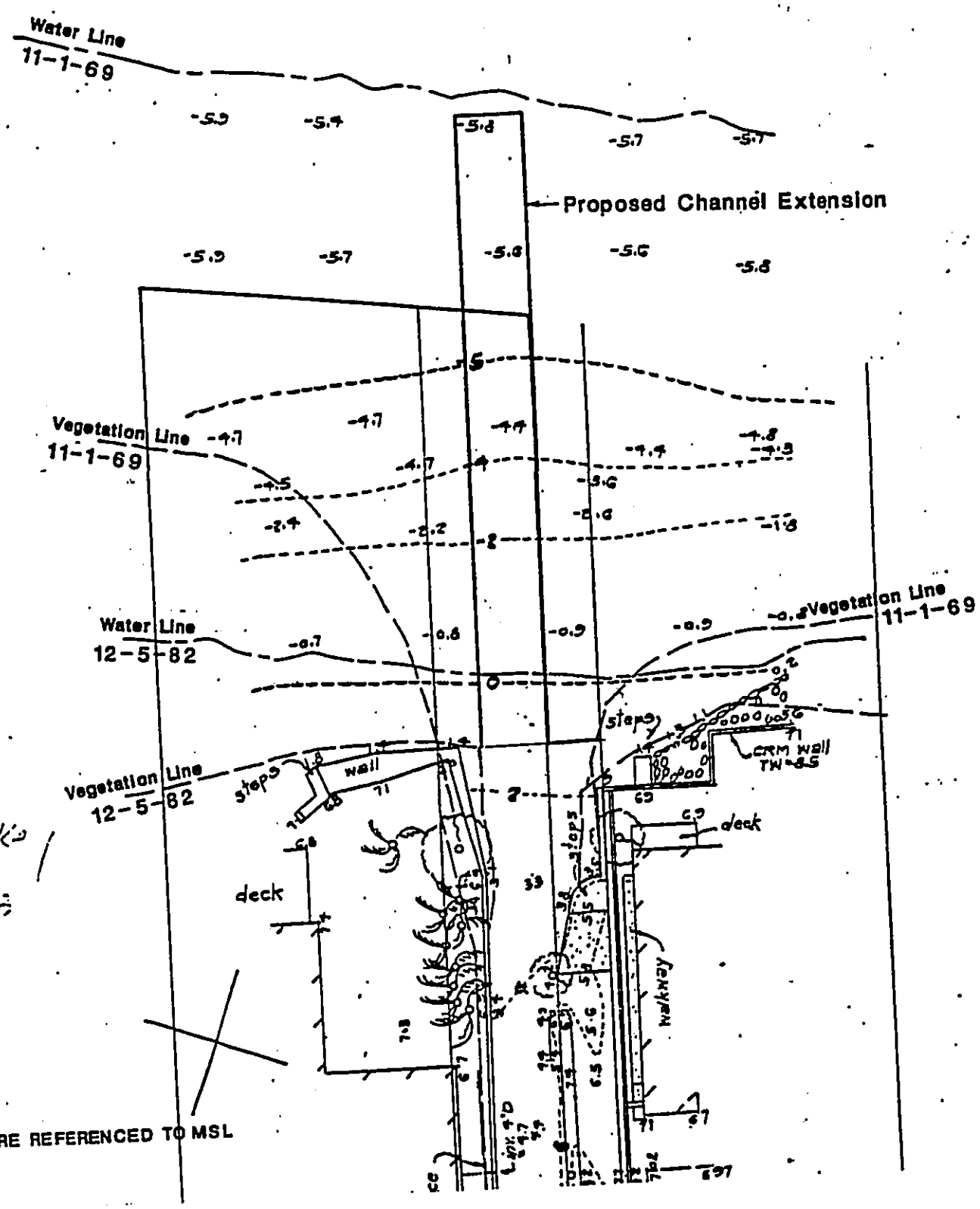


Figure 5. Survey of Existing Shoreline and Nearshore Area in the Vicinity of the Open Channel.

extension should have sloping rubble sides to dissipate wave energy and minimize the wave reflection and potential scouring effects. Since the channel is constrained in width, rubble jetty-type structures are not feasible. One alternative is a vertical-wall, open concrete channel, with exterior facing of stones. Figure 6 shows sketches of this proposed alternative.

The stones were sized to remain stable under the design nearshore wave conditions. For a design wave height of 6.2 feet, the stone size is 2000-3500 pounds, as detailed below:

$$W = \frac{w_r H^3}{K_D (S_r - 1)^3 \cot\theta} = 2825 \text{ lbs.}$$

where:
- W = individual stone weight, lbs.
- w_r = unit weight of stone, assume 160 lbs/ft^3
- H = wave height = 6.2 feet
- K_D = stability coefficient = 2 (rough, angular stones, random placement, breaking wave conditions)
- S_r = specific gravity = w_r/w_w
- w_w = unit weight of seawater = 64 lb/ft^3
- $\cot\theta$= cotangent of structure slope = 2 (45° wave approach on a 1:1.5 slope)

The stone size can range from 0.75 W to 1.25 W.

The foundation for the channel structure and armor stones should be prepared with a 2 foot thick bedding layer of spalls to 6 inch stone to prevent scouring and differential settling.

The open channel has side wall elevation at the typical beach crest elevation of +5 feet MSL. The intent is to have the channel elevation seaward of the property limits lower than the landside elevation, but high enough to maintain the channel opening through the beach zone. Since it would be expected that some amount of sand will infill the channel over time and reduce the hydraulic area of flow, this concept allows for initial overflow onto the beach until the sand is scoured from the

