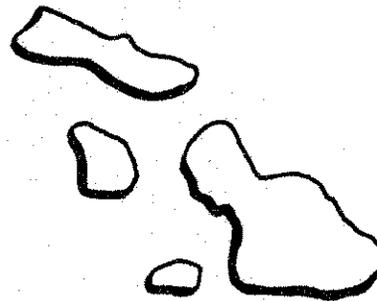
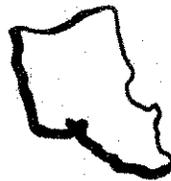


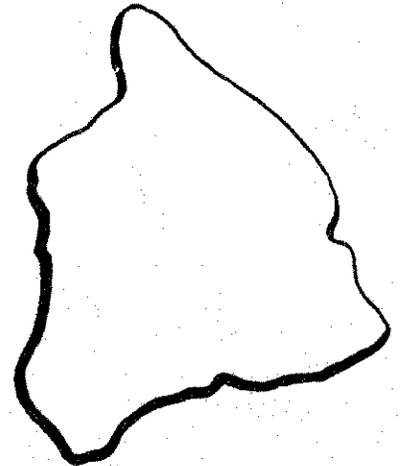
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revised
**ENVIRONMENTAL
IMPACT
STATEMENT**



**Kawa Stream
Flood Control**

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



VTT PACIFIC

**City & County of Honolulu
Dept. of Public Works**

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GEORGE R. ARIYOSHI
GOVERNOR

September 22, 1977

Mr. Wallace Miyahira, Director
Department of Public Works
City and County of Honolulu
Honolulu, Hawaii 96813

Dear Mr. Miyahira:

Based upon the recommendation of the Office of Environmental Quality Control, I am pleased to accept the Environmental Impact Statement for Kawa Stream Flood Control, Kaneohe, Oahu, as satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes, and the Executive Order of August 23, 1971. This environmental impact statement will be a useful tool in the process of deciding whether or not the action described therein should or should not be allowed to proceed. My acceptance of the statement is an affirmation of the adequacy of that statement under the applicable laws, and does not constitute an endorsement of the proposed action.

When you make your decision regarding the proposed action itself, I hope you will weigh carefully whether the societal benefits justify the environmental impacts which will likely occur. These impacts are adequately described in the statement, and, together with the comments made by reviewers, will provide you with a useful analysis of alternatives to the proposed action.

With warm personal regards, I remain,

Yours very truly,

George R. Ariyoshi

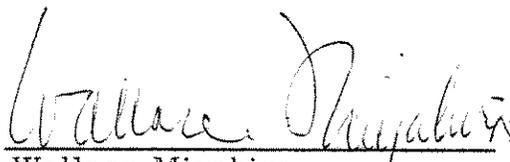
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

REVISED
ENVIRONMENTAL IMPACT STATEMENT
FOR THE
KAWA STREAM
FLOOD CONTROL PROJECT

Kaneohe, Oahu, Hawaii
TMK: 4-5-34, 61, 62, 63, 66, 67, 70, 84 & 89

This Environmental Document is submitted
pursuant to Chapter 343, HRS

Responsible Official


Wallace Miyahira
Director and Chief Engineer

Date: August 17, 1977

Prepared by
VTN-Pacific
1164 Bishop St., Suite 906
Honolulu, Hawaii 96813

Revised
Environmental Impact Statement
for the
Kawa Stream Flood Control Project

SUMMARY

Proposing Agency

Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Accepting Authority

Governor, State of Hawaii

Description of the Proposed Project

The proposed project consists of flood and erosion control improvements to Kawa Stream, from Kaneohe Bay Drive to below Mokulele Drive. The proposed concrete lining is to be constructed in three increments of 1,800 to 2,000 feet in length for a total of 5,600 feet of channel.

Description of the Environmental Setting

The majority of the Kawa Stream watershed has been developed in urban land uses. The banks of the stream in the project area are completely occupied by residences and Castle High School. These structures are threatened by bank-overtopping and erosion. Kawa Stream has already been realigned and partially lined, concurrent with urbanization of the watershed. The project area was found to support only introduced species of stream animals, although several native fish were found in the estuarine portion of the stream near Kaneohe Bay.

Probable Impacts of the Proposed Project and Mitigating Measures

The proposed improvements will have the beneficial impacts of reducing the flood potential and eliminating erosion in the stream channel.

The project will have no significant effect on the present exotic stream animals, will not induce further development of the watershed, nor affect the water quality of Kaneohe Bay.

The proposed project may have the short-term adverse impact of increased turbidity during construction, but this can be reduced through the application of erosion control measures. Adjacent residents will be disturbed by construction activities.

Alternatives to the Proposed Project

Five categories of alternatives were evaluated; no project, non-structural alternatives, partial channel lining, full channel lining alternatives, and alternative invert modifications. The first three categories were rejected because they could not adequately meet the project goal of conveying the design discharge without causing erosion of the stream bank. A simplified invert modification is recommended to concentrate base flow in order to moderate water temperatures and improve fish habitat. . .

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- A. Agencies and Organizations Consulted for the EIS
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I. Description of the Proposed Project

A. Location

Kawa Stream is located in the southeastern part of Kaneohe, on the windward side of Oahu (Figure 1). The stream begins in the vicinity of the Hawaiian Memorial Park Cemetery on the northeasterly (makai) side of Kamehameha Highway at an elevation of 400 feet. Kawa Stream flows through the Pikoilua residential area, Castle High School, Bay View Golf Center, and empties into Kaneohe Bay near the Waikalua-Loko fish pond, a distance of about 2.5 miles.

The proposed flood control improvements are located in the mid-portion of the stream, beginning at the end of the concrete channel at the Parkway development, and extending downstream to Kaneohe Bay Drive. A tributary branch is also included in the proposed project. This project area is divided into three increments, designated according to the proposed sequence of improvement (Figure 2). The first increment, Unit 1A, is approximately 1,800 feet long and extends from the Parkway channel to the confluence with the tributary. The second increment, Unit 1B, extends approximately 2,000 feet from the confluence to Kaneohe Bay Drive. The third increment, Unit 2, consists of the 1,800 foot channel of the tributary branch.

B. Objectives

The objective of the proposed project is to convey the design storm flow through the residential development to Kaneohe Bay in such a manner as to minimize flooding and erosion damages.

1. Flood Hazard

Kawa Stream has a history of flooding that dates to the first housing developments constructed adjacent to the stream. By the late 1950's and early 1960's, both banks of the stream above Kaneohe Bay Drive had been developed with houses and most of the stream channel had been dredged, channelized and partially lined. However, these treatments have not prevented flood damage. Since 1963, at least 30 different residents have filed complaints and service requests to alleviate

flooding and/or erosion of their property adjacent to the stream. Floods in May of 1965 (4,750 cubic feet per second (cfs) at Kaneohe Bay Dr.) and February of 1969 (5,290 cfs at Kaneohe Bay Dr.) produced the greatest number of complaints. No estimate of the monetary value of the damage produced by these floods has been compiled. The design flow for the three increments, based on the City and County of Honolulu Storm Drain Standards, is 3,300 cfs for Unit 1A (tributary area of 345 acres), 6,600 cfs for Unit 1B (830 acres at Kaneohe Bay Dr.) and 2,300 cfs for Unit 2 (245 acres). These discharges exceeds the capacity of the present channel at several points, such as below Namoku Street (Unit 1A), near the end of Kenela Street (Unit 1B) and above Mokulele Drive (Unit 2). Bank overflow has occurred at these locations.

2. Erosion

Many examples of severe erosion can be found in the project area, where large portions of the stream banks have been carried away, or where holes have been scoured out of the bottom. In other sections the stream has more or less uniformly widened and deepened its channel by several feet, making the erosion less obvious. The stream banks and invert are lined at various sections which total approximately 46% of the length of the project area and 12% of the project area, respectively. The lined banks and invert, at the road crossings and at spots where erosion has been severe, range from 50 feet to 400 feet in length and have unlined sections in between. At several locations, lining one problem spot has merely shifted the erosion, and perhaps has increased erosion in some spots by increasing the stream velocity immediately downstream from the lined section. A reconnaissance was made of the stream channel in the project area, in which an estimate was made of the amount of channel enlargement that has occurred in the project area since the stream was channelized in the early 1960's. By comparing the existing channel dimensions with the dimensions indicated on the original construction plans, it is estimated that roughly 15,000 to 16,000 cubic yards of earth have been lost from the channel in the project area in about 16 years. This volume converts to a channel erosion rate of 800 tons of sediment per year, a very substantial amount when compared to the overall watershed erosion rate of approximately 2,000 tons per year

for the Kawa Stream watershed. (See Chapter II for further discussion of this subject.)

C. Technical Characteristics

A number of alternatives have been considered (see Chapter V), but a rectangular concrete channel is preferred because of greater hydraulic efficiency and minimal maintenance costs. The proposed channel will be approximately 16 to 20 feet wide by 10 to 12 feet deep, depending on the hydraulic requirements of each increment. (See Figure 3 for representative cross sections.) The new channel will realign several curves to improve flow, but will remain within the existing stream right-of-way. Plans for Unit 1A indicate a 1,900-foot channel, (the existing stream in this segment is approximately 1,800 feet long). Construction of Unit 1A will produce an excess of approximately 4,090 cubic yards of excavated material which will be trucked to an approved disposal site. The channel will have a slope of 1% to 2½%, and will have a flow velocity of 25 to 30 feet per second at 3,300 cfs. A cement rubble masonry (CRM) transition structure will be provided at the downstream end. The top of the channel will be fenced as shown on Plate 2, and the right-of-way will be landscaped.

Plans for Unit 1B and Unit 2 have not yet been developed, but the channel segments would have essentially the same design characteristics throughout, and lengths that would closely approximate the existing stream lengths (2,000 feet for Unit 1B and 1,800 feet for Unit 2).

The crossing at Namoku Street (Unit 1A) will be replaced by a box culvert 60 feet long, which will require demolition of the existing structure. Utility lines will remain in service but traffic may have to be detoured. A temporary pedestrian crossing will be provided.

The invert of the new channel will be modified to produce a greater depth of water during low-flow periods than is provided by the conventional flat invert. This will provide a better habitat for aquatic organisms and should keep the water temperature at near natural levels. (See Chapter V for a discussion of alternative modifications.)

D. Cost and Schedule

It is estimated that each increment would cost roughly \$1.1 to \$1.2 million to construct; the total project would cost roughly \$3.5 to \$4.0 million (order-of-magnitude estimate). Unit 1A has been tentatively scheduled for construction in 1978, with the second and third increments scheduled for completion by 1985. The project is programmed for construction by the City and County of Honolulu, and State assistance will be requested.

E. Historical Perspective

Urban development in the Kawa Stream watershed has almost reached full potential; 86% of the Urban District is developed, leaving only about 111 acres for future residential use. Development of the watershed began in the late 1940's with Castle High School and approximately 130 acres of homes (measured from a 1952 aerial photograph). By 1962 another 240 acres had been developed, and from 1962 to 1970, 115 acres were developed in residential uses. The most recent project is the Parkway townhouse development, where 12 of the total 40 acres have been constructed. Figure 4 shows the present land use in the watershed, and Figure 5 graphically illustrates the urban growth, as plotted from aerial photographs.

Attending this urbanization of the watershed has been a radical alteration of Kawa Stream. Each housing development has realigned or reinforced the stream in order to provide flood protection for the houses built on its banks. Figure 6 shows the original (c. 1952) stream alignment superimposed over the existing channel. The entire stream, from its mouth to Mokulele Drive, has been channelized and is periodically dredged and cleared of vegetation. From Kaneohe Bay Drive to Mokulele Drive, only 40% (2,150 feet) of the existing channel follows the alignment of the original stream. In addition, this section has been shortened by approximately 700 feet (12%), in part by cutting through two large meanders at the present locations of Puaae Place and Pouhanu Place (Figure 6). The banks in this section are lined with concrete over about one-half of the channel length, and the invert is lined over 12% of the length, including a rectangular concrete channel and a 480-foot

long box culvert at the Parkway development. The upper ends of the three tributaries have been filled in to create more useable land for houses and for the cemetery. Only the two upper forks of Kawa Stream have segments that have not been altered, amounting to approximately 6,300 feet, or 29% of the original combined stream length (four tributaries) of approximately 21,800 feet. Of these two unaltered segments, only the fork coming out of the cemetery (1,400 feet long) carries water year-round.

From the above analysis it can be seen that the proposed flood control improvements are the final stages of converting the midsection of Kawa Stream from a natural stream to an urban drainage channel. The process was first begun in the late 1950's, and has continued in piecemeal fashion to the present. The proposed project was initiated in 1970, in response to requests from residents living along the stream. An engineering design for the first increment was approved in 1972, but construction was delayed by lack of funding. The present Environmental Impact Statement is being prepared for this re-activated project, as well as the phased improvement of the second and third increments.

II. Description of the Environmental Setting

A. The Kawa Stream Watershed

1. Physical Characteristics

The Kawa Stream watershed is bounded on the east by a steep ridge 750 to 870 feet in elevation, on the west by the broad ridge on which Kaneohe is situated, and on the south by a low saddle (320 feet elevation) which separates Kawa Stream from a tributary of Kamooalii Stream (Figure 1). The total drainage area is approximately 1,070 acres (1.67 square miles). The drainage area upstream from Kaneohe Bay Drive (Unit 1B) is approximately 830 acres (1.3 mi²), and the drainage areas of the two main tributaries are 345 acres (0.54 mi²) for Unit 1A and 245 acres (0.38 mi²) for Unit 2.

2. Land Use

The growth of urban land uses in the Kawa Stream watershed was traced in the preceding chapter as a part of the historical background of the proposed project. The cause-effect relationship between urban development and degradation of the drainage system (in terms of increased flooding and erosion) is clearly evident in the Kawa Stream watershed. The watershed is divided into an Urban District (775 acres, 72%) and a Conservation District on the steep ridge (295 acres, 28%). These are shown on Figure 4, and the acreages in each category are broken-down in Table 1. Of the 775 acres of Urban District, 562 acres are currently developed in residential, commercial, public and quasi-public uses, and 102 acres are "developed" for the cemetery and golf course. This leaves approximately 111 acres of developable land (14% of the Urban District or 10% of the total watershed). It can be concluded that the extent of development of the Kawa Stream watershed has almost reached its full potential. It is estimated that the watershed supports a population of approximately 8,600 to 10,800 persons (4 to 5 units per acre, 4 persons per unit). The growth scenarios envisioned by the Corps of Engineers (1977) involve medium to high density residential uses in the remainder of the Urban District, and expansion of the com-

mercial area in the Kawa Stream watershed (at the expense of existing residential uses). These changes could increase the population of the watershed by about 1,000 to 2,000 persons.

Considering land use by the tributary watersheds, Table 1 shows that approximately 41% of Unit 1A is currently developed (including the entire Parkway subdivision which is graded and has streets, but is not completely built); this could increase to 62% if the remaining Urban land (75 acres) is developed. Approximately 39% of the Unit 2 watershed is developed, which is all of the available land (without changing the Conservation District boundary). The watershed area tributary to Unit 1B (which includes Units 1A and 2) is 56% developed and could increase to about 65%.

Certain land uses can be considered as "open space" with regard to rainfall runoff/infiltration relationships. Land uses in this category include the Hawaiian Memorial Park cemetery, the Bay View Golf Center, agriculture (grazing and banana) and the conservation lands on the steep ridge. This latter area (295 acres) supports a dense growth of guava and koa haole, with scattered mango and Java plum trees. For the watershed as a whole, approximately 47% of the land area is currently in these open space uses, which permit relatively unrestricted infiltration of rainfall. The permeability of the soils in these areas is moderate to moderately rapid (Foote, et al, 1972). The developed portions of the watershed do allow some rainfall infiltration, since a portion of the development includes lawns and school playgrounds. However, the soil structure is usually more compact and the houses, streets and parking lots seal off much of the land surface. The result is that more water enters the stream channel by overland flow, and enters it faster, than under natural conditions. The fact that over half of the watershed is thus affected is significant in its effect on the hydraulics of Kawa Stream. In the future, the proportion of open space will decrease to about 37%.

There are 110 residential lots bordering Kawa Stream in the project area (42 lots on Unit 1A, 22 lots on Unit 1B and 46 lots on Unit 2), 96 of which are owned by the Harold K. L. Castle Trust Estate. The individually-owned parcels are located on the lower portion of Unit 1B, opposite Castle High

Table 1 Land Use, Existing and Potential

Category	Total Watershed			Project Area						Downstream	
	Acres	(% of urb)	%	Unit 1A Acres	%	Unit 2 Acres	%	Unit 1B Acres	%	Acres	%
URBAN Developed ¹	562	(72.5)	52.5	140	40.6	95	38.8	465	56.0	97	40.4
Undeveloped ²	111	(14.3)	10.4	75	21.7			75	9.0	36	15.0
Cemetary and Golf Course	102	(13.2)	9.5	45	13.0			45	5.4	57	23.8
Sub total	775		72.4	260	75.3	95	38.8	585	70.5	190	79.2
CONSERVATION	295		27.6	85	24.6	150	61.2	245	29.5	50	20.8
Total	1070			345		245		830		240	
Summary											
Ultimate Development	673		63	215	62	95	39	540	65	133	55
"Open Space"	397		37	130	38	150	61	290	35	107	45
Total	1070			345		245		830		240	

Notes:

1. Commercial, residential, public and quasi-public
2. Zoned for low density residential

School. The City and County of Honolulu owns the stream right-of-way, which has a minimum width of 40 feet in Units 1A and 1B, and 35 feet in Unit 2.

3. Erosion

A great deal of concern over erosion in the Kaneohe Bay watershed has developed over the last few years. Increasing amounts of sediment from construction activities has been pointed out as one factor, along with other forms of urban pollution, that has contributed to the destruction of the coral reefs and the degradation of the aesthetic value of Kaneohe Bay (Bartram, 1976). Several attempts have therefore been made to estimate the amount of sediment produced by the streams that enter the bay. The current best estimate is that of the USGS (Jones, et al, 1971), which has been gathering sediment yield data from a number of Oahu streams. Other sediment yield estimating methods which have been used include the "Pacific Southwest Inter-Agency Committee" method (PSIAC) based on nine watershed factors (Ocean Engineering Consultants, Inc., 1973 in Bartram, 1976), and an empirical relationship between stream flow and sediment yield based on preliminary USGS data (Sunn, Low, Tom & Hara, Inc., 1971). The three estimating methods have yielded results of 1,200 tons/year, 1,210 tons/year and 320 tons/year, respectively, for the amount of sediment that Kawa Stream contributes to Kaneohe Bay. All of these figures are approximations, but since the USGS estimate is based on comparison with actual measurements on near-by streams (Kawa Stream has not been sampled), it is taken as the most reliable for the present. (However, some adjustments are necessary, as discussed below.) Kawa Stream is one of the smaller perennial streams draining into Kaneohe Bay, so its sediment contribution is relatively small, roughly 3% of the total. Only Keaahala Stream contributes less sediment (800 tons/year); the seven other perennial streams each contribute 2 to 4 times more sediment to Kaneohe Bay than does Kawa Stream (Jones, et al, 1971).

As noted in the USGS study, the reported yield is the suspended sediment that is delivered to Kaneohe Bay, and does not include sediment that settles out in the slow-moving water of the lower portion of the stream. This latter component is the bed load, which constitutes roughly 40% of the total material transported

by the stream (Jones, et al, 1971). The lower portion of Kawa Stream is very sluggish, and would be expected to trap most, if not all, of the bed load. A significant build-up of sediment has occurred below the golf course since the stream was last dredged in 1965. (Deposition is not presently occurring in the project area.) Adding this bed load component (800 tons/year) to the USGS figure give a total of 2,000 tons, as an average load of sediment carried by Kawa Stream in a year (of which 1,200 tons enters Kaneohe Bay).

