4-3 Basic Plan

4-3-1 Calculation of Sizes for Major Shore Facilities and Fish Carrier Vessels

(1) Tongatapu Area (New Fishing Port at Fuau)

1) Those facilities, whose construction has been decided for the new Fuau fishing port, are as follows.

2 Ton Blast Freezer	2 sets
10 Ton Cold Storage (-30°C)	2 sets
10 Ton Dual Temperature Cold Storage	1 set
10 Ton Cold Storage (for chilled fish)	1 set
3 Ton Flake Ice Plant	1 set

2) Operation Days: 270 days

All the above mentioned facilities, excepting the blast freezers for tuna freezing and storage and the -30°C cold storages (used for freezing fish for export), are the main subjects of the Fish Marketing Project.

$$\frac{\begin{array}{l}(\text{Unloaded Quantity at Tongatapu} + \\ \text{Unloaded Quantity at Ha'apai} + \\ \text{Unloaded Quantity at Vava'u} + \\ \text{Unloaded Quantity at Niuatoputapu} \\ - \text{Loaded Quantity from 'Eua})\end{array}}{\text{Operation Days}} = \frac{2{,}505 \text{ (tons)}}{270 \text{ (days)}} \fallingdotseq 9 \text{ tons/day}$$

The actual catch fluctuates depending on the season or the month. During the skipjack and tuna season from October to March, the catch is double the average. On the other hand, during the poor season between July and August, the catch declines to one third of the average. In view of this fluctuation of the catch, facilities to store some 18 tons of fish will be required during the skipjack and tuna season.

As 2 10-ton cold storages will not be sufficient for this requirement in light of their designed capacities, 2 additional 10 m^2cold storages will be necessary.

With regard to the required quantity of ice, the calculation is made based on 0.7 tons of ice for each ton of fish as, unlike other areas, there is no demand for ice by fish carrier vessels.

The required quantity of ice is as follows.

$$\frac{955 \text{ tons}}{270 \text{ days}} \times 2 \times 0.7 \fallingdotseq 4.9 \text{ tons/day}$$

Since the flake ice plant produces 3 tons per day, an ice making plant with a capacity of approximately 1 ton/day will be newly required.

(2) 'Eua Area

With an average catch of 0.33 tons/day (potential catch ÷ 270 days) and a maximum catch of 0.7 tons/day in this area, the provision of an ice making plant with a capacity of 1 ton/day is preferable.

While the major consumption markets in this area are 'Eua and Nukualofa, cold storage facility will not be required due to the relatively low production vis-a-vis the demand.

A generator will be required due to the fact that the supply of electricity to produce ice is restricted to certain hours. In addition, the provision of a service centre will be required as no repair factory currently exists.

(3) Ha'apai Area

As the Ha'apai area consists of a number of islands, the collection of fish in this area is carried out in 3 groups.

A: Lifuka Group (total number of fishing boats: 188)
B: Ha'afeva Group (total number of fishing boats: 100)
C: Nomuka Group (total number of fishing boats: 82)

1) Lifuka Group

Lifuka Island is the centre of the Ha'apai area. The Fisheries Division is located here and has 2 20 m^3cold storages and an ice making plant with a capacity of 1 ton/day.

Out of the possible supply quantity of 980 tons/year from the Ha'apai area to consumption areas, half is estimated to be caught in the Lifuka Group. Therefore, as the catch per day in the Lifuka Group is 1.8 tons (980 tons ÷ 270 days x $\frac{1}{2}$), the current ice making capacity of 1 ton/day will not meet the requirement. Accordingly, the provision of an ice making plant with a capacity of 1 ton/day (minimum unit) will be required on Lifuka Island.

Uiha Island, located near Lifuka Island, is expected to play a back-up role for Lifuka Island in the Group. While the use of the existing cold storage is assumed, no ice making facilities currently exist on the island and, therefore, the provision of an ice making plant with a capacity of 1 ton/day is expected to meet the requirement for ice to go with the fish collection in the Lifuka Group.

2) Ha'afeva Group and Nomuka Group

In both of these Groups, neither cold storages, ice making facilities, power generating facilities nor water supply facilities currently exist. Therefore, storage facilities, ice making facilities, service centres and power generators will be provided to both Ha'afeva Island and Nomuka Island in order to make these islands the stock points of their respective groups.

