JOHN WAIHEE
GOVERNOR OF HAWAII

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

REF:OCEA:SKK

FILE NO.: HA-3/27/92-2563
180-Day Exp. Date: 9/23/92
DOC. ID.: 635

MAY 6 1992

Mr. Michael Bradley
Engineering Dept.
Hawaiian Electric Light Company
P.O. Box 1027
Hilo, Hawaii 96721-1027

Dear Mr. Bradley:

NOTICE OF ACCEPTANCE AND ENVIRONMENTAL DETERMINATION
Conservation District Use Application for
Telecommunication Tower
Keahole, North Kona, Hawaii

This acknowledges the receipt and acceptance for processing your application to develop a telecommunications tower.

According to your information, you propose to construct a 50 foot galvanized steel three legged self supporting microwave tower. The tower will have one 12 foot solid microwave antenna mounted at 45 feet. The tower and antenna will be painted a light gray in color.

The tower will provide the means for allowing required communications for protection of transmission lines, supervisory control of the site, data acquisition and voice.

After reviewing the application, we find that:

1. The proposed use is a conditional use within the General subzone of the Conservation District according to Administrative Rules, Title 13, Chapter 2, as amended;

2. No public hearing pursuant to Section 183-41, Hawaii Revised Statutes (HRS), as amended, will be required; and

3. In conformance with Title 11, Chapter 200, of the Administrative Rules, a negative declaration was determined for the proposed action.

As the applicant, please be advised that it will be your responsibility to comply with the provisions of Section 205A-29(b), Hawaii Revised Statutes, relating to Interim Coastal Zone Management (Special Management Area) requirements.

Negative action as required by law, on your application by the Board of Land and Natural Resources can be expected should you fail to obtain from the County thirty (30) days prior to the 180-day expiration date, as noted on the first page of this notice, one of the following:

1. A determination that the proposed development is outside the Special Management Area (SMA);

2. A determination that the proposed development is exempt from the provisions of the county ordinance and/or regulation specific to Section 205A-29(b), HRS; or

3. A Special Management Area (SMA) permit for the proposed development.

Pending action on your application by the Land Board in the near future, your cooperation and early response to the matters presented herein will be appreciated. Should you have any questions, feel free to contact Ed Henry of our Office of Conservation and Environmental Affairs staff at 587-0377.

Very truly yours,

WILLIAM W. PATY

Attachment (receipt)

cc: Hawaii Board Member
Hawaii Land Agent
Hawaii Planning Dept.
DOH/OEQC/OHA/OSP/DOT
DBF/Telecommunications Division

1992-05-18-HI-FEA- Keahole Telecommunication Tower

MAY 18 1992

ENVIROMENTAL ASSESSMENT

Keahole Microwave Tower Addition

1. **APPLICANT**

Hawaii Electric Light Company, Inc.
P. O. Box 1027
Hilo, Hawaii 96721-1027
Phone: 1-935-1171

2. **APPROVING AGENCIES**

Approval is being sought from the following four agencies:

1. State of Hawaii
   Department of Land and Natural Resources

2. State of Hawaii
   Department of Transportation
   Airports Division
   (height restriction only)

3. Federal Aviation Agency
   Western-Pacific Regional Office
   Air traffic Division AWP-530
   (height restriction only)

4. Federal Communications Commission
   (fequency and emission only)

3. **AGENCIES CONSULTED**

1. State of Hawaii
   Department of Land and Natural Resources

2. State of Hawaii
   Department of Transportation
   Airports Division

3. Federal Aviation Agency
   Western-Pacific Regional Office
   Air traffic Division AWP-530

4. Federal Communications Commission

5. Comsearch

6. UTC Corporation

4. PROJECT DESCRIPTION

LOCATION

The Keahole generating station supplies power to the Kona region on the Big Island during peak load periods or system outages. Electrical power plant and transmission switching station site is owned by Hawaii Electric Light Company, Inc. (HELCO). The land, 14.998 acres, is situated at Keahole, North Kona, Hawaii, identified by Tax Map Key 7-3-49-36. Please refer to Exhibit 1, Location Map - TMK 7-3-49:36 and Exhibit 2, Keahole Agricultural Park. The facility currently occupies 3.1 acres.

PURPOSE

The initial driving force for the communication system at HELCO was for Supervisory Control and Distribution Automation, (SCADA), and voice communication. Substation or Switching Station locations which only required individual channel requirements, use 450 MHZ radios and/or telephone lease lines. These links provide system information to the dispatch center at Hilo. They also provide island wide communications for the three Base Yards located at Hilo, Waimea and Kailua.

The HELCO power system lacks the stability that comes from having ties with neighboring utilities. The critical clearing times at some locations on the system are low enough to require 100 milli-second clearing times for the total line to prevent stability problems. HELCO is now aggressively improving its communications system to

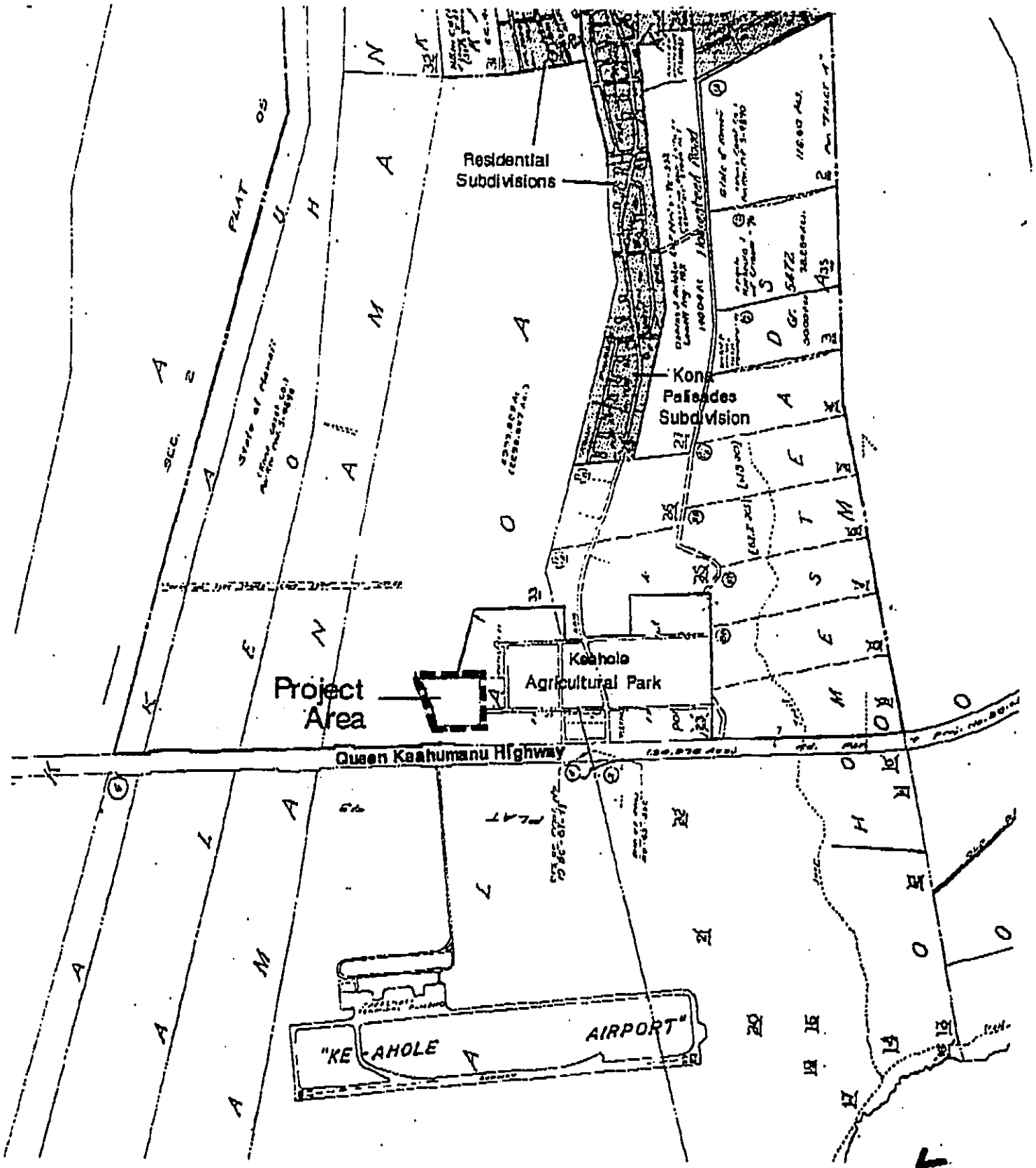
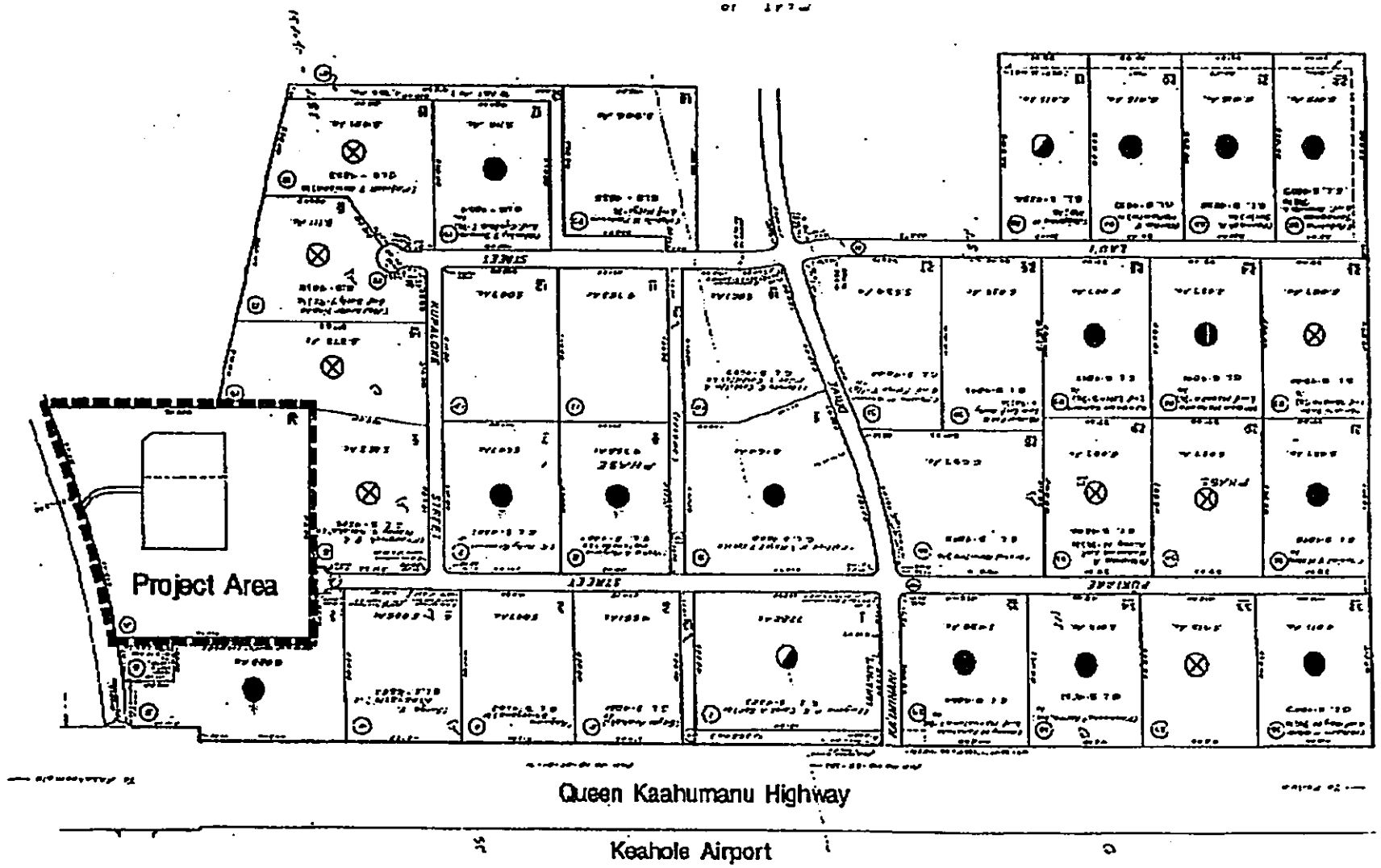


Exhibit 1 Location Map –TMK 7–3–49:36

Scale: 1 inch = 2000 feet



Existing residence
Residence proposed
Vacant
All other lots are being used for agricultural activities, or have been cleared and graded for agricultural use.

Source: DLNR – Hilo office

Scale: 1 inch = 500 feet

Exhibit 2 Keahole Agricultural Park
(TMK 7-3-49)

accommodate the new Protective Overreach Transfer Trip, (POTT) relaying scheme. The POTT scheme required a secure and reliable communication between switching stations for each transmission line so that the entire line can trip faster. The HELCO policy is to have a dedicated channel for each transmission line.

Five new microwave links are currently under various stages of installation which will terminate in two new switching stations and three existing switching stations of which one of them is the Keahole site.

HELCO's goal is to extend the microwave system to service all the remaining four switching stations. The stations are Keamuku, Kilauea, Kealia, and Puueo switching Stations.

PROPOSED ACTION

To construct a 50 foot galvanized steel three legged self supporting microwave tower. The tower will have one 12 foot solid antenna for 1.85-1.99 GHz mounted at 45 feet. The antenna will be pointed 47.2 degrees based on true north. The antenna and tower will be light gray in color. Appendix A has the detailed construction plans of the tower.

The 120 channel Western Multiplex Two-2000 radio will be located within the existing control house that the tower is located next to.

SOCIO-ECONOMIC IMPACTS

The tower is one of the necessary elements in providing safer and more reliable electric service to the surrounding area. The tower will provide the means for allowing required communications for protection of the transmission lines, supervisory control of the site, data acquisition, and voice.

EXISTING ENVIROMENTAL CHARACTERISTIC

The parcel is used for generation of electricity and a transmission switching station. Exhibit 3, Keahole Site Plan, shows the layout for the facility and keys the photos of the site which are shown on Exhibit 4. The 3.1 acre facility is completely enclosed by a chain link fence with one drive gate. The existing facilities consist of the following:

Generating Plant Area
- control house
- two switchgears
- six 2.75 MW diesel engine generators
- two fuel oil storage tanks
- control room for combustion turbine
- black start emergency diesel generator
- 14 MW combustion turbine (CT) with stack
- three water storage tanks for CT
- demineralizer for CT
- acid & caustic tanks for CT

Switching Station Area
- switchyard
- three transformers
- cesspool

The facility has paved and unpaved areas. The unpaved areas consist of a compacted gravel surface. The site is

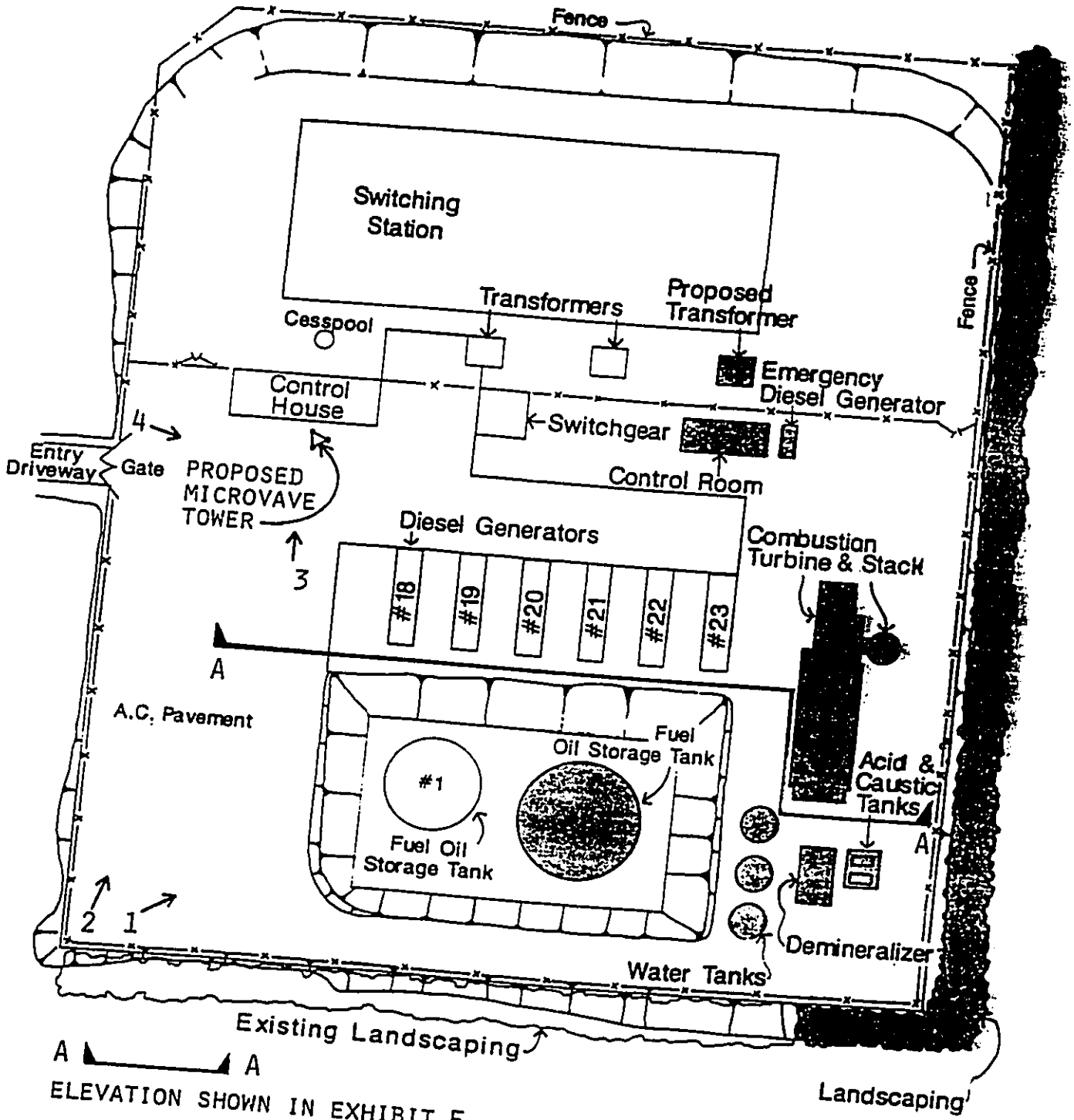
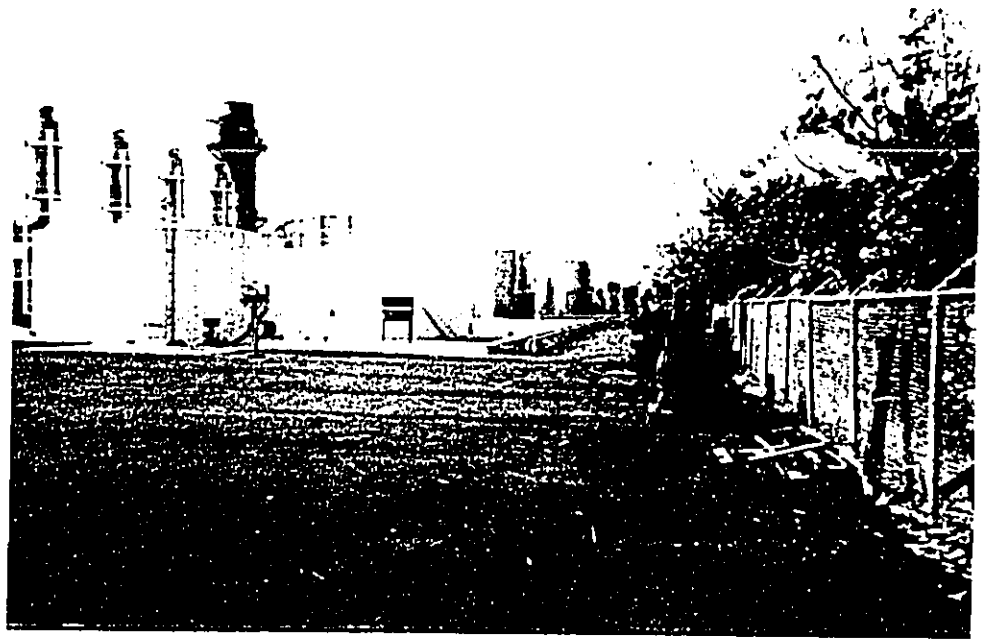
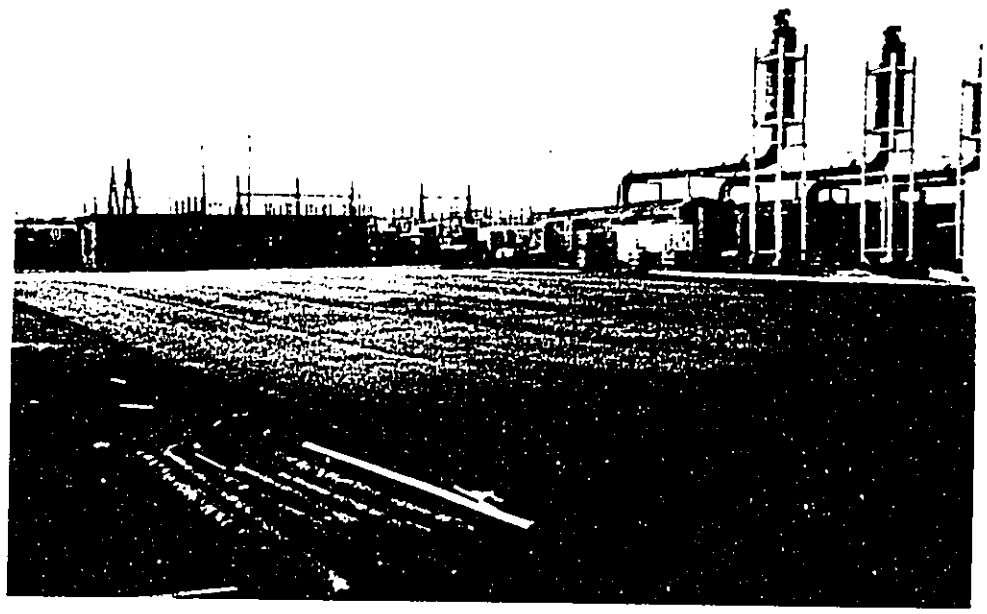


Exhibit 3: KEAHOLE SITE PLAN

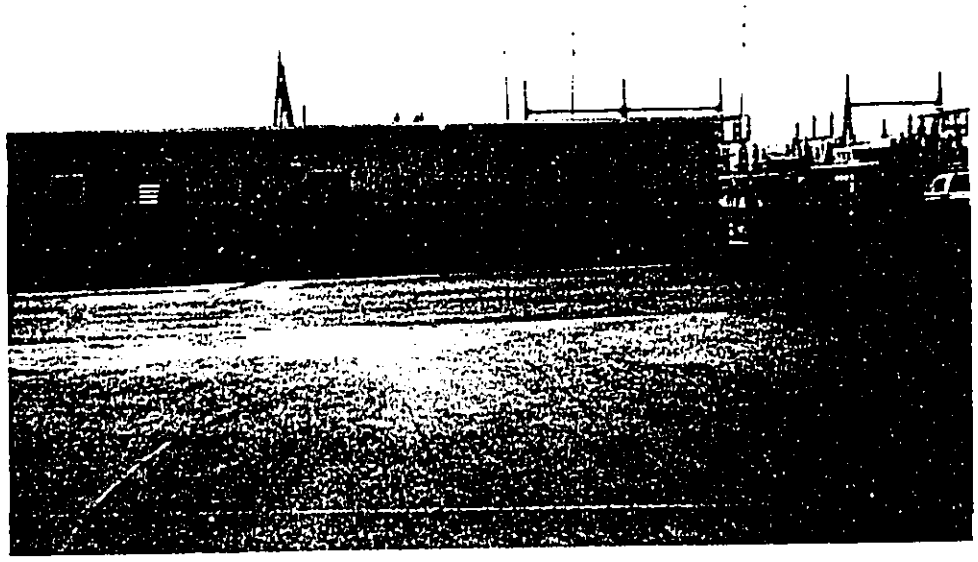


1. Existing Fuel Oil tanks with Combustion Turbine and four Diesel Generators stacks.



2. AC pavement areawith Control House, three Diesel Generators shown and 69 KV Switching Station in background

EXHIBIT 4A: Photos of Existing Generating Site



3. Frontal view of Control House. Tower to be placed between the middle and right side door.

4. Side view of Control House looking towards the Combustion Turbine and six Diesel Generators

EXHIBIT 4B: Photos of Existing Generating Site

relatively flat, with exception of a depressed berm area for the fuel oil storage tanks.

The unused portion of the 14.998 acre parcel is also predominately flat, and has been retained in its natural state, consisting of lava flows and clumps of vegetation of primarily grasses and low brush. There are some trees and shrubs along the fence on the Queen Kaahumanu Highway (west) side of the power plant, which partially screen the view of the Keahole facility from the highway.

NEW ENVIROMENTAL CHARACTERISTIC

The only enviromental characteristics that would change from the existing conditions are the Federal Aviation Administration (FAA) height restrictions, Federal Communications emission limitations and visual impacts.

5. DESCRIPTION OF AFFECTED ENVIRONMENT

EXISTING USE

The parcel is used for generation of electricity and a transmission switching station. The generation facility has six Electro Motive Division, EMD, high speed diesels rated at 2.75 MW each and one combustion turbine rated 14 MW. The stack heights for the EMD and the combustion turbine are 40 and 71 feet respectively above ground elevation. There are four 69,000 volt transmission lines that emanate from the parcel. The transmission lines use 70 and 75 foot poles.

TOPOGRAPHY AND SOILS

The facility has paved and unpaved areas. The unpaved areas

consist of a compacted gravel surface. The site is somewhat flat, with exception of ditches around the fuel oil storage area and along the mountain side of the switching station. The tower is to be placed in a level area that is paved.

