

FINAL ENVIRONMENTAL STATEMENT

FLOOD CONTROL AND ALLIED PURPOSES

IAO STREAM

MAUI, HAWAII

Office Of Environmental Quality Control
Office Of The Governor
550 Halekiauila Street
Tani Office Building, Third Floor
Honolulu, Hawaii 96813



U.S. ARMY ENGINEER DISTRICT, HONOLULU
HONOLULU, HAWAII

APRIL 1975

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STATEMENT OF FINDINGS
IAO STREAM, MAUI, HAWAII
PROPOSED FLOOD CONTROL AND RELATED IMPROVEMENTS

1. In consideration of the overall public interest, I have evaluated the pertinent information and stated views of other interested government agencies and the concerned public on the various practical alternatives for alleviating the flood problem on Iao Stream, Maui, Hawaii. In addition to the specifically stated desires of the residents of the project area, local government officials and citizen groups, the alternatives were evaluated according to engineering effectiveness, environmental acceptability, social well-being and economic feasibility.
2. During the course of the study, on-site investigations were made and discussions were held with County of Maui officials and interested environmental, agricultural and other citizen groups. Based on the early discussions, I found that the basic needs and desires defined during the survey study continue to prevail. Flood control improvements are still needed since the physical impact of floods on existing developments remains essentially the same as that defined during the earlier study. Erosion and sedimentation also continue to be a flood-related problem. I also found that awareness and concern for protecting and enhancing the environment have increased sharply since completion of the survey study in 1966. On Iao Stream, these concerns related primarily to retaining as much open space and natural stream as possible, preserving the aesthetic quality of these areas, and restoring fish and wildlife habitat in and around the stream. Socio-economic values and concerns were found to be related primarily to retention of agricultural lands in production and of community cohesion through avoidance of large-scale relocation.
3. Based on the above findings, I have determined that the alternative of "no action" would be non-responsive to the needs and therefore not an acceptable course of action. Alternative solutions considered included nonstructural and structural measures. Preliminary screening of the possible solutions showed a combination of channel improvements, levees, and flood plain management to be the most practical solution. Three alternative plans incorporating variations of these measures were developed and evaluated. Plan A would provide for complete channelization of floodflows but would impose a man-made greenbelt or grass-lined waterway along the stream. This plan would also remove considerable acreages of agricultural lands from productivity, but would provide a waterway and open space for fish and wildlife use.
4. Plan B would minimize channelization and retain the stream in its natural state wherever possible, but would require designation of flood plain limits in overflow areas within agricultural lands which would continue to be subject to inundation and erosion during major floods. The acceptance of some inundation and erosion under Plan B is a tradeoff with the desire to minimize loss of productive agricultural lands and to retain the aesthetic

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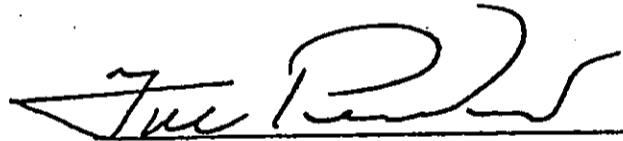


qualities of natural open spaces. Plan C provides for upstream channelization followed by a grass-lined channel along most of the remaining stream, and would convert about half of the lands in residential use in the Paukukalo area to open space. This plan is the best plan from the environmental standpoint because it has the longest length of grassed channel and the best potential for enhancing wildlife habitats. However, Plan C would remove the largest acreage of agricultural lands from production and require relocation of a major part of the Paukukalo community.

5. The three alternative plans, all of which include low flow channels and boulder-concrete lining to facilitate migration of aquatic life, were coordinated with Federal agencies, State and County agencies, citizen groups and interested citizens. The comments received during this coordination effort, during the 17 January 1974 and 8 July 1974 public meetings, and in response to the draft environmental statement were considered in the decision-making process. Based on review of all of the comments received, I find that Plan B reflects the best balancing of all factors pertinent to the flood and related problems on Iao Stream and is the plan with the most support from government agencies and citizens. I believe that all necessary investigations have been accomplished and sufficient data and information on the engineering, economic, social, and environmental aspects of the alternatives considered have been reviewed to facilitate making this decision. I therefore conclude that none of the other alternatives considered would fulfill the project objectives and socio-economic needs of the project area as effectively as Plan B, and that the public interest would be best served by implementation of this plan.

14 April 1975

(Date)



F. M. PENDER
Colonel, Corps of Engineers
District Engineer

I concur in the District Engineer's findings.

15 April 1975

(Date)

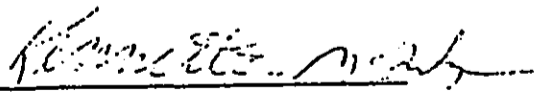


WESLEY E. PIEL
Brigadier General, USA
Division Engineer

I concur in the preceding Statement of Findings.

3 Sep 75

(Date)



KENNETH E. MCINTYRE
Brigadier General, USA
Acting Director of Civil Works

SUMMARY

IAO STREAM, MAUI, HAWAII
FLOOD CONTROL AND ALLIED PURPOSES

() Draft

(X) Final Environmental Statement

Responsible Office: US Army Engineer District, Honolulu, APO San Francisco
96558 Telephone No. (808) 438-1091

1. Name of Action: () Administrative (X) Legislative

2. Description of Action: The proposed plan extends from the mouth of Iao Stream to a point about 2.5 miles upstream where a debris basin would be constructed. The plan combines about 4,400 feet of concrete channelization between the debris basin and near the mouth, with about 7,300 feet of stream left in its existing condition, but with a system of levees to protect the adjacent lands.

3. a. Environmental Impacts: The proposed project will protect land and developments in the Wailuku and Paukukalo areas from floods up to the magnitude of the design flood of 26,500 cubic feet per second. The canefields on the left bank between the Market Street Bridge and the Pihana Heiau site will remain unprotected. Three thousand feet of stream through Wailuku town and another 1,400 feet of stream near the outlet will be lined with concrete. A 6,600-foot length between these channelized sections and about 700 feet upstream of the mouth will remain in its existing condition. The agricultural lands subject to flooding can be a source of significant soil erosion although this condition exists at the present time and will not be increased by the project.

Channelization will remove bankside vegetation, reduce fish and wildlife habitat, and change the visual appearance of the existing stream. The flood protection provided is consistent with the Wailuku-Kahului General Plan to increase light industrial activity in lower Wailuku and will require no relocation, but may encourage upgrading of property and higher rents in the Paukukalo area.

b. Adverse Environmental Effects: The most significant adverse effects are those associated with channelization and concrete lining of a stream. In addition, the elimination of river flooding may encourage some improvement of properties in spite of continuing tsunami potential in the Paukukalo area. The highly visible floodwalls and levees, as well as the concrete channel and loss of vegetation, will result in some adverse visual changes in the area.

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4. **Alternatives:** Alternatives considered include "no action", total relocation, floodproofing, dam and reservoir, total channelization, and three alternative plans which combine channelization with nonstructural measures or with alternate channel linings.

5. **Comments Received:**

US Advisory Council on Historic Preservation
US Department of Commerce
US Department of the Interior
US Environmental Protection Agency
US Department of Transportation, FHWA
US Department of Agriculture, Soil Conservation Service
Office of Environmental Quality Control, State of Hawaii
(Clearinghouse for State and local agencies)
Department of Planning, County of Maui
West Maui Soil and Water Conservation District
C. Brewer and Company, Ltd.
Alexander and Baldwin, Hawaiian Commercial and Sugar Company
Ms. Virginia K. Kalaiwaa

-6. **Draft Statement to CEQ: 19 November 1974**
Final Statement to CEQ: 4 September 1975

FINAL
ENVIRONMENTAL STATEMENT

FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM
MAUI, HAWAII

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ENVIRONMENTAL STATEMENT FOR
FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM, MAUI, HAWAII

1. PROJECT DESCRIPTION

a. Introduction

1.01 The development of flood control improvements for Iao Stream has been discussed at public meetings and studied since the early 1950's. A survey report was completed by the Honolulu District, US Army Corps of Engineers in 1966 under the authority of Section 205 of the Flood Control Act of 1950 and Section 209 of the Flood Control Act of 23 October 1962. The proposed project to provide channel and related modifications to protect Wailuku town was authorized by the US Congress in the Flood Control Act of 1968 (P.L. 90-483).

1.02 Post authorization studies were initiated in FY 1974 as funds became available for the Phase I General Design Memorandum (GDM) studies, or the project plan formulation stage. The purpose of this phase of planning is to reassess the current needs and problems of the project area and to revise the authorized plan as necessary. The lapse of six years since the project's authorization necessitates a through reevaluation of the project's compatibility with present conditions of Iao Stream and Wailuku area.

1.03 This environmental statement has been prepared to accompany the Phase I GDM for submission to the Chief of Engineers in April 1975. Following approval of these documents and adequate funding, Phase II or detailed design studies will be conducted. Construction can be initiated upon completion of construction plans and specifications, possibly as early as 1977.

b. Project Features

1.04 The proposed plan of improvement is shown on Plate 1 and extends from the mouth to a point about 2.5 miles upstream, near the valley entrance. The plan combines structural channel modifications with a nonstructural open space concept. The County of Maui will be responsible for operation and maintenance of the completed project. A summary of the benefit-cost analysis is included in Appendix A.

1.05 The plan consists of the following features:

(a) Debris Basin. The debris basin would be constructed about 2.5 miles upstream from the mouth of Iao Stream. The basin is essentially an excavated channel, 300-foot maximum bottom width by 800 feet in length, with a storage capacity of 80,000 cubic yards. The debris basin would have inlet and outlet transitional channels, drop structures to reduce the stream velocities, and a check dam structure at the outlet to collect large boulders and debris.

(b) Channel Modifications. Between the debris basin and the existing drop structure upstream of Market Street, the existing channel bottom would be widened from 80 to 100 feet and lined with boulders embedded in concrete. The channel side slopes will be lined with concrete except where existing County structures are retained. Drop structures would be placed within the channel to reduce flow velocities, and floodwalls would be constructed as necessary to protect the Happy Valley Community. Downstream of the existing drop structure, the invert (bottom) of the stream would be concrete-lined to reduce the flow depths and to allow the flows to pass under the Market Street Bridge.

A 50-foot-wide rectangular concrete channel would extend through the Market Street Bridge. The channel width would then be increased gradually to 100 feet and end in a 25-foot drop structure extending 60 feet in length and located about 230 feet downstream of the Market Street Bridge. At the end of the drop structure, a grassed channel would be excavated to meet the level of the existing channel bottom, about 700 feet away. The floodwaters would overflow the left bank, and the existing canefields would remain in the flood plain. Levees with grouted riprap (rock) slope protection would be constructed to protect the residential developments which extend into the left bank flood plain.

Earth levees with grouted riprap (rock) slope protection would also be constructed on the right bank between the Wailuku Sugar Company Bridge and the Waiehu Beach Road to prevent overtopping of the right bank and protect the urban developments and adjoining canefields.

At the Waiehu Beach Road Bridge, a reinforced concrete bottom would be constructed to lower the floodwater level and carry the flows under the bridge. From Waiehu Beach Road to the ocean, the channel would be realigned to eliminate the existing 90-degree bend. A smoothly curved rectangular channel with channel walls along the banks and boulder concrete lining on the bottom is planned. The channel works would end about 700 feet from the mouth of the stream, leaving the mouth and near-shore area unaltered. The banks immediately adjacent to the outlet would continue to be subject to flooding as shown on Plate 1.

2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

a. Physical Setting

2.1 Iao Stream (Plate 2) is located on the easterly slopes of the West Maui Mountains on the island of Maui, Hawaii. The 10.14 square mile drainage basin extends from the boundary between the Lahaina and Wailuku Districts, and along the crests of the Kahoolawe and Kapilau Ridges to the Pacific Ocean. The drainage basin is about 8 miles long and average 1.25 miles in width.

2.2 The valley is the largest in West Maui, and its steep walls form a nearly circular shape with the highest point on the ridges being Puu Kukui, nearly 5,800 feet above sea level. About 80 percent of the

drainage basin is forest reserve and the remainder is highly developed for residential, commercial, and agricultural uses.

2.3 Geology. The West Maui Mountain was formed by volcanic activity and is nearly circular in shape. It has been highly eroded, with the eroded material being carried to the sea and deposited on a thick veneer of sedimentary rock on the flank of the mountains and in the isthmus between the West Maui and East Maui Mountains. Seaward slopes of the sedimentary deposits consist of unconsolidated, stream-laid brown silt, sand, and gravel. Toward the mountains, consolidated or partly consolidated fine-grained cream colored dunes composed of calcareous sand, blown inland from ancient beach deposits, are found. The lower slopes of the mountains contain consolidated earthy deposits of mottled red-brown, deeply weathered, poorly sorted, nearly impermeable and friable conglomerates that form conspicuous terraces. Soils in the vicinity of Wailuku consist of clay, silt, and sand with varying amounts of gravel, cobbles, and boulders. The fine sandy silt is high in organic matter and is very productive.

b. Climate

2.4 The climate in Iao Valley is tropical with cooler and wetter areas at the higher elevations. Mean annual precipitation varies from about 25 inches at Wailuku to about 400 inches at the summit of Kukui in the upper reaches. The greatest annual rainfall at Kukui was 578 inches during 1950. There are no humidity records available for the Iao Basin. A summary of temperature and precipitation data is given in Table 1.

c. Vegetation

2.5 Vegetation within the coastal lowlands is characterized by fields of cultivated sugarcane, thickets and forests of Prospis (kiawe), and an abundance of ornamental plants within the developed community. Further inland at the entrance to Iao Valley proper is a dense mixed artificial forest of Persea americana (Avocado), Aleurites moluccana (kukui), Eugenia cumini (Java plum), Samanea saman (monkeypod), Melia azedarach (Pride of India), Mangifera indica (Mango), Psidium guajava (guava), and other introduced species. The higher slopes around the valley mouth are covered by Casuarina (ironwood) forest and dense Leucaena scrub (Haole koa).

2.6 Deeper within the eroded canyon, kukui and guava forests predominate. Grass covers the steeper slopes while the more gentle slopes are covered with open to closed low scrub, with a transition to guava scrub. Low woods are found on the highest peaks and ridges. The guava-kukui forest extends into the valley and up the slopes, often in competition with each other. Patches of native ohia forest are also found in this area. Those areas of the valley developed for park use exhibit a wide assortment of planted ornamentals. The precipitous Iao Needle is covered by dense guava scrub, a variety of ferns, small trees and bushes.

Table 1. SUMMARY OF CLIMATOLOGICAL DATA AT
WAILUKU (392), ST. ANTHONY SCHOOL
WAILUKU, MAUI, HAWAII

Month	TEMPERATURE (Period of record 1907-1960)			PRECIPITATION (Period of record 1901-1960)		
	Mean Monthly	Record Highest	Record Lowest	Mean Monthly	Maximum Monthly	Minimum Monthly
January	71.2	88	51	4.52	13.52	0.20
February	71.0	88	51	3.73	17.90	0.17
March	71.4	89	53	3.73	14.60	0.32
April	72.6	89	55	3.06	12.81	0.14
May	74.5	93	58	1.30	6.66	0.02
June	76.3	90	61	0.44	1.97	0.00
July	77.4	92	61	0.70	2.68	0.02
August	78.0	94	62	0.88	3.40	0.05
September	77.8	92	61	0.74	2.05	0.02
October	76.8	92	58	1.53	7.95	T
November	74.5	92	57	2.68	14.89	0.13
December	72.3	89	53	4.71	19.04	0.16
Period of Record	74.6*	94	51	28.02**	19.04	0.00

* Mean annual temperature.

** Mean annual precipitation.

2.7 Although the valley has few native Hawaiian plants, the forest cover is luxuriant and the striking setting and generally abundant rainfall make it an area of high botanical interest.

d. Wildlife

2.8 Birds are the primary form of wildlife in the project area. Among the birds found in the area are the Amakihi (Loxops virens), Apapane (Himatione sanguinea), Kentucky Cardinal (Richmondia cardinalis), house finch (Carpodacus mexicanus), house sparrow (Passer domesticus), white eye (Zosterops japonica), Pacific golden plover (Pluvialis dominica), ruddy turnstone (Arenaria interpres), red-billed leiothrix (Leiothrix lutea), mocking bird (Mimus polyglottos), and common mynah (Acridotheris tristis). Barred dove (Geopelia striata) and laced-necked dove (Streptopelia chinensis), as well as small populations of ring-necked pheasant (Phasianus colchicus) and francolin (Francolinus specie) inhabit the uplands. At the seaward end of the stream, migratory shorebirds and local marsh birds, including black-crowned night heron (Nycticorax nycticorax) and the endangered Hawaiian stilt (Himantopus himantopus), utilize the lowland area and a small seashore marsh near the stream mouth.

2.9 Wildlife usage in the vicinity of the proposed improvements is very limited as most of the structural work will be located in already developed areas or areas near existing development. Some game animals such as wild goats, pigs, or deer might be found in the forest reserve areas outside the project limits. Mongoose, mice, and rats would also be expected in and near the canefields.

2.10 The extensive diversions of surface water for sugarcane irrigation leaves Iao Stream intermittent below the Iao Intake, just upstream of Kepaniwai Park. Consequently, there are no significant populations of fish in the stream within the project limits. During and after floodflows however, endemic, but not rare, freshwater gobies and freshwater crustaceans (opae) which inhabit the upper stream reaches are able to migrate to and from the ocean during their reproductive cycles. These lifeforms have pelagic larval stages and need to migrate between the ocean and stream to complete their life cycles. The stream supports a sparse population of diadromous species due to the intermittent flow.

e. Existing Stream Conditions

2.11 Iao Stream originates at the confluence of Pooahoahoa and Nakalalooa Streams. The stream gradient at the headwaters is about 1,800 feet per mile as compared to 120 feet per mile at the ocean. A third major tributary, Kinihapai Stream joins Iao Stream near the base of Iao Needle, the most striking topographical feature in the valley. This feature is 1,200 feet high and is an eroded remnant made of basalt, cut with dikes. It is the central feature of the Iao Needle State Park, developed about 1950 by the State Division of Forestry.

2.12 The lower half of the valley is the site of the County of Maui's Kepaniwai Park, about 4 miles upstream from the ocean. The entrance to the valley is located about 3 miles from the sea where the sloping hillsides are used for cattle and hog raising. The existing natural stream channel in this reach is about 80-100 feet wide and heavily shaded by bankside vegetation. The channel slope is approximately 4 percent. The Waihee Ditch passes flow beneath the stream in a pipe encased in concrete at about the 370-foot elevation.

2.13 The stream continues to flow east-northeasterly through the broad coastal plain and the town of Wailuku. The subdrainage area of Happy Valley is located north of the stream, about 2 miles upstream from the ocean, and the first major bridge crossing is located at Market Street. There are several existing County of Maui improvements between the valley entrance and Market Street which were built between 1951 and 1955. Within this reach, the natural stream bottom has a 2.5 percent slope, and the width of the stream widens to 100 feet. Levees have been constructed on the north bank while the south bank remains naturally vegetated. The north bank along this reach has grouted riprap (GRP) slope paving. There is a GRP drop structure near a park site in Happy Valley which is 7 feet high, 80 feet wide and 50 feet long. A second concrete drop structure is located about 520 feet above the Market Street Bridge and is 11 feet high, 120 feet wide, and 76 feet long. Upstream of this structure, a 10-foot-high floodwall lines the south bank for about 312 feet, while a levee protects the north bank. Downstream of this drop structure, a 5-foot-high floodwall on concrete side slopes lines this section along the north bank, while concrete slope lining is found along the south bank.

2.14 The Market Street Bridge itself has a clear span over the channel with a bottom width of 50 feet. The channel bottom for about 100 feet upstream and downstream of the bridge has reinforced concrete lining. Down stream of the concrete lining, the banks have GRP slope paving which appears to act as retaining walls for the residential dwellings.

2.15 The Hawaiian Commercial and Sugar Company (HC&S), Spreckels irrigation ditch is located about 540 feet downstream of the Market Street Bridge. It is an elevated flume about 20 feet high, supported on two piers within the streambed. HC&S also maintains an irrigation water intake, upstream of the Market Street Bridge, and an irrigation tunnel under Iao Stream near Happy Valley. Further downstream is the second major road crossing, the Wailuku Sugar Company Bridge. This structure is erected on two piers within the streambed and has a 80-foot average width and 13-foot vertical clearance. Between Market Street and the Wailuku Sugar Company Bridge, the existing channel is generally trapezoidal in shape with natural growth on the banks. The channel is about 80 feet wide and the streambed is covered with cobbles. The south bank is higher than the north bank by 5 to 10 feet.

2.16 From the Wailuku Sugar Company Bridge, the stream continues to flow northeasterly for about 1 mile before it reaches the Waiehu Beach Road. About midway through this reach the north bank becomes higher than the south bank, and at the Waiehu Beach Road, the two banks are at the same elevation. The Pihana and Halekii Heiaus are located on high ground outside of the flood plain, where the north streambank rises to ridges above the stream. The Waiehu Beach Road Bridge is a concrete structure supported by two piers in the streambed. The three spans total 176 feet in length.

2.17 Below the Waiehu Beach Road, the stream channel is natural, with heavy vegetation along the banks and a cobble-strewn bottom. About 800 feet from the road, the stream forms a sharp bend towards the east, then sharply north to its outlet at Nehe Point. The coastal area at the mouth is in pasture or low density residential use. A small marshy area used by shorebirds is located south of the mouth. Higher density residential development has occurred to the southeast of the stream where the Paukukalo subdivision is located. The shoreline north of the outlet is a sandy beach, often littered with trash and debris. To the south of the outlet, the shoreline is a mixture of sand and cobbles, and the cobbles extend from the stream mouth toward the Kahului area.

f. Previous Federal Participation

2.18 Prior Federal flood control activities on Iao Stream have consisted of emergency work. Under the authority of Section 2 of the Flood Control Act of August 28, 1937, as amended, a 5,500-foot-long emergency snagging and clearing project was completed on October 20, 1954, at a cost of \$48,932. Emergency bank protection at Kepaniwai Park and at Waiehu Beach Road was provided under authority of Section 14 of the Flood Control Act of July 24, 1946, as amended. The restoration work was completed on September 10, 1972 at a cost of \$96,775.

g. Flood Problem

2.19 Iao Stream is perennial from its source to the Wailuku Sugar Company's Iao Intake, near Kepaniwai Park, and intermittent from the intake to the ocean. The upper reaches of the drainage basin are characterized by high, deeply dissected mountains. The steep gradients and rocky character of the soil contribute to high velocity flows during storms. Accumulations of boulders and debris compound the flood problem by reducing the already inadequate channel capacity. The existing stream channel below the Market Street Bridge has a maximum capacity of about 4,200 cubic feet per second (cfs). Consequently, the lower portion of Wailuku town is more susceptible to flooding. The design flood plain (26,500 cfs) shown on Plate 3 encompasses about 400 acres.

2.20 While the stream has a long history of flood problems, information is documented only since 1900. Medium to large floods have occurred in 1903, 1912, 1916, 1924, 1928, 1930, 1948, 1950, 1955, 1961, and 1971. The flood of 1916 is considered to be the greatest flood of record since 1900. A total of 12.42 inches of rain fell during the three-day storm,

and the peak discharge of 17,000 cfs at Market Street was estimated. Damages to agricultural and residential areas were extensive, and thirteen lives were lost. A flood of similar magnitude occurring today would cause an estimated \$9 million in damages, while a design flood would result in \$13 million in damages. The most severe flood since 1966 occurred on 27-28 January 1971. This flood, the second flood on Iao Stream during that month, had an estimated peak discharge of 5,820 cfs which was the second highest discharge since establishment of the gaging station at Wailuku (the highest discharge of 7,540 cfs occurred in December 1950). The flood caused severe bank erosion at five locations stretching approximately 4 miles upstream of the mouth. Damages were particularly severe at the Waiehu Beach Road Bridge and the County of Maui's Kepaniwai Park in Iao Valley.