This sediment is eroded from the land surface and from the stream channel itself. Since the proposed project will significantly reduce channel erosion, an attempt was made to determine the magnitude of this sediment source. Since the stream was channelized and partially reinforced in the early 1960's, accurate information could be obtained on the original channel dimensions (the "as built" dimensions, not the natural dimensions) and the date of construction. The difference between the original and the existing cross-sectional area, multiplied by the appropriate length of channel, would give the volume of earth removed from the channel by the stream. Dividing this volume by the elapsed time would give the average rate of channel enlargement. This procedure was carried out in the project area (as a rough approximation) and yielded the following results: Unit 1A, 307 cubic yards/year from 1,800 feet of channel; Unit 1B, 511 cubic yards/year from 2,000 feet of channel; and Unit 2, 147 cubic yards/year from 1,800 feet of channel. The total for the project area is 965 cubic yards/year, which converts to approximately 800 tons/year (using a density of 61.3 lb./ft³ from Jones, et al, 1971, pg. 40). This rate applies only to the project area, where the stream alignment has been radically altered (Figure 6); it is not applicable to the section below Kaneohe Bay Drive where sediment deposition is occurring, nor to the section above Mokulele Drive where the channel is essentially undisturbed. It is coincidental that the estimated bed load component equals the estimated channel erosion in the project area, since erosion of the channel, which is partly constructed in disturbed soil, would produce a significant proportion of suspended sediment as well as bed load material.

The PSIAC method of estimating sediment yield is based on topographic and land use characteristics of the watershed and does not include a factor for channel erosion, whereas

the USGS measurements reflect the sediment concentration in the stream from all sources of sediment. The sum of the PSIAC estimate (1,200 tons/year) and the estimate of channel erosion obtained in this study (800 tons/year) should therefore approximate the USGS estimate (2,000 tons/year), which turns out to be the case.

The erosion of soil from the land or from a channel and its subsequent redeposition elsewhere is affected by many interacting factors, most of which are seasonal (eg. rainfall, vegetation), cyclical (eg. wet and dry years), or changing with time (eg. land use, channel dimensions, topography, climate). The seasonal and cyclical variations reduce the value of expressing erosion as an annual rate; for example, it has been estimated that 90% of the sediment load of some Oahu streams is carried during short periods of peak runoff which total less than 20 hours per year (Bartram, 1976). Likewise, it is probable that a major portion of the 15,000 to 16,000 cubic yards of material removed from the Kawa Stream channel since the early 1960's was eroded by the 1965 and 1969 storms, both of which produced a large number of service requests for repair of the stream banks. However, the long-range changes that affect erosion and sedimentation are of more concern in terms of environmental effects, since some are influenced by human activities and can significantly alter the quasi-equilibrium of the seasonal and cyclical variations. Table 2 describes the changes in sediment yield and channel erosion as a watershed goes through a series of changes in land use, from natural forest to stable urban. The Kawa Stream watershed is currently at the "stabilization" stage following urban construction, which is characterized by stream bed degradation, severe bank erosion and a moderate sediment yield. It is impossible (with present knowledge) to predict how long stabilization will require, but since the Kawa Stream watershed has only recently reached its full potential level of urban development, it is reasonable to conclude that the stream is at the early stages of stabilization and that erosion will continue to enlarge the channel. While the sediment contribution of the Kawa Stream watershed is relatively small compared to the other streams draining into Kaneohe Bay, the local effects of channel erosion, which threatens properties adjacent to the stream, can be serious.

Table 2

RELATIVE STRENGTH OF SHEET AND CHANNEL EROSION DURING
A SEQUENCE OF LAND USE CHANGE

Land Use	Sediment Yield	Channel Erosion
A. Natural forest or grassland	Low	Relatively stable with some bank erosion
B. Heavily graded areas	Low to moderate	Somewhat less stable than A
C. Cropping	Moderate to heavy	Some aggradation and increased bank erosion
D. Retirement of land from cropping	Low to moderate	Increasing stability
E. Urban construction	Very heavy	Rapid aggradation and some bank erosion
F. Stabilization	Moderate	Degradation and severe bank erosion
G. Stable urban	Low to moderate	Relatively stable

Source: Guy, 1970 (in Bartram, 1976)

B. Kawa Stream

1. Hydrology and Hydraulics

The average rainfall in the project area is 50 inches per year with the majority occurring in the winter months. Rainfall in the area can be very intense; the storm of February 1, 1969 produced a record peak of 5,290 cfs in Kawa Stream at Kaneohe Bay Drive. Other peak flows from 1965 to 1976 are given in the following table. The perennial base discharge of Kawa Stream, primarily from springs below the cemetery (elevation 200 feet \pm), has been estimated to be 0.2 million gallons per day (MGD) (0.3 cfs) and the mean discharge to be 1.0 MGD (1.5 cfs) (Takasaki, et al, 1969).

Table 3. Peak Storm Discharges, Kawa Stream at Kaneohe Bay Drive

<u>Water Year</u>	<u>Date</u>	<u>Gage Ht. (ft.)</u>	<u>Discharge (cfs)</u>
1965	5/2/65	17.00	4,750
1968	1/27/68	11.30	2,260
1969	2/1/69	17.90	5,290
1970	1/26/70	6.37	580
1971	4/24/71	6.96	758
1972	4/14/72	7.03	779
1973	--	4.43	200
1974	1/27/74	6.26	548
1975		(Gage Discontinued)	
1976	11/25/75	(Estimate)	400

Sources: 1965-1973, Nakahara, 1974; 1974, USGS, 1975;
1975-1976, R.H. Nakahara, Pers. comm.

From its mouth to Kaneohe Bay Drive, Kawa Stream flows sluggishly through a dredged channel that is clogged in places with aquatic plants (Plate 1). At Kaneohe Bay Drive, the stream cuts through bedrock and has a very pristine appearance for several hundred feet (Plate 2). Through the project area, from Kaneohe Bay Drive to the recently constructed Parkway townhouse development, the stream is channelized with partially lined sides and an unlined invert (Plates 3 and

4). At the Parkway Development, Kawa Stream flows through an 835-foot long concrete lined channel (Plate 5) and a 440-foot long box culvert (1,275 feet total). Above the Parkway Development, the stream is undisturbed as it flows through a dense forest of mango, java plum and banana (Plate 6).

As discussed above, the Kawa Stream channel has been enlarged by erosion since it was realigned in the early 1960's. This erosion is presumably a result of changes in the hydraulics of the stream, brought about by realigning the channel and developing the watershed. Figure 6 documents the changes made to the stream; shortening the channel has caused a 20% increase in the gradient between Mokulele Drive and Kaneohe Bay Drive (0.020 ft/ft to 0.025 ft/ft), and straightening and grading the channel has reduced its "roughness", so that the water probably flows much faster now than it did under natural conditions. Using the existing cross sections (developed for the erosion estimates) and the design discharges for each unit, the following velocities can be calculated: Unit 1A (3,300 cfs), 7.0 to 10.2 feet per second; Unit 1B (6,600 cfs), 9.3 to 15.6 fps; Unit 2 (2,300 cfs), 9.3 to 13.8 fps. The maximum allowable velocity in grassed earth channels of 5 feet per second (City and County of Honolulu Storm Drain Standards) would be exceeded by flows greater than about 1,900 cfs in Unit 1A, 2,700 cfs in Unit 1B, and 1,000 cfs in Unit 2.

There is insufficient data on Kawa Stream to document any increases in discharge associated with development, but the cause-effect relationship between urbanization and increased peak flow can be demonstrated theoretically with various modeling techniques. Using such an approach, a graduate student at the University of Hawaii (Lopez, 1975) predicted peak floods on Kawa Stream with the 1969 land use pattern and with the development of the Parkway Subdivision (see also HESL, 1973). It was found that four homes (Figure 7) could be damaged by either a 50-year flood or a 100-year flood (3,600 cfs, and 4,300 cfs, respectively, at Kaneohe Bay Drive); up to 26 homes could be damaged with the "probable maximum precipitation" (43 inches in 24 hours, or approximately 13,000 cfs at Kaneohe Bay Drive). The model did not take into account flooding caused by backwater effects at the Namoku Street culvert, where significant damage to homes could occur if the culvert became clogged by debris (Lopez, 1975). It was concluded that the Parkway Development

(which represents less than 10% of the watershed) would not significantly increase flooding, although the lined channel could cause channel scour immediately downstream (HESL, 1973 and Lopez, 1975).

2. Water Quality

Water quality analyses have recently been conducted on Kawa Stream as a part of the Kaneohe Bay Urban Water Resources Study coordinated by the US Army Corps of Engineers (Konno, et al, 1976); the results for Kawa Stream are presented in Table 4 and compared with the other streams and with the Kaneohe Bay stations. For most parameters, the quality of Kawa Stream is better than or comparable to the other streams. However, there are some notable exceptions. Kawa Stream exhibited the greatest range of temperature and the highest mean temperature of any of the streams, which may be due to the combination of low flow and exposed channel. It also had one of the highest dissolved oxygen concentrations, perhaps due to flourishing filamentous algae (Maciolek and Timbol, unpubl.). Kawa Stream had some of the highest concentrations of dissolved organic carbon and total organic concentrations; the reasons for which are not known. Kawa Stream was also relatively high in the several nitrogen measurements, along with the other streams draining urban areas.

Kawa Stream drains into the south end of Kaneohe Bay, the portion of the bay that receives the majority of the urban runoff and sewage discharge. Since circulation is poor in this portion of the bay, the water quality is degraded. In the south bay, many life forms which were once abundant are now almost totally absent, such as corals, reef fishes and many species of algae (Smith, et al, 1973). However, since it has a relatively low flow (approximately 6% of the total stream discharges into the south bay), Kawa Stream is probably not a major contributor to the water quality problems of Kaneohe Bay.

Table 4 Kawa Stream Wet Weather Water Quality
Compared with Other Stream and Bay stations¹

Parameter	Unit	Kawa Stream ²		Other Streams ³	Kaneohe Bay ⁴
		Range	Mean	Overall Range	Overall Range
Streamflow	cfs	2-3	2.5	1.5-29	NA
pH		7.5-8.0	7.6	6.0-8.6	7.6-8.4
Temperature	°c	23.0-27.2	24.6	20.0-26.7	21.8-26.0
Dissolved oxygen	mg/l	8.3-10.2	9.6	6.0-10.4	5.6-9.8
Turbidity	NTU	2-89	28	1-140	2-50
Volatile Suspended Solids	mg/l	1.5-2.75	2.25	0.25-89.0	0-20.6
Suspended Solids	mg/l	6-49	18	3-640	4-127
Dissolved Organic Carbon	mg/l	<1-13.75	5.0	<1-5.2	<1-9.7
Total Organic Carbon	mg/l	5.5-17.8	10.8	<1-32.25	<1-40.5
Total Phosphorus	mg/l	0-0.32	0.12	0-1.47	0.007-0.226
Dissolved Total Kjeldahl Nitrogen	mg/l	<0.02-2.02	0.8	<0.02-1.2	<0.02-0.39
Total Kjeldahl Nitrogen	mg/l	0.07-2.12	0.79	<0.02-6.17	<0.02-1.8
Nitrate + Nitrite N	mg/l	0.42-1.4	0.92	0.04-0.71	<0.04-0.26
Total Nitrogen	mg/l	1.28-2.78	1.7	0.05-7.25	<0.02-1.90
Chlorophyll-a	4g/l	0.3-1.4	0.9	0-19.8	0-13.6
Fecal Coliform	no./100ml	1,000-5,300	3,600	<10-250,000	ND
Fecal Streptococcus	no./100ml	400-3,300	2,200	<10-100,000	ND

Notes:

1. Source: Konno, et. al., 1976, Figures 5 to 35.
2. Sampling station "k", located just above Kaneohe Bay Drive.
3. Kaneohe (2 stations), Waihee, Kahuluu, Waikane, Waiahole, Keaahala, and Heeiu Streams, and culverts from Valley of the Temples and Hokuloa subdivisions; all of which drain into Kaneohe Bay.
4. Stations near the shore, at stream mouths, at the sewer outfalls and in the channel.

3. Aquatic Life

A reconnaissance survey was made on all perennially-flowing sections of Kawa Stream to qualitatively assess aquatic habitat and to inventory species present. The stream is conveniently divisible into four habitat zones: the estuarine zone, from the mouth to the golf course; the lower stream, from the golf course to Kaneohe Bay Drive; the middle stream, from Kaneohe Bay Drive to Mokulele Drive (includes the project area); and the upper stream, from Mokulele Drive to the cemetery. Table 5 lists the animals found in each zone.

The reach of stream from the mouth to the lower edge of the golf course (approximately 2,400 feet) is subject to tidal fluctuations and a mixing of fresh and salt water. The channel is 20 to 30 feet wide and 1 to 6 feet deep (the depth increases gradually toward the mouth). It was dredged to its present width around 1958, when the wetlands at the mouth were drained for construction of the Kaneohe sewage treatment plant, and was dredged again in 1965 to remove accumulated sediment. There is a small mangrove thicket at the mouth, but aquatic vegetation is absent from the channel up to the golf course. This zone supports a larger and more diverse fauna than the other portions of Kawa Stream. It is estuarine in character, as demonstrated by the species observed. Barnacles and oysters are common on the scattered rocks at the edge of the water, and occur almost up to the golf course. Frequently observed fish were tilapia, "poecilids" (family Poeciliidae-guppies, mollies and swordtails), aholehole and o'opu okuhe. The latter two are the only native fish observed in Kawa Stream.

The lower stream zone is characterized by sluggish flow through a channel clogged with water hyacinths and other vegetation. It is probable that the hyacinths, which prefer fresh water, mark the upper limit of salt water intrusion. Species collected on five occasions in this section by the Hawaii Cooperative Fisheries Research program were poecilids, Chinese catfish and crayfish (Mike Nishimoto, USFWS, pers. comm.). The introduced poecilids were the most abundant fish.

The middle stream zone (Kaneohe Bay Drive to Mokulele Drive) has received the greatest degree of alteration (Figure 6); there is virtually no "natural" stream in this area. Where the invert

Table 5 Aquatic Fauna of Kawa Stream

Habitat Zone	% of Stream	Species Observed or Collected (VTN and/or USFWS)	
		Common Name	Scientific Name
Estuarine	17%	<u>Fish</u>	
		Tilapia	<u>Tilapiu</u> sp.
		Poecilids	<u>Poecilia</u> spp.
			<u>Xiphophorus</u> spp.
		Aholehole	<u>Kuhlia sandwicensis</u>
		O'opu okhue	<u>Eleotris sandwicensis</u>
		<u>Crustaceans</u>	
		Opae	<u>Palemon debilis</u>
		Haupa Crab	<u>Thalimita crenata</u> (?)
		"Grapsoid" Crab	Not identified
		<u>Others</u>	
		Barnacles	Not identified
		Oysters	<u>Crassotrea</u> sp.
Polychaete worm	Not identified		
Lower Stream	18%	<u>Fish</u>	
		Poecilids	<u>Poecilia</u> spp.
			<u>Xiphophorus</u> spp.
		Chinese Catfish	<u>Clarius fuscus</u>
		<u>Crustaceans</u>	
		Crayfish	<u>Procambarus clarkii</u>
Middle Stream	40%	<u>Fish</u>	
		Poecilids	<u>Poecilia</u> spp.
			<u>Xiphophorus</u> spp.
		<u>Crustaceans</u>	
		Crayfish	<u>Procambarus clarkii</u>
		<u>Amphibians</u>	
		Bullfrog	<u>Rana catesbeiana</u>
Wrinkled frog	<u>Rana rugosa</u>		

Table 5 (Continued)

Upper Stream	10%	<u>Fish</u>	
		Poecilids	<u>Poecilia</u> spp.
		Chinese Catfish	<u>Xiphophorus</u> spp. <u>Clarius fuscus</u>
		<u>Crustaceans</u>	
		Crayfish	<u>Procambarus clarkii</u>
		<u>Amphibians</u>	
		Bullfrog	<u>Rana catesbeiana</u>
		Wrinkled frog	<u>Rana rugosa</u>
		<u>Other</u>	
		Aquatic snails	Not identified
		Aquatic insects	Several families

Notes:

- a. This is not an exhaustive inventory, but is representative of the dominant species present in the stream.
- b. Appreciation is extended to the US Fish and Wildlife Service for providing records of their collections and for assistance in identifications.

is unlined, holes, obstructions and aquatic vegetation provides some habitat for aquatic organisms. However, this habitat is disturbed each time the channel is cleaned by a bulldozer operating in the stream (Plate 4). A resident reported having caught o'opu, Chinese catfish and tilapia near the lower end of the Parkway channel until their disappearance in the early 1970's; he had noted a marked decline in the number of aquatic animals concurrent with the urbanization of the watershed. This zone is now dominated by the poecilids and several species of frogs. The Parkway channel, in spite of being completely lined, was found to contain a large number of poecilids, frogs and aquatic snails. However, there is no protection, other than a few clumps of vegetation, behind which these animals can take refuge during high flows.

Kawa Stream branches into two forks above the Parkway box culvert; the longer fork is undisturbed, but does not flow perennially (although residents report that it did in the past). The shorter fork is fed by springs and runoff from the cemetery; the upper 700 feet of this fork has been filled in, but the remainder is undisturbed. The section between the cemetery and the Parkway culvert (1,400 feet) supports a relatively diverse fauna, considering the small size of the stream. The dominant fish are the poecilids, but Chinese catfish are also found, and crayfish and frogs are abundant.

The entire stream supports aquatic life, but the number of species and individuals appears to vary with the degree of disturbance to which the stream has been subjected. Native species were found only in the estuarine portion of the stream. A survey of Hawaiian streams by the University of Hawaii supports these observations; preliminary results of this survey indicate that channel modification is detrimental to the native animals, since exotic species were found to be dominant in all types of altered channels, whereas native species were uncommon in altered channels and entirely absent from stream segments with concrete lined inverts (Maciolek and Timbol, unpubl.).

III. Probable Impacts of the Proposed Project and Mitigation Measures

A. Flooding

The curving alignment of the existing channel through the project area contributes to an unstable flow resulting in bank over-topping at lesser discharges than would be predicted by standard modeling procedures. In addition, culvert crossings, as at Namoku Street, can (and have) become clogged with debris causing the stream to overflow. Six residents have reported flooding from Kawa Stream overflowing its banks; Lopez (1975) predicts an additional four homes potentially affected by 50 or 100-year events (none of which have yet complained of flooding). It is not known how many residents might have experienced minor flooding of yards but did not report damage.

The proposed channel, designed to City and County of Honolulu Storm Drain Standards, will stabilize the flow and will provide flood protection from a 100-year storm. A storm of greater magnitude could cause some damage to adjacent homes, but would be much less destructive than with the existing channel. The capacity of the Namoku Street culvert will also be increased, reducing the potential hazard of it becoming clogged.

The lower portion of Kawa Stream (below Kaneohe Bay Drive), with an estimated capacity of only 1,000 cfs, is the most flood-prone section of the stream. The flood of February, 1969 caused an estimated \$8,000 damage to the golf course, and partially inundated the sewage treatment plant without causing major damage (Corps of Engineers, 1969). However, no major channel improvements are proposed for this section of the stream, since the golf course is a relatively compatible use for a flood plain, and the treatment plant can be flood-proofed (it is already situated on higher ground).