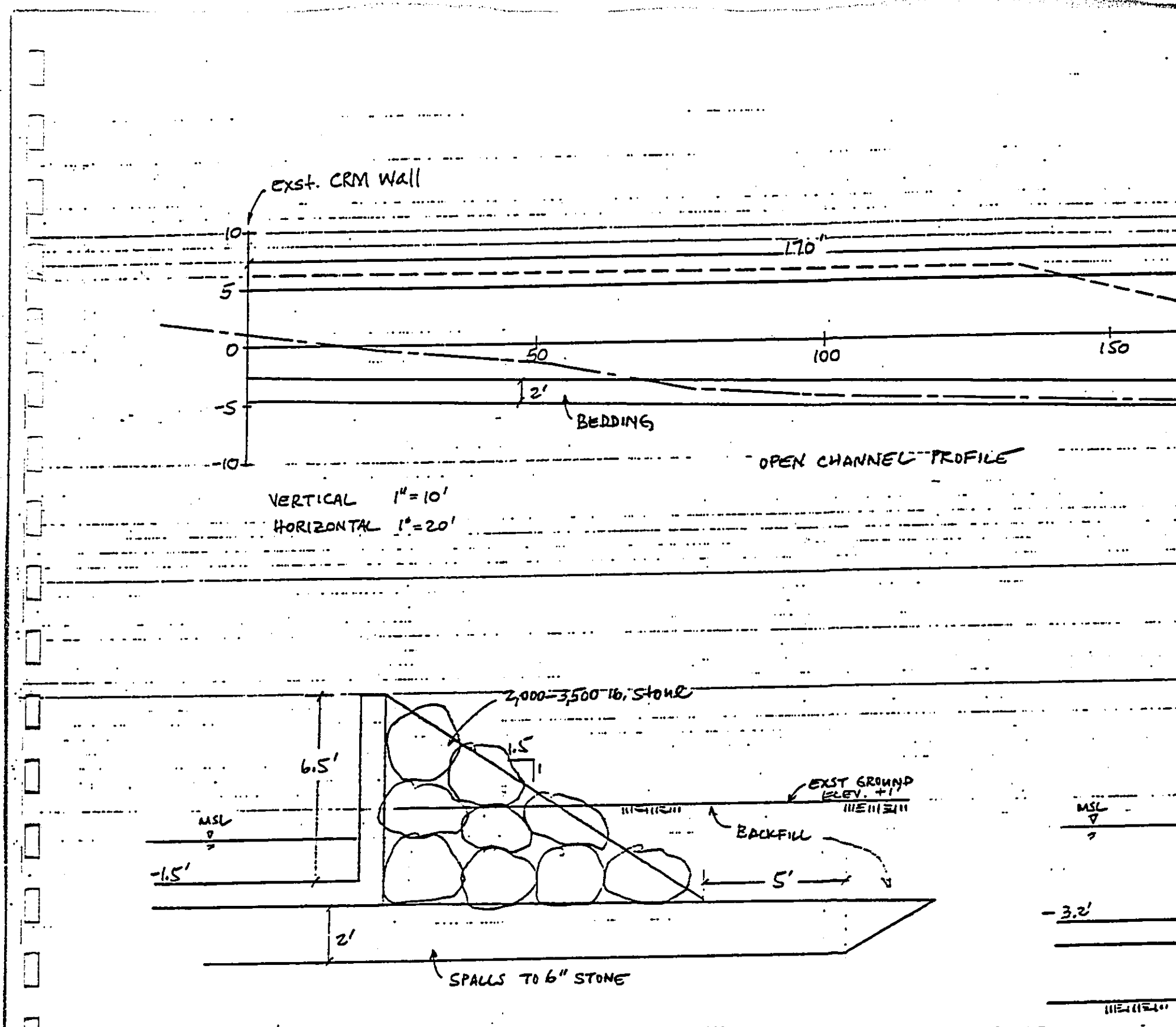
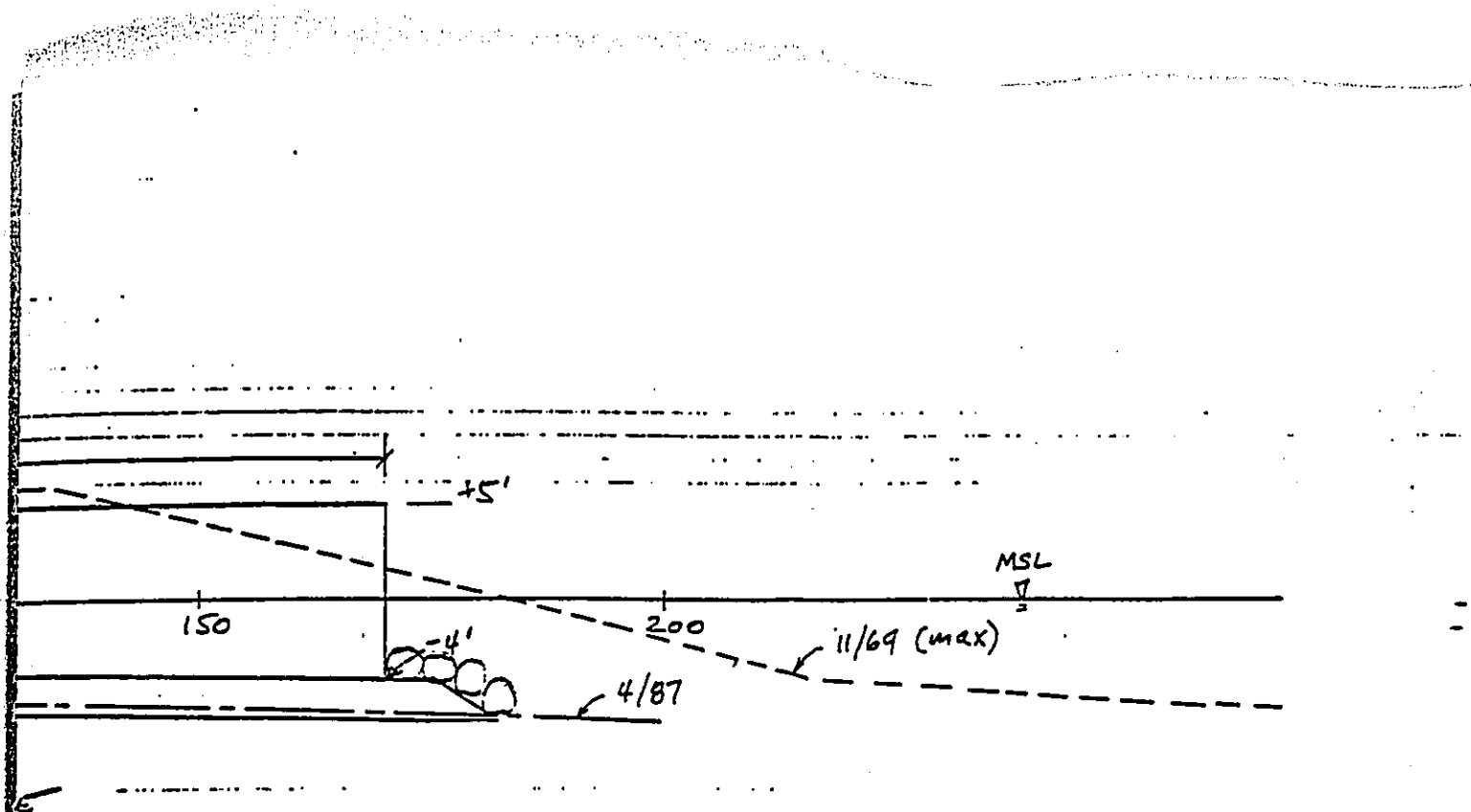
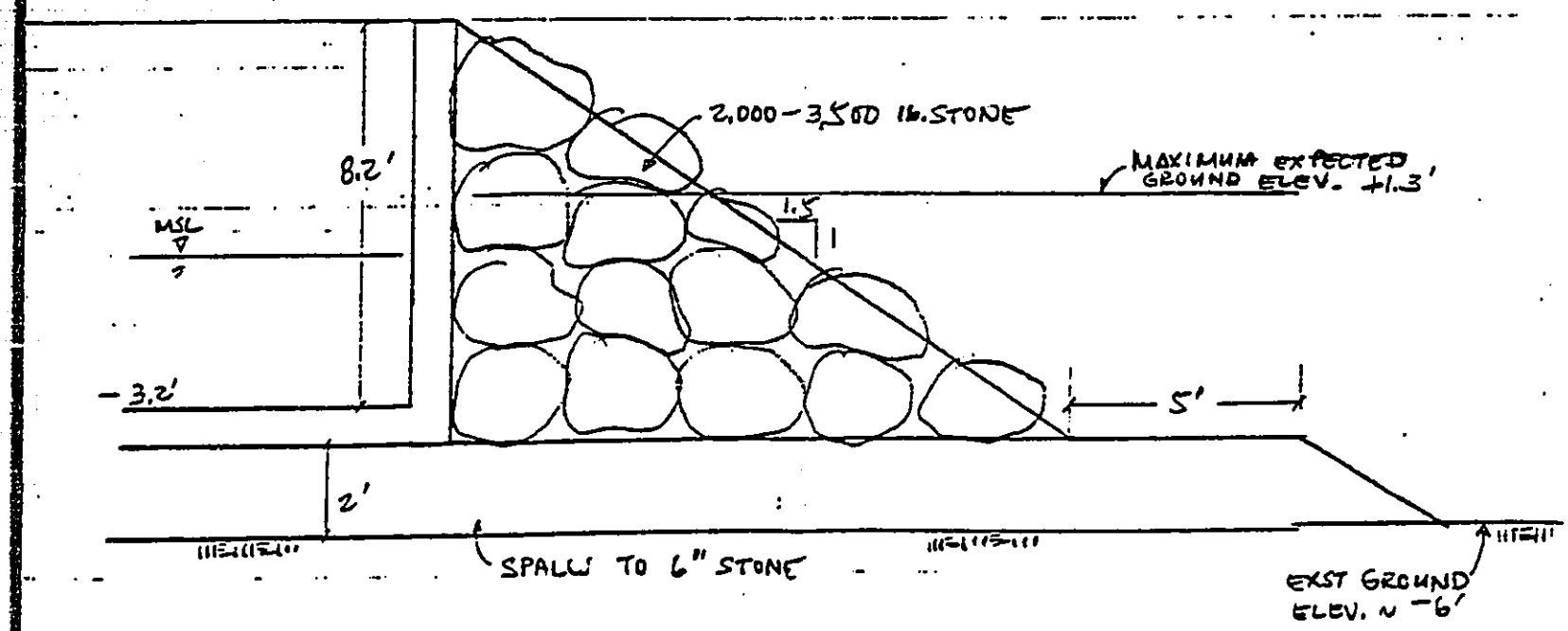


Figure 6. Sketch of the Proposed Channel Ex





TYPICAL SECTION AT SEAWARD END

posed Channel Extension.

LANIKAI OPEN CHANNEL
8/7/87

channel by the discharge flows. Pedestrian access should be provided over the channel.

6. DESIGN CONSIDERATIONS FOR DRAIN PIPE

The shoreline and beach width in the vicinity of the drain pipe have been relatively constant over the years. Why the drain outlet was constructed below the beach crest elevation is a mystery. The drain pipe should extend beyond the beach zone to prevent plugging.

Figure 7 is a survey of the existing shoreline elevations and nearshore depths, and depicting the proposed drain pipe extension. Also shown are the vegetation line and waterline from the 1980 and 1982 aerial photos, which are the minimum and maximum seaward beach limits. The drain pipe is proposed to extend 200 feet seaward from the existing seawall. The pipe outlet should be above the sandy offshore bottom to minimize infill.

Figure 8 shows sketches of the proposed drain pipe extension. Assuming that the 1982 waterline represents the maximum historical seaward extent of the beach, and that the offshore profile follows the present profile, then the drain pipe is extended far enough offshore such that the expected fluctuations in beach width would result in very little change to the sandy bottom elevation at the pipe outlet (about 1 foot or less change in bottom elevation). From the aerial photos, the 200 feet distance from the shoreline is about where the coral heads are first visible, indicating a relatively stable bottom seaward of this point. The pipe invert at the outlet end is at -5 feet MSL, about 2 feet above the existing bottom and about 1 foot above the estimated maximum accreted bottom.

The pipe would be buried through much of the beach area, minimizing the aesthetic impacts and potential littoral transport