2.21 The shoreline areas at the mouth of Iao Stream are also subject to potential tsunami inundation and damages. Tsunamis have caused extensive flooding and damages along Hawaiian coastlines, and the most destructive occurrence nearest to the study area took place on April 1, 1946. Waves about 20 feet high were recorded at Waiehu Point located about 1 mile north of the Iao coast. These waves were generated by an earthquake in the Aleutian Islands. No tsunami damages have been recorded in the project area to date.

2.22 A Flood Plain and Tsunami Inundation Area Ordinance was enacted by the County of Maui in 1972. The ordinance regulates development within floodways, or that area of a stream channel and the adjacent flood plain which are required to carry floodwaters. It provides guidance for any remaining development in the Iao Stream area since most of the coastal flood plain is already fully developed. Any future development in the flood plain would only be permitted if protection were provided against a flood of the magnitude that would have a frequency of occurrence of once in a hundred years. Plate 3 presents the project design flood plain (26,500 cfs) and the potential tsunami inundation limit.

h. Socio-Economic Setting

2.23 Cultural-Historical Aspects. Iao Valley is rich in early Hawaiian history although much of its significance is documented only in legend. The natural scenery and topography play a key role in the historical events within the valley. Although there are no sites in the project area currently on the National Register of Historic Places, the valley above the West Maui Forest Reserve boundary was designated a National Natural Landmark in December 1972. The site designation draws its significance not only from the prominent Iao Needle feature, but from the entire valley's volcanic formation and the erosion of a great caldera.

2.24 Portions of the valley have been referenced in legend as sites of royal burial caves and ancient trails, but the most notable recorded historical event is the Battle of Kepaniwai. The famous battle was fought about 1790 between Kamehameha the Great and the sons of the King of Maui, Kahekili. The battle ground is located near Kepaniwai Park on State-owned land. The event is marked by a monument in the Park, and although there are no physical remains of the battle, the site is of historical interest.

2.25 During the 1880's Iao Valley is said to have been populated by several hundred people engaged in extensive cultivation of rice and taro. The people were generally Hawaiians although Chinese immigrants were hired to work the fields. By 1900, very few families were left in the valley area as increasing amounts of water from Iao Stream were diverted for plantation irrigation uses in the sugarcane fields. The town of Wailuku developed around the sugar plantation.

2.26 A recent field survey (January 1974) by a National Park Service archaeologist indicated that modern developments and activities have extended right up to the banks of Iao Stream, except along the steepest banks. It appears that most, if not all archeo-historical remains within the project limits have been destroyed by modern development, except in the uppermost portion of the project area near the debris basin. In April 1974, a preliminary walk-through survey of the debris basin area by the Bishop Museum revealed stone structural remains which were thought to be taro terraces. The National Park Service then contracted the Museum to do a detailed site recording study of the area, including photography, mapping of the sites and obtaining relevant cultural data from local informants.

2.27 The survey recorded two major areas of agricultural terracing. The study concludes that the archaeological remains were principally historic (post-European contact) in age and that no further archaeological work of any kind is necessary or justified. The October 1974 report states that "when compared with other similar sites on this and other islands, (the sites) were judged to be insignificant in terms of archaeological value. In other valleys, the terrace systems appear to be more extensive in both construction technique and land area covered. The other terrace systems also appear to have less historic disturbance than those of Iao Valley."

2.28 In subsequent discussions with Museum personnel, the Museum indicated that it will recommend to the National Park Service that neither of the sites described in the report be nominated to the National Register of Historic Places as their value lies with the information already gathered. Based on the study maps, both of the terrace systems identified are outside the project limits (see Plate 3).

2.29 As noted, earlier, the Halekii and Pihana Kalani Heiaus are located on high ridges above the north banks of Iao Stream between the Wailuku Sugar Company Bridge and the Waiehu Beach Road. These ancient temples of worship and sacrifice were used in the mid-to-late 1700's. The sites were marked by the State Commission of Historical Sites in 1959. Due to their elevated location on the ridgetops, neither site is subject to flooding by the Iao Stream.

2.30 The Maui County Council passed Ordinance No. 661, effective on July 7, 1970 which established a historic district in Wailuku town. The purpose of the district is to "preserve and protect the several well preserved historic structures and sites now existing, which are deemed to be of great value because they are closely identified with the early history

of Maui County." An area several blocks inland from Iao Stream forms the district and includes the following historic structures and sites: Kaahumanu Church, Alexander House, Hale Hoikeike (Bailey House) and Annex, and the Kama Ditch and Aqueduct. Only Bailey House has been entered on the National Register of Historic Places. The entire district is not in an area subject to flooding or flood damages.

2.31 Population. The population trend on the island of Maui between the years 1930 and 1960 can be characterized by a steady decline attributed to the mechanization of the pineapple and sugar industries which forced many residents to seek jobs elsewhere. Between 1960 and 1970, however, there was a reversal in the trend with an 8 percent increase from 35,700 to 38,700. This increase is primarily due to the growth of the tourist industry on the island.

2.32 The population of the Wailuku Judicial District has paralleled the trends for the island. The District's population declined from 21,300 in 1930 to 19,400 in 1960. However, the 1970 Census showed an increase of more than 14 percent between 1960 and 1970 to 22,200. Furthermore, a comparison of 1960 and 1970 Census figures for the Wailuku Division (Maui County Census Tracts 309 and 310) shows a 30 percent increase from 6,969 to 9,084. Countywide, there appears to be a declining rural population and a shift to the urban centers. Wailuku, being the County seat, and with its close proximity to Kahului, is expected to continue to grow as a major urban center.

2.33 The 1970 Wailuku Division population had a median age of 29.5 years and a median family income of \$10,000-11,999. There are 2,150 families with 10.5 percent having incomes below the poverty level. Of the 8,000 residents of Wailuku town, about 34 percent live within the Iao Stream design flood plain which has a total of 637 dwellings within it.

2.34 Economic Development. Agriculture is the primary industry in Maui County. The principal crops are sugarcane, pineapple, fruits, vegetables, flowers and livestock. Tourism and scientific research are also playing a greater role in the County economy and are expected to continue to contribute to the economy as large scale agricultural operations decline.

2.35 The principal industry in the Wailuku flood plain is sugarcane production and processing. The Wailuku Sugar Company, a subsidiary of C. Brewer and Company, Limited, owns and operates a sugar plantation which extends from Waihee on the north to Maalaea on the south. In 1973, the Company produced 27,712 tons of sugar from 213,197 tons of cane, and had a total of 277 employees.

2.36 There is some limited hog and cattle raising along the lower mountain slopes near the valley entrance and also in the Puakukalo coastal area. Within the town itself, business and commercial establishments as well as light industrial operations can be found.

2.37 The importance of Iao Valley to the visitor industry should continue and increase as improvements are made to the State and County parks located there. Agriculture is expected to continue to be the principal industry while a growth in light industrial activities in the area between Wailuku and Kahului is evidenced by the Wailuku-Kahului General Plan.

i. Related Studies and Programs

2.38 A number of other Federal, State, and County projects and programs for the Iao Valley area have been noted and their relationship to the flood control improvements have been examined during the project re-formulation. The first project is the Happy Valley Flood Prevention, Resource Conservation and Development (RC & D) Measure Plan. It is jointly sponsored by the Public Works Department of the County of Maui, the Central Maui Soil and Water Conservation District (SWCD) and the West Maui SWCD. The project is being assisted by the U. S. Soil Conservation Service under the authority of Section 102 of the Flood and Agriculture Act of 1962 (P.L. 87-703) and the Soil Conservation Act of April 27, 1935 (86 U.S.C.-590a-f). The plan calls for channelization and land treatment to reduce flood damages and to convey the peak discharge of about 1,500 cfs from this area to Iao Stream between Market Street and the Wailuku Sugar Company Road. The Happy Valley project has been coordinated with the Iao Stream Flood Control project to assure that the designs are compatible.

2.39 In October 1971 a study was completed for the State Department of Land and Natural Resources, concerning the feasibility of developing and expanding the existing Iao Valley State Park. The proposed flood control improvements do not extend beyond the mouth of the valley, and the park proposals in upper Iao Valley should not be affected in any way.

2.40 A third project is the Vineyard Urban Renewal Plan sponsored by the Maui Redevelopment Agency. The plan was completed in November 1973 and was undertaken pursuant to the Urban Renewal Law of the State of Hawaii (Chapter 53, Hawaii Revised Statutes, as amended). The area to be renovated is a portion of Wailuku's central business district and is about 27 acres in size. It includes the oldest section of the town, just south of Iao Stream in the vicinity of the Market Street Bridge. Except for a 500-foot strip upstream of the Market Street Bridge and immediately fronting the stream, the urban renewal project area does not lie within the flood plain.

j. Water Quality

2.41 According to State of Hawaii Water Quality Standards (Chapter 37-A), Iao Stream is subject to class 2 standards and are to be protected for recreational purposes, propagation of fish and other aquatic life, and agricultural and industrial water supply. The coastal waters off the project area are within the class A designation, to be protected for recreational use, aesthetic enjoyment, and the support and propagation of aquatic life. The bacteriological standards for classes A and 2 are

identical, with total coliform not to exceed 1,000 MPN/100 ml and fecal coliform not to exceed 200 MPN/100 ml.

2.42 No specific water quality studies of the stream or shoreline have been conducted as part of this project, and the only water quality data available at this time is the State of Hawaii, Department of Health bacteriological data. No chemical analyses have been performed by the department on the stream samples.

2.43 The department's data covers four sampling sites, as well as sampling of the Wailuku Sugar Mill cane washwater settling pond effluent. The effluent is no longer discharged into the stream since the sugar company now recycles the effluent. The period of sampling varies for each sampling point, and the number of samples was dependent upon conditions at the sampling site. However, a few general conclusions can be drawn from the data which is available in detail at the State Department of Health and at the office of the District Engineer.

2.44 The point furthest upstream is the Iao Needle Park site. Sampling continued from 9 March 1971 to 16 October 1972. Over the 1-1/2-year period, one-fourth of the 24 samples exceeded the total coliform standards. Only two of the twenty-four samples exceeded the fecal coliform standards. The second station was downstream at the Happy Valley Inn. Except for the very first sample taken on 9 March 1971, no water was observed in the stream through 16 November 1971, after which this sampling point was discontinued.

2.45 The next point was sampling of the Wailuku Sugar Mill effluent. Until 1973, this effluent was discharged into the stream and its bacteriological content is evident at the two remaining sampling points further downstream. The effluent probably constituted all or most of the streamflow below its discharge point. Samples were taken from 9 March 1971 to 9 April 1973. Two-thirds of the twenty-one samples were greater than or equal to 2.4×10^6 MPN/100 ml., and the minimum recorded was 1.1×10^4 MPN/100 ml. Fecal coliform levels were never below 1.2×10^3 and 19 of the 21 samples exceeded or were equal to 2.4×10^5 MPN/100 ml.

2.46 Sampling at Waiehu Beach Road Bridge extended over about 2 years, from 9 March 1971 to 20 February 1973. Total coliform levels ranged from greater than 1.1×10^4 to greater than 2.4×10^7 MPN/100 ml. Half of the samples recorded greater than 2.4×10^6 MPN/100 ml. Fecal coliform ranged from 430 to greater than 4.6×10^6 MPN/100 ml, with ten of the twenty-four samples reading greater than 2.4×10^6 MPN/100 ml.

2.47 The last sampling point is at the Iao Stream mouth, along the shoreline. Sampling extended from 9 March 1971 to 24 June 1974. Of the 48 samples taken over the three-year period, only three were within the State standard for total coliform count. For fecal coliform counts, only four were acceptable.

2.48 Unfortunately, sampling of these sites along Iao Stream was discontinued in 1974, and no reliable comparison of water quality can be made of conditions since the termination of sugar mill effluent into the stream. Further, for most of the year, there is no streamflow to test. Shoreline samples would reflect coastal conditions rather than the quality of stream water.

2.49 Since the stream is intermittent within the project limits, very little can be said of stream water quality or testing at the present time. The Health Department bacteriological testing indicates that water quality at Iao Needle Park presents no serious problems. The results at stations downstream indicated serious problems, but they were largely due to sugar mill effluent discharges which no longer exist.

3. RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

3.1 The State of Hawaii Land Use Law of 1961 and its amendments of 1963 and 1965 specify four land use districts. Urban lands are those already in urban use or required for future urban growth. Those lands with a high capacity for intensive cultivation have been designated agriculture districts. The Conservation District includes forest and water reserves, national or state parks, lands with a slope of 20 percent or greater, and marine waters and offshore islands. Lands primarily in small farms mixed with low-density residential lots are classed rural districts.

3.2 About 80 percent of the Iao Stream drainage basin is in the Conservation District, concurrent with the lands within the forest reserve boundary. Below the forest reserve boundary, the drainage basin is fairly evenly divided between urban and agriculture districts.

3.3 The Wailuku-Kahului General Plan, approved by the County in 1972 (Plate 4) attempts to maintain the intent of the State's Land Use Law by avoiding the conversion of prime agricultural lands to urban use except in "extreme and rational cases". During development of the general plan, it was found that not all the vacant urban lands were in appropriate locations or configuration to accommodate the projected land requirements for urban growth. Consequently, the general plan suggests some modifications of the State Land Use boundaries. The modifications were based upon an evaluation of the physical, economic, social and political considerations and constraints, and the plan was intended to be a "framework of usability, not a dogma of land use".

3.4 According to the General Plan, 80 of the 102 acres of agricultural land in the Iao Stream drainage basin are expected to remain in agricultural use. The remaining agricultural land is in the South Wailuku area. Portions of the area south of the stream and upstream from the Waiehu Beach Road are considered physically unsuitable for agriculture, though they are now cultivated, and future light industrial development is proposed in its place. The 22 acres of presently agricultural land within the flood plain are generally planned for light industrial use.

4. ENVIRONMENTAL IMPACT OF THE PROPOSED PROJECT

4.1 The proposed plan of flood control improvements will affect about 2-1/2 miles of Iao Stream, either within the stream proper, or along its banks. The plan is a combination of structural and nonstructural features, with different sections of the stream being affected to varying degrees.

4.2 The most pronounced changes from the existing stream conditions occur at the uppermost project limits and at the 1,400-foot reach downstream of the Waiehu Beach Road. Both of these areas are now minimally developed. The debris basin to be constructed about 2.5 miles upstream from the mouth will change the stream through extensive excavation for debris storage and related channels and structures. Below Waiehu Beach Road, the existing stream would be realigned and lined with boulders embedded in concrete on the bottom and with concrete channel walls along both banks. The final 700 feet of the stream at its outlet would be left unaltered.

4.3 Between the debris basin and the Waiehu Beach Road, most of the structural features will affect the lands adjacent to the river bank, and actual changes to the stream proper are limited to the upper third of this reach (debris basin to Spreckels Ditch). As discussed in the description of existing conditions, a number of Maui County channel improvements have been constructed upstream of Market Street Bridge, including levees, drop structures within the stream to reduce flow velocities, slope paving and floodwalls. In addition to widening the existing channel, the proposed improvements will add to the existing slope paving and floodwalls. The existing stream bottom is presently unlined, and the proposed improvements will line about 3,030 feet between the debris basin and the vicinity downstream of Market Street Bridge with either boulder concrete or concrete. Alterations to this portion of the stream include drop structures and excavation of a 700-foot-long grassed channel in the vicinity of the HC&S Spreckels Ditch. From the end of the grassed channel, the stream will flow in its natural undisturbed state for about 6,600 feet until it reaches the Waiehu Beach Road crossing.

4.4 Within this stretch of natural stream, earth levees with grouted riprap slope protection will be constructed along the right bank to protect developments on this bank. Additional levees around existing developments in the fields of the left bank will protect those areas from floodwaters. A concrete wingwall will be provided on the right bank upstream of the Waiehu Beach Road for bank protection. Under design flood conditions, the water surface at the Wailuku Sugar Company bridge would be at approximately the elevation of the underside of the bridge. The capacity of the bridge is about 9,600 cfs. However, because most of the floodwaters would flow along the natural route through the canefields north of the bridge, no alteration of the bridge is planned.

4.5 The more specific physical, biological, social, and economic impacts of these proposed structures and changes as well as the overall consequences of the selected Plan B are discussed in the following paragraphs.

4.6 The improvements will protect developments in the lower Wailuku and Paukukalo area from floods up to the magnitude of the design flood of 26,500 cfs. The canefields on the left bank between Market Street and the Pihana Heiau Site will remain unprotected.

4.7 It should be noted that flooding and damages can still occur if a flood with a magnitude greater than the design flood should occur. The low coastal lands downstream of Waiehu Beach Road in the Paukukalo area are also subject to potential tsunami flooding and damages. These occurrences can take place if damaging waves reach the coastline following seismic disturbances.

4.8 The debris basin is designed to collect debris and boulders, preventing them from accumulating downstream to reduce channel capacity and impede floodwaters. Consequently, the amount of boulder and debris accumulation within the stream and at the outlet should be reduced. In addition, the lining of the improved channel sections, both on side slopes and invert will reduce bank erosion and sedimentation due to bank erosion. None of the structures, however, will reduce the turbidity of the floodwaters originating from the upper reaches of Iao Valley. Moreover, the waters inundating the cane lands within the flood plain along the left bank can be expected to cause some erosion of the canefields. Under existing conditions, the design flood would flow through the canefields at about 32 feet per second. The project will allow flows up to about 29 feet per second within this flood plain. The project will not alter the existing conditions. At the outer limits of the flood plain, the velocity varies from 2 to 6 feet per second. Erosion is likely to be more serious if flooding occurs immediately after harvesting or planting the canefields when the fields are exposed.

4.9 No erosion control plan has been developed although the need for one with or without the project under minor flooding conditions is recognized. The potential erosion problems have been brought to the attention of the County of Maui and the Wailuku Sugar Company. It is expected that the sugar company and the West and Central Soil and Water Conservation Districts of Maui (SWCD) will cooperate in the development of a land management, erosion control plan for minor flood conditions.

4.10 Existing structures and improvements are being retained to the maximum extent possible. The structures built by Maui County are to be modified and incorporated into the proposed design. Both the Market Street and Waiehu Beach Road Bridges will be retained, with some excavation below them to pass floodflows as well as modification upstream and downstream of the bridges. The Wailuku Sugar Company Bridge is not adequate to pass floodflows in excess of 9,600 cfs. Floodwaters would flow along the natural route over the road north of this bridge. As a result, under design flood conditions the road would be subject to inundation, and traffic may be temporarily inconvenienced.

4.11 No homes or businesses will be displaced or require relocation. The project will require about 29.5 acres of Wailuku Sugar Company land,

13.7 acres of which are in active sugarcane production. About 56 acres along the left bank within the flood plain will remain unprotected during design flood conditions. Except for the earth levees on the right bank and around the existing developments within the canefields, there will be no other structural impediments near or within the stream to interfere with cane cultivation.

4.12 Although the canefields of the left bank will continue to be a flood plain and its designation as a floodway will subject future development there to the Maui County Flood Plain and Tsunami Inundation Area Ordinance, the lands in south Wailuku on the right bank will be protected from the design flood. The flood protection provided will allow these presently cultivated lands near Waiehu Beach Road to be developed in accordance with the Wailuku-Kahului General Plan which envisions limited expansion of light industrial uses in the lower Wailuku area.

4.13 The increased flood protection will also have an impact on the residential community of Paukukalo, downstream of Waiehu Beach Road. With the proposed improvements, the value of the once flood-prone land may rise, encouraging landowners to upgrade their properties and add to their investments in the area. Since a number of the dwellings there are now dilapidated and/or abandoned, the change could be considerable, and families renting units that are improved, would face higher rents in the future. Although the degree of improvements and higher rents are also restricted by the potential but rare tsunami inundation danger, the decrease in river flood damages would encourage a marked change in the residential area and affect housing pressures and availability in other parts of Wailuku-Kahului in spite of potential tsunami occurrence.

4.14 The proposed project conforms basically with the Wailuku-Kahului General Plan by protecting existing uses of the land and allowing for the future light industrial growth of the lower Wailuku area. As the General Plan described a low-intensity open-space use along both streambanks from the ocean to the valley, the flood control plan attempted to keep as much of the stream within the project limits in its natural state. Consequently, about 54 percent of the 2-1/2 miles within the project limits are left unaltered, and the temporary inundation of the left bank canefields was accepted over increased channelization. Bike and hike trails were originally incorporated with the greenbelt stream areas; however, it was pointed out by the County that trails of this type constitute medium-density open-space use and therefore were not consistent with the low-density use specified by the General Plan. In addition, the Wailuku Sugar Company stated that increased usage and access to the lands cultivated along the stream would increase the possibility of canefield fires and traffic hazards with agricultural vehicles. Consequently, the plans for trails have been deleted and the streambanks will remain in low-density open-space use, contributing to the visual and aesthetic qualities of the area.

4.15 The proposed improvements will modify sections of the existing stream in the vicinity of the debris basin through the HC&S Spreckels Ditch, and downstream of the Waiehu Beach Road crossing. Within these

areas, bankside vegetation will be removed, sides and bottoms excavated, existing wildlife, fish, and insects disturbed, and side slopes and inverts will be lined with concrete or boulder concrete lining.

4.16 The removal of bankside vegetation, lining of channel sides and bottoms, combined with the low flows will generally result in higher water temperatures for aquatic life, a reduction in resting and watering sites for birds and other wildlife, and presents both thermal and structural impediments to the migration of certain fish species such as the goby.

4.17 A number of design features have been taken into consideration to minimize these potential adverse effects and maximize the retention of 54 percent of the stream within the project limits in its natural state. All channelized sections have incorporated a low flow or pilot channel within the main channel. This V-notch smaller channel can be located on either side of the larger channel, or in the middle to concentrate and facilitate the passage of low flows and to allow the flows to pass through areas shaded by bankside landscaping. At the present time, a single low-flow channel located on the right side of the main channel upstream of Waiehu Beach Road and on the left side below Waiehu appears to be the most feasible alignment. A final determination will be made during Phase II studies. The low flow channel will be lined with boulders to provide a more natural setting than smooth concrete. Wherever the floodflow conditions permitted, grouted riprap or boulder concrete linings were selected over reinforced concrete, particularly for the stream bottom lining. The boulder concrete lining allows for protruding boulders grouted on the bottom by concrete, and this design can provide shelter and niches for various aquatic and terrestrial forms of life. Landscaping to replace bankside vegetation, providing shade and shelter, will be an essential part of the final design.

4.18 The amount of temperature change due to concrete lining cannot be predicted with accuracy as there are a number of variables such as the amount of water flowing in the stream, the ambient temperatures, the effectiveness of bankside vegetation, and the adequacy of the low flow channel in concentrating streamflow. In meetings with fish and wildlife agencies, it has been pointed out that while the gobies in Iao Stream are not rare species or officially endangered, they are considered threatened in this particular stream because of the lack of streamflow in the lower reaches, a condition that exists without the project.

4.19 Should low flow become available, it has been estimated that a 5°F. increase in temperature can be detrimental to gobies, but specific research has not been done to determine precise lethal limits. During fish and wildlife coordination, some studies done on Manoa Stream were cited which give a general indication of the potential heating effects that concrete lining might have on other streams. The Manoa Stream study showed that over 1/2 mile of stream, one inch depth of flow in a wide sheet could increase 10°F. in temperature.

4.20 For these reasons, mitigative measures such as a low flow channel, bankside vegetation, and boulder-embedded channel bottoms will be included. The importance of shading by vegetation and boulders was stressed during all coordination meetings, and incorporation of these measures will minimize temperature rises.