B. Erosion and Sedimentation

The velocity in the first increment to be constructed (Unit 1A) will be 25 to 30 feet per second at 3,300 cfs. This high velocity flow can be expected to cause some channel scour at the downstream end, as it enters the upper section of Unit 1B. Both banks of Unit 1B are lined for about 250 feet below the end of Unit 1A, but the invert is unlined. Below this lined section, the east bank of Unit 1B appears to be eroding under existing conditions. The adjacent property is vacant so there is no threat to structures, but the loose fill that makes up the stream bank is contributing to the sediment load of the stream. A transition structure will be provided at the downstream end of Unit 1A, but additional temporary protection from erosion may be required downstream until the Unit 1B lining is completed.

Below the end of Unit 1B (at Kaneohe Bay Drive) the stream drops about 20 feet in a cascade over several hundred feet of bedrock. At the base of this cascade the stream has scoured out a large pool. It is possible that the increased velocity will cause this pool to be enlarged by scouring out more alluvial material in the direction of the golf course. Kaneohe Bay Drive will not be threatened, though, since it is protected by the bedrock. The pool will continue to function as a natural velocity control.

Once the lining is completed, it will eliminate erosion of the channel in the project area, which produces about 800 tons of sediment per year. The increased velocity in the project area is not expected to result in more sediment being delivered to Kaneohe Bay. The pool below Kaneohe Bay Drive and the vegetation in the channel will reduce the velocity of the smaller flows. Major floods will overflow the banks at the golf course (as occurs under present conditions) which will cause sediment deposition in the flood plain.

Construction activities in the stream may generate sediment. This will increase the turbidity of the base flow (which is presently clear) but will not result in much greater sedimentation than presently occurs during periodic channel maintenance or with storm runoff. The construction will not disturb the settling and filtering action of the pool below Kaneohe Bay Drive or the vegetation in the channel through the golf course. In addition, the Contractor is required by the City and County "Standard Specifications for Public Works Construction" to comply with all Federal, State, and County regulations concerning water pollution. The most applicable regulation is

Chapter 37a of the State Public Health Regulations, section 6.A. which states, in part, that "All waters shall also be free from soil particles resulting from erosion on land involved in earthwork... This standard shall be deemed met if it can be shown that the land on which the erosion occurred or is occurring is being managed in accordance with soil conservation practices acceptable to the Director...". Since it will be necessary to keep the construction area relatively dry, it is probable that the small base flow will be diverted around the construction area, thus reducing the potential for serious sedimentation. It is unlikely that construction can be completed in less than a year, so provisions for handling storm runoff will be made. Providing adequate diversion capacity and protecting exposed banks with riprap are typical measures.

C. Water Quality

Altered streams typically have a higher temperature, pH and oxygen supersaturation than unaltered streams, and tend to be more variable in these parameters (Maciolek and Timbol, unpubl.). These characteristics are currently found in Kawa Stream, since the majority of the stream has already been significantly altered. If the invert is not modified, temperature may be increased over present levels (Table 4) with the proposed lining. Turbidity will be decreased, except possibly during construction (see above). The Contractor will comply with Chapter 37a of the State Public Health Regulations which prohibits the discharge of deleterious substances. Persons wishing to monitor the construction activities may request notification of commencement.

The lining will not result in a greater volume of fresh water reaching Kaneohe Bay. The stream bed is at or below the water table for most of its length (the springs are at an elevation of around 200 feet), and flows over relatively impermeable bedrock. There is therefore no significant loss to channel infiltration under current conditions. Furthermore, storm waters will not reach the Bay much faster in a fully-lined channel than they do in the existing partially-lined channel. The volume of water that reaches the Bay is more a function of the paving of the watershed than the paving of the stream channel.

D. Aquatic Life

The existing stream animals in the project area, consisting entirely of introduced species, have demonstrated their ability to live in altered channels, even with full lining. Therefore, the habitat alteration that will occur from the proposed project will not result in a radical change of the stream faunal community, as would occur if Kawa was a natural stream with native organisms. Rather, a shift in species dominance and a reduction in the number of individuals can be expected. The stream community will probably be more unstable than at present, since the channel will be periodically cleared out by high flows, and will take some time to be recolonized. The native animals in the estuarine portion of the stream may be adversely affected by warmer water coming out of the channel.

In order to mitigate the destruction of habitat and increase in water temperature that typically occurs with a standard flat invert, a modification to the invert is being considered. Superelevating (tilting) the invert will concentrate the base flow while still providing slower water on the shallow edge where fish can congregate. Rocks and clumps of vegetation that invariably collect in a lined channel will provide additional habitat. Other modifications have been evaluated (Chapter V).

E. Land Use

The proposed lining will not induce any new land uses in the immediate project area, since both banks of the channel are already completely developed. It is possible that construction of the flood control improvements could facilitate development of the land in the upper portion of Unit 1A above the Parkway subdivision (75 acres). With the existing problems in the channel downstream, there might be a hesitation to develop the remaining Urban lands for fear of contributing to (and being held responsible for) the erosion and flood hazard. The new channel will be adequate to handle the runoff should this land be developed, although improvements to the natural channel above Mokulele Drive could be required. However, flood control is usually a minor obstacle to development, so removal of the obstacle should not have much of a stimulating effect.

There are no "sensitive" land uses in the project area, such as parks, water wells, archaeological or historical sites, that would be permanently affected by the project. Noise from construction could temporarily disturb classroom activities at Castle High School.

F. Aesthetics

The appearance of the stream right-of-way will be significantly changed by the project. The proposed rectangular channel will take up much less room than the existing trapezoidal channel, so that the stream will seem smaller. In Unit 1A, for which plans have already been drawn up, the existing channel takes up about 60% of the right-of-way whereas the new channel will take only 33%. The net result will be to add an average of about 10 feet of land to the back yards of the adjacent residences. This land will be landscaped with a suitable low-maintenance ground cover. There are no major trees in the right-of-way that will have to be removed. The appearance of the new structure will be considered by many to be an improvement over the present eroded channel; especially to those residents who have been requesting a lined channel since the 1969 flood. The residents do not appear to be dumping a significant amount of trash or yard clippings into the present channel, so it is unlikely that they will do so in the new channel. The fence at the top of the channel will also serve as a deterrent to this practice.

G. Noise, Emissions and Solid Waste

The operation of construction equipment such as tractors, trucks, cranes and air compressors will create noise that may disturb nearby residents and students at Castle High School. It is anticipated that the average noise levels at the construction site (at the adjacent property lines) will range from 78 dBA to 88 dBA, depending on the phase of construction; the noisiest equipment will be earthmovers (79-85 dBA), concrete mixers (85 dBA) and trucks (91 dBA) (Bolt, Beranek and Newman, 1971). These levels will exceed the applicable standard of the Public Health Regulations

Chaper 44 B, "Community Noise Control for Oahu", which sets 55dBA as the maximum allowable noise level at the property line in a residential zone. A permit from the Department of Health will therefore be required. The conditions of the permit will allow construction activities between 7:00 a.m. and 6:00 p.m., unless the noise levels exceed 95 dBA, in which case the operating hours will be reduced to 9:00 a.m. to 5:30 p.m. Construction which exceeds the allowable noise level will not be permitted on Sundays or holidays. If noise levels prove to be too disruptive in the temporary classrooms adjacent to the stream, some form of noise barrier or special equipment mufflers may be necessary.

Exhaust emissions will be generated by equipment during construction. Every effort will be made to create a minimum of disturbances to surrounding areas. Dust control measures, such as watering and covering excavated material in transport, will be the responsibility of the Contractor, who shall comply with Chapter 43 Section 10 of the State Public Health Regulations, pertaining to fugitive dust.

It is estimated that the construction of Unit 1A will produce an excess of 4,090 cubic yards of earth. This, and all other solid wastes such as construction debris and demolished structures will be trucked away from the site for disposal at either the Kapaa Sanitary Landfill or at a designated construction site needing fill material.

The transportation of this material could cause disturbance of the neighborhood, and some disruption of traffic. Construction vehicles must comply with Chapter 44A, "Vehicular Noise Control for Oahu". The time restrictions for the construction activities will dictate the operating hours for the construction vehicles. Consideration will be given to restricting construction vehicles from Namoku Street, mauka of the stream. All required traffic control devices will be installed by the Contractor.

IV. Unavoidable Adverse Impacts

The proposed project will permanently remove approximately 5,600 feet of altered stream habitat. The importance of this unavoidable loss is lessened by the poor quality of the existing habitat.

Adjacent residents will be temporarily disturbed by the construction activities.

The turbidity of the stream may be increased during construction, in spite of the application of erosion control procedures.

V. Alternatives to the Proposed Project

A. No Project

The No Project alternative would consist of retaining the stream in its present, partially-lined condition. Periodic maintenance would be performed to remove vegetation and to repair eroded sections. As in the past, short sections of the banks would be lined as emergency repair projects, where erosion threatens the adjacent properties. It is therefore likely that the banks and much of the invert in the project area would eventually be completely lined.

This alternative would have the advantage of saving the cost of constructing a concrete channel, although this savings would be partially offset by maintenance costs. The disadvantages would be continuation of the channel erosion and flood hazard. Since the stream channel in the project area is not "natural", there is no inherent advantage to retaining it in its present condition.

B. Non-Structural Alternatives

Non-structural alternatives include control of land use throughout a watershed, restricting development of flood plains, manipulating land surfaces to increase raindrop retention time (thus decreasing flood peaks), providing water storage areas (eg. reservoirs, ponds, spreading areas), and other flood-control measures short of converting a stream into a "storm drain".

For all practical purposes, the stream through the project area has already been converted into a "storm drain" (but an inefficient one), so any non-structural alternative would have to provide for flood protection as well as erosion control.

Since the Kawa Stream watershed is almost developed to its full potential, and the flood plain is already occupied, it is obvious that land use planning measures cannot alleviate the existing problems in the project area. Land surface treatments are likewise inapplicable, since the existing dense vegetation probably provides the best possible runoff retention for the steep slopes that characterize

the majority of the undeveloped watershed. The topography of the flood plain upstream from the project area is not suited for any simple type of water storage such as a spreading basin, and a dam would be unjustifiably expensive as well as presenting a hazard to downstream land uses.

The alternative of removing flood-threatened homes and redeveloping the flood plain as a greenway has been recommended for evaluation. This alternative could take several forms, from simply relocating about 10 families, to removing over 60 homes and restoring the stream to its original alignment. The hydraulic study noted above (Lopez, 1975) identified four homes in the Magno Subdivision, off of Pouhanuu Place, that could be damaged by a 50 or 100-year event. Six additional residents have complained of flooding directly from the stream or from overflow at the Namoku or Mokulele crossings. Purchasing these homes and providing relocation assistance to the families would cost an estimated \$660,000 to \$700,000 (\$62,000-\$66,000 for the home, plus \$4,000 each for relocation). However, this alternative would not reduce the present erosion of the stream channel.

To reduce erosion without lining or placing any structures in the stream would require a radical readjustment of the hydraulics of the channel. Water velocity in the existing channel is as high as 15 feet per second at the design discharge of 6,600 cfs (at Kaneohe Bay Drive); this velocity would have to be reduced to 5 feet per second to meet the standards for an unlined channel. Without performing a detailed hydraulic analysis, it can be shown that this would require a much larger channel. Solving the standard velocity equation, $V = Q/a$ (discharge divided by cross-sectional area), for area (given a velocity of 5 fps and the design discharge for each unit), gives the following results: Unit 1A, 660 ft², Unit 1B, 1,320 ft² and Unit 2, 460 ft². These areas are almost twice those of the existing channel cross sections. Assuming a depth of six feet, the channel would have to be about 75 feet wide in Unit 2, to over 200 feet wide in Unit 1B. To achieve this width half of the homes along the stream would have to be removed, and the channel completely regraded. If the two original meanders were restored in Unit 1B an additional 8 homes would have to be taken. The cost for purchasing 63 homes and relocating the residents would be on the order of \$4.16 million to \$4.41 million. The cost for regrading the stream would be on the order of \$500,000, for a total cost ranging from \$4.66 million to \$4.91 million to create a greenway in the project area that could handle the design discharge without

serious erosion. This is roughly one million dollars (25%) more than the estimated cost range of the proposed concrete lined channel. Aside from the greater cost, the greenway alternative would have serious social impacts on the 63 families that would have to be relocated. It would also have much greater construction impacts, due to the large amount of grading required.

The ultimate greenway concept could be modified by placing velocity control structures in the channel and reducing the width to retain some of the homes. However, erosion would continue to be a problem at the velocity control structures, and the cost would still be high. Compared to the benefit of making a "natural" stream the social and economic cost of relocating even 10 families is disproportionately high.

C. Partial Channel Lining

Although it is a viable alternative for some flood control projects, partial lining is not appropriate for Kawa Stream since that is the existing condition. Even under the No Project alternative, it is likely that the stream banks and much of the invert will eventually be fully lined as emergency repairs are carried out.

D. Full Channel Lining Alternatives

A trapezoidal channel is not recommended because of the curvaceous alignment of the existing stream; trapezoidal sections are more prone to overflow along the curves. The existing trapezoidal channel has demonstrated this fact. Utilization of more land would be required due to the wider top width. Also, trapezoidal sections are more likely to attract skateboarders.

A CRM lined rectangular channel might be more aesthetic, but is not recommended due to the higher cost of excavation required to construct the CRM gravity retaining walls for the channel. A CRM channel would require a larger cross section than a concrete channel to convey the design discharge. Utilization of more land would be required due to the larger cross section.

A box culvert system is not recommended because of the extremely high cost of construction. The existing runoff from the areas surrounding the project site are currently flowing directly into the stream. Therefore, a box culvert or conduit system would require numerous grated inlets and diversion ditches to direct surface runoff into the system, and would require continuous maintenance to prevent clogging.

E. Alternative Project Designs

Alternative designs for a rectangular concrete channel, based on engineering criteria such as degree of curvature, width, depth, gradient and so forth will not be discussed here since they relate primarily to the hydraulics of the channel and to the construction costs. The environmental impacts of such minor variations in design do not significantly differ. However, alternative modifications to the lined invert, for the purpose of moderating temperature and improving aquatic habitat, have been considered (Figure 7).

The most promising modification is the first one pictured on Figure 7. It consists of simply superelevating (tilting) the invert approximately 5% so that the base discharge flows along one side of the channel. This is normally done on curves to counteract the tendency of the water to rise up on the outside wall when it is flowing at a high velocity. Where it would not conflict with the superelevation at a curve, the water could be directed to the shadiest side of the channel; on Kawa Stream this would be the westerly bank (shaded from the afternoon sun). Concentrating the water and keeping it in the shade should prevent it from getting too hot. The water would also vary in depth and velocity, so that fish could find the current most to their liking.

The other concepts considered consisted of more well-defined low-flow channels to provide a greater degree of concentration of the water. However, these channels would also produce a greater flow velocity than if the water were more spread out; therefore, some type of obstruction (such as rocks) or slow-water area (such as pools) or combination of the two, would be required so that the fish could maintain their position in the channel. The major problem with these concepts, aside from their greater construction cost, is that they would introduce an "irregularity" in the channel.

At high volumes, this would cause an unstable flow and could necessitate a larger channel. Also, any depression would have a tendency to fill with silt, thus defeating its intended purposes. Superelevating the invert slightly would not cause these problems and would not greatly add to the construction costs.

VI. The Relationship Between Short-Term Uses and Long-Term Productivity

The proposed improvements to Kawa Stream have been precipitated by the past development of the watershed. Urban land uses have been placed in a location where they need to be protected from flood and erosion damage. Realistically, neither the existing urban development, nor the proposed project, can be thought of as short-term uses. Once urbanized, it is very unlikely for an area to be returned to a less intensive use. These urban land uses constitute the "productivity" of the Kawa Stream environment; therefore, the proposed project does have a favorable relationship to that productivity in that the improved stream channel will maintain and enhance the urban development. The productivity of the affected portion of Kawa Stream, in terms of providing habitat for native stream animals, has already been severely degraded by the urban land uses and past alteration of the stream.

VII. Commitments of Resources

The proposed project will commit tax money, manpower, and materials to the construction of improvements to Kawa Stream. In another sense, the potential resource of stream habitat represented by the existing channel will be irreversibly committed. However, this resource has been degraded, and could only be improved at great expense. Other resources, such as groundwater, or the aesthetics and aquatic life of Kaneohe Bay, would not be affected.

VIII. Governmental Policies Offsetting Adverse Effects

The State Public Health Regulations, Chapters 37A (water pollution), 43 (fugitive dust) and 44B (noise), have already been cited (Chapter III) as providing adequate mitigation measures for the anticipated short-term impacts of the proposed construction activities in Kawa Stream.

IX. Relationship to Land Use Policies

The policy of the City and County of Honolulu General Plan (dated January 18, 1977), to require development projects to consider natural features such as flood and erosion hazards (policy 3.A.2), came too late for the Kawa Stream watershed since houses have already been built in the flood plain. It is this condition that has brought about the need for the proposed flood control improvements. This past development has also limited the options for designing a flood control system in a manner that will help preserve the natural setting of the stream (policy 3.A.5); the "natural setting" of the stream has already been significantly degraded in the project area. The proposed project does have a positive relationship with the policy to "participate with State and Federal agencies in the funding and construction of flood control projects" (policy 7.B.6).

X. Summary of Unresolved Issues

Two major issues were raised in the responses to the EIS Preparation Notice; the primary and secondary impacts of the proposed lining on the downstream section and on Kaneohe Bay, and consideration of alternatives other than full channel lining. These concerns have been evaluated in this EIS and the following conclusions have been reached: due to the slowing action of the large pool and vegetation-clogged channel downstream from the project, changes in the hydraulics and sedimentation characteristics of the lower stream will be minor; the amount or timing of fresh water reaching Kaneohe Bay will not be changed, and sediment will be decreased by reducing channel erosion; above the project area, only 75 acres of Urban land remains undeveloped, so any induced growth from the proposed project would be small in extent; given the hydraulic characteristics of the channel in the project area, a rectangular concrete lined channel will provide the most practical solution (in terms of costs and impacts) for handling storm flow and controlling erosion.

XI. Necessary Approvals

The proposed action will require a Department of the Army Permit for Activities in Waterways (Section 404 permit). The necessary forms and supplemental data will be submitted with the Revised EIS. Also, a permit for excessive noise will be required from the Department of Health; this will be the responsibility of the Contractor.