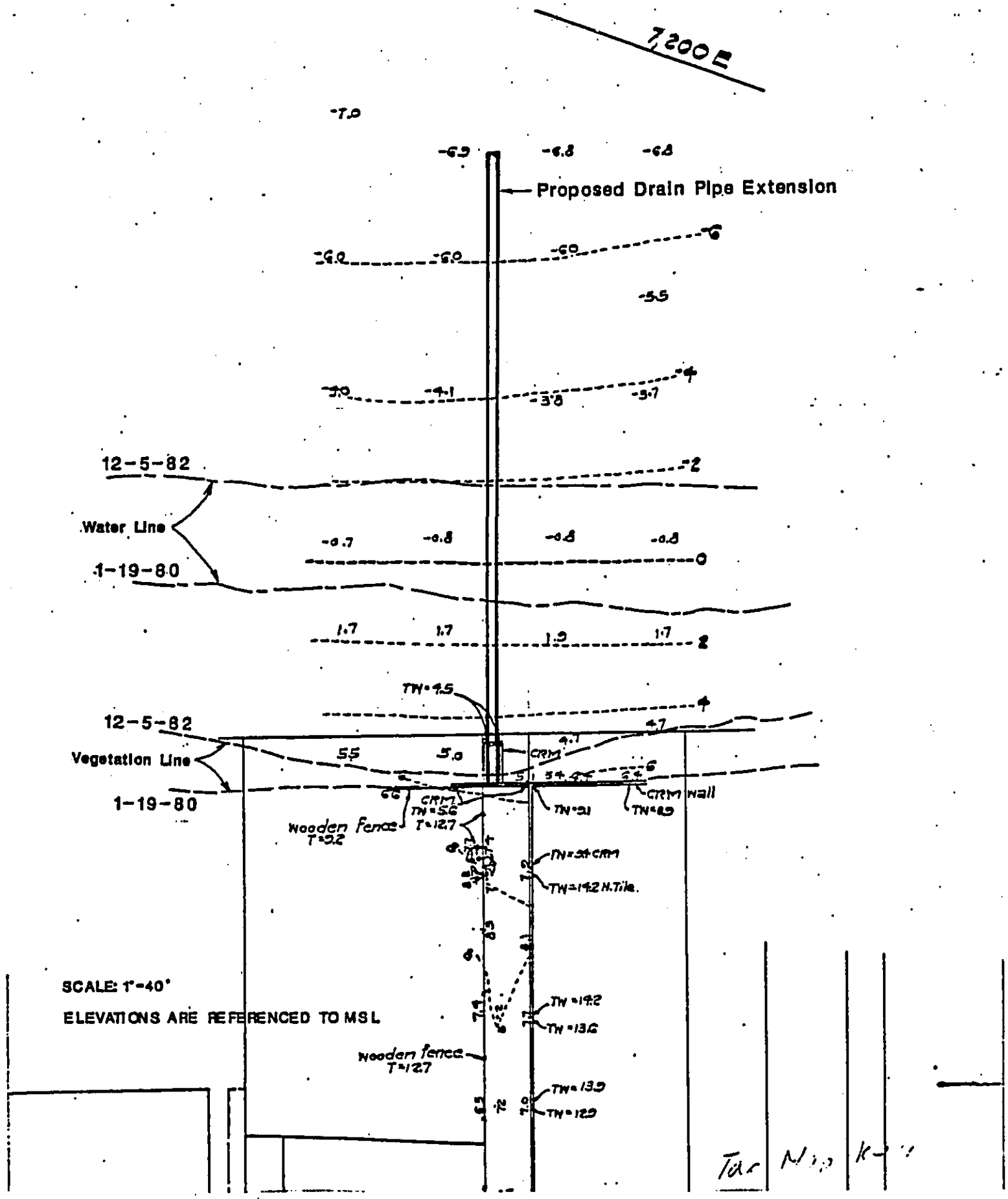
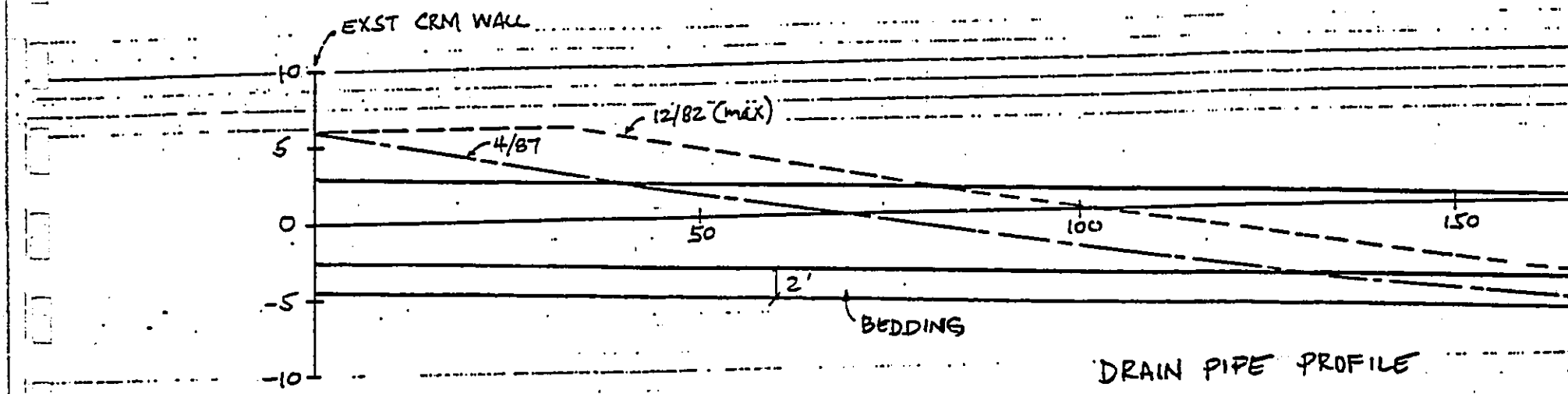
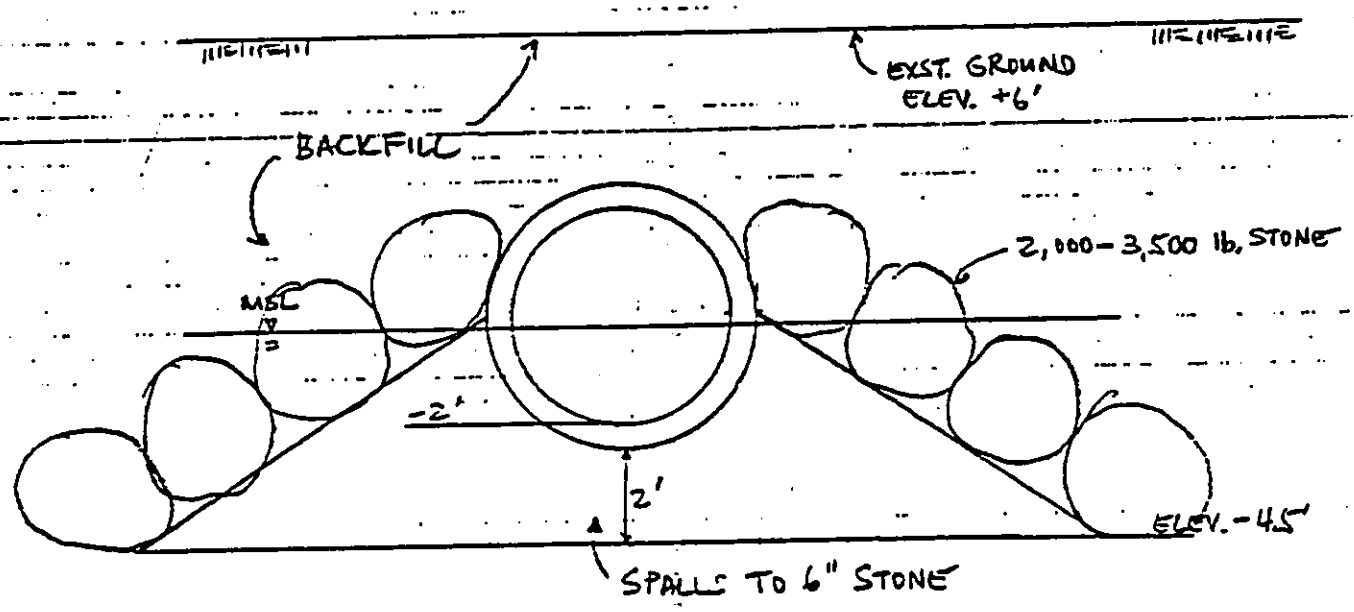


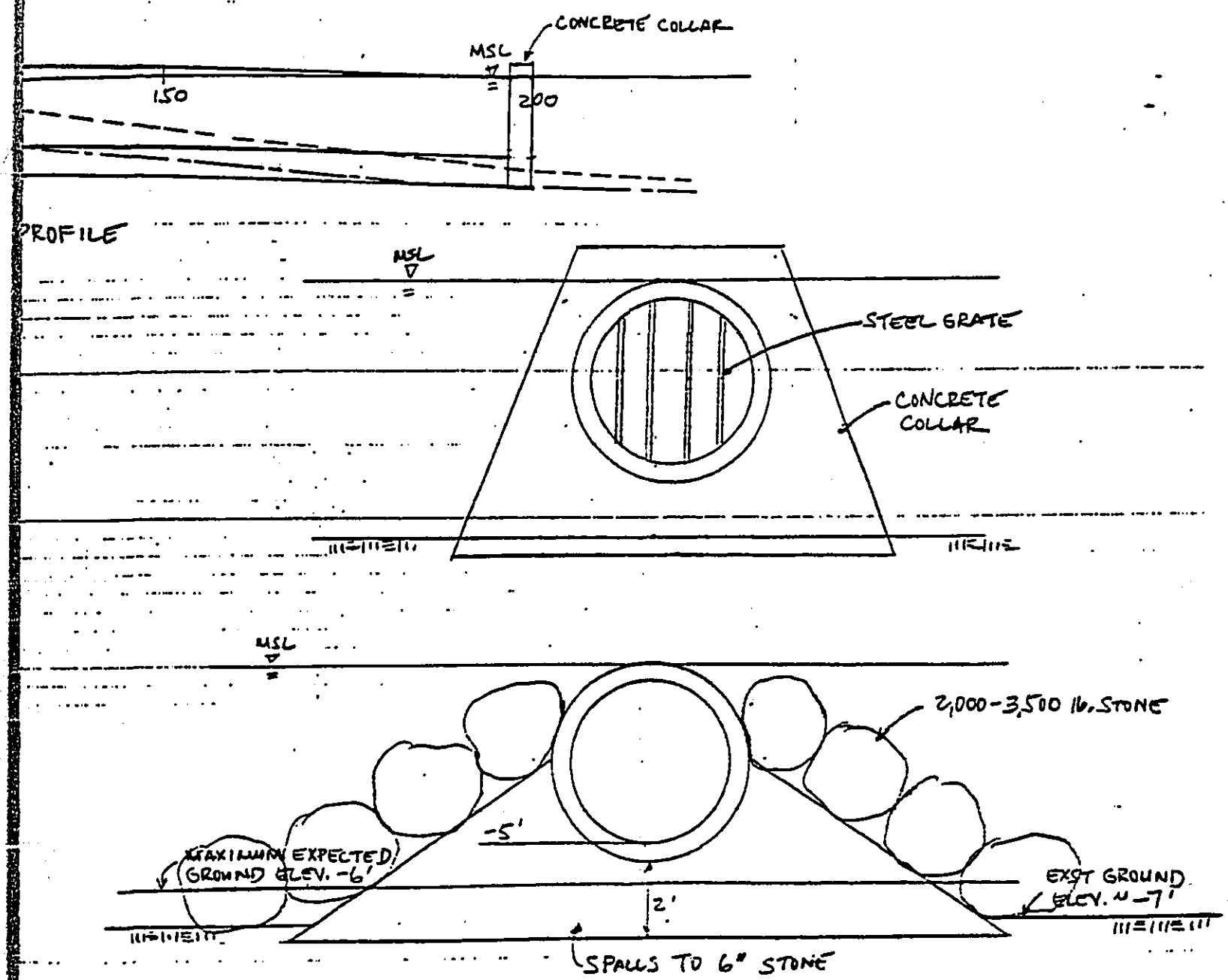
Figure 7. Survey of Existing Shoreline and Nearshore Area in the Vicinity of the Drain Pipe.