(4) Vava'u Area

The possible supply quantity of some 2 tons/day is found by dividing the annual possible supply quantity for consumption areas of 580 tons by 270 operation days. As operation takes place 5 days a week, the weekly supply quantity is 10 tons. As in the case of Tongatapu and 'Eua, the skipjack and tuna season lasts from October to March in this area when the catch is doubled. The existing storage capacity of some 16 tons (mostly for skipjack and tuna) falls short by some 4 tons and, therefore, the provision of an additional 10 m^3 cold storage is preferred. In addition, with a daily unloaded quantity of some 4 tons, the provision of an additional ice making plant with a capacity of 1 ton/day is also preferred in view of the existing capacity.

(5) Niuatoputapu Area

As the annual possible supply quantity from this area to consumption areas is 60 tons, the monthly collection is expected to be 4-5 tons, necessitating the provision of a new 10 m^3 cold storage. The average catch per day is some 0.5 tons, however, in summer (October-March) skipjack and tuna migrate to this area. If the potential catch in summer is considered to be 1 ton/day, an ice making plant with a capacity of 1 ton/day will be required. Niuatoputapu is an isolated island without an electricity service and, therefore, the provision of a generator and a service centre is also required.

(6) Large Ice Boxes (approx. 1 m^3 x 3 pcs. = 1 unit)

The large ice boxes consist of a series of 31 m^3 heat-proof boxes. 2 boxes can store either 1 ton of ice or fish with the remaining box being used for cargo trimming or as a stand-by is case of a good catch.

1) 'Eua Area

Since no cold storage is provided on 'Eua Island, 2 units of large ice boxes will be provided in order to maintain the freshness of the fish while waiting for a fish carrier vessel to transport the fish to Tongatapu Island.

2) Ha'apai Area

As described earlier, the Ha'apai area consists of a large number of islands, making the direct unloading of fish from fishing boats to the respective major stock points (Lifuka, Uiha, Ha'afeva and Nomuka) difficult. Therefore, 11 units of large ice boxes will be provided to the 10 major islands (see Appendix 8) as sub-stock points at fishing villages to maintain the freshness of the fish while waiting for the small fish carrier vessel to transport the fish to the respective major stock points. This fish carrier vessel will supply ice for maintaining fish freshness and will transport the fish on its return journey. Large ice boxes are planned to be located at the following places.

Lifuka Group	Ha'ano Island	(45 boats)	2 units
	Mo'unga'one Island	(20 boats)	1 unit
	Lofanga Island	(16 boats)	1 unit
	Fotuha'a Island	(5 boats)	1 unit
Ha'afeva Group	Kotu Island	(18 boats)	1 unit
	Matuku Island	(16 boats)	1 unit
	Tungua Island	(16 boats)	1 unit
	O'ha Island	(17 boats)	1 unit
Nomuka Group	Fonoifua Island	(26 boats)	1 unit
	Mango Island	(14 boats)	1 unit

3) Vava'u Area

The Vava'u area also consists of a number of islands and, therefore, several-day storage is required before collections are made. Particularly at the Matamaka Village on Nuapapu Island, there are as many as 30 fishermen, resulting in a fairly large catch. As a result, the provision of a large ice box (1 unit) will be necessary to maintain fish freshness while waiting for a fish carrier vessel to Vava'u Island.

(7) Other Equipment and Machinery

Apart from the shore facilities described so far, large fish boxes (approximately 1 m^3) to be loaded onto vehicles for marketing on Tongatapu Island and various equipment and facilities, such as service centres, for the maintenance of the marketing facilities on remote islands, etc. will be required. Moreover, as most fishing boats have no ice storage facilities, ice boxes should be made and loaded onto boats to maintain fish freshness. In this regard, it may be preferable for the Government of Tonga to provide wood which is domestically available while the Japanese side provides heat insulation materials. Furthermore, the provision of display freezers at scores of villages on Tongatapu Island and the villages of other islands is preferred so that these freezers can act as stock points on the consumer-side.