References

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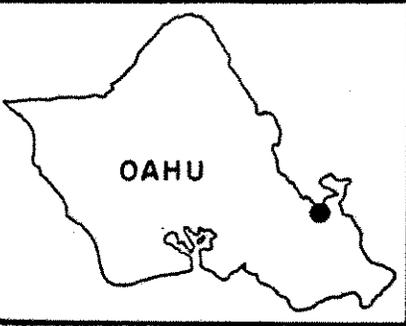
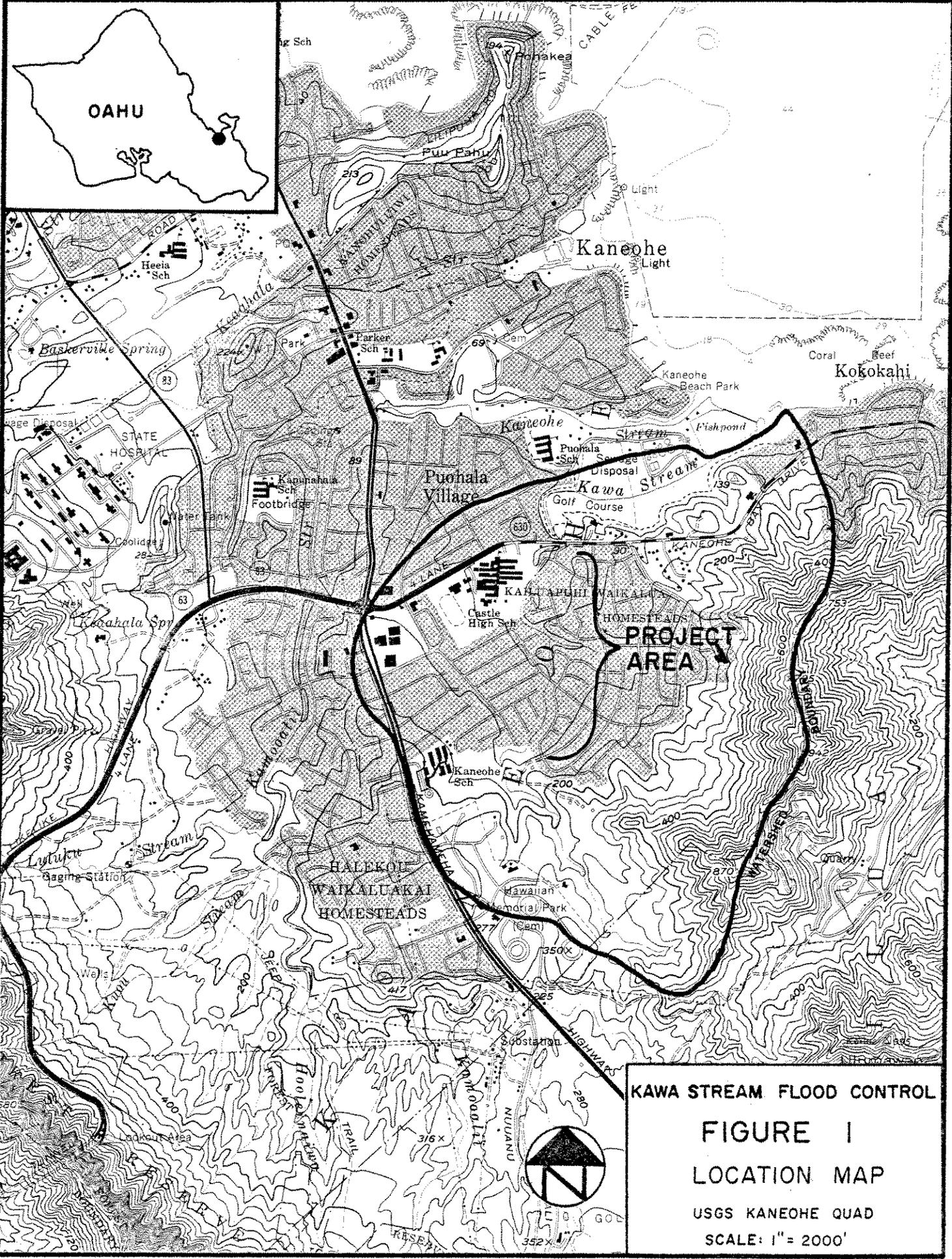
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FIGURES

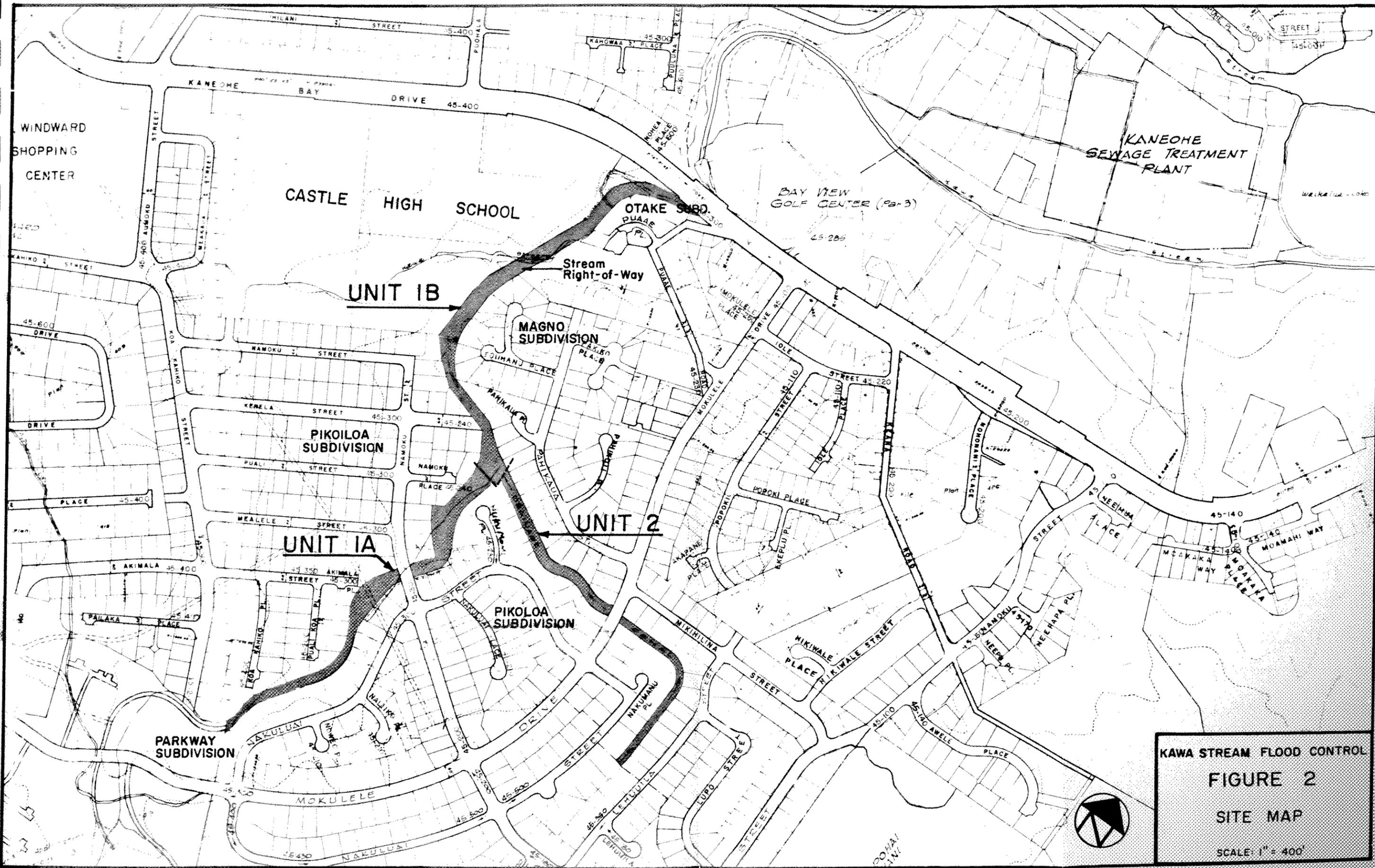




KAWA STREAM FLOOD CONTROL
FIGURE I
LOCATION MAP
 USGS KANEOHE QUAD
 SCALE: 1" = 2000'

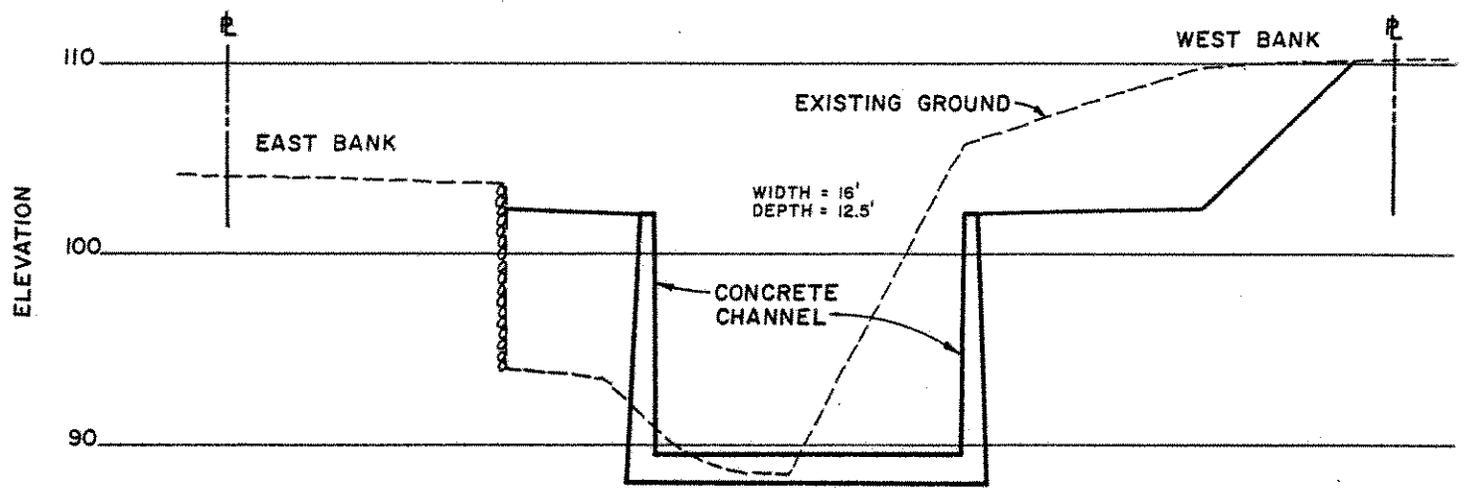




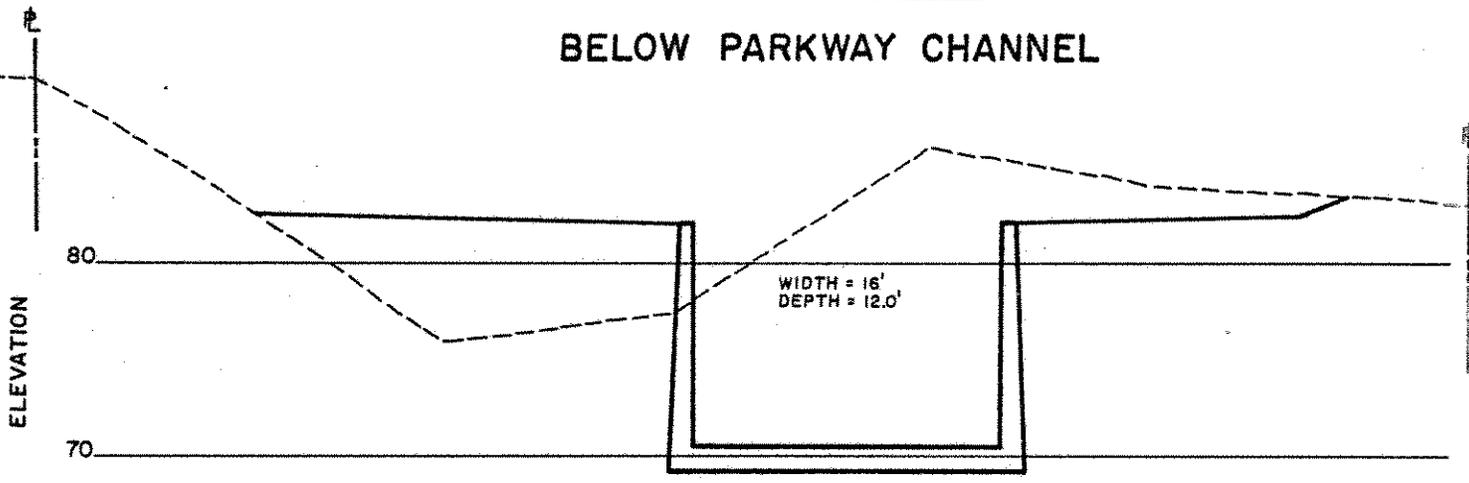


KAWA STREAM FLOOD CONTROL
FIGURE 2
SITE MAP
 SCALE 1" = 400'

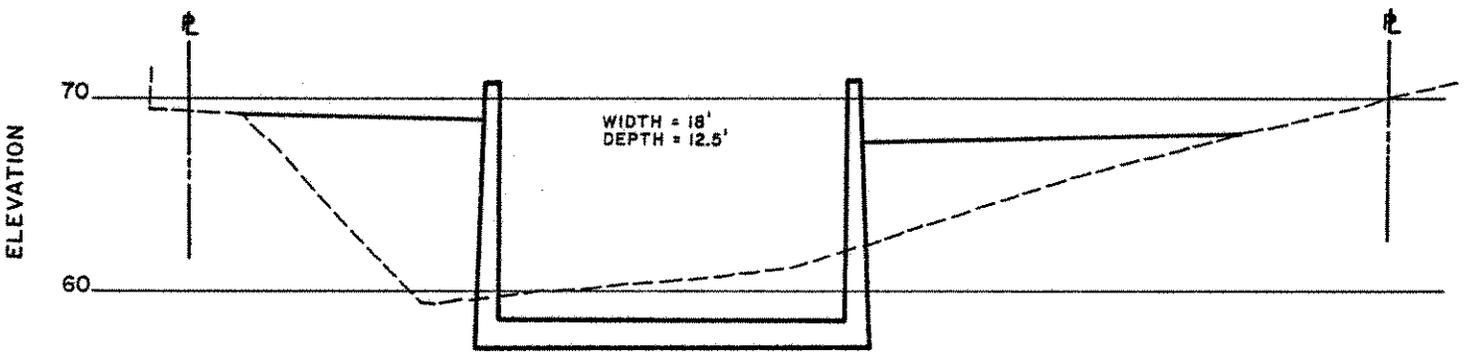




BELOW PARKWAY CHANNEL



ABOVE NAMOKU STREET



ABOVE CONFLUENCE WITH UNIT 2

KAWA STREAM FLOOD CONTROL
FIGURE 3
 REPRESENTATIVE
 SECTIONS UNIT IA
 SCALE: 1 INCH = 10 FEET

LEGEND

URBAN DISTRICT

DEVELOPED



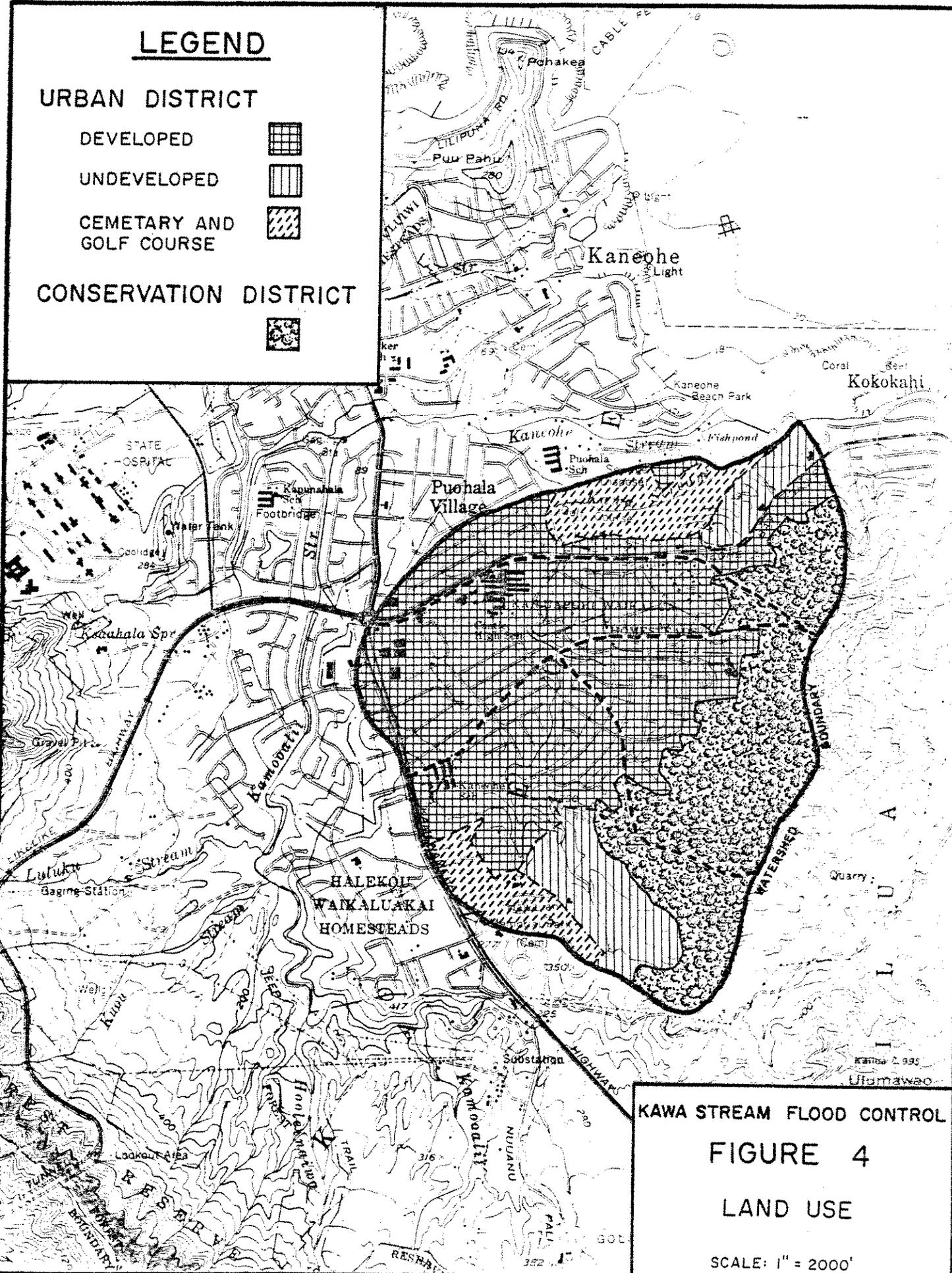
UNDEVELOPED



CEMETARY AND GOLF COURSE



CONSERVATION DISTRICT

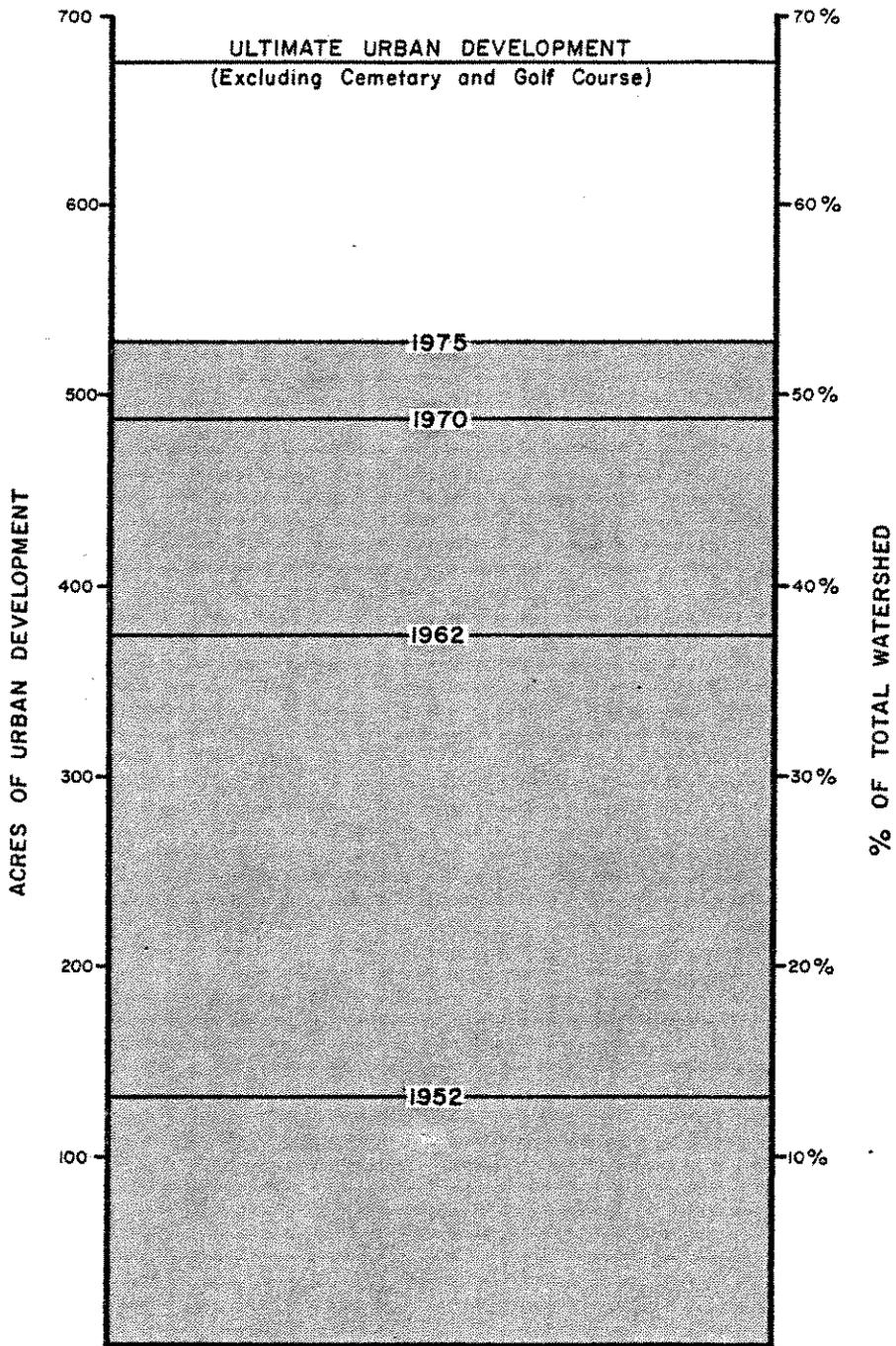


KAWA STREAM FLOOD CONTROL

FIGURE 4

LAND USE

SCALE: 1" = 2000'