SCALE : 1" = 4'

Figure 8. Sketch of the Proposed Drain Pipe Extensi



TYPICAL SECTION AT SEAWARD END

LANIKAI DRAIN PIPE
8/7/87

rain Pipe Extension.

impacts. The top of the pipe at the headwall is at +3 feet MSL and at the outlet end is at approximately MSL. Rubble bedding is provided along the entire length of the pipe extension to prevent wave scour and to provide support for the pipe. For a 65-inch O.D. pipe, the design wave force on the seaward end of the pipe is about 300 lb/ft, acting perpendicular to the pipe axis. The net weight of the pipe in water is about 720 lb/ft. Assuming a coefficient of friction of 0.8, the pipe's lateral resistance to sliding is about 580 lb/ft. While the pipe has adequate weight to resist wave loads, a single layer of armor stones will be used to prevent scouring of the bedding support and to provide additional lateral stability for the pipe. A concrete collar protects the pipe end from possible impact loads due to floating debris, and a grate over the pipe opening is provided as a safety measure to prevent intrusion of debris or inquisitive individuals.

REFERENCES

[1] Edward K. Noda and Associates (1984), "40-MW OTEC Pilot Plant, Phase II Preliminary Design, CWP Design Criteria, Waves and Currents: Installation and Extreme Conditions," Report No. EKN-1034-R-1-1, prepared for Hawaiian Dredging and Construction Co., Honolulu.

[2] Edward K. Noda and Associates (1977), "Beach Processes Study, Kailua Beach, Oahu, Hawaii", prepared for the U.S. Army Engineering Division, Pacific Ocean.

[3] Edward K. Noda and Associates (1985), "Hurricane Vulnerability Study for Honolulu, Hawaii, and Vicinity, Volume 2, Determination of Coastal Inundation Limits for Southern Oahu from Barbers Point to Koko Head", prepared for the U.S. Army Corps of Engineers.

ASSESSMENT OF IMPACTS RELATED TO OFFSHORE EXTENSION OF DRAIN PIPE AND OPEN CHANNEL

PREPARED BT;

EDWARD K. NODA AND ASSOCIATES, INC.
615 PIIKOI STREET SUITE 1000
HONOLULU, HAWAII 96814

LANIKAI FLOOD CONTROL PROJECT

ASSESSMENT OF IMPACTS RELATED TO
OFFSHORE EXTENSION OF DRAIN PIPE AND OPEN CHANNEL

IMPACT ON LITTORAL PROCESSES:

"Littoral processes" refers to the dynamic processes in the nearshore coastal zone driven by winds, waves and currents. These forces are responsible for transporting sediments in the nearshore and beach zone, with wave energy being the more dominant mechanism for sand transport. Waves are responsible for the shoreward transport of sediment from nearshore reef areas, and for the longshore transport of sediment in the surf zone and on the beach slope. Structures which are placed on the beach or in nearshore waters can affect the littoral processes by modifying wave patterns or interfering with littoral transport of sediments.

Along the Lanikai shoreline, the wave climate is relatively mild because of the protection afforded by the shallow offshore fringing reefs and islands. Large deepwater waves initially break on the shallow reefs and what energy remains propagates to the shoreline as reformed waves which break on the beaches and shoreline. Because the offshore reefs are highly irregular, the resulting wave approach patterns in the nearshore zone are quite variable due to refraction and diffraction effects. Figure 1 shows an example of wave patterns observed from a 1950 aerial photo, superimposed on a 1982 color aerial photo which reveals the ocean bottom features in the nearshore zone. The deepwater wave approach is approximately from the northeast, typical of the predominant tradewind waves.

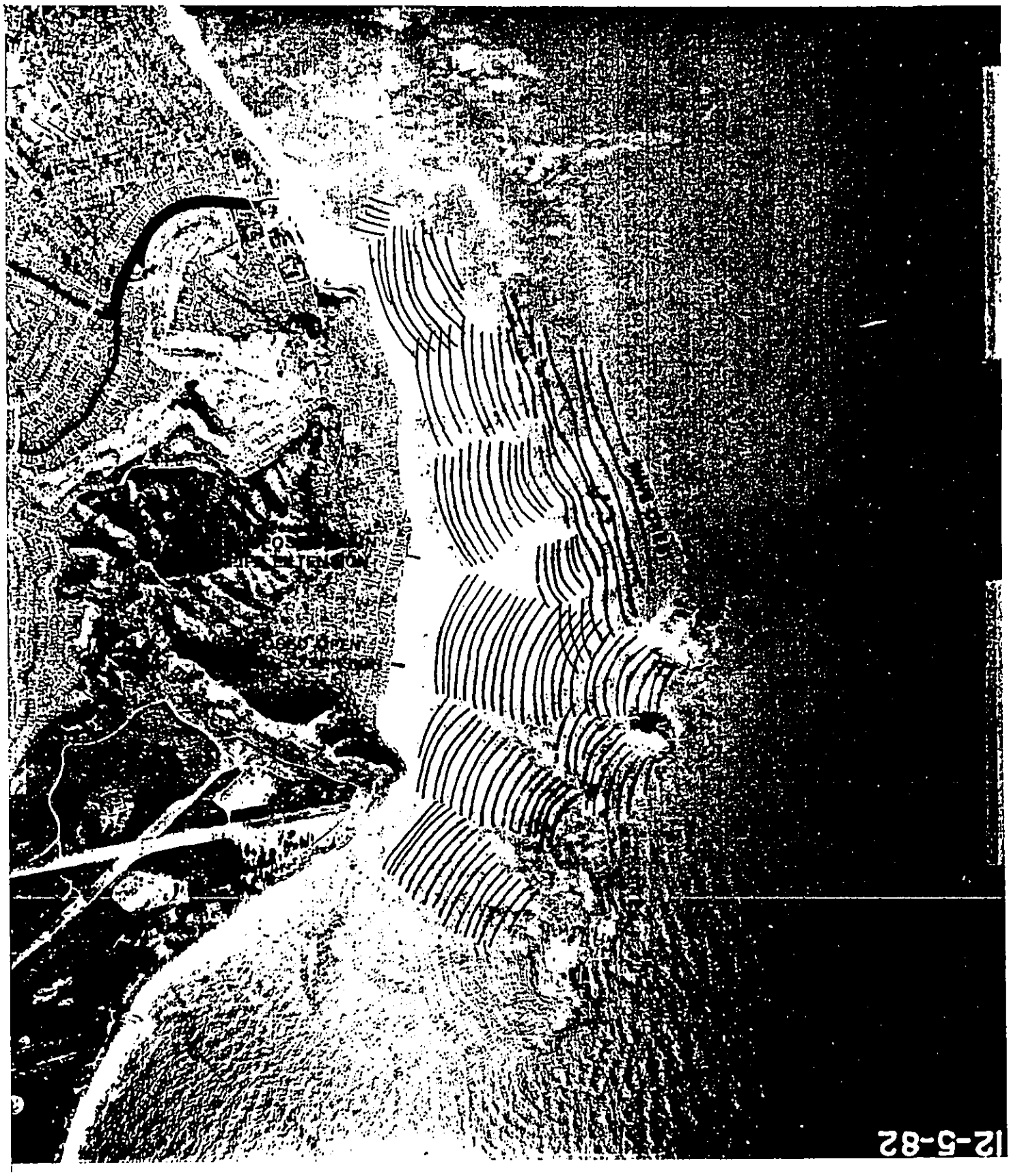


Figure 1. Typical Nearshore Wave Patterns due to NE Deepwater Wave Approach

In general, the northeasterly wave approach would result in southerly longshore transport along the northern reaches of Lanikai, and a northerly longshore transport along the southern reaches of the Lanikai shoreline, as schematically depicted in Figure 2. This is why the Lanikai shoreline in general from Alala Point to Wailea Point has a slightly convex shape. The large sand channel in the middle of the Lanikai shoreline reach directly offshore the drain outlet is the convergence point for the southerly and northerly movement of sand.

On a micro-scale, the irregular wave approach patterns over the offshore reefs and around the islands result in variable wave energy levels along short reaches of the shoreline. This results in the "wavy" nature of the shoreline, whereby high energy reaches tend to be concave-shaped and low energy reaches tend to be convex-shaped. Figure 3 schematically depicts the micro-scale littoral transport patterns based on the typical tradewind wave patterns shown on Figure 1.

The drain outlet and open channel are generally located in areas of convergence of littoral transport. Depending on the direction of deepwater wave approach, the dominant or net direction of longshore transport can vary. Under northerly wave conditions during the winter months, the net direction of longshore transport would be expected to be southward. Under easterly wave conditions during the summer months, the net direction of longshore transport would be expected to be northward. However, because of the micro-scale patterns of convergence and divergence, the net transport rates are not expected to be large.