4-3-2 Fish Carrier Vessels

(1) Distance Tables

Table 4-3-1

(Unit: nautical mile)

	Tongatapu	Nomuka	Ha'afeva	Uiha	Lifuka	Vava'u	Niuatop-utapu
Tongatapu		60	75	85	90	170	340
Nomuka	60		18	30		100	
Ha'afeva	75	18		17	20	85	
Uiha	85	28	17		8	80	
Lifuka	90	30	20	8		75	
Vava'u	170	100	85	80	75		170
Niuatoputapu	340					170	
'Eua	20						

Table 4-3-2 (Lifuka Group)

(Unit: nautical mile)

	Lifuka	Ha'ano	Moungaone	Lofanga	Fotuha'a	Uiha
Lifuka		10	12	11	20	8
Ha'ano	10		10	17	26	16
Moungaone	12	10		12	17	16
Lofanga	11	17	12		10	9
Fotuha'a	20	26	17	10		18
Uiha	8	16	16	9	18	

Table 4-3-3 (Ha'afeva Group) (Unit: nautical mile)

	Ha'afeva	Kotu	Natuku	Tungua	O'ua
Ha'afeva		5	5	5	1
Kotu	5		4	8	3
Natuku	5	4		5	3
Tungua	5	8	5		6
O'ua	2	3	3	6	

Table 4-3-4 (Nomuka Group) (Unit: nautical mile)

	Nomuka	Fonoifua	Mango
Nomuka		10	7
Fonoifua	10		15
Mango	7	15	

(2) Collection Amount

Ha'apai: 18 tons/week
Vava'u: 10 tons/week (winter), 20 tons/week (summer)
Niuatoputapu: 5 tons/month (winter), 10 tons/month (summer)

(3) Basic Design

A fish carrier vessel operating between major stock points should be able to make one trip between Tongatapu and Vava'u and another trip between Tongatapu and Ha'apai in a week to maintain the smooth operation of the fish marketing facilities at production areas and a stable supply of fish to consumption areas based on the collection amount shown in 3-2-2 above. As the loading amount is expected to be 70% of the collection amount (30% will be transported by the

cruising ferry "Oldvaha"), the maximum loading amount will be 14 tons. In addition, the use of this vessel for trip to the Niuatoputapu area should also be made possible.

Another fish carrier vessels operating in the Ha'apai Island area will connect major stock points and sub-stock points. It should be able to load 2 tons of fish, 4 tons of ice and should have a fuel supply to last for a week (5 days equivalent) for 1 trip visiting 1 major stock point and 2 sub-stock points. As it will cruise in the shallow water inside the reefs, a flat bottom type is preferable.

Since the period between the catch and the consumption of fish is within 10 days, both vessels should be equipped with ice packed fish transportation facilities.

4-3-3 List of Granted Facilities

(1) Shore Facilities

Table 4-3-5

Location	Item	Specifications	Quantity
Niuatoput-apu	Cold Storage	Approx. 9m^3, -20°C, air cooling type, 2 refrigerators	1
	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Service Centre		1
	Generator	Air cooling type, continuous operation	1
	Oil Tank for Generator	300ℓ-400ℓ	1
	Scale Weight 1 Suspended Type 2 Dial Type	 2kg 100kg	 1 1

Table 4-3-5 Ctd.

Location	Item	Specifications	Quantity
	Radio	SSB with antenna, compatible with the exisisting type	1
	Water Tank	$4m^3$	1
	Pump	For ice making and service centre, sea-water specification	1
	Plastic Container	Approx. 30ℓ	20
	Shelves		2
	Tools	For repair	1 set
	Spare Parts	For cold storage, ice making plant, generator, radio, etc.	for 1 year
Vava'u	Cold Storage	Approx. $9m^3$, -5°c, air cooling type, 2 refrigerators	1
	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Ice Box	Approx. $1m^3$ x 3 pieces, key, with drain hole	1 unit
	Radio	VHF, international version with 12CH, 1CH = 156.525 MHz, over 25W with antenna	1
	Plastic Container	Approx. 30ℓ	20
	Shelves		2
	Spare Parts	For cold storage, ice making plant, radio, etc.	for 1 year

Table 4-3-5 Ctd.