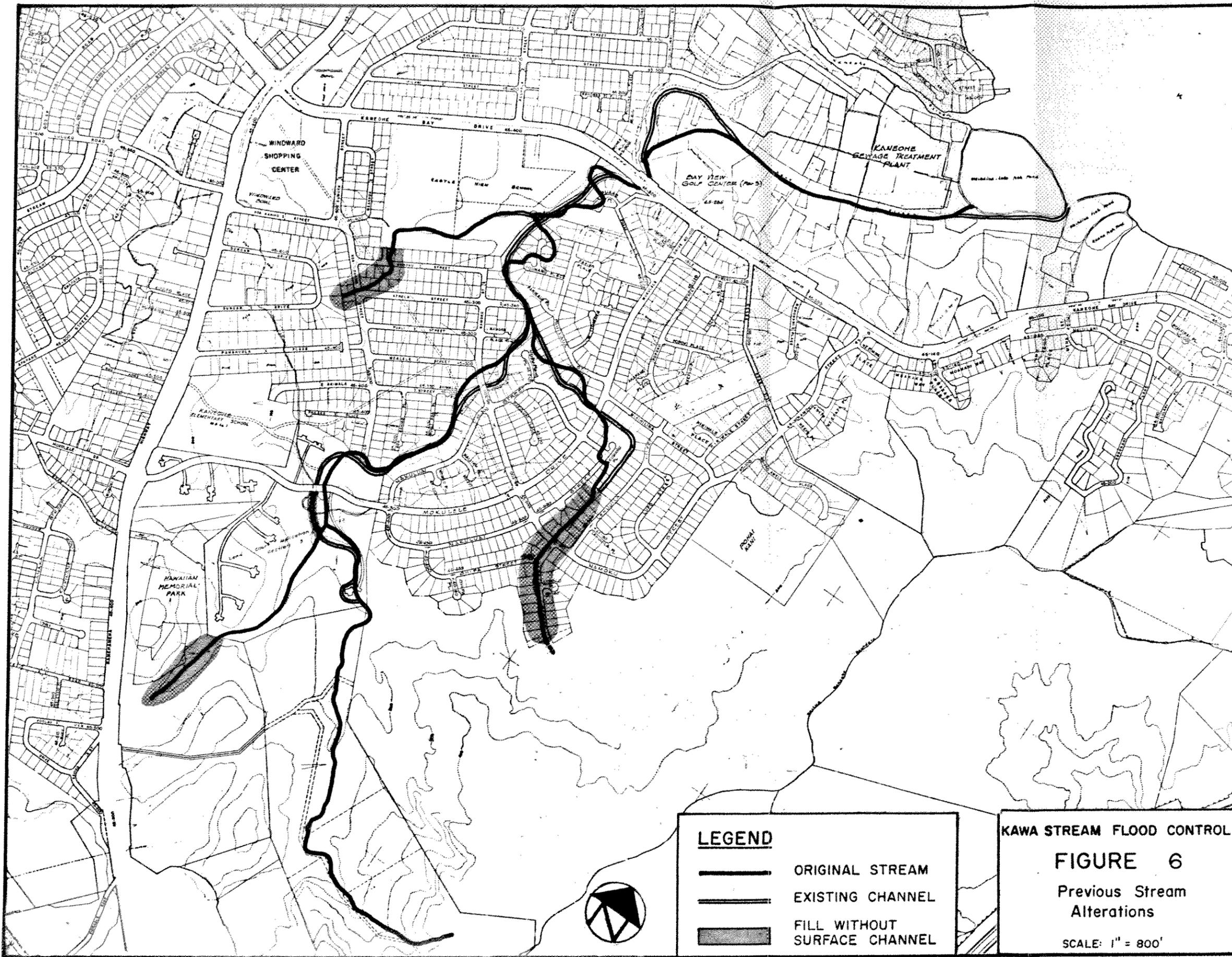
KAWA STREAM FLOOD CONTROL

FIGURE 5

Progress of Urbanization
in the Kawa Stream Watershed

(From Aerial Photographs)





LEGEND

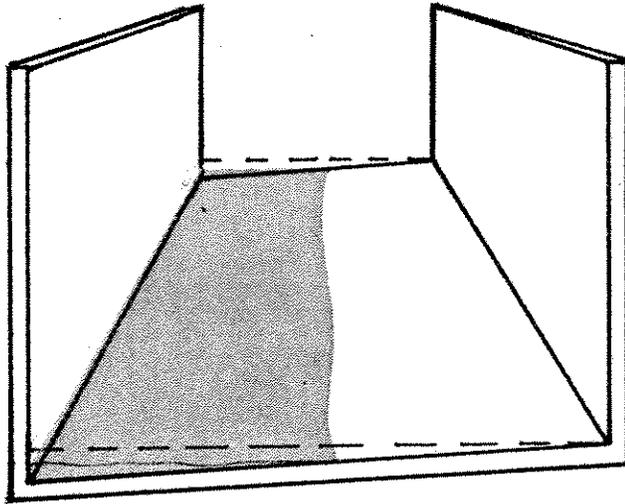
-  ORIGINAL STREAM
-  EXISTING CHANNEL
-  FILL WITHOUT SURFACE CHANNEL

KAWA STREAM FLOOD CONTROL

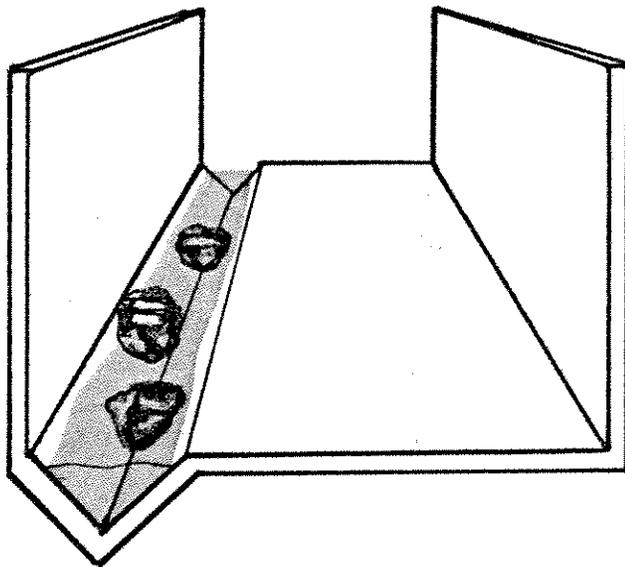
FIGURE 6

Previous Stream Alterations

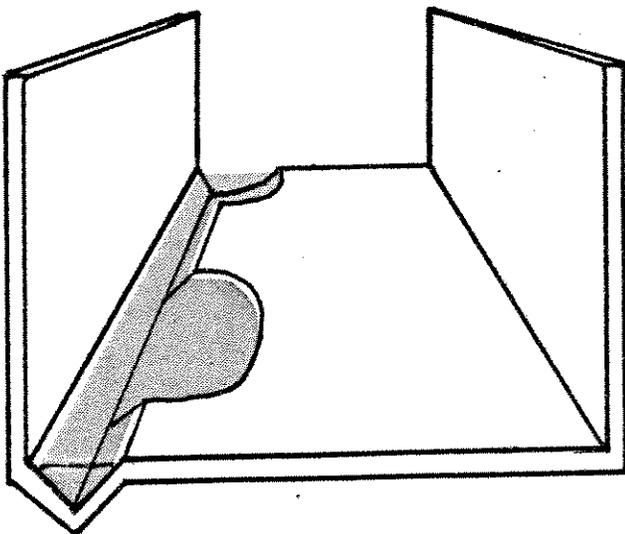
SCALE: 1" = 800'



DESIGN 1
5% SUPERELEVATION



DESIGN 2
V-NOTCH WITH ROCKS



DESIGN 3
V-NOTCH WITH POOLS

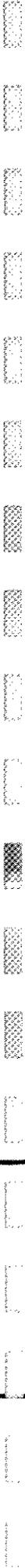
KAWA STREAM FLOOD CONTROL

FIGURE 7

Alternative Invert
Modifications

NOT TO SCALE





PLATES



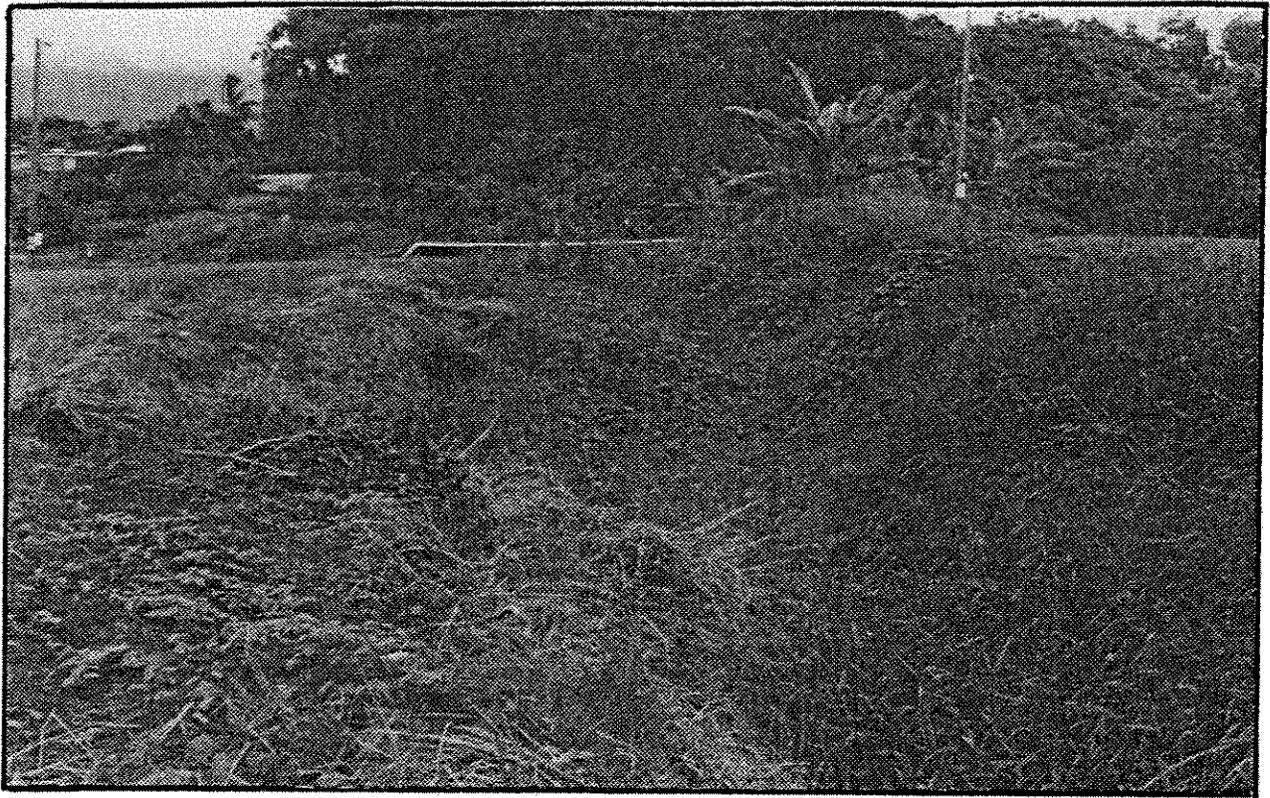


Plate 1 Kawa Stream at the Bay View Golf Center. Note vegetation and debris constricting the channel.

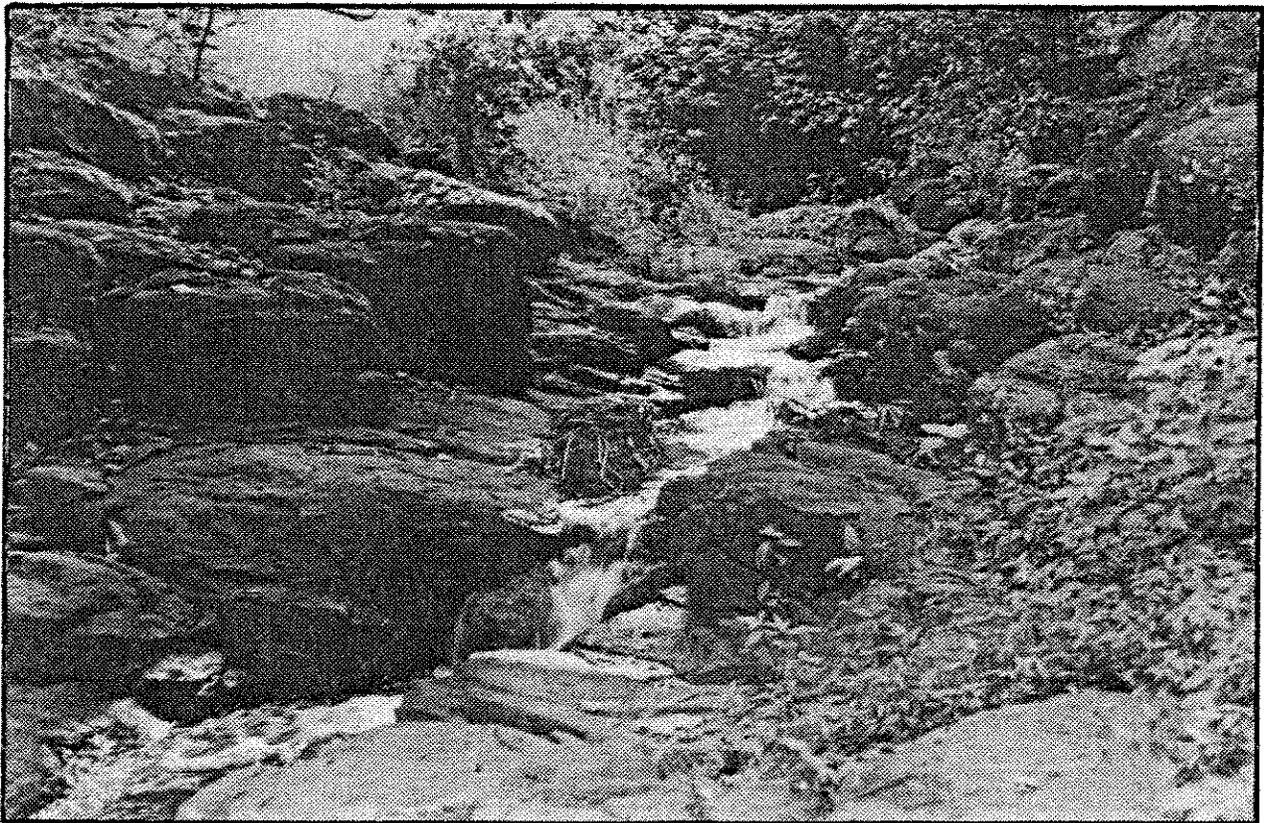


Plate 2 Kawa Stream immediately downstream from Kaneohe Bay Drive, flowing over bedrock for approximately 200 feet.



Plate 3 Lined channel adjacent to Castle High School, looking upstream. In the foreground is a velocity control structure; behind it the invert is unlined.



Plate 4 Unlined channel near Castle High School. Tributary channel entering from the right (arrow) causes erosion of the left stream bank.

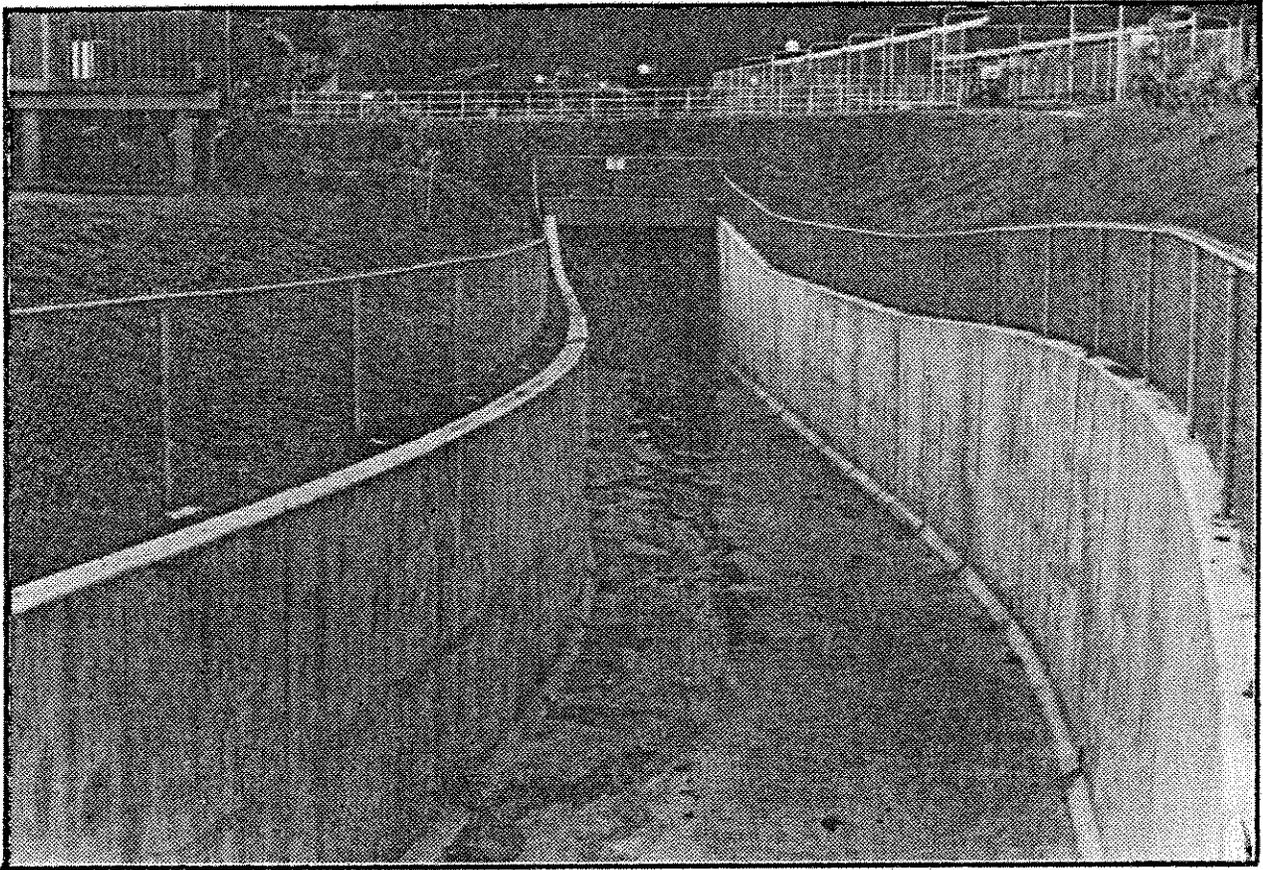


Plate 5 Lined channel and box culvert at the Parkway Development.