FLORA AND FAUNA

The unused portion of the 14.998 acre parcel is also predominately flat, and has been retained in its natural state, consisting of lava flows and clumps of vegetation of primarily grasses and low brush. There are some trees and shrubs along the bottom half of the fencing on the Queen Kaahumanu Highway (West) side of the power plant, which partially screen the view of the Keahole facility from the highway.

DRAINAGE

No change is made to the existing site since it is currently paved and the area under the tower will be repaved.

HISTORICAL AND ARCHAEOLOGICAL

The State Historic Sites Office of DLNR reviewed the project area for the 1987 CDUA amendment (File No. HA-9/11/86-487A). They had no objections to that proposal because it was located with previously disturbed facilities area. There are no historical and archaeological impacts from the proposed action. The site has been previously graded under previous projects and is paved.

SURROUNDING LAND USE

The project site is surrounded by State lands. Lands to the north and east are vacant and consist of open lava flow areas with low grasses. The State Land Use District designation for this area is Conservation, General Subzone.

The Keahole Agricultural Park is located to the south and west of the subject property, and is designated Agricultural on the State Land Use District map. Most of lots are currently being used for some agricultural activities.

Kona Palisades, the closest residential subdivision, is about 4,800 feet southeast of the Keahole plant.

UTILITIES AND SERVICES

Electrical, telephone and water services are available.

6. PROBABLE IMPACTS

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There are no irreversible and irretrievable commitment of resources.

SHORT TERM

Anticipated short term impacts will be increased noise and dust levels during construction.

LONG TERM

The tower will provide safer and more reliable electric service to the surrounding area.

ALTERNATIVES TO THE PROPOSED ACTION

One alternative to the proposed action would be to construct landlines from adjacent facilities. This alternative would increase the project costs substantially and would make it unfeasible and impracticable.

7. MITIGATING MEASURES

Other than standard construction practices during excavation, no mitigating measures will be needed other than Federal Aviation Administration (FAA) height restrictions, Federal Communications emission limitations and visual impacts.

HEIGHT RESTRICTIONS

The proximity of the Keahole plant to the Keahole Airport requires that all construction be in accordance with FAA Airport Zoning Regulations. The FAA has set an "accepted height limitation" of 35 feet above the ground level at the project site that allows structures up to 35 feet high to be built without permitting. However, since the tower height is to be 50 feet tall, Helco must file a "Notice of Proposed Construction or Alteration" with the FAA and receive permission for the proposed action.

It seems probable that permission for the stack will be granted, particularly since the site is off to the side of the runways and primary flight paths. HELCO will meet all FAA and DOT requirements.

EMISSION LIMITATION

FCC has set a maximum emission level for private microwave user. The equipment has been purchased to comply with the FCC requirements.

VISUAL IMPACTS

The major visual vantage point of the project area is the Queen Kaahumanu Highway, over 750 feet to the west. Due to the diminishing effect of the distance and the partial screen provided by the existing vegetation and planted vegetation screen consisting of an Oleander hedge Wiliwili and Coconut trees, only the upper portions of the plant's structures are visible. Exhibit 3 is a plot plan of the generation site with section "A-A" indicated. Exhibit 5 shows the elevation of the existing Combustion Turbine, the six diesels and the proposed microwave tower. The Photos showing the views of the project site are shown in Exhibit 6.

The VOG was quite heavy on the day that the Photos were taken. However, if the day was clear, the tan colored muffler supports would not have blended as well as the gray Combustion Turbine stack against the dark mountain backdrop. The lighter colored equipment when viewed from either the north or the south tended to blend better with the light sky. The proposed gray is a lighter gray than the existing exhaust stack and blend better. The tower should have a negligible visual impact.

SECTION A–A

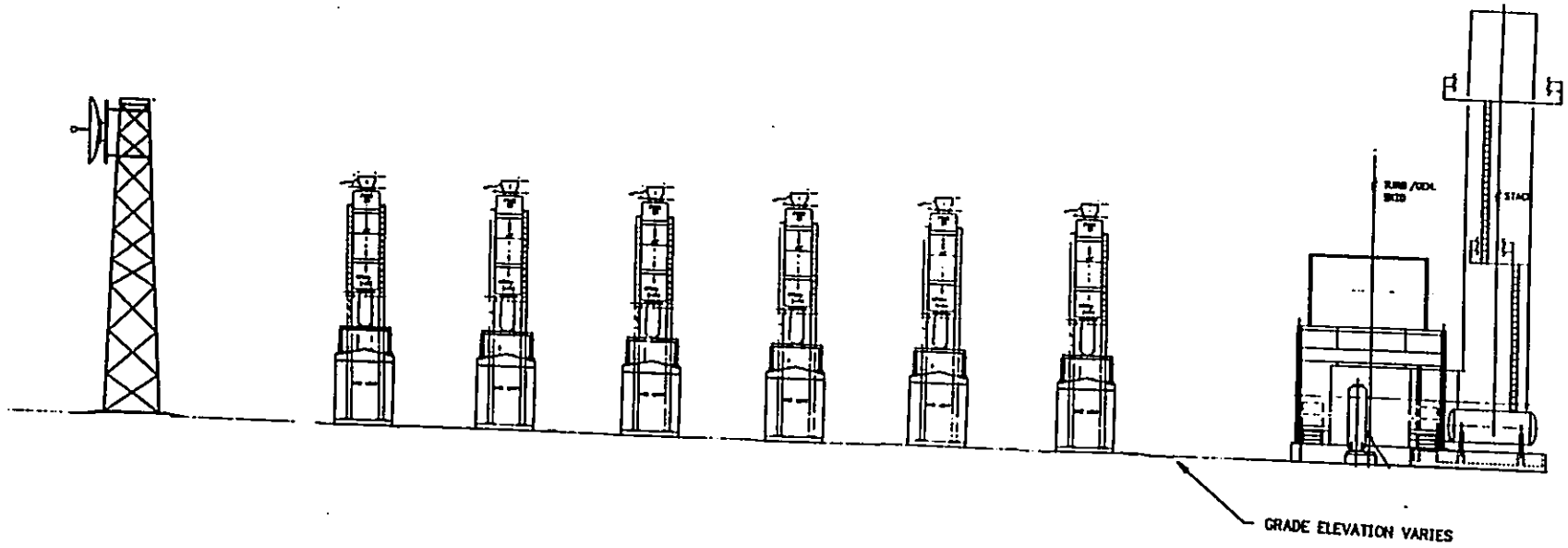
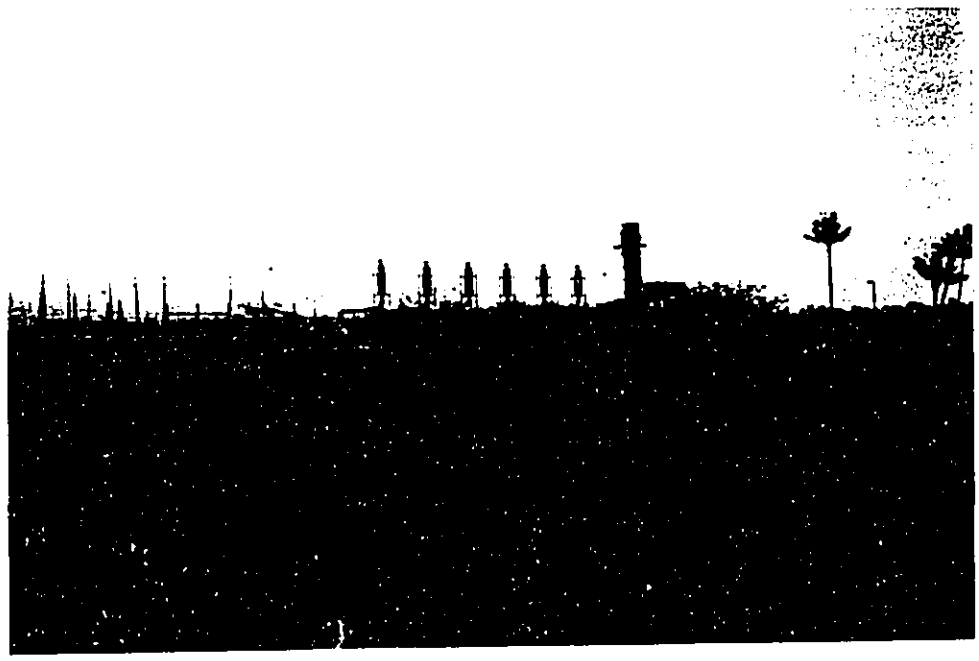
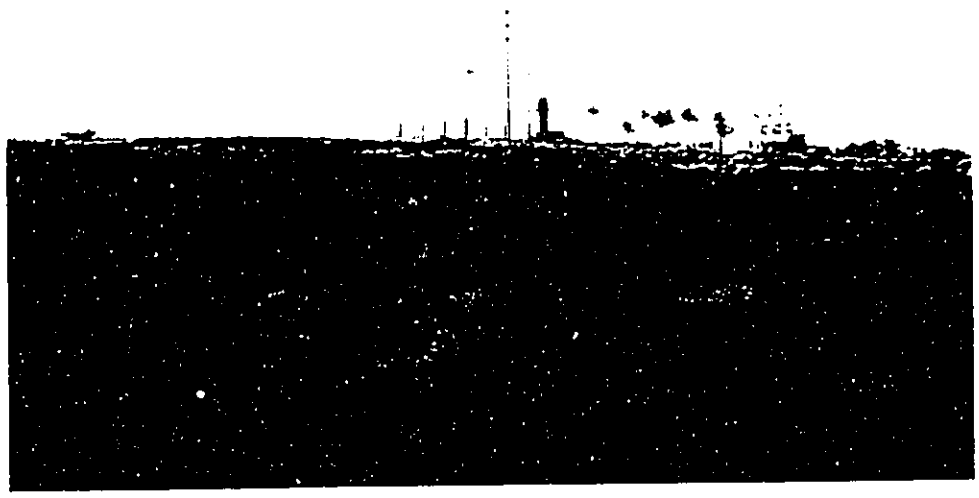


EXHIBIT 5: ELEVATION OF THE PROPOSED 50 FT MICROWAVE TOWER, 71 FT COMBUSTION TURBINE, AND SIX 40 FT DIESEL GENERATORS

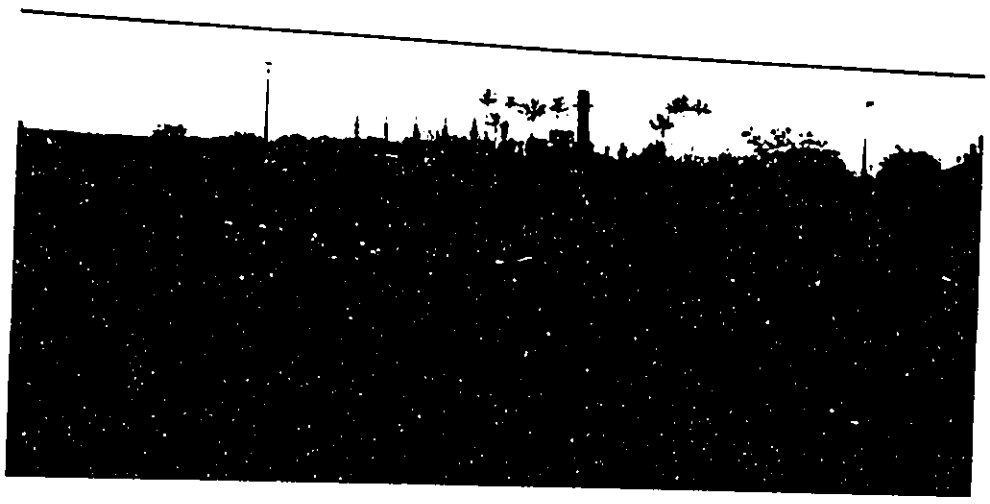


1. View to Keahole Power Plant from North East corner of property. (about 300 feet distance)



2. View to Keahole Power Plant from Queen Kaahumanu Highway North. (about 1700 feet distance)

EXHIBIT 6A: Photos of Existing Generating Site



3. View of Keahole Power Plant from Queen Kaahumanu Highway by airport entrance. (about 750 feet distance)

4. View of Keahole Power Plant from aiport access road. (about 1600 feet distance)

EXHIBIT 6B: Photos of Existing Generating Site

6. View to Keahole Power Plant from Queen Kaahumanu Highway. (about 1000 feet distance)

7. View to Keahole Power Plant from Queen Kaahumanu Highway and Ka'imani drive. (about 2200 feet distance)

EXHIBIT 6C: Photos of Existing Generating Site

8. **DETERMINATION**

In review of the probable impacts and mitigating measures, HELCO requests that this Enviromental Assessment be identified as a Negative Declaration.

9. **REASONS SUPPORTING DETERMINATION**

As shown in Exhibit 4B, Photo 3, the tower will be placed next to the existing paved area. The existing drainage of the site will not be affected. There are no historic or significant sites at this location. It seems probable that permission for the 50 foot tower will be granted by FAA and DOT, particularly since the site is off to the side of the runways and primary flight paths and over shadowed by the 71 foot Combustion Turbine Stack. The light gray color has been chosen to help blend with the sky background and the mountain backdrop. The younger coconut trees that have been planted, in time, will further help to disguise the facilities existence.

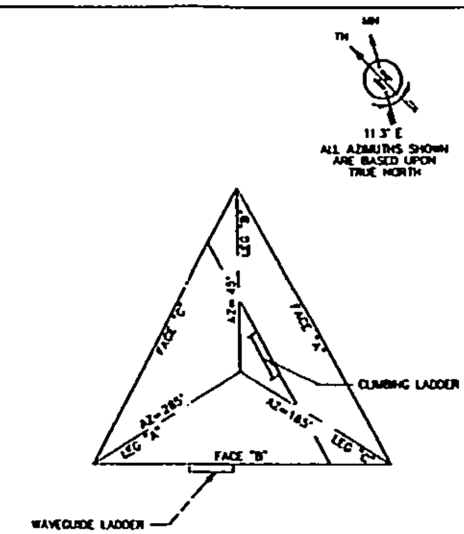
10. **AGENCIES TO BE CONSULTED IN THE PREERATION OF THE EIS**

Not required.

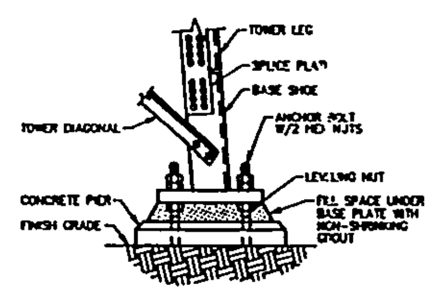
APPENDIX A

GENERAL NOTES:

1. TOWER HEIGHT 50'
2. CONCRETE TOWER FOUNDATION PER DWG NO. SF-1729-06
   CONCRETE: 21.6 CU YDS (TOTAL - 3 PIERS)
   BASE SHOE PIECE MARK 04-9096-2
   BASE PLATE SIZE 1 1/2" X 11" X 11"
3. GROUNDING REQUIRED: ☐ YES ■ NO
4. REMOVE UPPER ANCHOR BOLT TEMPLATE BEFORE INSTALLING TOWER BASE.
5. LIGHTNING ROD REQUIRED: ■ YES ☐ NO
   INSTALL PER DWG NO. 3ST-00-TOP
6. FINISH: ALL STEEL HOT DIP GALVANIZED
   PAINT REQUIRED: ☐ YES ■ NO
7. INSTALL ■ LOCKWASHERS AND HEX NUTS ☐ LOCKNUTS AT ALL BOLTED CONNECTIONS. (SEE SPECIAL NOTE)
8. LIGHTS REQUIRED: ☐ YES ■ NO
9. INTERNAL CLIMBING LADDER REQUIRED: ■ YES ☐ NO
   INSTALL LADDER BETWEEN FACES "B" AND "C"
   PER SECTION ASSEMBLIES AND DWG. NO. 3ST-00-CD
10. SAFETY CLIMB DEVICE REQUIRED: ☐ YES ■ NO
11. WAVEGUIDE SUPPORTS REQUIRED: ■ YES ☐ NO
    ■ 6 RUN WAVEGUIDE SUPPORT ON OUTSIDE OF FACE "B"
    INSTALL WG. SUPPORT PER DWG. NO. 3ST-00-W
12. WAVEGUIDE BRIDGE REQUIRED: ☐ YES ■ NO
13. INSTALL ANTENNAS PER CHART THIS DRAWING.
14. ANDREW TOWER NAME PLATE TO BE BOLTED TO OUTSIDE OF TOWER APPROX. 5'-0" ABOVE BASE PLATE.
15. ANY FIELD DAMAGE OR FIELD MODIFICATIONS NEED TO BE DOCUMENTED TO ANDREW CORPORATION AND ALL EXPOSED (BARE) METAL SHALL BE GIVEN ONE COAT (MINIMUM) OF ZINC RICH PAINT.
16. REMOVE ALL TRASH AND DEBRIS FROM SITE.

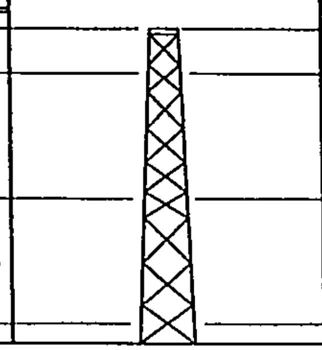


TOWER ORIENTATION
PLAN VIEW



TOWER BASE DETAIL

SECTION ASSEMBLY DWG. NO.	SPLICE LEVEL	LEG PIECE MARK	PAINT BAND LEVELS
	50'		NO PAINT
3ST-0207-C2		02-9185	
	45'		
3ST-03-02		03-9656	
	25'		
3ST-04-E2		04-9096	
	5'		



ELEVATION VIEW

ANTENNA INSTALLATION CHART

ANTENNA TYPE	ELEV.	AZIMUTH	OFFSET	ANTENNA MOUNT INSTALL. DWG.
(1) - 12' STD.	44'	47.19°	INY	MI-1729-06

DESIGN LOAD: (1) - 12' STD @ 44'

HAL K. KAJIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

[signature]

NOTE:
IT IS THE ERECTOR'S RESPONSIBILITY TO INSURE THAT ALL PRACTICES AND PROCEDURES UTILIZED DURING ASSEMBLY AND ERECTION WORK REQUIRED ON THE TOWER DO NOT ENDANGER THE SAFETY OF ANY PERSONNEL NOR THE STRUCTURAL INTEGRITY OF THE TOWER.

SPECIAL NOTE:
ALL NUTS SHALL BE TIGHTENED TO THE SNUG TIGHT CONDITION DEFINED AS THE TIGHTNESS ATTAINED BY A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF A MAN USING AN ORDINARY SPUD WRENCH.

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

[signature]

1/24/92

DRAWINGS REQUIRED:

- 3ST-00-CD
- 3ST-00-TOP
- 3ST-0207-C2
- 3ST-03-02
- 3ST-04-E2
- MI-1729-06
- SF-1729-06
- 3ST-00-W
- PACKING LIST

DESIGN LOAD: 82.5 PSF + 0" ICE (EIA RS-222 REV. C)

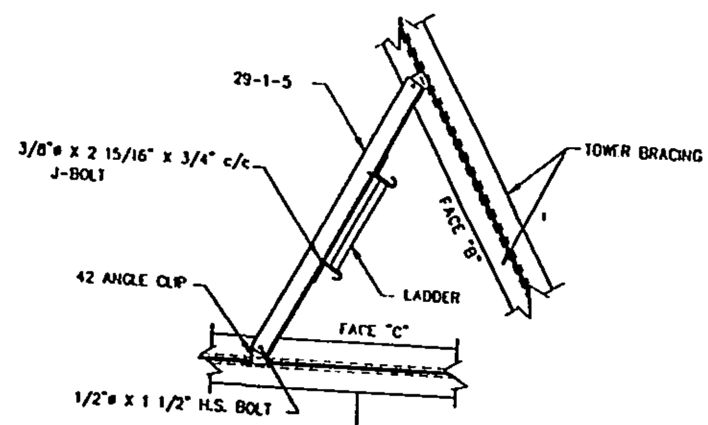
ANDREW
ANDREW CORPORATION
2701 Mayhill Road
Denton, TX U.S.A. 76201
Telephone (817) 566-24[illegible]
TWX 510-877-4507

ISSUE	REVISIONS	DWN	APPR	DATE
A	RELEASED	MPJ	[illegible]	1/1[illegible]

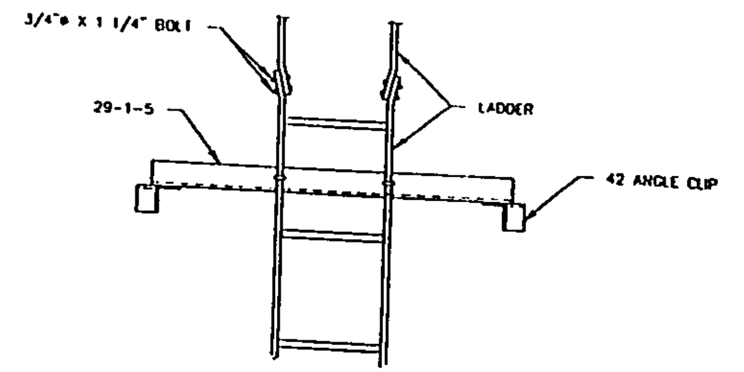
TITLE: KEY ASSEMBLY
FOR A 50 FT. 3ST TYPE TOWER
HAWAII ELECTRIC

KEAHOLE

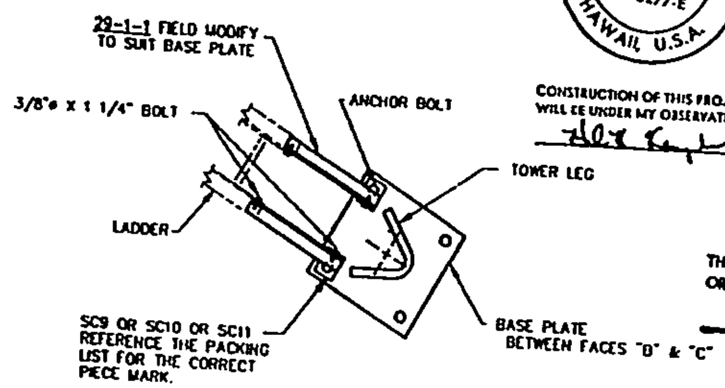
DRAWING NO. SI-1729-06



PLAN VIEW



TYPICAL LADDER
ASSEMBLY ELEVATION



BOTTOM END LADDER CONNECTION

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
1/24/92

GENERAL NOTES:

1. REFERENCE KEY ASSEMBLY FOR BOLT TORQUE REQUIREMENTS.
2. REFERENCE SECTION ASSEMBLIES FOR INSTALLATION OF 42 TO TOWER BRACING.
3. INSTALL SAFETY CLIMB FOR LADDER (IF REQ'D) PER MANUFACTURER'S INSTRUCTIONS.

