DEPARTMENT OF HAWAIIAN HOME LANDS
WAIMANALO GRAVITY SEWER SYSTEM, SECTION 5

PRELIMINARY ENGINEERING REPORT AND ENVIRONMENTAL IMPACT ASSESSMENT

LOCATION: WAIMANALO
ISLAND OF OAHU
STATE OF HAWAII

PROPOSING AGENCY: DEPARTMENT OF HAWAIIAN HOME LANDS
STATE OF HAWAII

CONSULTANT: FUKUNAGA & ASSOCIATES, INC.
1388 KAPIOLANI BLVD., 2ND FLOOR
HONOLULU, HAWAII 96814

DATE: DECEMBER 1989

TABLE OF CONTENTS

DEPARTMENT OF HAWAIIAN HOME LANDS
WAIMANALO GRAVITY SEWER SYSTEM SECTION 5

A. GENERAL INFORMATION

1. The project involves the design and construction of a gravity sewer collection system and a sewage pumping system to serve a portion of the existing Hawaiian Home Lands (HHL) residential subdivision located in Waimanalo, Oahu, Hawaii.

2. The project location is shown in Figure 1, and boundaries of the project area are shown in Figure 2. The project area is located near Waimanalo Town within the existing HHL residential subdivision and is served by existing electrical, water, telephone, and drainage utilities. Sewage is being disposed of by individual cesspools. Existing access is from Kalanianaole Highway and various asphalt paved roads within the HHL residential subdivision.

3. The properties to be served by the project are zoned for residential use by county regulations, and are identified by the following Tax Map Key (TMK) numbers as shown on Figures 3 and 4.

TMK 4-1-16 Parcels: 1 through 6
41 through 49
71, 72, 74 through 88
94, 95, and 97,

TMK 4-1-17 Parcels: 2 through 20, and
22 through 26

4. The topography of the project area generally slopes upwards from the shoreline to Kalanianaole Highway. Ground elevations varying from about 11 feet MSL to 17 feet MSL along the project boundary. A high area, with ground elevations at about 30 feet MSL, exists near

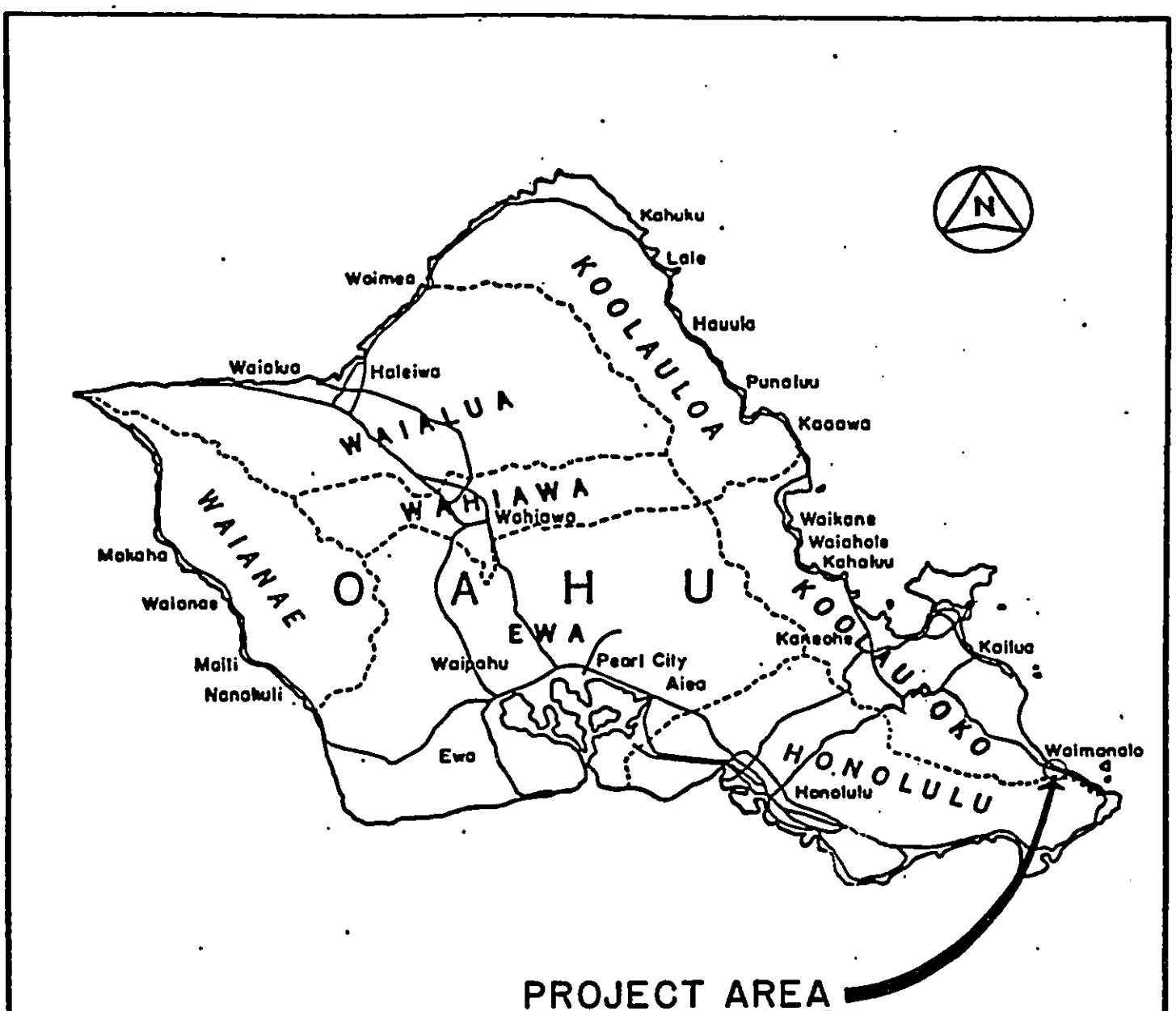

N
Kahuku
Laie
Waimea
Hauula
KOOLAULOA
Waialua
Haleiwa
Punaluu
Kaaawa
WAIALUA
WAHIAWA
Wahiawa
Waikane
Waiahole
Kahaluu
Makaha
WAIANAE
O A H U
KOOLAUPOKO
Waianae
EWA
Kaneohe
Kailua
Maili
Waipahu
Pearl City
Aiea
Nanakuli
Ewa
Waimanalo
HONOLULU
Honolulu
PROJECT AREA
LOCATION MAP
4 0 4 8
SCALE IN MILES

FIGURE 1

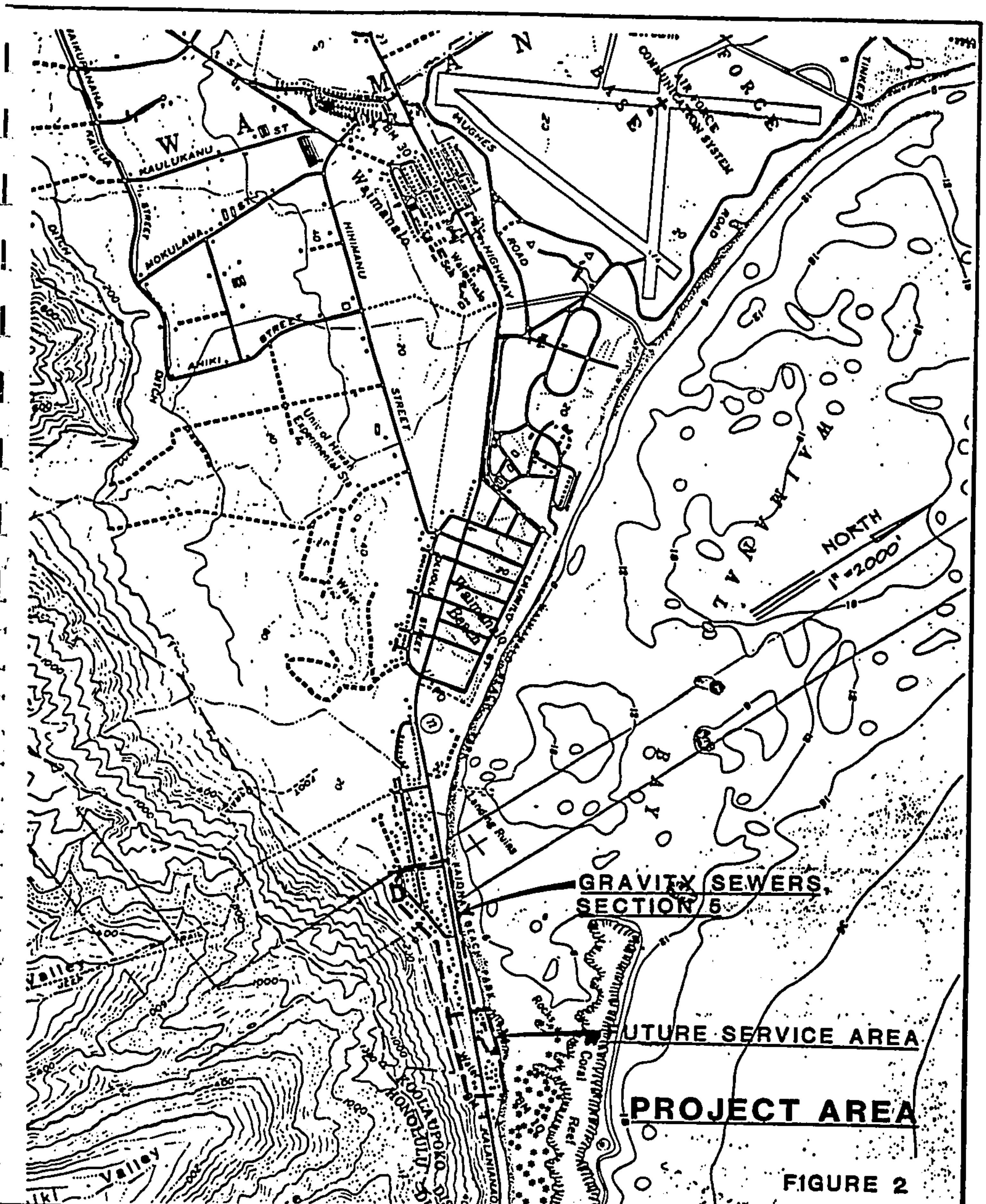


FIGURE 2

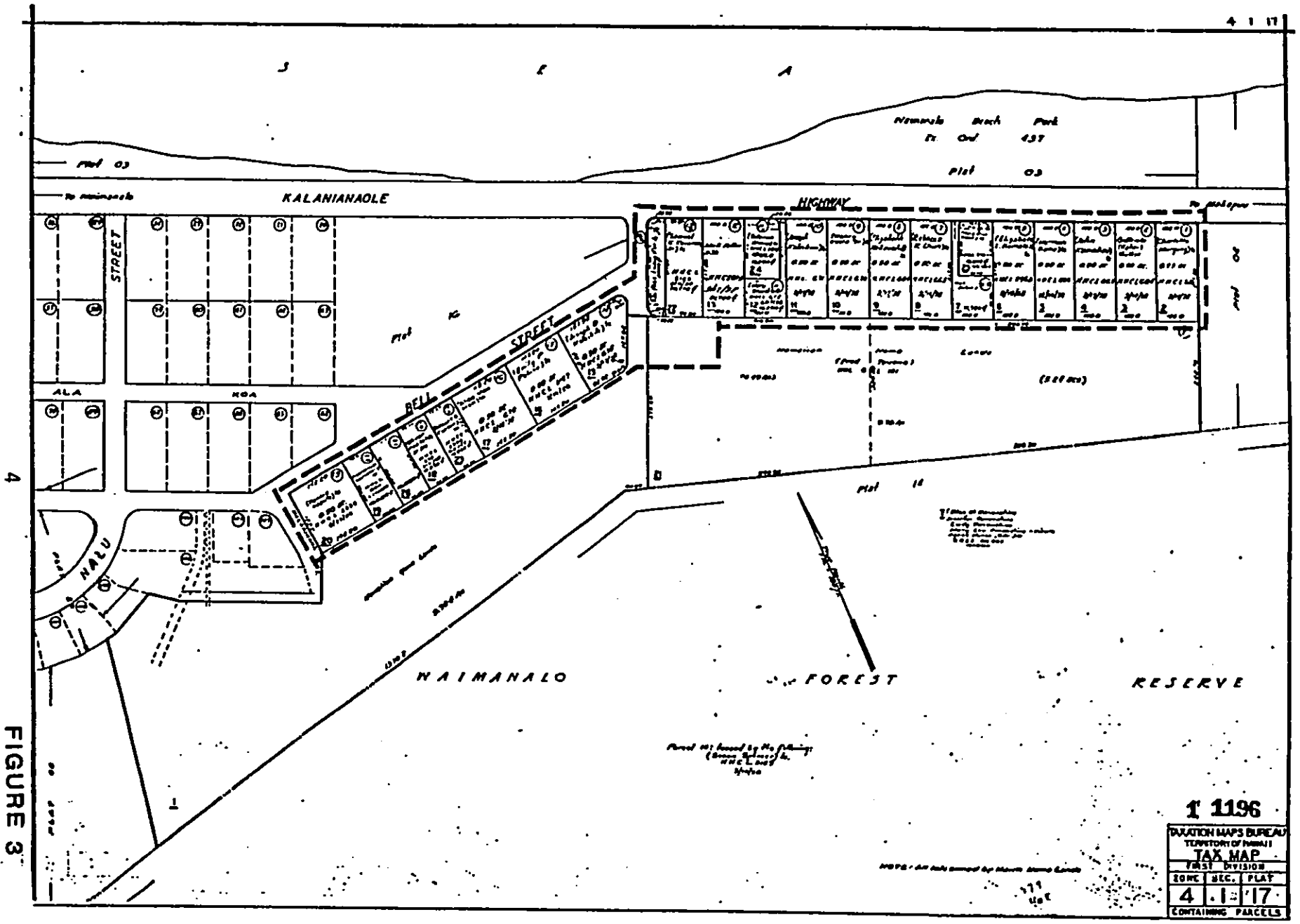


FIGURE 3

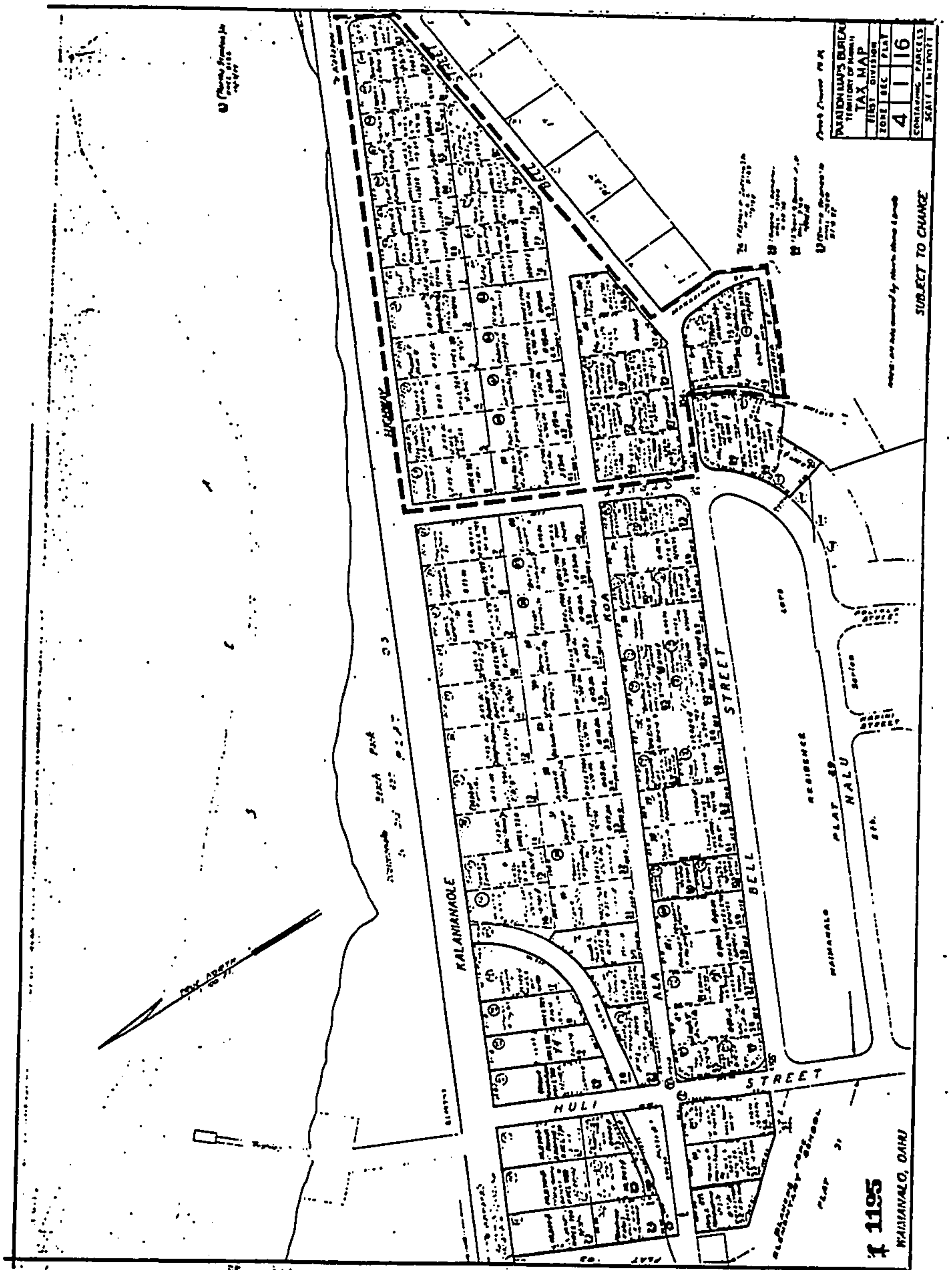


FIGURE 4

the intersection of Nalu Street and Bell Street. From there the ground generally slopes downward in an easterly direction to elevations of about 9 feet near the intersection of Kalanianaole Highway and Bell Street. Because of the high ground near Nalu Street, sewage collected from homes within the project area cannot flow by gravity to the Waimanalo Sewage Treatment Plant (STP). A separate gravity sewer system and a sewage pump station (SPS) are necessary to collect the sewage at a convenient location, and to pump the sewage over the hill to a location where it can flow by gravity to Waimanalo STP.

5. The proposed sewage pump station is to be located at the northwest corner of TMK 4-1-17:21, and will occupy approximately 0.5 acres. The land there belongs to HHL, and is leased to Fred Teixeira under HHL G.L. 181. Access to the pump station will be across TMK 4-1-17:1. Both Parcels 1 and 2 are within the State designated Conservation District Use area, and are zoned P-1 by County zoning regulations. A State Conservation District Use Application for Conditional Use Subzone and a County Special Management Area Permit Application must be prepared, and appropriate permits obtained. The project is not within a flood hazard area according to U.S. Department of Housing and Urban Development Flood maps as indicated in Figure 5.

6. Anticipated construction commencement date for the project is July 1990, and the estimated completion date is August 1991.