Location	Item	Specifications	Quantity
Ha'ano & Other Islands	Ice Box	Approx. $1m^3$ x 3 pieces, key, with drain hole	11 units
Lifuka	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Generator	Air cooling type, continuous operation	1
	Oil Tank for Generator	300ℓ-400ℓ	1
	Water Tank	$4m^3$	1
	Pump	Sea-water specification	1
	Spare Parts	For ice making plant, generator, etc.	For 1 year
Nomuka	Cold Storage	Approx. $9m^3$, -5°C, air cooling type, 2 refrigerators	1
	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Service Centre		1
	Generator	Air cooling type, continuous operation	1
	Oil Tank for Generator	300ℓ-400ℓ	1
	Scale Weight		
	1 Suspended Type	2kg	1
	2 Dial Type	100kg	1
	Radio	VHF, international version with 12CH, 1CH=156.525MHz, over 25W, with antenna	1

Table 4-3-5 Ctd.

Location	Item	Specifications	Quantity
	Water Tank	$4m^3$	1
	Pump	Sea-water specification	2
	Plastic Container	Approx. 30ℓ	20
	Shelves		2
	Tools	For repair	1 set
	Spare Parts	For cold storage, ice making plant, generator, radio, etc.	for 1 year
Ha'afeva	Cold Storage	Approx. $9m^3$, -5°C, air cooling type, 2 refrigerators	1
	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Service Centre		1
	Generator	Air cooling type, continuous operation	1
	Oil Tank for Generator	300ℓ-400ℓ	1
	Scale Weight		
	1 Suspended Type	2kg	1
	2 Dial Type	100kg	1
	Radio	VHF, international version with 12CH, 1CH=156.525MHz, over 25W, with antenna	1
	Water Tank	$4m^3$	1
	Pump	Sea-water specification	2
	Plastic Container	Approx. 30ℓ	20

Table 4-3-5 Ctd.

Location	Item	Specifications	Quantity
	Shelves		2
	Tools	For repair	1 set
	Spare Parts	For cold storage, ice making plant, generator, radio, etc.	for 1 year
Uiha	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Water Tank	$4m^3$	1
	Pump	Sea-water specification	1
	Generator	Air cooling type, continuous operation	1
	Oil Tank for Generator	300ℓ-400ℓ	1
	Spare Parts	For ice making plant, generator, etc.	for 1 year
Tongatapu	Cold Storage	Approx. $9m^3$, -50°C, air cooling type, 2 refrigerators for 1 room	2
	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Radio	UHF, international version with 12CH, 1CH = 156.525 MHz, over 25W, with antenna	1
	Shelves		4
	Plastic Container		40

Table 4-3-5 Ctd.

Location	Item	Specifications	Quantity
	Spare Parts	For cold storage, ice making plant, etc.	for 1 year
'Eua	Ice Making Plant	Plate ice, 1 ton/day, air cooling type with crasher, sea-water specification with 3-ton ice storage	1
	Service Centre		1
	Scale Weight		
	1 Suspended Type	2kg	1
	2 Dial Type	100kg	1
	Ice Box	Approx. $1m^3$ x 3 pieces key, with drain hole	1 unit
	Tools	For repair	1 set
	Spare Parts	For ice making plant, etc.	for 1 year
General	Display Freezer	Approx. 500ℓ, -20°C, 240V	
	Ice Box	Approx. 160ℓ	60
	Polystyrene Board	50mm	1 set
	Ice Box	Approx. $1m^3$ for distribution	5

(2) Fish Carrier Vessels

The basic design of fish carrier vessels should be based on the following considerations.

a.	Material	FRP (as described earlier)
b.	Navigating Area	Either coastal or offshore
c.	Type of Boat	Either standard or barge type
d.	Speed & Engine	Required speed and HP of main engine
e.	Economy	Low running cost

1) Inter-Islands Fish Carrier Vessel (FRP)

L.O.A.	:	approx. 16 m
Main Engine	:	150 - 180 HP
Fish Hold Capacity:		approx. 20 m^3
Speed	:	over 6 kt
Crising Range	:	600 - 800 nautical miles
Crew:	:	4
Derrick		
Tender Boat		