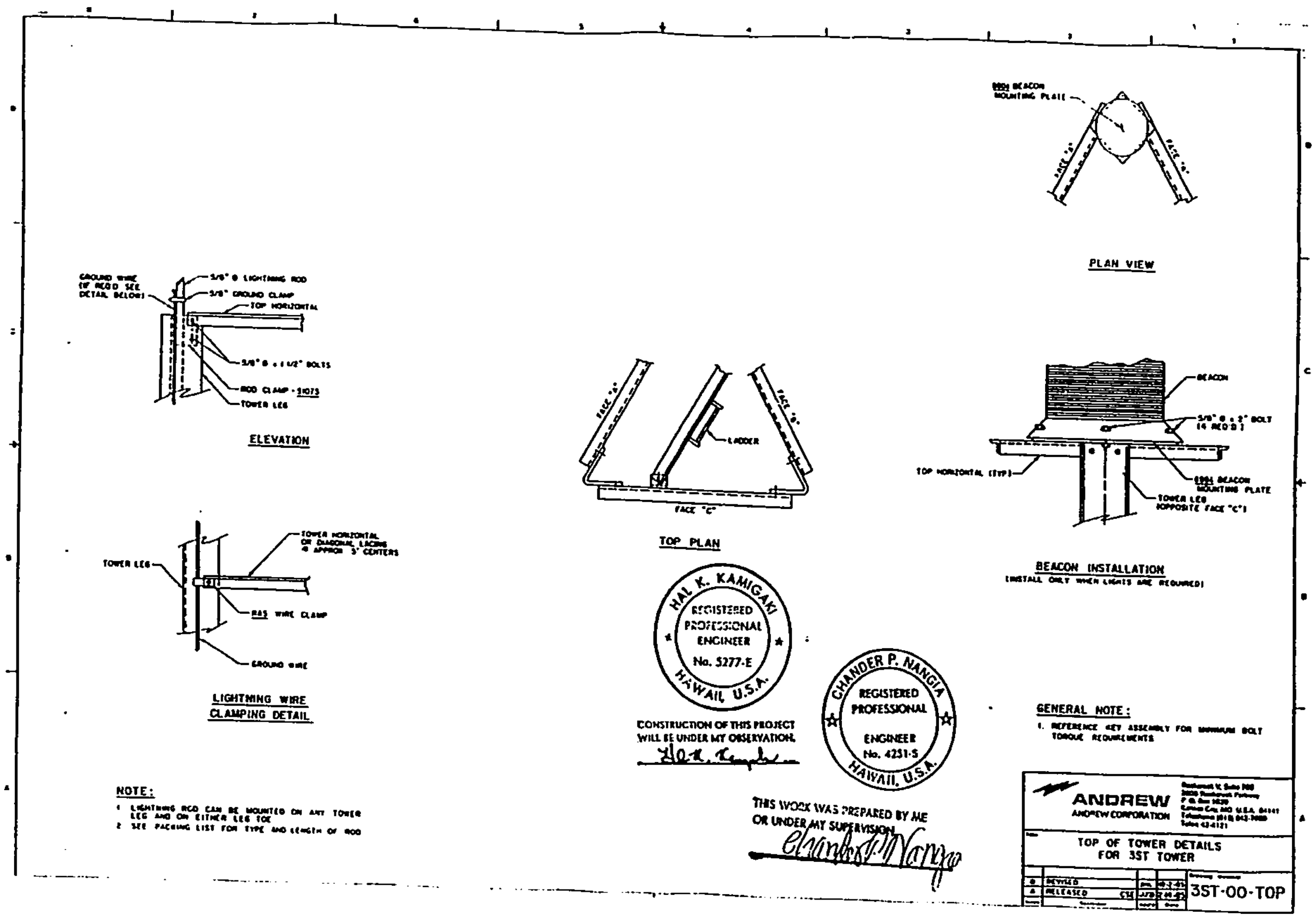
ANDREW

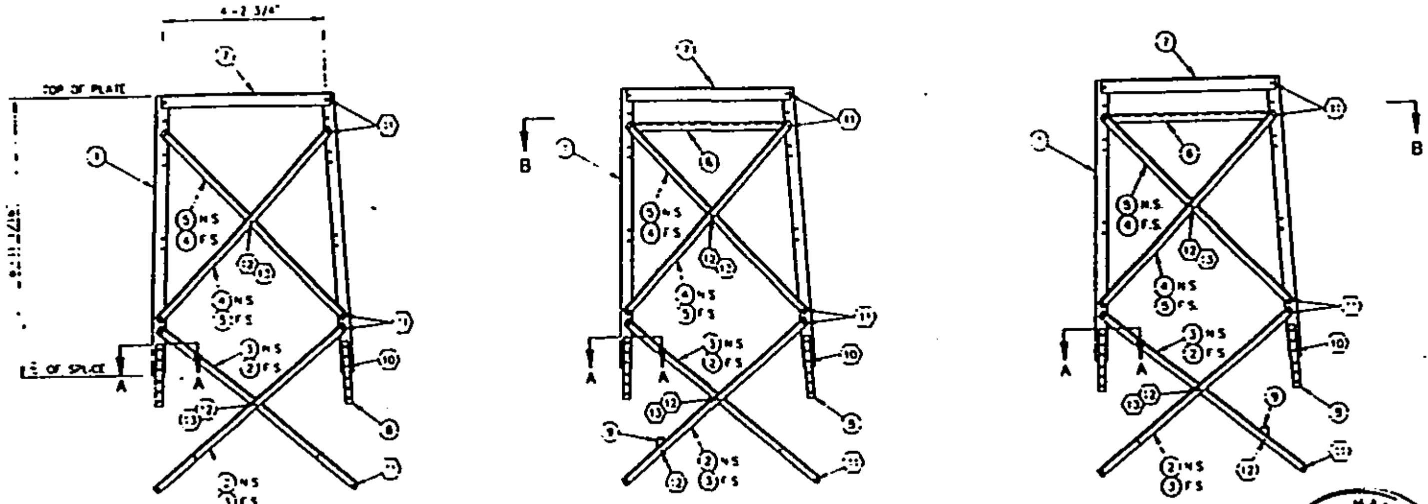
ISSUE	REVISIONS	DWN	APPR	DATE
D	REDRAWN & REVISED	CAM	GD	4/4/91
C	REVISED	DHK	DHK	8/7/87
B	REVISED	JRF	JRF	8/19/85
A	RELEASED	CSE	GD	2/18/85

TITLE: CLIMBING DEVICE INSTALLATION FOR 3ST TOWER

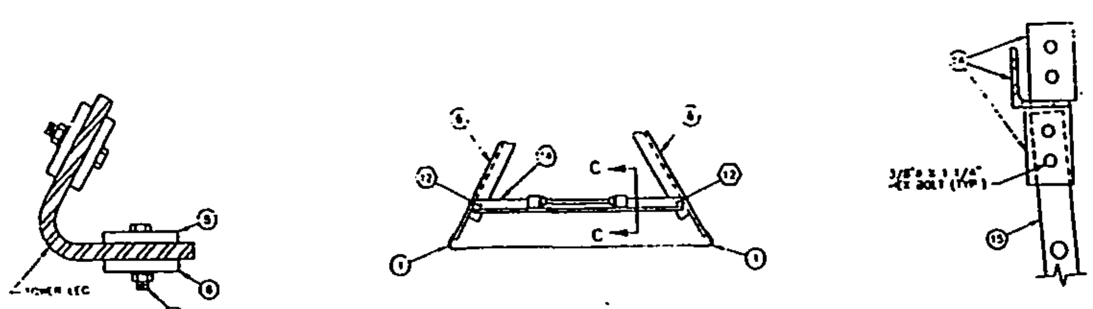
FOR: STANDARD

NO. CC03-V10


GROUND WIRE (IF REQD SEE DETAIL BELOW)
5/8" Ø LIGHTNING ROD
5/8" GROUND CLAMP
TOP HORIZONTAL
5/8" Ø x 1 1/2" BOLTS
ROD CLAMP - 31075
TOWER LEG
ELEVATION
TOWER LEG
TOWER HORIZONTAL OR DIAGONAL LACING @ APPROX 3' CENTERS
RAS WIRE CLAMP
GROUND WIRE
LIGHTNING WIRE CLAMPING DETAIL
NOTE:
1 LIGHTNING ROD CAN BE MOUNTED ON ANY TOWER LEG AND ON EITHER LEG TOE
2 SEE PACKING LIST FOR TYPE AND LENGTH OF ROD
FACE "A"
FACE "B"
FACE "C"
LADDER
TOP PLAN
HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.
CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.
CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
BEACON MOUNTING PLATE
FACE "A"
FACE "B"
PLAN VIEW
BEACON
5/8" Ø x 2" BOLT (4 REQ'D)
TOP HORIZONTAL (TYP)
BEACON MOUNTING PLATE
TOWER LEG (OPPOSITE FACE "C")
BEACON INSTALLATION
(INSTALL ONLY WHEN LIGHTS ARE REQUIRED)
GENERAL NOTE:
1. REFERENCE KEY ASSEMBLY FOR MINIMUM BOLT TORQUE REQUIREMENTS
ANDREW
ANDREW CORPORATION
TOP OF TOWER DETAILS
FOR 3ST TOWER
B REVISED
A RELEASED
3ST-00-TOP



FACE "A" | FACE "C" | FACE "B"



SECTION A-A | SECTION B-B | SECTION C-C

CHANDER P NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

HAL K. KAMIC...
PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

MATERIAL LIST

ITEM NO	PIECE MARK	QTY	DESCRIPTION	TOTAL WEIGHT
1	02-0405	3	PL 3/4 x 8 x 8 x 0'-11"	103.1
2	2-12-1	6	∠ 4 3/4 x 4 3/4 x 1/8 x 6'-5 13/32"	30.0
3	2-22-1	6	∠ 4 3/4 x 4 3/4 x 1/8 x 6'-5 13/32"	30.0
4	2-32-1	6	∠ 1 3/4 x 1 3/4 x 1/8 x 6'-0 3/8"	30.0
5	2-42-1	6	∠ 1 3/4 x 1 3/4 x 1/8 x 6'-0 3/8"	30.4
6	2-90-16	2	∠ 2 x 2 x 1/8 x 4'-5 7/8"	70.0
7	2-03-30	3	∠ 2 1/2 x 2 x 1/4 x 6'-5"	73.3
8	[illegible]	12	PL 1/2 x 2 1/2 x 5'-0 1/2"	43.0
9	42	1	∠ 4 x 3 x 1/4 x 9'-1 1/2"	13
10	340053-2	36	5/8" x 2 1/2" H.S. HEX BOLT	12.9
11	340053-3	30	5/8" x 2" H.S. HEX BOLT	33
12	340057-1	40	1/2" x 1 1/2" H.S. HEX BOLT	12
13	340017-2	6	1/4" THICK [illegible]	13
14	2-[illegible]-6	1	[illegible] ∠ 2 x 2 x 1/4 x 6'-0 1/2"	22.2
15	02-6	1	LADDER ASSEMBLY x 6'-2 3/4" LG	11.0

GENERAL NOTES:

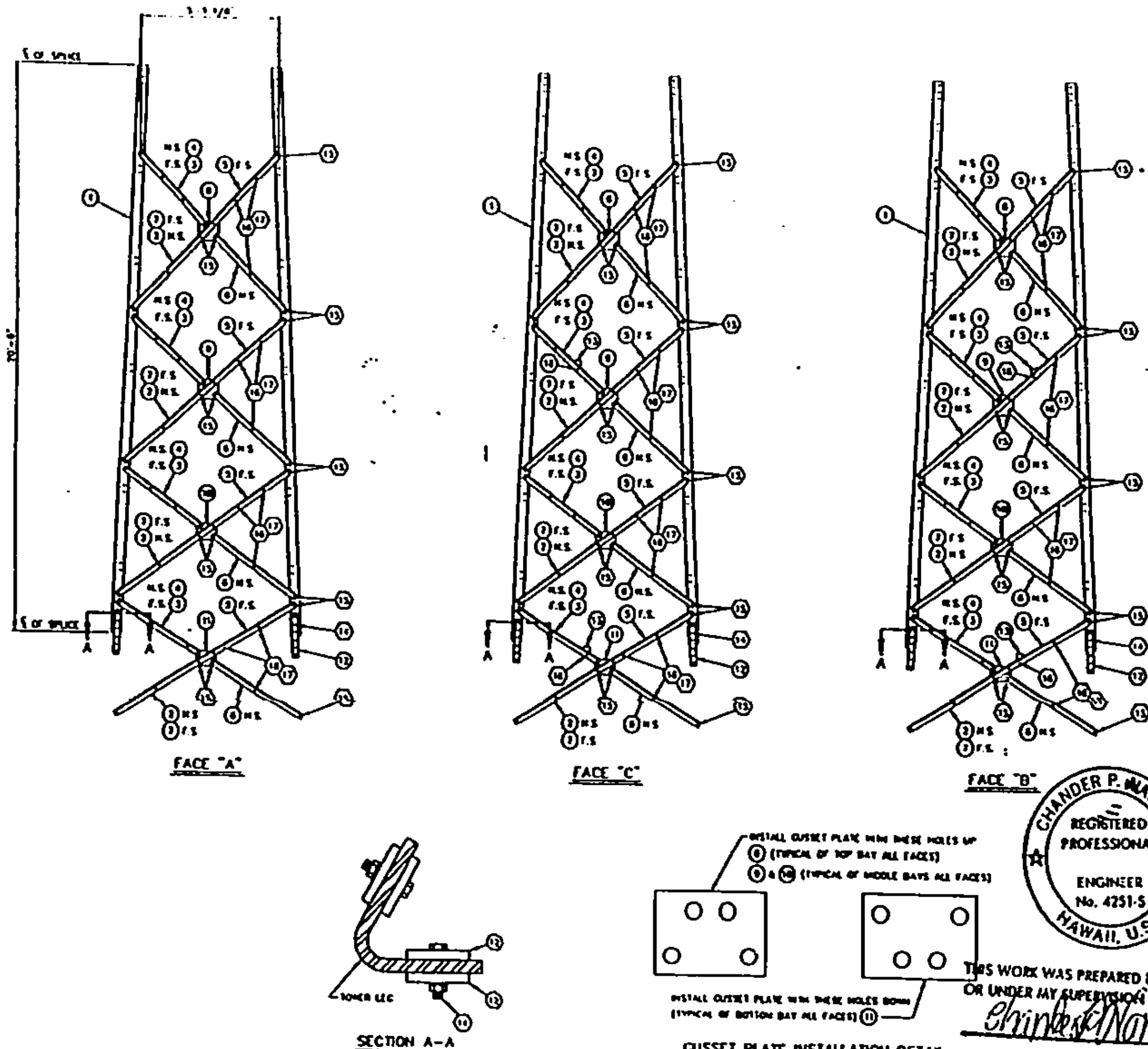
1. FOR SECTION LOCATION AND ORIENTATION SEE KEY ASSEMBLY
2. ALL LEGS TO BE INSTALLED WITH PART NO AT BOTTOM END
3. FOR LADDER INSTALLATION SEE DWG 3ST-00-C0
4. ALL UNUSED HOLES TO BE LEFT OPEN
5. INSTALL HEX NUTS AND LOCKWASHERS OR LOCKNUTS PER NOTE NO 7 LISTED ON KEY ASSEMBLY
6. (N.S.)-INDICATES NEAR SIDE OR OUTSIDE OF TOWER (F.S.)-INDICATES FAR SIDE OR INSIDE OF TOWER
7. FOR BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY
8. SECTIONS B-B & C-C APPLY ONLY WHEN LADDER IS REQUIRED PER NOTE NO 9 LISTED ON KEY ASSEMBLY

ANDREW
ANDREW CORPORATION
301 Duck Road
Grandview, Mo 64030
Telephone (816) 765-4600
Telex: 42-4121

A	RELEASED	CD	AA	[illegible]
ISSUE	REVISIONS	DWN	APPD	DATE

TITLE 3ST SECTION 02 ASSEMBLY
DOUBLE BRACED
STANDARD

SCALE VARIOUS | DRAWING NO. 3ST 0207-C2



MATERIAL LIST

ITEM NO.	PART NUMBER	QTY	DESCRIPTION	TOTAL WEIGHT
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

[signature]

GENERAL NOTES:

1. FOR SECTION LOCATION AND ORIENTATION SEE KEY ASSEMBLY.
2. ALL LEGS TO BE INSTALLED WITH PART NO. AT BOTTOM END
3. FOR LADDER INSTALLATION SEE DWG. 351-00-CB.
4. ALL MEMBER HOLES [illegible]
5. INSTALL HEX NUTS AND LOCKWASHERS OR LOCKNUTS PER NOTE NO. 7 LISTED ON KEY ASSEMBLY.
6. (N.S.)—INDICATES NEAR SIDE OR OUTSIDE OF TOWER. (F.S.)—INDICATES FAR SIDE OR INSIDE OF TOWER.
7. FOR BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY

CHANDER P. MANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

[signature]

ANDREW

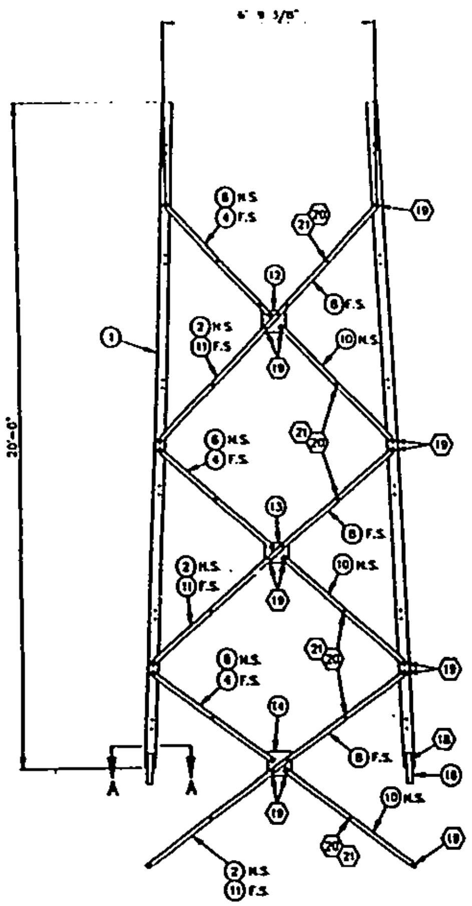
ANDREW CORPORATION
[illegible]
Telephone: [illegible]
Telex: [illegible]

A	RELEASED	[illegible]	[illegible]	[illegible]

3ST SECTION 03 ASSEMBLY
DOUBLE BRACED
STANDARD

VARIOUS

351-03-02



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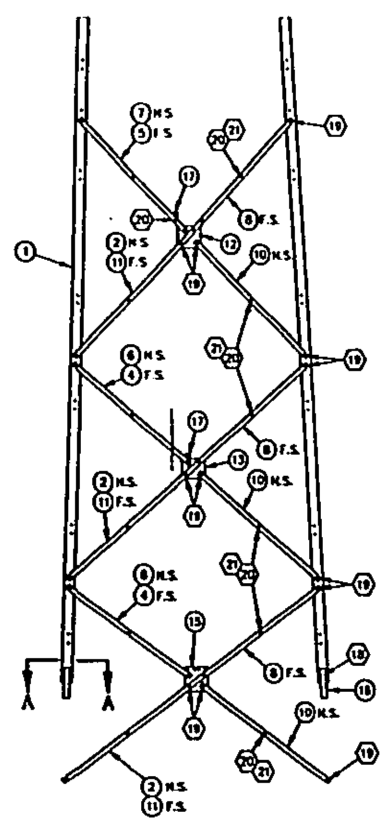

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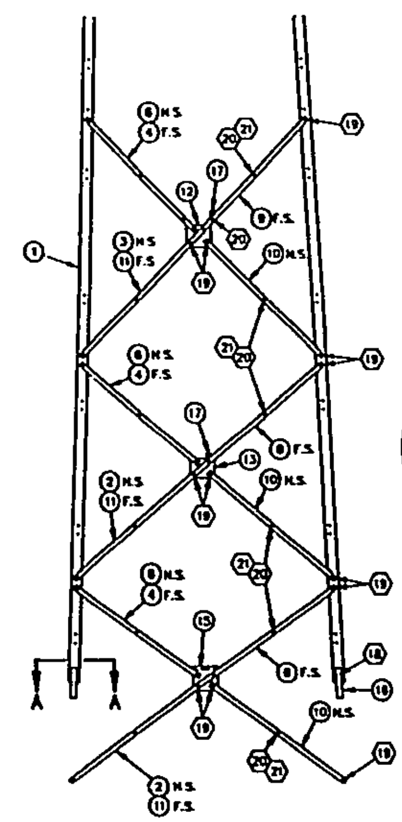

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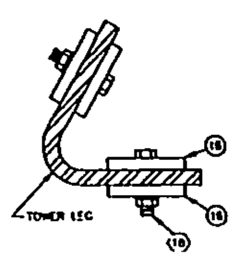
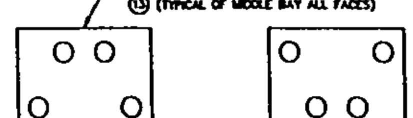


INSTALL GUSSET PLATE WITH THESE HOLES UP
(12) (TYPICAL OF TOP BAY ALL FACES)
(13) (TYPICAL OF MIDDLE BAY ALL FACES)



INSTALL GUSSET PLATE WITH THESE HOLES DOWN
(TYPICAL OF BOTTOM BAY ALL FACES) (14) & (15)

MATERIAL LIST

ITEM NO	PIECE MARK	QTY	DESCRIPTION	TOTAL WEIGHT
1	[illegible]	3	PL [illegible]	[illegible]
2	4-1-3	[illegible]	[illegible]	[illegible]
3	4-11-3	1	[illegible]	[illegible]
4	4-5-3	[illegible]	[illegible]	[illegible]
5	[illegible]	1	[illegible]	[illegible]
6	4-4-3	[illegible]	[illegible]	[illegible]
7	[illegible]	1	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	1	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	3	PL [illegible]	[illegible]
13	[illegible]	3	PL [illegible]	[illegible]
14	[illegible]	[illegible]	PL [illegible]	[illegible]
15	[illegible]	3	PL [illegible]	[illegible]
16	[illegible]	12	PL [illegible]	[illegible]
17	43	4	[illegible]	[illegible]
18	[illegible]	36	[illegible] H.S. HEX BOLT	[illegible]
19	[illegible]	72	[illegible] H.S. HEX BOLT	[illegible]
20	[illegible]	36	[illegible] H.S. HEX BOLT	4.5
21	[illegible]	36	[illegible] THICK STITCHWASHER	11.5

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277 E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT
WILL BE UNDER MY OBSERVATION.

[signature]

GENERAL NOTES:

1. FOR SECTION LOCATION AND ORIENTATION SEE KEY ASSEMBLY.
2. ALL LEGS TO BE INSTALLED WITH PART NO. AT BOTTOM END.
3. FOR LADDER INSTALLATION SEE DWG. 3ST-00-CD.
4. ALL UNUSED HOLES TO BE LEFT OPEN.
5. INSTALL HEX NUTS AND LOCKWASHERS OR LOCKNUTS PER NOTE NO. 7 LISTED ON KEY ASSEMBLY.
6. (N.S.)-INDICATES NEAR SIDE OR OUTSIDE OF TOWER. (F.S.)-INDICATES FAR SIDE OR INSIDE OF TOWER.
7. FOR BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY.

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION

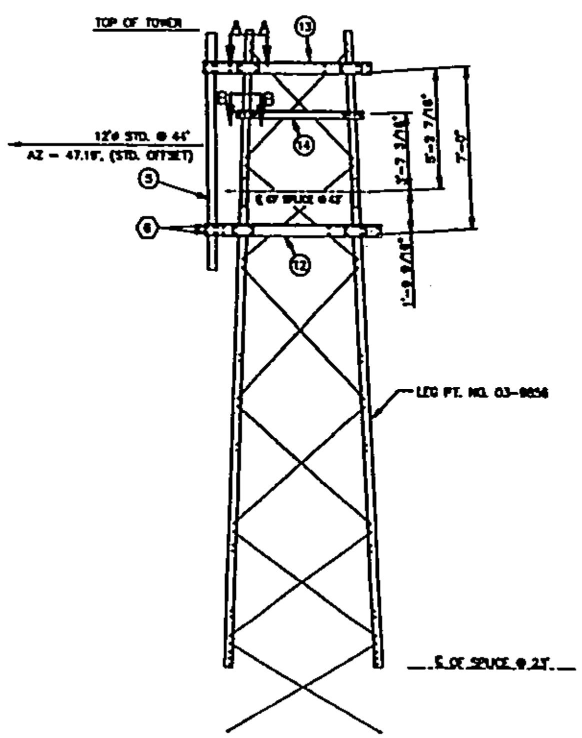
[signature]

ANDREW

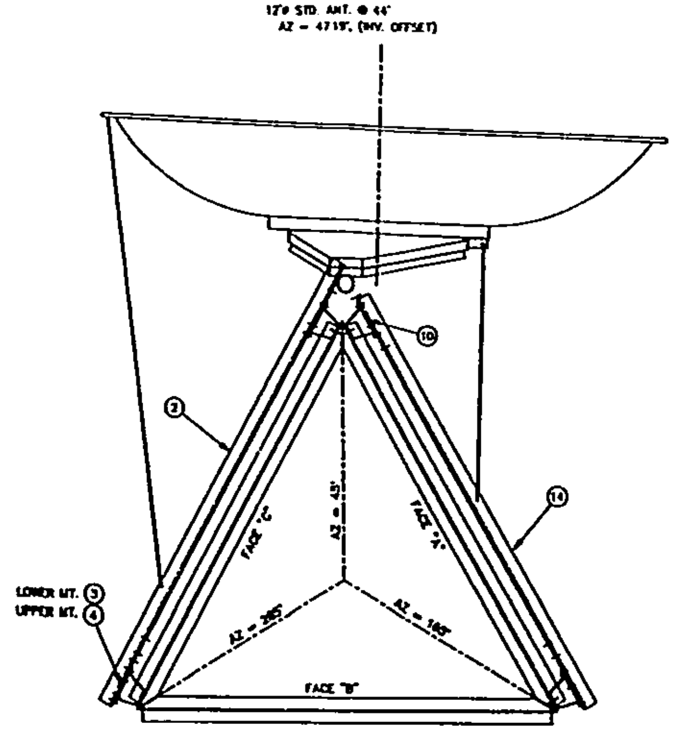
ANDREW CORPORATION
2701 Mayhill Road
Denton, TX U.S.A. 76201
Telephone (817) 566-2400
TWX 810-877-4307

A	REDRAWN	MPJ	[illegible]	11/13
ISSUE	REVISIONS	DWN	APPR	DATE

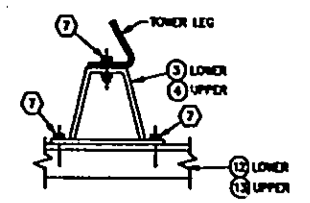
TITLE 3ST SECTION 04 ASSEMBLY
DOUBLE BRACED
STANDARD



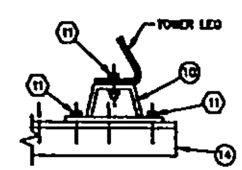
ELEVATION VIEW



PLAN VIEW



SECTION A–A



SECTION B–B

MATERIAL LIST

ITEM NO.	PIECE MARK	QTY.	DESCRIPTION	TOTAL WEIGHT
		1	KIT # 340199-01 CONTAINS THE FOLLOWING ITEMS FOR (1) ANT. MT.	
12	[illegible]	1	ANG. 6 X 3 1/2 X 5/16 X 7'-0 15/16"	[illegible]
13	[illegible]	1	ANG. 6 X 3 1/2 X 5/16 X 6'-10 3/4"	[illegible]
3	[illegible]	2	STANDOFF ASSEMBLY (LOWER)	[illegible]
4	[illegible]	2	STANDOFF ASSEMBLY (UPPER)	[illegible]
5	[illegible]	1	4 1/2" O.D. PIPE X 10'-0"	[illegible]
6	340057-5	4	5/8"Ø X 8 1/4" C/C U-BOLT	[illegible]
7	340023-3	24	5/8"Ø X 2" H.A. BOLT	[illegible]
8	340071-3	4	5/8"Ø FLATWASHER	[illegible]
		2	KIT # 340199-01 CONTAINS THE FOLLOWING ITEMS FOR (2) STIFFARM MTS.	
14	30-713-3	2	ANG. 4 X 4 X 1/4 X 6'-0 5/16"	[illegible]
10	2265	4	STANDOFF ASSEMBLY	[illegible]
11	340022-3	12	5/8"Ø X 2" HEX BOLT	[illegible]

NOTES:
1. ALL HOLES ARE EXISTING, NO FIELD PUNCHING IS REQUIRED.
2. FOR MINIMUM BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY.
3. WORK THIS DRAWING WITH SECTION ASSEMBLY NO. 35T-03-02 AND 35T-0207-C2.
4. ALL BOLTS 5/8"Ø X 2" UNLESS NOTED OTHERWISE.
5. USE 5/8"Ø FLATWASHERS ON ALL SLOTTED HOLES.