7. Preliminary construction drawings of the proposed gravity collection system and sewage pump station are included as Appendix I

NATIONAL FLOOD INSURANCE PROGRAM

FLOODWAY

FLOOD BOUNDARY AND FLOODWAY MAP

CITY AND COUNTY OF
HONOLULU, HAWAII

PANEL 95 OF 135
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
150001 0095 A

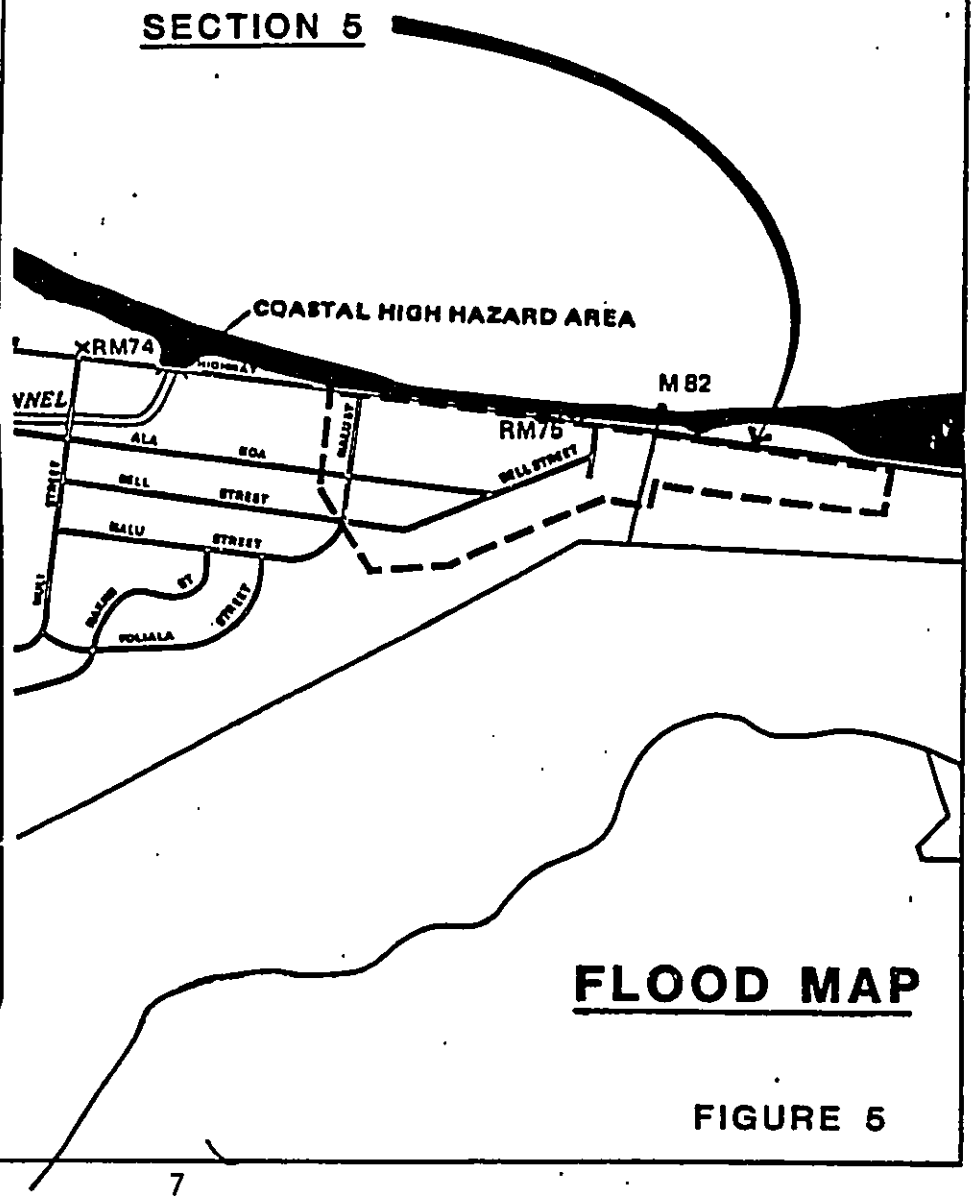
EFFECTIVE DATE:
SEPTEMBER 3, 1980

U.S. DEPARTMENT OF HOUSING
AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

APPROXIMATE SCALE
1000 0 1000 FEET

WAIMANALO GRAVITY SEWERS

SECTION 5



FLOOD MAP

FIGURE 5

(Gravity Collection System) and Appendix II (Sewage Pump Station).

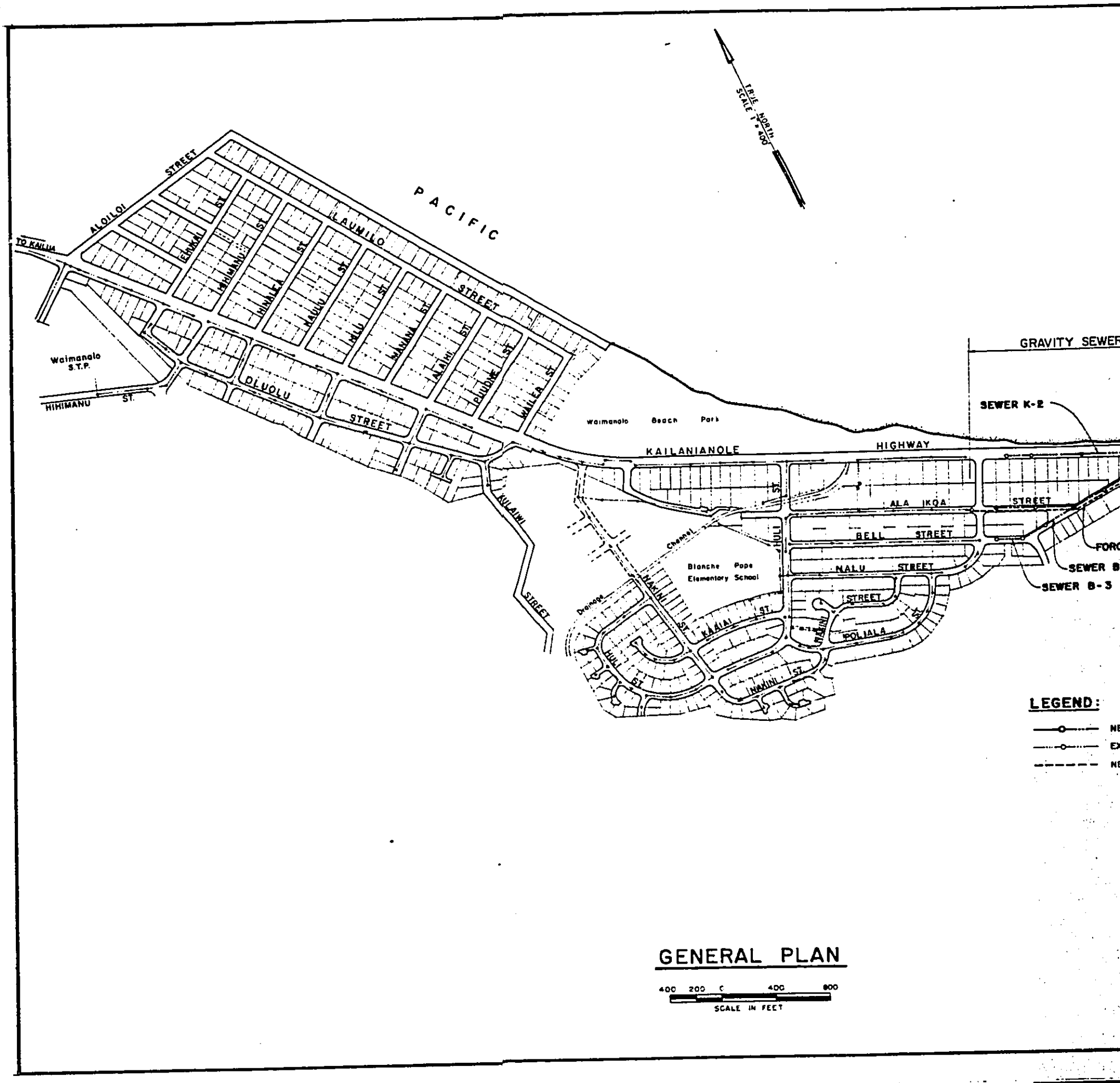
B. CHARACTERISTICS AND QUANTITY OF WASTEWATER

1. The existing HHL residential area to be served includes 59 house lots and is shown in Figure 6. In addition, HHL has directed that future flows from areas outside of the existing HHL residential area be allowed for in the the design of the proposed pump station. The future flows would be generated from 34 existing private lots along the coast and future HHL developments (allowance for 190 units) toward the east. See Figure 6.

2. Since the project area to be served is part of the existing HHL residential subdivision and future flows will be from residential developments, the wastewaters generated are expected to be ordinary domestic sewage.

3. The quantities of wastewater have been estimated by using criteria established in the Design Standards of the Division of Wastewater Management, Volume 1 dated February 1984, with modifications as noted below. The criteria used are as follows:

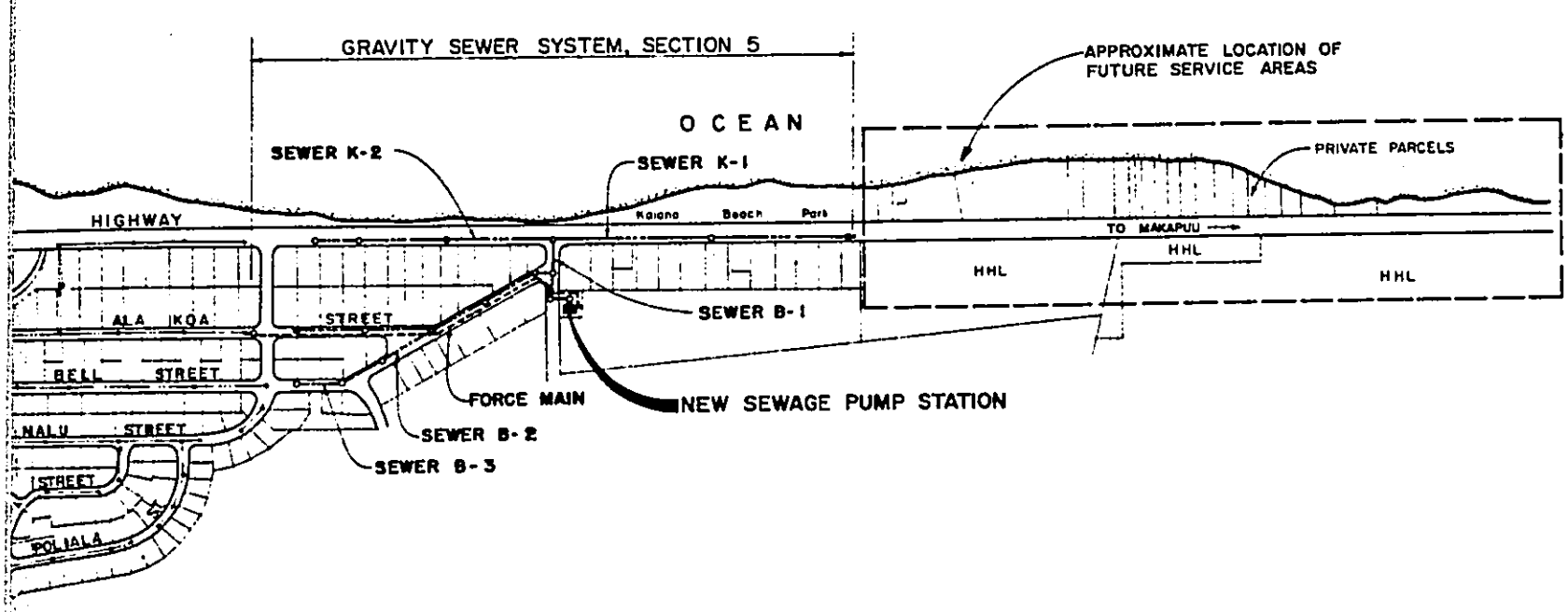
Average Daily Per Capita Flow	80 gallons/day
Density per residential unit	4 persons/home
Dry Weather Infiltration/Inflow:	
HHL lots within project area	5 gallons/capita/day
Future flows from Private lots and HHL property	*20 gallons/capita/day
Wet Weather Infiltration/Inflow:	
HHL lots within project area	1,250 gallons/acre/day
Future flows from Private lots and HHL property	*2,000 gallons/acre/day



GENERAL PLAN

400 200 0 400 800

SCALE IN FEET



LEGEND:

—o— NEW SEWER LINE

—·o·— EXISTING SEWER LINE

– – – – NEW FORCE MAIN

REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2203-C
HAWAII U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

FUKUNAGA & ASSOCIATES

PROJECT: WAIMANALO RESIDENCE LOTS GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII

ITEM: GENERAL PLAN

DESIGNED S. YOUNG SCALE 1" = 400'
DRAFTSMAN H. S. APP CHECKED BY R. FUKUNAGA
APPROVED BRANCH HEAD
CHIEF, DIV. OF WASTEWATER MANAGEMENT DATE

JOB NO.

SHEET OF FIGURE 6

*values deviate from standards because many of the private lots are along low coastal areas.

4. Based on the above criteria, and the service areas decribed, the estimated wastewater flows were calculated and compiled as Appendix III.

5. The estimated wastewater quantities are summarized as follows:

	INITIAL	FUTURE
Residential units	59	283
Population served	236 persons	1132 persons
Average Wastewater Flow	0.019 mgd	0.091 mgd*
Max Flow Factor	5	5
Maximum Wastewater Flow	0.095 mgd	0.456 mgd
Dry Weather Infiltration	0.001 mgd	0.019 mgd
Design Average Flow	0.02 mgd	0.110 mgd
Design Maximum Flow	0.096 mgd	0.475 mgd
Wet Weather I/I	0.0375 mgd	0.105 mgd
Design Peak Flow	0.133 mgd or 92 gpm**	0.58 mgd or 403 gpm

* MGD or mgd = million gallons per day

**gpm = gallons per minute

6. The sewage pump station will be designed to accommodate the future design peak flow of 0.58 MGD. Two (2) constant speed pumps capable of 403 gpm @ 60± ft. TDH are proposed. Initially, smaller impellers will be provided to pump at about 315 gpm. One pump is to be for operation and the other for standby. Calculations are attached as Appendix IV. Based on the proposed pumps and a wet well

operating volume of 510 gallons, the pump cycle times would be as follows:

	INITIAL	FUTURE
Pump Rating	315 gpm	405 gpm
Motor HP	15 HP	15 HP
Wet Well Volume	510 gal	510 gal
Min. Cycle Time @ Design Peak Flow	8 min	5.0 min
Pump Cycle Time @ Design Ave Flow	38 min	8 min
Maximum Retention Time @ Design Ave. Flow	5.9 min	5.4 min

C. PROPOSED COLLECTION AND TRANSMISSION SYSTEM

1. The existing Waimanalo area sewerage system is shown in Figure 6, and is comprised of gravity sewers, a sewage pump station and one municipal sewage treatment facility. Un-sewered residences are served by individual cesspools. The Waimanalo Sewage Treatment Plant (STP) was designed and constructed by the State of Hawaii in 1972 to handle a design average daily flow of 1.1 mgd. At present, the facility is operated and maintained by the City and County of Honolulu, Department of Public Works, Division of Wastewater Management. Treated effluent is disposed via effluent disposal injection wells. According to Division of Wastewater Management information, the present effective plant capacity is 0.7 mgd, and the average daily flow (FY88 data) entering the plant is 0.38 mgd.

2. The proposed Waimanalo Gravity Sewer System Section 5 project will initially serve the remaining 59 un-sewered HHL house lots in their Waimanalo area subdivision. Future planning allowances required by HHL include 34 private house lots along Kalanianaole Highway and 190

future HHL residential units. Therefore, initial average daily flows are expected to be about 0.019 mgd, and future average daily flows could amount to about 0.091 mgd. Based on the information available from the Division of Wastewater Management, the existing Waimanalo STP can accommodate the initial 0.019 mgd as well as the future 0.091 mgd average daily flows. Review of existing gravity lines which will convey flows from the project area to the STP indicates that the pipe capacities are adequate.

3. Because there is a hill between the project area and the Waimanalo STP a separate gravity sewer system and a pumping system are proposed to collect the sewage and convey it through a forcemain for discharge at a convenient location where it can flow by gravity to the STP. The proposed system is shown in Figure 6.

4. All proposed wastewater facilities including gravity sewers, sewage pump station and force main will be designed in accordance with the Division of Wastewater Management Design Standards. The same agency will operate and maintain the system upon construction completion and acceptance of the system.

5. Pertinent design features of the sewage collection and pumping system shall be as follows:

   a. Gravity Sewers shall be of vitrified clay.

   b. Force Main shall be of Ductile Iron, cement lined and polywrapped.

c. Sewage Pump Station:

(1) Designed to discharge the "future" peak sewage flow of 0.58 mgd or 403 gpm. Initial pumping capacity about 315 gpm,

(2) Substructure consisting of a dry pump room and wet well shall be of reinforced concrete. Wet well to be PVC lined,

(3) Superstructure shall be of concrete masonry units with built up roofing,

(4) Two (2) constant-speed pedestal mounted centrifugal non-clog pumps initially sized for 315 gpm and located in the dry pump room shall be provided. One pump shall be for operation while the second is for standby.

(5) Miscellaneous site work including fencing, paved roadways and parking areas, and landscaping shall be provided.

d. Auxiliary equipment shall include:

(1) Sump pumps in dry pump room to remove washdown water and excess water from pump packing,

(2) Air exhaust equipment to provide 3 minutes air change,

(3) Flow meter shall be Venturi Tube type,

(4) Motor Control center with indicating lights to control, show status of equipment, and record information,

(5) Telemetering of various signals as required by the Division of Wastewater Management.

e. Standby emergency electrical generator.

D. ESTIMATED COSTS

The estimated construction costs for major components of the system are included below.

1. Gravity Sewers		
Mob/Demob, Traffic Control, Misc.		$ 110,000
8" diameter	3,000 LF	345,000
10" diameter	1,600 LF	192,000
2. Sewage Pump Station		1,000,000
3. Force Main: 6" dia.	1,600 LF	104,000
TOTAL ESTIMATED CONSTRUCTION COST		1,751,000
30% ENGINEERING, ADMIN. & CONTINGENCY		525,000
TOTAL		$2,276,000

E. ENVIRONMENTAL IMPACT ASSESSMENT

1. The existing 59 HHL lots to be served by the project is the last remaining un-sewered HHL lots in the Waimanalo subdivision. Accordingly, the objectives of this project are to eliminate the cesspool disposal method from the existing HHL subdivision and to allow for future collection and conveyance of sewage from off-site areas to the west.

2. Environmental Setting:

a. Location: The Waimanalo area is located on the southeastern corner of the Island of Oahu as shown in Figure 1. The project area is shown in Figure 2, and is bounded by Kalanianaole Highway on the north and by the Koolau mountain range to the south.

b. Climate: The climate of that area is generally typical of Windward Oahu, with mild annual average temperatures of about

74 degrees F and annual average rainfall of about 40 inches. Prevailing winds in the area are northeasterly tradewinds which occur approximately 80 percent of the time. Overall, the climate is considered to be comfortable because of the cooling effect of the tradewinds.

c. Geology: In general, a layer of permeable sands and limestones extending 20 to 30 feet immediately below the ground surface overlays alternate layers of impermeable alluvium and permeable layers of calcareous dune limestone and coral.

d. Topography: The overall topography of the area is variable and generally rises inland from the shoreline to the Koolau Mountain range.

e. Land use: The project area is within a residential area zoned by the State for urban use, and by the County for residential use, R-10. Areas seaward of Kalanianaole Highway are zoned for parks use, and areas immediately inland of the HHL subdivision are zoned by the State for Conservation, and by the County for Preservation.

f. Flora and Fauna: Based on available information there are no endangered species of vegetation or wildlife inhabiting the project area or that will be endangered by the project.

g. Archaeological Features: There are no archaeological or historical sites existing within the project area or that will be endangered by the project. As shown in Figure 7, four historic and archaeological sites have been designated in the Waimanalo area. Three of the sites are farther than a mile away. The fourth site, Pahonu Turtle Pond, is across Kalanianaole Highway along the seashore, and will not be impacted by the project.

Archaeological & Historical Sites

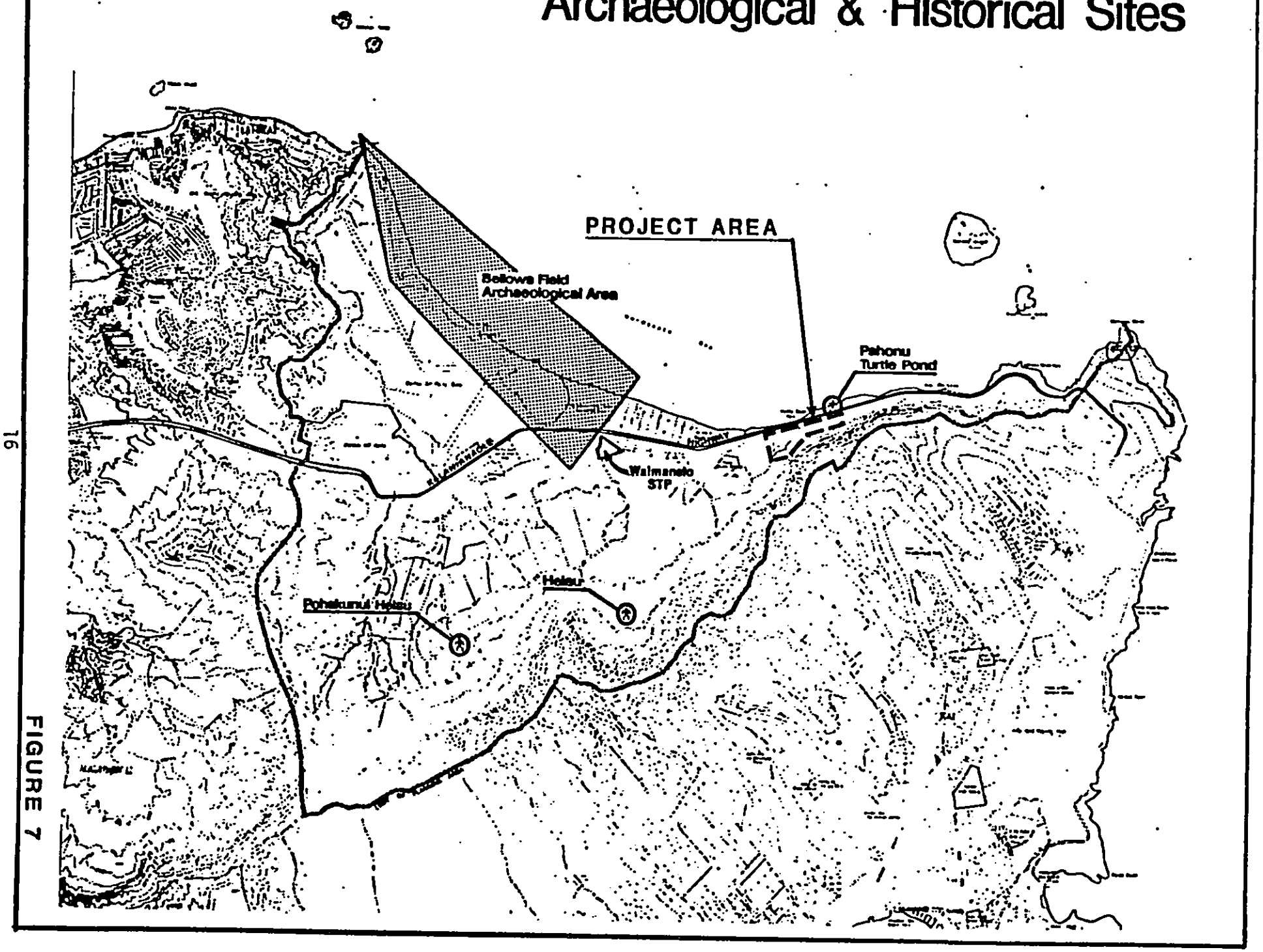


FIGURE 7

h. Flooding: During heavy rain storms large areas of Waimanalo flood because of the low-lying coastal plains and inadequate stream carrying capacities. However, the project area is not within the flood hazard areas, nor is it within the tsunami inundation area as delineated in U. S. Department of Housing and Urban Development Flood Insurance Maps. See Figure 5.