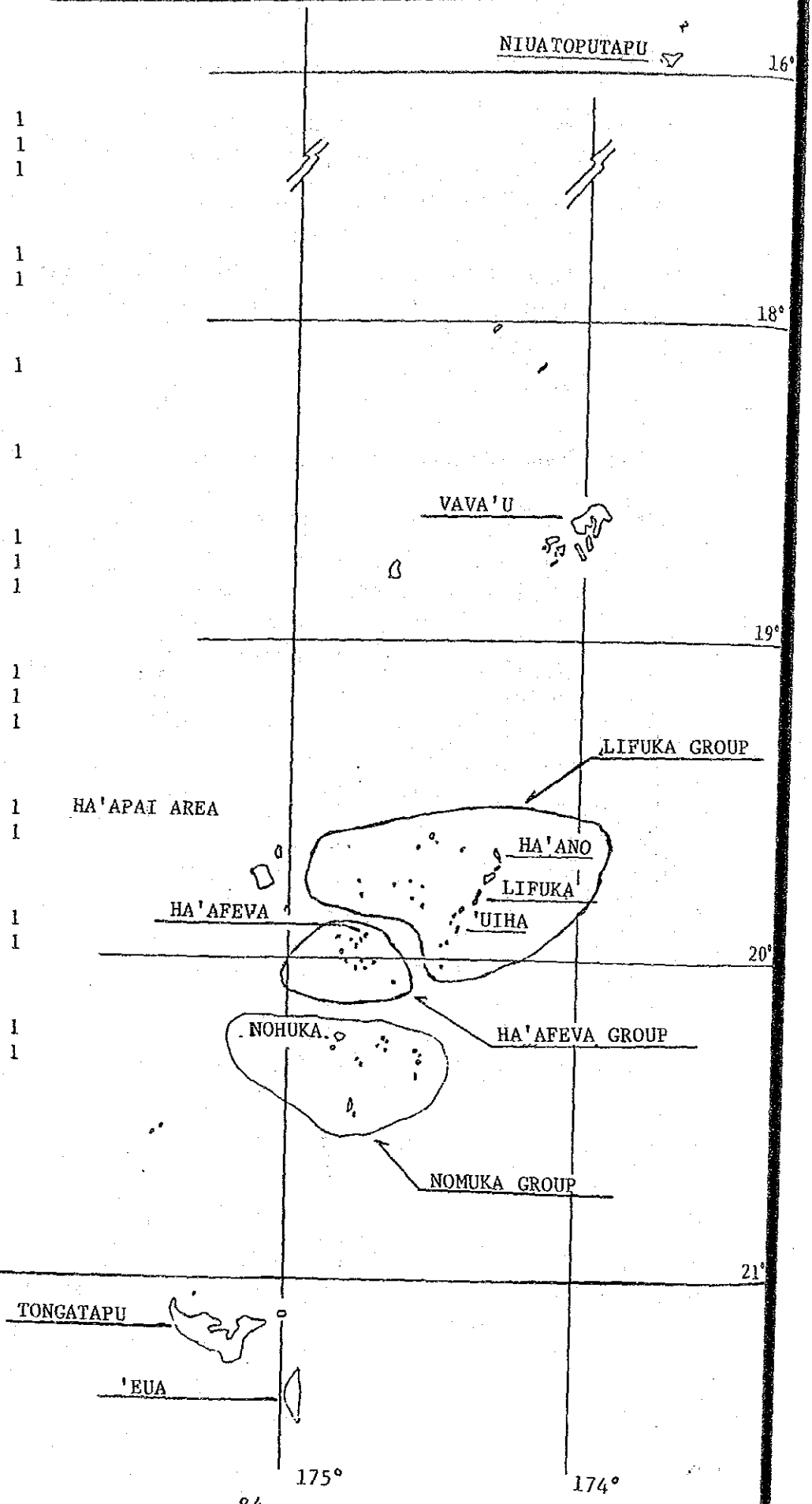
2) Inter-Ha'apai Area Fish Carrier Vessel (Flat-Bottom)

L.O.A.	:	approx. 10 m
Main Engine	:	60 - 90 HP
Fish Hold Capacity:		3 - 5 m^3 25 - 30 ice boxes
Speed	:	approx. 6 kt
Crew:	:	3
Derrick		
Tender Boat		