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

[signature]

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

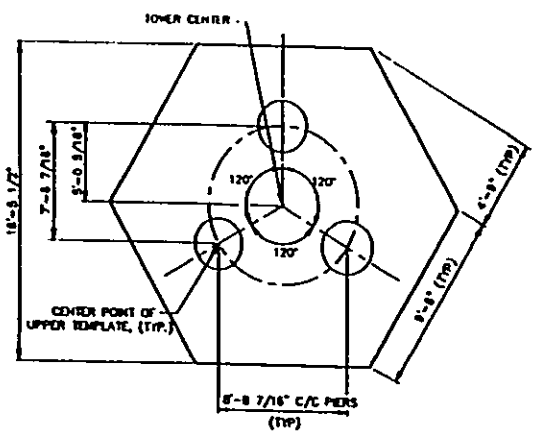
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

[signature]

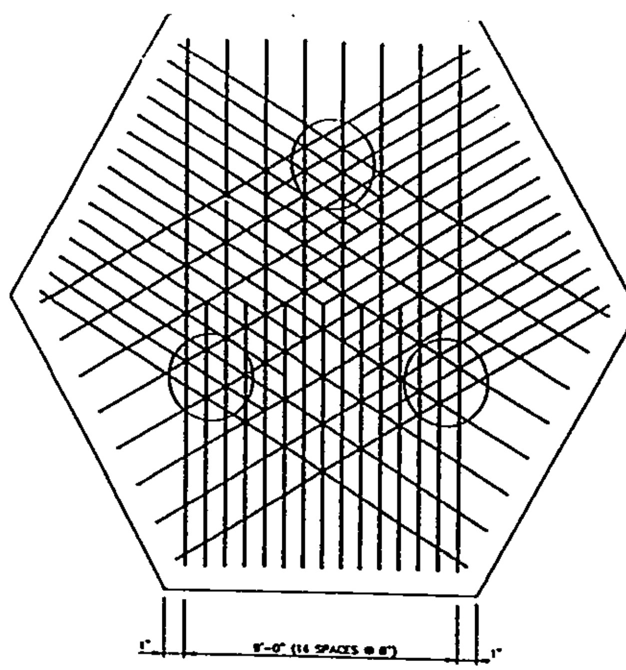
ANDREW
ANDREW CORPORATION
2701 Mayhill Road
Denton, TX U.S.A. 76201
Telephone (817) 566-24[illegible]
TWX 910-877-4807

ISSUE	REVISIONS	DRN	APPR	DATE
A	RELEASED	MPV	[illegible]	[illegible]

TITLE: 3ST ANTENNA MOUNT INSTALLATION AT 44 FT. ELEVATION
FOR: HAWAII ELECTRIC
SITE: KEAHOLE
DRAWING NUMBER: MI-1729-06

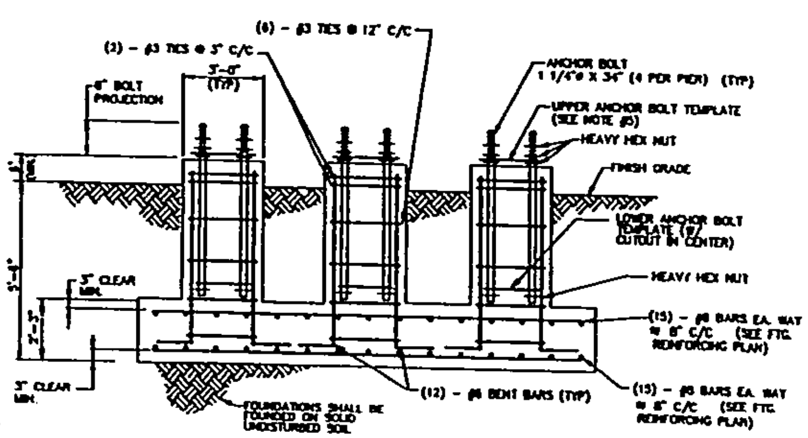


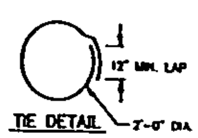
FOUNDATION PLAN



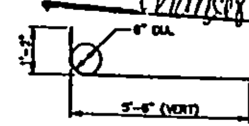
FOOTING REINFORCING PLAN

TOP AND BOTTOM OF FOOTING

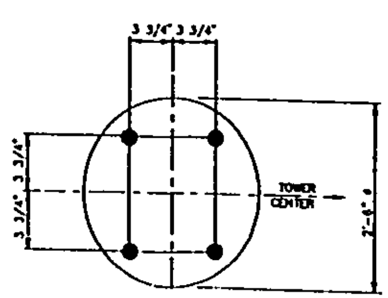




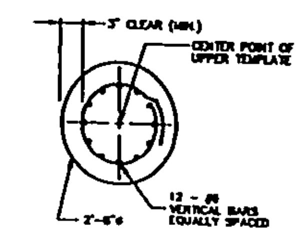
TIE DETAIL



VERTICAL BAR DETAIL



ANCHOR BOLT LAYOUT



PIER REINFORCING DETAIL

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

GENERAL NOTES:

1. 21.8 CUBIC YARDS OF CONCRETE REQUIRED PER PIER. ALL LOOSE MAT'L SHALL BE REMOVED FROM EACH EXCAVATION BEFORE CONCRETE IS POURED. ALL STANDING WATER IN THE FROM EXCAVATION SHALL BE REMOVED PRIOR TO PLACEMENT OF CONCRETE.
2. MAXIMUM FREE DROP OF CONCRETE SHALL BE 6 FT., PROVIDED IT IS DIRECTED THRU A HOPPER OR EQUIVALENT. CONCRETE SHALL NOT HIT SIDES OF SOIL OR REINFORCING.
3. CONCRETE SHALL HAVE A MINIMUM COMPRESSION STRENGTH OF 3,000 PSI AT 28 DAYS AND SHALL BE INSTALLED IN ACCORDANCE WITH THE ACI-318-83 BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.
4. VERTICAL REINFORCING BARS SHALL BE OF GRADE 60, TIES OF GRADE 40 STEEL, WITH ASTM-A305 DEFORMATIONS AND DETAILED IN ACCORDANCE WITH ACI-315-80 (MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES).
5. ANCHOR BOLTS SHALL HAVE UNDISTURBED THREADS AND BE POSITIONED SO THAT INSPECTOR CAN MOVE THE ANCHOR BOLT TEMPLATE FROM TOP OF PIER TO TOP OF ANCHOR BOLTS. COAT THREADS WITH HEAVY GREASE.
6. BOTTOM ANCHOR BOLT TEMPLATE SHALL BE LEFT IN PLACE AS SHOWN.
7. TEST CYLINDERS SHALL BE MOLDED AND LABORATORY CURED IN ACCORDANCE WITH ASTM C31. THESE CYLINDERS SHALL BE TAKEN FOR EACH TRUCK. CYLINDERS SHALL BE TESTED IN ACCORDANCE WITH ASTM C39.
8. ALL REINFORCING STEEL MUST HAVE A 3 INCH COVER OF CONCRETE.
9. A 2'-6" SQ. PIER MAY BE USED INSTEAD OF THE 2'-6" DIA. PIER INDICATED (PER OPTION OF CONTRACTOR)
10. TOP OF ALL FOOTING PEDESTALS MUST BE AT THE SAME ELEVATION WITH RESPECT TO EACH OTHER. IN THE INSTANCE THAT GROUND LEVEL VARIES, THE MINIMUM DISTANCE FROM FINISHED GRADE TO TOP OF PEDESTAL SHALL BE 6".
11. FOUNDATION DESIGN IS BASED ON EIA "STANDARD SOIL".
12. EXCAVATIONS SHALL BE BACKFILLED AND THOROUGHLY COMPACTED IN 6" MAXIMUM LIFTS. FILL MAT'L SHOULD BE NEARLY-FREE OF ORGANIC DEBRIS, ESSENTIALLY NON-PLASTIC, AND LESS THAN 3" IN MAXIMUM DIMENSION. IN GENERAL, WELL-GRADED MIXTURES OF GRAVEL, SAND, NON-PLASTIC SILT, AND/OR SMALL QTYS. OF CLAY ARE ACCEPTABLE FOR USE AS FILL.

ACTUAL REACTIONS:

DOWN	70.7 k
UP	67.3 k
SHEAR	7.7 k

DESIGN REACTIONS:

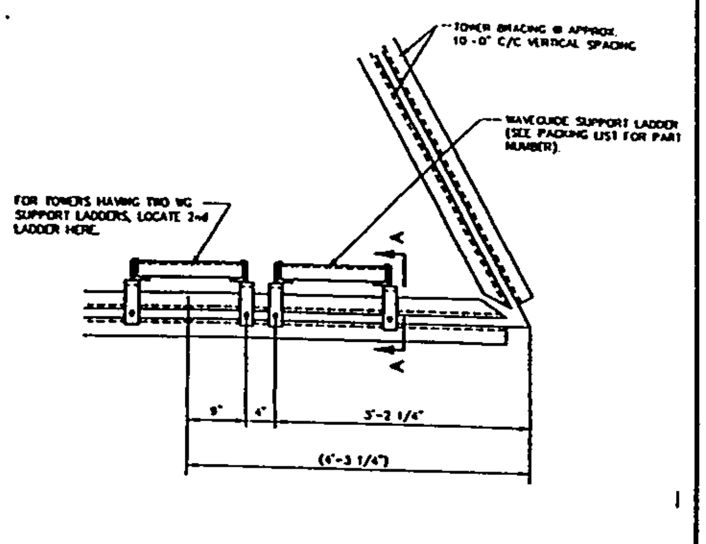
DOWN	101.25 k
UP	91.125 k
TOTAL TOWER SHEAR	20.25 k
MOMENT	714,9[illegible] FT.-

ANDREW

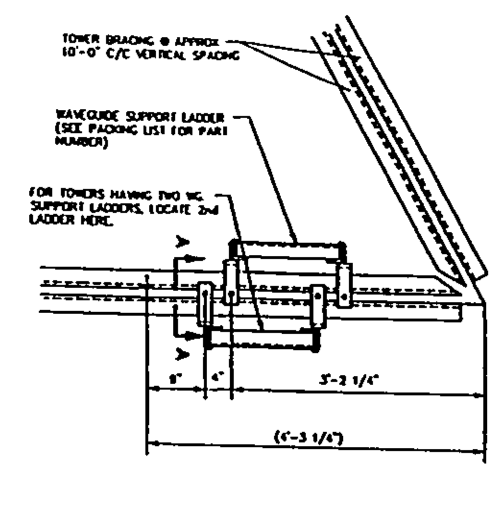
ANDREW CORPORATION
2701 [illegible] Road
Denton, TX U.S.A. 76201
Telephone (817) 566-240[illegible]
TWX 910-877-4507

A	RELEASED	MPJ	[illegible]	[illegible]
	REVISIONS	DRN	APPD	DATE

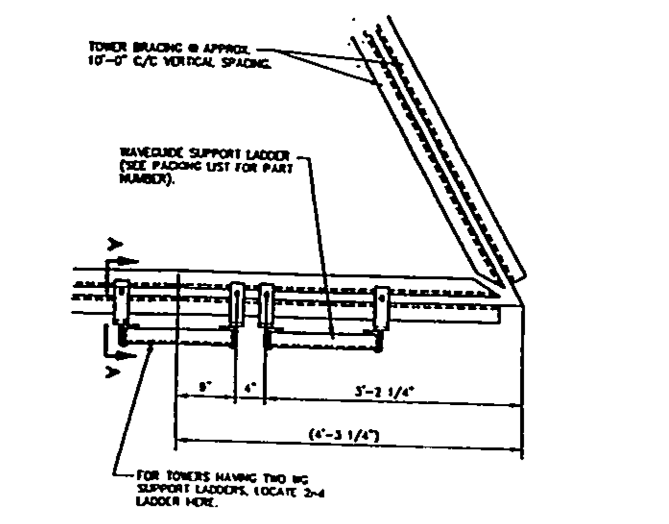
MAT FOUNDATION
FOR A 50' 3ST TOWER
HAWAII ELECTRIC



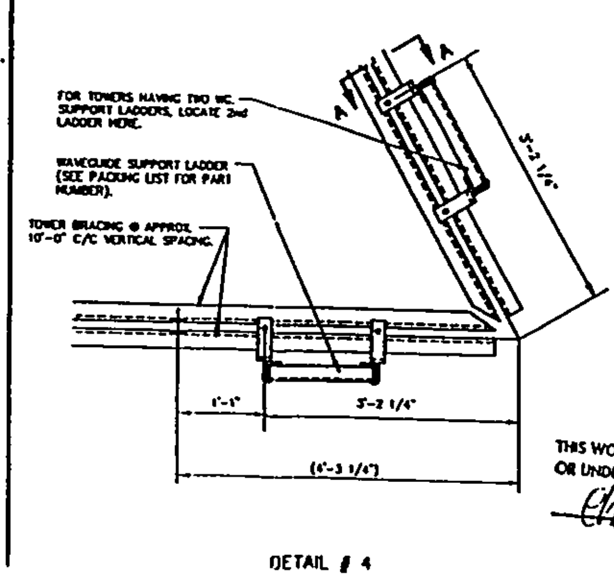
DETAIL # 1



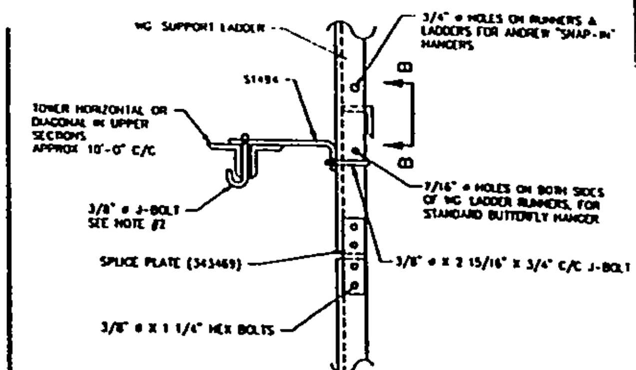
DETAIL # 2



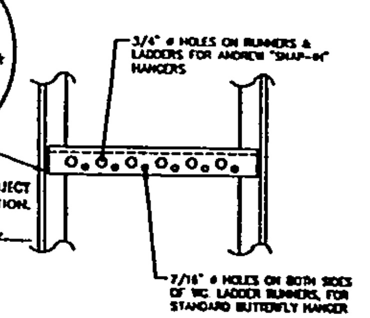
DETAIL # 3



DETAIL # 4



SECTION A-A



SECTION B-B

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

HAL K. KANIGAKI — REGISTERED PROFESSIONAL ENGINEER No. 5277-E — HAWAII, U.S.A.

NOTES:

1. SEE KEY ASSEMBLY FOR PROPER MOUNTING FACE.
2. 3/8" ⌀ X 2 15/16" X 3/4" C/C J-BOLT FOR HORIZ. (DIAG.) ANGLE LEGS 2" OR LESS.
   3/8" ⌀ X 4" X 3/4" C/C J-BOLT FOR HORIZ. (DIAG.) ANGLE LEGS 2 1/2" AND 3".
   3/8" ⌀ X 6" X 3/4" C/C J-BOLT FOR ANGLE LEGS 3 1/2" AND 4".
3. USE TYPE "RB" CLAMP & 3/8" ⌀ X 1 1/4" HEX BOLTS FOR 1/2" CONDUIT. USE TYPE "RC" CLAMP & 3/8" ⌀ X 1 1/4" HEX BOLTS FOR 3/4" ⌀ AND 1" ⌀ CONDUIT. ATTACH CONDUIT TO WAVEGUIDE LADDER AT APPROX. 10' CENTERS AND USE HOLE NEAREST BEACON ABOVE. WRAPLOCK S.S. TAPE MAY ALSO BE USED TO ATTACH WAVEGUIDE OR CONDUIT TO WAVEGUIDE LADDER INSTEAD OF CLAMPS IF APPROVED BY CUSTOMER.

CHANG ... ANGIA — REGISTERED PROFESSIONAL ENGINEER — HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

ANDREW

ANDREW CORPORATION
2701 Mayhill Road
Denton, Tx. U.S.A. 76201
Telephone: (817) 566-240
TWX: 910-877-4507

ISSUE	REVISIONS	DRN	APPD	DATE
G	DET. #2 3'-2 1/4" WAS 3'-6 1/4"	MF	SJ	2/13/
F	REV. PICTORIAL SECT. A-A	MF	CD	5/3/
E	REV. SPLICE PLT. LOC. SEC. A-A	MF	CD	1/3/
D	REVISED DETAIL NO. 2 AND NOTES	JRC	DHK	4/29/
C	REVISED SECT A-A	DJS	LAF	9/17/
B	REVISED DETAIL NO. 2	JRC	JRF	9/19/
A	RELEASED	CSE	DJD	2/20/

TITLE: 3ST WAVEGUIDE SUPPORT INSTALLATION

STD.

DWG. 01004-310

I. DESCRIPTION OF PARCEL

A. Existing structures/Use.

The Keahole generating station supplies power to the Kona region on the Big Island during peak load periods or system outages. The electrical power plant and transmission switching station site is owned by Hawaii Electric Light Company, Inc. (HELCO). The land, 14.998 acres, is situated at Keahole, North Kona, Hawaii, identified by Tax Map Key 7-3-49-36. Please refer to Exhibit 1, Location Map - TMK 7-3-49:36 and Exhibit 2, Keahole Agricultural Park. The facility currently occupies 3.1 acres.

The parcel is used for generation of electricity and a transmission switching station. Exhibit 3, Keahole Site Plan, shows the layout for the facility and keys the photos of the site which are shown on Exhibit 4. The 3.1 acre facility is completely enclosed by a chain link fence with one drive gate. The existing facilities consist of the following:

Generating Plant Area

- control house
- two switchgears
- six 2.75 MW diesel engine generators
- two fuel oil storage tanks
- control room for combustion turbine
- black start emergency diesel generator
- 14 MW combustion turbine (CT) with stack
- three water storage tanks for CT
- demineralizer for CT
- acid & caustic tanks for CT

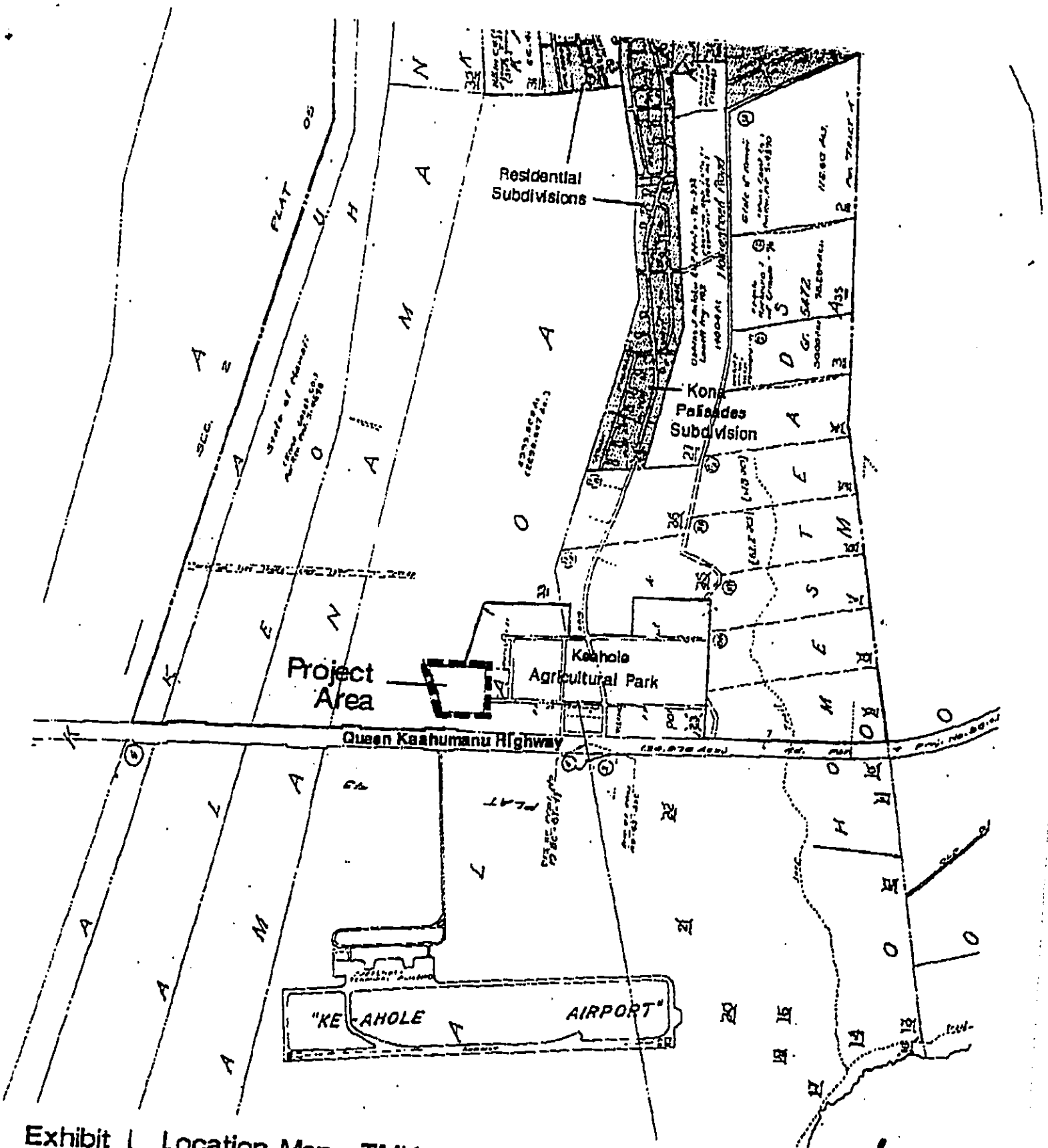


Exhibit 1 Location Map –TMK 7–3–49:36

Scale: 1 inch = 2000 feet

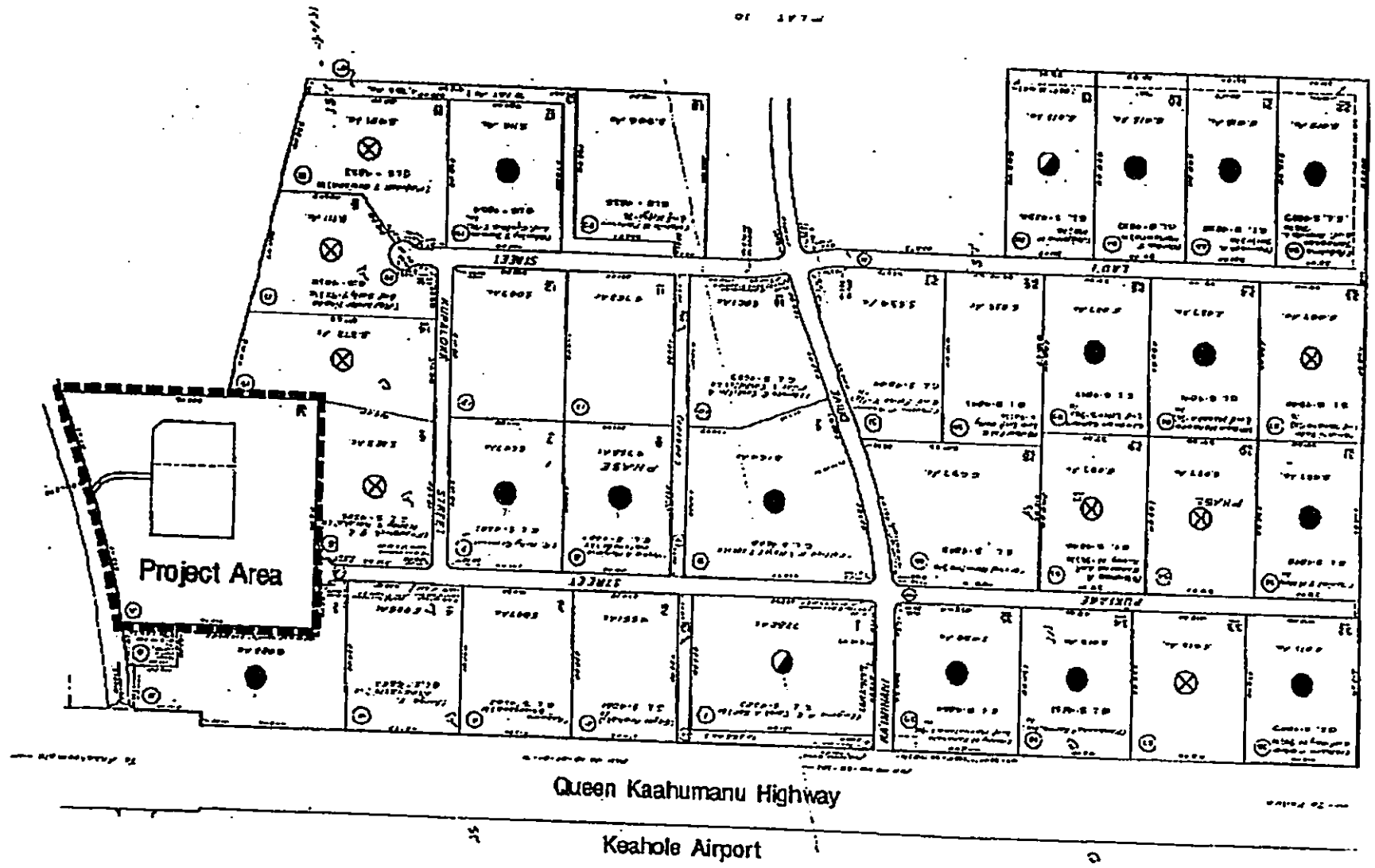


Exhibit 2 Keahole Agricultural Park
(TMK 7-3-49)

- Existing residence
- Residence proposed
- Vacant

All other lots are being used for agricultural activities, or have been cleared and graded for agricultural use.