4.21 While the full benefits of these design modifications for fish and wildlife usage cannot be realized with the presently low flows in the stream, the provisions are consistent with the goals of the General Plan to restore the free flowing stream and aquatic life, should water become available in the future. As discussed earlier, the Wailuku Sugar Company is an irrigated plantation and requires a minimum of 55 million gallons of water a day (mgd). Thus, most of the annual 50 mgd flow is diverted in accordance with water rights agreements for irrigation purposes, and all of the 18 mgd average low flow during dry seasons is used, and supplemented by other sources. According to the sugar company, the supply of water from Iao Stream during dry periods is not sufficient to maintain the canefields within the drainage basin, and any proposal to release water for low flow stream maintenance has been opposed by them.

4.22 The structural features of the plan will modify the existing appearance and visual quality of the flood plain, although most of the changes will be localized. The area for the debris basin will be cleared and excavated. The basin will be a larger, wider feature with several rock or concrete supplementary structures within it. The densely vegetated area surrounding the debris basin will remain unaltered. From the debris basin to the area downstream of the Market Street Bridge, the changes will not be as pronounced since a number of man-made structures such as channel work, floodwalls, and levees have already been built by the County. The proposed improvements will extend and enlarge these features. While the stream will remain natural and unaltered for over 1-1/4 miles to the Waiehu Beach Road, earth levees along the right bank, levees within the flood plain to protect existing developments, and a right bank wingwall near the Beach Road will be visible new structures in the predominantly agricultural scene. They will vary from 4 to 15 feet above the existing ground.

4.23 Below the Waiehu Beach Road, the rectangular concrete channel section should not be visible from adjacent areas except when standing immediately on the streambank and looking down. The banks behind the channel will be backfilled and grassed so that the channel walls will not be exposed to the residential community.

4.24 Based on a check of the National Register of Historic Places, on the Bishop Museum's studies of the project area for the National Park Service, and on coordination with the State Historic Preservation Officer and the Maui County Historic Commission, no historic, cultural or archaeological sites in the project area will be affected by the proposed project.

4.25 Some of the excavated material would be used for levee construction. However, an estimated 132,000 cubic yards of excess material would result from the proposed excavation work. The excess material would be hauled to a disposal site within reasonable distance. The site would be designated by the County of Maui during Phase II studies when the quantities are better defined through field survey data. Sources of construction material, such as boulders and aggregates for concrete, and suitable fill material would be determined after foundation and material studies to be accomplished at a later date.

5. ANY PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROJECT BE IMPLEMENTED

5.1 The susceptibility of the left bank canefields within the flood plain to erosion during floods can result in adverse economic, natural resource, and water quality consequences. A joint sugar company-SWCD land management program could reduce erosion under minor flood conditions. However, in the event of major floods such as the design flood, sugar crops would be extensively damaged, valuable soils lost to the stream and ocean, and serious turbidity and sedimentation of the waters would continue. This condition would prevail with or without the project.

5.2 Although the proposed improvements will protect the coastal lands at Paukukalo from river flooding, the area will still be subject to tsunami flooding and to the Maui County Flood Plain and Tsunami Inundation Area Ordinance. Future developments within the tsunami inundation area should be subject to the restrictions of the ordinance. However, the elimination of river flooding may encourage some improvement of properties in the area in spite of the continuing tsunami potential.

5.3 The adverse visual aspects of structural improvements have been discussed. Especially visible will be the floodwalls and levees which are above the stream and ground level. Landscaping and design modifications will be incorporated to minimize visual intrusion, but some adverse changes can be expected.

5.4 Adverse effects to the natural environment associated with channelization and structural features are also unavoidable although measures are being taken to reduce their effects. The loss of existing vegetation, wildlife, and stream bottom, and increased water temperatures caused by solar heating would be permanent in those sections that are excavated and completely lined. While effects to aquatic life are not significantly adverse to the limited existing populations, the possibility of future low flow maintenance could result in more significant effects in the future. Portions of the stream would no longer be natural and unlined, however, lined sections would be modified to maximize the passage of low flows.

5.5 Among the effects which cannot be avoided are the temporary construction impacts and inconveniences associated with construction. Noise, dust, additional traffic load, and increased siltation of the stream waters can be expected at varying times during the estimated 2 years

construction period. Every effort will be made to minimize these effects through construction controls such as immediate grassing and stabilizing of exposed surfaces, removal of debris and materials to County designated and approved disposal areas, and phasing of activities to prevent adverse cumulative impacts.

6. ALTERNATIVES TO THE PROPOSED ACTION

6.1 The following objectives were established to permit development and selection of a plan which would best respond to the expressed needs and desires of the Wailuku community.

(1) The plan should enhance public safety and welfare by providing a high degree of flood protection compatible with local interests' desires and project economics;

(2) Flood control improvements should reduce erosion and sedimentation;

(3) Existing improvements should be retained if possible, and displacement of homes and businesses should be avoided;

(4) Lining of stream channels should be minimized;

(5) Fish and wildlife should be enhanced through establishment of minimum low flow in the stream and selection of types of lining which would be conducive to the development of these habitats;

(6) Wetlands and rare species of wildlife should be protected;

(7) The quality of stream waters should be improved where feasible;

(8) Open space should be maximized;

(9) The improvements should be compatible with historic and scenic sites and with the Wailuku-Kahului General Plan.

6.2 During the project reformulation and reevaluation, a number of non-structural and structural measures as well as combinations of these were examined. While "no-action" will allow the existing conditions of the stream to be preserved, the long history of flood damages and threat to life prompted development of other alternatives to solve the flood problems. Relocation of all residences and businesses within the flood plain was considered as a nonstructural solution. This plan would call for demolition and removal of all existing structures and landscaping of the flood plain. Agricultural land would be kept in production. It would be essential that flood plain ordinances be implemented to prevent future building within the flood plain. The plan allows for preserving the stream in its present condition and permitting the development of parks and open-space greenbelt areas along the banks. There are several major disadvantages to this plan. Finding suitable relocation sites for 637 dwellings and 83 businesses and other structures would be a difficult and demanding process. Disruption of

existing neighborhoods, established over a period of years, would have serious social effects. The cost of relocation, demolition, and landscaping throughout the flood plain would be about \$30 million. Should acquisition of the agricultural lands be included the costs would increase by at least \$10 million. For these very significant disadvantages, the total relocation plan was generally rejected by the County and the residents of the area.

6.3 Another basically nonstructural method considered was floodproofing of all damageable structures within the flood plain. This would be accomplished by raising buildings or constructing small levees around the structures and regulating future development within the flood plain by flood plain ordinances. As with relocation, the existing stream would remain unaltered and park or greenbelt planning for the river banks could be incorporated. Flood-proofing of each and every damageable structure would be a complex undertaking involving discomfort and inconvenience for the residents. Floodwalls and levees would probably be quite visible and numerous. The costs of this plan would be in excess of \$15 million. For these reasons, flood-proofing was rejected as a suitable alternative for flood control in the Iao Stream area.

6.4 Structural measures are generally intended to physically prevent or control floodflow by containing floodwaters in a storage reservoir or by confining the floodwaters to a defined floodway through the construction of channel improvements or levees. The construction of a dam at the confluence of Kintahpai and Iao Streams to impound and control the release of floodwaters was among the structural alternatives considered. A suitable damsite could not be found further downstream, and consequently, the dam at this location would require additional channel or levee construction downstream to prevent flooding from runoff in the lower reaches. Built for the single purpose of flood control, a dam would cost in excess of \$29 million.

6.5 A dam would extend into the Iao Valley park area, inundating many acres of forest reserve area, and reducing the existing vegetation and wildlife habitat. Although a new lake-type setting would result, it would also alter the visual quality from an area of free-flowing streams to an open water body. The pronounced change to a valley of historical and visual significance, the necessity for supplemental downstream structures, and the high costs eliminated this alternative from further consideration.

6.6 The possibility of providing additional benefits such as irrigation, water supply, and power with a multi-purpose dam was studied during the survey study stage in 1966. This type of dam would be 400 feet high and cost about \$40 million. The analysis made during the survey study and confirmed during the recent reevaluation, indicates that the additional amount of benefit derived could not offset the higher costs and the extensive changes to the upper reaches.

6.7 The remainder of the alternatives considered utilized channels, levees, or a combination of these with nonstructural measures to confine the floodwaters to a defined waterway. A debris basin, about

2.5 miles upstream from the mouth, was found to be a necessary and common feature to all the channel-type alternatives. No construction or alteration would be proposed upstream of the debris basin, confining all changes to the area outside the valley proper.

6.8 A preliminary alternative involved complete concrete channelization of the stream channel from above the Market Street Bridge to the mouth. Some realignment would be necessary, but this plan would confine the high velocity floodwaters within a very narrow channel. The channel bottom widths would vary from 80 to 100 feet, and maintenance requirements would be facilitated as compared to an unlined or natural channel which is highly susceptible to bank erosion and accumulation of debris.

6.9 The disadvantages, however, appeared to outweigh the advantages, and the plan was rejected. First, a concrete channel two miles long would have significant adverse visual impact, producing a complete change in the appearance of the lower stream reaches. Concrete lining of intermittent or low flow streams, coupled by a lack of shady bankside vegetation over the entire width of the channel, can raise stream temperature to lethal levels for fish and other aquatic life. The loss of natural stream bottom and the rise in water temperature would be detrimental to the reestablishment of stream life if continuous low flow becomes available in the future. The cost per lineal foot of concrete channel is extremely high, and total cost of such a plan would be about \$20 million. Most importantly, this plan for complete channelization is substantially incompatible with the goals of the Wailuku-Kahului General Plan as well as with the project objectives to minimize stream channel lining.

6.10 In an effort to better meet the general plan and project objectives, alternatives combining channel improvements, levees, and flood plain management were developed. While channel improvements are designed to increase the existing capacity of the stream by realignment, excavation and deepening, and lining of the sides and bottom, levees or dikes direct and confine floodwaters in the designated channel. In urban areas where property values are high and land acquisition is difficult, reinforced concrete floodwalls are used instead of earth levees or dikes.

6.11 Thus, three alternative plans combining structural and nonstructural measures were designed to provide protection against the design flood known as the standard project flood with a magnitude of 26,500 cfs. Plan A, like all three plans, begins at the upstream end with an 80,000 cubic yard capacity debris basin, about 2,600 feet from the Market Street Bridge (Plate 5). Existing levees would be extended and floodwalls or levees constructed where necessary to confine the flows to the stream channel. Between the debris basin and the Market Street drop structure, the channel would be widened, lined with concrete and boulder concrete, and drop structures would be provided. Downstream of the drop structure, the stream bottom through Market Street Bridge would be paved with reinforced concrete, and a rectangular concrete channel widened from 50 feet to 90 feet wide would extend from Market Street Bridge to the Wailuku Sugar Company Bridge. A transitional channel 90 to 100 feet wide and 25-foot drop structure would then precede a grass-lined earth channel. The grassed

channel would be 400-foot-wide and would be constructed by excavating and widening the stream. The grassed channel would contain additional drop structures to maintain a flow velocity no greater than 5 to 10 feet per second (fps). The 3,300-foot-long grassed channel would end at high grounds near the heiaus on the left bank about 2,300 feet upstream of the Waiehu Beach Road. About 12-foot-high earth levees on the right bank would guide the flows from the grass channel through the natural stream course up to the Waiehu Beach Road. Under the bridge, the existing channel would be excavated and lined with reinforced concrete. Downstream of the bridge, the channel would be realigned to eliminate the existing sharp bend, channel walls would be built along both banks, and the bottom would be lined with boulder concrete. The rectangular-shaped channel improvements would end about 700 feet from the shoreline. Both banks adjacent to this unchanneled 700 feet at the outlet would be subject to inundation as shown on Plate 5.

6.12 Plan B (Plate 1) is essentially the same as Plan A, except for two sections: (1) Market Street Bridge to Wailuku Sugar Company Bridge and (2) Wailuku Sugar Company Bridge to Waiehu Beach Road. Instead of complete channelization in the first section, a concrete channel would extend through the Market Street Bridge, gradually widen to 100 feet and end in a 25-foot drop structure located about 300 feet upstream of the elevated flume. At the end of the structure, a grassed channel would be excavated to meet the existing channel invert about 700 feet downstream. From the grassed channel, the floodwaters would be allowed to overflow the left bank, and the existing canefields would remain in the flood plain. Levees would be constructed to protect the residential developments which extend into this flood plain.

6.13 In the second reach (Wailuku Sugar Company Bridge to Waiehu Beach Road), levees would be constructed along the right bank to protect the existing development. Levees would also be constructed within the left bank around existing developments.

6.14 Like Plans A and B, Plan C includes a debris basin, modifications to the existing Maui County improvements and construction of a 25-foot drop structure in the same location as Plan B about 230 feet downstream of the Market Street Bridge (Plate 6). Between the drop structure and a point 2,300 feet upstream of the Waiehu Beach Road, a 400-foot-wide grassed channel with additional drop structures within it is proposed. The drop structures are required to reduce the floodflow velocities to 5 to 10 cfs. The downstream end of the grassed channel will be excavated to meet the existing natural streambed, and levees will extend further inland along the right bank to the Waiehu Beach Road. This plan will require the reconstruction of the Wailuku Sugar Company Bridge and the Spreckels Ditch to span the width of the new grassed channel.

6.15 Beyond Waiehu Beach Road, three alternative measures were considered for Plan C. The first consideration was to realign the stream as in Plans A and B. The second consideration would be to relocate all the homes within this reach of the flood plain (approximately 120 families).

This plan would allow the stream to remain unaltered and present an opportunity to create a greenbelt and open space area that would maximize environmental benefits by providing habitat for water birds and stream life. These benefits are gained at the expense of removal and relocation of a major segment of the community, resulting in serious social and economic impacts.

6.16 A third consideration would be to relocate only a portion of the homes in the Paukukalo flood plain, allowing for the creation of a partial greenbelt and open space area. Under this consideration about 80 families would be relocated, and levees would be constructed on both banks to protect the remaining homes. Benefits to open space and wildlife would not be as significant as with the previous consideration of total relocation, although the economic and social costs of relocating this segment of the community would still have significant adverse effects.

6.17 A comparison of Plans A, B, and C shows that they are identical in their proposals and impacts from the vicinity of the debris basin to just below the Market Street Bridge. Of the three plans, Plan A is the most efficient from the engineering standpoint and proposes the most extensive amount of channelization, extending the concrete channel to below the Wailuku Sugar Company Bridge. Consequently, Plan A protects both agricultural and urban developments, but preserves the least amount of stream in its existing unlined condition and would result in the greatest degree of adverse effects associated with concrete lining.

6.18 Plan B, on the other hand, utilizes a short concrete channel which is followed by a transitional grassed channel below Market Street. The grassed channel is followed by a system of levees that utilizes an existing flood plain on the left bank and also keeps the stream in its existing condition for about 6,600 feet. This plan is the most economical of the three plans.

6.19 Plan C is similar to Plan A, but provides for more grassed channel than concrete. The grassed channel would begin below Market Street as compared to below the Wailuku Sugar Company Bridge in Plan A. The grassed channel would be a man-made structure, but the lining would make it suitable for use by wildlife and fish, should a source of streamflow become available. Like Plan A, Plan C offers flood protection to all of the adjacent remaining canefields in the flood plain and reduces erosion, but the grassed channel would require 41.9 acres of agricultural land as opposed to about 13.7 acres for Plan B and 26.5 acres for Plan A. Plan B would allow the stream to remain in its existing condition at the expense of periodic flooding and erosion of the canefields on the left bank, while Plan C would involve excavation and construction of a grassed channel in order to protect all adjacent lands.

6.20 Plans A and B would provide design flood protection from river flooding for all families in the flood plain below Waiehu Beach Road. This protection would be achieved with no relocation of homes, but the stream would be channelized and lined with concrete and boulder concrete. In an attempt to maximize benefits to the natural environment, Plan C offers alternative considerations for preserving the existing condition of the stream in this reach. With either total or partial relocation, varying degrees of greenbelt and open space as well as wetland and stream habitat

could be developed. Relocation of families would remove them from lands subject to both river and potential tsunami flooding and prevent any encouragement of future development in the area. These benefits must be considered against the costs and availability of suitable replacement homes and the social and community disruption aspects related to displacement. Plan C is the most costly plan and is only marginally feasible from the economic standpoint.

6.21 A summary of the social, economic, and environmental effects of these three alternative plans are presented in Table 2. The three plans were discussed at a public meeting on 8 July 1974. Based upon the analysis of effects and the testimony at the public meeting, Plan B has been selected as the recommended plan, and is the plan discussed in Section 1. This plan removes the least amount of land from agricultural use, preserves nearly 54 percent of the stream between the debris basin and the ocean in its existing state and requires no relocation of homes.

7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.1 Man's encroachment into the Iao Stream flood plain since the development of Wailuku around the sugar company activities has resulted in extensive flood damages to property and loss of human lives over the years. While future development within areas subject to river and potential tsunami inundation is now subject to the County of Maui's Flood Plain and Tsunami Inundation Area Ordinance, as well as the Flood Disaster Protection Act of 1973 on the Federal level, existing damageable property is still subject to flooding.

7.2 The present and long-term uses of the flood plain are not expected to change significantly. Agriculture, in terms of sugarcane production, is expected to continue as the major industry in Wailuku. The urban developments are expected to remain and expand as Wailuku's role as a major urban center grows.

7.3 According to the general plan, restoration of a continuous low stream-flow in Iao Stream is a future goal. The benefits of keeping the stream in the most natural state possible become even more crucial if lands along the stream are made available for medium- or high-intensity open-space and recreational use. The proposed plan attempts to provide a level of flood protection consistent with protecting existing urban type developments without precluding future use of the stream for fish and wildlife and recreation use. Hence, the consequences of some occasional damage to agriculture lands are accepted in order to avoid channelizing an additional 1-1/4 miles of stream and foreclosing future options to enhance and maintain its naturalness.

Table 2 - EFFECTS OF ALTERNATIVE PLANS

EFFECTS OF PLAN	PLAN A		PLAN B		PLAN C	
	NO ACTION	Short term: Yes Long term: No	Short term: Yes Long term: No	Short term: Yes Long term: No	Short term: Yes Long term: No	Short term: Yes Long term: No
<u>THE ECONOMY</u>						
* <u>Desirable Regional Growth</u>	No	No	No	No	No	No
Is the plan consistent with regional and local objectives?	No	No	No	No	No	No
Will the plan change the output of goods and services?	No	No	No	No	No	No
Will the plan induce use of scarce or undeveloped resources?	No	No	No	No	No	No
Will the plan affect per capita and family income?	No	No	No	No	No	No
Will the plan change settlement and migration patterns?	No	No	No	No	No	No
<u>National Economic Development</u>						
Does the plan contribute to National Economic Development?	No	No	No	No	No	No
Does the plan affect public or private investments in the area?	Yes	Yes	Yes	Yes	Yes	Yes
Would the plan alter the regional economic base?	No	No	No	No	No	No
What is the calculated benefit/cost ratio of the plan?	N.A.	1.03	1.03	1.03	1.03	0.8
* <u>Employment/Labor Force</u>						
Will the plan increase/decrease employment opportunities?	No	Temporary increase during construction of project	Same as A.	Same as A.	Same as A.	Same as A.
Will the plan change composition or character of the labor force?	No	No	No	No	No	No
* <u>Local Government Finance</u>						
Will the plan increase the demand/need for additional public goods or services?	Continued need for flood emergency and cleanup crews.	None, other than operation for flood emergency and maintenance of project.	Same as A.	Same as A.	Same as A.	Same as A.
Would the plan affect land values?	No	No	No	Yes	No	No
Does the plan have the support of the local cooperating agency?	No	No	No	Yes	No	No
Is the local sponsor willing and able to meet local cooperation requirements (acquisition, maintenance, regulations, etc.)?	N.A.	No	No	Yes	No	No
* <u>Business/Industry Activity</u>						
Will the plan encourage new industry?	No	Possible new light industry in lower Wailuku.	Same as A.	Same as A.	Same as A.	Same as A.
Will the plan affect other existing business, industry, or commercial enterprises? If so, what and how?	No	Yes, flood protection provided.	Same as A.	Same as A.	Same as A.	Same as A.
<u>Agricultural Activity</u>						
Will the plan remove land from agricultural use? How much?	No	Yes, 26.5 acres.	Yes, 13.7 acres.	Yes, 41.9 acres.	Yes, 41.9 acres.	Yes, 41.9 acres.
Will the plan affect agricultural water supply?	No	No	No	No	No	No
Will the plan protect fertile flood plains?	No	Yes, protects land on both banks.	Yes, lands on south bank only protected. 56 acres on north bank not protected.	Yes, lands on south bank only protected. 56 acres on north bank not protected.	Yes, lands on south bank only protected. 56 acres on north bank not protected.	Yes, lands on south bank only protected. 56 acres on north bank not protected.
Does the plan have the support of agricultural interests?	No	No	No	Yes	No	No
<u>Income Distribution</u>						
Will the plan change income distribution patterns?	No	No	No	No	No	No

Table 2 - EFFECTS OF ALTERNATIVE PLANS Contd.

EFFECTS OF PLAN	NO ACTION			PLAN A	PLAN B	PLAN C
	NO ACTION	NO ACTION	NO ACTION	NO ACTION	NO ACTION	NO ACTION
THE ENVIRONMENT						
* Air Pollution	No	No	No	Temporary effects during construction	Same as A	Same as A
Will the plan adversely affect air quality?	No	No	No	Yes, during construction	Same as A	Same as A
* Water Pollution	Yes	No	No	No	No	No
Will the plan adversely affect surface and coastal water quality?	Yes	No	No	Yes, 9,600 feet of stream channelized	Yes, loss of 5,100 feet of stream channelized	Yes, 8,200 feet of stream channelized
Will ground water quality be adversely affected?	No	No	No	Partially, bank erosion reduced but 56 acres of cane land still subject to erosion	Partially, bank erosion reduced but 56 acres of cane land still subject to erosion	Same as A
* Natural Resources	No	No	No	No, erosion of banks and fields continues	Same as A	Same as A
Will the plan irretrievably commit valuable natural resources?	No	No	No	To be recommended	Same as A	Same as A
Will soil erosion be reduced?	No	No	No	No	No	No
Will the plan affect: (1) Existing parks and recreation facilities? (2) Historical or Archeological sites?	No	No	No	No	Same as A	Same as A
Have any land treatment plans been developed?	No	No	No	No	No	No
* Man-Made Resources	No	No	No	Yes, may limit migration during high flows	Possibly, low flow channel provided in channelized sections and concrete lining reduced	Possibly, extensive grass lined channel provided
Will the plan adversely affect upland wildlife habitat?	No	No	No	Possibly, below Waiehu Beach Road	Same as A	No, habitat development potential
Will the plan adversely affect existing stream fishery?	No	No	No	Yes, low-flow channels, bankside revegetation	Yes, same as A	Yes, same as A. Improved habitat below Waiehu Beach Road
Will the plan adversely affect waterfowl habitat?	No	No	No	No	Same as A	No, habitat development potential
Have any measures to reduce adverse effects been developed?	N.A.	N.A.	N.A.	Yes	Yes	Yes
Does the plan allow for future enhancement if low stream flows become available?	Yes	Yes	Yes	No, limited clearing for debris basin	Same as A	Same as A
Vegetation	No	No	No	Yes	Yes, in lined sections least amount affected	Yes, in lined sections
Does the plan adversely affect forest vegetation?	No	No	No	No	No	No
Does the plan adversely affect streamside vegetation?	No	No	No	No	No	No
SOCIAL SETTING						
Population Density	No	No	No	No	No	No
Will the plan increase/decrease population density? Where?	No	No	No	No	No	Yes, decrease due to relocation of Paubukalo area

Table 2 - EFFECTS OF ALTERNATIVE PLANS Contd.