Plate 6 Undisturbed stream through dense forest above the Parkway Development.



APPENDIX A



APPENDIX A

Agencies and Organizations Consulted for the EIS

<u>Federal Government</u>	<u>Response to Preparation Notice</u>
U. S. Army Engineer District, Honolulu	2/11/77
USDI Fish and Wildlife Service	2/16/77
USDA Soil Conservation Service	2/9/77
<u>State of Hawaii</u>	
Dept. of Accounting & General Services	none
Dept. of Health	2/25/77
Dept. Land and Natural Resources	2/10/77
Dept. of Planning and Economic Development	2/11/77
Office of Environmental Quality Control	2/16/77
University of Hawaii	2/3/77
<u>City and County of Honolulu</u>	
Board of Water Supply	none
Dept. of General Planning	1/31/77
Dept. of Land Utilization	2/28/77
<u>Others</u>	
Kaneohe Community Council	none
Pikoiloa Community Association	none
Life of the Land	none
Bay View Golf Center	none



DEPARTMENT OF THE ARMY
 DISTRICT OF ENGINEERS
 DEPT. OF PUBLIC WORKS
 APO SAN FRANCISCO 96558

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11 February 1977

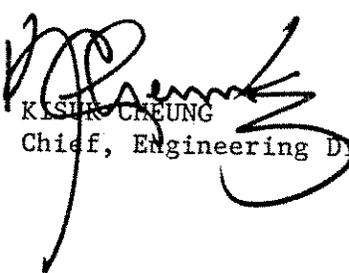
Mr. Wallace Miyahira
 Director and Chief Engineer
 Department of Public Works
 City and County of Honolulu
 650 South King Street
 Honolulu, Hawaii 96813

Dear Mr. Miyahira:

We have reviewed the Environmental Impact Statement Preparation Notice for the Kawa Stream Flood Control Project, Oahu, and offer the following comments for your consideration.

- a. We suggest that a more aesthetic and natural alternate for the use of reinforced concrete for the channel be explored (pg 2).
- b. Under the proposed DLU flood plain regulations, wouldn't potential flood problems for future residential developments be the responsibility of the builder (pg 5)?
- c. The design criteria presented in the report would prevent flooding from the regulatory (100 year) flood as indicated on the flood insurance study.
- d. It appears that the project will involve the placement of dredged or fill materials in navigable waters. If that is the case, a Department of the Army permit under Section 404 of the Federal Water Pollution Control Act Amendments (Public Law 92-500) will be required.

Thank you for the opportunity to review the document.

Sincerely yours,

 KISTE CHEUNG
 Chief, Engineering Division



DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0175

April 13, 1977

Mr. Kisuk Cheung
Chief, Engineering Division
Honolulu District
U. S. Army Corps of Engineers
Building 230, Fort Shafter
APO San Francisco 96558

Dear Mr. Cheung:

SUBJECT: YOUR LETTER OF FEBRUARY 11, 1977, RELATING
TO THE EIS PREPARATION NOTICE FOR KAWA STREAM
FLOOD CONTROL PROJECT

Thank you for your comments on the subject EIS Preparation Notice.

Consideration will be given in the EIS to a broad range of alternatives, including a more aesthetic design than the proposed rectangular concrete channel. The "environmental benefits," hydraulic adequacy, and construction cost will be the main criteria used in evaluating alternatives.

The purpose of the reference to potential future development of the watershed above the project area was to point out that the existing problems in the channel could be aggravated. It is doubtful that a future developer could be held responsible for a problem that already exists, although he would be responsible for his incremental contribution to it.

We are aware that a Department of the Army Permit would be required, and will submit the permit application prior to construction of the project.

Very truly yours,

Handwritten signature of Wallace Miyahira in cursive script.
WALLACE MIYAHIRA
Director and Chief Engineer



United States Department of the Interior

RECEIVED
DIV. OF FISH AND WILDLIFE SERVICE
Division of Ecological Services
821 Mililani Street
Honolulu, Hawaii 96813
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Reference: ES

February 16, 1977

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

Dear Sir:

This provides comments on the Environmental Impact Statement, dated January 13, 1977, for the Kawa Stream Flood Control Project, Kaneohe, Oahu. The project involves construction of 5,600 feet of concrete-lined channel in the middle stream reaches of Kawa Stream, between Mokulele Drive and Kaneohe Bay Drive.

General Comments

We suggest the statement be expanded to discuss in more detail the impacts of mid-stream channelization on the physical characteristics and aquatic resources in Kawa Stream's lower reaches and the receiving waters south of Kaneohe Bay. Altered stream parameters, such as increased flow rates and volume discharges, and elevated temperatures resulting from upstream channelization may have significant adverse effects on downstream environments.

As mentioned in the preparation notice, dense vegetation can be found clogging and impeding water flow in the downstream section, and other portions of Kawa Stream. Periodic clearing of excessive vegetation from the streambed could relieve flooding problems while restoring aquatic habitat and preserving the aesthetic values remaining in Kawa Stream. We recommend that the feasibility of this alternative be examined.

Specific Comments

Page 4, Sec. IV. Description of the Affected Environment. We suggest the description of Kawa Stream mention that the stream has a perennial/uninterrupted flow to the ocean.



Same page and section, fourth paragraph, should include a description and specific location of those stream portions subject to erosion and flooding.

Page 6, Sec. V. Discussion of the Assessment Process, second paragraph, first sentence, should include a statement concerning the effects of increased flow velocities, volumes, sediment loads, etc., on further degradation of Kaneohe Bay among the long-term adverse impacts of this project.

Page 7, Sec. VI.B. Geology and Soil Erosion, and D. Biological Resources. See General Comments, first paragraph.

Page 7, Sec. VI.C. Water Resources and Hazards. A discussion of primary and secondary project impacts on water quality and aquatic resources in Kawa Stream and Kaneohe Bay, expanded elsewhere in the environmental impact statement, should be summarized in this section.

Page 8, Sec. VI.H. Aesthetics. We suggest that this section address various landscaping schemes, including a greenway for the stream bank areas.

Page 9, Sec. VII. Alternatives, should consider other engineering designs, such as riprap or rock masonry banks, in those areas subject to erosion, which involve minimal stream modifications while reducing environmental impacts to Kawa Stream and Kaneohe Bay.

We appreciate this opportunity to comment.

Sincerely yours,

Maurice H. Taylor
Maurice H. Taylor
Field Supervisor

cc: ARD, AE
HA
HDF&G

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0176

April 13, 1977

Mr. Maurice H. Taylor
Field Supervisor
Division of Ecological Services
Fish and Wildlife Service
U. S. Department of the Interior
821 Mililani Street
Honolulu, Hawaii 96813

Dear Mr. Taylor:

SUBJECT: YOUR LETTER OF FEBRUARY 16, 1977, RELATING
TO THE EIS PREPARATION NOTICE FOR KAWA STREAM
FLOOD CONTROL PROJECT

Thank you for your review and comments. We would like to clarify that the document reviewed by your office was a Preparation Notice, not an Environmental Impact Statement as stated in your opening sentence. The following are our responses to your comments.

General Comments

The EIS will cover the entire reach of Kawa Stream, as well as the affected portion of Kaneohe Bay. The potential changes to the flow regime and water quality (including erosion/siltation) of Kawa Stream will be discussed. Kawa Stream is periodically cleared of clogging vegetation; the last such clearing was completed in December 1976. The high cost of this maintenance is one reason that full channel lining has been proposed. The EIS will discuss the pros and cons of other alternatives.

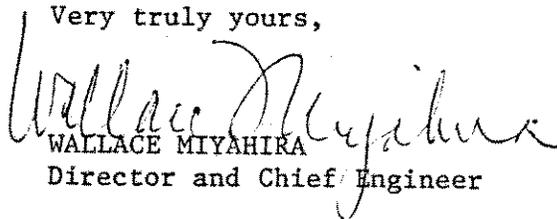
Specific Comments

1. The EIS will describe the flow characteristics of Kawa Stream.
2. The specific "problem areas" have been identified from service requests by landowners on the stream; the EIS will present these data.
3. See General Comments.
4. See General Comments.

Mr. Maurice H. Taylor
Page 2

5. The organization of the EIS will differ from the Preparation Notice; the potential impacts to water quality and aquatic resources will be addressed.
6. The stream has a sufficient right-of-way for ample landscaping. The "greenway" concept will be addressed as an alternative to full channel lining.
7. Alternatives other than full channel lining will be discussed in the EIS.

Very truly yours,


WALLACE MIYAHIRA
Director and Chief Engineer

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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7700 904

440 Alexander Young Building, Honolulu, HI 968

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February 9, 1977

ENVELOPE
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Mr. Wallace Miyahira
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mr. Miyahira:

Subject: Kawa Stream Flood Control Project, Kaneohe, Oahu

We have reviewed the above-mentioned preparation notice and have no comments to offer.

Thank you for the opportunity to review this document.

Sincerely,

Wm H Mann - Acting
Jack P. Kanalz
State Conservationist



7701308

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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DIV. OF ENGINEERING
MAR 3 3 18 PM '77



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STATE OF HAWAII MAR 3 9 56 AM '77
DEPARTMENT OF HEALTH
P.O. Box 3378 TO ENV
HONOLULU, HAWAII 96801

February 25, 1977

Engry

GEORGE A. L. YUEN
DIRECTOR OF HEALTH
Audrey W. Mertz, M.D., M.P.H.
Deputy Director of Health
Henry N. Thompson, M.A.
Deputy Director of Health
James S. Kumagai, Ph.D., P.E.
Deputy Director of Health

In reply, please refer to:
File: EPHS -SS

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

Dear Mr. Miyahira:

Subject: Request for Comments on Proposed Environmental Impact Statement (EIS) for Kawa Stream Flood Control Project Kaneohe, Oahu, TMK: 4-5-63, 66, 67, 84 and 89

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

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.

Sincerely,

James S. Kumagai
JAMES S. KUMAGAI, Ph.D.
Deputy Director for
Environmental Health

770982

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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CHRISTOPHER COBB, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

TO
STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621

HONOLULU, HAWAII 96809

February 10, 1977

DIVISIONS:

- CONVEYANCES
- FISH AND GAME
- FORESTRY
- LAND MANAGEMENT
- STATE PARKS
- WATER AND LAND DEVELOPMENT

Your: 701-12-0007

Honorable Wallace Miyahira
Dept. of Public Works
650 So. King St.
Honolulu, HI 96813

Dear Sir:

We have reviewed the EIS preparation notice for the Kawa Stream flood control project.

We recommend that the following points be addressed in the forthcoming EIS:

- 1) Impact upon the 4400 feet of unlined drainage system downstream.
- 2) Elaboration of the proposed "standard construction practices" which will serve as soil erosion preventive measures during the construction period.
- 3) Impact upon specific spoil disposal sites and elaboration of the handling of spoil.
- 4) More specific documentation for the following statement on page 4, para.3: "As a result of previous channel modifications, Kawa Stream does not support any native fish or other stream macrofauna (University of Hawaii, unpublished data)." Alternatively, an on-site assessment of stream fauna.

Very truly yours,

GORDON SOH
Program Planning Coordinator

cc: DOWALD
Fish & Game

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0177

April 13, 1977

Mr. Gordon Soh
Program Planning Coordinator
Department of Land and Natural Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Soh:

SUBJECT: YOUR LETTER OF FEBRUARY 10, 1977, RELATING
TO THE EIS PREPARATION NOTICE FOR KAWA STREAM
FLOOD CONTROL PROJECT

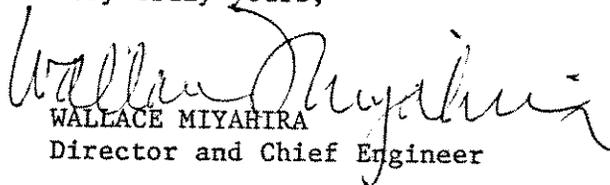
Thank you for your comments on the subject EIS Preparation Notice. Our response to your numbered comments are as follows:

1. The reach of Kawa Stream from the terminus of the project at Kaneohe Bay Drive to the mouth of the stream is very important in providing aquatic habitat and a spreading and silting area for floodwaters. The hydraulic impact of the proposed project on this portion of the stream is expected to be minor; the EIS will elaborate on this point.
2. The erosion control practices referred to are City and County construction standards and other laws and ordinances regulating the effects of construction activities on the environment. These will be described in the EIS.
3. The preliminary designs for the first increment of channel improvement indicate that there will be an excess of approximately 4,090 cubic yards of excavated material. The disposal site cannot be known until construction is scheduled, but the site and handling method used by the Contractor will be subject to the approval of the Department of Public Works.
4. The reference to aquatic life is somewhat misleading; Kawa Stream has not been found to support any native species of fish, shrimp or prawns. Zoologists from the U. S. Fish and Wildlife Service and the University of Hawaii have sampled Kawa Stream at two points

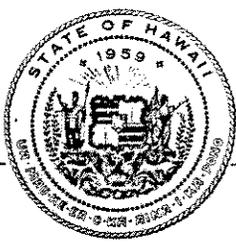
Mr. Gordon Soh
Page 2

for an entire year and have found only introduced species. This is reported in "Stream Channel Modification (Channelization) in Hawaii and Its Environmental Effects on Native Fauna, Part A, Statewide Inventory of Channelization With Preliminary Survey of Environmental Factors and Associated Biota," and unpublished progress report (November 1976) by Amadeo S. Timbol and John A. Maciolek of the University of Hawaii, as part of the Hawaii Cooperative Fisheries Research program. In addition, the entire length of the stream has been assessed for stream fauna by our consultant, the results of which will be reported in the EIS.

Very truly yours,


WALLACE MIYAHIRA
Director and Chief Engineer

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RECEIVED DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT RECEIVED DEPARTMENT OF PUBLIC WORKS
FEB 18 10 05 AM '77 FEB 17 9 25 AM '77

GEORGE R. ARIYOSHI
Governor
HIDETO KONO
Director
FRANK SKRIVANEK
Deputy Director

Kamamalu Building, 250 South King St., Honolulu, Hawaii • Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

February 11, 1977

TO ENVA
Engg

Ref. No. 2958

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

Dear Mr. Miyahira:

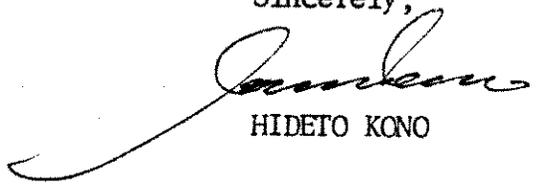
Subject: Environmental Impact Statement Preparation Notice for the
Kawa Stream Flood Control Project

We have reviewed the subject E.I.S. Preparation Notice and find that, in general, it seems to adequately acknowledge the important environmental impacts which can be anticipated to result from the proposed project.

Regarding alternatives to the proposed action, we assume that you are aware of a February 3, 1977, letter from Dr. Albert H. Banner of the University of Hawaii, in which he urges that an evaluation be made of his proposal for the development of a park on the Kawa Stream floodplain as an alternative flood control measure. We feel that his proposal warrants an evaluation as to its feasibility.

We have no further comments to offer, however, we do appreciate the opportunity to review this E.I.S. Preparation Notice.

Sincerely,


HIDETO KONO

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0172

April 13, 1977

Mr. Hideto Kono, Director
Department of Planning and
Economic Development
State of Hawaii
P. O. Box 2359
Honolulu, Hawaii 96804

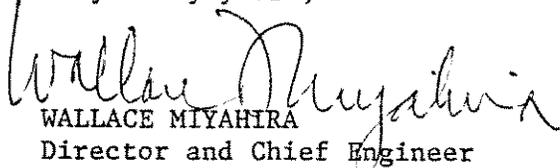
Dear Mr. Kono:

SUBJECT: YOUR LETTER OF FEBRUARY 11, 1977, RELATING
TO EIS PREPARATION NOTICE FOR KAWA STREAM
FLOOD CONTROL PROJECT

Thank you for your comments on the subject EIS Preparation Notice.

The EIS will evaluate a wide range of alternatives, including Mr. Banner's suggestion of removing homes and restoring Kawa Stream to a more natural configuration. The EIS will trace the history of the development of the watershed and the alteration of the stream. This will indicate what would be required to implement such an alternative.

Very truly yours,


WALLACE MIYAHIRA
Director and Chief Engineer

7701048

GEORGE R. ARIYOSHI
GOVERNOR

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DIV. OF ENGINEERING
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RICHARD E. MARLAND, PH.D.
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII

OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR

550 HALEKAUWILA ST.
ROOM 301

HONOLULU, HAWAII 96813

February 16, 1977

ENV ULP
Engly

Wallace Miyahira
Director and Chief Engineer
Department of Public Works
City and County of Honolulu

Dear Mr. Miyahira,

SUBJECT: EIS Preparation Notice for Kawa Stream Flood
Control Project, Kaneohe, Oahu

This Office has reviewed the subject EIS Preparation Notice
and offers the following comments:

The potential for significant impacts on Kaneohe Bay has been
recognized in the Preparation Notice. A detailed discussion of
this impact should be provided in the EIS. The sedimentation impacts
during the construction period and thereafter should be discussed.
An analysis of salinity changes should also be provided.

The relationship between this project and the Corps of Engineers
flood control project for Kaneohe should be discussed, especially
in respect to cumulative impacts on Kaneohe Bay.

The potential secondary impact of increased urbanization in the
area should be discussed in the EIS.

The affect of this project on the lower stream area should be
discussed, especially where channelization plans have got to be made.
The impacts associated with the increase in runoff velocity on this
downstream area should be discussed. In other words, the impacts
on the whole stream should be evaluated and discussed in the EIS.

Thank you for the opportunity to comment on this EIS preparation
notice.

Sincerely,

Richard E. Marland
Director

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0178

April 13, 1977

Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Gentlemen:

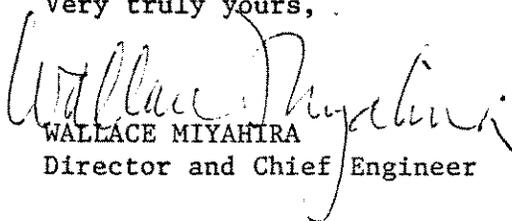
SUBJECT: YOUR LETTER OF FEBRUARY 16, 1977, RELATING
TO THE EIS PREPARATION NOTICE FOR KAWA STREAM
FLOOD CONTROL PROJECT

Thank you for your review of the subject EIS Preparation Notice.