3. Approvals Required:

a. State of Hawaii Department of Hawaiian Home Lands-for project construction plans and specifications.

b. State of Hawaii, Department of Health-for wastewater collection and pumping facilities.

c. State of Hawaii, Department of Land and Natural Resources-for SPS Conservation District Use permit.

d. City and County of Honolulu, Department of Land Utilization-for Special Management Area Permit.

e. City and County of Honolulu, Department of Public Works-for construction of Wastewater collection and pumping facilities.

4. Environmental and Economic Impacts:

a. Short Term Impacts: The short term impacts are all associated with construction activities. Air quality, increased traffic, construction noise, access, and aesthetics may be temporarily impacted during construction. However, the impacts are temporary and are not expected to be significant because strict adherence to governmental regulations and implementation of practical control measures will confine and mitigate adverse impacts.

b. Long Term Impacts:

(1) The most important long term impact is the discontinuation of sewage disposal by means of cesspools.

(2) Design and construction of the sewage facilities will involve the commitment of HHL funds, land area, energy, materials, manpower and funding to operate and maintain the facilities. However, elimination of the cesspools is consistent with State Department of Health policies and benefits the environment by eliminating many potential sources of contamination and nuisance.

(3) The proposed improvements are not expected to encourage long term unplanned population growth nor economic development of the Waimanalo area because the project will serve only a small portion of an existing HHL subdivision. However, the sewage pump station will be sized to accommodate future off-site flows from a few existing private homes and a future limited HHL development to the east. Sewage service to those areas does not appear imminent and will depend on how quickly HHL completes their feasibility studies.

5. Alternate Considerations:

a. The no-action alternative is not acceptable in light of the State Department of Health's public health policies and priorities to eliminate cesspools; especially where municipal sewage treatment plants exist nearby, and where the project area is located above the State's Underground Injection Control line as is the situation for this project.

b. Utilization of individual wastewater treatment and disposal systems is also not acceptable for the same reasons presented above.

c. The proposed project is the most viable because:

(1) The project can be implemented quickly and completed in a timely manner,

(2) The project is consistent with State Department of Health policies and the City and County Department of Public Works Wastewater Management plans for the area.

d. Alternative sewage pump station locations and designs, sewer alignments, and service areas were considered, but the proposed project was determined to be the most feasible.

6. Assessment of Environmental Impacts:

The proposed project will not have any significant adverse impacts on the environment.

7. Agencies Consulted:

a. Department of Hawaiian Homes Lands, State of Hawaii

b. Department of Health Drinking Water Section State of Hawaii

c. Department of Land and Natural Resources, State of Hawaii

d. Department of Public Works, Division of Wastewater Management City and County of Honolulu

REFERENCES

1. Waimanalo Facility Plan, Division of Wastewater Management, Department of Public Works, City and County of Honolulu, prepared by Wilson Okamoto & Associates, Inc. January 1984.

2. Design Standards of the Division of Wastewater Management, Volume 1, February 1984.

APPENDIX I

GRAVITY SEWERS - PRELIMINARY PLAN AND PROFILES

JOB NO.

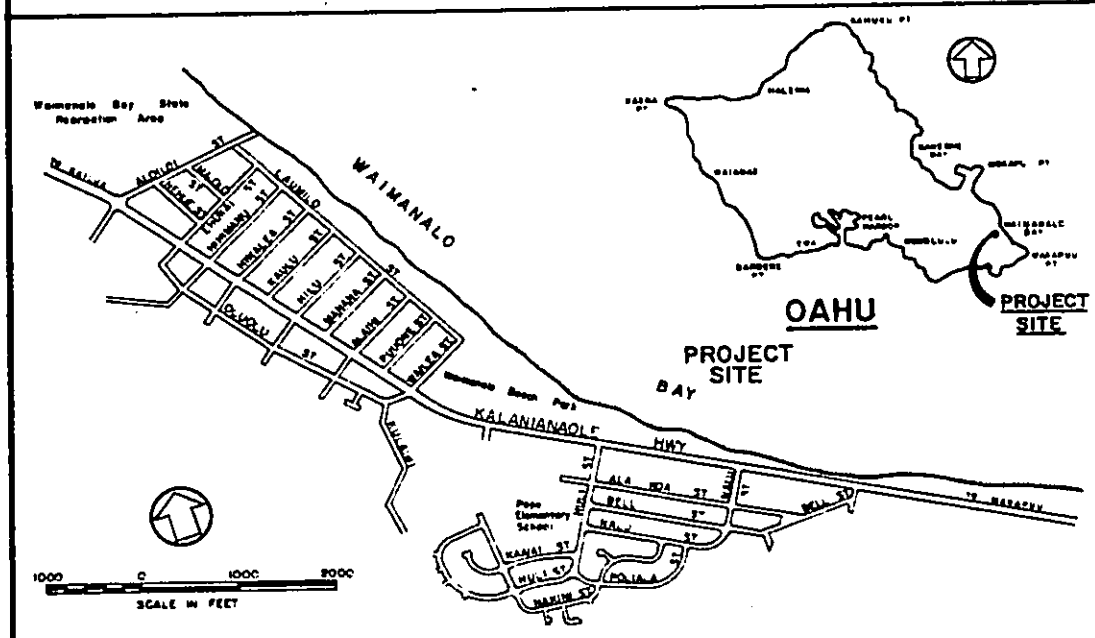
WAIMANALO RESIDE
GRAVITY SEWER SYSTE

WAIMANALO, OAHU, HAWA

DIVISION OF WASTEWATER MAN
DEPARTMENT OF PUBLIC WOR
CITY & COUNTY OF HONOLULU

FUKUNAGA & ASSOCIATES, INC.
Consulting Engineers

LOCATION MAP



INDEX

DESCRIPTION	SHEET N

JOB NO.

RESIDENCE LOTS SYSTEM, SECTION 5

O, OAHU, HAWAII

STEWATER MANAGEMENT
NT OF PUBLIC WORKS
OUNTY OF HONOLULU

GA & ASSOCIATES, INC.
onsulting Engineers

INDEX

ION SHEET NO

APPROVED

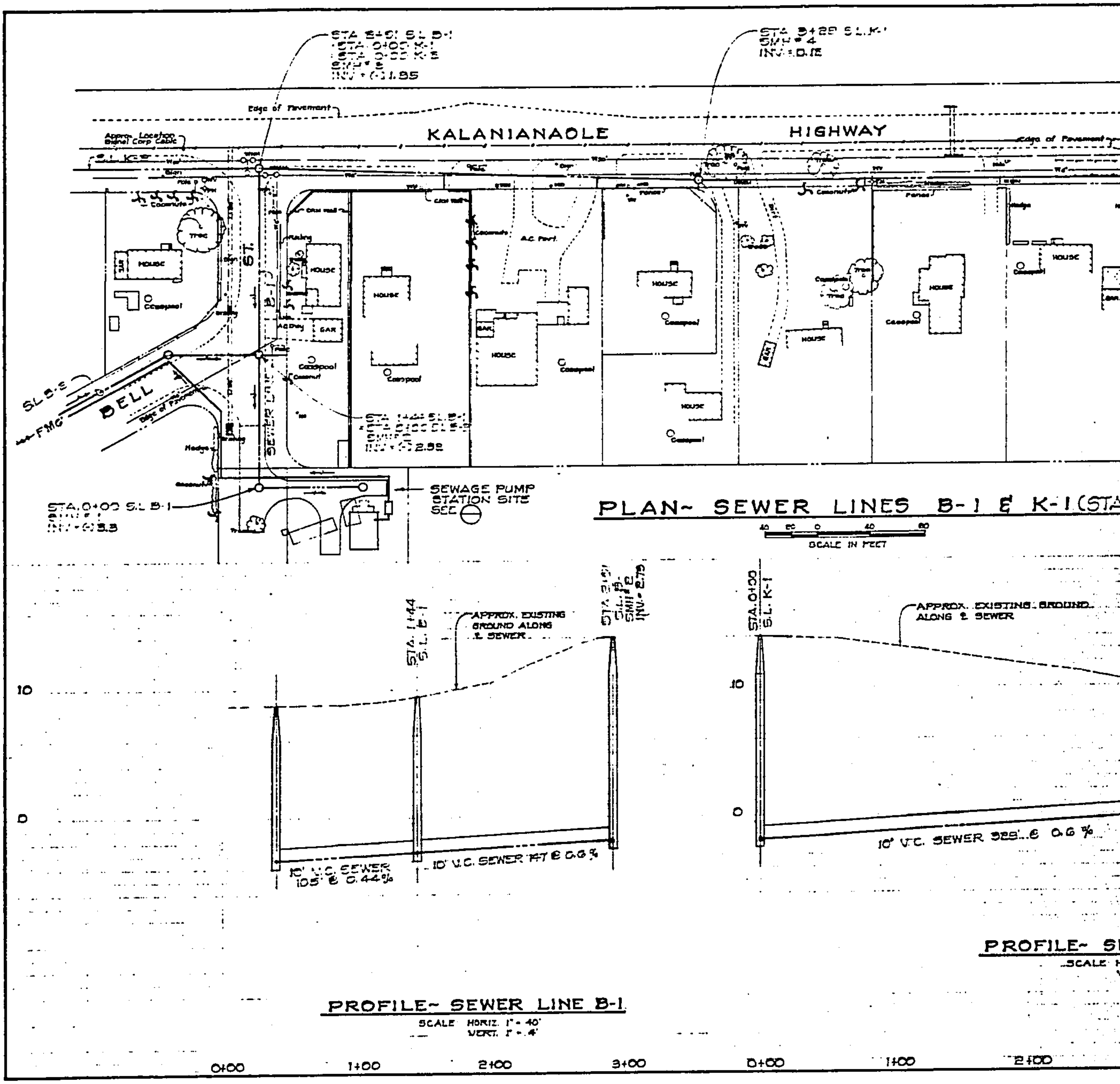
DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU — DATE

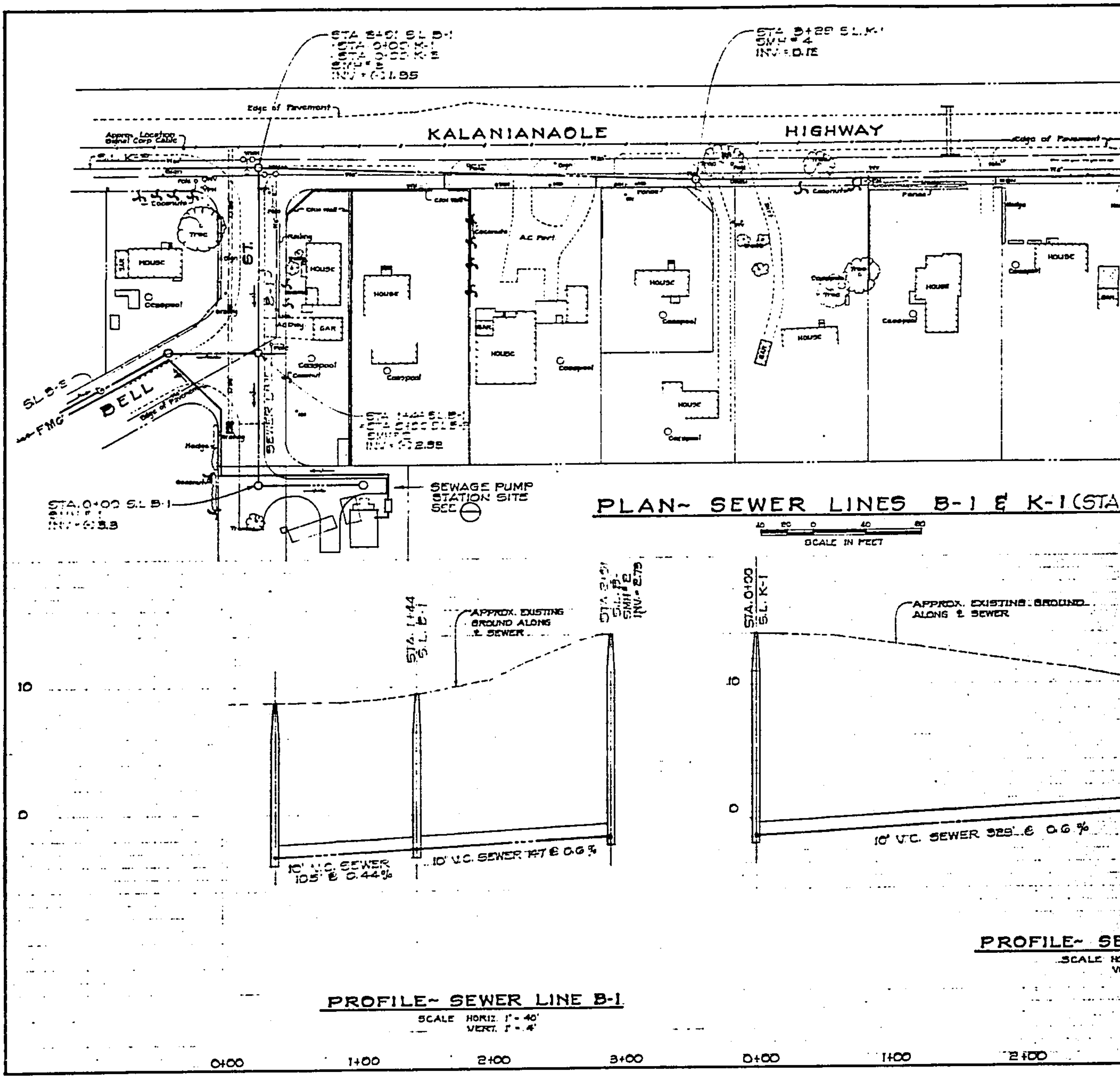
CHIEF, HIGHWAYS DIVISION (APPROVAL GRANTED FOR WORK WITHIN STATE RIGHT-OF-WAY ONLY)
DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII
APPROVAL LETTER NO HWY-CM DATE
I D NO. O- — DATE

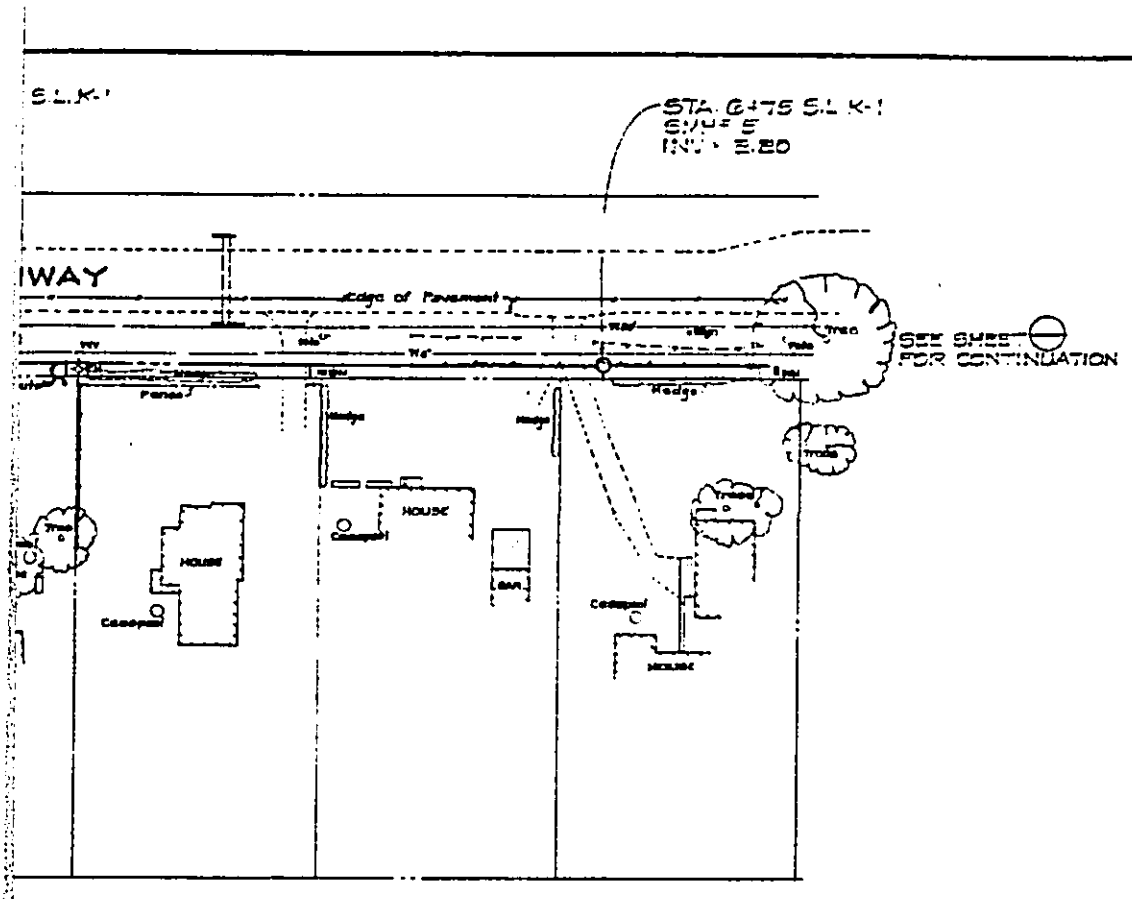
CHIEF, ENVIRONMENTAL PROTECTION AND HEALTH SERVICES DIVISION
DEPARTMENT OF HEALTH
STATE OF HAWAII — DATE

CHAIRMAN, HAWAIIAN HOMES COMMISSION
STATE OF HAWAII — DATE

SHEET 1 OF

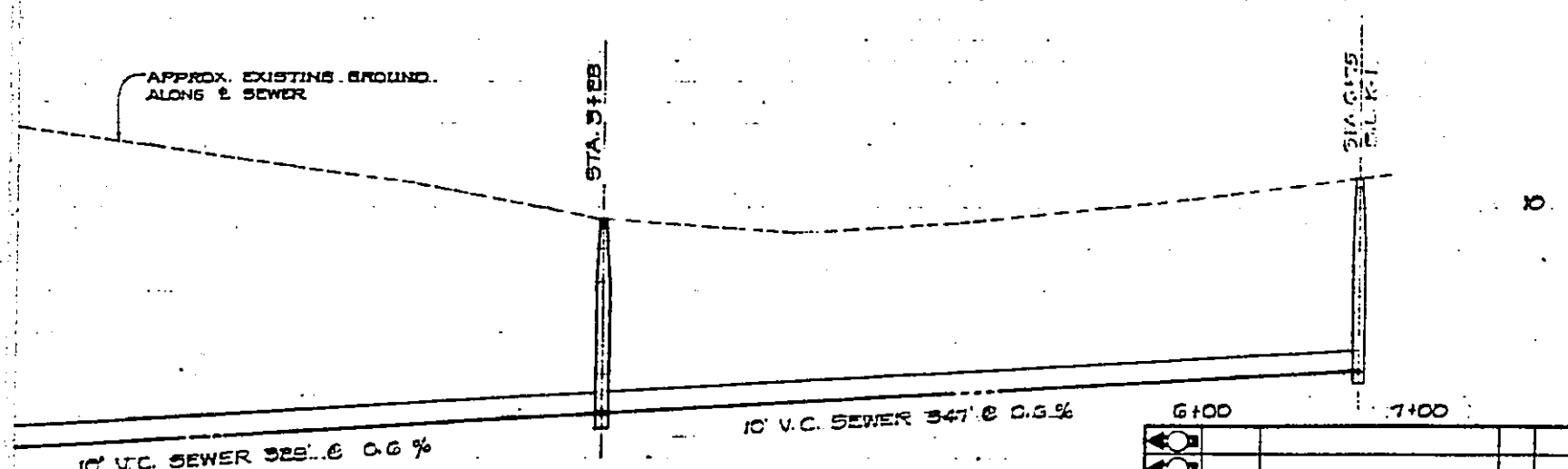

KALANIANAOLE
HIGHWAY
Edge of Pavement
Approx. Location Signal Corp Cable
BELL
ST.
SEWER LINE B-1
SL B-2
FMG
SEWAGE PUMP STATION SITE
STA. 0+00 S.L. B-1
PLAN~ SEWER LINES B-1 & K-1
SCALE IN FEET
APPROX. EXISTING GROUND ALONG ℄ SEWER
STA. 1+44 S.L. B-1
STA. 0+00 S.L. K-1
10' V.C. SEWER 105' @ 0.44%
10' V.C. SEWER 147' @ 0.6%
10' V.C. SEWER 325' @ 0.6%
PROFILE~ SEWER LINE B-1
SCALE HORIZ. 1" = 40' VERT. 1" = 4'
0+00
1+00
2+00
3+00
PROFILE~ S