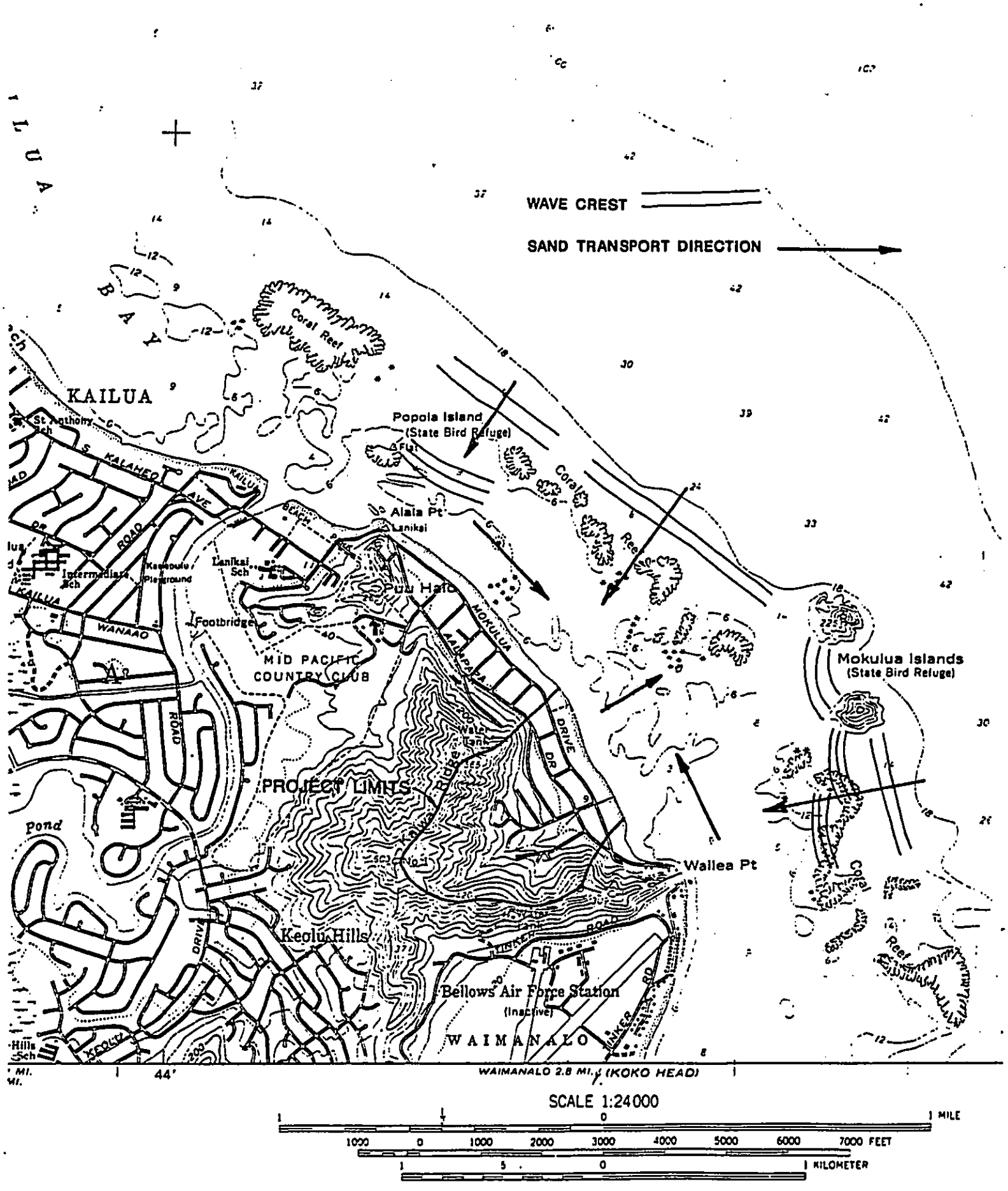


Figure 2. General Net Sand Transport Pattern Along Lanikai Shoreline

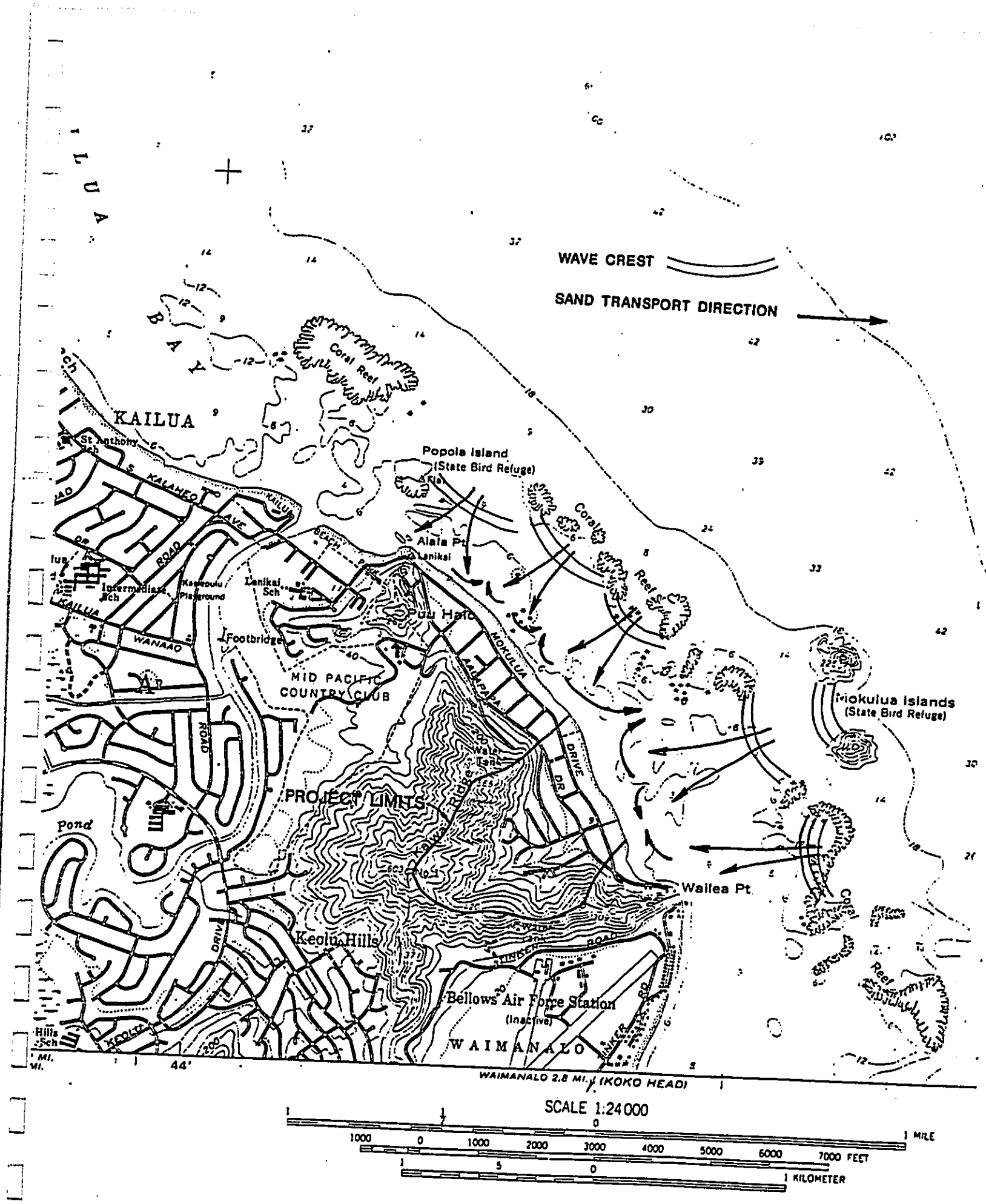


Figure 3. Micro-scale Sand Transport Patterns due to Typical NE Wave Approach

From analysis of historical aerial photos spanning the period April 1950 to December 1982[1], the shoreline and beach width in the vicinity of the drain outlet have been relatively stable. This is reasonable to expect since this area is apparently the dominant convergence point for net southerly and northerly alongshore transport, and transport offshore into the sand channel. The proposed drain pipe extension will not change the present littoral processes in this area. The pipe will be buried through much of the beach, and will be extended seaward to a point where the beach width fluctuations would not be expected to plug the outlet.

The historical aerial photos show that the shoreline and beach width in the vicinity of the open channel have fluctuated greatly over the past 37 years, being the most accreted in 1969 when the shoreline was over 100 feet seaward of the present shoreline. The shoreline and beach width were about the same in 1950 as in the early 1980's. Figure 4 shows the historical cycle of accretion/erosion at the open channel location. Thus, if the historical long-term cycle repeats, then it is possible that this reach in the vicinity of the open channel could accrete in the future. Because of the potential for accretion and plugging of the open channel, the channel is proposed to be extended beyond the maximum estimated beach zone limits, which was about 170 feet seaward of the existing seawalls in 1969. The channel extension could effectively stabilize the southern shoreline towards Wailea Point by acting as a barrier to the northward longshore transport along this reach, and resulting in potential accretion. The shoreline reach north of the channel could also potentially accrete since the channel extension would act as a barrier to the

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[1]"Lanikai Flood Control Project, Oceanographic Design Considerations for Drainage Discharge Structures", prepared for Kwock Associates, Inc., by Edward K. Noda and Associates, August 1987.