EFFECTS OF PLAN	PLAN A			PLAN B			PLAN C		
	NO ACTION	PLAN A	PLAN B	NO ACTION	PLAN A	PLAN B	NO ACTION	PLAN A	PLAN B
SOCIAL SETTING Contd									
Population Mobility									
Will the plan restrict population mobility in the project area?	No	No	No	No	No	No	No	No	No
Will the plan affect mobility of neighboring areas?	No	No	No	No	No	No	No	No	No
Housing									
Will the plan diminish the supply of available housing?	No	No	No	No	No	No	No	No	No
Will the plan increase cost or difficulty of buying a home?	No	No	No	No	No	No	No	No	No
Will the plan have an inflationary effect on rents? Where?	No	Possibly, in Peukukalo area and upstream south side of Waiehu Beach Rd	Same as A	No	Possibly, in Peukukalo area and upstream south side of Waiehu Beach Rd	Same as A	No	Possibly, upstream of Waiehu Beach Road	Yes, in Peukukalo area
* Displacement									
Will the plan displace any homes or private property?	No	No	No	No	No	No	No	No	Yes, 120 homes in Peukukalo
Will the plan displace religious, health, education, or other public facilities?	No	No	No	No	No	No	No	No	Possibly, a church in Peukukalo flood plain
Will the plan relocate public utilities?	No	Yes, sewer and water lines at Waiehu Beach Rd	Same as A	No	Yes, sewer and water lines at Waiehu Beach Rd	Same as A	No	Same as A	Same as A
Transportation									
Will the plan change or disrupt existing road or highway routes? Yes, damages during floods make roads, bridges impassable	Possibly	No	No	No	No	Possibly disrupt traffic at Waiehu Sugar Co road during extreme flood conditions	No	Yes	Yes, Waiehu Sugar Co road bridge would be reconstructed
Will the plan result in a need for new routes or facilities?	Possibly	No	No	No	No	No	No	No	No
* Desirable Community Growth									
Is the plan consistent with the local General and/or Land Use Plans?	No	Yes	Yes	No	Yes	Yes	No	No	No
Is the plan supported by the local community?	No	No	No	No	No	No	No	No	No
*Aesthetic Values									
Will the plan alter existing scenic views? Where?	No	Possibly--along stream from Pihauna overlook	Possibly, but not as much as A, less channelisation	No	Possibly--along stream from Pihauna overlook	Possibly, but not as much as A, less channelisation	No	Same as B	Same as B
Health and Welfare									
What level of flood protection will the plan provide?	None	Design flood magnitude of 26,500 cu ft/second	Same as A except for north bank cove lands and Waiehu Sugar Co Bridge	None	Design flood magnitude of 26,500 cu ft/second	Same as A except for north bank cove lands and Waiehu Sugar Co Bridge	None	Same as A	Same as A
Does the plan affect the tsunami inundation area?	No	Yes, below Waiehu Beach Road still subject to tsunami damages	Same as A	No	Yes, below Waiehu Beach Road still subject to tsunami damages	Same as A	No	Same as A, but all damageable structures removed	Same as A
Will the project affect disease vectors or sanitary conditions?									
Will the project affect disease vectors or sanitary conditions?	No	Yes, improved conditions with better flood drainage	Same as A	No	Yes, improved conditions with better flood drainage	Same as A	No	Same as A	Same as A
Will the plan require additional public health services and facilities?									
Will the plan require additional public health services and facilities?	No	No	No	No	No	No	No	No	No
*Community Cohesion									
Will the plan result in physical barriers within the community?	No	No	No	No	No	No	No	No	No
Will the plan relocate a significant part of the community?	No	No	No	No	No	No	No	No	No
Will the plan adversely affect minority groups or other specific groups or interests?	No	Yes, sugar industry	Yes, but less than A	No	Yes, sugar industry	Yes, but less than A	No	Yes	Yes, greatest effect on sugar industry and on Peukukalo residents

Table 2 - EFFECTS OF ALTERNATIVE PLANS Contd.

EFFECTS OF PLAN	NO ACTION			PLAN A	PLAN B	PLAN C
	Yes, continued flooding, damages and disruption	No	Yes, temporarily, but no schools or hospitals are near construction areas	No	Same as A	Yes, relocation of Pukukalo
<u>*Community Cohesion Contd.</u> Will the plan adversely affect the character and stability of the community?	No	No	Yes, temporarily, but no schools or hospitals are near construction areas	No	Same as A	Same as A
<u>*Noise</u> Will the noise levels increase adversely during construction?	No	No	Yes, temporarily, but no schools or hospitals are near construction areas	No	Same as A	Same as A
Will undesirable noise levels result during operation and maintenance?	N.A.	N.A.	No	No	No	No
<u>Leisure/Cultural/Recreation/Education Opportunities</u> Does the plan provide increased opportunities?	No	No	No	No	No	Yes, Pukukalo becomes natural, open area
Does the plan adversely affect existing facilities?	N.A.	N.A.	No	No	No	No
Does the plan preserve or increase open space values?	N.A.	N.A.	Preserves existing open space	Same as A	Same as A	Increases open space below Waitehu Beach Road

N * Specifically required for consideration by Section 122, River and Harbor Act of 1970.

8. ANY IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

8.1 The proposed action will commit about 8.5 acres of presently undeveloped land and natural stream passing through it to the function of a debris and boulder catchment area with all of its appurtenant structures. Furthermore, it will require the commitment of labor and materials to assure that the debris basin is regularly and thoroughly cleared and maintained so that overall flood control capacity is not reduced.

8.2 The excavation and lining of channels will permanently remove existing vegetation and wildlife in and along the streambanks as well as in the areas covered by floodwalls and levees.

8.3 Of the 29.5 acres of project lands to be acquired, approximately 13.7 acres will be removed from active production of sugarcane for levees and channel improvement. In addition, 56 acres of canefield will remain permanently in flood plain, subject to occasional inundation during flood periods. Although these lands can remain in cane cultivation, no flood damageable structures can be built within the area, nor any structures or activities included that might restrict the flood capacity of the area.

9. COORDINATION

a. Public Participation.

9.1 The first public hearing for flood control improvements on Iao Stream was held in February 1951 by the District Engineer. The Committee on Public Works, House of Representatives, U.S. Congress 1st session also conducted a hearing in the Wailuku area in November 1956 as part of a series of hearings on public works projects in Hawaii. At both meetings, concerns were expressed for the threat to life, damages to homes, personal property, businesses, and agricultural lands.

9.2 Upon initiation of the post-authorization studies, a third public meeting was held on 17 January 1974. The meeting was well attended by County officials, Congressional representatives, and residents of Happy Valley and Paukukalo. All who testified were in favor of improvements and expressed concern at the delays. Paukukalo residents suggested that the stream between the ocean and Waiehu Beach Road be straightened to eliminate overtopping on the right bank. Another suggestion included additional debris basins to collect boulders and bankside debris.

9.3 A fourth public meeting was held on 8 July 1974 to discuss the proposed solutions. Three plans, A, B, and C, which were discussed in the alternatives section, were presented, and the environmental impacts of the proposed solutions reviewed. A variety of testimony from agencies, organizations and individuals was received, but all were unanimous in their support of Plan B. Those testifying in favor of Plan B included the County of Maui, the Wailuku Sugar Company, and representatives of the Happy Valley and Paukukalo

communities. Residents, recalling floods as recent as January 1973, repeated their concern for speedy implementation. The U.S. Fish and Wildlife Service also favored Plan B over Plan A, although a number of adverse effects to fish and wildlife resources were also attributed to Plan A.

b. Government Agencies and Citizen Groups.

9.4 The draft environmental statement was circulated in November 1974 to the following governmental agencies for their review and comments. Their responses, including extensive comments, have been summarized in the following section, and copies of their letters are attached to this statement as Appendix B for reference.

FEDERAL AGENCIES

(1) U.S. ADVISORY COUNCIL ON HISTORIC PRESERVATION

Comment: The draft environmental statement appears adequate.

(2) U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION, REGION NINE

Comment: No comments to offer.

(3) U.S. ENVIRONMENTAL PROTECTION AGENCY

Comment: The statement should include water quality and temperature data for the existing conditions. In addition, the anticipated temperature increases for various low flow channel designs should be compared.

Response: As noted in the statement, the stream within the project limits is dry for most of the year, except during periods of heavy rainfall. Water quality data available from the State of Hawaii, Department of Health's testing program is included in paragraphs 2.41 to 2.49. The increase in temperature due to concrete channelization is discussed in paragraphs 4.16 to 4.20. A combination of measures including the low flow channel, bank-side vegetation, protruding boulders, and varying the location of the low flow channel within the main channel to maximize shading will be incorporated to reduce the adverse effects of concrete channelization. It appears that a single low flow channel would most effectively concentrate flows.

Comment: EPA requests a reevaluation of the issue of turbidity and its impacts, should it be determined that turbidity will be increased with the project.

Response: Overall turbidity and sediment deposition should be reduced, not increased with the project. During flood periods, sediments and debris are contributed by the upper watershed (beyond the debris basin), stream-bank erosion, and erosion from canefields in the lower reaches. Contributions from the upper watershed above the debris basin will remain essentially the same, but streambank erosion for those sections that are to be channelized, grassed, or protected by floodwalls will be reduced. Severe

erosion of canefields by high velocity flows can and does occur under existing conditions. While it is true that some of the sediments settle out of the ponded waters, much of the turbid high velocity floodwaters now flow overland and out to sea, carrying a heavy load of silt. Implementation of the project will protect all of the flood-prone canefields except for a maximum of 56 acres on the left bank which will continue to be subject to flooding as they are without the project. Consequently, canefield erosion will be reduced overall although prevailing conditions will continue on the left bank.

Land treatment measures can be instituted by the landowner and the appropriate Soil and Water Conservation District, but they will only be effective against small to moderate flooding conditions. Floods such as the design flood are infrequent events, and the consequences of occasional flooding of the left bank were traded off in favor of the retention of 1-1/4 mile of stream in its natural conditions.

Comment: A detailed diagram showing pre- and post- project conditions for inundation should be included to clarify the differences in area flooded or eroded.

Response: Plate 3 shows the pre-project Iao Stream design flood plain limits as well as the potential tsunami inundation limit. Plate 1 shows the post-project condition with the recommended project. In this case, flooding is limited to the left bank canefields under the design flood conditions. A slight increase in flood plain at its fringes (7 acres) is expected, but is not considered significant in terms of erosion because of the low velocity flows at the fringes and the level topography. See U.S. Soil Conservation Service comments. Overbank flows are also expected downstream of the channel improvements near the shoreline.

Comment: What are the anticipated streamflow velocities for the selected alternative?

Response: Streamflow velocities vary at different points along the stream for each alternative plan. Further, the velocities are controlled by the use of drop structures or different channel linings. Therefore, any analysis of streamflow velocities must be made in the context of the total project description. The 5-10 feet per second (fps) cited for Alternatives A and C, if read in context, applies only to the grassed channel sections. The grassed channel sections are designed to adequately pass these velocities without excessive scouring. For these reasons, drop structures precede grassed sections to sufficiently slow the flows.

In the proposed project, Plan B, a drop structure is located just upstream of the grassed channel. Floodwaters leaving the drop structure and flowing into the grassed channel under this plan have a starting velocity of 11 fps, which increases downstream up to 29 fps in the canefields as described in paragraph 4.8.

In comparison, the design flood velocity at the same starting point under existing conditions would be about 30 fps, and would increase downstream up to 32 fps. In terms of erosion potential within the left bank

canefields, the changes in velocity and area flooded are not considered significant.

It should also be noted that velocities differ at different positions within the flood plain. For example, with the proposed project, flow velocities at the fringes of the flood plain could be as low as 2 fps. Therefore, any reference to velocities must be read in context. Each alternative has incorporated drop structures and various channel linings to assure that flow velocities are compatible with the protection provided.

Comment: A major concern is the channelization and realignment downstream of Waiehu Beach Road. The impact of this action on the marsh areas and the relationship of the action to the Maui Flood Plain and Tsunami Inundation Area Ordinance and the Wailuku-Kahului General Plan should be addressed. Further consideration should be given to an alternative which has no modifications in the lower reach and allows for open-space preservation.

Response: The channel improvements below Waiehu Beach Road stop about 700 feet upstream of the stream mouth, and the marsh area south of the river mouth should not be affected. (See response to Office of Environmental Quality Control comment, pages 38-39).

As a full disclosure document, the impact statement recognizes the potential tsunami danger as well as the potential upgrading of property due to reduced river flooding. These points were discussed at the final public meeting and are recognized by the County of Maui and residents of the area. The County of Maui is responsible for implementation of the General Plan and enforcement of the flood plain and tsunami ordinances which will determine the extent to which upgrading or new development takes place. Based on total consideration of these points as well as other economic, environmental and social impacts, the County of Maui and residents of the area, urged selection of Plan B, rather than Plan C which called for relocation of residents below Waiehu Beach Road.

Comment: Will flooding be compounded in the area of the Pihana Heiau? Reference is made to Plate 3 and to paragraph 4.6 of the draft statement.

Response: As shown on Plate 3, Pihana Heiau is on high ground, outside the limits of the design flood plain (magnitude, 26,500 cfs). The reference to paragraph 4.6 is clearly misquoted. As printed, paragraph 4.6 states that "the canefields on the left bank between Market Street and the Pihana Heiau Site will remain unprotected." This statement is graphically depicted on Plate 1 and described in detail in the project description and impact sections of the draft statement.

Comment: The apparent inconsistency between the Wailuku-Kahului General Plan and the proposed project on the matter of future restoration of low flows should be clarified.

Response: The General Plan states that it is meant to be a guide, "not a dogma of land use." Consequently, the desire for a minimum low flow is still a goal the County would like to meet for fish and wildlife purposes.

However, it has been recognized during coordination meetings by the County and fish and wildlife agencies that the needs of the agricultural interests for water presently exceed the supply and that any change in water use would require legal resolution. In this case, both the landowner and the County of Maui, as well as some residents at the public meetings, stressed that the interests of sugar production are of primary concern as it is the main industry for the community. As stated in the environmental statement, channel design modifications have been incorporated to assure that low flows can be adequately accommodated for wildlife purposes, if water becomes available in the future. Where sections of the channel are lined, however, fish habitat conditions would be less than ideal.

(4) U.S. DEPARTMENT OF THE INTERIOR

Comment: The statement should discuss the quantity and disposal of excavated channel materials and the source of construction material.

Response: The exact quantities of fill material and aggregate required for the project will be determined during the Phase II studies. At the present time, channel excavation is estimated to yield about 272,000 cubic yards (cy) of material, which is more than adequate for the estimated 140,000 cy of fill required. Since all of the fill requirement can be obtained on-site from the channel excavation, no off-site borrow areas should be necessary. The approximately 132,000 cubic yards of excess excavation material will be disposed of at a site designated by the County of Maui during Phase II studies.

Comment: The Department favors recommendation of a plan that includes relocation of at least some structures downstream from Waiehu Beach Road. Appropriate alternatives for utilization of this flood-prone land should then be considered.

Response: The advantages and disadvantages of this alternative and alternative land uses are discussed in paragraphs 6.15-6.20 in the alternatives section. In addition to the high economic costs and the social impacts of relocation of the community, the plan is only marginally feasible and does not have the support of either the local sponsor, Maui County, or the residents of the area.

Comment: New information regarding archaeological sites in the project area should be discussed and compliance with applicable historic preservation laws should be documented.

Response: The most recent studies done by the Bishop Museum for the National Park Service are summarized in paragraphs 2.26 to 2.28. As summarized in the impact section, paragraph 4.24, none of the sites identified in these studies are within the project limits. The Museum has also recommended that none of these sites be nominated to the National Register. Consequently, all applicable historical preservation procedures have been complied with to date.

Comment: The extent and kind of protection provided below Waiehu Beach Road should be clarified.

Response: The statement on page 21 referenced in the comments should be modified to read, "Plans A and B would provide design flood protection from river flooding for all families in the flood plain below Waiehu Beach Road." It is also true as stated on page 12 that the area will still be subject to potential tsunami flooding and river floods of a magnitude greater than 26,500 cfs (design flood).

Comment: The flood flow velocities presented should be confirmed as they appear incompatible with agricultural use of the land. Consideration should be given to erosion-control measures.

Response: The flow velocities under design flood conditions are correct as presented in paragraph 4.8. Consideration will be given to erosion control and land management plans during Phase II detailed design studies. These plans would be jointly developed by the Wailuku Sugar Company and the West and Central Maui soil and Water Conservation Districts. It should be noted that land management/erosion control plans are only effective against minor flooding. Under rare occurrences such as major floods or the design flood, erosion would occur as described. The acceptance of occasional erosion allowed for preservation of 1-1/4 mile of existing stream and reduction of agricultural land requirements.

Comment: Information of the fish population of the stream, the presence of endangered species, and the effect of stream temperature rise on the streamlife should be included.

Response: The information requested is provided in paragraphs 2.10 and 4.15-4.20

Comment: Quantification of the reduction in debris expected, the particle size to be entrapped, and the amount of silt loads generated by the upper reaches and the sugarcane lands should be listed.

Response: The design of the debris basin is based on estimated mass transport of material from the upper basin, not on particle size. The 80,000 cubic yard capacity was determined from estimates of bedload sediment concentration for Kamooalii Stream which is discussed in the USGS cooperative study with the State of Hawaii, "Reconnaissance Study of Sediment Transported by Streams, Island of Oahu" by B. L. Jones, R. H. Nakahara, and S. S. W. Chinn. The estimate was further based on the higher debris (boulder) potential expected at Iao Stream and upon consideration of successive storms which might occur under extremely rare conditions. Therefore, a number of factors have been considered to assure that the design is adequate for debris collection. Details of the design and estimates are available in the Design Memorandum No. 1, Hydrology and in the General Design Memorandum Report. No estimates of silt loads from the upper watershed or canefields have been made as there is insufficient stream gaging data on sediments.

Comment: It is suggested that one of the alternative plans be designated the best environmental plan and that the length of stream channelized for each alternative be broken down into concrete-lined and grass-lined sections.

Response: As stated in paragraph 6.20, Plan C was developed in an effort to maximize benefits to the natural environment and was presented as the

environmental plan at the final public meeting. The lengths of grassed channel and concrete channels are as follows:

<u>Plan</u>	<u>Grassed Channel</u>	<u>Concrete Channel</u>	<u>Total Channel</u>
A	3,300 feet	6,300 feet	9,600 feet
B	700 feet	4,400 feet	5,100 feet
C	5,200 feet	3,000 feet	8,200 feet

(5) U.S. DEPARTMENT OF COMMERCE

Comment: With the exception of a previous recommendation to provide for minimum flow escapement to fill, at least partially, the entire streambed throughout the year, the Proposed Plan B will have a minimal effect on the resources for which the National Marine Fisheries Service has responsibility. NMFS maintains that the release of at least part of the 50 mgd flow is very important to assure the survival of the many rare and endemic diadromous species found in Iao Stream.

Response: The establishment of a minimum low flow in Iao Stream for fish and wildlife purposes was discussed at several informal meetings as well as at the public meetings held on the project. At this time, the Wailuku Sugar Company has stated that it objects to any proposal to interfere with its use of the waters as it is already operating under water deficit conditions. According to the firm, all of the water sources within the stream are legally owned by the Wailuku Sugar Company. The County of Maui, in its support of the recommended plan, has stressed the primary importance of agriculture for the Wailuku community. Thus, establishment of an all-year low flow appears to be a matter requiring legal resolution, and would not be undertaken as a part of the project. In any case, the channel improvements will include design features that will allow for some benefits of low flows should they become available in the future.

(6) U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

Comment: Since the agricultural land that will remain subject to flooding (between Market Street and Pihana Heiau on the left bank) is relatively flat and is not considered highly erodable, and because the condition exists with or without the project, the statement that the area can be a source of significant erosion should not be attributed as a project effect.

Response: The statement acknowledges that implementation of the proposed project will not increase or change the existing conditions with regard to erosion of the agricultural land on the left bank. It recognizes, however, that the land will continue to be subject to flooding.

Comment: The effect of the flood flows on the vegetative cover in the grass-lined waterway should be discussed.

Response: Estimates of flow velocities for the recommended design show that the flows leaving the drop structure and entering the grassed channel

would be about 11 fps. The velocities would range between 11 and 14 fps before it leaves the grassed channel. Some scouring may be expected and during detailed design studies, an additional riprap transition channel between the drop structure and the grassed channel will be considered to prevent scouring.

Comment: Table 2 should be revised to reflect some decrease in the agricultural economy and employment due to the loss of caneland and reduction in sugar production. Similarly, the effect on agricultural water supply should be assessed in view of the reduced production.

Response: The purpose of Table 2 is to summarize significant effects of the plan alternatives which have a material bearing upon selection of the recommended plan. While it is recognized that the loss of 13.7 acres of caneland would result in reduced sugar production of about 150 tons (11 tons per acre) and reduced water needs of .09 mgd (90,000 gallons per day), the net effect is not considered to be significant. (See Department of Agriculture, State of Hawaii comments.) In comparison, the Wailuku Sugar Company has stated that 27,712 tons of sugar was produced from 213,197 tons of cane in 1973. Furthermore, the firm has also stated that it requires a minimum of 55 mgd daily and operates at a deficit at the present time. The .09 mgd would probably be unnoticed in view of the deficit, and it is unlikely that it could be effectively used for any purpose other than agriculture at this time.

Comment: A possible increase in population density with the provision of flood protection should be addressed.

Response: While it is true that population density often increases with flood protection, the existing lands within the flood plain are already highly developed, or planned for light industrial use or open space. The project will not make available large areas of land for urbanization, and no significant change in population density is expected.

(7) U.S. DEPARTMENT OF THE ARMY, U.S. ARMY SUPPORT COMMAND, HAWAII

No comments to offer.

(8) U.S. DEPARTMENT OF THE AIR FORCE

No comments to offer.

(9) U.S. DEPARTMENT OF THE ARMY, HQ USASCH

No comments to offer.

STATE OF HAWAII AGENCIES

(1) OFFICE OF ENVIRONMENTAL QUALITY CONTROL

Comment: The type of channel lining to be used between the debris basin and the existing drop structure upstream of Market Street Bridge should be stated.

Response: Paragraph 1.04 (b) has been expanded to include this information.

Comment: Would the widening of the channel from 50 to 100 feet between the Market Street Bridge and the section upstream of it cause a "bottle neck" situation and possible inundation?

Response: From the existing drop structure to Market Street Bridge, the flow velocity will rapidly increase due to the steep gradient. The high velocity would control the flow depth to adequately pass flows under the Market Street Bridge.

Comment: With respect to the continued flooding of the left bank canefields, how will erosion and sedimentation be controlled? Would the proposed project add to the cause of erosion since agricultural lands will not be protected? Will the ocean become turbid?

Response: Downstream of the debris basin, erosion of adjacent lands can be controlled or reduced by channel lining or by land treatment. As discussed in the statement and in responses to other agencies, land treatment measures will be investigated during detailed design studies, but they can only be viewed as a partial solution. Channel lining and improvements have been minimized to retain as much of the stream in its natural state, and the upstream improvements are designed to reduce flow velocities sufficiently to prevent increased erosion of the canefields or streambanks. The proposed project will neither prevent nor increase the erosion of the canefields subject to inundation under existing conditions. As under existing conditions, suspended sediments would continue to cause turbidity.

Comment: Why is flooding being allowed on the left bank? Is the project only for protection of the urban district?

Response: Flooding occurs on the left bank because the area is a natural swale or flow path which has been incorporated into the project as a flood plain waterway. The occasional and infrequent inundation of the left bank canefields allows for a minimum of channelization and does not preclude full utilization of the agricultural land during non-flood conditions. Since the plan required the least permanent commitment (loss) of agricultural land, it was favored by the agricultural interests. The proposed project does protect agricultural lands on the right bank and is not restricted to protection of urban lands.

Comment: Will the Waiehu Beach Road Bridge be adequate to handle a faster and increased runoff, without inundation?

Response: As described in paragraph 1.05 (b), a reinforced concrete invert would be constructed under the existing bridge to lower the floodwater level and adequately carry the flows under the bridge.