KALANIANAOLE
HIGHWAY
Edge of Pavement
Approx. Location Signal Corp Cable
BELL
ST.
SEWER LINE B-1
SL B-2
FMC
Edge of Pavement
HOUSE
GAR
Cesspool
Coconut
Tree
Hedge
A.C. Port
SEWAGE PUMP STATION SITE
STA. 0+00 S.L. B-1
PLAN~ SEWER LINES B-1 & K-1 (STA
SCALE IN FEET
STA. 1+44 S.L. B-1
STA. 3+01 S.L. B-1 SMH # 2 INV. 2.79
APPROX. EXISTING GROUND ALONG ℄ SEWER
10" V.C. SEWER 105' @ 0.44%
10" V.C. SEWER 157' @ 0.6%
PROFILE~ SEWER LINE B-1
SCALE HORIZ. 1" = 40' VERT. 1" = 4'
STA. 0+00 S.L. K-1
APPROX. EXISTING GROUND ALONG ℄ SEWER
10" V.C. SEWER 329' @ 0.6%
PROFILE~ SE
SCALE H
10
0
0+00
1+00
2+00
3+00
0+00
1+00
2+00



LINES B-1 & K-1 (STA. 0+00 TO STA. 6+75)

40 80
IN FEET



PROFILE~ SEWER LINE K-1

SCALE HORIZ. 1" = 40
VERT. 1" = 4'

APPROVED

CHIEF, PLANNING AND ENGINEERING DIVISION, BWS — DATE

STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2263 C
HAWAII U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

WAIMANALO & ASSOCIATES

REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

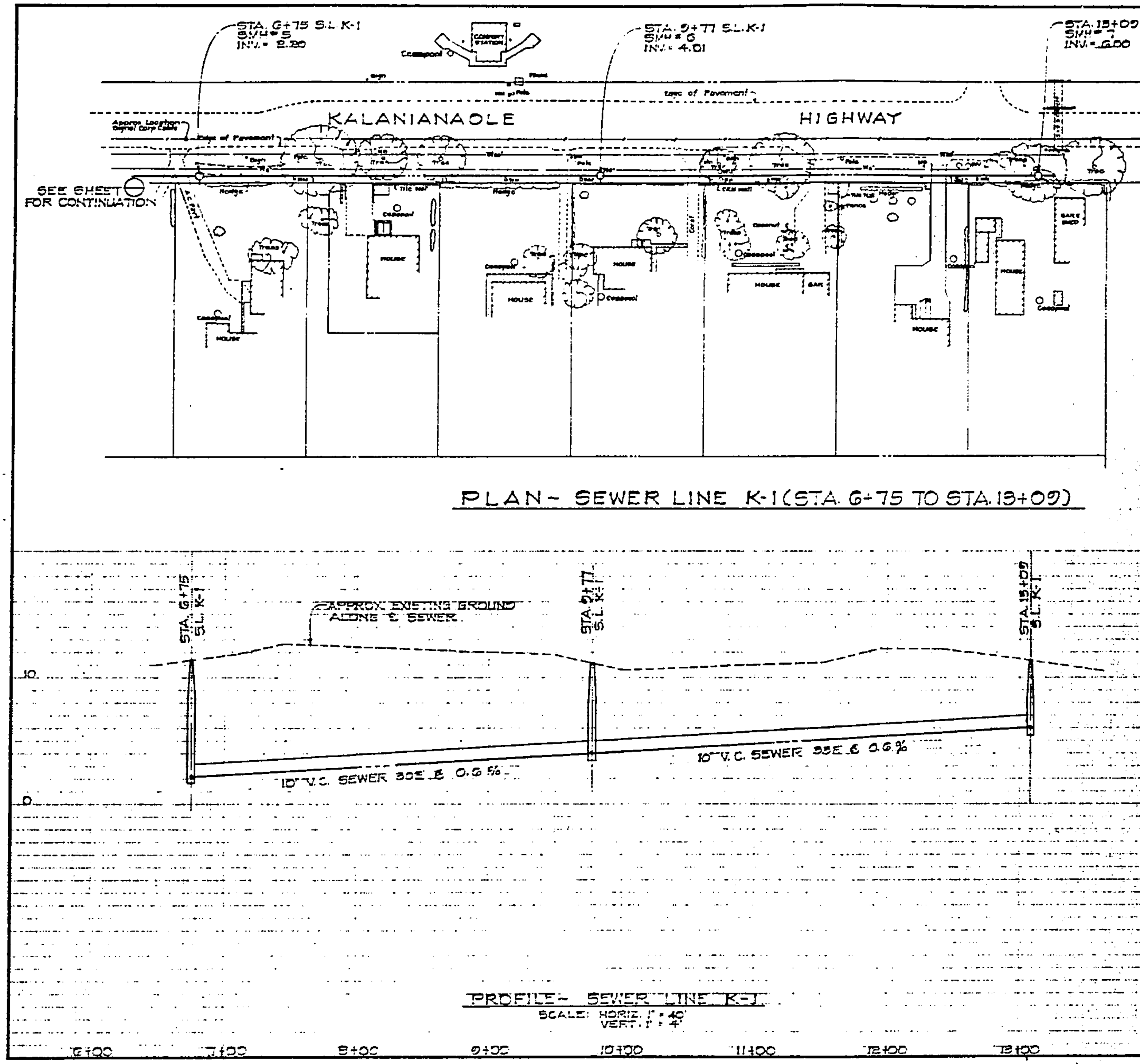
PROJECT: WAIMANALO RESIDENCE LOTS GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII

ITEM

ENGINEER S. Young — SCALE 1" = 40'
DRAFTSMAN N.S. Ayo — CHECKED BY A. Fukunaga
APPROVED: — SECTION HEAD
DIRECTOR OF WASTEWATER MANAGEMENT — DATE

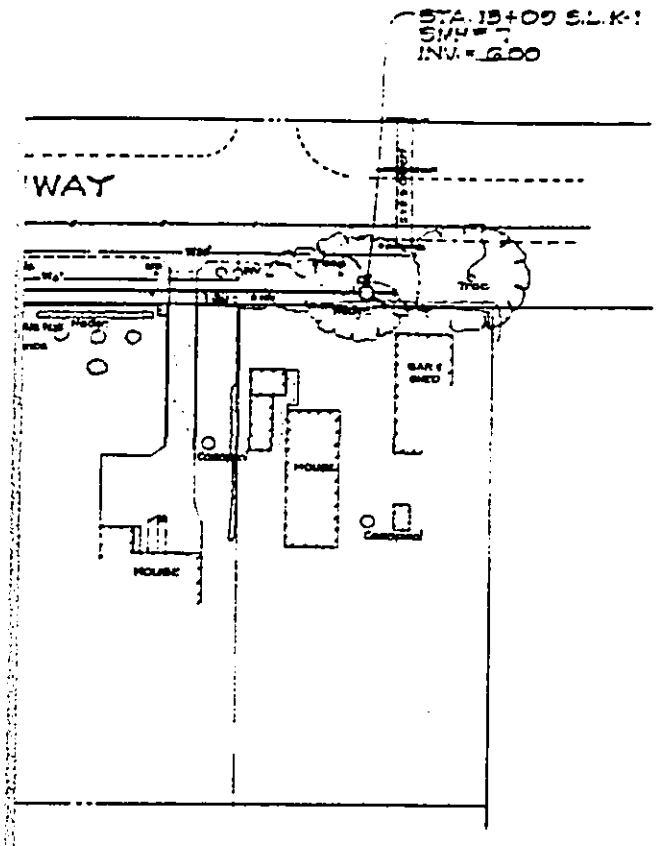
JOB NO.

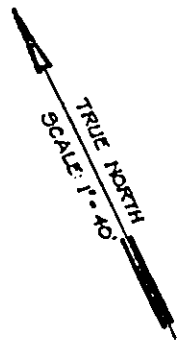
SHEET 2 OF



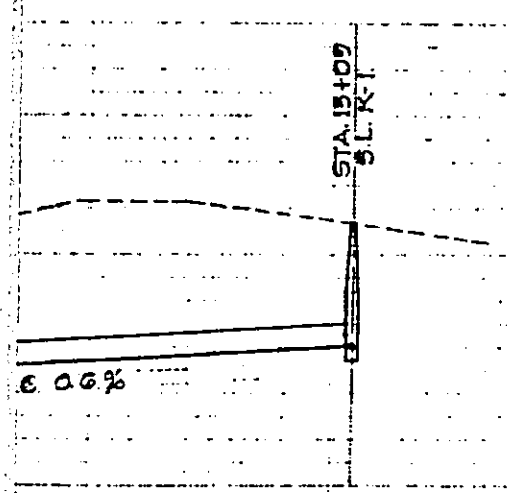
PLAN - SEWER LINE K-1 (STA. 6+75 TO STA. 13+09)

PROFILE - SEWER LINE K-1





6+75 TO STA. 13+09)



REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

PROJECT: WAIMANALO RESIDENCE LOTS
GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII

ITEM:

DESIGNED: S. Yuen — SCALE: 1" = 40'
DRAFTSMAN: H.S. Ma — CHECKED BY: R. Fukumoto
APPROVED: — SECTION HEAD:
CHIEF, PLANNING AND ENGINEERING DIVISION, DWM — DATE — DATE

STANLEY S. F. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2205-C
HAWAII, U.S.A.

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FUKUNAGA & ASSOCIATES

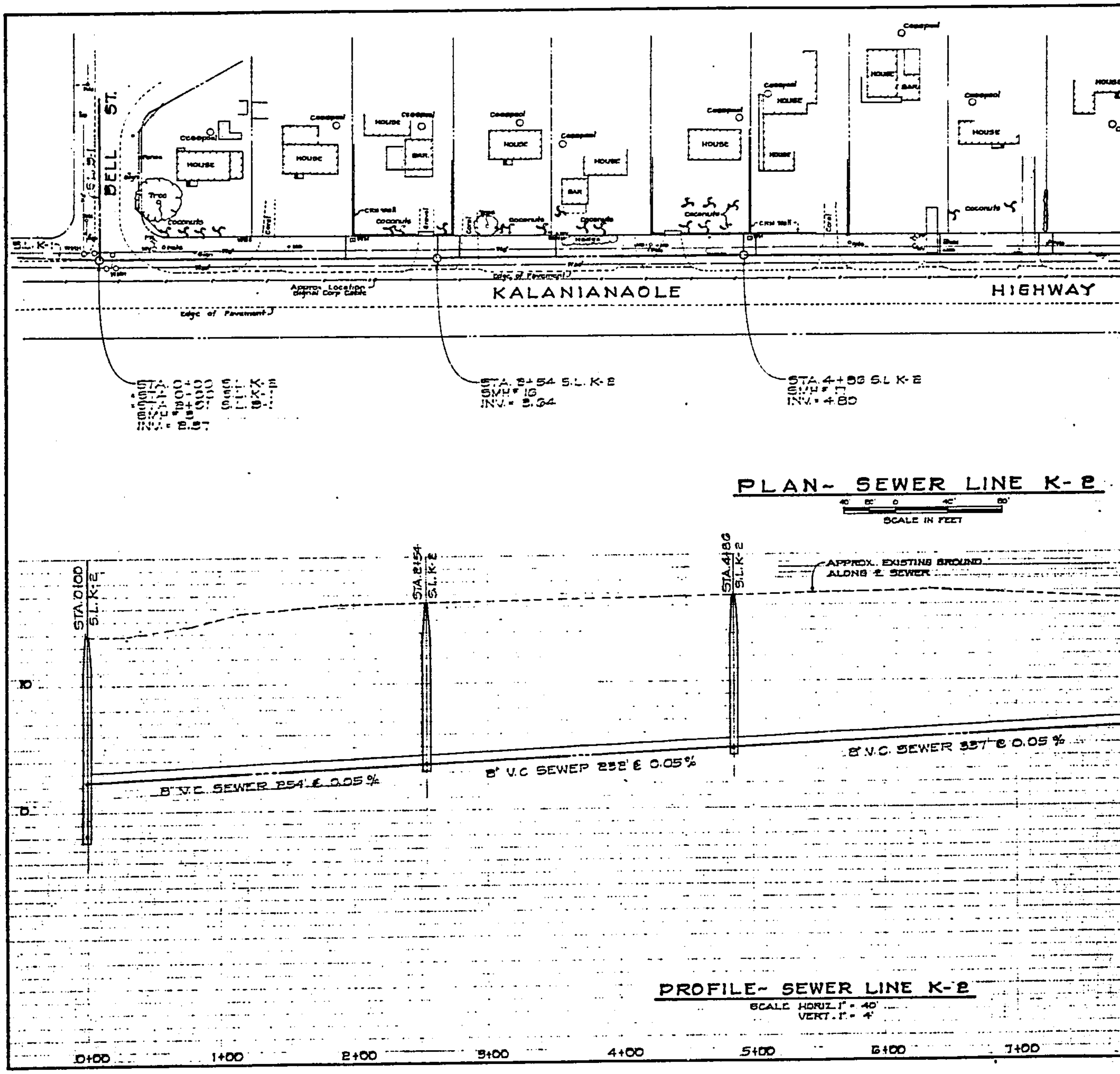
APPROVED

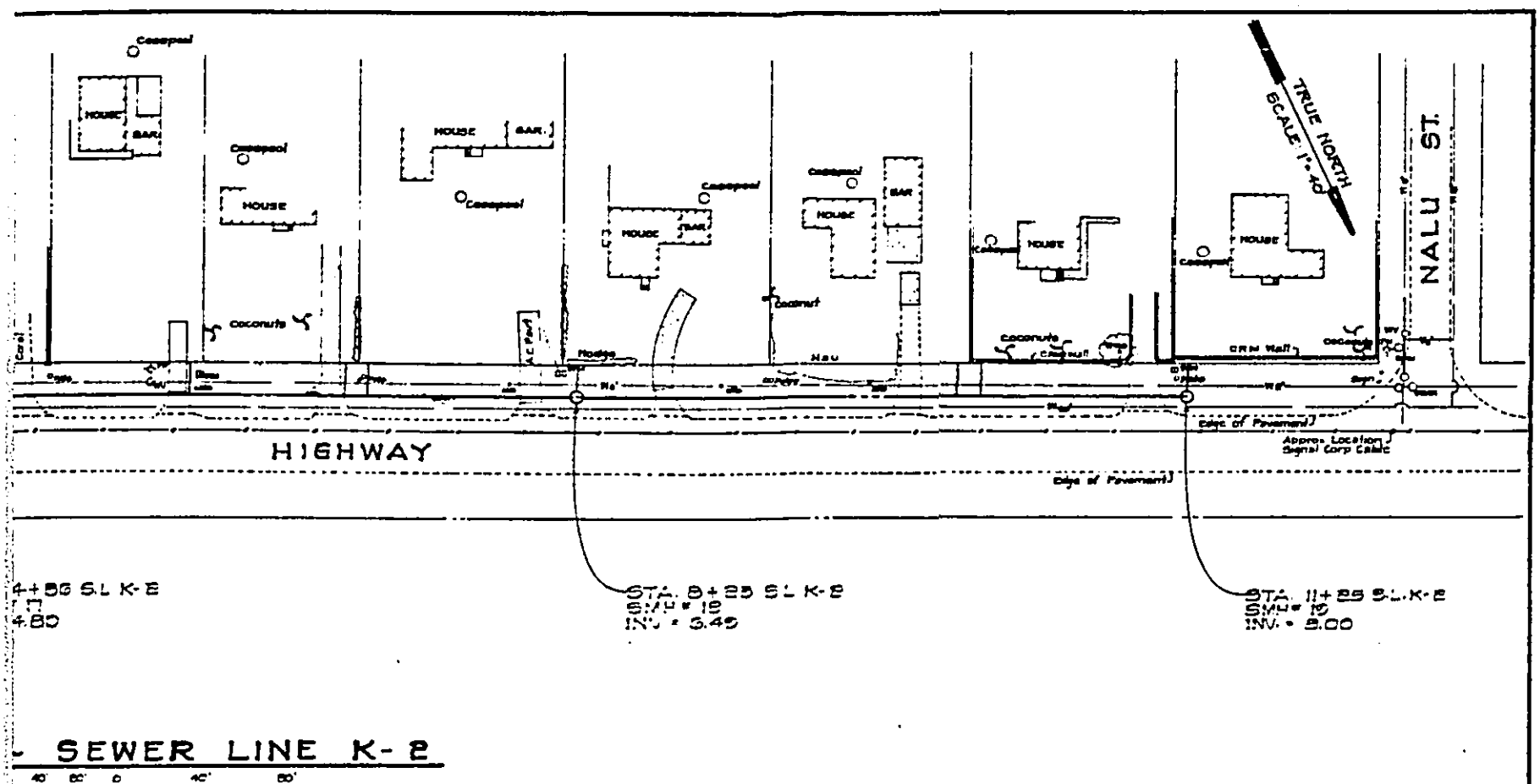
CHIEF, PLANNING AND ENGINEERING DIVISION, DWM — DATE

12+00 13+00

JOB NO.

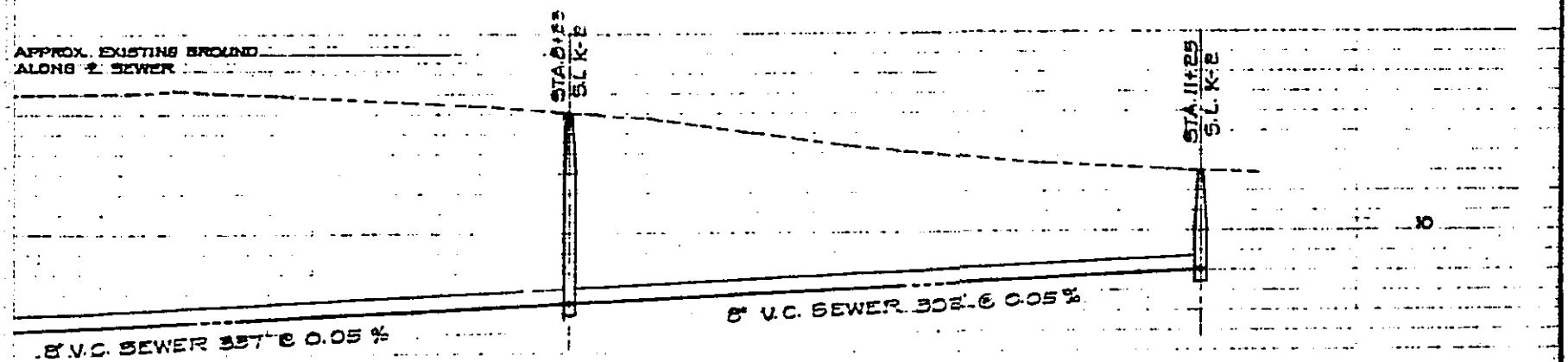
SHEET 3 OF


BELL ST.
KALANIANAOLE HIGHWAY
HOUSE
BAR
Cesspool
Coconuts
Tree
Hedge
CRM Wall
Approx. Location of Signal Corp Cable
Edge of Pavement
S.L. K-1
STA. 0+00 S.L. K-2
SMH # 15
INV. = 2.57
STA. 2+54 S.L. K-2
SMH # 16
INV. = 3.34
STA. 4+86 S.L. K-2
SMH # 17
INV. = 4.80
PLAN- SEWER LINE K-2
SCALE IN FEET
STA. 0+00 S.L. K-2
STA. 2+54 S.L. K-2
STA. 4+86 S.L. K-2
APPROX. EXISTING GROUND ALONG ℄ SEWER
8" V.C. SEWER 254' @ 0.05%
8" V.C. SEWER 232' @ 0.05%
8" V.C. SEWER 337' @ 0.05%
10
0
PROFILE- SEWER LINE K-2
SCALE HORIZ. 1" = 40'
VERT. 1" = 4'
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00



SEWER LINE K-2

40' 20' 0 40' 80'
SCALE IN FEET



ER LINE K-2
1" = 40'
1" = 4'

APPROVED

CHIEF, PLANNING AND ENGINEERING DIVISION, DWM — DATE

STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2703-C
HAWAII U.S.A.