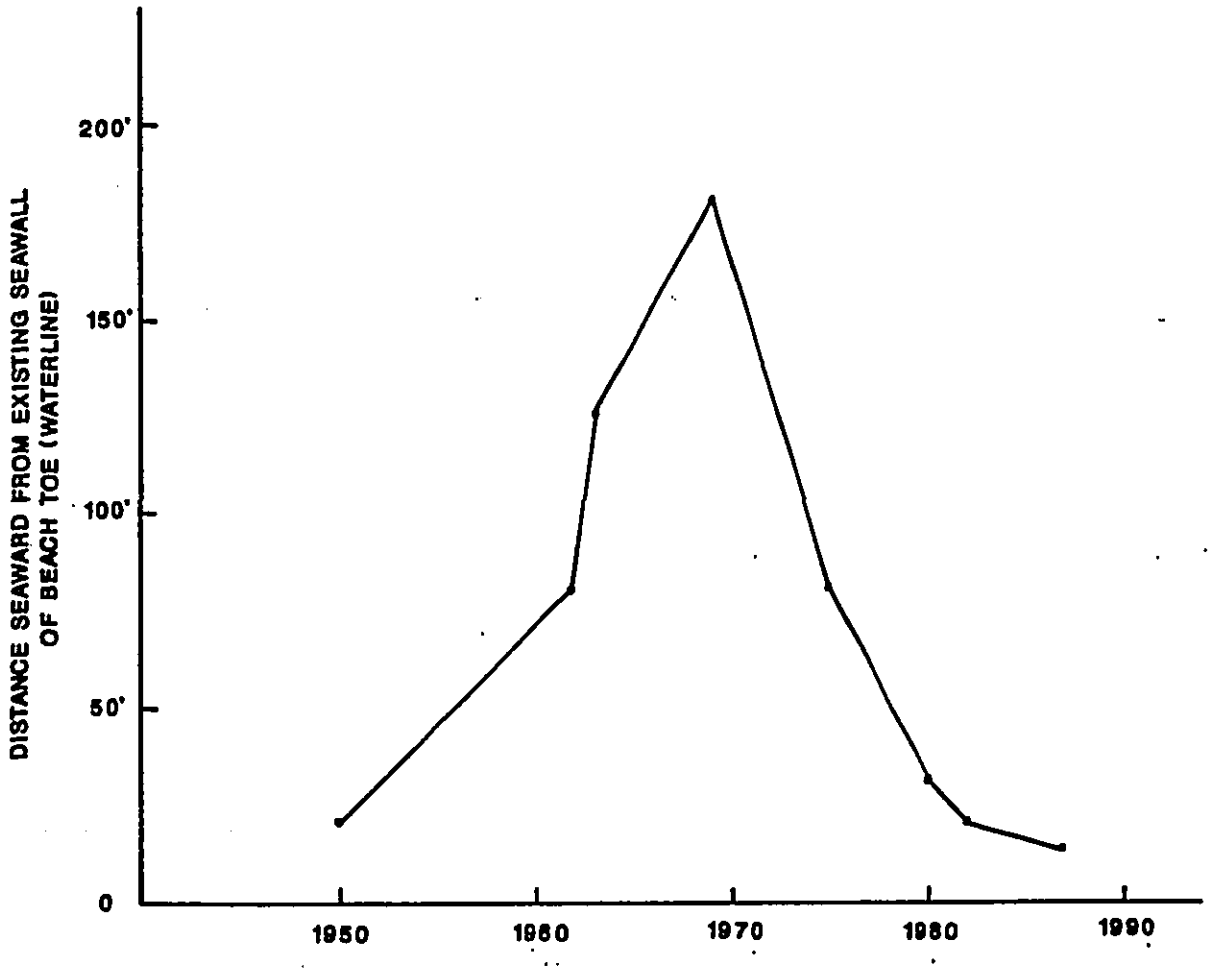

Figure 4. Long-term Cycle of Accretion/Erosion at the Open Channel Location as Determined from Historical Aerial Photos

southward longshore transport. The channel extension would have no significant detrimental impacts to the littoral processes north and south of the flood control project limits. Presently, the shoreline areas immediately north and south of the open channel are protected by seawalls. Hence, any potential for short-term erosion will not result in erosion damage to adjacent properties.

IMPACTS TO RECREATION AND BEACH ACCESS:

The drainage pipe will be buried through much of the beach area, and therefore will not impede beach access or restrict beach use. The pipe will not extend far beyond the beach, and therefore will not impact offshore water activities such as sailing and windsurfing. The top of the pipe will be at or just above the water surface, and therefore will be visible to swimmers. A permanent visual marker will be placed at the seaward end of the pipe to ensure that water users who launch/beach small craft or sailboards in this area do not run over the pipe.

The open channel will be somewhat of a barrier to beach access and nearshore water access. However, a bridge will allow pedestrian access over the channel (similar to other drainage channels throughout Oahu). If the beach accretes, then the maximum top of beach elevation would be about the same as the top of channel elevation, and the distance that the channel extends seaward from the beach into the water will be reduced. The rubble slope on the outside of the channel walls will reduce wave reflection and scouring and will help to promote beach accretion. The channel will not extend far beyond the shoreline, and therefore will not impact offshore water activities such as sailing and windsurfing. The channel walls will extend about 4 feet above the waterline at high tide, and will be clearly visible to water users who launch/beach small craft or sailboards

in this area so as not to pose as a hazard. In the present eroded state, recreational beach use of this shoreline area is limited. However, in the event that future accretion occurs, increased usage of the beach area would be expected.

ALTERNATIVE TO OPEN CHANNEL EXTENSION:

No Extension: If the open channel is not extended through the beach zone, longshore transport of sand can lead to blockage of the channel opening. During periods when there is little or no dry beach along this reach (typically during summer months), then the channel opening will effectively remain clear. However, during periods when this reach may accrete, the beach will extend across the channel entrance and the sand berm elevation within the channel will be similar to the beach crest elevation on the adjacent shores, similar to the sand berm across Kaelepulu Stream mouth. Beach accretion is likely to occur during winter months, when there is also the highest likelihood for storms and extreme rainfall. To prevent flooding, the sand berm will have to be removed before every storm. There is also a possibility of long-term accretion, such as in the late 1960's when the beach was over 100 feet wide. If this situation were to occur again, it would be virtually impossible to keep the 18-foot wide channel opening clear. Kaelepulu Stream mouth is over 100 feet wide, and maintaining the opening is a continual effort. Not extending the open channel will require continual maintenance with continued risk of flooding.

Pipe or Box Culvert Extension: One alternative is to block the open channel at the shoreline and provide a pipe or box culvert extension to discharge the drainage flows into the ocean. However, the discharge pipe or box culvert would necessarily be quite large and could not be buried sufficiently deep enough so as to remain below the beach and ocean surface. The discharge

pipe or box culvert extension would have similar profile height above the water as the proposed channel extension except that it would be covered, resulting in greater visual obtrusiveness as well as being difficult to maintain. This alternative offers no advantage over the proposed open channel extension.

ALTERNATIVE TO DRAIN PIPE EXTENSION:

There is no technically sound alternative for maintaining adequate drainage discharge. Because the interior land elevations are low, the elevation at the discharge end of the drain pipe cannot be raised above the beach. Thus, any outlet structure which terminates behind or within the beach zone will ultimately become plugged, as evidenced by the present drain pipe outlet. The pipe is proposed to be extended far enough offshore such that the expected fluctuations in beach width would result in very little change to the sandy bottom elevation at the pipe outlet. From the aerial photos, the 200 feet distance from the existing headwall is about where the coral heads are first visible, indicating a relatively stable bottom seaward of this point.

AECOS No. 553

LANIKAI FLOOD CONTROL PROJECT

BIOLOGICAL RECONNAISSANCE SURVEYS OF THE LANIKAI FRINGING REEF OFF THE PROJECT AREA

Prepared For:

Kwock Associates, Inc.
1100 Ward Avenue, Suite 920
Honolulu, Hawaii 96814

Prepared By:

E.B. Guinther
AECOS, Inc.
970 N. Kalaheo Ave, Suite A300
Kailua, Hawaii 96744

January 1989

INTRODUCTION

Biological reconnaissance surveys of the nearshore reef flat off of the southern end of Lanikai Beach were conducted to assess the potential impacts of drainage improvements proposed by the City and County of Honolulu for this part of Lanikai (see Figure 1). The results of snorkeling dives conducted in January 1989 in this area and an assessment of the proposed project on the marine biota are reported herein.

General Description of the Shore and Reef

The residential community of Lanikai, on the windward side of Oahu, occupies a narrow shelf of land at the coast and surrounded by an eroded ridgeline rising to elevations of 300 to 400 feet and curving between Wailea Point (Popo'oka'ala) on the south and Alala Point on the north. Between these rocky headlands, the shoreline is usually a continuous beach. However, at the present time, erosion has cut back the sand at the south end to seawalls placed to protect properties along the shore. These seawalls likely exacerbate the beach erosion problem.

The nearshore region off of Lanikai is a broad fringing reef extending out to the offshore islands known as Na Mokulua, located some 4000 feet (1220 m) off of the southeast end of Lanikai Beach. The depth of water over this fringing reef is on the order of 6 feet (2 m), a depth reached within 100 feet of the beach in most places, although the bottom shoals to seaward over hard-bottom areas off of the south end, and exceeds 8 or 9 feet (3 m) depth in many places off the north end. The latter depths over the reef are also typical for the area off of Waimanalo Beach (located south of Wailea Point). Considering the Kailua/Waimanalo fringing reef as a whole -- a truly massive structure by Hawaiian reef standards which extends a distance of 9.6 miles (15.5 km) from Kapoho Point at the north end of Kailua Bay to Kaupo Peninsula (near Makapu'u Beach) on the south -- the portion off of Lanikai has perhaps the shallowest average depth (a short, narrow segment at the south end of this reef between Kaiona Beach and the Makai Pier, is similarly shallow). True to the classic form of a fringing coral reef, the bottom shoals along the outer margin (parts my expose on low tides), then descends into deep water as the reef "front". Whether the shallower nature of the Lanikai portion of this reef is due to its isolation from land run-off on the otherwise generally wet windward side of Oahu or to differences in the geology of the underlying basaltic basement on which the reef structure has developed, is uncertain.