Comment: "More channelization increases the water runoff, . . . Iao Stream may become dry". With depletion of the water supply, the marshlands near the stream's outlet could also become dry, with adverse effects on wetland wildlife.

Response: The extent of channelization and lining is not considered sufficient to cause the stream to become dry. Between the debris basin and

the ocean, over 50 percent of the stream will remain in its natural state. The remaining portions are already lined or will be lined by the project. Local rainfall and interior drainage will continue to collect in the irregular stream bottom of the unlined portions. The marsh area is located south of the stream mouth, along the reach where the last 700 feet of the stream will be unaltered. Flood flows will continue to overflow and inundate the shoreline area since no channelization is proposed at the outlet. Under non-flood conditions, local rainfall and interior drainage should prevent drying of the low-lying marsh area.

Comment: The discussion of the extent of flooding, including areas flooded, damages in terms of cost and lives, and where flooding occurs should be expanded.

Response: Paragraphs 2.19 and 2.20 have been expanded to include this information.

Comment: In view of the poor condition cited for some dwellings in the project area, the \$30 million estimated for relocation appears inaccurate. Relocation of residents appears to be a more advantageous action to take and should be discussed.

Response: The reviewer has erroneously associated the \$30 million estimate for total flood plain relocation with the relocation of either 120 or 80 families in the Paukukalo area which may be subject to potential tsunami occurrence. Thirty million dollars covers the relocation and associated costs for 637 residences and 83 businesses in the approximately 400 acre flood plain. This plan would be a total solution in itself and would not require any other structural measures.

Partial relocation of about 80 homes in Paukukalo would cost about \$5 million, and relocation of all 120 homes in the river/tsunami flood plain under project conditions would be \$7 million. In comparison, channelization downstream of Waiehu Beach Road would cost about \$2 million. In any event, relocation channel improvements in Paukukalo would be supplemented by upstream improvements to protect the remainder of the flood plain.

Comment: What is the ratio of acres used to the acres saved for Plans A, B, and C?

Response: The number of acres of land to be acquired for each plan is as follows:

Plan A	53.1 acres
Plan B	29.5 acres
Plan C	84.2 acres

These acreages do not include lands along the channel between the debris basin and Market Street that are already acquired by the County of Maui for construction of the existing flood control improvements. The intent of the comment regarding "acres saved" is not clear. All three plans protect lands within the approximately 400-acre flood plain with the exception that Plan B does not protect 56 acres of canefields. The amount of agricultural

land required for permanent structural measures for each plan is given in Table 2. A comparison of the land commitments based on permanent structural measures and multiple uses of the flood plain waterway would be a better indicator of tradeoffs than a perhaps misleading ratio of "land used to land saved."

Comment: The difference between the \$1,660,000 authorized for the project and the \$9 million project cost should be explained.

Response: The total Federal first cost for the originally authorized project was \$1.66 million in 1966. Since then, the project has been re-formulated and redesigned to reflect public interests, new criteria and updated information and rainfall data. As a result, the project as now proposed includes additional channel with inclusion of provision for low flows, a larger debris basin, and other modifications. These modifications have resulted in higher construction costs, and, coupled by the escalation of price levels, the project Federal first cost in 1975 is \$9.5 million.

Comment: Will fences be provided along the channels for safety?

Response: See response to County of Maui, Department of Planning, page 46.

Comment: Have readings of the stream flows been taken during heavy rains?

Response: Stream flows have been recorded since 1951 by the USGS Gage No. 6070 which is located about 550 feet upstream of the Market Street Bridge. The gage records have served as the basis of the hydrology studies conducted for this project.

(2) DEPARTMENT OF TRANSPORTATION, STATE OF HAWAII

Comment: No comments to offer as it relates to and affects our transportation program.

(3) DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

Comment: The draft statement is reasonably adequate in its consideration of environmental impacts.

(4) DEPARTMENT OF AGRICULTURE, STATE OF HAWAII

Comment: The Department favors selection of Plan B and states that the proposed channelization will not have a significant impact on agriculture.

(5) DEPARTMENT OF HEALTH, STATE OF HAWAII

Comment: The Department has no objections to the project.

(6) ENVIRONMENTAL CENTER, UNIVERSITY OF HAWAII

Comment: The reason for using a 3 1/4 percent discount rate should be explained.

Response: The 3 1/4 percent discount rate is established by Section 80 of the 1974 Water Resources Development Act (Public Law 93-251) which states

that those projects authorized prior to 3 January 1969 would use the rate in effect prior to 24 December 1968. The effective rate at that time was 3-1/4 percent. This project was authorized by the Flood Control Act of 1968 (P.L. 90-483).

Comment: The design of the debris basin and its downstream effects are questioned.

Response: The debris basin not only serves to reduce downstream accumulations of boulders and debris, but also protects downstream structures from damages and failure caused by fast-moving boulders. Without a debris basin, channel improvements would be subject to such damages, causing possible failure and inundation. The response to a similar comment from the U.S. Department of the Interior discusses the debris basin design. The design flood flow velocities at various points along the proposed project takes into account the reduction in debris at the basin, and bankside erosion is not expected. The cost of maintaining the debris basin is included in the total average annual cost and is estimated at \$6,800. The disposal site for the debris removed will be determined by the County of Maui during Phase II design studies. The debris basin will not completely eliminate the transport of sediments. Suspended materials will continue to be transported to the mouth, and shoreline retreat is not expected.

Comment: The statement should include the following additional information: flood frequency curves, streamflow measurements, historical storm rainfall depths and intensities over the entire basin, the capacity of the existing bridges.

Response: Some corrections and additions have been made to the statement in accordance with the comment. Some of the information requested is not included in the statement as the circulation of the environmental statement is not intended to be a technical review, but primarily an opportunity for all concerned parties to comment on the probable environment impacts of alternative actions. The nature of the Environmental Center review comments indicates a serious concern about the technical adequacy of project design, and these matters are fully documented in the Phase I General Design Memorandum and the Design Memorandum No. 1 Hydrology. These documents are available for review in the office of the District Engineer for any flood control project. Design of U.S. Army Corps of Engineers projects are performed in accordance with applicable design criteria established by the Chief of Engineers. The bridge capacities are as follows: Market Street - 20,000 cfs, Wailuku Sugar Company Road - 9,600 cfs, Waiehu Beach Road - 38,000 cfs.

Comment: The discussion of the flood hazard should include the relationship of the peak flood discharge rates to their frequency and the average recurrence interval between peak flood discharge of 26,500 cfs.

Response: The peak flood discharge rate for the flood of record is included. Details of the other floods are recorded in the Design Memorandum No. 1, Hydrology. The flood history is only mentioned to present a general record of the frequency and severity of flooding in the Wailuku area. The design flood discharge of 26,500 cfs is the standard project flood with a recurrence interval of approximately 300 years.

Comment: The effect of the project on the unaltered stream sections should be reassessed in view of the possible increased streamflow velocities caused by the channelized sections.

Response: Velocities of channelized sections would be reduced significantly below velocities under existing conditions prior to release into the unaltered stream areas. The dissipation of channel velocities would be accomplished by a drop structure. The overall average and maximum streamflow velocities will be slightly reduced, and no increase in erosion of the unaltered streambanks is expected.

Comment: Would the channelization at the stream mouth or scouring lower the water table in the swampy coastal area and adversely affect it.

Response: Since the channel improvements end about 700 upstream from the mouth, some scouring of the remaining natural channel is expected. The coastal marsh area is located south of the stream mouth, and should not be affected adversely either by scouring or lowering of the water table. See similar OEQC comment, pages 38-39. The marsh is a coastal lowland that is periodically inundated during storms. Tidal waters should continue to fill the stream outlet.

Comment: Additional information on the migratory patterns for gobies and opae, the post-project velocity, and flow duration is needed to evaluate the ecological impacts.

Response: Information on fish resources and project effects has been based on coordination meetings with and letters from the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. No comments were received from the State Division of Fish and Game on the project. The major consideration in assessing impacts is that for most of the year, all waters below Kepaniwai Park are diverted for agricultural purposes, leaving the stream below that point dry except for local rainfall. No specific studies have been conducted by any agency on the flow velocities and duration with respect to migratory species, but it has been pointed out that during periods when there is flow in the stream, gobies and opae have the opportunity to migrate. It has also been noted that the gobies are not rare species, but are endangered in Iao Stream because of the lack of water. The project does not change the availability of water, but does provide low flow channels should it become available in the future.

Comment: The possibility that the erosion potential of downstream waters may increase due to a decrease in the debris content of the upstream floodwaters should be discussed.

Response: The potential of floodwaters to erode the streambanks is not increased by the project. Although the debris basin will trap boulders and vegetation, suspended sediment load will not be appreciably reduced, and the sediment carrying capacity of the floodwaters should remain unchanged.

Comment: The effects of a flood exceeding the design capacity should be discussed.

Response: In the event of a flood of magnitude exceeding the design flood, damages would occur. The recommended design does include safety factors

which would compensate for floods slightly exceeding design conditions, however, in an extremely rare flood event damages can be expected. The possibility of structural failure cannot be discounted, but is considered highly unlikely because of the conservative design criteria used.

Comment: The extent to which bank erosion will be reduced by channel lining should be explained, particularly the susceptibility of the left bank which will not be protected by levees or channelization.

Response: Bank erosion will be essentially eliminated for all lined sections of the stream. Erosion of the left bank not protected by channel improvements would not be aggravated by the project. An additional seven acres on the left bank will be inundated, an extension of the flood plain fringes. Flow velocities at the fringes are as low as 2 fps and the land is relatively flat and not highly erodable. The increase in flood plain area is not considered to be significant in terms of erosion or sediment transport. Planting of trees or other flood-resistant vegetation along the streambanks to reduce erosion was considered, but the possibility of fallen trees obstructing flow at Waiehu Beach Road may result in overtopping of the levees on the right bank.

Comment: A cross-section and profile of the flood channel should be shown.

Response: The cross-sections and profiles of typical sections are available in the office of the District Engineer. The channel sections are described in the project description section and vary at different reaches. Detailed construction plans are not available at this time.

Comment: The discussion of relocation alternatives should state the number of residences in both the tsunami and river flood plains and explain the alternative cost estimates. The assessment and comparison of benefits should account for lands subject to tsunami damage and damages incurred should structural improvements fail.

Response: Without the project, there are about 250 homes in the design river flood plain which are also subject to potential tsunami occurrence. If flood control improvements are implemented upstream from Waiehu Beach Road, and all the potential tsunami/river flood prone homes downstream are relocated, about 120 homes would be involved at a relocation cost of \$7 million. The partial relocation plan downstream of Waiehu Road would involve 80 homes at a cost of \$5 million. These relocation alternatives were explored with the County and residents, who stated that any relocation of homes would be unacceptable. Due to the strong opposition to the relocation concept and the correspondingly high cost expected, benefits based on potential tsunami damages were not developed and other alternatives were developed in more detail. Damages due to failure of channel structures is highly unlikely in view of the conservative design criteria followed.

Comment: The applicability of the National Flood Insurance Program as part of a comprehensive flood hazard management plan including flood plain management, flood proofing, structural methods, and relocation should be discussed.

Response: Protection under the National Flood Insurance Program by itself or in combination with other non-structural plans will not prevent loss of lives and flood damages and will not meet project objectives and needs. Flood plain management and other non-structural measures were considered as alternatives in themselves and as part of combination plans. The recommended plan includes flood plain management of the left bank canefield waterway area. In areas where considerable development has taken place already, full application of a flood management program is not always possible or desirable, although partial management can be combined with structural measures as in the recommended plan.

Comment: The statement should consider the impacts of concrete lining on water percolation and on aquatic flora and fauna in the stream.

Response: Concrete lining of sections of the stream will reduce to some extent the amount of percolation, but the result should not be significant in terms of groundwater recharge. Moreover, under most conditions, the streamflow is non-existent within the limits of improvement, and percolation is very limited. The impacts on flora and fauna in the stream are covered in the impact section.

Comment: Consideration should be given to using large boulders from stockpiles in the canefields for the construction of the proposed project.

Response: Sources of aggregate for the project construction will be examined in detail during Phase II detailed design studies. No stockpiles of boulders have been observed in the Wailuku Sugar Company fields at Iao Stream to date.

(7) WATER RESOURCES RESEARCH CENTER, UNIVERSITY OF HAWAII

Comment: The future costs of not relocating the Paukukalo community at this time should be taken into consideration. These costs would include expenditures for public facilities and potential tsunami damages.

Response: See response to Office of Environmental Quality Control comment, page 39. Potential future tsunami occurrence has been recognized throughout the public and agency coordination of alternatives. The economic, social, and physical consequences of relocation were weighed against potential future tsunami occurrence. The cost of relocation (\$5-7 million) would be between two and three times the cost of retaining the homes and channelizing the stream (\$2 million). The community disruption and difficulty of finding suitable and acceptable replacement housing was considered a distinct disadvantage. These disadvantages were considered to be of greater concern to the County of Maui and the residents than the advantages of relocation and creation of open space. In view of the desires of the local interests, Plan B is being recommended. While potential future tsunami occurrence cannot be ignored, the event is considered rare, and there is no record of prior tsunami inundation or damage in the project area.

Comment: The method for determining the 100-year frequency flood and the standard project flood should be documented.

Response: The 100-year frequency flood is determined by the Log Pearson Type III frequency analysis. The standard project flood is based upon Corps of Engineers criteria. Details of the methodology are available in the Office of the District Engineer.

Comment: A cross-section and profile of the improved flood channel should be shown to indicate whether the proposed plan will be adequate to carry the 100-year and standard project floods.

Response: Cross-sections, profiles and other technical plan data are available in the Office of the District Engineer. They are not included in the environmental statement as the circulation of the statement is not intended as a technical review of the project design. The proposed plan is designed in accordance with Corps of Engineers criteria, and the adequacy of the design is subject to review by higher authorities.

Comment: The current interest rate should be used in the benefit-cost analysis.

Response: See response to Environmental Center comments, page 40. The project economics were also analyzed at the current interest rate of 5-7/8 percent for comparative purposes. The benefit-cost ratio at that rate would be 1.2.

(8) WEST MAUI SOIL AND WATER CONSERVATION DISTRICT

Comment: The statement appears to be adequate in most places. Table 2 should reflect the loss in employment opportunities and the increase in available water due to the loss of agricultural acreage with the project.

Response: See response to U.S. SCS comment, page 37.

Comment: Table 2 should also be revised to include an increase in population density resulting from the flood protection provided.

Response: See response to U.S. SCS comment, page 37.

COUNTY OF MAUI

(1) DEPARTMENT OF PLANNING, COUNTY OF MAUI

Comment: The draft statement adequately addresses the environmental impacts. The Department and the County of Maui are fully supportive of the proposed Plan B and suggest that the project be implemented without delay. Further clarification of the archaeological investigation of the debris basin area should be included.

Response: The results of the study are discussed in paragraphs 2.26 to 2.28.

Comment: Current estimates of total project cost and the cost and type of equipment required for maintenance of the debris basin and channel should be included.

Response: Current cost estimates are included in Appendix A. The average annual cost of \$6,800 estimated for maintenance of the debris basin is included in total average annual cost. The total estimated annual cost for operation, maintenance and replacement is \$21,700. Equipment may

include crawler crane (40 tons) estimated at \$85,000; front-end track type loader (2-1/2 cubic yard capacity) estimated at \$50,000; and dump trucks (14 cubic yards capacity) estimated at \$30,000 each.

Comment: Safety features to prevent children from having access to the streambed should be considered.

Response: Safety features, such as fencing, will be considered in detail during Phase II studies. In addition to safety, the visual acceptability of alternative types of barriers will be evaluated.

ORGANIZATIONS AND INDIVIDUALS

(1) HAWAIIAN COMMERCIAL AND SUGAR COMPANY

Comment: The description of existing stream conditions should mention the HC&S irrigation water intake upstream of the Market Street Bridge and the irrigation tunnel under Iao Stream in Happy Valley.

Response: The additional information has been added to the statement.

Comment: The responsibility for reconstruction of the Spreckels Ditch flume or installation of a siphon should be clarified.

Response: As local sponsor of the project, the County of Maui will be responsible for reconstruction of the flume or installation of a siphon.

(2) C. BREWER AND COMPANY, LIMITED

Comment: The firm restates its support for Plan B and reaffirms its objection to future diminution of its water supply for other purposes. The number of acres of caneland required for the project should be clarified.

Response: 13.7 acres of cane land is required for the project and includes 7 acres between Market Street and the end of the grassed channel, and 6.7 acres for the levees bordering the residential areas in the left bank canefields.

(3) VIRGINIA V. KALAIWAA

Comment: The reviewer concurs with the recommendation of Plan B. Continued consideration should be given to preservation of natural areas for wildlife and for aesthetic and recreation purposes.

Response: As discussed in the impact sections of this statement, preservation of the natural environment will continue to be considered, and every effort will be made to minimize adverse effects to wildlife, recreation and aesthetics.

The following government agencies and citizen groups were also sent copies of the draft environmental statement in November 1974 for review. No comments have been received from them as of 15 April 1975.

U.S. Department of Health, Education, and Welfare
U.S. Department of Housing and Urban Development

State Historic Preservation Officer (17 May 1974 letter printed in Draft
ES)

Central Maui Soil and Water Conservation District
County of Maui

Department of Public Works
Department of Water Supply
Redevelopment Agency

Chamber of Commerce of Maui

Conservation Council of Hawaii, Maui Chapter

Happy Valley Community Association

Friends of the Earth







Outdoor Circle, Maui Chapter

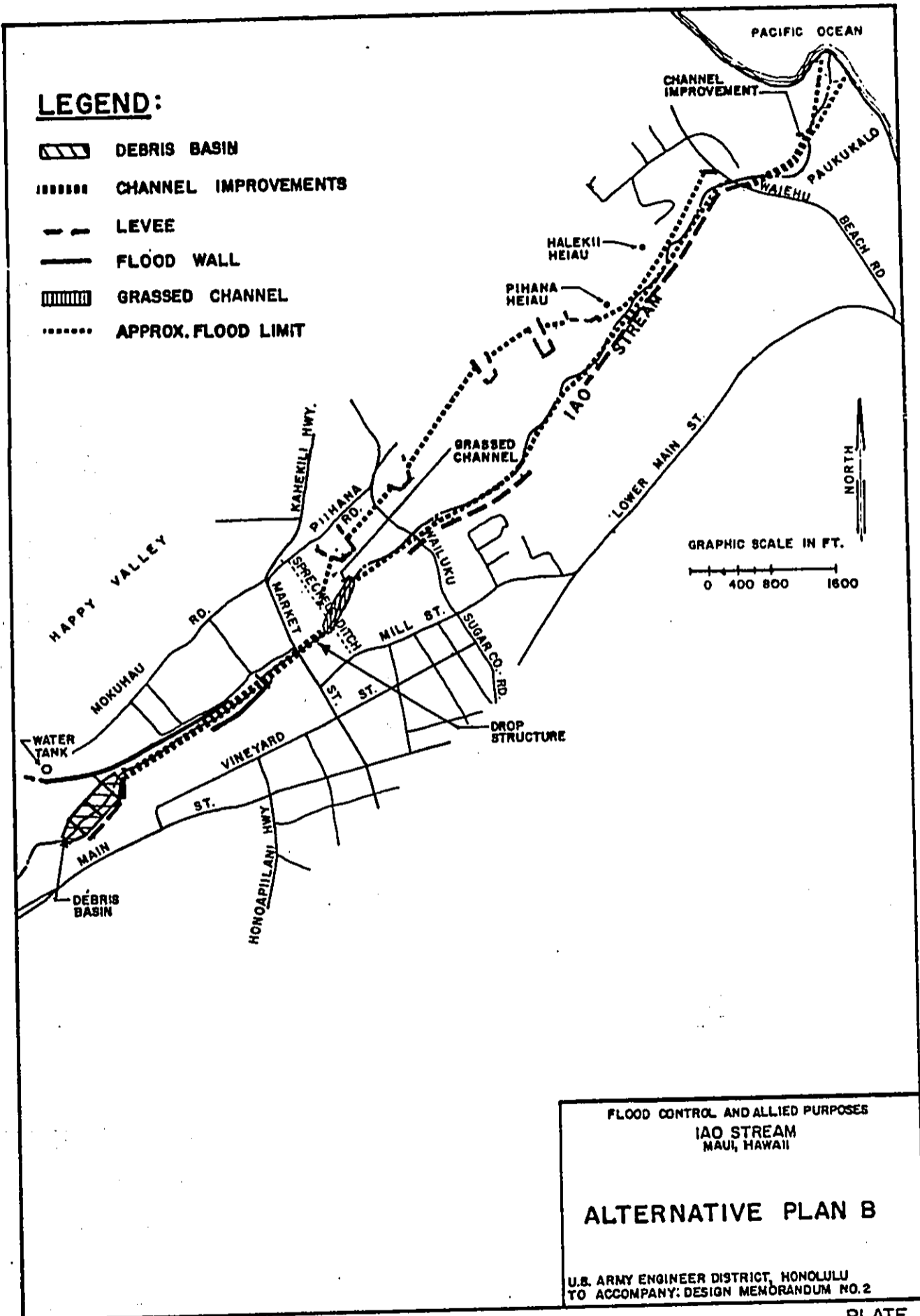
Life of the Land, Maui Chapter

Sierra Club

Paukukalo Community Association

LEGEND:

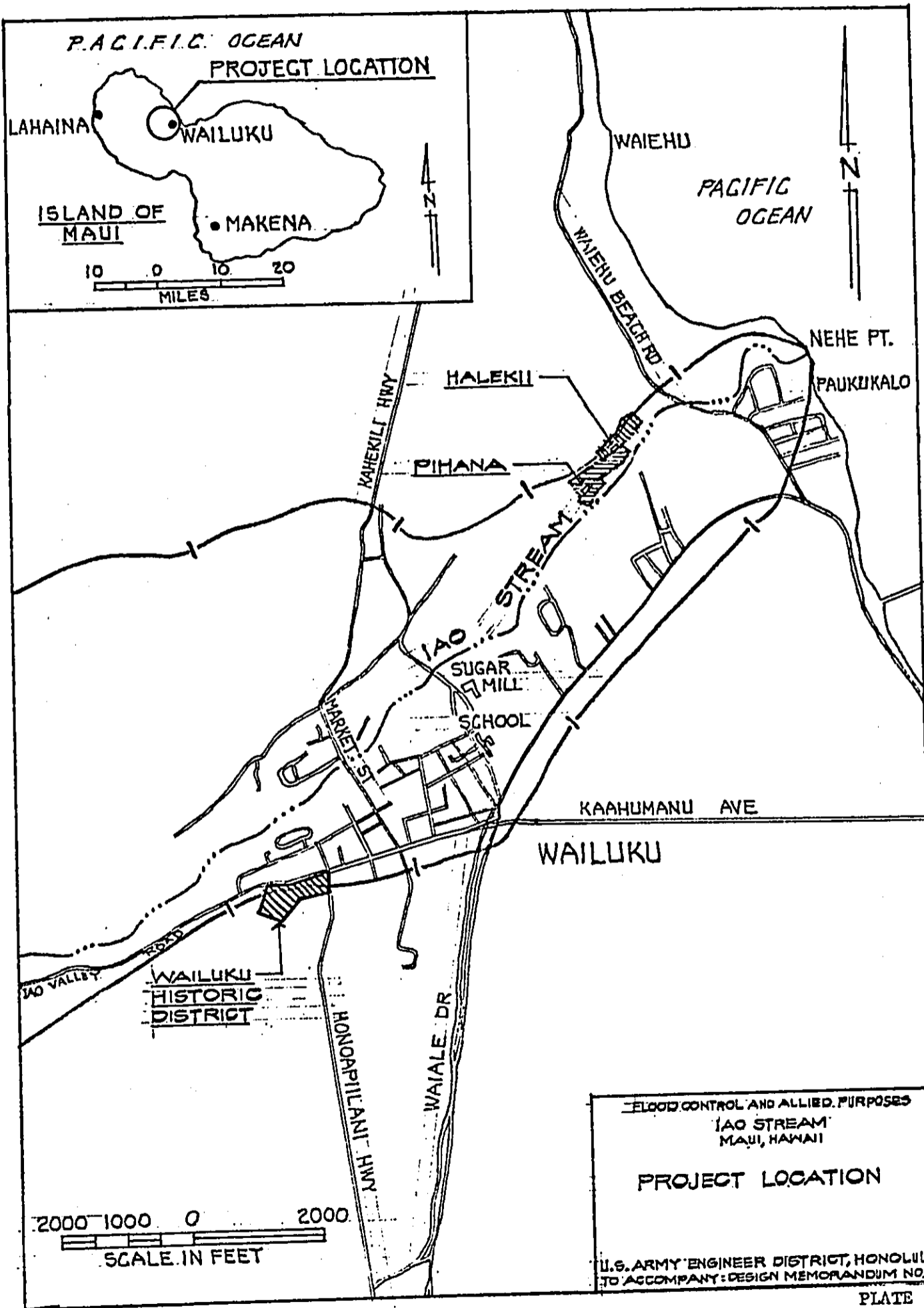
-  DEBRIS BASIN
-  CHANNEL IMPROVEMENTS
-  LEVEE
-  FLOOD WALL
-  GRASSED CHANNEL
-  APPROX. FLOOD LIMIT