The Environmental Impact Statement will cover the entire Kawa Stream and the Kaneohe Bay receiving waters. Particular emphasis will be given to the question of erosion/siltation, since it is such an important aspect of the water quality of the Bay.

Since the majority of the watershed has already been developed, it is unlikely that reducing the existing flood and erosion problem would induce further development. However, development of the remaining residentially-zoned lands at the headwaters of Kawa Stream could increase the flood and erosion hazard. The Corps of Engineers' project will be discussed.

Very truly yours,


WALLACE MIYAHIRA
Director and Chief Engineer

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DIV. OF ENGINEERING



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FEB 11 10 45 AM '77

University of Hawaii at Manoa

FEB 10 2 14 PM '77
TO ENVU

Hawaii Institute of Marine Biology
P.O. Box 1346 • Coconut Island • Kaneohe, Hawaii 96744
Cable Address: UNIHAW

Engg

February 3, 1977

Mr. Wallace Miyahira
Director and Chief Engineer
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

Re: Kawa Stream Flood Control Project EIS Preparation Notice

Dear Mr. Miyahira:

We have here a repetition, so often found in the Kaneohe area, of where the City and County Planning Department advises the City Council to approve the construction of homes in flood plains to the profit of the developer, to the hazard of the residents and to the injury of the delicate ecosystem of Kaneohe Bay. This has happened, with deaths occurring, in Keapuka subdivision in the early 1960s; the McCormack Development Company is presently channelizing Heeia Stream and is proposing to "develop" its flood plain. Then, after floods occur and property and life is threatened in homes built on the flood plain, the City and County engineers are asked to expend millions of tax dollars to protect the homes that should not have been built in the first place, a protection for the residents that will further degrade the bay's environment.

I therefore urge that the proposed Environmental Impact Statement carefully weigh, under "Alternatives C" (p. 9), the advantages of removing the homes from the flood plain, converting the area into a winding park that would slow the rush of waters from a storm, thereby giving further protection to the bay. The advantages of such a park to the nearby residents, the advantages of such a park to the ecology of Kaneohe Bay should be considered as well as its actual cost as opposed to the \$3,500,000 to \$4,000,000 your office suggests the stream "improvements" will cost.

If one were sanguine, one would hope that the agencies of the City and County government and the State government, and the City Council would learn from previous experience that it is dangerous to permit homes to be built on flood

Mr. Wallace Miyahira
Page Two
February 3, 1977

plains, and that it is hazardous to existing homes downstream to permit channelization of stream higher for developments in the watershed. However, to view the lined channel and box culvert of the recently developed Parkway Development, shown in your Plate 5, shows that all approving bodies still put profit to the developer above the protection of the environment and the safety of the residents.

Yours sincerely,



Albert H. Banner
Professor of Zoology

mk

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0174

April 13, 1977

Mr. Albert H. Banner
Professor of Zoology
Hawaii Institute of Marine Biology
University of Hawaii at Manoa
P. O. Box 1346
Kaneohe, Hawaii 96744

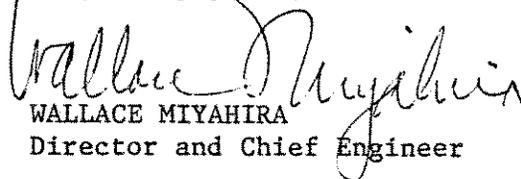
Dear Mr. Banner:

SUBJECT: YOUR LETTER OF FEBRUARY 3, 1977, RELATING
TO EIS PREPARATION NOTICE FOR KAWA STREAM
FLOOD CONTROL PROJECT

Thank you for your comments on the subject EIS Preparation Notice.

The EIS will evaluate a wide range of alternatives, including your suggestion of removing homes and restoring Kawa Stream to a more natural configuration. The EIS will trace the history of the development of the watershed and the alteration of the stream. This will indicate what would be required to implement such an alternative.

Very truly yours,

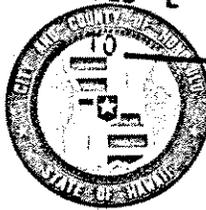

WALLACE MIYAHIRA
Director and Chief Engineer

7700 681

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

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DGP/177-091 (CT)

FRANK F. FASI
MAYOR

ROBERT R. WAY
CHIEF PLANNING OFFICER

January 31, 1977

Mr. Wallace Miyahara
Director and Chief Engineer
Department of Public Works
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Miyahara:

Kawa Stream Flood Control Project, Kaneohe
EIS Preparation Notice - DPW 701-12-0007
Review and Comments Requested 1/13/77

Since it has been determined that "the proposed Kawa Stream Flood Control Project will require an Environmental Impact Statement", we offer the following suggestions:

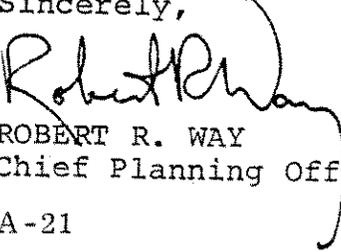
1. The EIS should provide estimates of expected State aid and/or an indication of State and County funding.
2. The description of existing stream conditions (p.4., par.2) should include a map showing what areas are lined, partially-lined, and natural; and what areas are fenced.
3. Previous floods are mentioned, with peak flow data for a February 1969 storm. Peak discharges for the three increments are given (p.2.) The design flood should be specified.
4. The sedimentation load from Kawa Stream into Kaneohe Bay is 320 tons per year out of an estimated 35,000 tons per year. This is less than 1 percent of the total. It is also indicated (p.5) that Kawa Stream contributes the least amount of the three stream discharging into the south bay. The EIS should include some discussion on the other streams and how this project relates in terms of priorities for improvements.

5. The EIS should also show how much of the 320 tons per year of sedimentation is entering Kawa Stream from the various areas along the stream presently, and how much is projected after project completion.
 6. The preparation notice indicates that there are 120 acres of residentially zoned land and 250 acres of preservation, agriculture, park and cemetery land upstream of the project (p.5.) These should be shown on a generalized land use map. The EIS should also provide estimated stream flows and sedimentation loads from areas upstream of the project before and after projected development, particularly since it is indicated that "If the remaining residential acreage is developed, the flooding situation could worsen" (p.5, par.3.)
 7. Timing of construction activities can have a direct effect on sedimentation during the construction period. Limiting construction to the drier summer months could minimize sedimentation and the impact of noise on Castle High School activities.
 8. Construction noise is indicated as a temporary impact. Traffic disruption could also be a problem depending on how much material will be excavated and have to be trucked out the area.
 9. The preparation notice indicates:

"The project would have regional economic benefits through the provision of jobs and could result in local economic benefits from an influx of construction workers." (p.8.)
- Unless this can be quantified, such general statements should not be made.
10. The EIS should include discussion of the alternative of purchasing some of the 110 homes and properties in the project area--those that are likely to be damaged by future floods; and prohibition of development upstream of the project.

We hope these comments will help you in the preparation of the environmental impact statement for the project.

Sincerely,


ROBERT R. WAY
Chief Planning Officer

RRW:iek

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0173

April 13, 1977

TO : MR. ROBERT R. WAY, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM : WALLACE MIYAHIRA, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR LETTER OF JANUARY 31, 1977, RELATING TO THE EIS
PREPARATION NOTICE FOR KAWA STREAM FLOOD CONTROL PROJECT

Thank you for your comments on the subject EIS Preparation Notice. Our responses to your numbered comments are as follows:

1. Funding has not been developed, but State aid will be sought.
2. The EIS will trace the history of the development of the Kawa Stream watershed and the alteration of the stream. Included in this will be a description of the existing improvements to the channel.
3. The subject paragraph of the Preparation Notice was unclear; the "peak discharge" indicated for each of the three increments is the "design flood" as determined from the City and County of Honolulu Storm Drainage Standards. (This is not to be confused with the "100-year flood" and "project flood" used by the Corps of Engineers.)
4. The sediment rate cited may be revised in the EIS, but since Kawa Stream has a small watershed, its relative contribution is still expected to be low. Your comment regarding project priorities presupposes that a reduction in the amount of sediment delivered to Kaneohe Bay is a project objective. More accurately, sediment reduction is a secondary benefit; a primary objective of the project is the reduction of streambank erosion, which is threatening the properties along the stream. The priorities for stream channel improvement are determined by such factors as flood frequency and damage.
5. The EIS will attempt to determine the contribution of bank erosion to the total sediment yield of the watershed. A detailed sub-basin analysis may not be required for such a determination. The proposed project would not affect sediment production outside of the stream channel.

Mr. Robert R. Way
Page 2

6. The existing land use in the watershed will be shown. However, the storm runoff and sediment load from potential land development projects in the upper watershed is independent of the proposed project; predicting the hydrologic impacts of such development is, therefore, beyond the scope of this EIS. The comment to which you refer, regarding the potential impact of upstream development, is qualitative, not quantitative.
7. Depending on final project design, it is possible that construction of the first increment could require a full year or more, in which case it would not be possible to avoid the rainy season. However, consideration will be given to this means of mitigating the construction impacts on water quality.
8. The preliminary designs for the first increment of channel improvement indicate that there will be an excess of approximately 4,090 cubic yards of excavated material. The transport of this material would be part of the disturbance to the neighborhood resulting from construction activities.
9. The comment will be deleted.
10. The purchase of affected homes is a possible, though impractical, alternative and will be discussed in the EIS. However, preventing future development upstream would not reduce the existing problems downstream.

Very truly yours,


WALLACE MIYAHIRA
Director and Chief Engineer

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DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU

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HONOLULU, HAWAII 96813

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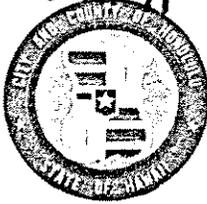
MAR 1 9 45 AM '77

TO _____

ENV
Engg

GEORGE S. MORIGUCHI
DIRECTOR

LUL/77-178 (CS)



FRANK F. FASI
MAYOR

February 28, 1977

MEMORANDUM

TO : MR. WALLACE MIYAHIRA, DIRECTOR
DEPARTMENT OF PUBLIC WORKS

FROM : GEORGE S. MORIGUCHI, DIRECTOR

SUBJECT: KAWA STREAM FLOOD CONTROL PROJECT, KANEOHE
EIS PREPARATION NOTICE
TAX MAP KEY 4-5-63, 66, 67, 84, & 89

Thank you for the opportunity to comment on the Kawa Stream project.

We are, of course, interested in this project as it ties to the drainage improvements associated with the Parkway Planned Development. At this time, we have no comments to submit on the EIS Preparation Notice.

George Moriguchi
GEORGE S. MORIGUCHI
Director of Land Utilization

GSM:ey

APPENDIX B



APPENDIX B. Comments and Responses to EIS

	<u>Comment Date</u>
<u>Federal Government</u>	
Fourteenth Naval District	6/28/77*
Soil Conservation Service	7/28/77*
US Army Corps of Engineers	8/2/77
US Army Support Command	6/20/77*
US Coast Guard	6/22/77*
<u>State of Hawaii Agencies</u>	
Dept. of Agriculture	7/25/77*
Dept. of Defense	6/20/77*
Dept. of Health	7/11/77
Dept. of Planning and Economic Development	7/8/77*
Dept. of Social Services and Housing	6/27/77*
Dept. of Transportation	7/25/77*
Office of Environmental Quality Control	7/22/77
<u>University of Hawaii</u>	
Environmental Center	7/25/77
<u>City and County of Honolulu</u>	
Board of Water Supply	6/22/77*
Dept. of Housing and Community Development	7/1/77*
Dept. of Land Utilization	7/5/77*
Dept. of Transportation Services	7/1/77

* Denotes no comment, or comment not requiring a response.

HEADQUARTERS
FOURTEENTH NAVAL DISTRICT

BOX 110
FPO SAN FRANCISCO 96610

IN REPLY REFER TO:
48A:AMN:amn
Ser 1330
28 JUN 1977

Environmental Quality Commission
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Kawa Stream Flood Control Project
Environmental Impact Statement

The Navy has reviewed the Environmental Impact Statement for the Kawa Stream Flood Control Project and has no comments. As requested by your letter of 15 June 1977, the subject EIS is returned.

Thank you for the opportunity to review the EIS.

Sincerely,



Encl

R. P. NYSTEDT
CAPTAIN, OEC, USN
DISTRICT CIVIL ENGINEER
BY DIRECTION OF THE COMMANDANT

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

P. O. Box 50004, Honolulu, HI 96850

July 28, 1977

Mr. Donald Bremner
Environmental Quality Commission
550 Halekauwila St., Rm. 301
Honolulu, Hawaii 96813

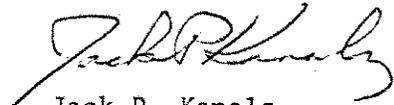
Dear Mr. Bremner:

Subject: EIS - Kawa Stream Flood Control Project, Oahu

We have reviewed the above EIS and have no comments to offer.

Thank you for the opportunity to review this document.

Sincerely,



Jack P. Kanalz
State Conservationist

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



7705814



RECEIVED DEPARTMENT OF THE ARMY RECEIVED
HONOLULU DISTRICT, CORPS OF ENGINEERS
BLDG. 230, FT. SHAFTER,
PO SAN FRANCISCO 96544

AUG 5 2 37 PM '77

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TO ENV

Engy 2 August 1977

PODED-PV

Mr. Wallace Miyahira, Director
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Miyahira:

We received the Environmental Impact Statement for the Kawa Stream Flood Control Project on 17 June 1977. At this time, we offer the following comments for your consideration:

- a. The second sentence in the paragraph entitled "Alternatives to the Proposed Project" on page ii should read "The first three categories..."
- b. The growth scenario described on pages 6 and 7 is not the Corps of Engineers' projection of what will happen, as the EIS implies, nor is it what the Corps recommends should happen. The scenario is simply one of several developed to estimate the impacts upon Kaneohe Bay water quality created by alternative future land use patterns.
- c. Discussion of design alternatives centers on different invert structures, all with concrete floors. Regardless of allowance for low flows, such a sterile, flat substratum is not acceptable for the support of aquatic macrofaunal communities. The EIS has not addressed more aesthetically and ecologically oriented alternatives such as non-invert channel designs. Also, please refer to our earlier letter of 11 February 1977.
- d. The Kaneohe sewage treatment facility and a golf course lie in the common flood plain of Kawa and Kaneohe streams. Completion of the Kaneohe Flood Control Project will provide limited protection to these facilities. However, the proposed invert structures in Kawa Stream may increase flooding in the area below the channelized portion. Conveyance of flood waters in the channel may be expected to reach high velocities,



PODED-PV

2 August 1977

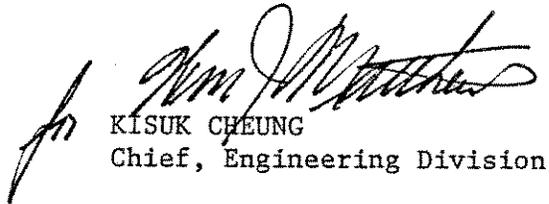
Mr. Wallace Miyahira, Director

and peak flooding will occur more rapidly. As a consequence, damage to the facilities located below the channelized portion attributed to implementation of the proposed project may occur.

e. In general, the assessment of existing conditions and impacts on water quality seem reasonable in light of Kawa Stream's relatively small contribution to runoff entering Kaneohe Bay. Since Kawa is already partially channelized, the impact on existing water quality will probably be minimal. However, in view of the County and State's desire to improve conditions in the Bay (as reflected by the diversion of sewage effluent out of Kaneohe Bay), any additional channelization of streams entering Kaneohe Bay should be examined critically. The relative importance of discharges from Kawa Stream in degrading water quality will probably increase after sewage diversion and this probable impact should be addressed. For example, will the increased stream velocity during flood flows cause greater streambank erosion below the channelized portion and will these waters convey greater sediment loads into Kaneohe Bay?

Thank you for the opportunity to comment on this EIS document.

Sincerely yours,


KISUK CHEUNG
Chief, Engineering Division

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR



WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0399

August 16, 1977

Colonel F. M. Pender
District Engineer
Honolulu District
U.S. Army Corps of Engineers
Building 230, Fort Shafter
APO San Francisco 96558

Dear Colonel Pender:

SUBJECT: YOUR LETTER OF AUGUST 2, 1977, RELATING TO
THE EIS FOR THE KAWA STREAM FLOOD CONTROL
PROJECT

Thank you for your comments on the subject EIS; our corresponding responses follow:

- a. The noted change on page ii has been made.
- b. The phrase, "growth scenarios envisioned" (page 6, third line from bottom), does not imply a projection or a recommendation by the Corps of Engineers. The subject discussion was purposely kept to very general terms in order to avoid such an implication.
- c. We concur that a concrete substratum does not provide habitat for native aquatic macrofauna. However, a lined invert is far from "sterile," as a significant number of frogs, poecilids and aquatic snails were found in the Parkway channel (page 20, first paragraph). The main issue here is the protection of Hawaii's streams in order to preserve their threatened native fauna. As a result of previous alterations, Kawa Stream does not contain any native macrofauna (except in the estuarine section), nor is there any undisturbed habitat in the project area. If a "natural" habitat were restored, it is almost certain that it would be occupied by the aggressive exotic macrofauna, rather than the natives. Since the exotics (which are not valued by the scientific community) can live on a "sterile" concrete invert, there is no point in providing habitat for them.

With regard to aesthetics, we must respond that in this case it is "in the eye of the beholder." In its present condition, the portion of Kawa Stream proposed for improvement does not have a pleasing appearance (see Plates 3 and 4, which are representative). Only the residents who live next to the stream can see the channel (visibility from Mokulele Drive and Namoku Street is very poor), and it is their complaints and requests for lining that have initiated this project. The new channel will leave more of the right-of-way open for landscaping than is presently available. We did take your earlier comments into account in the evaluation of alternatives, specifically the wide greenway and CRM designs (page 28, and page 29, last paragraph).

- d. As discussed on page 22 (paragraphs 2 and 3), the pool below Kaneohe Bay Drive will continue to function as a natural velocity control structure. It is conceivable that a larger and more rapid peak could occur with a fully lined channel than would occur in the existing partially lined channel, but that the actual difference in magnitude may not be significant.
- e. We agree that the relative importance of all of the stream discharges into Kaneohe Bay will increase when the effluent from the Kaneohe STP is diverted to the Mokapu Ocean Outfall. But this is not an impact of the proposed project as implied in the comment, since it is agreed that the effect of the lining on the quality of Kawa Stream will be minimal. The specific example cited is discussed on page 22, paragraph 3.

Very truly yours,


for WALLACE MIYAHIRA
Director and Chief Engineer



DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
APO SAN FRANCISCO 96558

AFZV-FE-EE

20 JUN 1977

Environmental Quality Commission
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Environmental Impact Statement (EIS) for Kawa Stream Flood Control Project, Kaneohe, Hawaii, dated June 1977 has been reviewed and we have no comments to offer. There are no Army installations in the immediate area of the proposed project.

The EIS is returned in accordance with your request. Thank you for the opportunity to review the document.