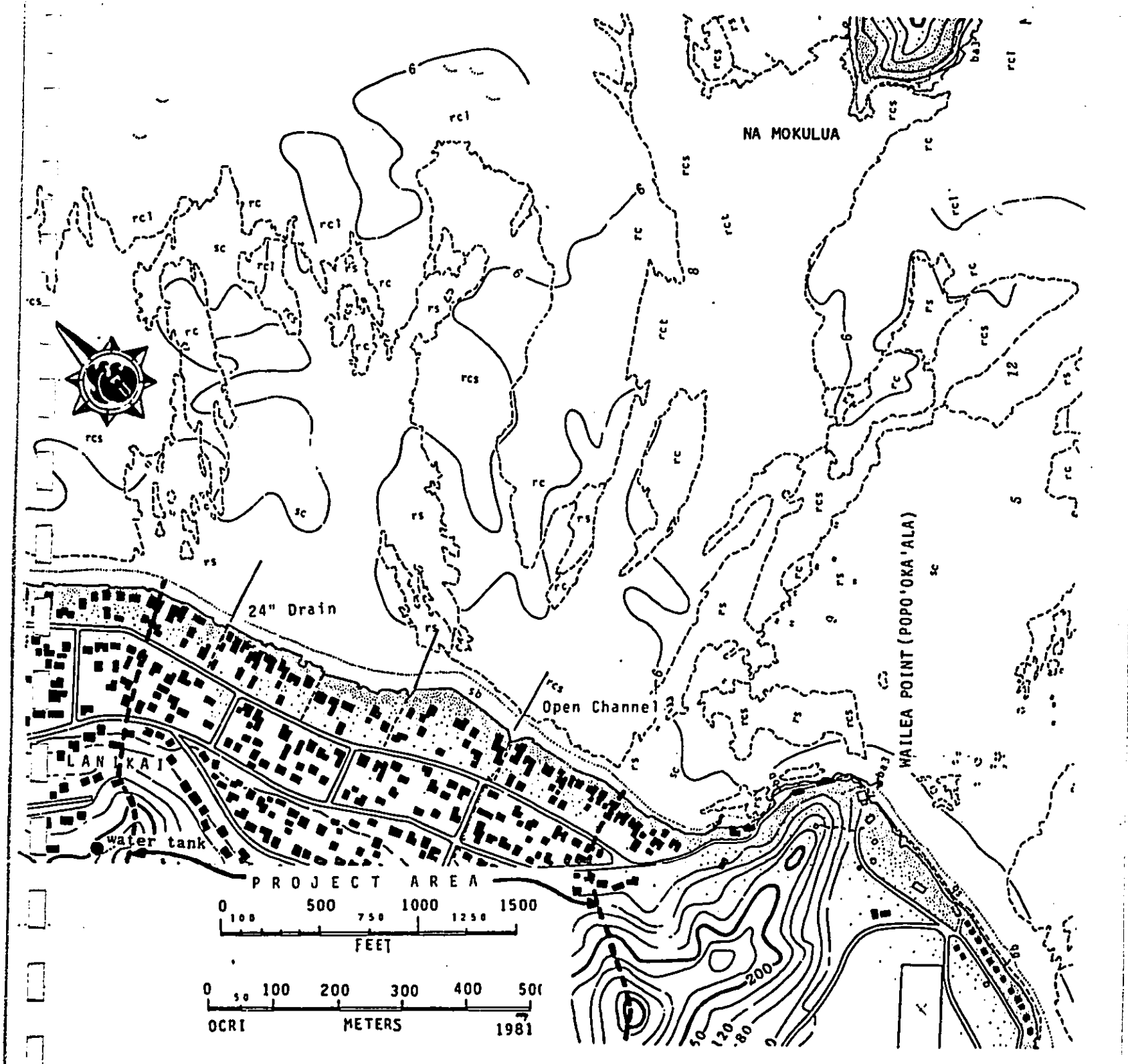

Figure 1. Map of the Lanikai fringing reef showing the project area and approximate locations of the survey transect lines (Base map after AECOS, 1981).

That portion of the reef which extends outward from the beach is called the reef flat. The bottom is comprised of a complex mixture of low limestone areas, sand patches and sand-bottom channels, and extensive areas of limestone rubble and sand. Near the southern end of the reef, sand bottom predominates in the form of a broad patch which extends outward across the flat from the beach in the vicinity of the existing drain pipe.

Previous Surveys

The biological resources on the reef flat off Lanikai have not been previously surveyed to any extent. Only the brief reconnaissance conducted for OCRI (AECOS, 1979) off Wailea Point (and around Na Mokulua) has direct relevance to the project area. This survey reported an abundance of algae (mostly Lyngbya sp., Dictyopteris australis, Centroceras sp., Laurencia sp., Gracilaria coronopifolia, and Halimeda discoidea), but essentially no fishes or corals in the nearshore area off Wailea Point. Kay and Reed (Water Resources Research Center, 1973) conducted several transects in Kailua Bay, the southernmost in the areas off Popoi'a and Na Mokulua. Russo, Dollar, and Kay (1977, 1979) included a station near Popoi'a (Flat) Island in their studies related to impacts of the Mokapu Ocean Outfall. These surveys, however, are far removed from the project area, and were conducted in the deeper water off the reef front. Nearshore areas off the southern end of Kailua Beach were surveyed by ECI (1977) and included some of the area off Alala Point. The following summary of this survey is taken from OCRI (AECOS, 1979):

> Basalt boulders and sand bottom off Alala Point harbor a wider variety of marine plants and animals than at comparable distances off Kailua Beach. Algal cover ranges from 10 to 20 percent, with Padina japonica, Codium arabicum, Spyridia sp., and Zonaria hawaiiensis the most common species. Only scattered heads of Porites lobata and P. compressa are seen offshore of the Point. Sea cucumbers (Holothuria leucospilota, H. pervicax, and H. atra) are conspicuous, as is the mussel, Brachidontes crebristriatus. Stethojulis balteata and Acanthurus triostegus dominate the fish fauna.

BIOLOGICAL SURVEY RESULTS

The Lanikai reef flat was surveyed in January 1989 from the shore outwards for a distance of 330 to 500 feet (100 to 150 meters) for the purposes of this assessment. A 100-meter measuring tape (transect line) was laid out perpendicular to the shore at several points (Figure 1) to provide a reference line for the descriptions of the area that follow.

Off the 24" Drain Pipe

The northernmost transect was conducted off an existing drain pipe which terminates beneath the beach opposite the foot-path linking Mokulua Drive (between Aala Drive and Onekea Drive) with the beach. The proposed project entails extending the drain pipe seaward a distance of 200 feet to place the opening beyond the active accretion zone of the beach and avoid sand plugging of the drain. This area is one of sand bottom which extends seaward over 1500 feet (450 m). Measured from a survey mark at the seaward corner of a concrete and rock masonry "box" on the beach (existing drain outlet structure), the active beach presently extends some 120 feet (37 meters) seaward. In this area, the sand shows evidence of extensive reworking by waves, with a corresponding absence of marine algae (limu) and macroinvertebrates. Beyond this beach and sub-beach zone, the bottom is mostly sand, but the sand is compacted and appears to contain a higher proportion of very fine particles than is the case for the lower beach deposit. This sand bottom is quite extensive throughout the area and unbroken except for scattered outcrops of limestone and massive coral heads which, along the transect line, start at about 200 feet (62 m) seaward and continue as isolated pinnacles well out beyond the end of the survey line at 330 feet (100 m).

The sand areas are barren, although no doubt inhabited by a variety of infaunal invertebrates adapted to this somewhat unstable substratum. The limestone outcrops are essentially of two types: 1) limestone blocks rising one to two meters off the bottom, and 2) very massive individual heads of living Porites lobata coral. The limestone blocks harbor a variety of corals and some limu. Noted as present on this hard substratum are the corals Porites lobata, Porites compressa, and Montipora verrucosa. Cover varies, but probably does not exceed 20% of the hard substratum in most cases. Limu manuaea or Asparagopsis taxiformis is the most common seaweed. Also present are Lyngbya majuscula and Laurencia nidifica. None of these species is particularly abundant in this area.

Some of the massive heads of living Porites lobata exceed 6 feet (2 meters) in diameter, and are in remarkably good condition, lacking bare areas of dead tissue or evidence of damage by boats, despite the fact that they rise off a bottom which is 6 to 7 feet deep to within one or two feet of the water surface.

Although fishes are present in this area, the fauna is deemed very sparse. The paucity of suitable cover may, in part, explain the lack of typical reef fishes, and no doubt the very turbid water present during the survey interfered with a proper enumeration of those present. However, this area appears to have been, or is being, subjected to fairly heavy fishing pressure, with a corresponding depression in the populations of the species that might have once been abundant over the sand-bottom areas.

Middle Transect

A "Middle Transect" was run off the shoreline at the pedestrian right-of-way near the intersection of Mokulua Drive and Pokole Way. The shoreline here is a very narrow sand beach banked against high concrete seawalls (except at the right-of-way where the beach extends up to the vegetation line). On concrete at the shore are growths of several algae: Giffordia breviarticulata, Enteromorpha sp., and Liagora papenfussi. Except for some basalt boulders scattered on the bottom near the foot of the beach, a continuous deposit of fine sand extends offshore for some 20 meters or more. Thereafter, sand bottom predominates, but small limestone boulders are scattered across the bottom. These harbor several species of algae, including Dictyota acutiloba, Laurencia nidifica, Padina japonica, Lyngbya majuscula, Porolithon onkodes, and a small amount of Sargassum sp. and Halimeda opuntia. Some coral growth (mostly Porites spp., but Montipora flabellata, Pocillopora damicornis, Porites (Synaraea) sp., and Cyphastrea ocellina are present) occurs on these boulders. The sea cucumber, Holothuria atra, is common in this area.

The transition to hard bottom is gradual. Moving offshore beyond about the 30 meter mark, the limestone outcrops increase in density and size. Large fronds of the alga, Dictyopteris australis become more common. Other species of algae noted are Porolithon onkodes, Asparagopsis taxiformis, Dasyopsis sp., and Porolithon gardineri. Coverage by live coral also increases. The outcrops become mounds of (mostly) Porites compressa about one meter high and two to several meters across. Several other species of corals are present, including Porites lobata, Montipora flabellata, M. patula, M. verrucosa, and Pocillopora meandrina. Live coral coverage on these mounds ranges from 60 to 80 percent. However, the abundance of live coral over a wider

area (that is, the average cover) is difficult to estimate because the mounds are separated by areas of sand and limestone rubble bottom and visibility is poor owing to turbid water. Beyond the end of the transect occur massive mounds of Porites lobata, generally similar to those described on the previous transect line.