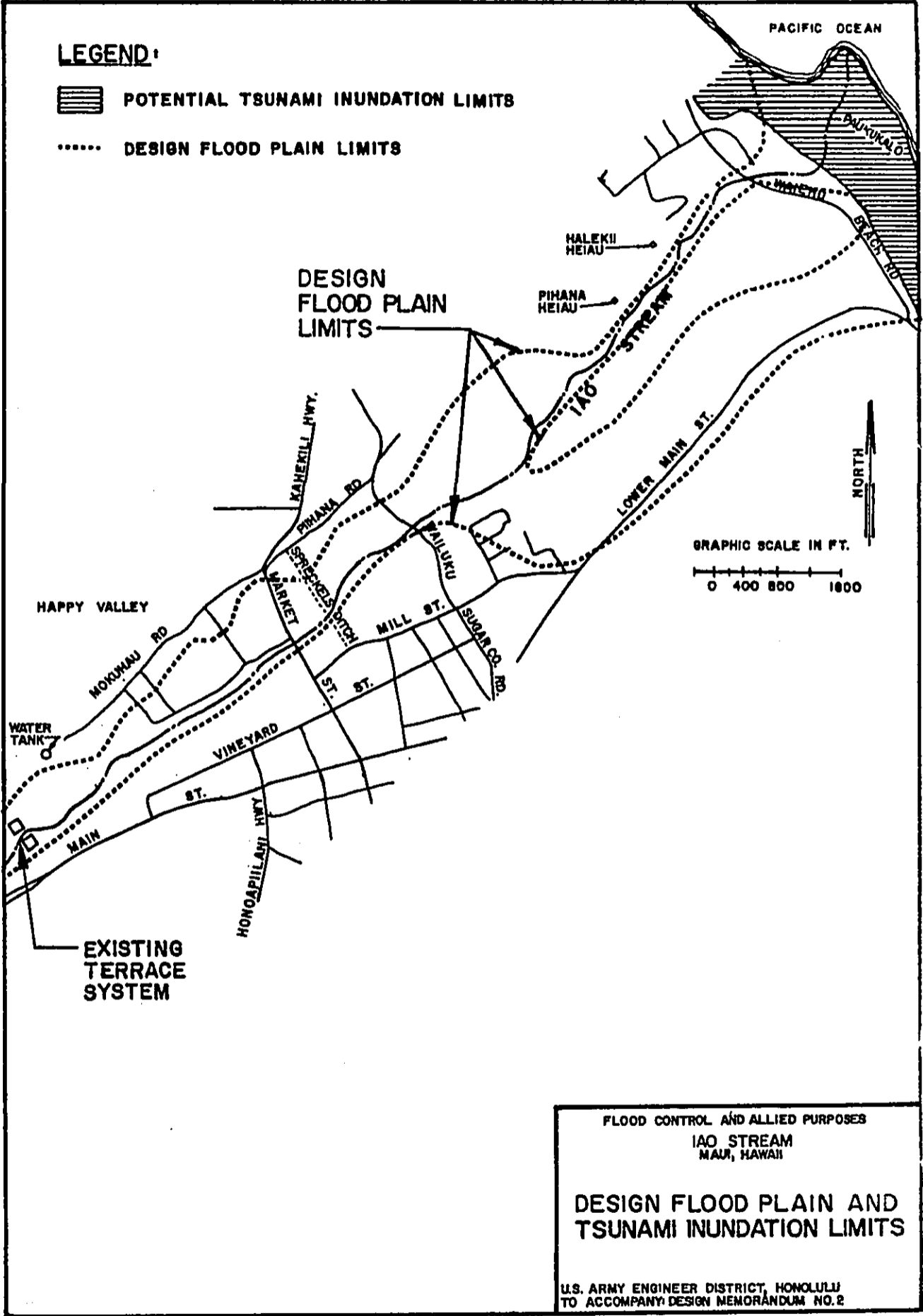


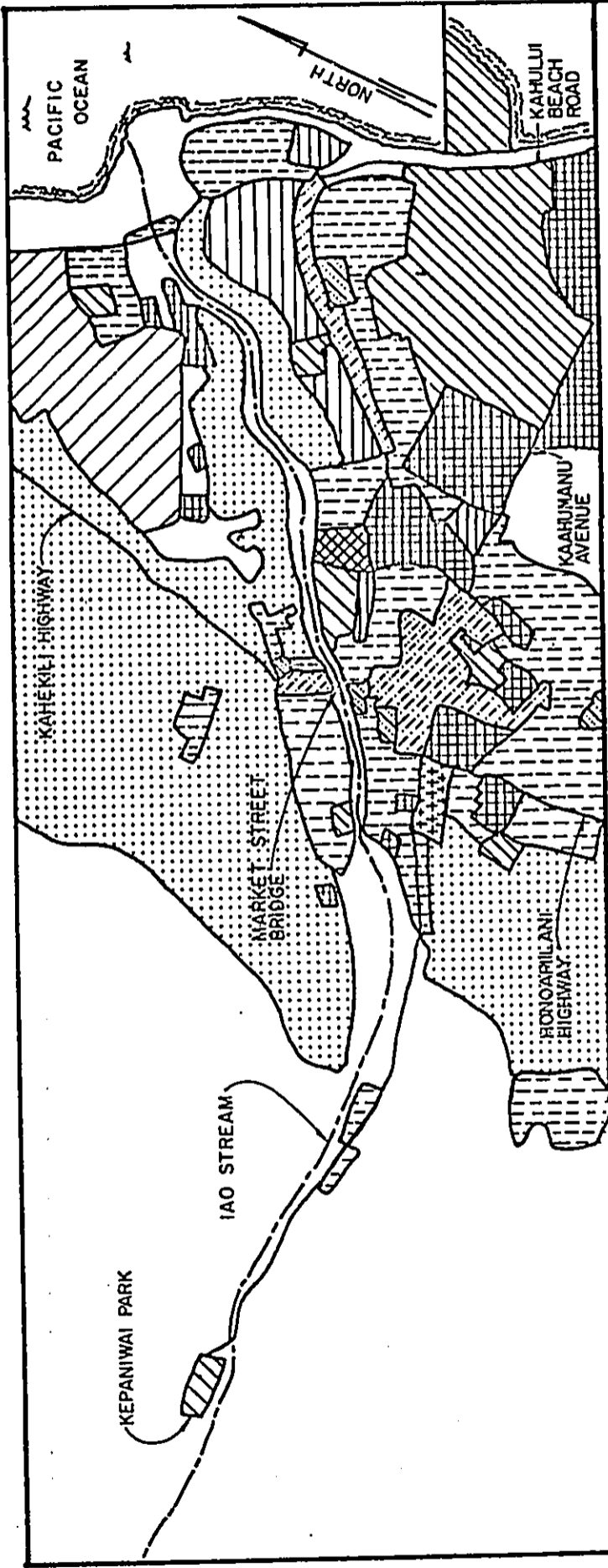
FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM
MAUI, HAWAII

ALTERNATIVE PLAN B

U.S. ARMY ENGINEER DISTRICT, HONOLULU
TO ACCOMPANY: DESIGN MEMORANDUM NO. 2







LEGEND:

- | | | | |
|--|-----------------------------|--|------------------|
| | RESIDENTIAL (MULTI-FAMILY) | | LIGHT INDUSTRY |
| | RESIDENTIAL (SINGLE FAMILY) | | HEAVY INDUSTRY |
| | COMMERCIAL | | AGRICULTURAL |
| | PUBLIC/QUASI-PUBLIC | | OPEN SPACE |
| | HISTORIC DISTRICT | | PARK |
| | | | PROJECT DISTRICT |

GRAPHIC SCALE (IN MILES)









FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM
MAUI, HAWAII

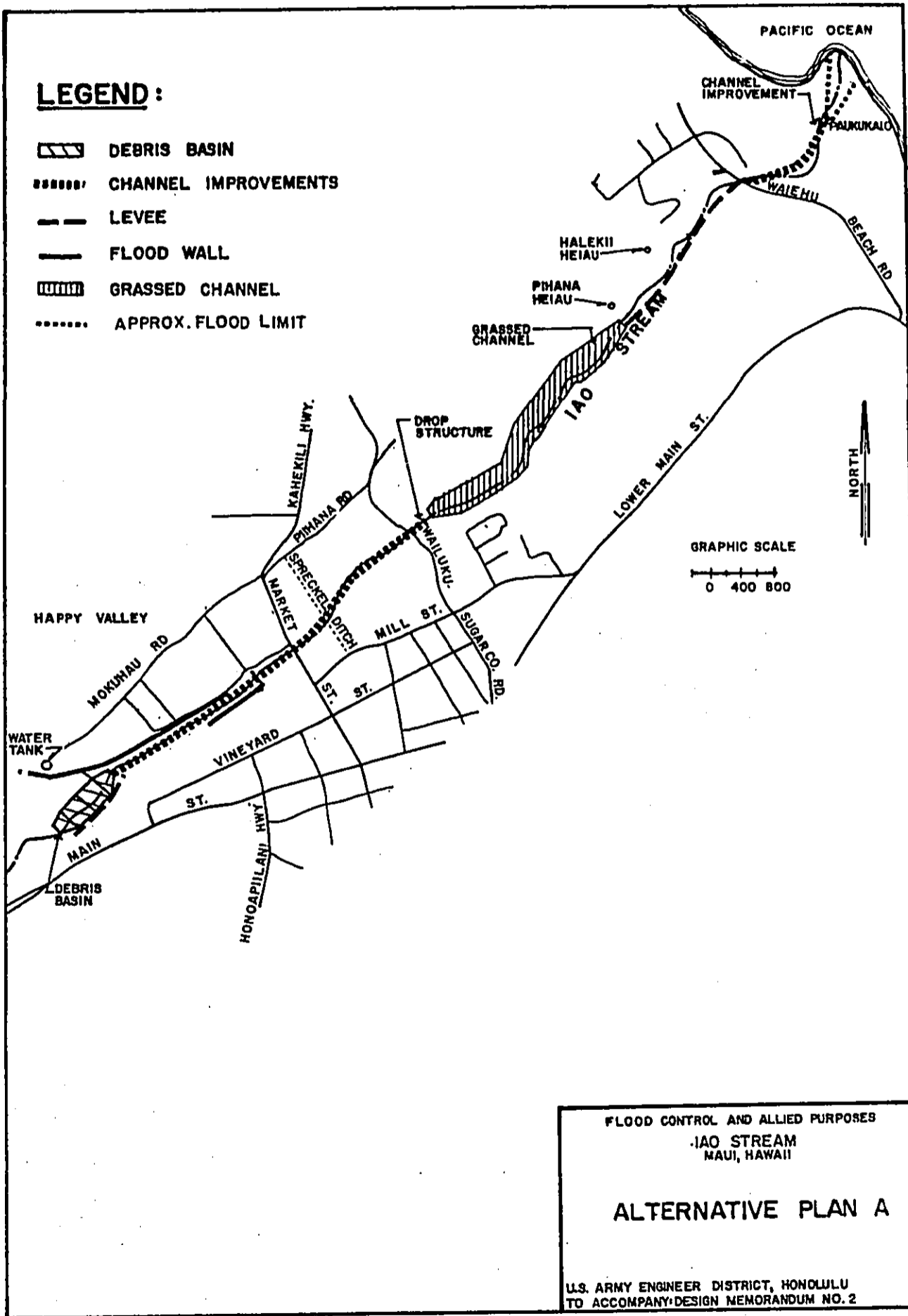
**WAILUKU-KAHULUI
LAND USE MAP**

WAILUKU-KAHULUI
GENERAL PLAN 1972








U.S. ARMY ENGINEER DISTRICT, HONOLULU
TO ACCOMPANY DESIGN MEMORANDUM NO. 2

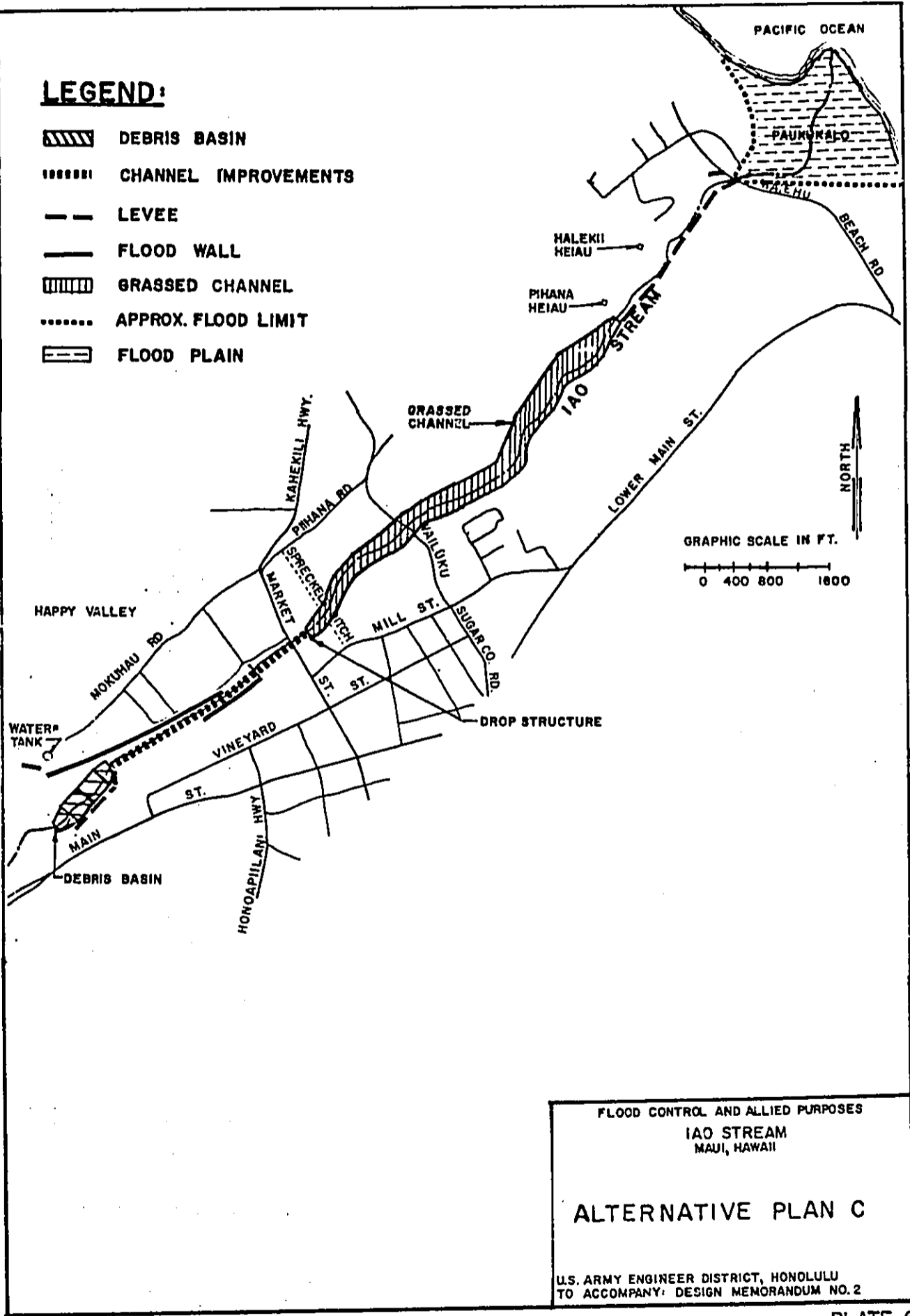
LEGEND:

-  DEBRIS BASIN
-  CHANNEL IMPROVEMENTS
-  LEVEE
-  FLOOD WALL
-  GRASSED CHANNEL
-  APPROX. FLOOD LIMIT



LEGEND:

-  DEBRIS BASIN
-  CHANNEL IMPROVEMENTS
-  LEVEE
-  FLOOD WALL
-  GRASSED CHANNEL
-  APPROX. FLOOD LIMIT
-  FLOOD PLAIN



APPENDIX A

SUMMARY OF BENEFITS AND COSTS

The total project first cost is estimated to be \$9,950,000, of which \$9,500,000 will be borne by the Federal Government. The remaining \$450,000 will be borne by the County of Maui.

The analysis of benefits and costs is based upon a comparison of the equivalent average annual charges (i.e., interest, amortization, operation and maintenance cost) with the equivalent average annual benefits anticipated to accrue over the 50-year life of the project. The value given to benefits and costs (March 1975 price levels in Hawaii) at their time of accrual was made comparable by converting them to an equivalent time basis using an interest rate of 3-1/4 percent. The following summarizes the average annual benefits and costs from which the benefit-cost ratio of 1.8 was derived. The fiscal analysis does not include intangible environmental costs, either beneficial or adverse. These environmental impacts such as fish and wildlife losses and visual impacts are discussed in the text of this statement and are not quantified in terms of dollar costs.

The following is extracted from the Phase I General Design Memorandum, Flood Control and Allied Purposes, Iao Stream, Maui, Hawaii. The complete document is available at the U.S. Army Engineer District, Honolulu, Bldg. 230, Ft. Shafter, APO San Francisco 96558.

Summary of Benefit-Cost Analysis

Federal First Cost	\$9,500,000
Non-Federal First Cost	450,000
Total Project First Cost	<u>\$9,950,000</u>
Total Average Annual Cost	\$427,000
Average Annual Benefits	
Residential Damage Prevention	\$558,000
Commercial Damage Prevention	159,000
Public Damage Prevention	19,000
Emergency Costs Reduction	<u>27,000</u>
TOTAL AVERAGE ANNUAL BENEFITS ^{1/}	\$763,000
BENEFIT-COST RATIO	1.8

^{1/} Benefits do not include prevention of damages to future upgrading.

LETTERS RECEIVED BY THE
DISTRICT ENGINEER ON THE
DRAFT ENVIRONMENTAL STATEMENT

APPENDIX B

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION - REGION ~~SIX~~ NINE

Advisory Council
On Historic Preservation
1522 K Street N.W. Suite 430
Washington D.C. 20005

450 Golden Gate Avenue, Box 36096, San Francisco, Calif. 94102

December 17, 1974

IN REPLY REFER TO:

9ED

Mr. Elroy Chinn
Acting Chief, Engineering Division
Corps of Engineers, Honolulu District
U.S. Department of the Army
Building 230, Fort Shafter
APO San Francisco, California 96558

Mr. Elroy Chinn
Acting Chief, Engineering Division
U.S. Army Engineer District, Honolulu
Building 230, Fort Shafter
APO San Francisco 96558

DEC 16 1974

Dear Mr. Chinn:

Dear Mr. Chinn:

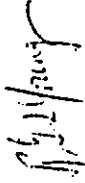
This is in response to your request of November 19, 1974 for comments on the draft environmental statement (DES) and Phase I General Design Memorandum (GDM) for the flood control improvements on Iao Stream, Maui, Hawaii. Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969, the Advisory Council on Historic Preservation has determined that your DES and GDM appear adequate with respect to detailing the Corps of Engineers' responsibilities pursuant to Section 106 of the National Historic Preservation Act of 1966 and the provisions of Executive Order 11593, "Protection and Enhancement of the Cultural Environment" issued May 13, 1971.

We have reviewed the Draft Environmental Impact Statement for the Iao Stream Flood Control Project, Island of Maui, Hawaii, and have no comments to offer.

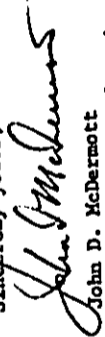
We appreciate this opportunity to review the subject Draft EIS.

However, the Council notes on page 28 of the DES and on page 13 of the GDM that the National Park Service will conduct additional cultural surveys in the vicinity of the proposed debris basin. The Corps is reminded that should these surveys identify properties eligible for inclusion in the National Register of Historic Places that will be affected by this project, then it is required to request Council comments in accordance with the "procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800) which set forth steps for compliance with Section 106 and the Executive Order 11593. Steps to determine eligibility and effect are detailed in Section 800.4 of the procedures. A copy of these procedures is enclosed for your convenience.

Sincerely yours,

For: 
F. E. Hawley
Regional Administrator

Sincerely yours,


John D. McDermott
Director, Office of Review
and Compliance

Enclosure

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

Mr. Elroy Chinn

Department of the Army
U. S. Army Engineer District, Honolulu
Bldg. 230, Ft. Shafter
APO San Francisco CA 96558

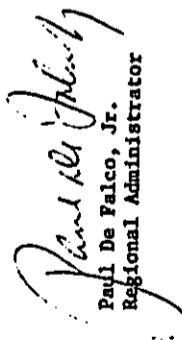
Dear Mr. Chinn:

The Environmental Protection Agency has received and reviewed the draft environmental statement for the Flood Control and Allied Purposes Iao Stream, Maui, Hawaii.

EPA's comments on the draft environmental statement have been classified as Category ER-2. Definitions of the categories are provided on the enclosure. The classification and the date of EPA's comments will be published in the Federal Register in accordance with our responsibility to inform the public of our reviews on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action and the adequacy of the environmental statement.

EPA appreciates the opportunity to comment on this draft environmental statement and requests one copy of the final environmental statement when available.

Sincerely,


Paul De Falco, Jr.
Regional Administrator

Enclosure

cc: Council on Environmental Quality

COMMENTS ON THE DRAFT ENVIRONMENTAL STATEMENT
FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM, MAUI, HAWAII

1. In the draft EIS there is a lack of information on water quality conditions. EPA suggests that water quality data be included for specific water quality parameters under existing stream conditions.
2. On Page 14 it is stated that, "The removal of bankside vegetation, lining of channel sides and bottoms, combined with generally low flows will generally result in high water temperatures ...". EPA is interested in the existing water temperature ranges and the anticipated increases in temperature within the stream for post-project conditions. In addition, what will be the differences in temperature increases between the single middle low flow channel and the channels located along the side of the larger channel (see 4.17 Page 14)? EPA encourages the Corps to utilize those features which will result in the maximum mitigation for temperature increases.
3. In the discussion of turbidity and erosion (see 4.8, Page 12) it is indicated that none of the proposed structures will reduce the turbidity of the flood waters and that flood waters inundating the cane lands can be expected to cause some erosion. Also, it is stated that, "The project will not alter the existing conditions." In considering the discussion in Section 4.8, EPA is concerned about the following points:
 - A. Generally, with flooding there usually is sediment deposited in the area flooded. Since flooding will be essentially eliminated in upstream reaches, i.e., the flood waters will be confined in the enlarged channels, material which would have been deposited on the upper flood plain will be transported downstream in the channels. Therefore, EPA requests the Corps to re-evaluate the issue of turbidity -- i.e., whether turbidity will be increased as a result of the project.
 - B. In the event that turbidity is increased as a result of the project, it is further suggested that the physical, chemical and biological impacts of increased turbidity in the ocean waters be addressed.