Sincerely yours,

for CARL P. RODOLPH

Colonel, CE

Director of Facilities Engineering

1 Incl

As stated

CF:

Dept of Public Works
City and County of Honolulu
Honolulu Municipal Bldg
650 South King Street
Honolulu, Hawaii 96813

7704786



RECEIVED DEPARTMENT OF TRANSPORTATION
DIV. OF ENGINEERING
UNITED STATES COAST GUARD
RECEIVED DEPT. OF PUBLIC WORKS
JUN 24 4 06 PM '77

Address reply to:
COMMANDER (mep)
Fourteenth Coast Guard District
677 Ala Moana
Honolulu, Hawaii 96813

JUN 24 1 44 PM '77
TO ENV *Engg*
16475
22 JUN 1977

Department of Public Works
City & County of Honolulu
Honolulu Municipal Bldg
Honolulu, Hawaii 96813

Gentlemen:

Staff review of the "Environmental Impact Statement for Kawa Stream Flood Control" has been completed, and the Coast Guard has no comments to offer on the project.

The opportunity to review and comment on the EIS is appreciated.

Sincerely,

J. V. CAFFREY
Chief of Staff

Copy to:
Commandant (G-WEP-7)
CEQ Washington DC
OEQC Hawaii



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

July 25, 1977

JOHN FARIAS, JR.
CHAIRMAN, BOARD OF AGRICULTURE

YUKIO KITAGAWA
DEPUTY TO THE CHAIRMAN

BOARD MEMBERS:

IRWIN M. HIGASHI
MEMBER - AT - LARGE

ERNEST F. MORGADO
MEMBER - AT - LARGE

KALFRED K. YEE
MEMBER - AT - LARGE

SHIZUTO KADOTA
HAWAII MEMBER

STEPHEN Q. L. AU
KAUAI MEMBER

FRED M. OGASAWARA
MAUI MEMBER

MEMORANDUM

To: Environmental Quality Commission

Subject: Kawa Stream Flood Control Project
Kaneohe, Oahu, Hawaii
C&C of Honolulu Public Works Department
TMK: 4-5-34, 61, 62, 63, 66, 67, 70, 84 & 89

The Department of Agriculture has reviewed the subject request.

This agency has no objections or comments on the proposed project.

We appreciate the opportunity to comment.

John Farias, Jr.
JOHN FARIAS, JR.
Chairman, Board of Agriculture

GEORGE R. ARIYOSHI
GOVERNOR



VALENTINE A. SIEFERMANN
MAJOR GENERAL
ADJUTANT GENERAL

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
FORT RUGER, HONOLULU, HAWAII 96816

20 JUN 1977

HIENG

Dr. Albert Tom, Chairman
Office of Environmental Quality Commission
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Tom:

Kawa Stream Flood Control

Thank you for sending us a copy of the "Kawa Stream Flood Control"
Environmental Impact Statement. We have received the publication and have
no comments to offer.

Very truly yours,


WAYNE R. TOMOYASU
Captain, CE, HARNG
Contr & Engr Officer

Enclosure

11 03233

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

RECEIVED
DIV. OF ENGINEERING
JUL 13 10 30 AM '77



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DEPT. OF PUBLIC WORKS

JUL 13 7 32 AM '77

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

Env Eng

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

Audrey W. Mertz, M.D., M.P.
Deputy Director of Health

Henry N. Thompson, M.A.
Deputy Director of Health

James S. Kumagai, Ph.D., P.
Deputy Director of Health

In reply, please refer to:
File: _____

JUL 11 1977

MEMORANDUM

To: Office of Environmental Quality Control
From: Deputy Director of Environmental Programs
Subject: EIS Kawa Stream Flood Control Project

Thank you for allowing us to review and comment on this EIS.

The following comments are offered in addition to those we submitted in the EIS preparation notice.

1. The EIS should also address the noise problems from heavy vehicle traveling to and from construction site:
 - a. Heavy vehicle must comply with the provision of Public Health Regulations, Chapter 44A, Vehicular Noise Control for Oahu.
 - b. Efforts must be made to minimize the effect of noise from heavy vehicle to the affected population such as routing, scheduling, etc.

James S. Kumagai
JAMES S. KUMAGAI, Ph.D.

cc: Department of Public Works, City and County of Honolulu, HI ✓

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR



WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0401

August 17, 1977

Dr. James S. Kumagai
Director
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, HI 96801

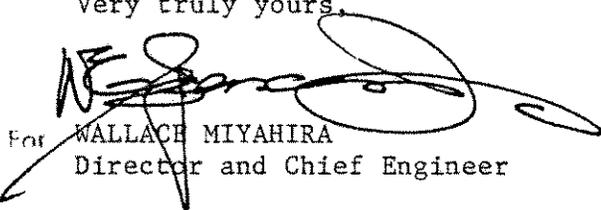
Dear Dr. Kumagai:

SUBJECT: YOUR LETTER OF JULY 11, 1977, RELATING TO
THE EIS FOR THE KAWA STREAM FLOOD CONTROL
PROJECT

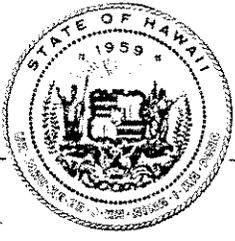
Thank you for your comments on the subject EIS.

It will be the responsibility of the Contractor to comply with the vehicular and community noise control ordinances (Public Health Regulations Chapters 44A and 44B); any necessary permits will be obtained prior to construction. As you suggested, reference has been made to this in the Revised EIS, on page 26.

Very truly yours,


For WALLACE MIYAHIRA
Director and Chief Engineer

7705204



DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT RECEIVED

Kamamalu Building, 250 South King Street, Honolulu, Hawaii • Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

GEORGE R. ARIYOSHI
Governor

HIDETO KONO
Director

FRANK SKRIVANEK
Deputy Director

RECEIVED
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JUL 17 3 07 PM '77

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JUL 12 7 42 AM '77

July 8, 1977

TO ENV
Engg

Ref. No. 4008

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

Dear Mr. Miyahira:

Subject: Kawa Stream Flood Control Environmental Support Statement

We have received the subject EIS and have determined that, in general, it has adequately addressed the major environmental impacts which can be anticipated resulting from the proposed project. We were pleased to note that our suggestion to evaluate Dr. Albert Benner's park-open space suggestion was incorporated and evaluated within this document.

We have no further comments to offer at this time. Thank you for the opportunity to review and give comment on this statement.

Sincerely,

Frank Skrivaneck
for HIDETO KONO

GEORGE R. ARIYOSHI
GOVERNOR

ANDREW I. T. CHANG
DIRECTOR OF SOCIAL SERVICES & HOUSING

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JUN 28 3 03 PM '77

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING
P. O. Box 339
Honolulu, Hawaii 96809

EW
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June 27, 1977

MEMORANDUM

TO: Environmental Quality Commission
550 Halekauwila St., Rm. 301
Honolulu, Hawaii 96813

FROM: Andrew I. T. Chang, Director
Department of Social Services and Housing

SUBJECT: Kawa Stream Flood Control Project Environmental Impact Statement

Subject EIS has been reviewed for its effect on departmental programs.

There is agreement with the project due to the continuing urban growth in the project area and the need for efficient drainage throughout the area.

We are returning the EIS for your further usage.

Thank you for the opportunity to review and comment.



DIRECTOR

Attachment
cc: Governor, State of Hawaii
Dept. of Public Works, C & C of Honolulu



E. ALVEY WRIGHT
DIRECTOR

DEPUTY DIRECTORS:

WALLACE AOKI
RYOKICHI HIGASHIONNA
DOUGLAS S. SAKAMOTO
CHARLES O. SWANSON

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

IN REPLY REFER TO:

July 25, 1977

STP 8.4377

Office of Environmental Quality
Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: Environmental Impact Statement
Kawa Stream Flood Control, Kaneohe, Oahu

Thank you for giving us the opportunity to review and comment on the above-captioned document. We have no comments which could improve the statement.

Sincerely,

E. Alvey Wright
E. ALVEY WRIGHT
Director

GEORGE R. ARIYOSHI
GOVERNOR

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RICHARD E. MARLAND, PH.D.
DIRECTOR

TELEPHONE NO.
548-6915

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

ENV
ll
Engng

550 HALEKAUWILA ST.
ROOM 301

HONOLULU, HAWAII 96813

July 22, 1977

Wallace Miyahira, Director
Department of Public Works
City and County of Honolulu
Honolulu, Hawaii 96813

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT FOR KAWA STREAM FLOOD CON-
TROL, KANEOHE, OAHU

Dear Mr. Miyahira,

As of this date, this Office has received 10 comments on the above subject. An attached sheet lists the responding agencies and/or organizations.

Overall, we have found the environmental impact statement, to be well organized and well done. Specifically, we have some minor comments:

1. We recommend that flood proofing of homes be considered as another alternative.
2. Has a cost-benefit analysis been made for this proposed action? if so, we recommend a discussion.
3. Will a sedimentation trap or desilting basin be necessary somewhere along the channel?

We note in the EIS Regulations that the accepting authority need not consider responses beyond the fourteen day response period. We will consider response beyond that period.

We thank you for the opportunity to review the EIS. We look forward to the revised EIS.

Sincerely,

Richard E. Marland
Director

attachments

List of Responding Agencies/Organization

Federal

*Department of the Army	June 20, 1977
*Coast Guard	June 22, 1977
Fourteen Naval District	June 28, 1977

State

Department of Defense	June 20, 1977
*Department of Social Services & Housing	June 27, 1977
*Department of Health	July 11, 1977

City and County of Honolulu

*Board of Water Supply	June 22, 1977
Department of Transportation Services	July 1, 1977
*Department of Housing & Community Services	July 1, 1977
*Department of Land Utilization	July 5, 1977

*denotes comments previously forwarded by reviewer

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0400

August 17, 1977

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

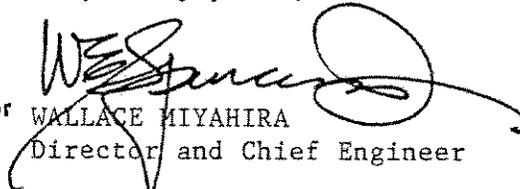
Dear Dr. Marland:

SUBJECT: YOUR LETTER OF JULY 22, 1977, RELATING TO
THE EIS FOR THE KAWA STREAM FLOOD CONTROL
PROJECT

Thank you for your comments on the subject EIS; our corresponding responses follow:

1. "Flood proofing", which would primarily involve the construction of levees at selected sites, is not a viable solution in this case because the problem of stream bank erosion would not be alleviated.
2. The Department of Public Works does not prepare cost-benefit analyses for its projects.
3. As noted on page 10 (first paragraph) and page 22 (third paragraph), the lower section of the stream is currently functioning as a sediment trap.

Very truly yours,


for WALLACE MIYAHIRA
Director and Chief Engineer

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DEPT OF PUBLIC WORKS
Jul 26 11 42 AM '77

University of Hawaii at Manoa

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

Office of the Director

July 25, 1977

RE: 0228

Office of Environmental
Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Sir:

Review of Environmental Impact Statement for
Kawa Stream Flood Control
Honolulu Department of Public Works
June 1977

The following comments relate to the Environmental Impact Statement (EIS) submitted by the Department of Public Works, City and County of Honolulu in June 1977 concerning the Kawa Stream Flood Control project. The comments are based on reviews by Paul Bartram (Pacific Urban Studies and Planning Program) and Paul Ekern (Water Resources Research Center). They relate principally to the potential impacts of the proposed project on sedimentation.

1. We suggest that the source of sediments carried by the stream be further described. It would be helpful if the soils in the drainage area (principally Kaneohe, Lolekaa, and Hanalii) were identified, located, and related to their physical properties (e.g. using "A Performance Standard for Erosion Control, Hawaii Environmental Simulation Labs, May 1976, Oahu version). We suggest that the soil conservation status of the area be discussed.
2. We suggest that the potential source for bed-load sediments be discussed. If the potential is significant, we suggest that construction of a sediment trap at the upstream end of the lined channel may be warranted.
3. If part of the golf source is within the floodplain, we consider that the EIS should indicate whether there are agreements as to the responsibility for damages resulting from flooding and associated accumulation of sediments.
4. We suggest that plans for maintaining the flood-passing and sediment-trapping capabilities of the lower channel of the stream be discussed. For example, is the lower stream channel to be maintained by periodic dredging.
5. We suggest the consideration of upstream debris barriers to prevent clogging of downstream culverts by brush and trees.

July 25, 1977

6. The existence of a natural rock channel immediately downstream of Kaneohe Bay Drive is noted in the EIS. The presence of any other natural rock channels that might provide erosion base levels for the stream should be noted.

Yours very truly,



Doak C. Cox
Director

CC: Department of Public Works, ✓
City & County of Honolulu
Contributors

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0403

August 17, 1977

Dr. Doak C. Cox
Director
Environmental Center
University of Hawaii at Manoa
2550 Campus Road, Crawford 317
Honolulu, HI 96822

Dear Dr. Cox:

SUBJECT: YOUR LETTER OF JULY 25, 1977, RELATING TO THE
EIS FOR THE KAWA STREAM FLOOD CONTROL PROJECT

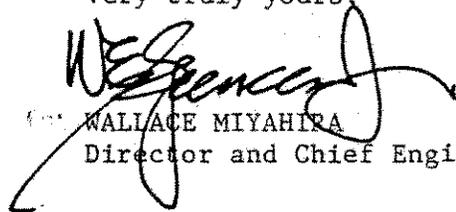
Thank you for your comments on the subject EIS. Our responses follow:

1. The discussion of erosion was intentionally limited to stream bank erosion, since that is what will be affected by the proposed project. In this context, the various erosion and sediment yield models are not applicable, since they deal only with surfaces in the watershed. In estimating the actual amount of channel enlargement that has occurred, the EIS presents data not available elsewhere. We agree that a basin-wide analysis of erosion would be of interest, but such a study would not shed additional light on the impacts of the proposed project.
2. The major source of bed-load sediment is erosion of the stream channel itself. The proposed lining will, of course, control this source. There is currently a sediment trap at the upstream end of the Parkway channel.
3. There are no such agreements.
4. The City and County does not hold the right-of-way for the stream through the golf course; maintenance is not provided for streams through private property.
5. There are no plans for upstream debris barriers; instead, the Namoku Street culvert will be enlarged.
6. Stream sections with a rock or "mud stone" invert were noted below the Parkway channel (Unit 1A), near Pouhanu Place (Unit 1B) and below

Dr. Doak C. Cox
Page 2

Mokulele Drive (Unit 2). While this may provide a limit to the depth of the channel, there is nothing (other than the partial lining) to prevent the channel from being widened by erosion. On an average, the channel has been deepened by 1-3 feet since the early 1960's, but has been widened by 40-90 feet. It is this tendency that presents a threat to the adjacent properties.

Very truly yours,



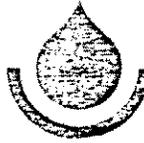
WALLACE MIYAHIRA
Director and Chief Engineer

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

630 SOUTH BERETANIA

HONOLULU, HAWAII 96843



FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
STANLEY S. TAKAHASHI, Vice Chairman
KAZU HAYASHIDA
TERESITA R. JUBINSKY
EDWARD F.C. LAU
E. ALVEY WRIGHT

EDWARD Y. HIRATA
Manager and Chief Engineer

June 22, 1977

Honorable George Ariyoshi
Governor, State of Hawaii
State Capitol
Honolulu, Hawaii 96813

Dear Governor Ariyoshi:

Subject: Environmental Impact Statement for
Kawa Stream Flood Control Project

We do not have any objections to the proposed project. However, we request that the construction plans be submitted to us for review and approval.

Our departmental contact is Lawrence Whang at 548-5221.

Very truly yours,

E. Y. Hirata
for Edward Y. Hirata
Manager and Chief Engineer

cc: Mr. Wallace Miyahira
Director and Chief Engineer
Dept. of Public Works
City and County of Honolulu

To: Director, Land/EOC.

For:

- Comment/Recommendation (if any)
- Appropriate attention
- Direct reply (bcc to Gov.)
- Your information/file
- Draft reply for Gov.'s signature
- Follow up
- Submit copy of response
- Other

DUE five days from date of receipt.
(If delay is encountered in meeting suspense
date, please advise by telephone immediately.)

In reply please refer to: 77-379-18

JUN 30 1977

B-24

RECEIVED
JUN 23 1977

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813
PHONE 523-4101

FRANK F. FASI
MAYOR

RICHARD K. SHARPLESS
MANAGING DIRECTOR



WILLIAM BLACKFIELD
DIRECTOR

TYRONE T. KUSAO
DEPUTY DIRECTOR

July 1, 1977

Environmental Quality Commission
550 Halekauwila Street, Rm. 301
Honolulu, Hawaii 96813

Gentlemen:

Re: Kawa Stream Flood Control Project
Environmental Impact Statement

Thank you for giving us the opportunity to
review the subject Environmental Impact Statement.

We have no objections to the project.

Per your request we are returning the copy
of the EIS forwarded to us.

Sincerely,

A handwritten signature in cursive script, appearing to read "T. Kusao".

TYRONE T. KUSAO
Acting Director

Enc.

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813



FRANK F. FASI
MAYOR

GEORGE S. MORIGUCHI
DIRECTOR

LU6/77-3072 (GN)

July 5, 1977

Mr. Donald Bremner, Acting Chairman
Environmental Quality Commission
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Mr. Bremner:

Environmental Impact Statement
Kawa Stream Flood Control Project

We have reviewed the above and are in agreement with the objectives of the proposed action and feel that the statement adequately describes potential effects of the environment.

Thank you for the opportunity to comment on this document.

Very truly yours,

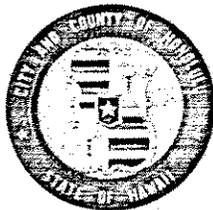

GEORGE S. MORIGUCHI
Director of Land Utilization

GSM:ey

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR



KAZU HAYASHIDA
DIRECTOR

TE6/77-2744

July 1, 1977

Environmental Quality Commission
550 Halekauwila St., Rm. 301
Honolulu, Hawaii 96813

Gentlemen:

Subject: EIS for Kawa Stream Flood Control Project

We recommend that the following paragraph be included in the construction section of the report:

The Contractor shall provide, install, and maintain all necessary signs and other protective facilities, which shall conform with the "Rules and Regulations Governing the Use of Traffic Control Devices at Work Sites on or Adjacent to Public Streets and Highways" adopted by the Highway Safety Coordinator, and the Federal Highway Administration "Manual on Uniform Traffic Control Devices for Streets and Highways", Part VI "Traffic Control for Highway Construction and Maintenance Operations".

Very truly yours,

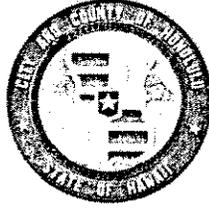
Kazu Hayashida
for KAZU HAYASHIDA
Director

cc: Governor Ariyoshi
Public Works

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR



WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

701-12-0402

August 17, 1977

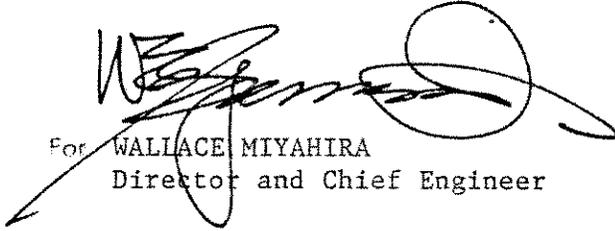
TO : MR. KAZU HAYASHIDA, DIRECTOR
DEPARTMENT OF TRANSPORTATION SERVICES

FROM : WALLACE MIYAHIRA, DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

SUBJECT: YOUR LETTER OF JULY 1, 1977, RELATING TO THE EIS FOR THE
KAWA STREAM FLOOD CONTROL PROJECT

Thank you for your comments on the subject EIS.

As you requested, we have made reference in the Revised EIS regarding the provision of traffic control devices (page 26).


For WALLACE MIYAHIRA
Director and Chief Engineer