Fishes were more abundant in the outer portion of the Middle Transect than elsewhere in the survey area. This fact follows from the greater amount of bottom relief and cover in this area. The abundance of fishes was not great, generally only a few to perhaps a dozen individuals were seen around the more massive limestone and coral outcrops. Species noted, in approximate order of abundance, are Ctenochaetus strigosus (Kole), Scarus sp. (juv. parrotfishes), Thalassoma duperrey (Hinalea lau wili), Parupeneus multifasciatus (Moano), Acanthurus leucopareius (Maiko), Stethojulis balteata ('Ohua), Abudefduf abdominalis (Mamo), Acanthurus sandvicensis (Manini), Zebrasoma flavescens (Laipala), Naso unicornis (Kala), Chaetodon auriga (Lau hau), Gomphosus varius (Hinalea nuku 'i'iwi), Pervagor spilosoma ('O'ili lepa), and Canthigaster jactator (White-spotted puffer).

Off the Open Channel

An existing open drainage channel is present along the shore opposite the point where Lanipo Drive intersects Mokulua Drive in Lanikai. At the time of the survey, this channel was plugged with sand, and no water was evident in the seaward end of the channel. With the exception of the sand beach at the mouth of the channel, the shoreline is presently one of basalt boulders, limestone rubble, and man-made seawalls. Algae present along the shore include Giffordia breviarticulata, Endarachne brighamiae, and Enteromorpha sp. The transect line was started near the middle of the boulder beach several meters south of the channel and 6 feet (2 meters) off a seawall. The water line was around the 1 meter mark on this transect line. Below the waterline, the bottom is basalt and limestone rubble mixed with sand out to about 18 meters. Thereafter, sand patches are more evident in depressions several meters across, coalescing into a larger sand patch between the 41 and 46 meter marks. Within all of this area, waves impinging on the shore stir the fine sediment to create very turbid water. A few sea cucumbers (Holothuria atra) are present on the bottom, and a sparse population of sea urchins (Echinometra mathaei) is found on scattered limestone outcrops. The alga, Padina japonica, is moderately abundant on the larger pieces of limestone and limestone rubble. Other species of algae present are Halimeda discoidea, Laurencia nidifica, and Asparagopsis taxiformis. At around 25 meters offshore, the alga Dictyota acutiloba is conspicuous.

Beyond 46 meters, the bottom is a mixture of sand, rubble, and limestone outcrops. The alga, Dictyota acutiloba is present, along with particularly luxuriant fronds of another alga, Dictyopteris australis. Small coral heads (Montipora flabellata, Psammocora (Stephanaria) stellata, and Pocillopora damicornis) appear on the limestone outcrops at about 50 meters from shore. To seaward, the extent of hard bottom increases as the outcrops become larger in size. These harbor a progressively more diverse coral fauna of larger colonies. Noted (in order of abundance) are Porites compressa, Porites lobata, Montipora flabellata, M. verrucosa, M. patula, Pocillopora damicornis, and Cyphastrea ocellina. Beyond the 80 meter mark, coral cover reaches 70 to 80% within patches of from one to several meters across. These are dominated by P. compressa. Overall abundance (patches plus intervening bare areas) probably does not exceed 5% of the bottom, however. Within the outer portion of the 100 m line, Dictyopteris australis remains abundant, although Asparagopsis taxiformis, becomes co-dominant. Other algae present are Martensia fragilis, Porolithon gardineri, Turbinaria ornata, Codium arabicum, and Lyngbya majuscula.

Fishes are generally sparse. Most abundant, although only about a dozen individuals of each species were seen, are Abudefduf abdominalis (Mamo) and Ctenochaetus strigosus (Kole). Present are the wrasses, Thalassoma duperrey (Hinalea lau wili) and T. ballieui (Hinalea luahine), the butterflyfishes, Chaetodon auriga (Lau hau) and C. lunula (Lau hau), and the goatfish, Mulloidichthys flavolineatus (Weke).

DISCUSSION

Operating storm drains can be expected to have negative impacts on nearshore marine communities. Depending upon various factors such as the volume of discharge, sediment load, tide state at the time of maximum discharge, and plume mixing characteristics, the resulting depression of salinities can be damaging to marine biota over some wider area off the storm drain. Fine sediment eroded from the land can be deposited on the bottom off the drain, and the continuous resuspension of this material by waves can contribute to a reduction in water quality which lasts for a long period of time after the fresh water has dissipated. In general, the potential for damage to the marine biological community is greatest where the discharge occurs in shallow, somewhat confined waters (reef flats, embayments), and least where the discharge occurs into deeper, more open waters. Fresh water discharged at the shore tends to float on the sea surface, spreading out from the discharge point as a surface layer of brackish water. Most fishes can readily escape a brackish plume (or are otherwise unharmed by it). Thus, concern focuses on the attached biota, particularly the reef corals because recovery of a coral assemblage will be slow (on the order of years to decades). Regrowth may not occur if the interval between significant flood events is short relative to the colonization and growth potentials of these animals.

The depth of the reef flat off of Lanikai is somewhat intermediate with respect to the potential for storm discharges to kill nearby coral growth. That is, particularly large flood events could have a deleterious impact on the coral community over some area seaward of the discharge points, whereas typical storm drainage volumes will not. As discussed further below, the proposed seaward extensions of the drains will not add measurably to the potential for unusual storm events to impact the nearshore biota, although improvements in the drainage network might. If the collection of water from the drainage basin becomes more efficient (presumably, a goal of the design engineers), producing a greater "instantaneous" discharge for a given rainfall event, and/or if the movement of soil from the watershed to the sea is enhanced (presumably, not a goal of the design engineers), the potential for adverse environmental impacts arising from the project will be increased.

Sea turtles are reportedly common around Na Mokulua. It was not determined if the nearshore waters off the project area are regularly used by turtles as well. Housing development along the shore at Lanikai encompasses the entire backshore, effectively rendering the beach unsuitable for nesting activities. The fronds of a few species of algae, notably Dictyopteris australis

and Asparagopsis taxiformis at the time of the survey, are exceptionally well developed on the reef flat within 50 meters of shore and at depths between 1 and 2 meters. These might serve as a food source for sea turtles. Owing to the very intermittant nature of the run-off from the watershed, the proposed project will not reduce the value of this potential resource.

The 24" Drain Pipe

It is proposed to extend the existing terminus of a 24" drain pipe in the seaward direction a distance of 200 feet. As noted in Edward K. Noda & Assoc. (1987)"...[this distance] is about where the coral heads are first visible [in aerial photographs]..." The construction of the pipe extension and associated rubble bedding and armor stone will not have serious impacts on the natural environment or biological resources within this sand-bottom zone. The resulting structure will provide additional hard substratum and cover that will encourage the development of a more abundant and diverse biota than is currently present in the area. This drain is functional only on an intermittent basis: the focused transport of fresh water to the shore occurring only during exceptional storm events. Presumably, somewhat more capacity would be added to this particular drainage by the proposed improvements, resulting in a greater focusing of run-off from land drainage at this point on the reef. Overall, an increase in the volume discharge will not contribute measurably more to potential damage to reef organisms in the area, with one exception as noted following.

The proximity of the proposed drainage terminus to some spectacular live coral heads should be of some concern. Depending upon a number of variables including duration of discharge and sea conditions as related to seawater/fresh water mixing at the time of discharge, these corals might well survive the intermittent flushing of land run-off in their immediate vicinity. However, over time, it can be expected that a particularly unfavorable set of circumstances will eventually occur, killing all or much of the coral tissue in the vicinity of the discharge. The extent of the area potentially threatened can not be easily determined, but will depend upon the form and duration of the discharge plume. Several massive heads were encountered directly along the transect line between the 62 and 100 meter marks, and thus live coral comprises perhaps between 10 and 20 % of the bottom directly off the end of the proposed drainage extension.

Porites lobata is the most abundant coral in the Hawaiian Islands, and massive heads such as those off Lanikai Beach can not be considered rare. Nonetheless, these heads represent perhaps a century or more of growth, and are unusual in the setting as oc-

curs in the project area. The present condition of the heads suggests this area remains conducive to their continued growth. Damage to these corals can be mitigated by shortening the outfall pipe (allowing for greater dilution of the discharge plume and/or its confinement to the surface before the area of coral growth is reached). The recommendation that the end of the pipe be placed in the coral zone is based, in part, on the correct assumption that the presence of these heads demonstrates stability of the bottom with respect to sand accretion (Edward K. Noda & Assoc., 1987). However, sufficiently low accretion rates may exist for a considerable distance inshore of the heads.

The Open Channel

Proposed construction in the area of the existing open drainage channel would extend this channel seaward for a distance of 170 feet. The channel would be lined with concrete or concrete-rock masonry walls with sloping boulder sides. Although the proposed length of the channel extension presently appears great, the end of the new channel would be within the historical seaward limits of the beach. Given that the beach at the southern end of Lanikai fluctuates in width to this extent, the construction impacts of the channel should not, by comparison, be unacceptable. Portions of the walls of the channel not buried by sand accretion will provide additional, stable substrata for algal growth and cover for juvenile fishes.

The proposed seaward limit of construction will be near the 50 meter mark of the survey transect line. Although this is the point where live coral is found closest to the shore in this area, the abundance and diversity of coral are both very low here. Coral growth increases gradually seaward from this point, becoming locally prominent perhaps 100 feet (30 m) beyond the proposed end of the channel. At this distance, the channel extension itself is of less concern than the changes in characteristics (volume and suspended load) of the discharge during storms that might result from planned changes in the drainage system design and unrelated construction/land clearing activities on the watershed. However, considering the distribution of live corals on the reef flat seaward of the entire project area, the planned location of the open channel appears suitable for minimizing potential adverse impacts.

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