Source: DLNR – Hilo office

Scale: 1 inch = 500 feet

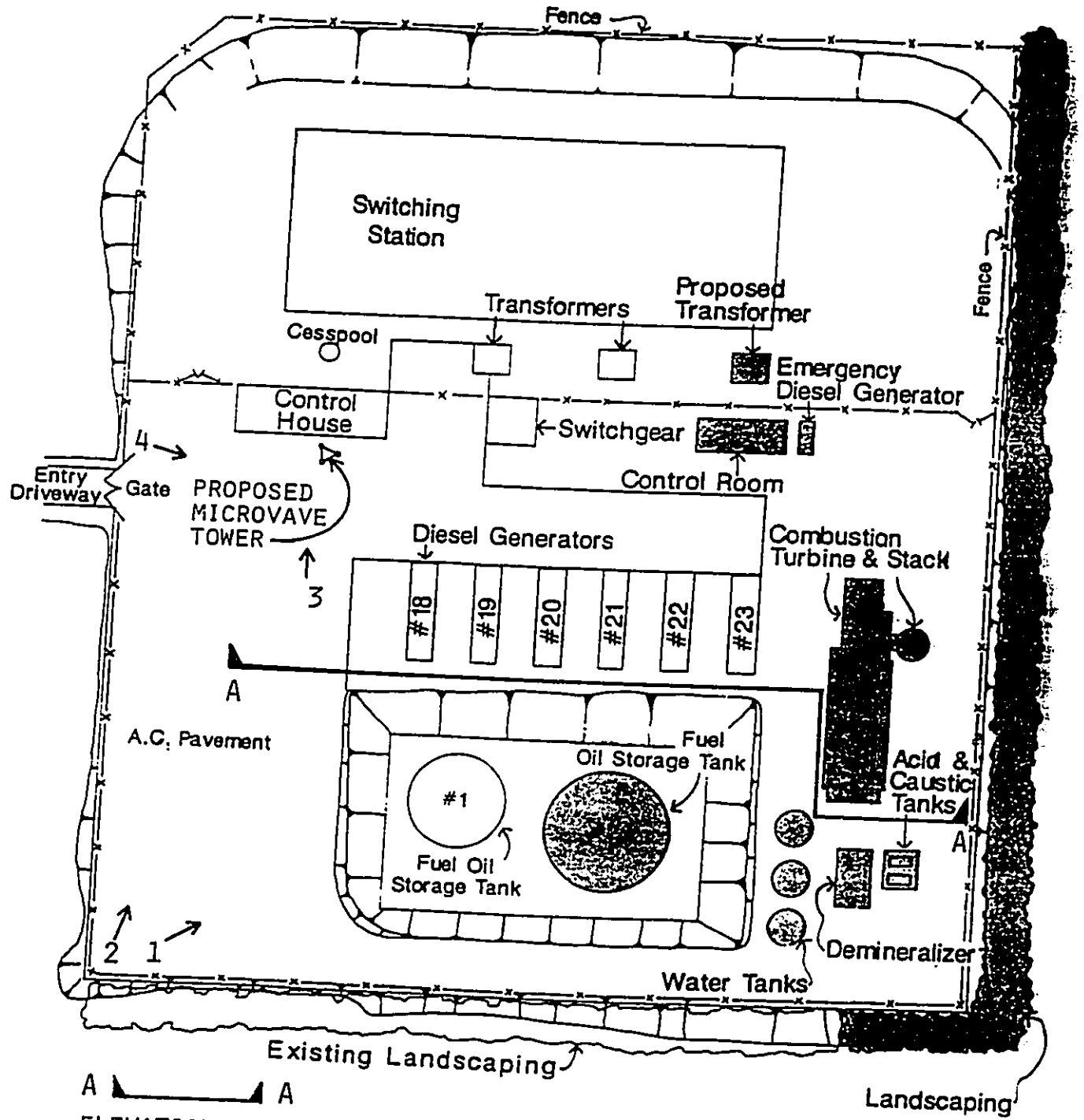
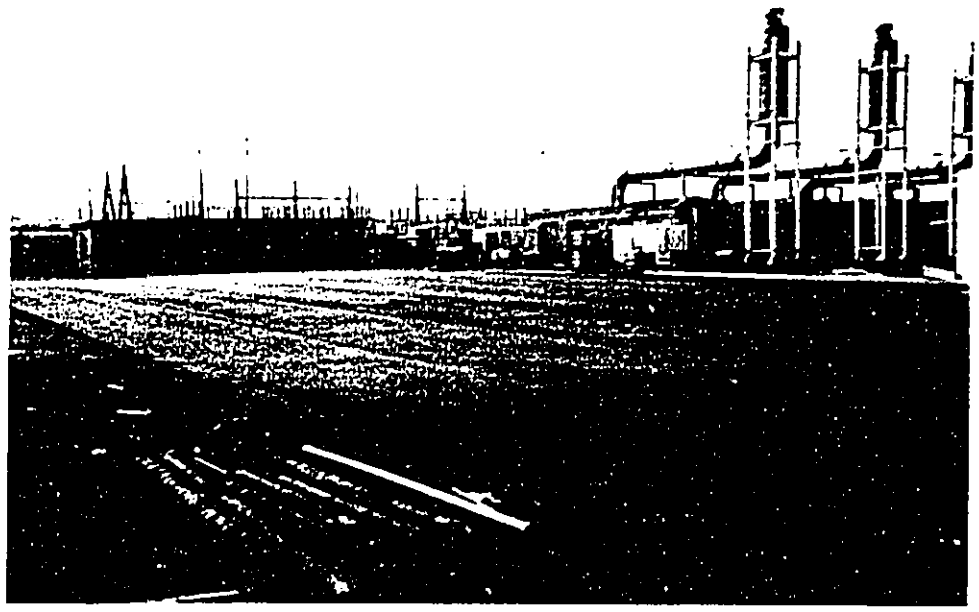


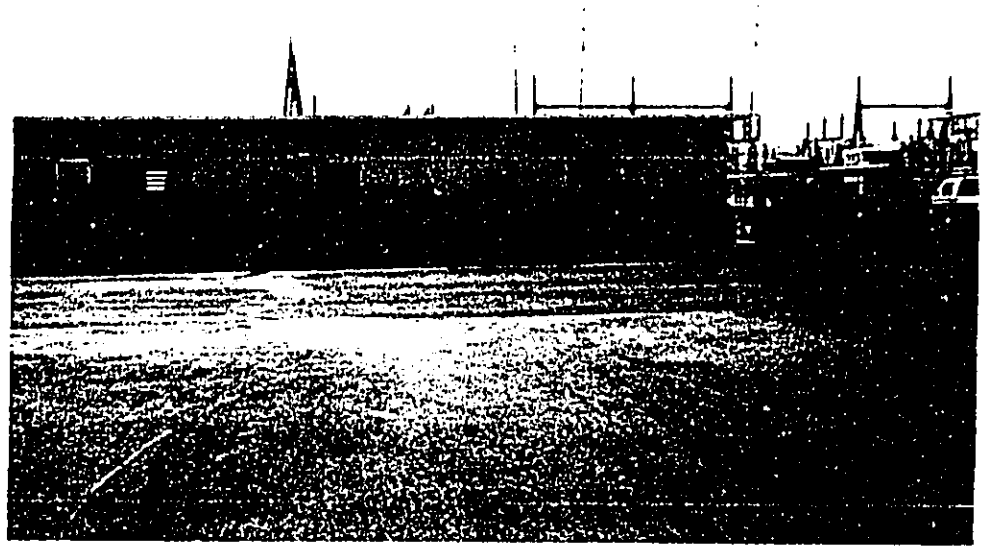
Exhibit 3: KEAHOLE SITE PLAN

1. Existing Fuel Oil tanks with Combustion Turbine and four Diesel Generators stacks.



2. AC pavement areawith Control House, three Diesel Generators shown and 69 KV Switching Station in background

EXHIBIT 4A: Photos of Existing Generating Site



3. Frontal view of Control House. Tower to be placed between the middle and right side door.

4. Side view of Control House looking towards the Combustion Turbine and six Diesel Generators

EXHIBIT 4B: Photos of Existing Generating Site

Switching Station Area
- o switchyard
- o three transformers
- o cesspool

The facility has paved and unpaved areas. The unpaved areas consist of a compacted gravel surface. The site is relatively flat, with exception of a depressed berm area for the fuel oil storage tanks.

The unused portion of the 14.998 acre parcel is also predominately flat, and has been retained in its natural state, consisting of lava flows and clumps of vegetation of primarily grasses and low brush. There are some trees and shrubs along the fence on the Queen Kaahumanu Highway (west) side of the power plant, which partially screen the view of the Keahole facility from the highway.

B. Existing utilities.

Electrical, telephone and water services are available. The existing water service plan is shown on Exhibit 5.

No change in drainage is made to the existing site since it is currently paved and the area under the tower will be repaved.

C. Existing access.

The Keahole generating plant and switching station is located mauka of Keahole Airport, in North Kona on the Big Island. It is about 750 feet mauka of the Queen Kaahumanu Highway, and adjacent to the mauka boundary of

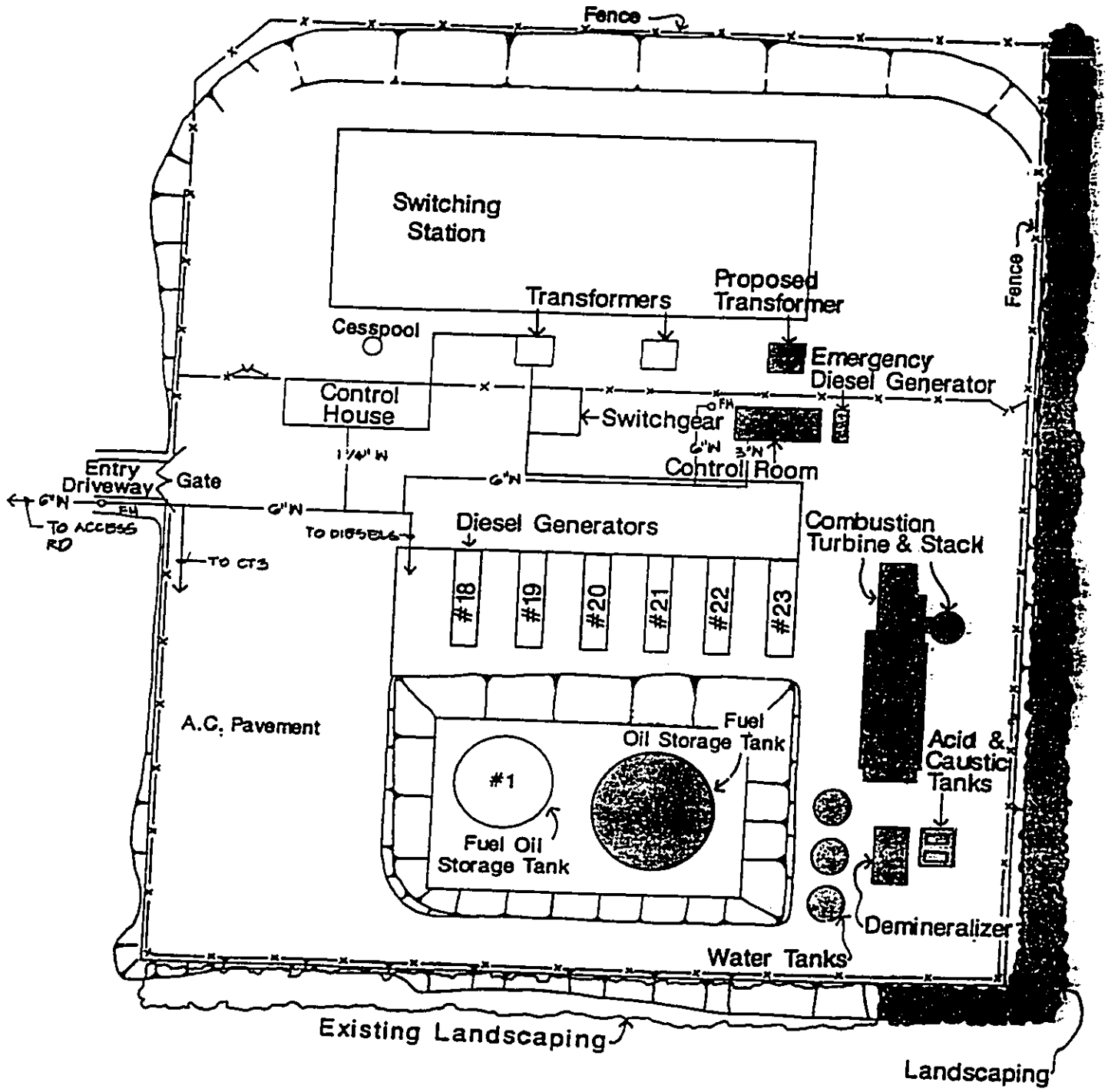


Exhibit 5: EXISTING WATER SERVICE AT KEAHOLE POWER PLANT

Scale: 1 inch = 60 feet

the Keahole substation. (See Exhibit 6). Access to the site from the Queen Kaahumanu Highway is via an existing 16 foot wide paved roadway within a "non-exclusive easement for access and utility" on state lands on the north side of the site.

D. Vegetation

The unused portion of the 14.998 acre parcel is also predominately flat, and has been retained in its natural state, consisting of lava flows and clumps of vegetation of primarily grasses and low brush. There are some trees and shrubs along the bottom half of the fencing on the Queen Kaahumanu Highway (West) side of the power plant, which partially screen the view of the Keahole facility from the highway.

E. Topography.

The facility has paved and unpaved areas. The unpaved areas consist of a compacted gravel surface. The site is somewhat flat, with exception of ditches around the fuel oil storage area and along the mountain side of the switching station. The tower is to be placed in a level area that is paved.

F. Shoreline area.

There is no shoreline area.

G. Existing covenants, easements, restrictions.

The Keahole generation station property is subject to

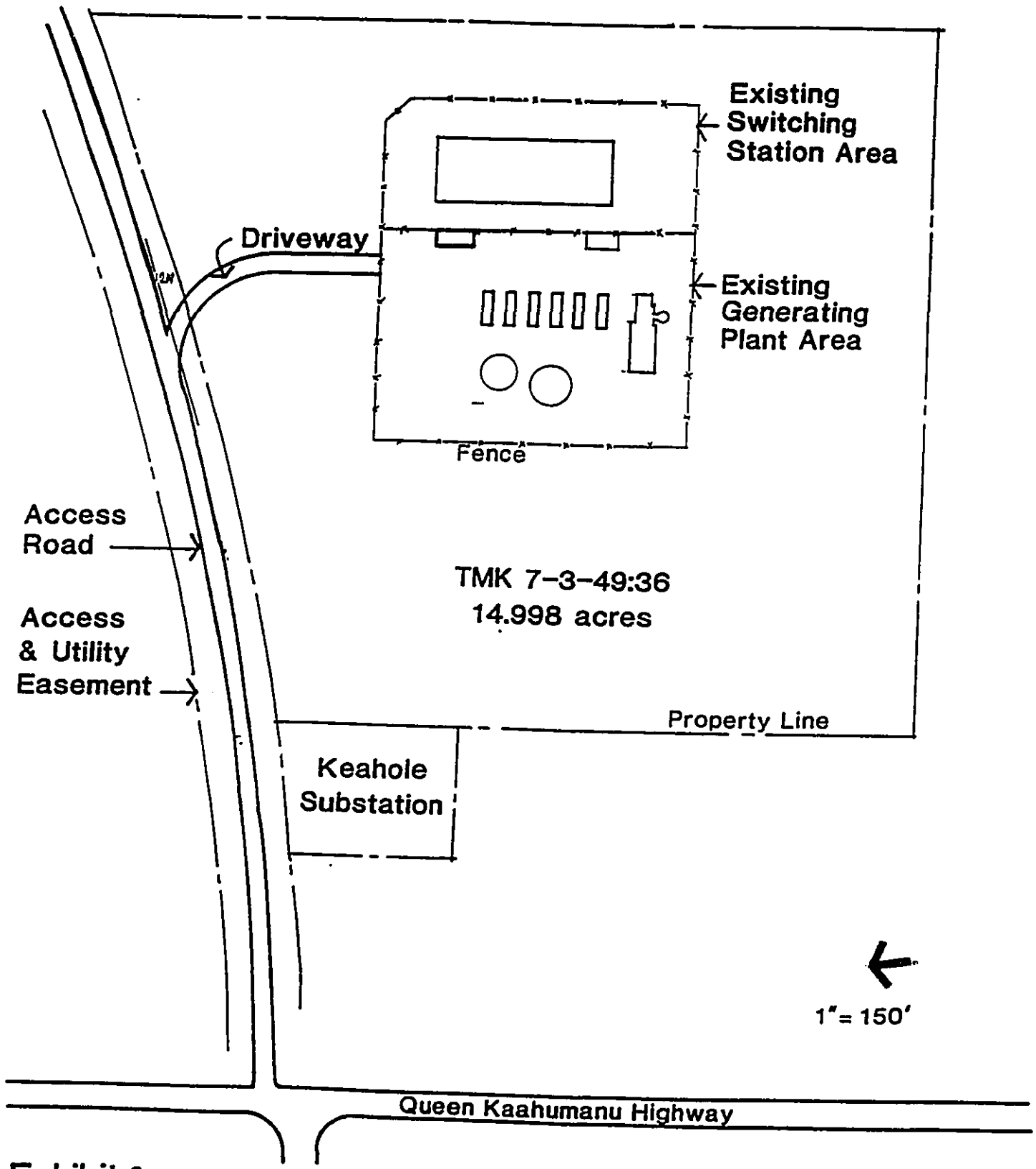


Exhibit 6 :

Keahole Generating Plant & Switching Station Site

the provisions of Land Patent No. S-15,591, granted December 14, 1973, and as amended. There is no provision that would negate the proposed action.

H. Historic sites affected.

The State Historic Sites Office of DLNR reviewed the project area for the 1987 CDUA amendment (File No. HA-9/11/86-487A). They had no objections to that proposal because it was located with previously disturbed facilities area. There are no historical and archaeological impacts from the proposed action. The site has been previously graded under previous projects and is paved.

II. DESCRIPTION

A. Facility system master plan

The HELCO microwave system started out with five links of 120 channel Collins MS-218A radios in 1973 and is shown as Exhibit 7. The initial driving force for the communication system at HELCO was for Supervisory Control and Data Acquisition, SCADA and voice communication. Substation or Switching Station locations which only required individual channel requirements, use 450 MHZ radios and/or telephone lease lines. These links provide system information to the dispatch center at Hilo. They also provide island wide communications for the three Base Yards located at Hilo, Waimea and Kailua.

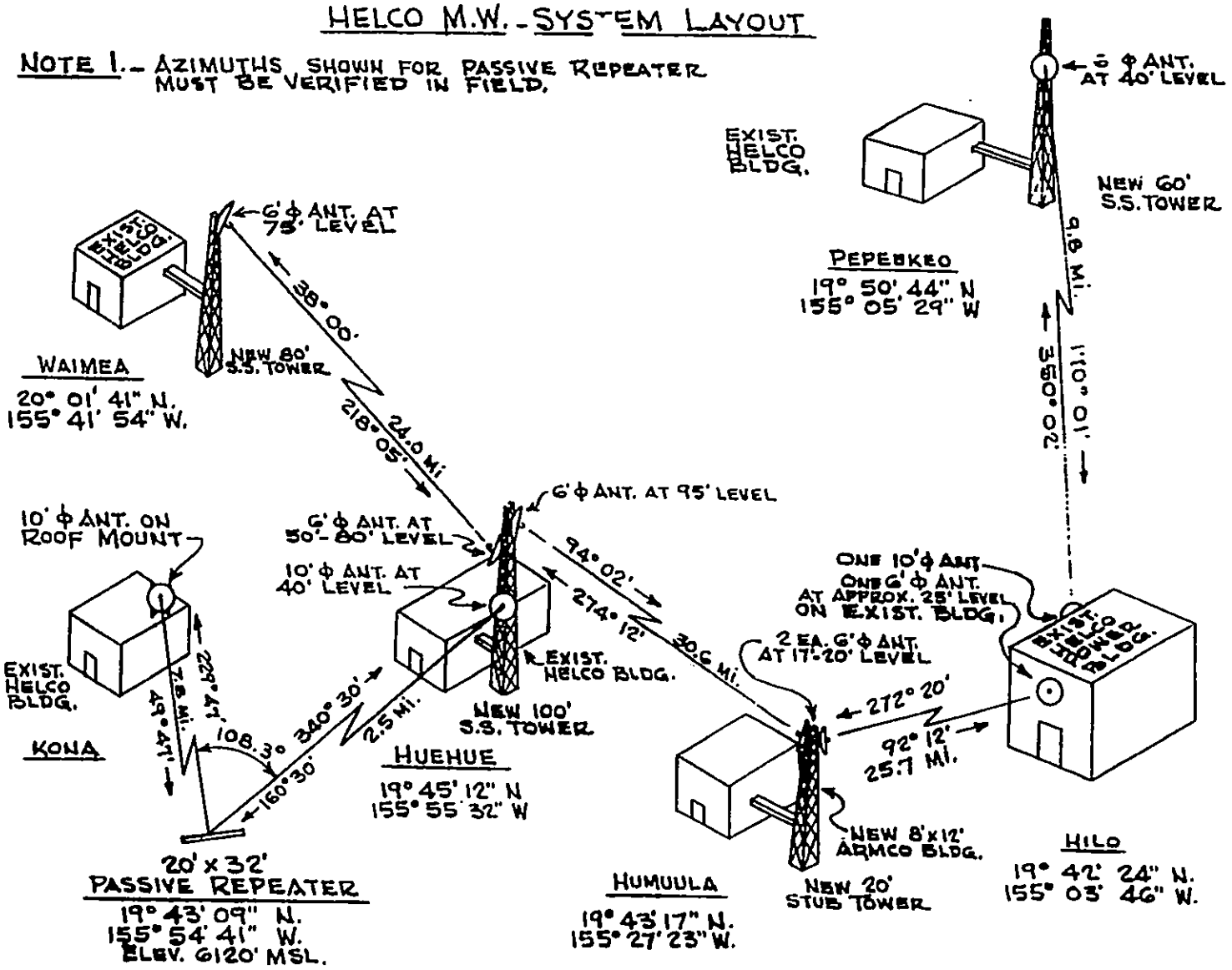


EXHIBIT 7: HELCO'S MICROWAVE SYSTEM IN 1973

In 1981, HELCO installed a link from Waimea to Honokaa via a passive reflector at Puu Kihe with 120 channel Collin MIR-6 radios. This installation was put in by the same driving force that was previously mentioned. The radio at Waimea is housed in the same existing building that was used in 1973. The existing switching station control house at Honokaa is used for the radio equipment.

The HELCO power system lacks the stability that comes from having ties with neighboring utilities. The critical clearing times at some locations on the system are low enough to require 100 milli-second clearing times for the total line. HELCO is now aggressively improving its communications system to accommodate the new Protective Overreach Transfer Trip, (POTT) relaying scheme. The POTT scheme required a secure and reliable communication between switching stations for each transmission line so the entire line can trip faster. The HELCO policy is to have a dedicated channel for each transmission line.

HELCO finished three microwave links emanating from Kaumana switching station in 1991. The far end terminals are Pohoiki Switching Station, Puna Power Plant, and the Hilo Hill 5 Power Plant. All the radios are Western Multiplex Two-2000. The two links form Kaumana to Hilo and Kaumana to Puna are 300 channels. The remaining link is 120 channels.

Five new microwave links are currently under various stages of installation which will terminate in two new switching stations and three existing switching stations of which one of them is the Keahole site. Exhibits 8 and 9 show the existing and near term microwave station and path locations and data. The station's TMK are shown in Exhibit 9A.

Two of the origional microwave links, Hilo to Humuula and Humuula to Huehue are being replaced. New 300 channel Western Multiplex Two-2000 radios will be used.

HELCO's goal is to extend the microwave system to service all the remaining four switching stations. The stations are Keamuku, Kilauea, Kealia, and Puueo switching Stations.

The HELCO microwave system has a 300 channel back bone (Supergroup 1 through 5) with 120 channel spurs (Supergroup 1 and 2). The top three Supergroups have been reserved for T1 links and Supergroup 1 has been separated between East and West Hawaii.