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FUKUNAGA & ASSOCIATES

REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

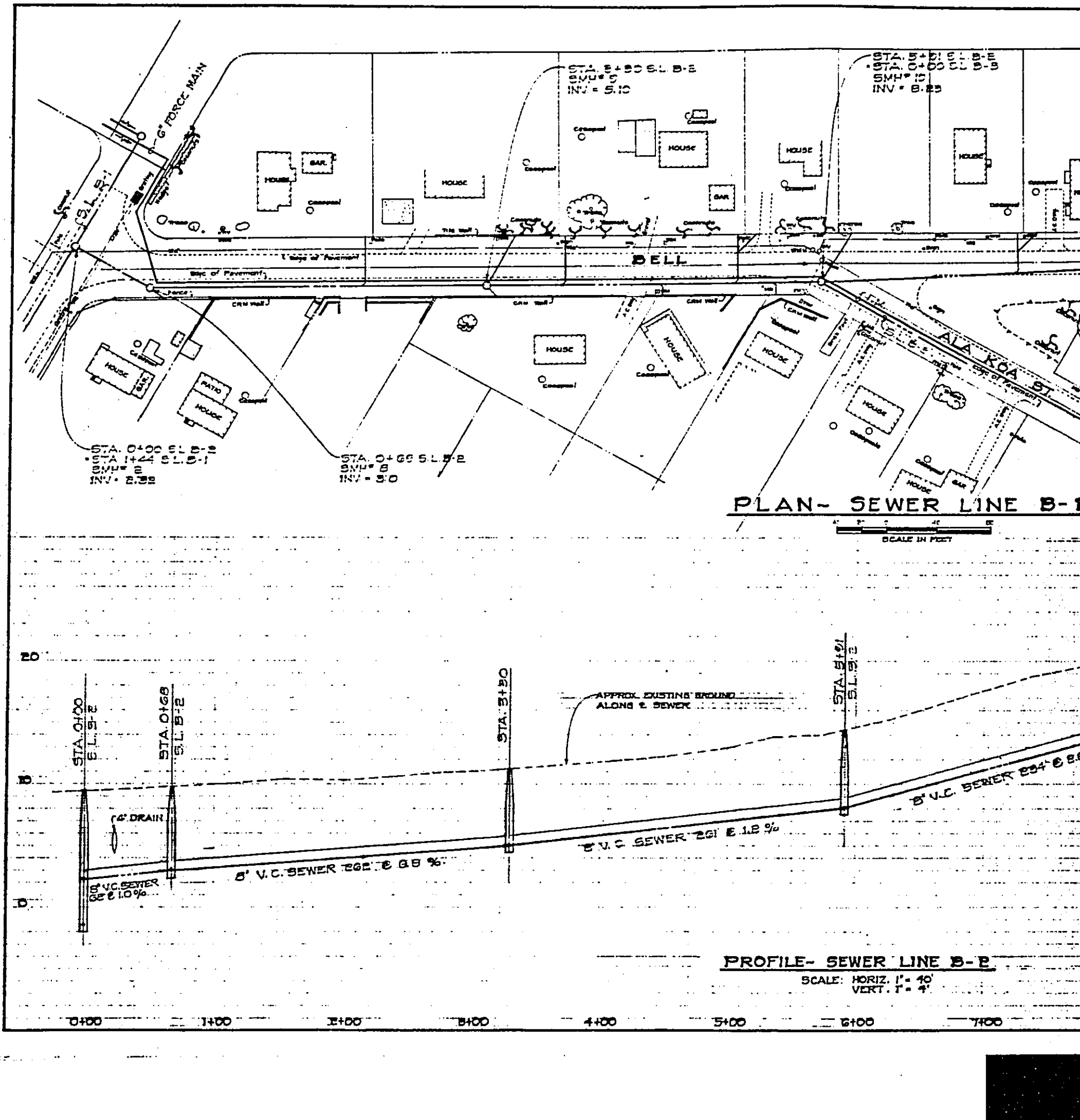
PROJECT: WAIMANALO RESIDENCE LOTS
GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII

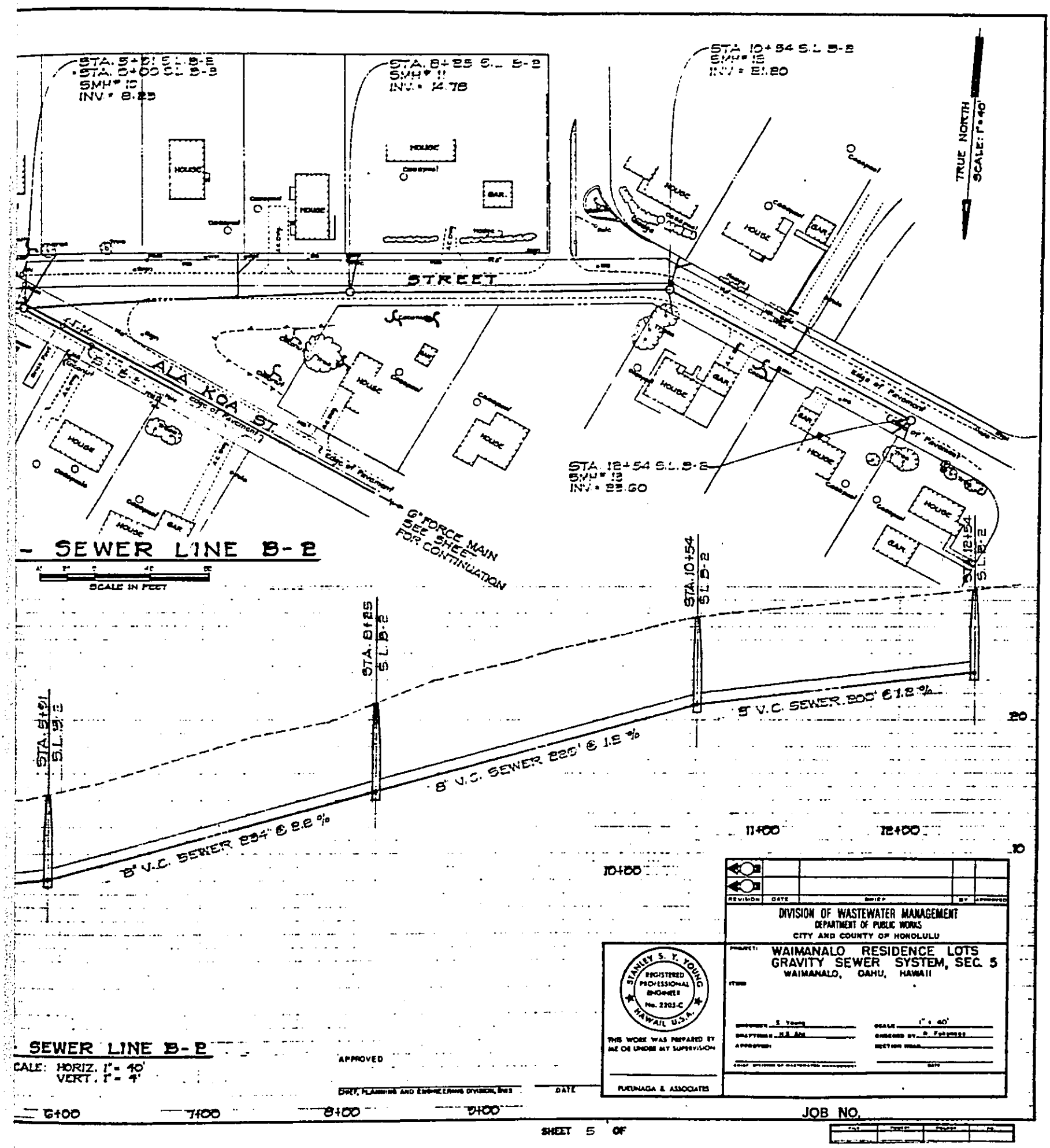
FROM

DESIGNED S. YOUNG — SCALE 1" = 40'
DRAFTSMAN H.S. Ajo — CHECKED BY S. Fukunaga
APPROVED: — SECTION HEAD
DEPT. DIVISION OF WASTEWATER MANAGEMENT — DATE

JOB NO.

SHEET 4 OF


6" FORCE MAIN
STA. 0+00 S.L. B-2
•STA 1+44 S.L.B-1
SMH" 2
INV. = 2.32
STA. 0+68 S.L.B-2
SMH" 8
INV. = 3.0
STA. 3+30 S.L. B-2
SMH" 5
INV. = 5.10
STA. 5+01 S.L. B-2
•STA. 0+00 S.L. B-3
SMH" 10
INV. = 8.23
HOUSE
BAR
PATIO
CMU wall
Edge of Pavement
BELL
ALA KOA ST.
PLAN- SEWER LINE B-2
SCALE IN FEET
STA. 0+00 S.L. B-2
STA. 0+68 S.L. B-2
STA. 3+30
STA. 5+01 S.L. B-2
APPROX. EXISTING GROUND ALONG ℄ SEWER
6" DRAIN
8" V.C. SEWER @ 1.0 %
8" V.C. SEWER 268' @ 0.8 %
8" V.C. SEWER 261' @ 1.2 %
8" V.C. SEWER 234' @
20
10
0
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
PROFILE- SEWER LINE B-2
SCALE: HORIZ. 1" = 40'
VERT. 1" = 4'


STA. 5+21 S.L. B-E
STA. 0+00 S.L. B-2
SMH# 10
INV. = 8.25
STA. 8+25 S.L. B-2
SMH# 11
INV. = 14.78
STA. 10+54 S.L. B-2
SMH# 12
INV. = 21.80
TRUE NORTH
SCALE: 1" = 40'
STREET
ALA KOA ST.
Edge of Pavement
HOUSE
BAR
STA. 12+54 S.L. B-2
SMH# 13
INV. = 28.60
6" FORCE MAIN
SEE SHEET
FOR CONTINUATION
SEWER LINE B-2
SCALE IN FEET
STA. 5+21
S.L. B-E
STA. 8+25
S.L. B-2
STA. 10+54
S.L. B-2
8" V.C. SEWER 234' @ 2.2 %
8" V.C. SEWER 525' @ 1.5 %
8" V.C. SEWER 800' @ 1.2 %
20
10
11+00
12+00
10+00
SEWER LINE B-2
SCALE: HORIZ. 1" = 40'
VERT. 1" = 4'
APPROVED
DIRT, PLANNING AND ENGINEERING DIVISION, DWS
DATE
6+00
7+00
8+00
9+00
REVISION
DATE
BRIEF
BY
APPROVED
DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
PROJECT:
WAIMANALO RESIDENCE LOTS
GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII
ITEM
DESIGNED S. Young
DRAFTSMAN H.S. Ahi
APPROVED
SCALE 1" = 40'
CHECKED BY P. Fukunaga
SECTION HEAD
DATE
STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2203-C
HAWAII U.S.A.
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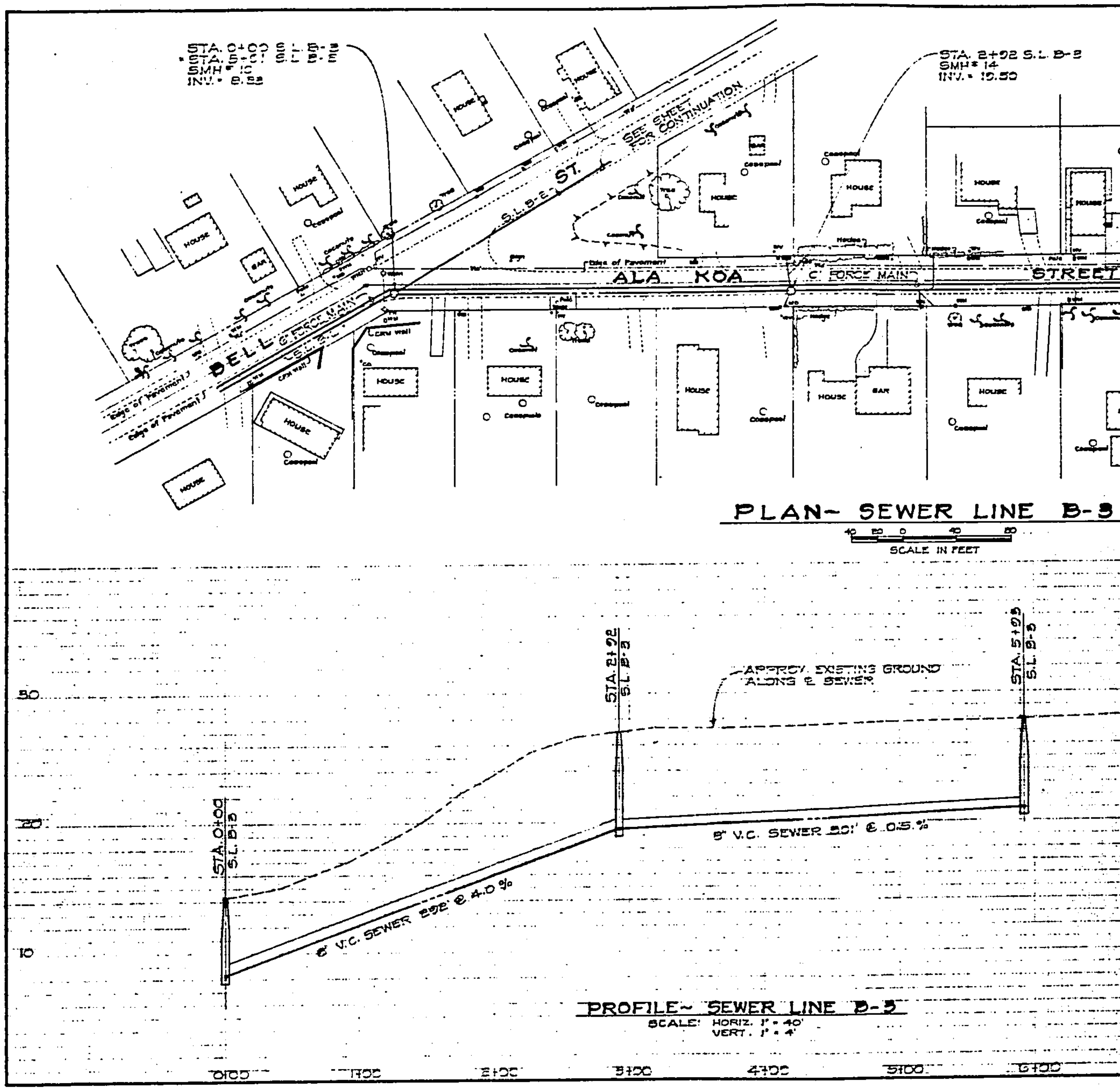
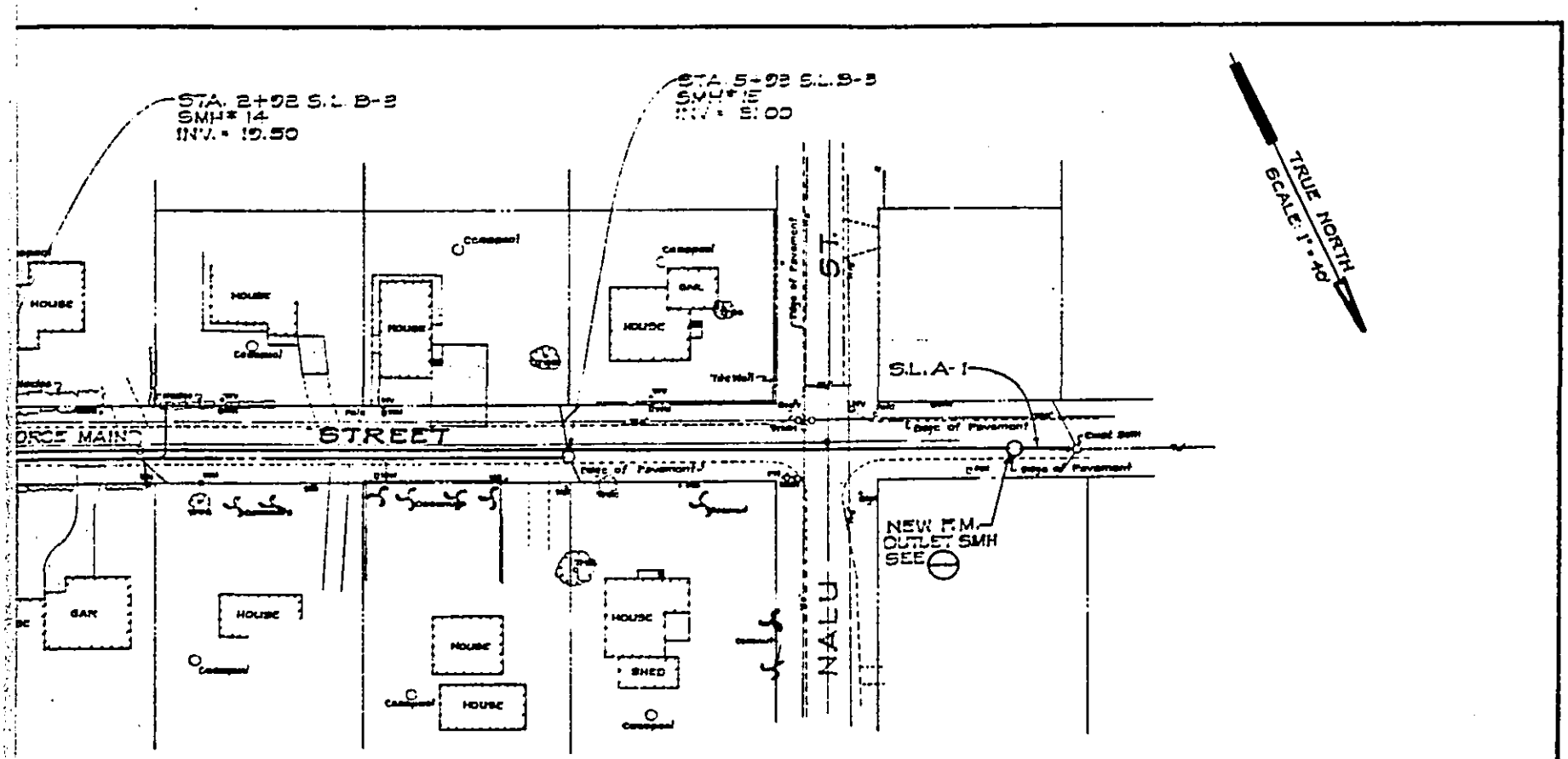
FUKUNAGA & ASSOCIATES
JOB NO.
SHEET 5 OF

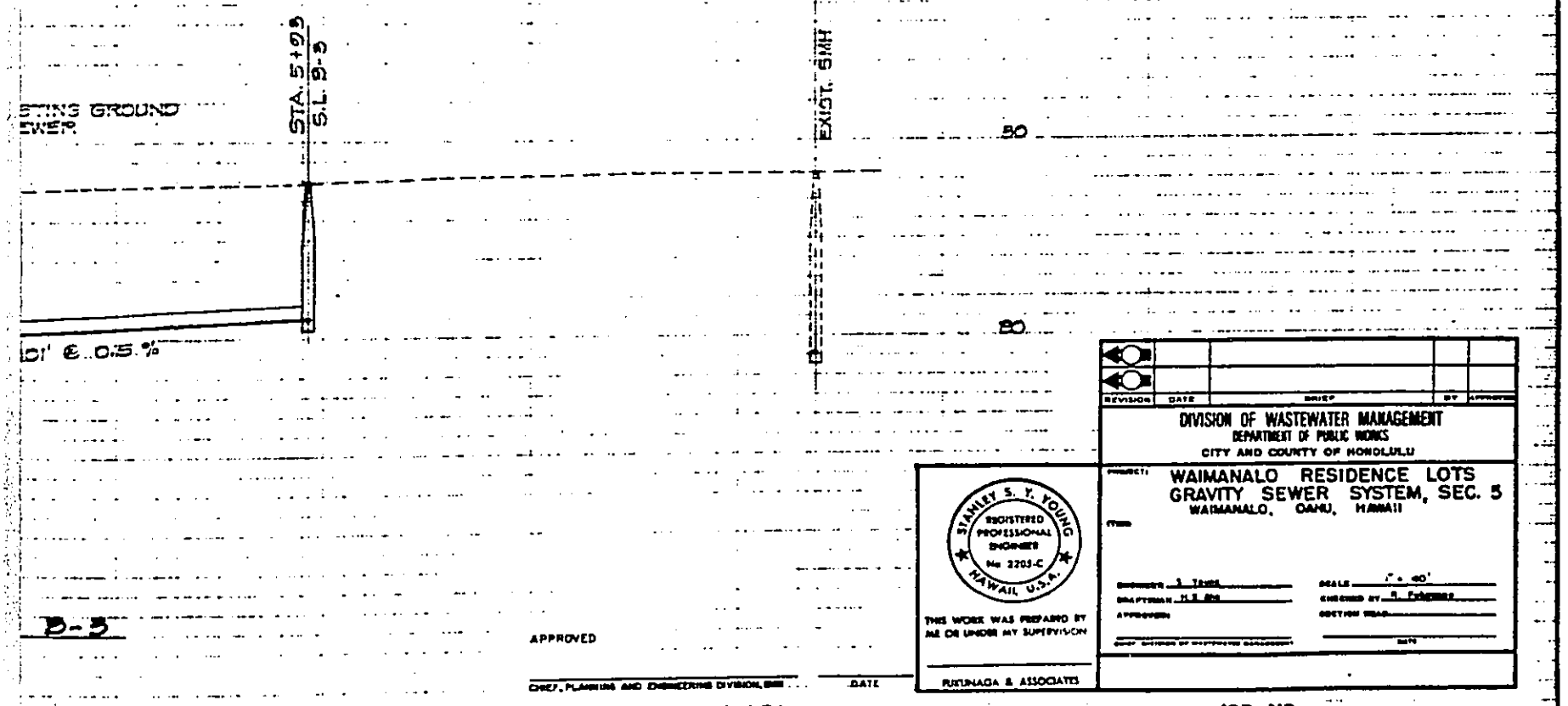


STA. 2+92 S.L. B-3
SMH # 14
INV. = 19.50
SEE SHEET FOR CONTINUATION
BELL ST.
ALA KOA STREET
FORCE MAIN
HOUSE
BAR
Cesspool
PLAN~ SEWER LINE B-3
SCALE IN FEET
APPROX. EXISTING GROUND ALONG ℄ SEWER
STA. 0+00 S.L. B-3
STA. 2+92 S.L. B-3
STA. 5+93 S.L. B-3
8" V.C. SEWER 292' @ 4.0%
8" V.C. SEWER 301' @ 0.5%
PROFILE~ SEWER LINE B-3
SCALE: HORIZ. 1" = 40'
VERT. 1" = 4'



SEWER LINE B-3

40 20 0 40 80
SCALE IN FEET



STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2203-C
HAWAII, U.S.A.