6. It is indicated that erosion will continue in the cane lands along the left bank. EPA is interested if the flooding in this area will be increased as a result of upstream modifications. The EIS indicates the velocity of flood flows to be about 32 feet per second pre-project condition, and 29 feet per second post-project condition. If the area (along the left bank) subject to inundation is increased, then the area subject to erosion will be increased. EPA suggests that a detailed diagram be included in the EIS showing pre-project and post-project conditions for inundation.

4. In the discussion of the Alternatives (Section 6) the velocities of stream flows are discussed for Alternative A and C (viz. 5 to 10 fps). However velocities for B, the selected Alternative, are not given. What are the anticipated velocities for the selected Alternative?

Additional information is requested to evaluate the erosion potential:

(a) What are the velocities under existing condition for the design flood? (b) Will there be an increase in velocities under post-project conditions? (c) Will the increase in velocity increase the erosion potential in the cane lands (along the left bank) and in unlined reaches of the stream?

5. A major concern is the channelization downstream of Waiehu Beach Road and the re-alignment of the stream in this reach. There are several points which should be given additional consideration:

(a) This area is in a Tsunami Inundation Area, and as the EIS indicates, the landowner may upgrade the property and add investments to the area. It would appear that to increase the value of this area would increase the damage costs when the area would be inundated.

(b) It would appear that the potential upgrading of property value and development in this area is counter to the intent of the Maui Flood Plain and Tsunami Inundation District Ordinance.

(c) Will the modifications in this lower reach have any effect on the Marsh in the area?

(d) It is pointed out that according to the Weiluku-Kehului land use map (plate 4) it appears that this lower reach is intended as an open space area. If the modifications are completed, to what degree might options be foreclosed on this plan for open space?

(e) Therefore, it is suggested that further consideration be given to an alternative which has no modifications in this lower reach.

7. According to Plate 3, the Pihana Heiau is outside the Flood Plain Limit. Yet on Page 12 (see 4.6) it is stated that, "... this Pihana Heiau Site will remain unprotected." Is the Flood Plain shown on Plate 3 the design flood plain? Is it expected that flooding will be compounded in the area of the Pihana Heiau as a result of the modifications upstream?

8. EPA suggests resolution of the following conflict identified in the EIS: On Page 15 it is stated, "... the provisions are consistent with the goals of the General Plan to restore the free flowing stream and aquatic life should water become available in the future." Yet, on Page 16 it is stated, "...the possibility of future low flow maintenance could result in more significant effects in the future. The permanence of structures preclude restoration of present type conditions for the life of the project."



UNITED STATES
DEPARTMENT OF THE INTERIOR

OFFICE OF THE SECRETARY
PACIFIC SOUTHWEST REGION
BOX 36098 • 450 GOLDEN GATE AVENUE
SAN FRANCISCO, CALIFORNIA 94102
(415) 558-8200

ER-74/1435

January 8, 1975

District Engineer
U.S. Army Engineer District, Honolulu
Building 230, Ft. Shafter
APO San Francisco 96558

Dear Sir:

The Department of the Interior has reviewed the draft environmental statement and general design memorandum for flood control, Iao Stream, Maui, Hawaii. For your convenience, our comments are presented under general and specific headings.

General

Discussion of disposal of excavated channel material does not appear in the statement text. The draft does not discuss the source of construction material. We assume that aggregate for concrete and riprap material for channel lining would probably be available from private quarries.

A review of the design memorandum and draft statement indicates that the selected plan would not appreciably affect recreational values.

We are concerned, however, with the general environmental implications of the project. It appears that both environmental and social values could be served by relocating structures. However this alternative is infeasible for the entire flood plain, since some areas are subject to both river flooding and tsunami inundation. The recommended plan is expected to result in increased development and upgrading of areas that are protected from river flooding, but subject to tsunami damage. From long term economic, environmental, and social aspects, it would seem reasonable to recommend relocation of at least some structures downstream from Walehu Beach Road. Such relocation could be complementary to recommended upstream improvements.

Another alternative that should be considered is the use of lands cleared through downstream relocation proposals listed under Plan C. If flood prone areas were cleared of structures, as suggested in Plan C, then a new land use could be determined by environmental conditions including soil types, ground

-2-

water availability, and climate. For example, utilization of flood prone lands would meet many of the stated project objectives and provide a variety of alternatives not covered in project discussions.

Since no appreciable amounts of water is now infiltrating the streambed, area water resources should not be significantly affected by the project. The debris basin could possibly improve the quality of water entering the ocean.

The draft does not specifically describe plans for spoil disposition from channel and debris basin excavation. The draft should state whether excavated material is to be used for levee construction. No estimate of volumes of excavation and fill are indicated. If these amounts are unequal, the difference should be explained.

Detailed archeological investigations around the debris basin site by the Arizona Archeological Center, National Park Service, through the Bernice P. Bishop Museum, have been conducted, but the National Park Service has not yet received the final report. Copies of the archeological report, and National Park Service's comments on it, will be provided to the Honolulu District, Corps of Engineers, when it is received. However, some of the archeological sites in the general area do appear to meet criteria for nomination to the National Register of Historic Places as outlined in Title 36 CFR 800.4 will be needed and should be documented in the final environmental statement. Archeological sites discovered in the project area should be preserved and left intact.

Specific Comments

There apparently is a conflict in the draft between the assertion (page 21) that "Plans A and B would provide protection from river flooding..." and (page 12) that, "It should be noted that flooding and damages can still occur under two conditions." Both of these conditions could probably affect the area referred to on page 21.

We suggest that the velocities estimated for flood flows through the cane fields be confirmed. The references to flows of "about 32 feet per second" and "about 29 feet per second" (p. 12, paragraph 4.8) appear incompatible with agricultural use of the land. If these flows are anticipated, erosion-control measures should be described.

Page 4, paragraph 2.8 - The spelling for the amakihi (Loxops virens) should be corrected, and the bird listed as ouku should be deleted since no record of this species exists in Hawaii.

Page 5, paragraph 2.10 - The assertion that "there are no significant populations of fish in the stream" should be documented. Mention should also be made here if any of the Iao Stream gobies are classified as endangered species.

We appreciate the opportunity to review and comment on the draft environmental statement and Phase I General Design Memorandum.

Cordially,

Michael Reis

Webster Otis
Special Assistant to the Secretary

cc: OEPR w/c Incoming
RD, FWS, Portland
RD, NPS, San Francisco
RD, BOR, San Francisco
Dir., USGS, Washington, D. C.
Dir., BOM, Washington, D. C.

Page 12, paragraph 4.8 - This paragraph should describe the reduction of debris and boulders expected with the debris basin and the particle size it is designed to control. Furthermore, the silt loads entering the stream from upper reaches of Iao Valley and sugar cane lands should be listed.

Page 14, paragraph 4.16 - The statement should indicate the extent of temperature rise, during low flow conditions, caused by the project and compare it with thermal tolerance levels of shrimp and goby species inhabiting Iao Stream. Reduction in nesting, resting and watering sites for birds and other wildlife should be quantified.

Page 21, paragraph 5.20 - We suggest a statement be added indicating which of the three alternative plans (A, B or C) is considered the best environmental plan.

Page 23, table 2 - The numbers of linear miles of concrete-lined and grass-lined channels that would be constructed with the project should be compared.

The following general and specific comments refer to the General Design Memorandum:

General

Plan C could provide long range benefits to fish and wildlife by reducing cane field flooding, erosion, and leaving the lower stream inundated. Plan B, tentatively selected, would reduce fish and wildlife habitat because of channelization and streamside vegetation removal. However, this plan would be acceptable if all vegetation removed during construction were replaced to adequately shade the stream channel, thus decreasing water temperatures. Tree cover would be desirable along the compacted fill on the right stream bank below Waiehu Bridge. Low flow channels containing protruding boulders would aid in retarding low flow runoff and maintain a somewhat longer flow period of benefit to fish and wildlife.

Although Plan B contains provisions to minimize stream bank erosion, we are concerned that the cane field runoff would cause additional erosion in the basin and siltation to the stream and marine environment. Perhaps sufficient agricultural lands bordering the fields and/or stream should be acquired to provide a vegetative buffer strip or greenbelt. The greenbelt could act as a filter to prevent silt from entering the stream and also provide valuable wildlife habitat.

Specific

Page 9, paragraph 8.6 of the Design Memorandum. The bird listed as the Ouku should be deleted since there is no record of this species having existed in Hawaii.



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

-2-

January 13, 1975

Mr. Elroy Chinn, Acting Chief
Engineering Division - Honolulu District
Corps of Engineers
U. S. Department of the Army
Bldg. 230, Ft. Shafter
APO San Francisco 96558

Dear Mr. Chinn:

The draft environmental impact statement "Flood Control and Allied Purposes - Ioa Stream, Maui, Hawaii," which accompanied your letter of November 19, 1975, has been received by the Department of Commerce for review and comment.

The statement has been reviewed and the following comments are offered for your consideration.

GENERAL COMMENTS

During the initial review of the proposed project the U. S. Department of Commerce National Marine Fisheries Service recommended minimum flow escapement to fill at least partially the entire stream bed throughout the year (See Appendix B. of the DEIS, letter dated February 22, 1974). The DEIS outlines a number of design features which will minimize the potential adverse effects of channelization, including the incorporation of a low flow or pilot channel within the main channel.

However, we note that plans to release water for low flow stream maintenance have not gone through as we recommended. In our opinion, the release of at least part of the 50 mgd flow is very important to assure the survival of the many rare and endemic diadromous species found in Ioa Stream.

With the exception of the above recommendation, we anticipate that the Proposed Plan B will have a minimal effect on the resources for which NMFS has responsibility.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you.

Sincerely,

Sidney R. Gailer
Sidney R. Gailer
Deputy Assistant Secretary
for Environmental Affairs

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

440 Alexander Young Building, Honolulu, Hawaii 96813

January 7, 1975

Mr. Elroy Chinn, Acting Chief
Engineering Division
U.S. Army Engineer District,
Honolulu
Bldg. 230, Fort Shafter
APO San Francisco 96558

Dear Mr. Chinn:

Subject: Draft Environmental Statement - Flood Control and
Allied Purposes, Iao Stream, Maui, Hawaii

We have reviewed the above-mentioned draft and offer the following
comments for the consideration of the planners:

The last sentence in Item 3 of the summary states that the
agricultural land that is subject to flooding can be a source
of significant erosion. This area is relatively flat and is
not considered a highly erodible area. At the same time, the
condition exists with or without the project, so should not be
considered an effect of the project.

Page 12 - The predicted rate of flow in the cane field is given
as 29 feet per second. We assume that this same rate of flow
will exist in the grass-lined waterway. What will be the effect
on the vegetative cover in the waterway, especially with poten-
tial scouring action of smaller rocks not trapped in the debris
basin?

Page 22 - Table 2 does not show any effect on agricultural
employment. The loss of 13.7 acres of canelamd and approximately
11 tons per acre of sugar production may cause some decrease in
the agricultural economy of the area.

The agricultural water supply item in Table 2 shows no effect
resulting from the project. Each acre of sugarcane in the
Mailuku area requires an average of approximately 6,500 net
gallons of water per day. The loss of 13.7 acres of sugarcane
land would mean nearly 90,000 gallons per day would be available
for existing or new canelamd or other uses.

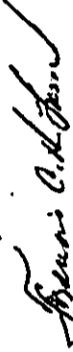
Mr. Elroy Chinn

Page 23 - Table 2 does not indicate any effect of the project
on population density. Very often when flood protection is
provided in an area, population density tends to increase.

We note that the RC&D Happy Valley Flood Control Project is noted in
the draft and this planning effort takes it into consideration.

Thank you for the opportunity to review this draft.

Sincerely,


Francis C. H. Lum
State Conservationist

cc: Dr. Richard E. Marland, OEQC, Honolulu, HI



GEORGE R. ARIYOSHI
GOVERNOR



STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR

350 MALDENBLUM ST.
ROOM 301
HONOLULU, HAWAII 96813

January 3, 1975

Mr. Elroy Chinn, Acting Chief,
Engineering Division
Department of the Army
U. S. Army Engineer District, Honolulu
Bldg. 230, Ft. Shafter
APO San Francisco 96358

SUBJECT: Draft Environmental Impact Statement for Flood Control
and Allied Purposes Iao Stream, Waialuku, Maui, Hawaii

Dear Mr. Chinn,

As of this date, this Office has received eight comments on the above subject. An attached sheet lists the responding agencies.

In our evaluation and comments provided on the draft EIS (dEIS), we find several areas in which the final EIS should expand discussion. The following comments are offered:

UPSTREAM CHANNEL MODIFICATIONS

The discussion of channel modifications between the debris basin and the existing drop structure upstream of Market Street Bridge should be expanded to include the type of channel lining.

In widening of the upstream channel to 100 feet with the Market Street Bridge opening at 50 feet, would this simulated bottle neck situation be subject to inundation? We recommend a discussion.

EROSION CONTROL AND FLOODING

On page 2, the dEIS states, "The floodwaters would overflow the left bank, and the existing canefields would remain in the flood plain." How will erosion and sedimentation beyond the debris

RICHARD E. MARLAND, Ph.D.
INTERNAL DIRECTOR
TELEPHONE NO.
548-9815

Page 2

basin be controlled? Would the proposed project add to the cause of erosion since agricultural lands will not be protected? Will the ocean become turbid?

Also, the above statement needs discussion. Why would flooding occur on the left bank? Is the flood control project only for the urban district?

RUN-OFF

Widening the building concrete structures along the stream's course would increase the rate of run-off. Since the dEIS does not mention to what extent the Waiehu Beach Road Bridge will be improved, will it be adequate to handle a faster and increased run-off without inundation?

Also, it should be noted that more channelization increases the water run-off. In other words, with any intensity of rain, water will be easily channeled into the ocean. Thus, Iao stream may become dry.

WILDLIFE

Channelization of the perennial stream along with irrigation purposes can deplete the water supply. The marsh lands near the stream's outlet could become dry. Thus, an adverse effect could harm the wildlife like the endangered Hawaiian stilts. On this basis, this Office recommends an expanded discussion.

FLOOD PROBLEM

Although flood frequency has been mentioned in the dEIS, a discussion of its extent is recommended. For example, how many acres were flooded, the damages in terms of cost and lives, and where the flooding has occurred.

RESIDENTIAL COMMUNITY OF PAUKAUKALO

The dEIS states, "...a number of dwellings there are now dilapidated and/or abandoned..." How could \$30 million dollars for relocation of residents be accurate for this area in the above condition? Wouldn't relocation be advantageous at this time rather than continue the risk of lives as brought out by the Water Resources Research Center? We strongly recommend a discussion in the final EIS.

LAND USED TO LAND SAVED

What is the ratio of acres used to the acres saved for Plan A, B, and C?

LIST OF RESPONDING AGENCIES

CLARIFICATION

Why does the General Design Plan authorize Corps of Engineers \$1,660,000 and the dEIS says 9 million dollars. A discussion would be helpful.

SAFETY

The discussion on the safety features of the flood control project is inadequate. Will fences be provided?

STREAM GAUGES

Have readings of the stream flows been taken during heavy rains?

RECOMMENDATIONS

For brevity and fairness, this Office did not attempt to summarize other commentors. Instead, we recommend that careful consideration be given to each comment.

We further recommend that 1) written responses be sent to all commentors including this Office, indicating how specific concerns were considered, evaluated, and disposed; 2) all comments and your responses should be incorporated as an appendix to the final EIS; 3) a copy of the final EIS should be sent to those individuals that provided substantive comments to the draft EIS.

We trust that these comments will be helpful to you in preparing the final EIS. Thank you for opportunity to review the draft EIS. We look forward to the final EIS.

Sincerely,

Richard E. Marland
Richard E. Marland
Interim Director

Attachment

*no comments

FEDERAL

*Department of the Air Force December 19, 1974

STATE

*Department of Transportation December 9, 1974

*Department of Planning and Economic Development December 12, 1974

Department of Agriculture December 20, 1974

Department of Health December 27, 1974

UNIVERSITY OF HAWAII

Water Resources Research Center December 24, 1974

Environmental Center December 23, 1974

Additional comment from the Environmental Center December 26, 1974

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 16th AIR BASE WING (PACAF)
APO SAN FRANCISCO 96353



DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
APO SAN FRANCISCO 96356

19 DEC 1974

26 December 1974

REPLY TO: DEEE (Mr Kimura, 4492158)

SUBJECT: Draft Environmental Impact Statement

TO: Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Third Floor
Honolulu, Hawaii 96813

Richard E. Marland, Ph.D.
Interim Director
Office of Environmental Quality Control
State of Hawaii
Room 301, 550 Halekauwila Street
Honolulu, Hawaii 96813

We have no comment to render relative to the draft environmental impact statements for the following projects:

- a. Kaukama Road Extension
- b. Relocation of Kapiolani Community College to Fort Ruger
- c. Expansion of Maimea Falls Park
- d. Flood Control, Iao Stream
- e. Kahe-Halawa Right-of Way for High Voltage Transmission Circuits

Dear Dr. Marland:

The draft environmental impact statements on Flood Control and Allied Purposes, Iao Stream, Maui, Hawaii, and Maianae Valley Road Reconstruction Subdivision were reviewed by this office and we have no comments to offer.

We thank you for the opportunity to review the environmental impact statements.

HENRY G. SNIDER, Colonel, USAF
Dep Comdr for Civil Engineering

Sincerely,

LEE C. HERWIG, JR.
Colonel, MSC
Environmental Consultant to Commander,
U.S. Army Support Command, Hawaii



GEORGE R. ARIYOSHI
GOVERNOR



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

December 9, 1974.

IN REPLY REFER TO:
ATP 8.2741

E. ALVEY WRIGHT
DIRECTOR
LAWRENCE P. O'NEILL
SENIOR DIRECTOR
MURRAY Y. W. LEE
SENIOR DIRECTOR
DOUGLASS SAKIMOTO
SENIOR DIRECTOR



DEPARTMENT OF PLANNING
AND ECONOMIC DEVELOPMENT

200 South King St. / Honolulu, Hawaii 96813 / P. O. Box 2368 / Honolulu, Hawaii 96808

December 12, 1974

Ref. No. 2554

JON A. BURNS
Governor
SHELLEY M. MARK
Deputy
EDWARD J. CREANEY, JR.
Deputy Director

Dr. Richard E. Marland
Interim Director
Office of Environmental Quality
Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

Subject: Draft Environmental Impact Statement
Flood Control and Allied Purposes,
Iao Stream, Maui, Hawaii

We have reviewed the subject environmental statement and have no
comments to offer as it relates to and affects our transportation
program.

Sincerely,

Ernest F. Saberski
Ernest F. Saberski
Director

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

FROM: *Ernest F. Saberski*

SUBJECT: Draft Environmental Impact Statement for Iao Stream Flood Control
Project, Maui

Our office has reviewed the subject draft and find it to be
reasonably adequate in its consideration of environmental impacts due to the
proposed project.

We have no comments to make at this time and appreciate this
opportunity to review the draft.

GEORGE R. ARIYOSHI
GOVERNOR



JOHN FARIAH, JR.
CHAIRMAN, BOARD OF AGRICULTURE

GEORGE B. ARIYOSHI
GOVERNOR OF HAWAII



GEORGE TIESI
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF AGRICULTURE
1428 SO. KING STREET
HONOLULU, HAWAII 96814

December 20, 1974

MEMORANDUM

To: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

Subject: Draft EIS for Flood Control and Allied Purposes
Iao Stream, Maui, Hawaii

The Department of Agriculture has reviewed this statement for agricultural impact. The proposed channelization, which includes construction of a debris basin and channel modification, will not have a significant impact on agriculture. The Department favors selection of Plan B.

The basic problem of sedimentation will not be improved significantly since waterborne suspended solids originate upstream of the projects boundaries. Improved soil protection practices will be required throughout the drainage basin to achieve any significant reduction in waterborne sediments.

All three plans require construction of a debris basin to retain large or more dense debris. This will aid in achieving a reduction of flood damages and threats to life by significantly reducing channel blockage in the downstream flood plain portion of the project. However, the flood plain risks will clearly remain. Plan B, 5100 feet of stream channelization, will achieve a majority of the intended improvements with the least impact on the existing agricultural activities.

It is well apparent that none of the alternatives will completely abate flood risks. Recognition of the flood risks rests in the County General Plan and Zoning ordinances. Agricultural activities will suffer occasional losses, but these are minimal when compared to losses that would occur with increased urbanization of the flood plain.

Thank you for the opportunity to review this statement.

Many thanks,

John Fariah, Jr.
Chairman, Board of Agriculture

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96807

December 27, 1974

Ref: File EPHSD-SS

MEMORANDUM

To: The Honorable Richard E. Marland, Interim Director
Office of Environmental Quality Control

From: Chief, Environmental Protection & Health Services Division

Subject: Draft Environmental Impact Statement (EIS) for Flood Control
and Allied Purposes Iao Stream, Maui, Hawaii

Thank you for allowing us to review and comment on the subject EIS. Please be informed that we have no objections to this project.

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

SHINJI SONEDA



UNIVERSITY OF HAWAII

Water Resources Research Center
Office of the Director

MEMORANDUM

December 24, 1974

MEMO TO: Richard E. Marland
Interim Director, OEQC

FROM: Reginald H. F. YoungSM
Asst. Director, WRRRC

SUBJECT: Review of Draft EIS, Iao Stream, Maui

This draft statement was reviewed for this office by E. Murabayashi, Y. Fok and H. Gee. Their review comments are submitted herewith for your consideration.

It would not seem wise to encourage upgrading the Paukukalo residential community (Para. 4.13, p. 13 and para. 5.2, p. 15) because in addition to the existing flood-prone conditions, the area is subject to tsunami inundation. As stated, ".....a number of the dwellings there are now dilapidated and/or abandoned," which seems like an opportune time to relocate the community rather than to invest moneys to realign Iao Stream below the Waiehu Beach Road.

Saving the community at this time means additional expenditures in the future to upgrade roads, installation of water and sewage lines, and other improvements which will be necessitated. One alternative is to exchange land on high ground for the inhabitants and put the existing community site into sugarcane, flood-water retention reservoir, or park use.

Para. 6.1, subsec. (3), p. 16; para. 6.2, p. 17; para. 6.15 and 6.16, p. 20, notwithstanding, in the Paukukalo area the flood control project will not alleviate the tsunami threat, nor the future expenditure the County will have to bear for upgrading the community road, water, and sewage facilities. Also, if a future tsunami should inundate the area, the loss of life and property would have an even greater adverse social and economic cost than relocating the community at this time. These future costs need to be taken into consideration.

The method for determining the 100-year frequency flood and the standard project flood should be documented.

The cross-section and the profile of the improved flood channel should be shown to indicate whether the proposed plan will be adequate to carry the 100-year frequency flood and the standard project flood.

If a benefit-cost analysis is provided for this EIS, it would be a good practice to use a current interest rate in the analysis to substantiate the 1.8 benefit-cost ratio.

RHFY:jmn
cc: H. Gee
Y. Fok
E. Murabayashi
Env. Ctr.



University of Hawaii at Manoa

Environmental Center
Main Bldg. 10 • 2540 Mānoa Way
Honolulu, Hawaii 96822
Telephone (808) 948-7361

Office of the Director

December 23, 1974

MEMORANDUM

TO: Richard Marland, OEQC
FROM: Doak C. Cox, Director
RE: Review of DEIS for Flood Control and Allied Purposes
Iao Stream, Maui, Hawaii

The following members of the University have contributed to the Environmental Center review of the above cited DEIS: Doak Cox, Jerry Johnson, Jacquelin Miller, Environmental Center; Ed Cheng and Yu Si Fok, Civil Engineering; Nancy Lopez, Hawaii Environmental Simulation Laboratory; and Glenn Shepherd, Maui Community College.