B. Detailed property master plan

The Keahole site will only have one microwave link terminating there. The site does not have any advantage in being able to extend links to other HELCO switching station locations. Keahole will have a 50 foot galvanized steel three legged self supporting microwave tower. The tower will have one 12 foot solid antenna

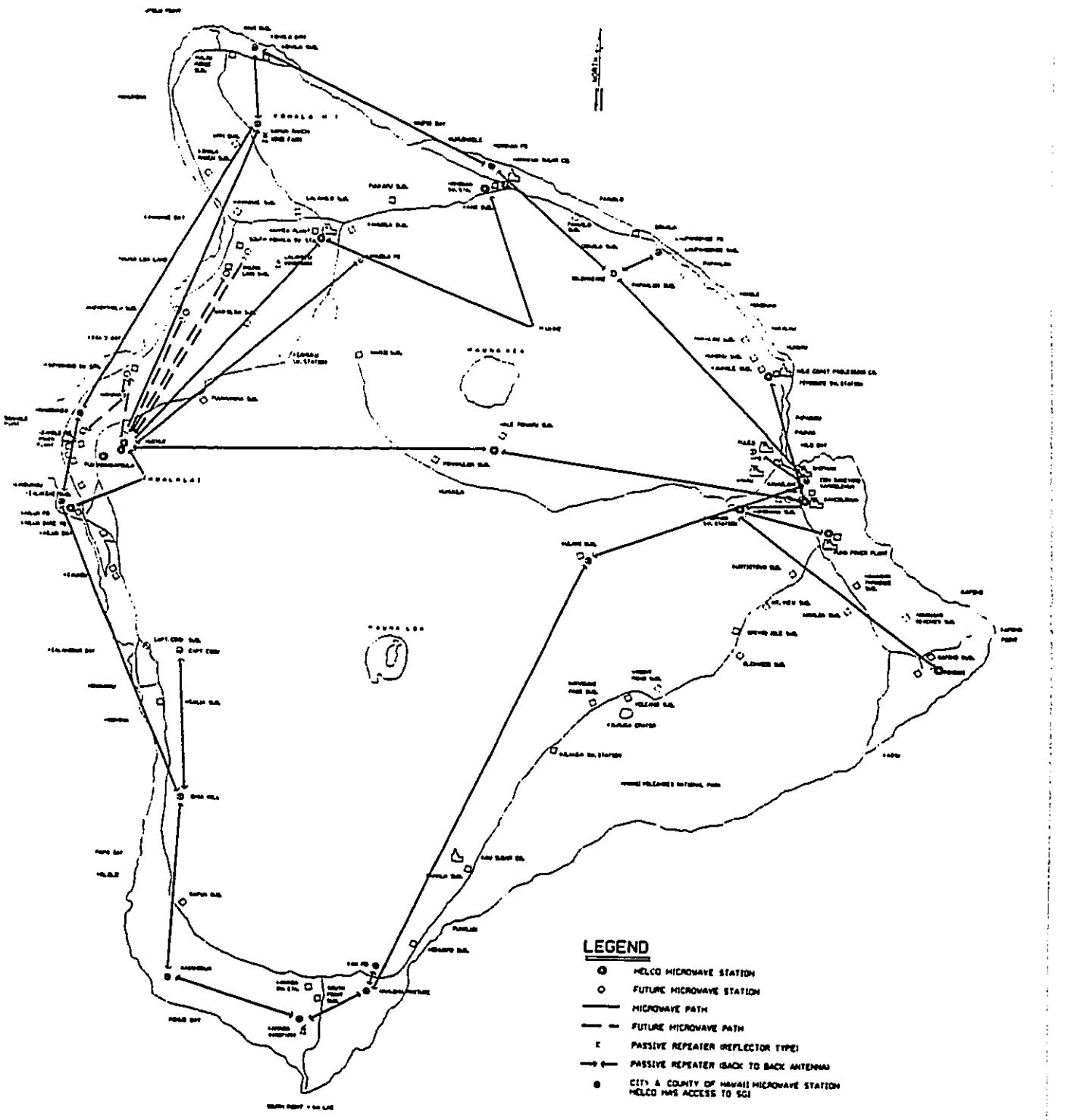


EXHIBIT 8: HAWAII ELECTRIC LIGHT CO. AND COUNTY OF HAWAII MICROWAVE SYSTEM STATION AND PATH LOCATIONS

EXHIBIT 9: HAWAII ELECTRIC LIGHT CO. AND COUNTY OF HAWAII MICROWAVE SYSTEM STATION AND PATH DATA

STATION DATA

	LOCATION	LATITUDE	LONGITUDE	GROUND ELEV	CALL SIGN
	KANOELEHUA	19°42'24" N	155°03'46" W	49.0'	WRR 57
**	KULAIA	19°31'25" N	155°05'29" W	157.0'	WRR 58
**	NAALEHU PASTURE	19°02'40" N	155°18'06" W	5515.0'	WBX 322
**	SOUTH POINT	19°00'19" N	155°35'00" W	580.0'	WBX 323
	HUMUULA	19°43'17" N	155°40'39" W	1200.0'	WBX 325
	HUEHUE	19°45'12" N	155°27'23" W	7600.0'	WRR 56
	PUU HNAKAPOULA	19°43'09" N	155°55'32" W	3369.4'	WRR55
	KAILUA	19°38'48" N	155°54'41" W	6616.5'	-----
**	OHIA MILL	19°13'36" N	156°00'12" W	44.0'	WRR 54
	WAIMEA	20°01'41" N	155°51'50" W	2230.0'	
	PUUKIHE	19°54'09" N	155°41'54" W	2450.0'	WRR 53
	HONOKAA	20°04'29" N	155°23'42" W	7834.5'	-----
**	KAHUA RANCH	20°07'43" N	155°28'33" W	1442.0'	WHC 323
+	HILO BASEYARD	19°42'36" N	155°46'49" W	3825.0'	WHK 400
+	IOLEHAEHAE	19°53'31" N	155°03'56" W	36.0'	
+	HONOKAA PD	20°04'49" N	155°23'07" W	8150.0'	
+	KOHALA GYM	20°07'42" N	155°27'54" W	1109.0'	
+	MOANUIAHEA	19°44'30" N	155°48'07" W	466.0'	
+	KAILUA PD	19°40'00" N	155°57'22" W	3222.0'	
+	KAIAKEKUA	19°03'12" N	156°00'38" W	97.0'	
	PUNA PWR PLT	19°38'01" N	155°52'43" W	100.0'	
	KAUMANA SW STA.	19°41'14" N	155°02'01" W	220.0'	WNTK 257
	POHOIKI SW STA	19°28'52" N	155°08'15" W	1425.0'	WNTK 258
+	HPD		154°53'37" W	600.0'	WNTK 259
+	LAUPAHOEHOE PD				
+	WAIMEA PD				
+	CAPT COOK				
+	KAU PD				
	POOPOOMNIO	19°48'15" N	155°59'10" W	440.0'	
	NAHAHA	19°46'43" N	155°58'50" W	1220.0'	-----
	KEAHOLE	19°44'6" N	156°1'49" W	440.0'	
	SOUTH KOHALA	20°00'19" N	155°48'06" W	610.0'	
	MAUNA LANI	19°58'41" N	155°49'19" W	258.0'	
	ANAEHOOMALU	19°54'43" N	155°52'41" W	60.0'	

PATH DATA

LOCATION NO. 1 NAME	XMTR FREQ MHZ	ANTENNA OR REFLECTOR (NOTE 4)	DISTANCE (NOTE 2) MILES	BEARING (NOTE 1)	LOCATION NO. 2 NAME	XMTR FREQ MHZ	ANTENNA OR REFLECTOR (NOTE 4)
KANOELEHUA	1985.00	6D-41'	9.80	348°58'	PEPEEKEO	1905.00	6D-55'
* KANOELEHUA	1965.00	6D-26'	25.70	272°20'	HUMUULA	1885.00	6D-19'
* KANOELEHUA CH	1935.00	6D-40'	20.00	230°02'	KULAIA	1855.00	6D-45'
KULAIA	1865.00	8D-162'	37.60	206°48'	NAALEHU PASTURE	1945.00	8D-49'
NAALEHU PASTURE	1935.00	6D-45'	6.80	245°08'	SOUTH POINT	1855.00	6D-20'
HUMUULA	1905.00	6D-19'	30.60	274°12'	HUEHUE	1985.00	6D-96'
HUEHUE	1945.00	6D-99'	24.00	038°00'	WAIMEA	1865.00	6D-79'
HUEHUE	1965.00	10D-39'	2.50	159°00'	PUU HNAKAPOULA	---	20X32-25'
PUU HNAKAPOULA	---	20X32-25'	7.80	230°15'	KAILUA	1885.00	10D-25'
KAILUA PD	1865.00	8D-55'	31.91	162°03'	OHIA MILL	1945.00	8D-60'
WAIMEA	6765.00	10D-70'	21.54	113°59'	PUUKIHE	---	30X32-80'
PUUKIHE	---	30X32-30'	12.96	336°09'	HONOKAA	6605.00	10D-48'
HUEHUE	1975.00	6D-17'	27.49	21°2'	KAHUA RANCH	1895.00	6D-14'
* KANOELEHUA CH	1945.00	6D-30'	1.60	290.3'	HPD		
* KANOELEHUA CH	1955.00	6D-40'	24.34	301.1'	IOLEHAEHAE	1875.00	6D-10'
* IOLEHAEHAE	1865.00	6D-10'	14.02	338.2'	HONOKAA PD	1945.00	6D-50'
* HONOKAA PD	1985.00	6D-75'	24.42	296.4'	KOHALA GYM	1905.00	6D-85'
* KOHALA GYM	1935.00	6D-57'	7.68	169.2'	KAHUA RANCH	1855.00	6D-30'
* KAHUA RANCH	1875.00	6D-15'	28.95	203.3'	MOANUIAHEA	1955.00	6D-20'
* KAHUA RANCH	1895.00	6D-14'	27.4	200.1'	HUEHUE		
* MOANUIAHEA	1975.00	6D-20'	6.29	214.5'	KAILUA PD	1895.00	6D-40'
* OHIA MILL	1935.00	6D-90'	18.3	350.0'	CAPT COOK		
* OHIA MILL	1955.00	6D-98'	11.85	185.3'	KAIAKEKUA	1875.00	6D-155'
* KAIAKEKUA	1895.00	6D-100'	13.57	104.1'	SOUTH POINT	1975.00	
KANOELEHUA	1975.00	6D-35'		254.7'	KAUMANA SW STA	1895.00	6D-60'
* KAUMANA SW STA	1855.00	6D-67'		118.0'	PUNA PWR PLT	1935.00	6D-67'
KAUMANA SW STA	1870.00	6D-60'		131.7'	POHOIKI SW STA	1950.00	6D-47'
HUEHUE	2138.00	8D-20'	19.11	24.9'	SOUTH KOHALA	21.88.00	8D-40'
HUEHUE	2140.00	8D-30'	16.86	23.6'	MAUNA LANI	2196.00	8D-40'
HUEHUE	2141.20	8D-20'	11.34	15.8'	ANAEHOOMALU	2191.20	8D-40'
HUEHUE	2131.60	6D-95'	5.27	311.6'	POOPOOMNIO	2181.60	6D-40'
POOPOOMNIO	1980.00	12D-45'	1.80	168.4'	NAHAHA	---	12D-35'
NAHAHA	---	12D-45'	4.41	227.2'	KEAHOLE	1900.00	12D-45'

NOTE

1. BEARINGS ARE BASED ON TRUE NORTH AND ARE CALCULATED FROM LOCATION NO. 1 TO LOCATION NO. 2.
2. DISTANCES SHOWN ARE THE ACTUAL PATH DISTANCES AND NOT GROUND DISTANCES.
3. ALL HELCO PATHS HAVE BILATERAL SWITCHING OF TRANSMITTERS AND RECEIVERS.
4. THE PARABOLIC ANTENNAS AND REFLECTORS ARE LISTED BY QUANTITY. WHERE MORE THAN ONE) SIZE IN FEET (LETTER D DENOTES DIAMETER) AND CENTERLINE HEIGHT ABOVE GROUND.
5. * ALL STATIONS MARKED WITH ASTERISKS ARE CITY AND COUNTY OF HAWAII MICROWAVE STATIONS WITH MULTIPLE DROPS OWNED AND USED BY HELCO.
6. ALL MICROWAVE LINKS SHOWN ARE 2 GHZ EXCEPT THE LINK FROM WAIMEA TO HONOKAA WHICH IS 6 GHZ.
7. + ALL PATHS AND STATIONS MARKED WITH PLUSES ARE CITY AND COUNTY OF HAWAII MICROWAVE PATHS AND STATIONS.

Note: The following PITT codes for the TMK's are from the 1991 edition of REDI Real Estate Information Service.

	Station Location	TMK	PITT
	Kanoelehua	2-2-58-19	400
	Pepeekeo	2-8-07-58	500
	Humuula	3-8-01-15	500
	Huehue	7-2-02-13	500
	Puu Hinakapoula	7-2-01-02	600
	Kailua	7-4-10-22	400
	Waimea	6-6-01-16	400
	Puu Kihe	4-2-08-13	500
	Honokaa	4-5-10-83	800
	Puna Pwr Plt	1-6-03-83	500
	Kaumana Sw Sta	2-5-5-124	800
	Pohoiki Sw Sta	1-4-01-02	500
1	Poopoomino	7-2-03-03	500, 600
2	Nahaha	7-2-04-04	500, 600
	Keahole	7-3-49-36	600
3	South Kohala	6-2-01-51	500
	Maunalani	6-6-01-63	500
	Anaehoomalu	6-8-01-28	500

1 Parcel has not been subdivided - elevation is 440 feet
2 Parcel has not been subdivided - elevation is 1220 feet
3 Parcel has not been subdivided - elevation is 610 feet

PITT CODES

(First digit) Property Classification	(Second digit) Agricultural Subclass	(Third digit) Governmental Land Subclass
1 - Residential	0 - None	0 - None
2 - Apartment	1 - Pineapple	1 - Federal
3 - Commercial	2 - Sugar Cane	2 - State
4 - Industrial	3 - Divesified	3 - County
5 - Agricultural & Rural	4 - Pasture	4 - Hawaiian Homes
6 - Conservational	5 - Institutional	
7 - Hotel & Resort		
8 - Unimproved Residential		

EXHIBIT 9A: HELCO MICROWAVE STATION TMK & PITT CODES

for 1.85-1.99 GHz mounted at 45 feet. The antenna will be pointed 47.2 degrees based on true north. The antenna and tower will be light gray in color. Appendix A has the detailed construction plans of the tower.

The 120 channel Western Multiplex Two-2000 radio will be located within the existing control house that the tower is located next to.

C. Mitigating Measures

Other than standard construction practices during excavation, no mitigating measures will be needed other than Federal Aviation Administration (FAA) height restrictions and visual impacts.

The proximity of the Keahole plant to the Keahole Airport requires that all construction be in accordance with FAA Airport Zoning Regulations. The FAA has set an "accepted height limitation" of 35 feet above the ground level at the project site that allows structures up to 35 feet high to be built without permitting. However, since the tower height is to be 50 feet tall, Helco must file a "Notice of Proposed Construction or Alteration" with the FAA and receive permission for the proposed action.

It seems probable that permission for the tower will be granted, particularly since the site is off to the side of the runways and primary flight paths. HELCO will

meet all FAA and DOT requirements.

The major visual vantage point of the project area is the Queen Kaahumanu Highway, over 750 feet to the west. Due to the diminishing effect of the distance and the partial screen provided by the existing vegetation and planted vegetation screen consisting of an Oleander hedge Wiliwili and Coconut trees, only the upper portions of the plant's structures are visible. Exhibit 3 is a plot plan of the generation site with section "A-A" indicated. Exhibit 10 shows the elevation of the existing Combustion Turbine, the six diesels and the proposed microwave tower. The Photos showing the views of the project site are shown in Exhibit 11.

The VOG was quite heavy on the day that the Photos were taken. However, if the day was clear, the tan colored muffler supports would not have blended as well as the gray Combustion Turbine stack against the dark mountain backdrop. the lighter colored equipment when viewed from either the north of the south tended to blend better with the light sky. The proposed gray is a lighter gray than the existing exhaust stack. The tower should have a negligible visual impact.

SECTION A–A

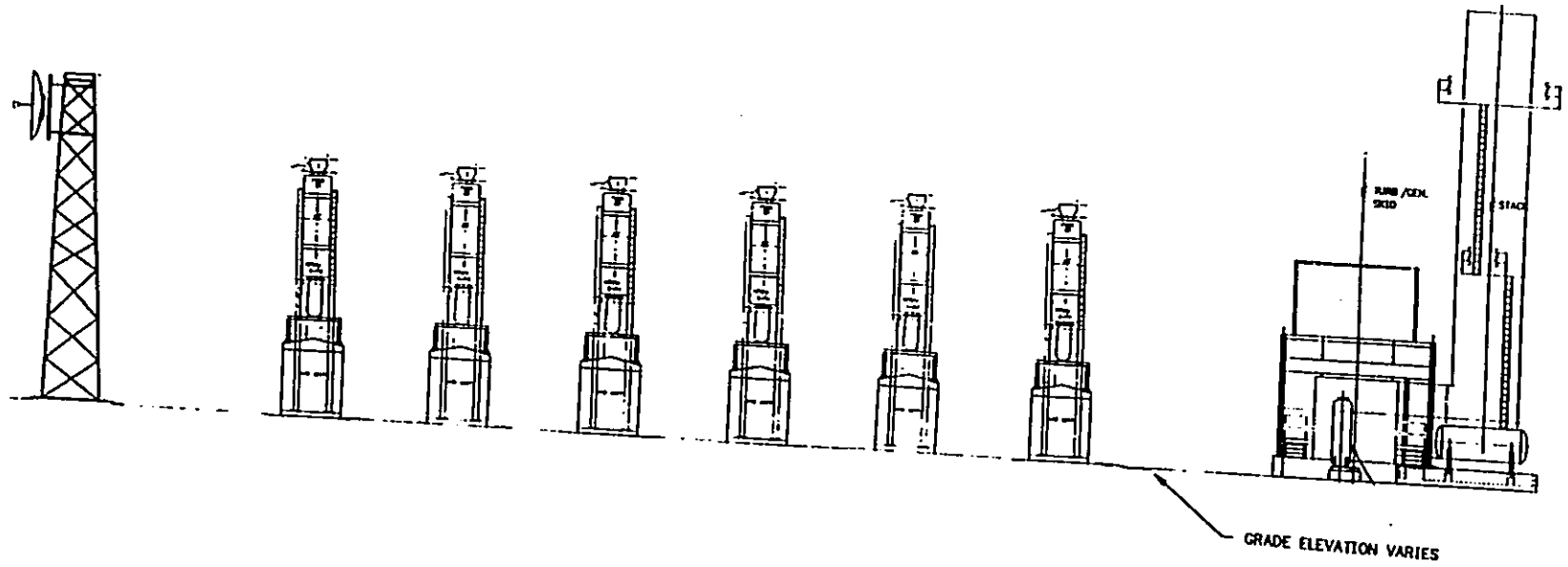
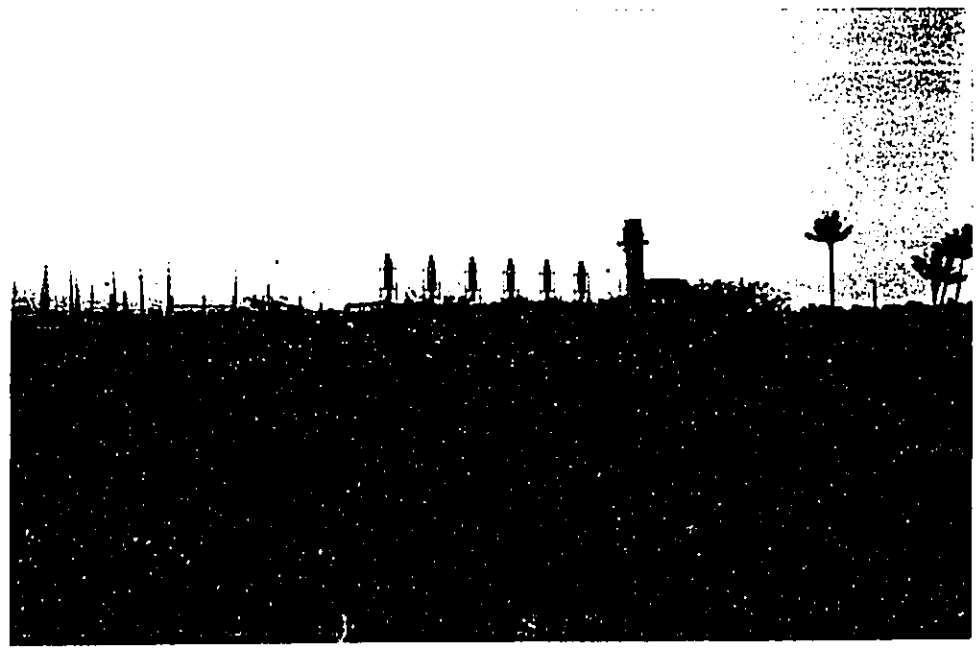
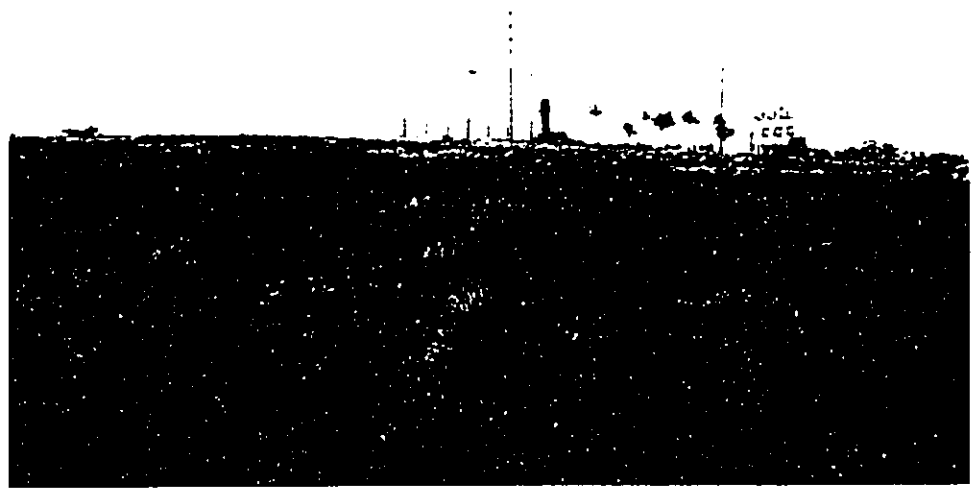


EXHIBIT 10: ELEVATION OF THE PROPOSED 50 FT MICROWAVE TOWER,
71 FT COMBUSTION TURBINE, AND SIX 40 FT DIESEL GENERATORS

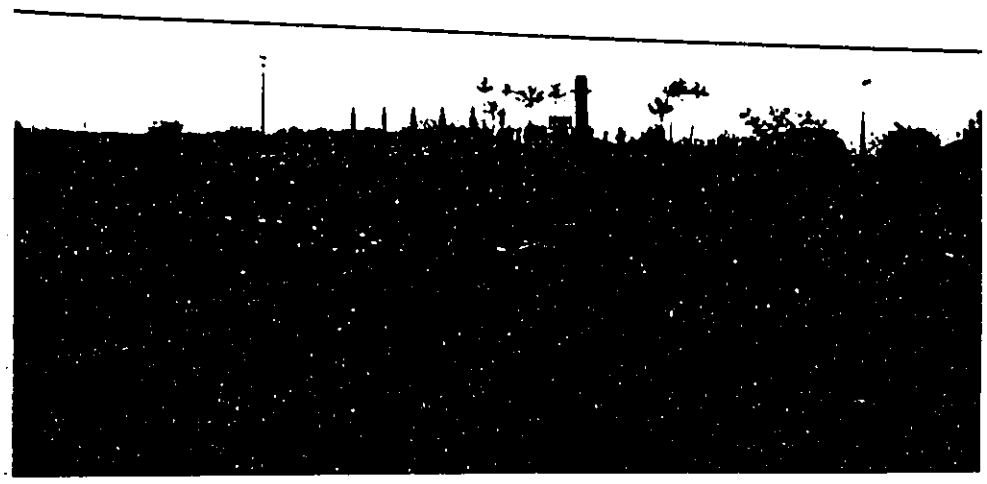


1. View to Keahole Power Plant from North East corner of property. (about 300 feet distance)



2. View to Keahole Power Plant from Queen Kaahumanu Highway North. (about 1700 feet distance)

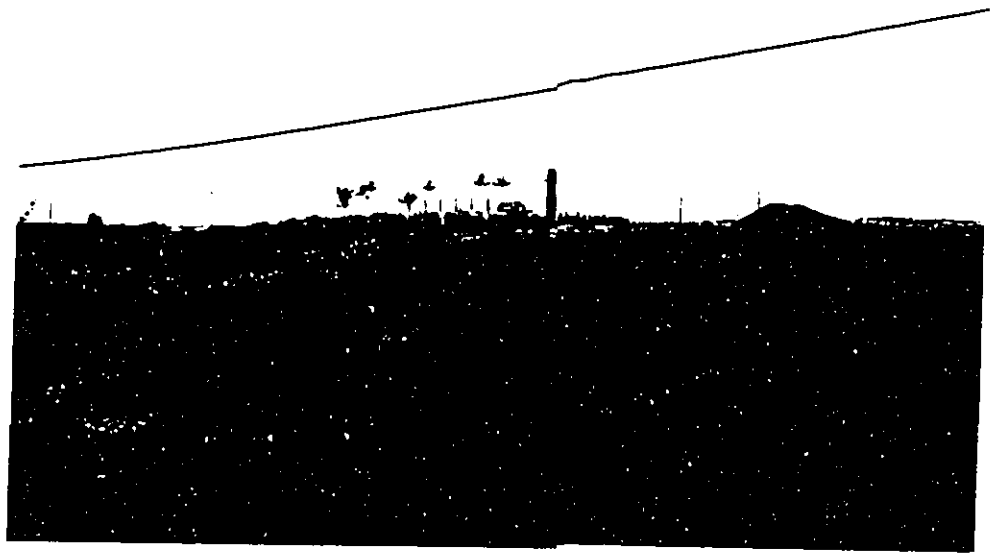
EXHIBIT 11A: Photos of Existing Generating Site



3. View of Keahole Power Plant from Queen Kaahumanu Highway by airport entrance. (about 750 feet distance)

4. View of Keahole Power Plant from aiport access road. (about 1600 feet distance)

EXHIBIT 11B: Photos of Existing Generating Site

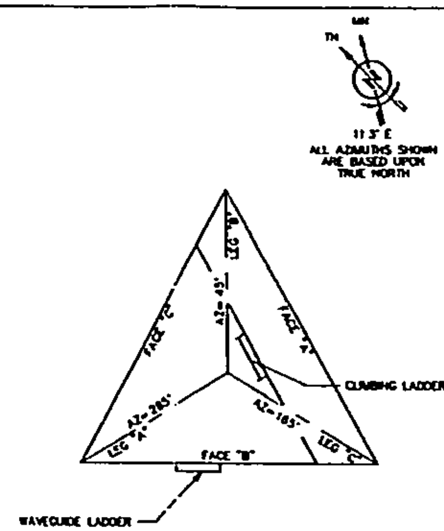


6. View to Keahole Power Plant from Queen Kaahumanu Highway. (about 1000 feet distance)

7. View to Keahole Power Plant from Queen Kaahumanu Highway and Ka'imani drive. (about 2200 feet distance)

EXHIBIT 11C: Photos of Existing Generating Site

APPENDIX A



TOWER ORIENTATION
PLAN VIEW

GENERAL NOTES:

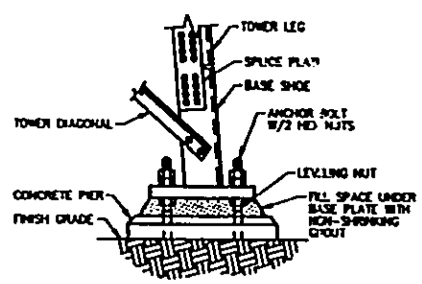
1. TOWER HEIGHT 50'
2. CONCRETE TOWER FOUNDATION PER DWG NO. SF-1729-06
   CONCRETE: 21.6 CU. YDS (TOTAL – 3 PIERS)
   BASE SHOE PIECE MARK 04-9096-2
   BASE PLATE SIZE 1 1/2" X 11" X 11"
3. GROUNDING REQUIRED: ☐ YES ■ NO
4. REMOVE UPPER ANCHOR BOLT TEMPLATE BEFORE INSTALLING TOWER BASE.
5. LIGHTNING ROD REQUIRED: ■ YES ☐ NO
   INSTALL PER DWG NO. 3ST-00-TOP
6. FINISH: ALL STEEL HOT DIP GALVANIZED.
   PAINT REQUIRED: ☐ YES ■ NO
7. INSTALL ■ LOCKWASHERS AND HEX NUTS ☐ LOCKNUTS AT ALL BOLTED CONNECTIONS. (SEE SPECIAL NOTE)
8. LIGHTS REQUIRED: ☐ YES ■ NO
9. INTERNAL CLIMBING LADDER REQUIRED: ■ YES ☐ NO
   INSTALL LADDER BETWEEN FACES "B" AND "C"
   PER SECTION ASSEMBLIES AND DWG. NO. 3ST-00-CD
10. SAFETY CLIMB DEVICE REQUIRED: ☐ YES ■ NO
11. WAVEGUIDE SUPPORTS REQUIRED: ■ YES ☐ NO
    ■ 6 RUN WAVEGUIDE SUPPORT ON OUTSIDE OF FACE "B"
    INSTALL WG. SUPPORT PER DWG. NO. 3ST-00-W
12. WAVEGUIDE BRIDGE REQUIRED: ☐ YES ■ NO
13. INSTALL ANTENNAS PER CHART THIS DRAWING.
14. ANDREW TOWER NAME PLATE TO BE BOLTED TO OUTSIDE OF TOWER APPROX. 5'-0" ABOVE BASE PLATE.
15. ANY FIELD DAMAGE OR FIELD MODIFICATIONS NEED TO BE DOCUMENTED TO ANDREW CORPORATION AND ALL EXPOSED (BARE) METAL SHALL BE GIVEN ONE COAT (MINIMUM) OF ZINC RICH PAINT.
16. REMOVE ALL TRASH AND DEBRIS FROM SITE.