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FUKUNAGA & ASSOCIATES

REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

PROJECT: WAIMANALO RESIDENCE LOTS GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII

ITEM

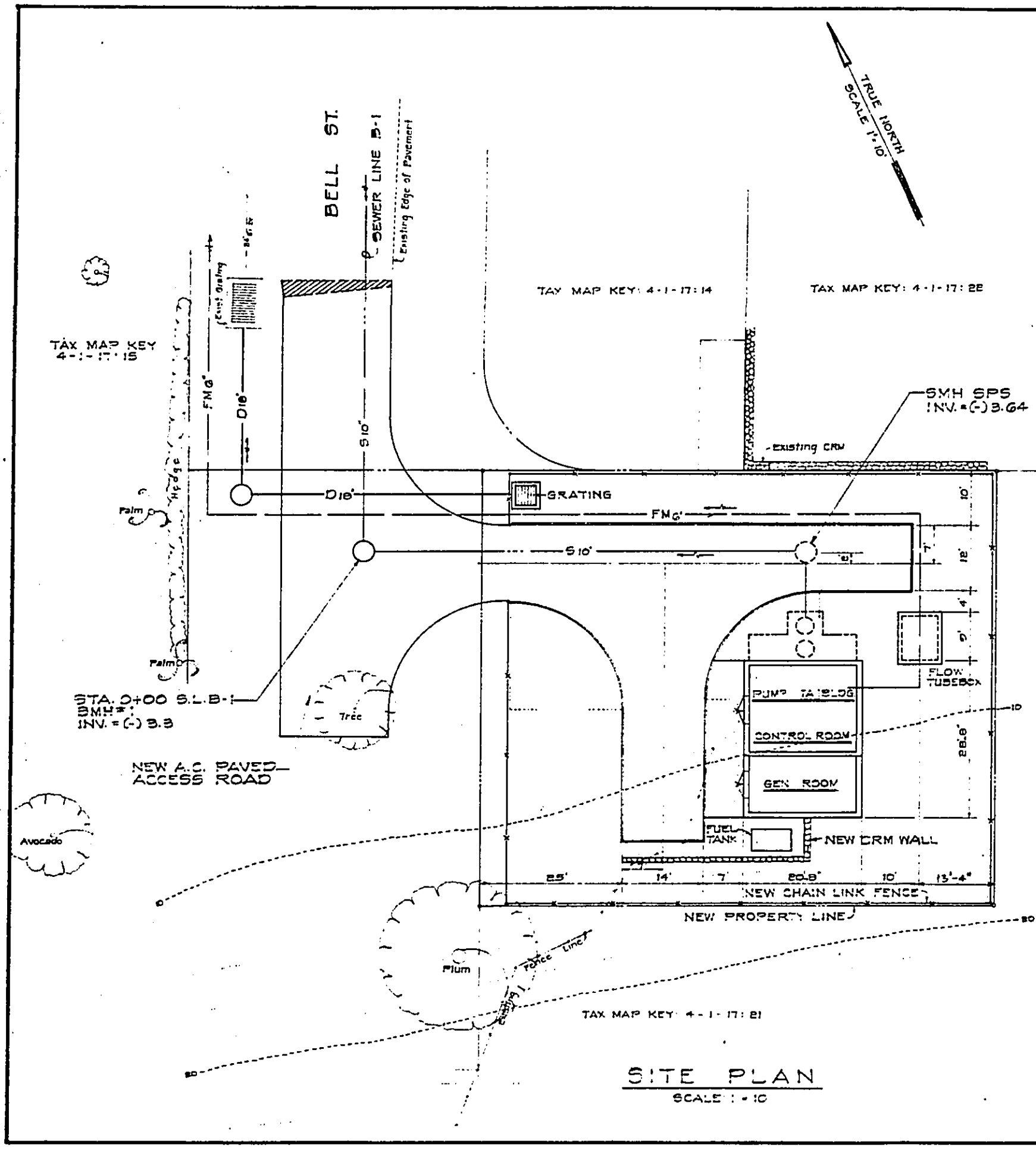
DESIGNED S. YOUNG — SCALE 1" = 40'
DRAFTSMAN H.S. Ako — CHECKED BY S. Fukunaga
APPROVED — SECTION HEAD
CHIEF, DIVISION OF WASTEWATER MANAGEMENT — DATE

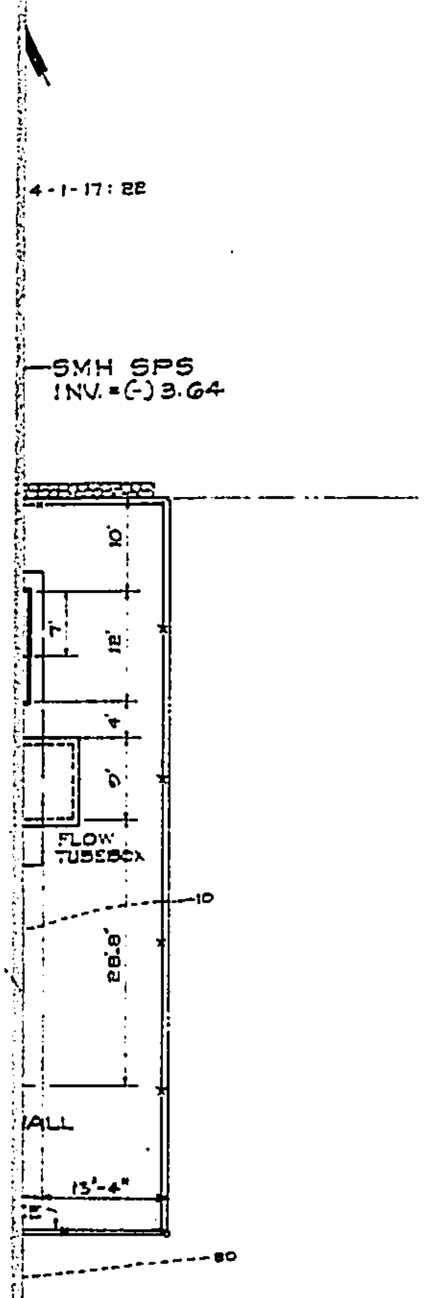
JOB NO.

SHEET 6 OF

APPENDIX II

SEWAGE PUMP STATION PRELIMINARY DRAWINGS


TRUE NORTH
SCALE 1"=10'
BELL ST.
SEWER LINE B-1
Existing Edge of Pavement
TAX MAP KEY: 4-1-17:14
TAX MAP KEY: 4-1-17:22
TAX MAP KEY 4-1-17:15
Existing Grating
FM 6"
D18"
S10"
SMH SPS
INV.=(-) 3.64
Existing CRM
GRATING
FM 6"
S10"
Palm
Hedge
Palm
STA. 0+00 S.L.B-1
SMH#1
INV.=(-) 3.3
Tree
NEW A.C. PAVED ACCESS ROAD
FLOW TUBE BOX
PUMP & BLDG
CONTROL ROOM
GEN. ROOM
FUEL TANK
NEW CRM WALL
Avocado
25'
14'
7'
20'-8"
10'
13'-4"
NEW CHAIN LINK FENCE
NEW PROPERTY LINE
Plum
Fence Line
TAX MAP KEY: 4-1-17:81
SITE PLAN
SCALE: 1"=10'



REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

PROJECT **WAIMANALO RESIDENCE LOTS GRAVITY SEWER SYSTEM, SEC. 5**
WAIMANALO, OAHU, HAWAII

ITEM

ENGINEER S. YOUNG SCALE 1" = 10'
DRAFTSMAN H.S. CHECKED BY R. FUJINAGA
APPROVED

CHIEF, DIV. OF WASTEWATER MANAGEMENT DATE

STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2205-C
HAWAII U.S.A.

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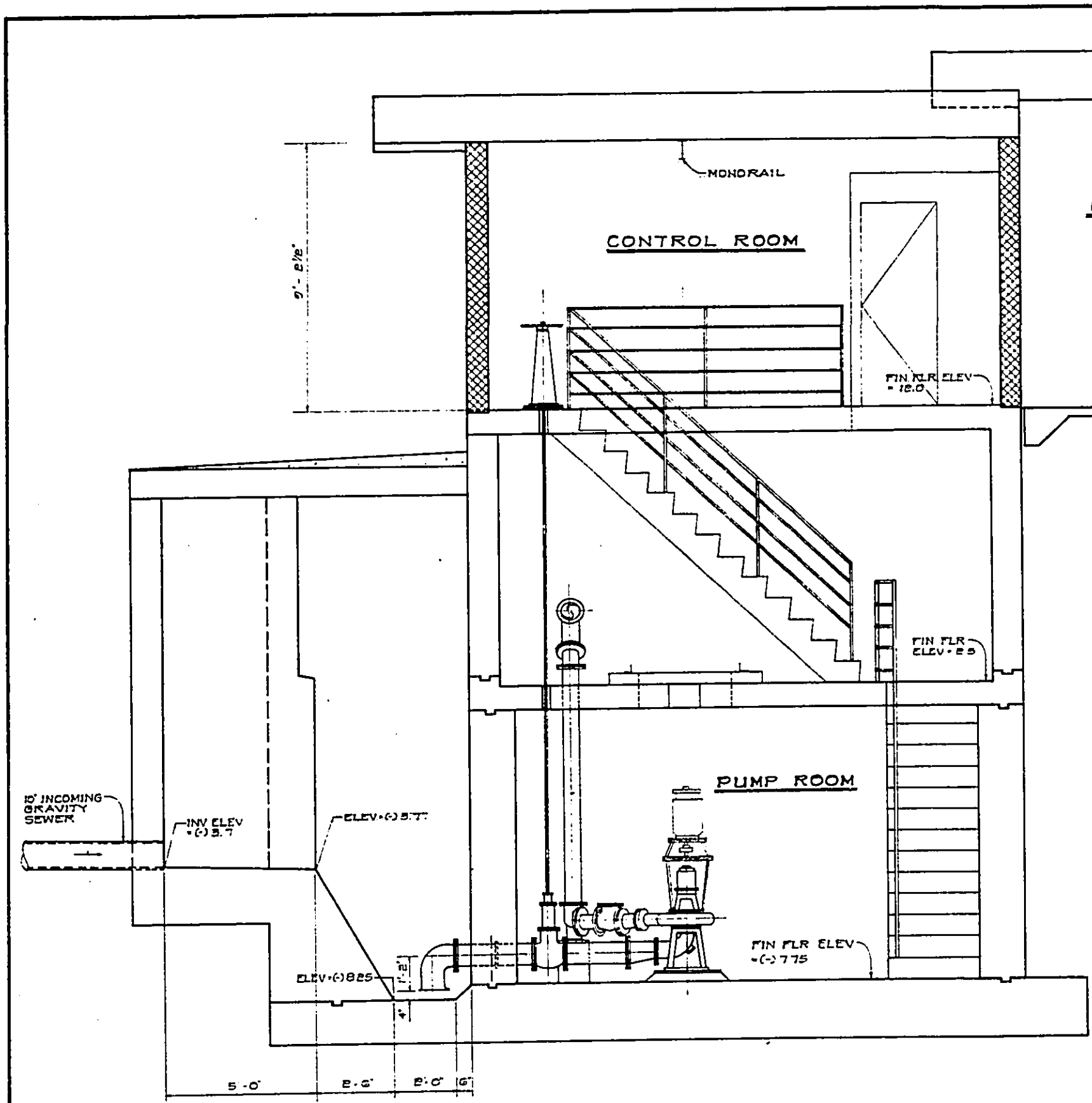
FUJINAGA & ASSOCIATES

SHEET 7

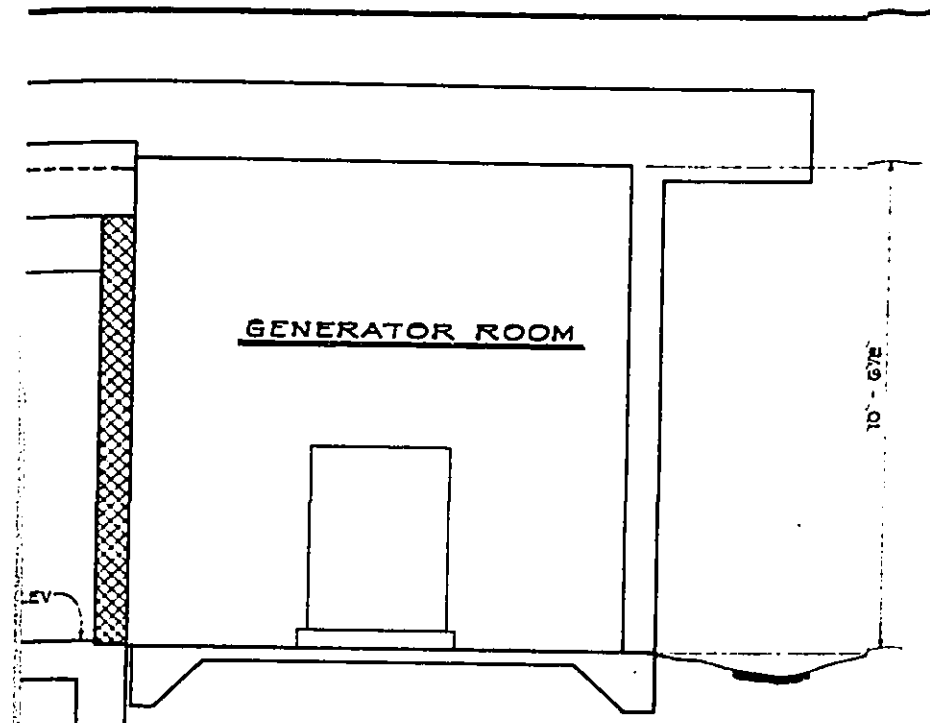
FILE	POCKET	FOLDER	NO.

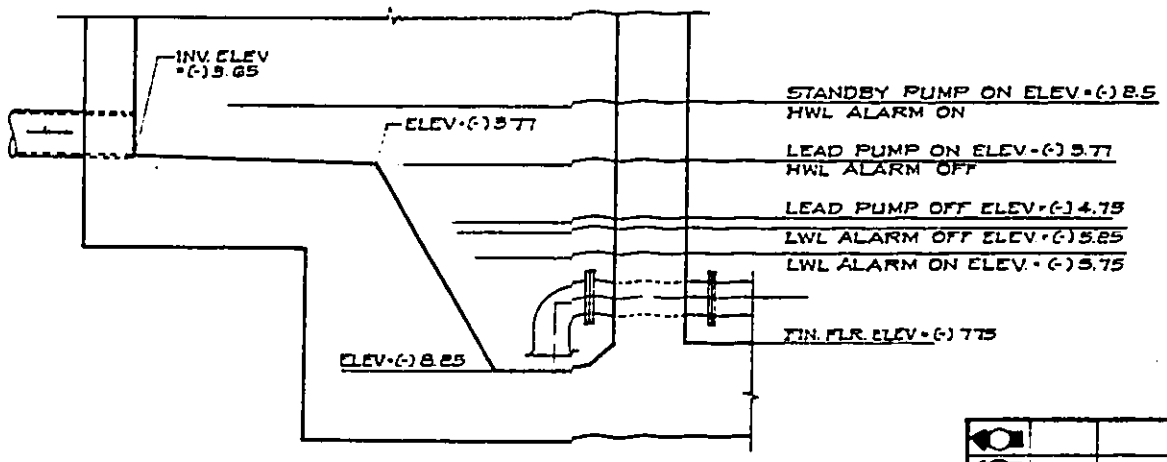


SECTION FACING WEST WALL

SCALE ½" = 1'-0"

PUMP





PUMP OPERATION SEQUENCE

REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

PROJECT: WAIMANALO RESIDENCE LOTS GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII

ITEM

ENGINEER S. Young ..... SCALE As noted .....
DRAFTSMAN ..... CHECKED BY R. Fukunaga .....
APPROVED BRANCH HEAD
CHIEF, DIV. OF WASTEWATER MANAGEMENT ..... DATE .....

STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2305
HAWAII U.S.A.

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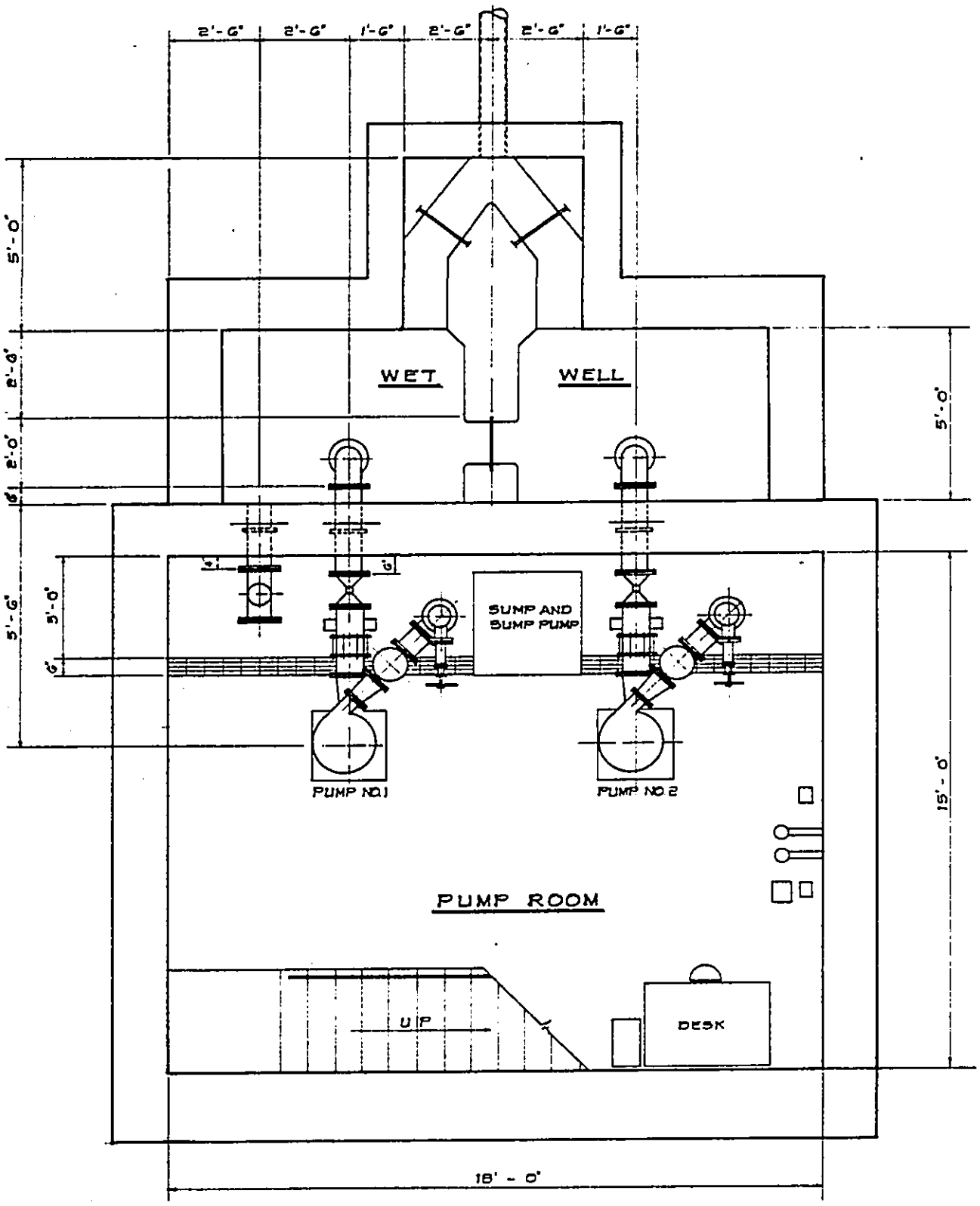
FUKUNAGA & ASSOCIATES

JOB NO.