1. PROJECT DESCRIPTION

Pg. 1. a. Introduction
Para. 1.02.

The need is addressed to re-evaluate the "project's compatibility with present conditions of Iao Stream and Mailuku area" because of the lapse of six years since the project's authorization. Since the project is 97 percent supported by federal funds, a review of the project's compatibility with current national programs and economic conditions is needed also.

A discount rate of 3 1/4 percent is used for this project. That rate is less than half of the 7 percent rate suggested by the Water Resources Council in 1971. A discount rate for this project which recognizes both the long standing commitment to the Mailuku community and the national economic condition would be more equitable. Why was 3 1/4 percent used?

Para. 1.05. Debris Basin

The plans call for construction of a debris basin of 80,000 cu. yd. capacity (Para. 1.05). The purpose is, apparently to minimize accumulations of boulders and debris downstream that reduce channel capacity (Para. 2.19, pgs. 7, 12, 4.8). Careful analysis should be made of the actual state of accumulations of boulders and debris in the channel and the places of and causes for such accumulation, the downstream impacts of trapping boulders and debris at the proposed basin, and the costs and impacts of maintaining the capacity of the proposed basin.

There is little reason to believe that the rate of delivery of boulders to the site of the proposed basin is significantly greater than the natural rate. The channelization that has been provided in the past and the channelization proposed should, in general, increase flood-flow velocities and hence decrease the tendency of boulders to accumulate. Reduction of the sediment load of the stream at the proposed basin will increase the excess of sediment carrying capacity over sediment load of the stream and hence may well increase the liability of the stream banks to erode where they are not proposed to be protected by the project.

Further, the natural delta at the stream mouth (described but not recognized as a delta in Para. 2.17), may well be subjected to shoreline retreat if the exposure to waves is continued but the rate of supply of sediment is reduced.

The cost of removing sediment and debris from the basin is not included among the costs of the project in Appendix A, and the site to which the sediment will be transported and the impacts of the deposition there are not described.

2. ENVIRONMENTAL SETTING WITHOUT THE PROJECT

Pg. 5. e. Existing Stream Conditions

The documentation of the existing hazard does not include several important data. The report should include flood frequency curves and a statement describing what streamflow measurements were used in the study. Plate 3 does not show the frequency associated with the floodplain limits. If the floodplain area is associated with the design discharge of 26,500 cfs it should be so stated. The average flow velocities in the stream reaches are not documented for comparison with post project velocities. Historical storm rainfall depths and intensities over the entire basin are not fully discussed. If such information is available, it is of more interest than mean monthly rainfall depths in the low rainfall area. Information on the capacity of the existing bridges in the project area is not presented although it is expected that the Waluku Sugar Company Bridge will be inundated during extreme flood periods (para-graph 4.4).

Pg. 7. g. Flood Problem

Para. 2.20.

The discussion of the flood hazard whose mitigation is the aim of the project seems quite inadequate. We do not find discussion of:

a. The relationship of peak flood discharge rates to their frequency. Para. 2.20 gives dates of major floods, but not corresponding flood discharges, either total or peak. For the maximum flood of 1916, total rainfall over 3 days is given, but place of measurement and distribution during the storm are not given. Rainfall at Waluku cannot be considered to represent well the rainfall over the watershed.

b. The average recurrence interval between peak flood discharge of 26,500 cfs., which according to Pg. 12, Para. 4.6 will be the design flood capacity of the project.

4. ENVIRONMENTAL IMPACT OF THE PROPOSED PROJECT

Pg. 11. Para. 4.2

Several questions regarding the post project conditions follow. The assumption that the sections of the stream which will not be subject to engineering measures will remain unaltered may not be valid. If the velocities in the natural sections are increased after the project is installed then they would be altered. The natural channel sections upstream of the Beach Road may be less stable if velocities increase. Of particular interest is the stream section at the mouth where the marsh lands are. Will channelization lower the water table in the swamp area? To what extent would possible scouring effect the habitat? This consideration is especially important since the marsh is used by Hawaiian stilt, which is endangered.

The post project's effects on gobis and opae are difficult to assess since information on the migratory seasons is not provided. The post project velocity information and flow duration information is also needed to evaluate this impact. Detailed discussion of the ecological impacts of the favored alternative is vital since they are not reflected in the costs of the benefit/cost analysis, which received very heavy weight in the comparison of alternatives.

By decreasing the debris content of the flood waters upstream, the erosion potential of the water downstream may increase. The vulnerability of the cane fields to erosion could increase with the project rather than remain the same. This may happen because the 3 cfs decrease (about 10 percent) in estimated velocity may possibly be more than offset by the increased capacity of the water to erode the cane field. The relationship between the total available work energy of flowing water and the debris loads is not addressed in standard hydraulic techniques.

Pg. 12. Para. 4.7.

The effects of a flood exceeding the design capacity are not discussed. Even if the average recurrence interval of peak discharges equal to the design capacity is as much as 100 years, there will be occasions when the design capacity will be exceeded. Such occasions may arise in less than 100 years. The possibility of "overbanking" is recognized in Para. 4.7, but the impact of flooding over the proposed levees are not described.

Pg. 12. Para. 4.8.

The exposure of the unprotected cane lands to erosion is discussed in Para. 4.8. It appears that the project will reduce somewhat the erosion hazard in these lands (velocity reduction from 32 to 29 ft/sec.). Consideration should be given to the further reduction of the erosion hazard by the planting of trees or other flood-resistant vegetation along the banks where the stream passes through such lands.

Paragraph 4.8 states that lining part of the channel "will reduce bank erosion and sedimentation due to bank erosion. Is this statement correct for all of the 2.5 miles of stream or only the lined sections? Once the right bank along the cane field is protected by levees what will happen to the left bank during large events?

Pg. 14. Para. 4.16, 4.17.

The adverse effect of the proposed project on the freshwater biota are recognized in Para. 4.16. Measures to reduce these adverse effects are presented in Para. 4.17. Assurance should be given that adequate importance is given to minimizing these effects in the final design.

Pg. 14, 15. Para. 4.17, 4.19.

A cross-section and the profile of the improved flood channel should be shown to indicate the proposed plan will be adequate to carry the 100-year frequency flood and the standard project flood.

6. ALTERNATIVES TO THE PROPOSED ACTION.

The following comments pertain to the alternatives explored in the statement. Floodproofing was considered only as an extreme alternative. Selective floodproofing for maximum benefit would be more realistic. Other schemes might include floodproofing only selected business and commercial structures.

The discussion of relocation alternatives does not clearly state how many residences are currently in the overlap of the tsunami and floodplain areas or how many residences are in the low density area near the stream mouth (paragraph 2.17). The application of objective number 3 (paragraph 6.1) which discourages relocation, may not be appropriate for this doubly threatened area. Planned relocation must be considered versus unexpected destruction. Since the Corps recognizes the possibility of "greater future


tsunami damage in Paikukalo as a result of the project, acquisition of all or part of this area should be considered in detail. New federal legislation enables agencies to use federal funds to subsidize such purchases up to 80 percent. What part of the project benefits accrue to this area? In evaluating structural alternatives, estimates of the damage that could be expected if the structures failed should be included. Comparing the relative benefits of structural alternatives and floodplain management alternatives without such information is inadequate.

The National Flood Insurance Program is not mentioned in the alternatives. Under that program some of the residents might be protected financially from flood damages. The use of flood insurance as part of a flood hazard management program should not be ignored.

Comprehensive flood hazard management schemes which represent a mix of floodplain management, insurance, floodproofing, structural control methods and relocation have not been explored.

Pg. 30, Appendix A.

If a benefit-cost analysis is provided for this EIS, it is a good practice to use current interest rate in the analysis to substantiate the 1.8 benefit-cost ratio.



Doak C. Cox, Director



University of Hawaii at Manoa

Environmental Center
Maile Bldg. 10 • 2540 Maile Way
Honolulu, Hawaii 96822
Telephone (808) 948-7361

Office of the Director

December 26, 1974

MEMORANDUM

TO: Richard Marland, OEQC
FROM: Doak C. Cox, Director
RE: Additional comments on DEIS for Flood Control
and Allied Purposes Iao Stream, Maui, Hawaii

The Environmental Center received late some additional comments on the above cited DEIS which we are submitting for your consideration.

The advisability of the proposed concrete lining of the channels should be examined in the light of the effects of such a lining on water percolation and on the aquatic flora and fauna in the stream.

Retention of an uncemented cobble bottom for the channel would probably have some advantage from the aspect of groundwater hydrology. Infiltration from the stream recharges directly only groundwater aquifers in the valley sediments. No use is made of the groundwater perched in these sediments. The communication between the sedimentary aquifers and the underlying bedrock aquifer is poor, and most of the recharge to the sedimentary aquifers is probably discharged through these aquifers to the sea. However, some of the water infiltrating from the stream probably does reach the basal aquifer and contribute somewhat to its recharge.

The proposed lining of part of the channel bottom by boulder concrete would promote the retention of riffles and pools at low-water stream stages, but the plain concrete lining of part would not allow retention of riffles and pools in the part without specific provision for them in the design. Riffles and pools would be most extensively provided if the channel bottom were unlined.

If there were no lining of the channel bottom, the channel walls would, of course, have to be carried deeper to prevent undermining during floods.

Richard Marland, OEQC

2

December 26, 1974

We note that the sugar companies have large stockpiles of large boulders within their canefields. Using these boulders for the proposed project would benefit the sugar companies and permit increased agricultural usage of the land as well as provide the needed structural material for the proposed project.

The relocation alternative certainly should be carefully evaluated, particularly since some of the area will remain in flood danger due to possible tsunami inundation regardless of Iao stream management. Paragraph 6.16, pg. 20 sites the need to relocate 80 families. Even at \$100,000 per house the total cost would be \$8,000,000 or less than a third the cost (\$30,000,000) suggested in paragraph 6.2, pg. 17. Some explanation of the alternative cost estimates seems necessary.

Doak C. Cox

cc: E. Cheng
Y. S. Fok
N. Lopez
G. Shepherd



PLANNING COMMISSION
Yoshitazu Matsui, Chairman
C. Allen Freeman, Vice-Chairman
SHIRO HOKIYAMA
KAZUO KANE
George Murayama
Stanley Gosh, Ex-Officio
Carl Nakama, Ex-Officio



COUNTY OF MAUI
PLANNING DEPARTMENT
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

January 24, 1975

Mr. Elroy Chinn, Acting Chief
Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Bldg. 230, Ft. Shafter
APO San Francisco 96558

Dear Mr. Chinn:

Subject: Draft EIS - Flood Control and Allied Purposes,
Iao Stream, Maui, Hawaii

Thank you for allowing the County of Maui to comment on the Draft Environmental Impact Statement. As noted in our previous testimony, the County of Maui is supportive of Plan B, as stated in the Draft EIS.

We offer the following comments for your consideration:

1. The current status of the archaeological investigation to be conducted by the National Park Service near the proposed debris basin should be clarified.
2. The best estimate of the total project cost based on current construction cost.
3. Safety features which will be incorporated in the design to prevent children from having access to the stream bed, especially in the Happy Valley residential area of the project.
4. Estimated cost and type of equipment which will be required for maintenance of the debris basin and channel.

In summary, the draft statement adequately addresses the environmental impacts, and we are fully supportive of the proposed project, and suggest that the project be implemented without delay.

Very truly yours,

Howard K. Nakamura

HOWARD K. NAKAMURA
Planning Director

West Maui Soil and
Water Conservation District



P. O. Box 1170
Wailuku, Hawaii 96793

December 12, 1974

MAUI

Chief, Engineering Division
Department of the Army
Honolulu District
Corps of Engineers
Bldg. 96, Fort Armstrong
Honolulu, Hawaii 96813

Dear Sir:

This letter is sent to you in response to your request for comments on the Iao Project's Environmental Statement. The statement appears to be adequate in most places in our point of view. However, we do have the following comments:

1. The statement shows that you are removing 13.7 acres of cameland from production and yet you do not show that this loss of acreage will create any loss in employment opportunities (see page 22).
2. Also on page 22, you indicate that there will be no effect on agricultural water, yet the removal of the cameland means that additional water will be available for existing cameland or for perhaps new cameland, or the water might be available for other uses.
3. On page 23, you indicate that there will be no effect on population density. However, in paragraphs 4.13 and 4.14 you show that the flood protection that will be provided will tend to encourage residential and business development in the protected areas. It is our opinion that this could mean an increase in population density.

Sincerely,

David Nobrighs

David Nobrighs, Chairman
Board of Directors

cc: Don Martin, Wailuku Sugar Co.
Carl Carlson, Chairman, Central Maui SMC

TELEGRAPHIC ADDRESS
"COMMERCIAL"

ALEXANDER & BALDWIN, INC.
HONOLULU - SAN FRANCISCO

HAWAIIAN COMMERCIAL & SUGAR COMPANY
A DIVISION OF ALEXANDER & BALDWIN, INC.
PUUNENE, MAUI, HAWAII 96784

December 31, 1974

Chief, Engineering Division
Department of the Army
Honolulu District
Corps of Engineers
Bldg. 96, Fort Armstrong
Honolulu, Hawaii 96813

Dear Sir:

This letter is in response to your request for comments on the Iao Project Draft Environmental Statement, dated November 1974.

On pages 5 and 6 under Existing Stream Conditions, there is no mention of the Hawaiian Commercial & Sugar Co. (HC&S) irrigation water intake just upstream of the Market Street Bridge. Also, there is no mention of the irrigation tunnel under Iao Stream in Happy Valley. Both of these facilities are shown on the enclosed map. A set of detail maps showing these facilities was presented to the Corps of Engineers during the public hearing held on Maui during January 1974.

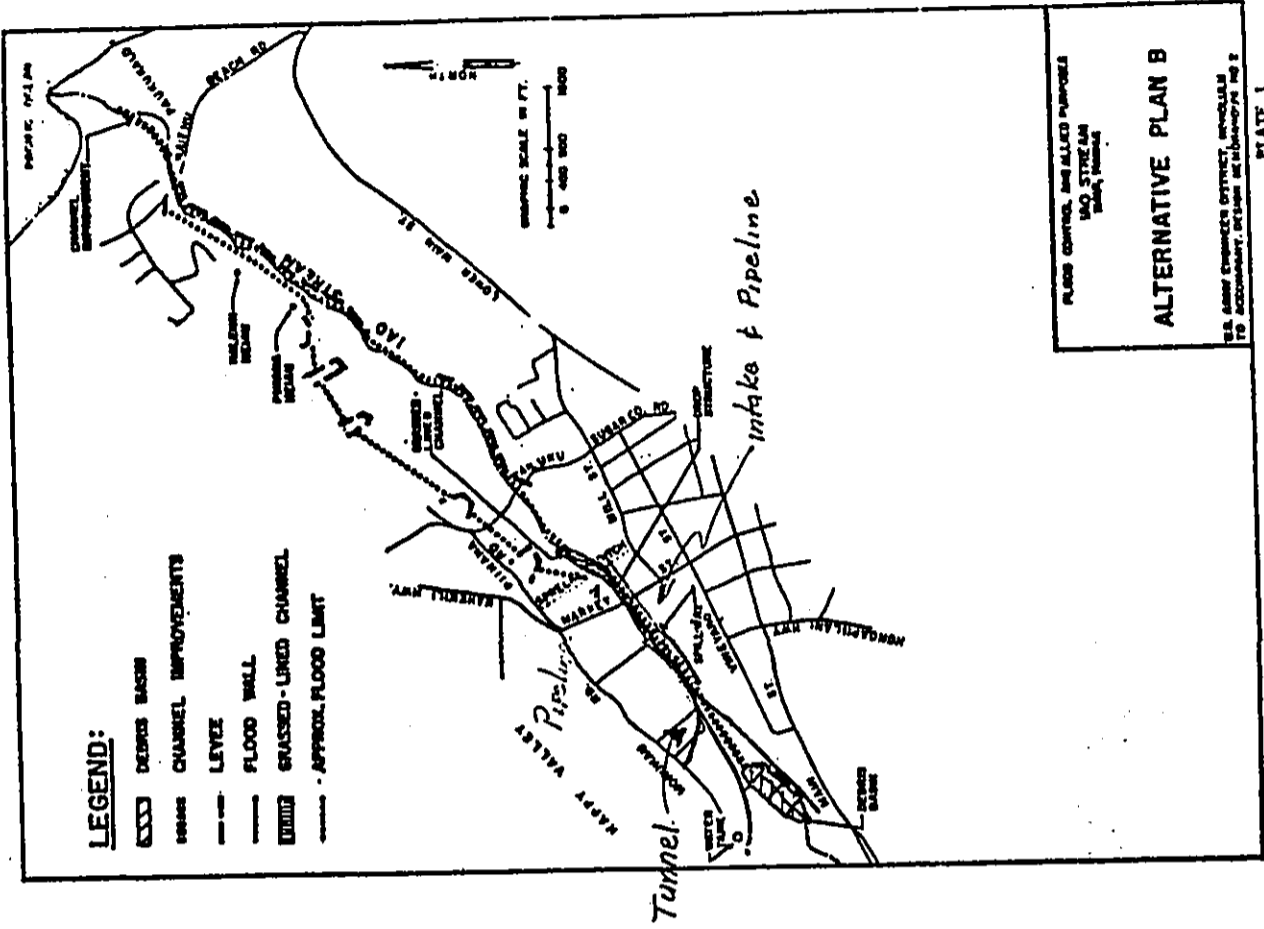
On page 29, item 9.6(b), includes the statement, "It is understood that the plans call for reconstruction of the Spreckels Ditch flume or installation of a siphon". Does this mean that this flume will have to be replaced as part of this project and financed by the sponsoring governmental agencies? HC&S Co. has no plans to reconstruct or replace this flume at any time in the future. Please clarify this matter.

Sincerely,

W. S. Haines
W. S. Haines
Manager

WSH:ec
CC: RLM
C. Carlson, Chairman, Central Maui SWCD

ADVISOR OF ALEXANDER & BALDWIN, INC.



FLOOD CONTROL AND RELATED PURPOSES
IAO STREAM
HAWAII

ALTERNATIVE PLAN B

SEE DRAWING CONTRACT, SPECIFICATIONS TO ACCOMPANY, DRAWING NUMBER 102-1

PLATE 1



C. BREWER AND COMPANY, LIMITED

December 31, 1974

PO BOX 300
HONOLULU, HAWAII 96808
CABLE ADDRESS: BREWER

Serial HLD 3026
Correas, Waialua 402

~~CONFIDENTIAL~~
Corps of Engineers
Honolulu District
Building 230, Fort Shafter
APO San Francisco, California 96558

Dear Colonel Edelstein:

Thank you for the opportunity to review in draft form the environmental statement on the flood control project for Iao Stream.

We again wish to state our support of Proposal B over the other proposals on the basis of Proposal B requiring less cane land and having a better cost benefit ratio.

In reviewing our previous testimony we have noted that Plan B would result in the loss of 7 acres of cane land. In the environmental impact statement on page 13, paragraph 4.11 the area to be lost is 29.5 acres of which 13.7 acres are in active sugar cane production. Has there been a change from prior data or is it a misunderstanding on our part?

We have also noted that the plan for trails has been deleted. We concur in this deletion for safety reasons.

We have noted that the plan also provides a discussion of minimum flows through low flow channels. We again wish to state for the record that Waialua Sugar Company is an irrigated plantation which requires approximately 55 million gallons of water a day as a minimum amount for proper irrigation practices. Iao Stream is one of the Company's most important sources of irrigation and will water and we would object to any further diminution of our water supply.

Very truly yours,

C. BREWER AND COMPANY, LIMITED

Harold P. Luscomb
Harold P. Luscomb
Manager, Land Department

HPL/dms

Iaohina, Hawaii, 96761
December 15, 1974

US NAVY ENGINEERS DISTRICT,
HONOLULU, HAWAII
RE: Draft Environmental Statement
FLOOD CONTROL AND RELATED PURPOSES
IAO STREAM, MAUI, HAWAII

Dear People:

Our Political Science class—335—of MCT was happy to receive copies of your first draft E.I.S. for the planned Iao Valley Flood Control Project. As a layman, very concerned with longterm and REGENERATED environmental effects, I must concur with your favored "plan B"; the tradeoffs appear humane; best with present technology. Our Head Instructor, Gene Deshield, has asked us, after three field trips, to furnish input based on site inspections as well as studying your first draft.

After living on Maui nearly three years, I am concerned with what I feel is many affected citizens' apathetic attitude; we can't do anything, so why bother? I hope I can speak for this silent majority of laymen.

Particularly, I consider your studied alternatives and firmly agree: People must not be relocated for those reasons—(alternate plans).

But, as a lifelong wildlife and nature lover, I still hope, along with such as IAU, etc., that more weight can be given to preserving A'AO and any endangered species. Further, I note our parker are already showing some over-use—parking, tables, etc. Naturally I don't know how much is possible, but am hoping for an increase in aesthetic and recreational considerations in your next draft, E.I.S. Mr. Deshield mentioned this.

As I mentioned in a former letter "input", the HIG flood plan (mostly concerned with tammulif) seemed so attractive when I lived there.

Now, Mr. Deshield encourages all of us learners to request a copy of the second draft E.I.S. Realizing paper costs, I will happily pay CDD; all donate to next class if needed. Our water Resources class has been very educational and fascinating.

Very sincerely,
Virginia V. Kalalawa
Virginia V. Kalalawa
175 Baker St. R-23
Iaohina, Hawaii, 96761

BIBLIOGRAPHY

1. Department of the Army, Corps of Engineers and DLNR, Iao Stream Flood Hazard Area, Wailuku, Maui, Hawaii, Map FP-15, April 1973.
2. Eckbo, Dean, Austin and Williams for the Department of Planning, County of Maui, Wailuku-Kahului General Plan, October 1972.
3. Fosberg, F. R., Guide to Excursion III, Tenth Pacific Science Congress, Revised Edition, July 1972, University of Hawaii, Department of Botany.
4. Land Study Bureau, University of Hawaii, Maui Lands Classified by Physical Qualities for Urban Usage, Circular No. 16, June 1970.
5. Mogi, Hitoshi, Iao Valley State Park Feasibility Study, Prepared for DLNR, 15 December 1971.
6. National Technical Advisory Committee, Report to the Secretary of the Interior, Water Quality Criteria, April 1, 1968.
7. Pararas-Carayannis, George, Catalog of Tsunamis in the Hawaiian Islands, World Data Center A. Tsunami, U.S. Department of Commerce, Environmental Science Service Administration, USCGC, May 1969.
8. Park Engineering, Inc. for Maui Redevelopment Agency, Vineyard Urban Renewal Project Plan, Wailuku, Maui, November 1973.
9. Tri-Isle Resource Conservation and Development Program, Happy Valley Flood Prevention, RC & D Measure Plan-DRAFT, April 1973.
10. U.S. Army Corps of Engineers, Pacific Ocean Division
General Design Memorandum, Iao Stream Flood Control and Allied Purposes, Wailuku, Maui, Hawaii, April 1975
Testimony of Public Meeting, 17 January 1974, Kahului Library
Testimony of Public Meeting, 8 July 1974, Kahului Library
11. U.S. Army Engineer District, Honolulu, Hawaii, Design Memorandum No. 1, Hydrology, Iao Stream Flood Control and Allied Purposes, Wailuku, Maui, Hawaii, March 1974.
12. U.S. Army Engineer District, Honolulu, Report on Survey for Flood Control and Allied Purposes on Iao Stream, Wailuku, Maui, Hawaii, 5 April 1966.
13. Yamanaga, George and C. J. Huzel, Jr., Preliminary Report on the Water Resources of the Wailuku Area, Maui, USGS-DLNR Circular C61, December 1970.
14. Connolly, Robert D., III, Phase I Archaeological Survey of Iao Valley Flood-Control-Project Area, Maui, Bishop Museum Ms. Report 100374 for National Park Service, 11 October 1974.