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
1/24/92

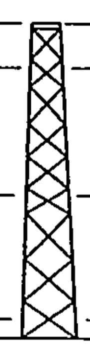


TOWER BASE DETAIL

NOTE:
IT IS THE ERECTOR'S RESPONSIBILITY TO INSURE THAT ALL PRACTICES AND PROCEDURES UTILIZED DURING ASSEMBLY AND ERECTION WORK REQUIRED ON THE TOWER DO NOT ENDANGER THE SAFETY OF ANY PERSONNEL NOR THE STRUCTURAL INTEGRITY OF THE TOWER.

SPECIAL NOTE:
ALL NUTS SHALL BE TIGHTENED TO THE SNUG TIGHT CONDITION DEFINED AS THE TIGHTNESS ATTAINED BY A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF A MAN USING AN ORDINARY SPUD WRENCH.

SECTION ASSEMBLY DWG. NO.	SPLICE LEVEL	LEG PIECE MARK	PAINT BAND LEVELS
	50'		NO PAINT
3ST-0207-C2		02-8185	
	43'		
3ST-03-D2		03-9056	
	25'		
3ST-04-E2		04-9096	
	3'		



ELEVATION VIEW

ANTENNA TYPE	ELEV.	AZIMUTH	OFFSET	ANTENNA MOUNT INSTALL. DWG.
(1) - 12'ø STD.	44'	47.19°	INV	MI-1729-06

ANTENNA INSTALLATION CHART

DESIGN LOAD: (1) - 12'ø STD @ 44'

DRAWINGS REQUIRED:
3ST-00-CD
3ST-00-TOP
3ST-0207-C2
3ST-03-D2
3ST-04-E2
MI-1729-06
SF-1729-06
3ST-00-W
PACKING LIST

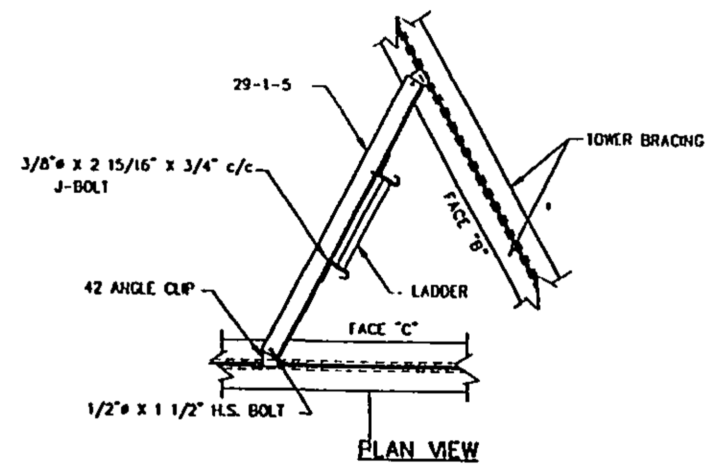
DESIGN LOAD: 82.5 PSF + 1/2" ICE (EIA RS-222 REV. C)

ANDREW
ANDREW CORPORATION
2701 Mayhill Road
Denton, TX U.S.A. 76201
Telephone (817) 566-24
TWX 910-877-4507

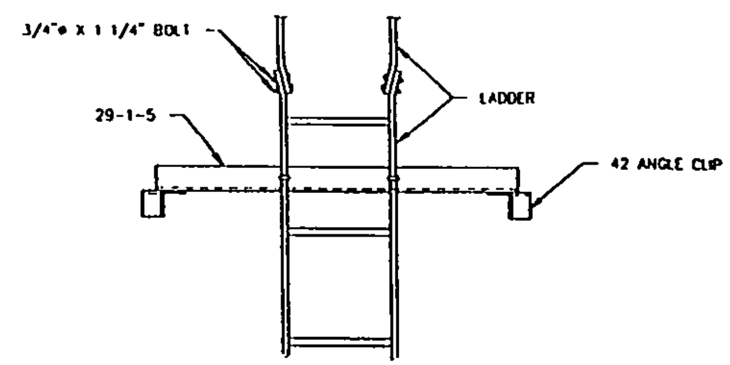
ISSUE	REVISIONS	DWN	APPR	DATE
A	RELEASED	MPJ		

KEY ASSEMBLY
FOR A 50 FT. 3ST TYPE TOWER
HAWAII ELECTRIC
KEAHOLE

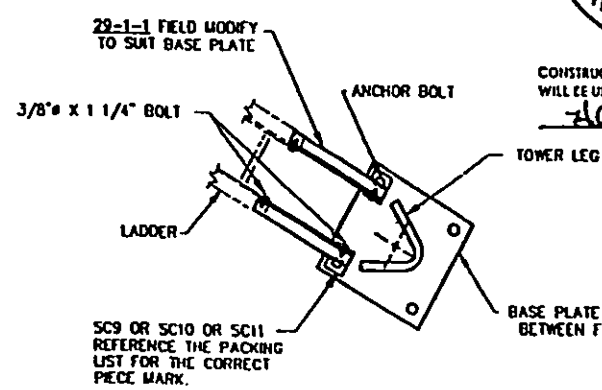
SI-1729-06



PLAN VIEW



TYPICAL LADDER ASSEMBLY ELEVATION



BOTTOM END LADDER CONNECTION

HAL K. KAMIGAKI REGISTERED PROFESSIONAL ENGINEER No. 5277-E HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

CHANDER P. NANGIA REGISTERED PROFESSIONAL ENGINEER No. 4251-S HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

1/24/92

GENERAL NOTES:

1. REFERENCE KEY ASSEMBLY FOR BOLT TORQUE REQUIREMENTS.
2. REFERENCE SECTION ASSEMBLIES FOR INSTALLATION OF 42 TO TOWER BRACING.
3. INSTALL SAFETY CLIMB FOR LADDER (IF REQ'D) PER MANUFACTURER'S INSTRUCTIONS.

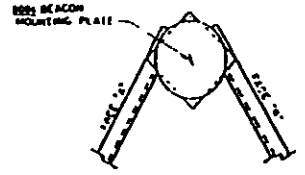
ANDREW

ISSUE	REVISIONS	DWN	APPR	DATE
D	REDRAWN & REVISED	CAM	GD	9/6/91
C	REVISED	DHK	DHK	8/1/87
B	REVISED	JWF	JWF	9/19/85
A	RELEASED	CSE	DJD	2/18/85

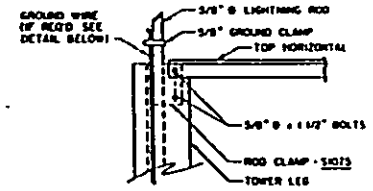
TITLE CLIMBING DEVICE INSTALLATION FOR 3ST TOWER

FOR STANDARD

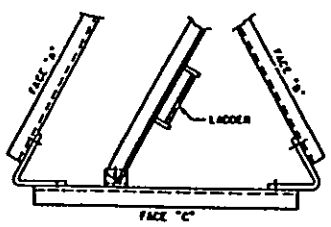
NO GC03FVID



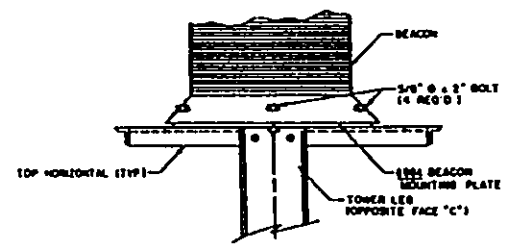
PLAN VIEW



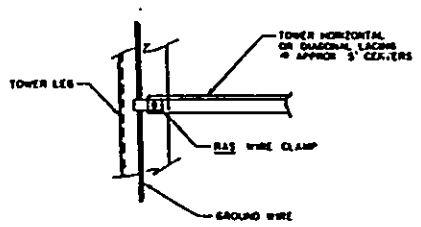
ELEVATION



TOP PLAN



BEACON INSTALLATION
(INSTALL ONLY WHEN LIGHTS ARE REQUIRED)



LIGHTNING WIRE CLAMPING DETAIL

NOTE:
1. LIGHTNING ROD CAN BE MOUNTED ON ANY TOWER LEG AND ON EITHER LEG TOE
2. SEE PACKING LIST FOR TYPE AND LENGTH OF ROD

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

GENERAL NOTE:
1. REFERENCE KEY ASSEMBLY FOR MINIMUM BOLT TORQUE REQUIREMENTS

ANDREW
ANDREW CORPORATION

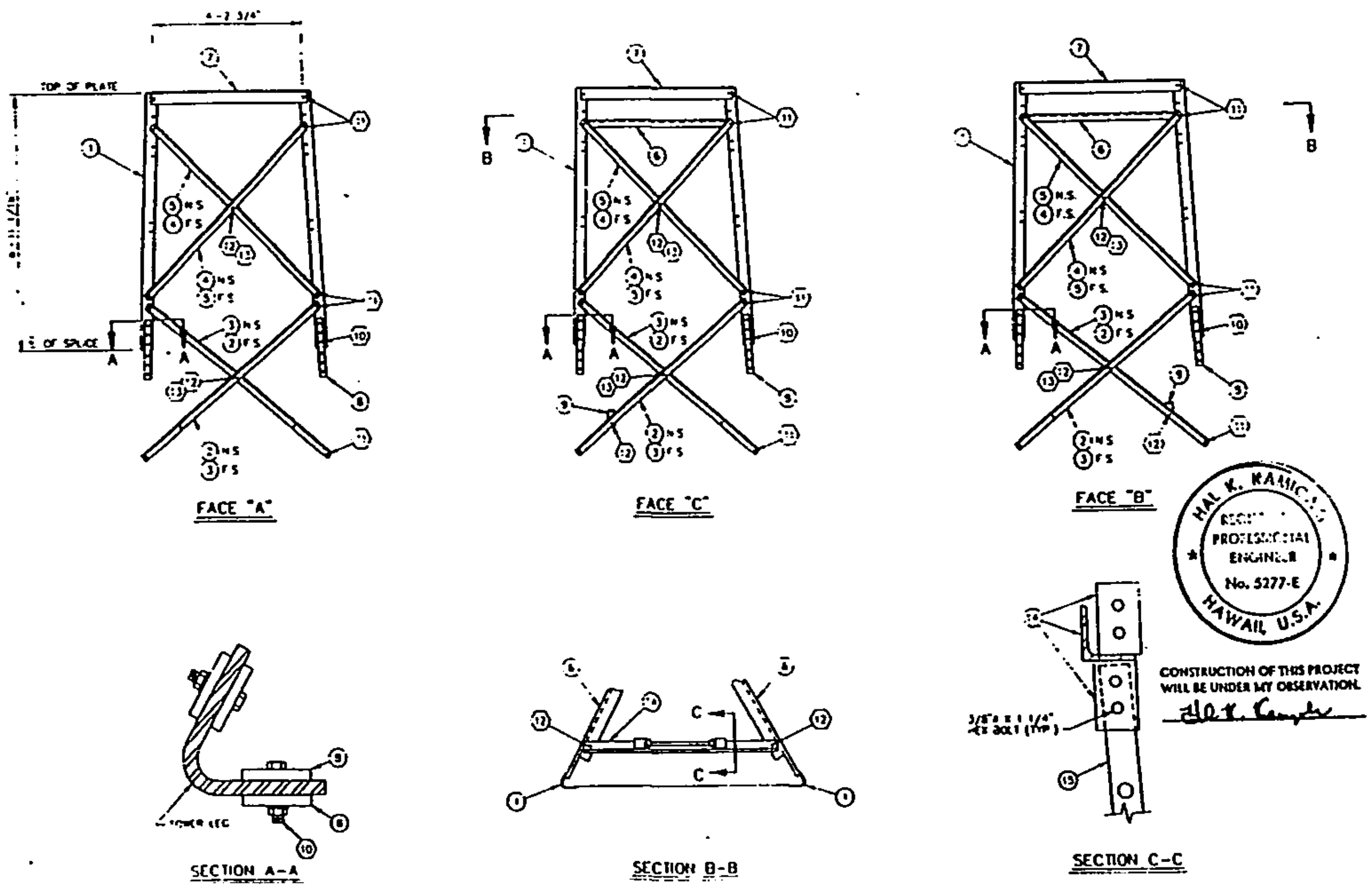
TOP OF TOWER DETAILS FOR 3ST TOWER

B	REVISED			
A	RELEASED	CSH	AJP	

3ST-00-TOP

MATERIAL LIST

ITEM NO	PIECE MARK	QTY	DESCRIPTION	TOTAL WEIGHT
1	02-0403	3	PL 5/16 x 8 x 6'-11"	103.1
2	2-12-1	6	∟ 1 3/4 x 1 3/4 x 1/8 x 6'-3 13/32"	36.0
3	2-22-1	6	∟ 1 3/4 x 1 3/4 x 1/8 x 6'-3 13/32"	36.0
4	2-32-1	6	∟ 1 3/4 x 1 3/4 x 1/8 x 6'-6 5/8"	36.4
5	2-42-1	6	∟ 1 3/4 x 1 3/4 x 1/8 x 6'-6 3/8"	36.4
6	2-99-16	2	∟ 2 x 2 x 1/8 x 4'-9 7/8"	19.0
7	2-02-30	3	∟ 2 1/2 x 2 x 1/8 x 4'-9"	23.3
8	00900	12	PL 1/2 x 2 1/2 x 1'-0 1/2"	63.0
9	42	2	∟ 4 x 3 x 1/4 x 0'-1 1/2"	1.2
10	340052-7	30	5/8" x 2 1/2" H.S. HEX BOLT	15.0
11	340052-3	30	5/8" x 2" H.S. HEX BOLT	[illegible]
12	340053-1	10	1/2" x 1 1/2" H.S. HEX BOLT	1.2
13	340037-2	6	1/4" THICK SPRINGWASHER	[illegible]
14	2-99-8	1	∟ 2 x 2 x 1/8 x 4'-8 1/2"	23.2
15	02-8	1	LADDER ASSEMBLY x 5'-3 3/4" LG	32.0



CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Chander P Nangia

HAL K. KAMIC...
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

Hal K. Kamic...

GENERAL NOTES:

1. FOR SECTION LOCATION AND ORIENTATION SEE KEY ASSEMBLY
2. ALL LEGS TO BE INSTALLED WITH PART NO AT BOTTOM END
3. FOR LADDER INSTALLATION SEE DWG 3ST-00-CD
4. ALL UNUSED HOLES TO BE LEFT OPEN
5. INSTALL HEX NUTS AND LOCKWASHERS OR LOCKNUTS PER NOTE NO 7 LISTED ON KEY ASSEMBLY
6. (N.S.)-INDICATES NEAR SIDE OR OUTSIDE OF TOWER
   (F.S.)-INDICATES FAR SIDE OR INSIDE OF TOWER.
7. FOR BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY
8. SECTIONS B-B & C-C APPLY ONLY WHEN LADDER IS REQUIRED PER NOTE NO. 9 LISTED ON KEY ASSEMBLY

ANDREW

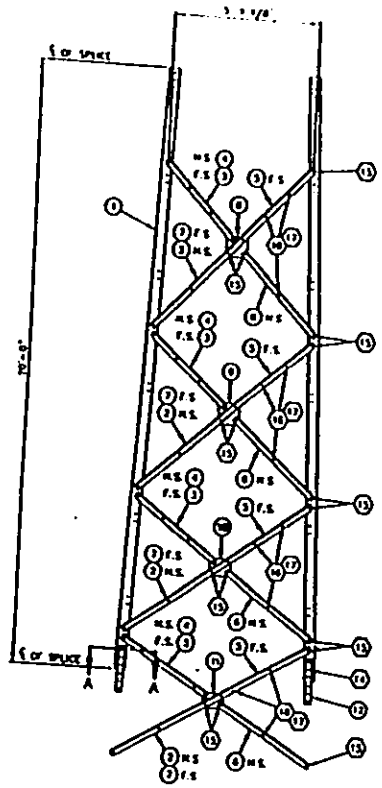
ANDREW CORPORATION
301 Duck Road
Grandview, Mo. 64030
Telephone: (816) 765-4600
Telex: 42-4121

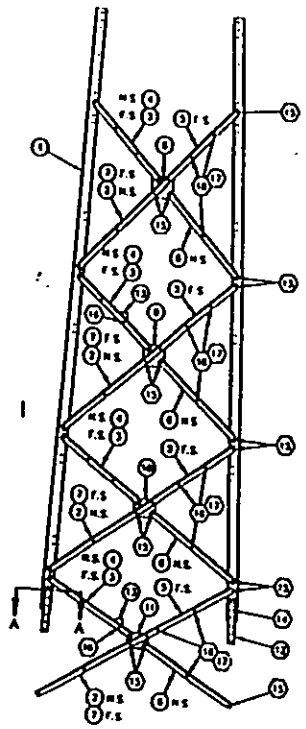
REV	REVISIONS	DRN	APPD	DATE
A	RELEASED	CD		

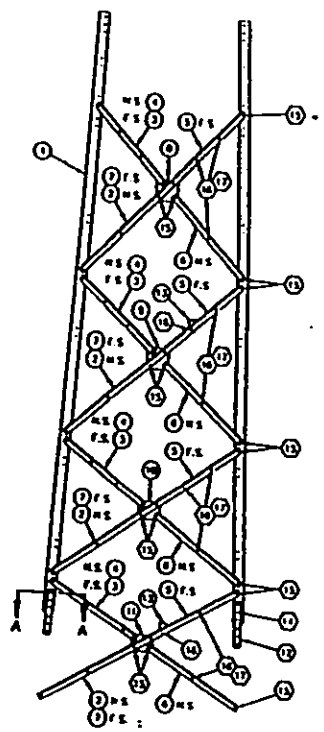
TITLE: 3ST SECTION 02 ASSEMBLY
DOUBLE BRACED
STANDARD

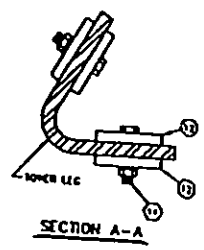
SCALE: VARIOUS

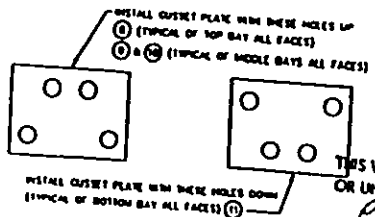
DRAWING NO. 3ST-0207-C2











CHANDER P. MANGIA No. 4251-S

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

Chander P. Mangia

HAL K. KAMIGAKI No. 5277-E

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

GENERAL NOTES:

1. FOR SECTION LOCATION AND ORIENTATION SEE KEY ASSEMBLY
2. ALL LEGS TO BE INSTALLED WITH PART NO. AT BOTTOM END
3. FOR LADDER INSTALLATION SEE DWG. 3ST-00-C8
4. ALL UNUSED HOLES TO BE LEFT OPEN
5. INSTALL HEX NUTS AND LOCKWASHERS OR LOCKNUTS PER NOTE NO. 7 LISTED ON KEY ASSEMBLY.
6. (N.S.)-INDICATES NEAR SIDE OR OUTSIDE OF TOWER (F.S.)-INDICATES FAR SIDE OR INSIDE OF TOWER.
7. FOR BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY

MATERIAL LIST

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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				[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]

ANDREW

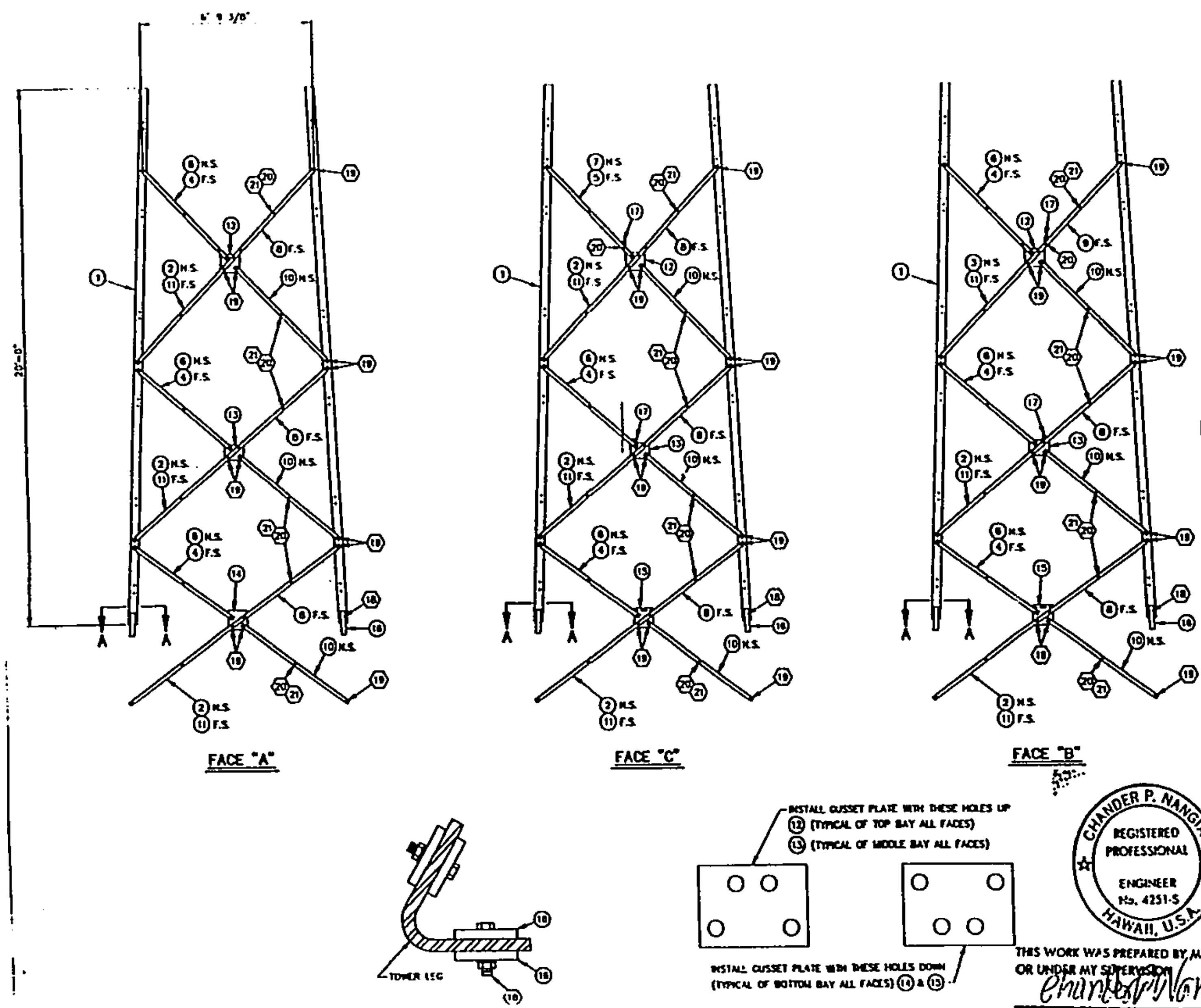
ANDREW CORPORATION

A RELEASED

3ST SECTION 03 ASSEMBLY
DOUBLE BRACED
STANDARD

VARIOUS

3ST-03-02



MATERIAL LIST

ITEM NO	PIECE MARK	QTY	DESCRIPTION	TOTAL WEIGHT
1	04-[illegible]	3	PL. 3/8 X 8 X 20'-0"	723.0
2	4-1-3	8	∠ 2 X 2 X 1/8 X 10'-2 1/8"	140.0
3	4-11-3	1	∠ 2 X 2 X 1/8 X 10'-2 1/8"	17.0
4	4-5-3	8	∠ 2 X 2 X 1/8 X 10'-2 1/8"	140.0
5	4-51-3	1	∠ 2 X 2 X 1/8 X 10'-2 1/8"	17.0
6	4-4-3	8	∠ 2 X 2 X 1/8 X 6'-0 7/8"	65.6
7	4-41-3	1	∠ 2 X 2 X 1/8 X 6'-0 7/8"	8.2
8	4-3-3	8	∠ 2 X 2 X 1/8 X 6'-0 7/8"	65.6
9	4-31-3	1	∠ 2 X 2 X 1/8 X 6'-0 7/8"	8.2
10	4-6-3	9	∠ 2 X 2 X 1/8 X 5'-0 3/8"	76.5
11	4-2-3	9	∠ 2 X 2 X 1/8 X 5'-0 3/8"	76.5
12	04-[illegible]	3	PL. 3/16 X 8 X 0'-8"	30.2
13	04-[illegible]	3	PL. 3/16 X 7 X 0'-8"	17.0
14	04-[illegible]	1	PL. 3/16 X 7 X 0'-8"	5.0
15	04-[illegible]	3	PL. 3/16 X 8 X 0'-11"	18.4
16	[illegible]	12	PL. 1/2 X 3 1/2 X 1'-0 1/2"	82.0
17	42	4	∠ 4 X 3 X 1/4 X 0'-4 1/2"	3.0
18	340[illegible]-7	36	5/8"Ø X 2 1/2" H.S. HEX BOLT	13.0
19	340[illegible]-3	72	5/8"Ø X 3" H.S. HEX BOLT	18.0
20	340[illegible]-1	36	1/2"Ø X 1 1/2" H.S. HEX BOLT	4.3
21	340[illegible]-3	36	3/8" THICK STITCHWASHER	11.5

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277 E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

[signature]

GENERAL NOTES:

1. FOR SECTION LOCATION AND ORIENTATION SEE KEY ASSEMBLY.
2. ALL LEGS TO BE INSTALLED WITH PART NO. AT BOTTOM END.
3. FOR LADDER INSTALLATION SEE DWG. 3ST-00-CO.
4. ALL UNUSED HOLES TO BE LEFT OPEN.
5. INSTALL HEX NUTS AND LOCKWASHERS OR LOCKNUTS PER NOTE NO. 7 LISTED ON KEY ASSEMBLY.
6. (N.S.)-INDICATES NEAR SIDE OR OUTSIDE OF TOWER. (F.S.)-INDICATES FAR SIDE OR INSIDE OF TOWER.
7. FOR BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY.