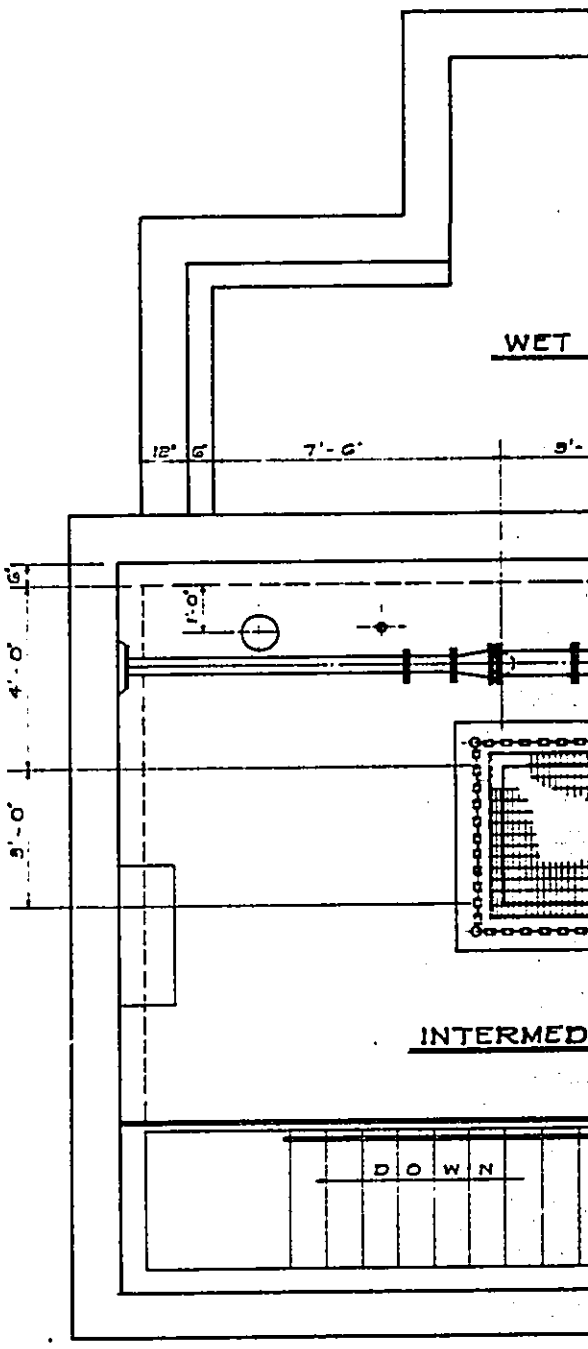
SHEET 10 OF

FILE	PROJECT	PAGES	AS



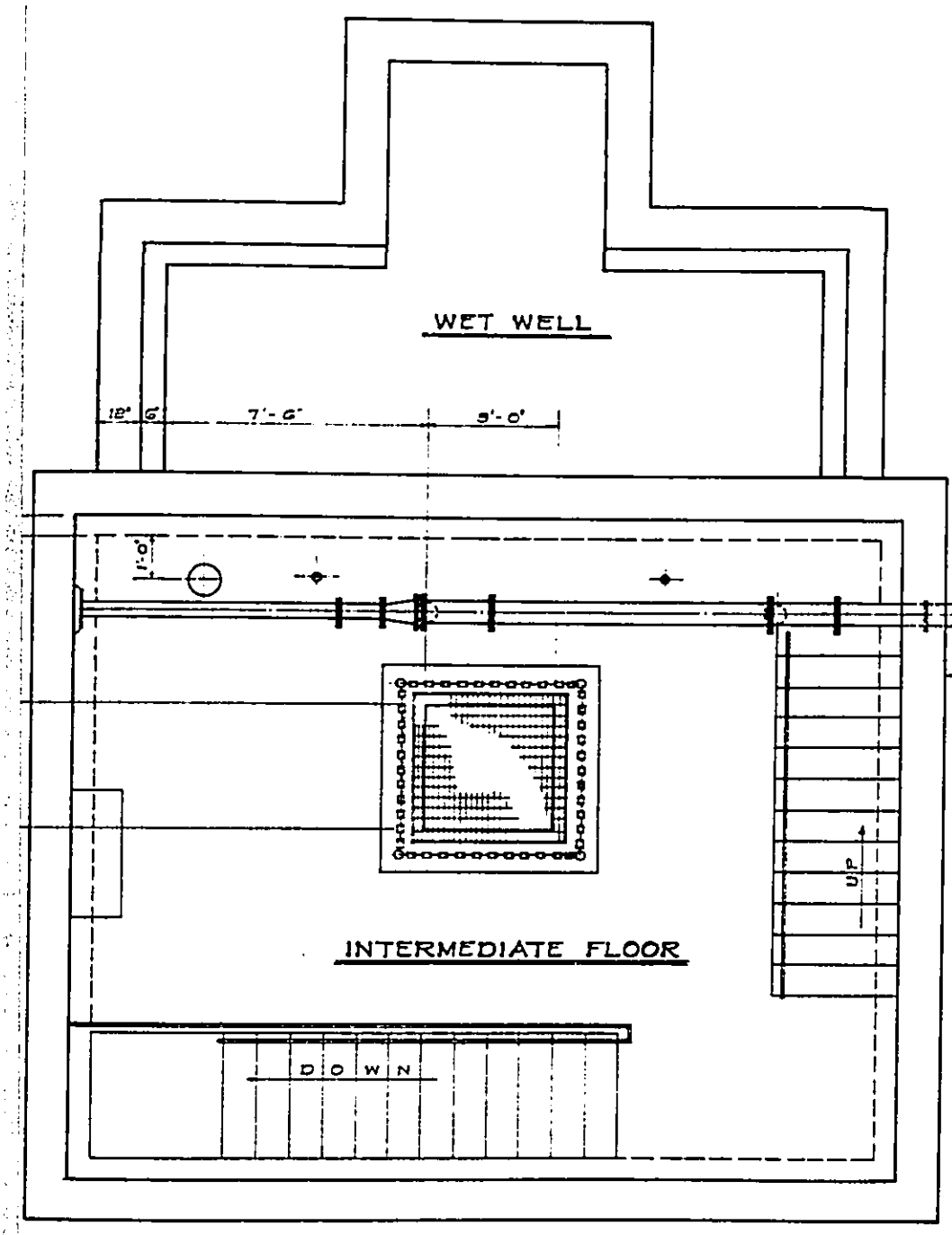
PUMP ROOM FLOOR

SCALE 1/8" = 1'-0"



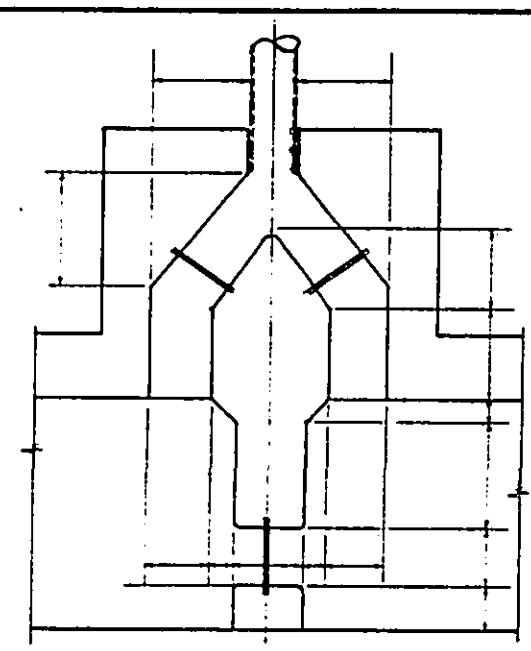
INTERMEDIA

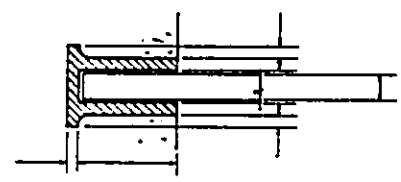
SCALE 1/8"

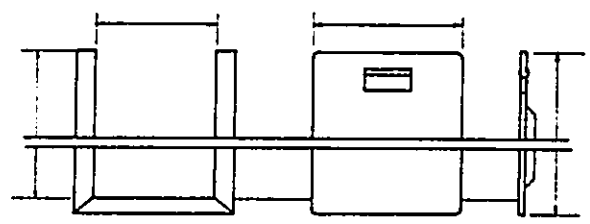


INTERMEDIATE FLOOR

SCALE 1/2"-1'-0"







REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

PROJECT: WAIMANALO RESIDENCE LOTS GRAVITY SEWER SYSTEM, SEC. 5
WAIMANALO, OAHU, HAWAII

ITEM

STANLEY S. Y. YOUNG REGISTERED PROFESSIONAL ENGINEER No. 2205 C HAWAII U.S.A.

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YAMANAGA & ASSOCIATES

JOB NO

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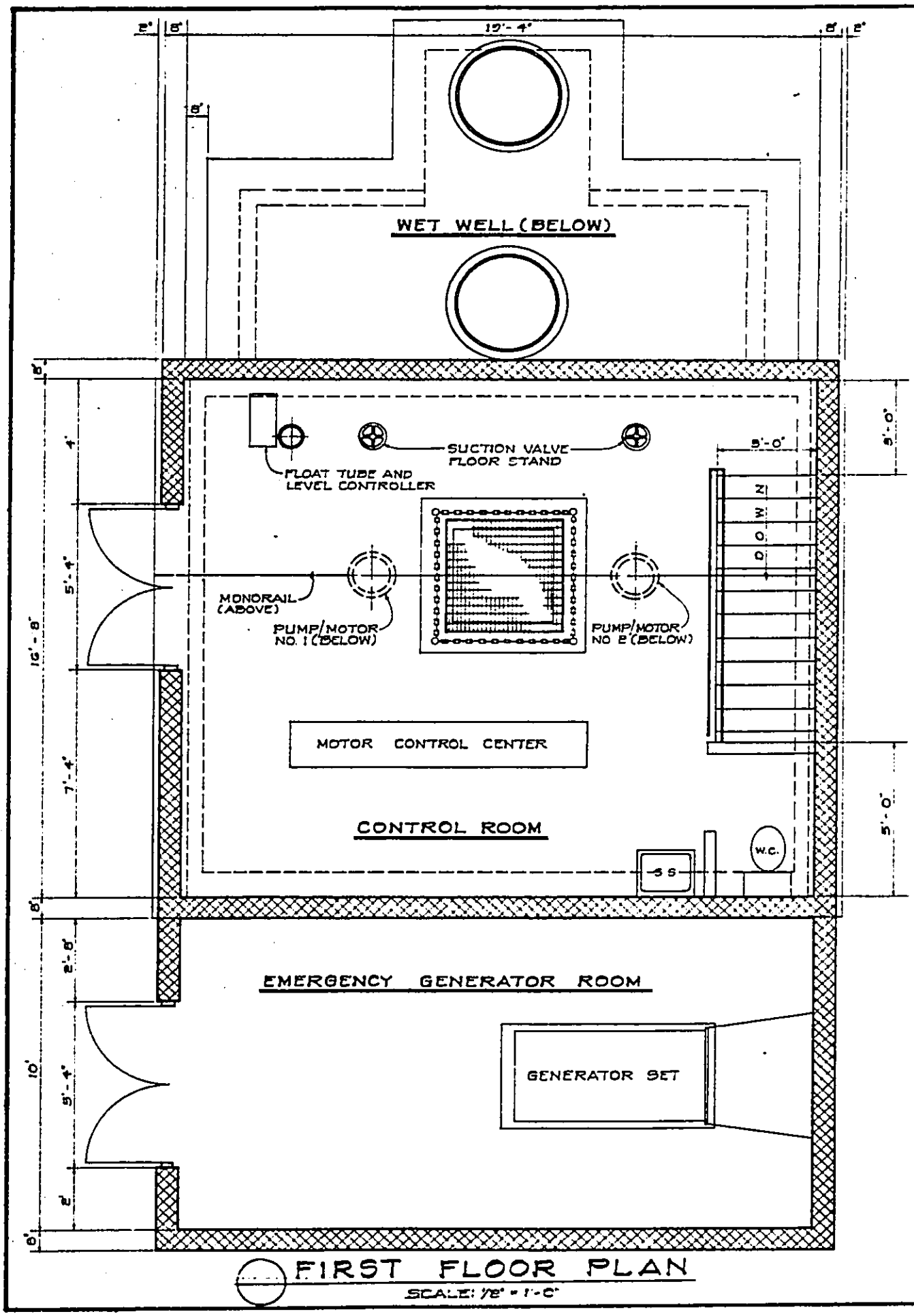

FIRST FLOOR PLAN

SCALE: 1/2" = 1'-0"

REVISION	DATE	BRIEF	BY	APPROVED

DIVISION OF WASTEWATER MANAGEMENT
DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU

PROJECT **WAIMANALO RESIDENCE LOTS GRAVITY SEWER SYSTEM, SEC. 5**
WAIMANALO, OAHU, HAWAII

ITEM

DESIGNED S. Young ..... SCALE .....
DRAFTSMAN ..... CHECKED BY R. Fukunaga .....
APPROVED ..... DRAWING NO. .....
CHIEF, DIV. OF WASTEWATER MANAGEMENT ..... DATE .....

STANLEY S. Y. YOUNG
REGISTERED PROFESSIONAL ENGINEER
No. 2705-C
HAWAII U.S.A.

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FUKUNAGA & ASSOCIATES

JOB NO.

SHEET OF

P. & A.	PROJECT	POLICE	A.D.

APPENDIX III

WASTEWATER FLOW COMPUTATIONS

Form: ...170 (11/83)

COMPUTATION OF WASTEWATER FLOW

SEWER: KALANIANAOLE HWY K-1 (INITIAL)

DISTRICT:

REFERENCE MAPS:

PAGE: 1

COMPUTED BY: SY

DATE: 2-9-87

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								( )EXISTING ( )ULTIMATE SEWER STUDY			
				RESIDENTIAL		*OTHER		TOTAL													
DISTRICT ZONE OR STREET	POINT	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	AVERAGE WASTEWATER FLOW @ ___ CPCD (MGD)	MAX FLOW FACTOR	MAX FLOW (MGD)	DRY WEATHER INFILTRATION @ ___ CPCD (MGD)	DESIGN AVE. FLOW (MGD)	DESIGN MAX. FLOW (MGD)	WET WEATHER INFILTRATION @ ___ CPAD (MGD)	DESIGN PEAK FLOW (MGD)	PIPE DIAMETER (IN)	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)
	7																				
		2	2	12	12			12	12	.001	5	.005	.0001	.0011	.0051	.0025	.0076	10	0.6	.7/2.7	.95
	6																				
		2	4	16	28			16	28	.0022	5	.0112	.0001	.0023	.0113	.005	.0163	10	0.6	.66/2.7	.95
	5																				
		2.5	6.5	16	44			16	44	.0035	5	.0176	.0002	.0037	.0178	.007/.012	.0298	10	0.6	1.1/2.7	.95
	4																				
		2	0.5	16	60			16	60	.0048	5	.024	.0003	.0051	.0243	.016/.018	.0423	10	0.6	1.2/2.7	.95
	3																				

REMARKS: * INCREMENT INFIL. → / ← TOTAL; PARTIAL FLOW VEL → / ← FULL FLOW VEL

Figure 22.2.10

COMPUTATION OF WASTEWATER FLOW

SEWER: KALANIANAOLE HIGHWAY K-1 (ULTIMATE)
DISTRICT:
REFERENCE MAPS:

PAGE: 2
COMPUTED BY: SY
DATE: 2/?/89

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								( ) EXISTING ( ) ULTIMATE SEWER STUDY			
				RESIDENTIAL		OTHER		TOTAL													
DISTRICT ZONE OR STREET	POINT	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	AVERAGE WASTEWATER FLOW @ ___ GPCD (MGD)	MAX FLOW FACTOR	MAX FLOW (MGD)	DRY WEATHER INFILTRATION @ ___ GPCD (MGD)	DESIGN AVE. FLOW (MGD)	DESIGN MAX. FLOW (MGD)	WET WEATHER INFILTRATION @ ___ GPAD (MGD)	DESIGN PEAK FLOW (MGD)	PIPE DIAMETER (IN)	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)
[illegible]	FM		30						896	.0717	5	.358	.0179	.09	.376	.060	.436				
	7																				
		2	2	12	12			12	12 / .908	.001	5	.005	.0001	.0011	.0051	.0035	.0076 / .444	10	0.6	.6 / 2.7	.95
	6																				
		2	4	16	28			16	28 / .924	.0022	5	.012	.0001	.0023	.0113	.005	.0163 / .452	10	0.6	.6 / 2.7	.95
	5																				
		2.5	6.5	16	44			16	44 / .940	.0035	5	.0176	.0002	.0037	.0178	.007 / .012	.0291 / .466	10	0.6	.7 / 2.7	.95
	4																				
		2	8.5	16	60			16	60 / .956	.0048	5	.024	.0003	.0051	.0243	.006 / .018	.0423 / .478	10	0.6	.8 / 2.7	.95
	3																				

REMARKS:
Initial pop. / ← Initial pop + future pop from [illegible] & private
Initial flow / ← Initial flow + future flow

4 persons/unit [illegible]

Wet weather infilt. from future FM = 2000 GPAD

FM inc / Total flow inc. .436 from off-site

Figure 22.2.10

COMPUTATION OF WASTEWATER FLOW

SEWER: KALANIAIOLE Hwy K-2
DISTRICT:
REFERENCE MAPS:

PAGE: 3
COMPUTED BY: SY
DATE: 2-9-87

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								( )EXISTING ( )ULTIMATE SEWER STUDY			
				RESIDENTIAL		OTHER		TOTAL													
DISTRICT ZONE OR STREET	POINT	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	AVERAGE WASTEWATER FLOW @ 350 GPCD (MGD)	MAX FLOW FACTOR	MAX FLOW (MGD)	DRY WEATHER INFILTRATION @ 350 GPCD (MGD)	DESIGN AVE. FLOW (MGD)	DESIGN MAX. FLOW (MGD)	WET WEATHER INFILTRATION @ 350 GPAD (MGD)	DESIGN PEAK FLOW (MGD)	PIPE DIAMETER (IN)	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)
	19																				
		3	3	16	16			16	16	.0013	5	.00105	.0001	.0014	.0066	.0038	.0104	8	0.5	.77 / 2.04	.46
	18																				
		2	5	16	32			16	32	.0026	5	.0130	.0002	.0028	.0132	.0016	.0148	8	0.5	.78 / 2.04	.46
	17																				
		1.5	6.5	12	44			12	44	.0035	5	.0176	.0007	.0037	.0178	.0011	.0189	8	0.5	1.02 / 2.04	.46
	16																				
		1.5	8	12	56			12	56	.0045	5	.0225	.0003	.0048	.0228	.0010	.0238	8	0.5	1.1 / 2.04	.46
	3																				

REMARKS: Population based on 4 persons / residence

Figure 22.2.10

COMPUTATION OF WASTEWATER FLOW

SEWER: ALA KOA STREET
DISTRICT:
REFERENCE MAPS:

PAGE: 2
COMPUTED BY: SY
DATE: 2-1-90

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								( )EXISTING ( )ULTIMATE SEWER STUDY			
				RESIDENTIAL		OTHER		TOTAL													
DISTRICT ZONE OR STREET	POINT	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	AVERAGE WASTEWATER FLOW @ 0.25 GPCD (MGD)	MAX FLOW FACTOR	MAX FLOW (MGD)	DRY WEATHER INFILTRATION @ 0.5 GPCD (MGD)	DESIGN AVE. FLOW (MGD)	DESIGN MAX. FLOW (MGD)	WET WEATHER INFILTRATION @ 1.0 GPCD (MGD)	DESIGN PEAK FLOW (MGD)	PIPE DIAMETER (IN)	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)
	15																				
		3	3	32	32			32	32	.0076	5	.0190	.0007	.0083	.0133	.0038	.0170	8	0.5	4/7.01	.46
	14																				
		4	5	16	48			16	48	.0038	5	.0190	.0007	.004	.0192	.0062	.0254	8	4	7.2/5.9	1.32
	10																				

REMARKS: *

Figure 22.2.10

COMPUTATION OF WASTEWATER FLOW

SEWER: BEN STREET B-2
DISTRICT:
REFERENCE MAPS:

PAGE: 5
COMPUTED BY: TY
DATE: 2-1-89

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								( )EXISTING ( )ULTIMATE SEWER STUDY			
				RESIDENTIAL		OTHER		TOTAL													
DISTRICT ZONE OR STREET	POINT	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	AVERAGE WASTEWATER FLOW @ 90 GPCD (MGD)	MAX FLOW FACTOR	MAX FLOW (MGD)	DRY WEATHER INFILTRATION @ 5 GPCD (MGD)	DESIGN AVE. FLOW (MGD)	DESIGN MAX. FLOW (MGD)	WET WEATHER INFILTRATION @ 400 GPCD (MGD)	DESIGN PEAK FLOW (MGD)	PIPE DIAMETER (IN)	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)
	13																				
		1	1	12	12			12	12	.0010	5	.005	.0001	.0011	.0051	.0012	.0063	8	1.7	2.1	.77
	12																				
		1	2	12	24			12	24	.0019	5	.0095	.0001	.0021	.0096	.0075	.0171	8	2.8	1.27/4.9	1.1
	11																				
		1.5	3.5	12	36			12	36	.0029	5	.0145	.0002	.0031	.0147	.0044	.0191	8	2.8	1.7/4.9	1.1
	10																				
		4.5 7	10.5		108			24+48 72	108	.0094	5	.043	.0005	.0091	.0435	.0131	.0566	8	1.7	1.7/3.1	.72
	9																				
		7	17.5	12	120			12	120	.0096	5	.048	.0006	.0107	.0486	.0156	.0642	8	.8	1.6/3.6	.59
REMARKS:	8																				
		.5	13	4	124			4	124	.0099	5	.049	.0006	.0105	.0496	.0163	.0659	8	.8	1.7/3.6	.59
	2																				

Figure 22.2.10

COMPUTATION OF WASTEWATER FLOW

SEWER: BELL STREET 3-1 (INITIAL)
DISTRICT:
REFERENCE MAPS:

PAGE: 6
COMPUTED BY: SY
DATE: 2-9-89

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								( )EXISTING ( )ULTIMATE SEWER STUDY			
				RESIDENTIAL		OTHER		TOTAL													
DISTRICT ZONE OR STREET	POINT	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	AVERAGE WASTEWATER FLOW @ ___ GPCD (MGD)	MAX FLOW FACTOR	MAX FLOW (MGD)	DRY WEATHER INFILTRATION @ 15 GPCD (MGD)	DESIGN AVE. FLOW (MGD)	DESIGN MAX. FLOW (MGD)	WET WEATHER INFILTRATION @ 1550 GPAD (MGD)	DESIGN PEAK FLOW (MGD)	PIPE DIAMETER (IN)	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)
	3																				
			112.5		116				116	.0093	5	.0465	.0006	.0099	.0471	.0306	.0677	10	0.10	1.4/2.7	.95
	2																				
		.5+11	70	4+114	944				944	.019	5	.095	.001	.02	.096	.0375	.133	10	0.44	1.6/2.3	.8
	1																				

REMARKS:

Figure 22.2.10

PW-WSA-STM (11/83)

COMPUTATION OF WASTEWATER FLOW

SEWER: BELL STREET B-1 (ULTIMATE)
DISTRICT:
REFERENCE MAPS:

PAGE: 7
COMPUTED BY: JY
DATE: 2-9-89

SEWER LOCATION		TRIBUTARY AREA (ACRES)		TRIBUTARY EQUIVALENT POPULATION						WASTEWATER FLOW COMPUTATION								( )EXISTING ( )ULTIMATE SEWER STUDY			
				RESIDENTIAL		OTHER		TOTAL													
DISTRICT ZONE OR STREET	POINT	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	INCREMENT	TOTAL	AVERAGE WASTEWATER FLOW @ ___ GPCD (MGD)	MAX FLOW FACTOR	MAX FLOW (MGD)	DRY WEATHER INFILTRATION @ ___ GPAD (MGD)	DESIGN AVE. FLOW (MGD)	DESIGN MAX. FLOW (MGD)	WET WEATHER INFILTRATION @ ___ GPAD (MGD)	DESIGN PEAK FLOW (MGD)	PIPE DIAMETER (IN)	SLOPE (%)	VELOCITY (FPS)	CAPACITY (MGD)
	3																				
TOTAL B-1 (ULT) + B-2			465						1012	.081	5	.405	.0105	.099	.423	.088 (FLOWS)	.511	10	0.6	2.8 / 2.7	.95
	2																				
B-2 + 1 PLUS		13.5	60	138	1140				1140	.091	5	.456	.019	.110	.475	.019 .105	.58	10	0.44	2.5 / 2.3	.8
	1																				

REMARKS:

Figure 22.2.10

4030

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APPENDIX IV

SEWAGE PUMP STATION CALCULATIONS

FUKUNAGA AND ASSOCIATES, INC.

Project: WAIMANALO GRAVITY SEWER SECTION 5 Sheet No.: 1
Location: Computed: SY Date: 4/26/99
Item: SPS SYSTEM HEAD CURVE CALCS Checked: Date:

1. STATIC HEAD

OUTLET MANHOLE INV = 19.5 ± @ ALAKOA ST.

WET WELL LEVEL PUMP ON = (-) 3.75 ± (MIN STATIC HD = 23.25')

WET WELL LEVEL PUMP OFF = (-) 5 ± (MAX STATIC HD = 24.5')

2. SYSTEM CURVES

FORCE MAIN 6"

FORCE MAIN LENGTH 1600'

C=100	Q gpd	Q gpm	ft/1000	Hf	MIN TDH	MAX TDH
	150,000	69.44	0.86	1.38	24.63	25.88
	300,000	208.33	6.6	10.56	33.81	35.06
	500,000	347.22	16.9	27.04	50.79	51.54
	700,000	486.11	31.6	50.56	73.81	75.06

C=140			ft/1000	Hf	MIN TDH	MAX TDH
	100,000		0.46	0.74	23.99	25.24
	300,000		3.54	5.66	28.91	30.16
	500,000		9.1	14.56	37.91	39.06
	700,000		17.0	27.20	50.45	51.70
	900,000	625	26.9	43.04	66.29	67.54

FUKUNAGA AND ASSOCIATES, INC.

Project: WAIMANALO GRAVITY SEWER SECTION 5 Sheet No.: 2
Location:
Computed: SX Date: 4/26/02
Item: SPS SYSTEM HEAD CURVE CALCS Checked: Date:

3. MODIFIED PUMP CURVE

SUCTION TO COMMON DISCHARGE POINT @ MANIFOLD

* REFERENCE CRANE CO. NOMOGRAPH

PUMP NO 1.	SIZE	EQ. LENGTH*
SUCTION 90° BELL INLET	8"	20'
ST. PIPE	8"	4'
GATE VALVE	8"	5'
REDUCER 8"x6"		16' / 45' ≅ 11' OF 6" PIPE
		EQ. LENGTH 6"
REDUCER 6" x 4"		14'
6" CHECK VALVE		37'
6" 90° BEND		16'
6" GATE VALVE		4
6" VERTICAL PIPING		9'
6" 45° BEND		8'
6" WYE		8'
		96'

TOTAL EQUIVALENT LENGTH OF 6" PIPE = 107' 6'

PIPE LOSSES @

Q gpd	$H_L/1000$ @ C=100	H_{f100}	$H_L/100$ @ C=140	H_{f140}
100,000	.86	.09	0.46	.05
300,000	3.1	.33	3.54	.30
500,000	16.9	1.8	9.1	.97
700,000	31.6	3.4	17.0	1.82
900,000	50	6.3	26.9	2.9

FUKUNAGA AND ASSOCIATES, INC.

Project: HAWAIIAN BEACH SEWER SECTION 5 Sheet No.: 3
Location: _____ Computed: SY Date: 4/26/97
Item: _____ Checked: _____ Date: _____

4. PUMP CYCLE TIME:

a. @ 405 GPM (1170 RPM) 64± % EFF 12½" IMP 15 HP MOTOR
WET WELL VOLUME = 510 GAL
MIN. CYCLE TIME @ ½(405) GPM = 5.0 MIN. FUTURE PEAK
CYCLE TIME @ 76 GPM = 0.2 MIN. FUTURE AVE

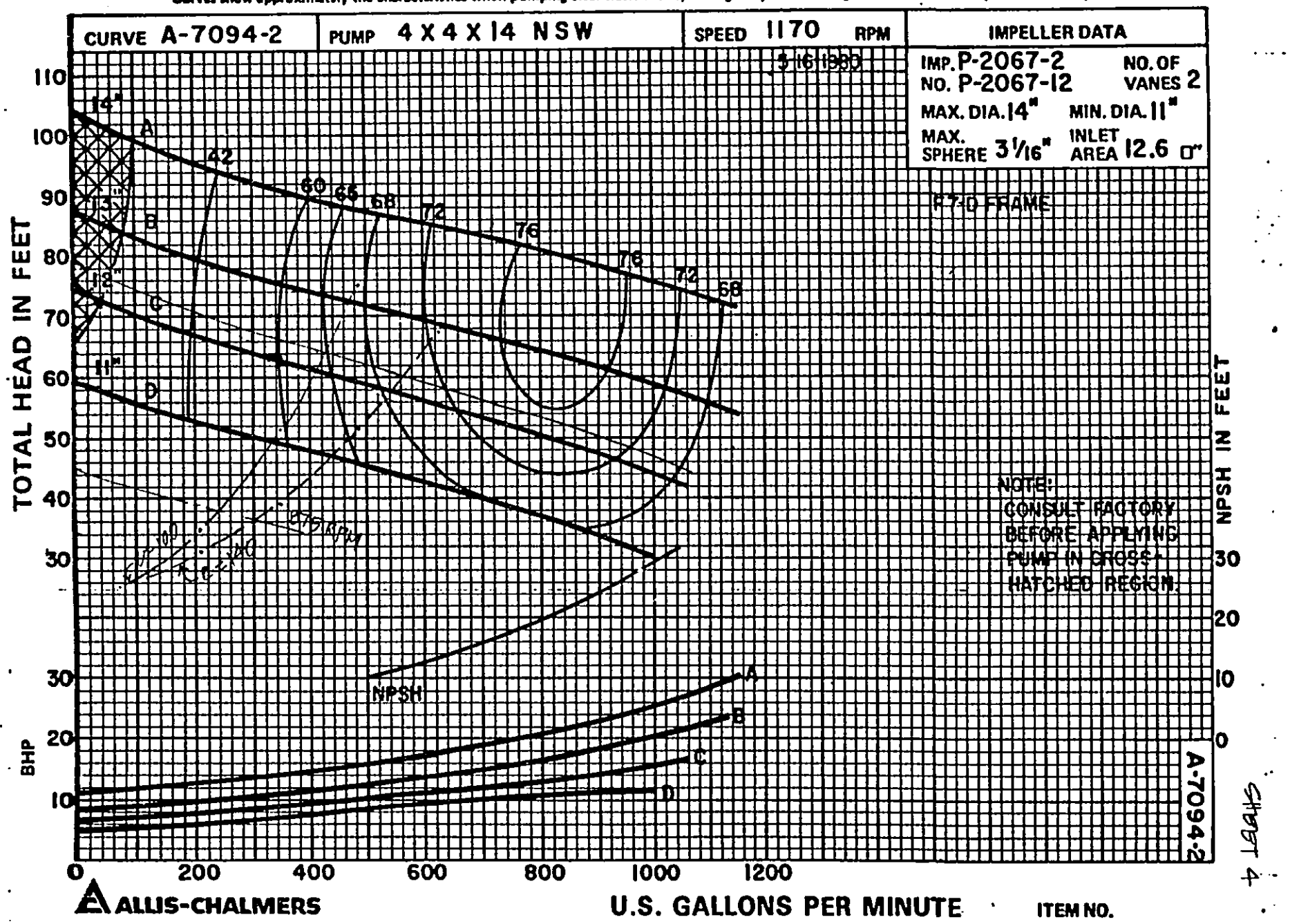
b. @ 315 GPM (1170 RPM) 11" IMPELLER
CYCLE TIME @ 92 GPM = 7.8 MIN. INITIAL PEAK
CYCLE TIME @ 12 GPM = 38.1 MIN. INITIAL AVE

c. MAX. WET WELL RETENTION TIME @ AVE FLOW
WET WELL VOLUME ½(5+2.5)x4.5x14x7.48 = 1767 GAL
RETENTION TIME @ FUTURE CONDITIONS 1767÷(405-76) = 5.4 MIN.
@ INITIAL CONDITIONS 1767÷(315-14) = 5.9 MIN.

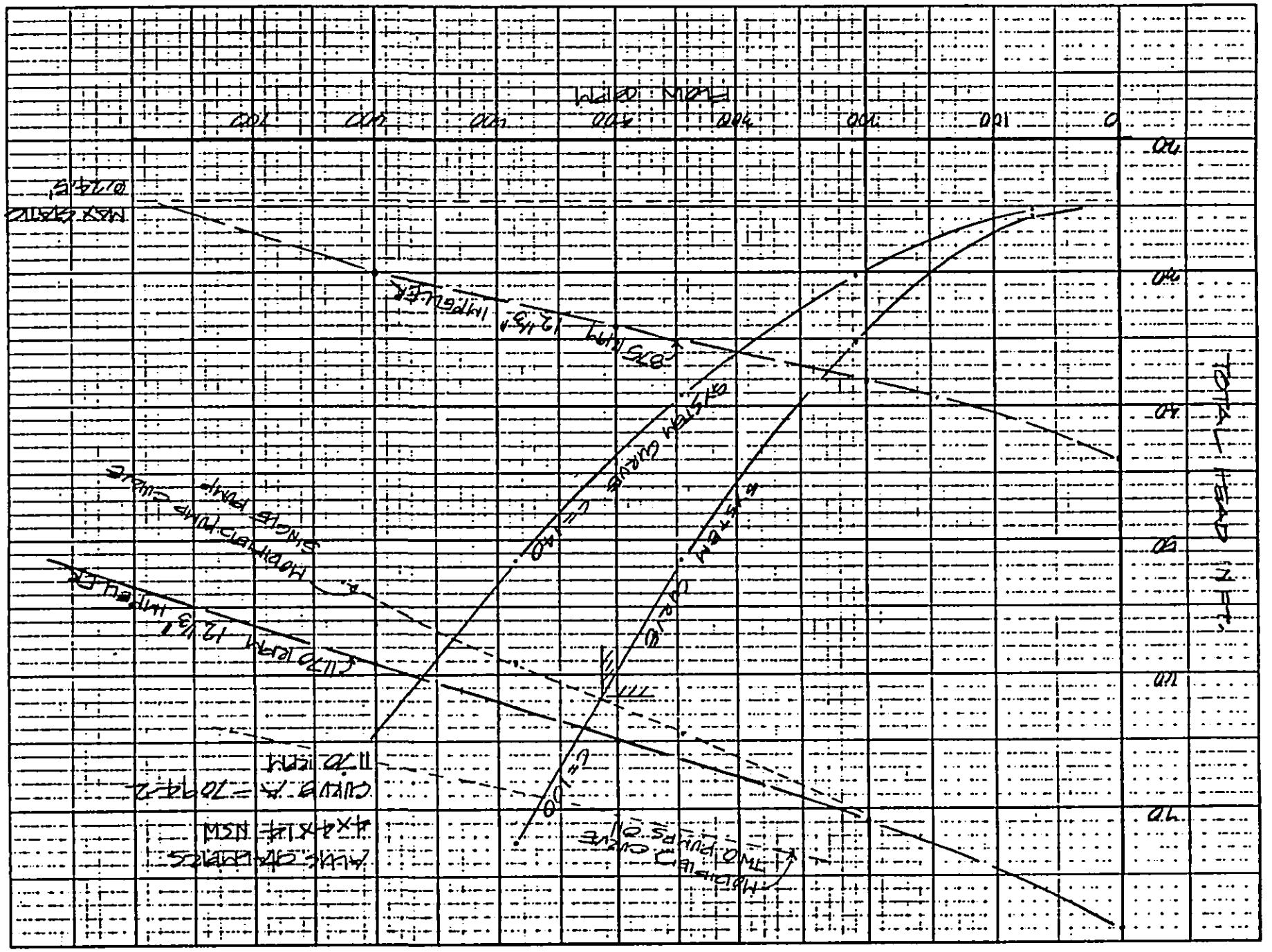
5. PROPOSED: SIZED BY MFG. CURVES — SIZE — MOTOR
FUTURE USE: 4x4x14 NSV W/12⅓" IMP. 405 GPM, 1170 RPM 3⌀ 64% 15HP
INITIAL USE: 4x4x14 NSV W/11" IMP. 319 GPM

ALTERNATE:
FUTURE USE: 4x4x14 NSW W/12⅓" IMP. 405 GPM, 1170 RPM @ 64% 15HP
INITIAL USE: 4x4x14 NSV W/12⅓" IMP. 330 GPM, 875 RPM 7½HP
(MAY NEED BOND.)

Curves show approximately the characteristics when pumping clear water with specific gravity of 1.0. No guarantee is made except for the rated point.

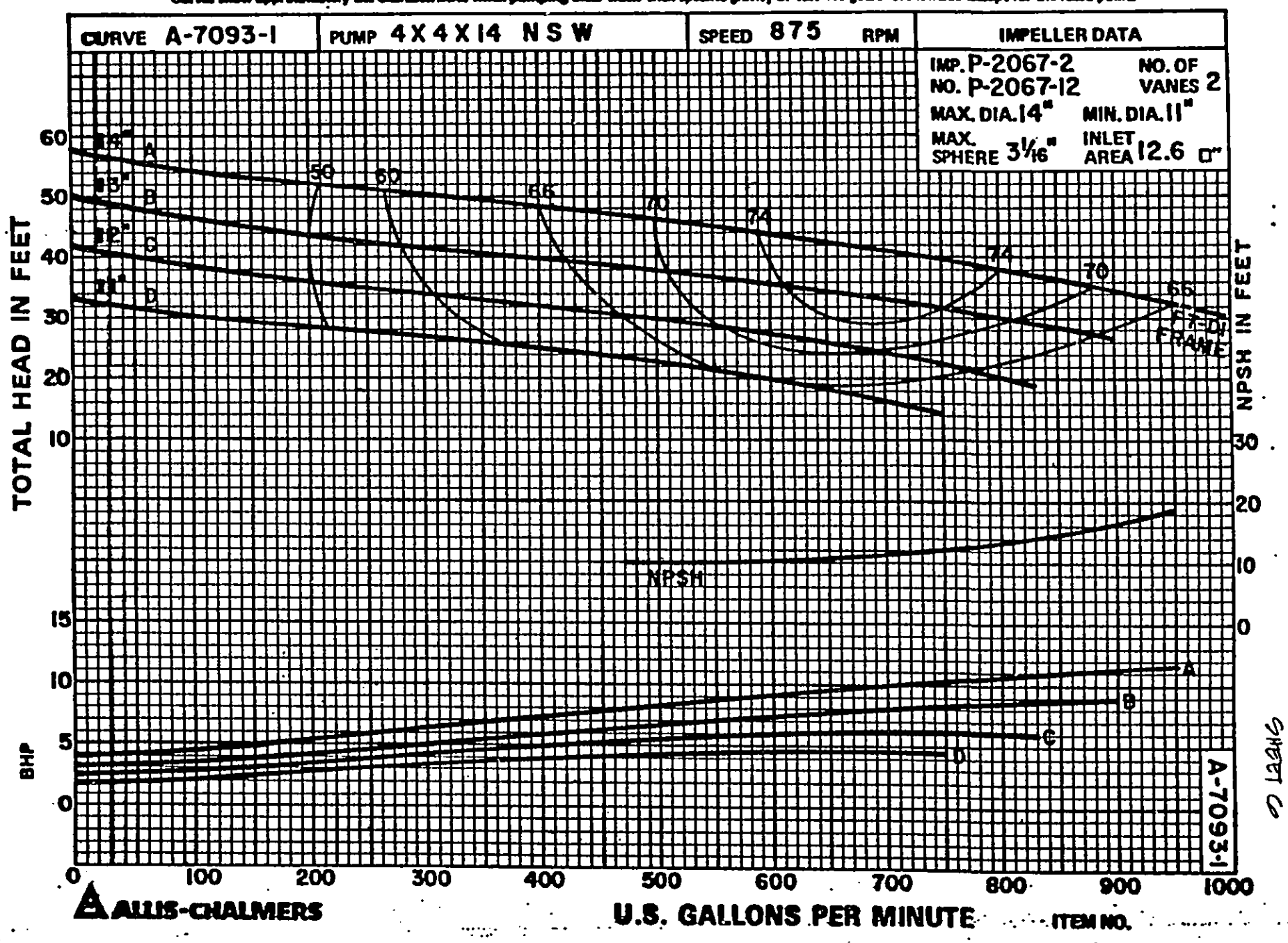


SHEET 4



Curves show approximately the characteristics when pumping clear water with specific gravity of 1.0. No guarantee is made except for the rated point.

CURVE A-7093-1	PUMP 4 X 4 X 14 N S W	SPEED 875 RPM	IMPELLER DATA
			IMP. P-2067-2 NO. OF VANES 2
			NO. P-2067-12
			MAX. DIA. 14" MIN. DIA. 11"
			MAX. SPHERE 3 1/16" INLET AREA 12.6 □"



ALLIS-CHALMERS

ITEM NO.

SHEET 0