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. 4251-S
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

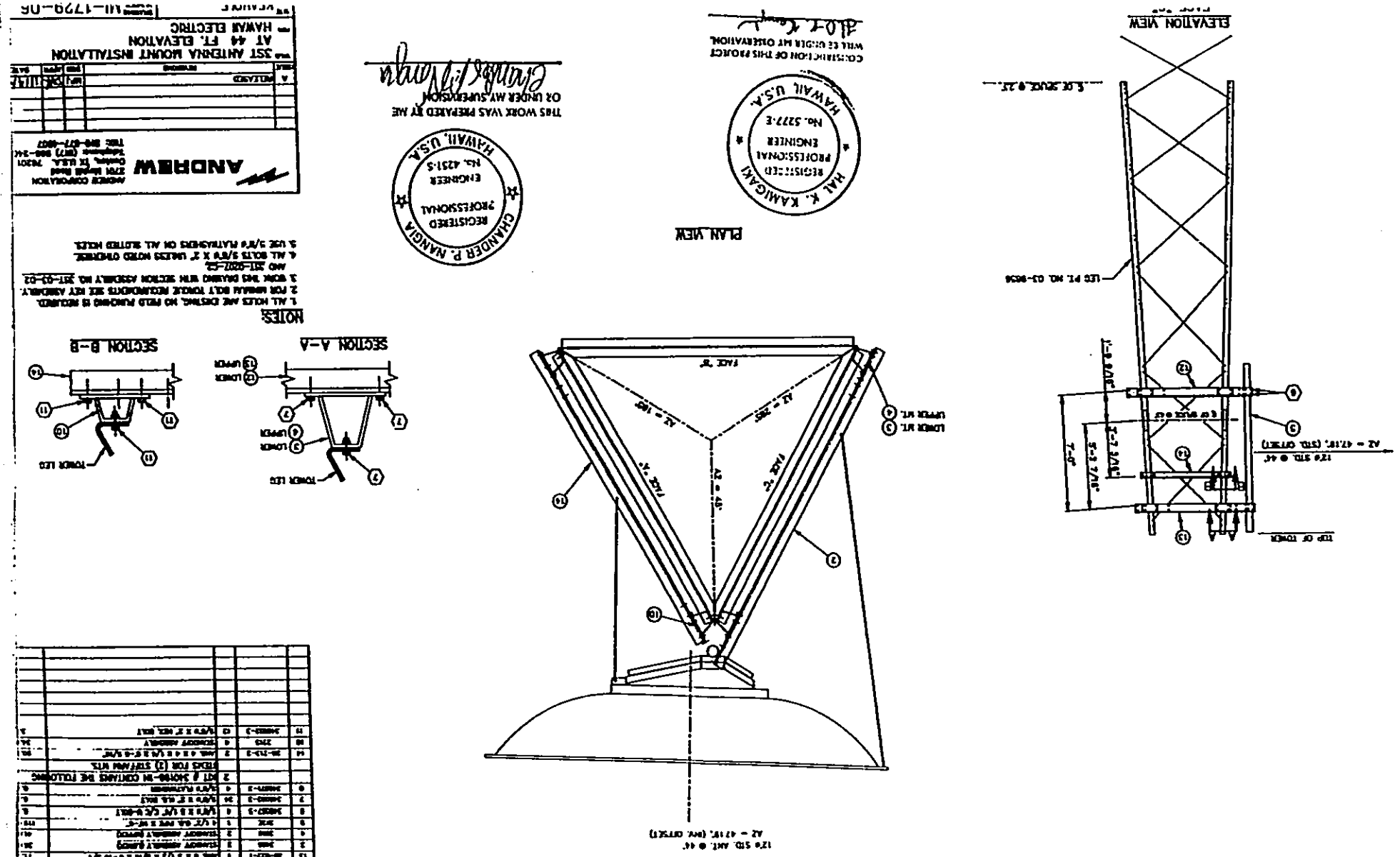
[signature]

ANDREW

ANDREW CORPORATION
2701 Mayhill Road
Denton, TX U.S.A. 76201
Telephone: (817) 566-2400
TWX: 910-877-4307

REV	REVISIONS	DRN	APPR	DATE
A	REDRAWN	MPJ	[illegible]	[illegible]

TITLE 3ST SECTION 04 ASSEMBLY
DOUBLE BRACED
— STANDARD



ELEVATION VIEW

PLAN VIEW

ITEM NO.	PIECE MARK	QTY.	DESCRIPTION	TOTAL WEIGHT
		1	KIT # 340199-4N CONTAINS THE FOLLOWING	
			ITEMS FOR (1) ANT. MT.	
12	30-630-1	1	ANG. 6 X 3 1/2 X 5/16 X 7'-6 15/16"	77.
13	30-622-1	1	ANG. 6 X 3 1/2 X 5/16 X 6'-10 3/4"	71.
3	[illegible]	2	STANDOFF ASSEMBLY (LOWER)	38.
4	[illegible]	2	STANDOFF ASSEMBLY (UPPER)	41.
9	[illegible]	1	4 1/2" O.D. PIPE X 10'-6"	[illegible]
8	340287-3	4	5/8"Ø X 5 1/4" C/C U-BOLT	6.
7	[illegible]	24	5/8"Ø X 2" H.S. BOLT	6.
6	[illegible]	4	5/8"Ø FLATWASHER	6.
		2	KIT # 340190-1N CONTAINS THE FOLLOWING	
			ITEMS FOR (2) STIFFARM MTS.	
14	30-213-3	2	ANG. 4 X 4 X 1/4 X 6'-6 5/16"	90.
10	[illegible]	4	STANDOFF ASSEMBLY	34.
11	[illegible]	12	5/8"Ø X 2" HEX. BOLT	3.

SECTION A-A

SECTION B-B

NOTES:

1. ALL HOLES ARE EXISTING, NO FIELD PUNCHING IS REQUIRED.
2. FOR MINIMUM BOLT TORQUE REQUIREMENTS SEE KEY ASSEMBLY.
3. WORK THIS DRAWING WITH SECTION ASSEMBLY NO. 3ST-03-02 AND 3ST-0207-C2.
4. ALL BOLTS 5/8"Ø X 2" UNLESS NOTED OTHERWISE.
5. USE 5/8"Ø FLATWASHERS ON ALL SLOTTED HOLES.

HAL K. KAMIGAKI
No. 5277-E

CONSTRUCTION OF THIS PROJECT
WILL BE UNDER MY OBSERVATION.

CHANDER P. NANGIA
No. 4251-S

THIS WORK WAS PREPARED BY ME
OR UNDER MY SUPERVISION
Chander P. Nangia

ANDREW

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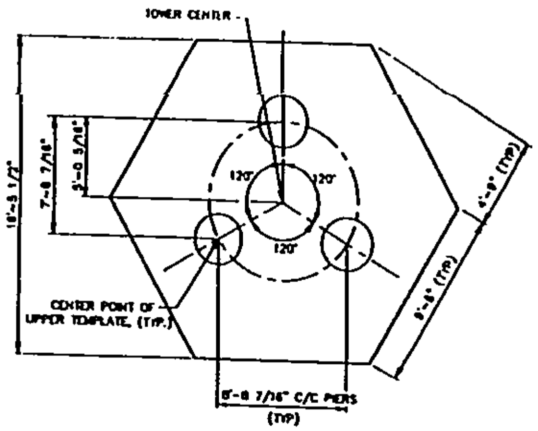
A	RELEASED	MPJ	[illegible]	11/4
LTR	REVISIONS	DWN	APPR	DATE

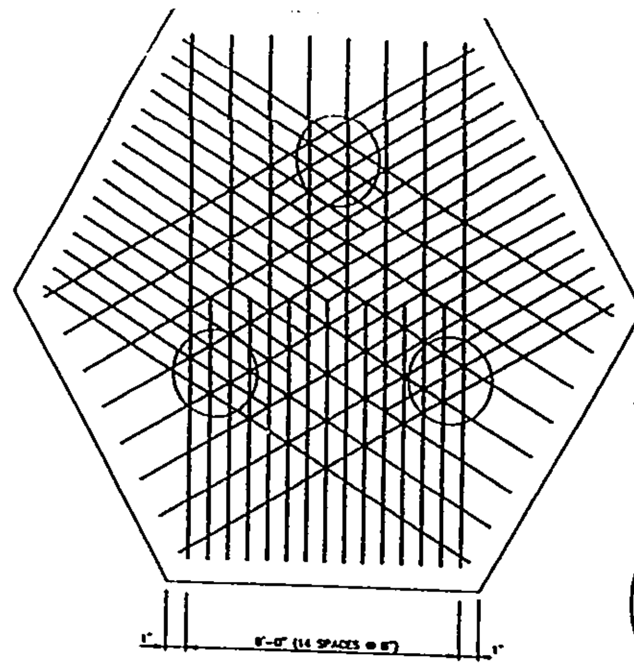
3ST ANTENNA MOUNT INSTALLATION
AT 44 FT. ELEVATION
HAWAII ELECTRIC

KEAHOLE

MI-1729-06

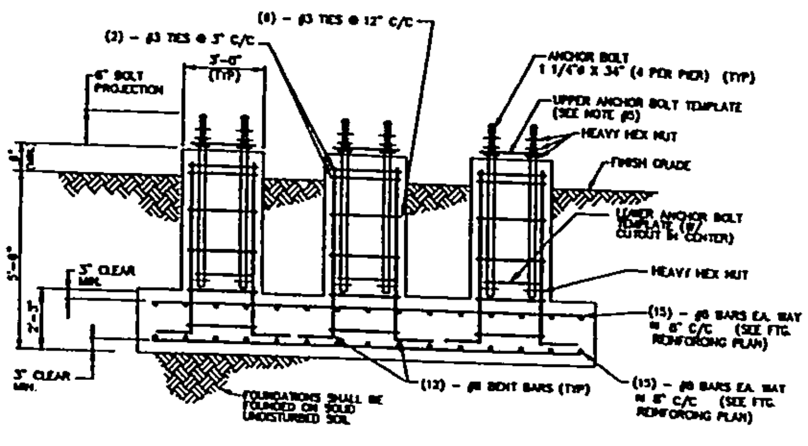


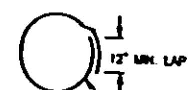
FOUNDATION PLAN



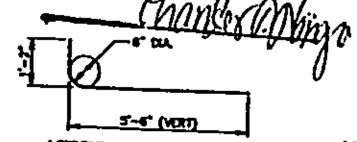
FOOTING REINFORCING PLAN

TOP AND BOTTOM OF FOOTING

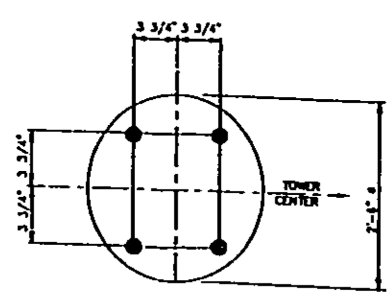




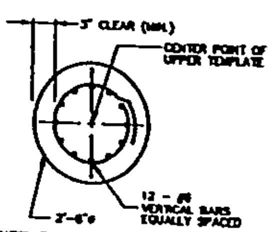
TIE DETAIL



VERTICAL BAR DETAIL



ANCHOR BOLT LAYOUT



PIER REINFORCING DETAIL

GENERAL NOTES:

1. 21.8 CUBIC YARDS OF CONCRETE REQUIRED PER PIER. ALL LOOSE MATL. SHALL BE REMOVED FROM EACH EXCAVATION BEFORE CONCRETE IS POURED. ALL STANDING WATER IN THE FROM EXCAVATION SHALL BE REMOVED PRIOR TO PLACEMENT OF CONCRETE.
2. MAXIMUM FREE DROP OF CONCRETE SHALL BE 6 FT. PROVIDED IT IS DIRECTED THRU A HOPPER OR EQUIVALENT. CONCRETE SHALL NOT HIT SIDES OF SOIL OR REINFORCING.
3. CONCRETE SHALL HAVE A MINIMUM COMPRESSION STRENGTH OF 3,000 PSI AT 28 DAYS AND SHALL BE INSTALLED IN ACCORDANCE WITH THE ACI-318-83 BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.
4. VERTICAL REINFORCING BARS SHALL BE OF GRADE 60, TIES OF GRADE 40 STEEL, WITH ASTM-A305 DEFORMATIONS AND DETAILED IN ACCORDANCE WITH ACI-315-80 (MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES).
5. ANCHOR BOLTS SHALL HAVE UNDISTURBED THREADS AND BE POSITIONED SO THAT INSPECTOR CAN MOVE THE ANCHOR BOLT TEMPLATE FROM TOP OF PIER TO TOP OF ANCHOR BOLTS. COAT THREADS WITH HEAVY GREASE.
6. BOTTOM ANCHOR BOLT TEMPLATE SHALL BE LEFT IN PLACE AS SHOWN.
7. TEST CYLINDERS SHALL BE MOLDED AND LABORATORY CURED IN ACCORDANCE WITH ASTM C31. THREE CYLINDERS SHALL BE TAKEN FOR EACH TRUCK. CYLINDERS SHALL BE TESTED IN ACCORDANCE WITH ASTM C39.
8. ALL REINFORCING STEEL MUST HAVE A 3 INCH COVER OF CONCRETE.
9. A 2'-6" SQ. PIER MAY BE USED INSTEAD OF THE 2'-6" DIA. PIER INDICATED (PER OPTION OF CONTRACTOR)
10. TOP OF ALL FOOTING PEDESTALS MUST BE AT THE SAME ELEVATION WITH RESPECT TO EACH OTHER. IN THE INSTANCE THAT GROUND LEVEL VARIES, THE MINIMUM DISTANCE FROM FINISHED GRADE TO TOP OF PEDESTAL SHALL BE 6".
11. FOUNDATION DESIGN IS BASED ON EIA "STANDARD SOIL".
12. EXCAVATIONS SHALL BE BACKFILLED AND THOROUGHLY COMPACTED IN 6" MAXIMUM LIFTS. FILL MATL. SHOULD BE NEARLY-FREE OF ORGANIC DEBRIS, ESSENTIALLY NON-PLASTIC, AND LESS THAN 3" IN MAXIMUM DIMENSION. IN GENERAL, WELL-GRADED MIXTURES OF GRAVEL, SAND, NON-PLASTIC SILT, AND/OR SMALL QTYS. OF CLAY ARE ACCEPTABLE FOR USE AS FILL.

HAL K. KAMIGAKI
REGISTERED PROFESSIONAL ENGINEER
No. 5277-E
HAWAII, U.S.A.

CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

[signature]

CHANDER P. NANGIA
REGISTERED PROFESSIONAL ENGINEER
No. [illegible]
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

[signature]

ACTUAL REACTIONS:

DOWN	70.7 k
UP	67.3 k
SHEAR	7.7 k

DESIGN REACTIONS:

DOWN	101.25 k
UP	91.125 k
TOTAL TOWER SHEAR	20.25 k
MOMENT	714.000 FT.-K

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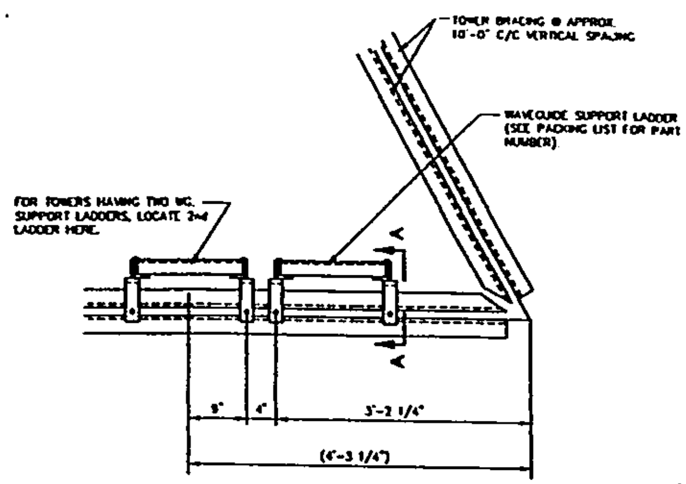
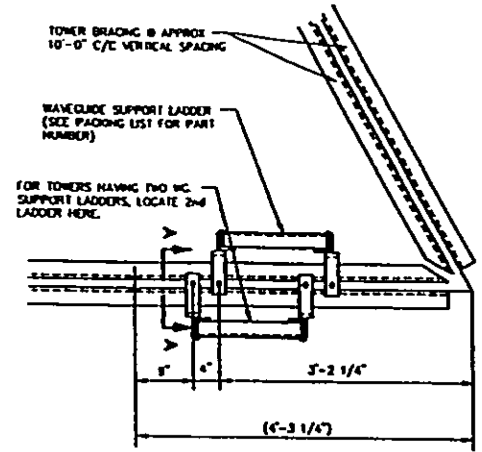
REV	DESCRIPTION	BY	APPD	DATE
A	RELEASED	MPJ	[illegible]	1/15/[illegible]

TITLE: MAT FOUNDATION FOR A 50' SST TOWER

FOR: HAWAII ELECTRIC



DETAIL # 1



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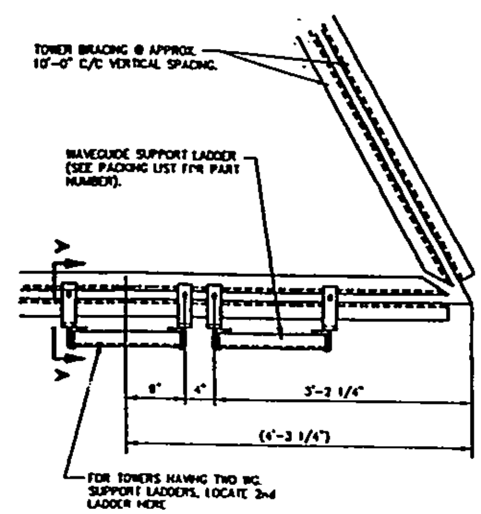

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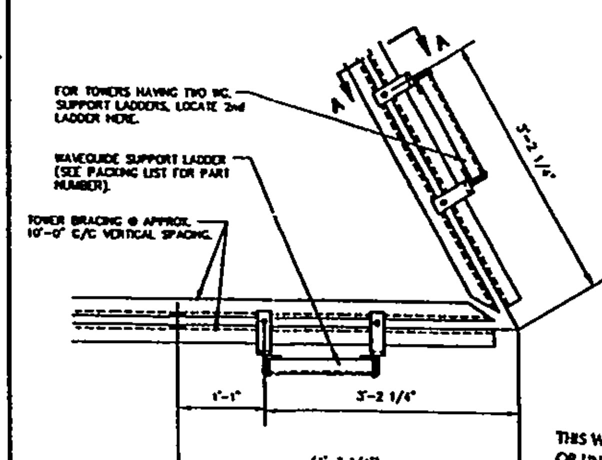

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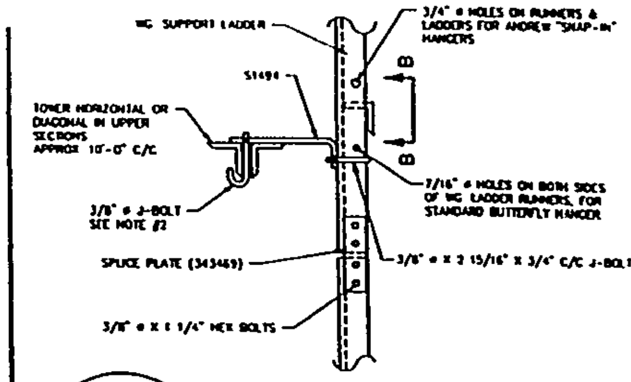

SECTION A–A

HAL K. KAMIGAKI
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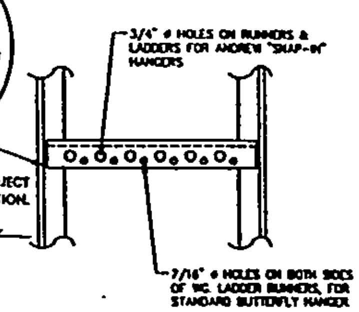

SECTION B–B

NOTES:

1. SEE KEY ASSEMBLY FOR PROPER MOUNTING FACE.
2. 3/8" ø X 2 15/16" X 3/4" C/C J-BOLT FOR HORIZ. (DIAG.) ANGLE LEGS 2" OR LESS.
   3/8" ø X 4" X 3/4" C/C J-BOLT FOR HORIZ. (DIAG.) ANGLE LEGS 2 1/2" AND 3".
   3/8" ø X 5" X 3/4" C/C J-BOLT FOR ANGLE LEGS 3 1/2" AND 4".
3. USE TYPE "HS" CLAMP & 3/8" ø X 1 1/4" HEX BOLTS FOR 1/2" CONDUIT. USE TYPE "HC" CLAMP & 3/8" ø X 1 1/4" HEX BOLTS FOR 3/4" ø AND 1" ø CONDUIT. ATTACH CONDUIT TO WAVEGUIDE LADDER AT APPROX. 10' CENTERS AND USE HOLE NEAREST RUNNER ABOVE. WRAPLOCK S.S. TAPE MAY ALSO BE USED TO ATTACH WAVEGUIDE OR CONDUIT TO WAVEGUIDE LADDER INSTEAD OF CLAMPS IF APPROVED BY CUSTOMER.

CHARLES ... NAGIA
REGISTERED PROFESSIONAL ENGINEER
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

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ISSUE	REVISIONS			DATE
G	DET. #2 3'-2 1/4" WAS 3'-6 1/4"	MF	S.J.	2/13/
F	REV. PICTORIAL SECT. A-A	MF	CD	5/3/8
E	REV. SPLICE PLT. LOC. SEC. A-A	MF	CD	1/3/8
D	REVISED DETAIL NO. 2 AND NOTES	JRC	DHK	4/29/
C	REVISED SECT A-A	BJB	LAF	9/12/
B	REVISED DETAIL NO. 2	JRC	JRF	9/19/
A	RELEASED	CSE	DJD	2/20/

TITLE: 3ST WAVEGUIDE SUPPORT INSTALLATION

STD.

01000215