(3) Location of Major Facilities

Location of Major Facilities (Draft)

Niuatoputapu	
Cold Storage	1
Ice Making Plant	1
Service Centre	1
Vava'u	
Cold Storage	1
Ice Making Plant	1
Lifuka	
Ice Making Plant	1
'Uiha	
Ice Making Plant	1
Ha'afeve	
Cold Storage	1
Ice Making Plant	1
Service Centre	1
Nomuka	
Cold Storage	1
Ice Making Plant	1
Service Centre	1
Tongatapu	
Cold Storage	1
Ice Making Plant	1
'Eua	
Ice Making Plant	1
Service Centre	1
Carrier Vessels	
Inter-Islands	1
Inter Ha'apai Area	1



4-3-4 Basic Design Standards

(1) Cold Storage Facilities

There are 2 types of cold storage facilities, i.e. reinforced concrete structure and steel-frame structure. In Japan, large multiple-story cold storages are generally built using the reinforced concrete structure while small one-story cold storages are built using the steel-frame structure.

As the cold storage facilities in the present Project are as small as some 9 m^3, the steel-frame structure will be used. With regard to the refrigerator itself, the pre-fabricated panel assembly method will be used in view of its short construction period and the easy nature of its construction.

It is assumed that the possible repair work for a refrigerator takes a long time and, therefore, 2 refrigerators, both with a capacity to meet the requirements by 100%, will be installed with a view to using a stand-by refrigerator to prevent the quality deterioration of stored fish at the time of a breakdown.

1) Design Criteria

Interior Capacity	: approx. 9 m^3
Exterior Measurements	: 2.7 m (W) x 1.8 m (L) x 2.2 m (H)
Minimum Temperature	: -20°C:(1 site), -5°C:(5 sites)
Outside Air Conditions	: +32°C, 70% (Humidity)
Storage Volume of Fresh Fish	: 600 kg/day, slow freeze
Loading Method	: Hand loading, 2 m high

2) Heat Insulation Plan

Heat Insulation Thickness:	100 mm
Finishing	: Ceiling and floor (coloured aluminium for both sides) Walls (coloured aluminium for exterior, key span for interior)
Heat-Proof Door	: 850 mm (W)x 1,700 mm(H)x 100 mm (T) (coloured aluminium for both sides)

3) Refrigerator Plan

Type	:	Uses fluorine refrigerant, sealed air-cooling type
Cooling Capacity	:	1,400 kCal/hour at a room temperature of -20°C and an outside temperature of +32°C, 2,500 kCal/hour at a room temperature of 5°C and an outside temperature of +32°C
Output	:	2.2 kW
Number of Units	:	2 units for 1 room

(2) Ice Making Facilities

Ice making facilities can be largely divided into 3 different categories depending on the types of ice produced, i.e. block ice, flake ice and plate ice. In view of the functional aspects of each type of ice, block ice is unsuitable when sea water is used as the raw water. Plate ice has an advantage over flake ice in that it is thicker and less quick to melt. Therefore, plate ice can use sea water as the raw water and is less quick to melt than block ice or flake ice.

As a result of the Study Team's survey, Plate ice has been selected as the ice most suitable for the Tongan situation.

1) Design Criteria

Raw Water Used	:	Sea water
Raw Water Temperature	:	28°C
Capacity	:	1 ton/day, plate ice, with crasher, fully-automatic production system

2) Ice Storage Plan

Ice Storage	:	Storage of 3 tons of ice
Panel	:	Coloured aluminium for both sides, hard urethane, sandwich panels

(3) Service Centres

Due to the current lack of a repair factory, service centres will be constructed at certain storage points to provide maintenance services for storage facilities. These service centres will also be engaged in the simple processing and sale of fish.

Design Criteria

Area	: 81 m^2
Structure	: Steel-frame
Roof	: Colour plates --- 0.6 mm(T) Inside --- heat-proof material (polyetyrene) 4 mm (T)
Outer Walls	: Corrugated coloured steel plates
Bottom Walls	: 800 mm (H) with concrete blocks

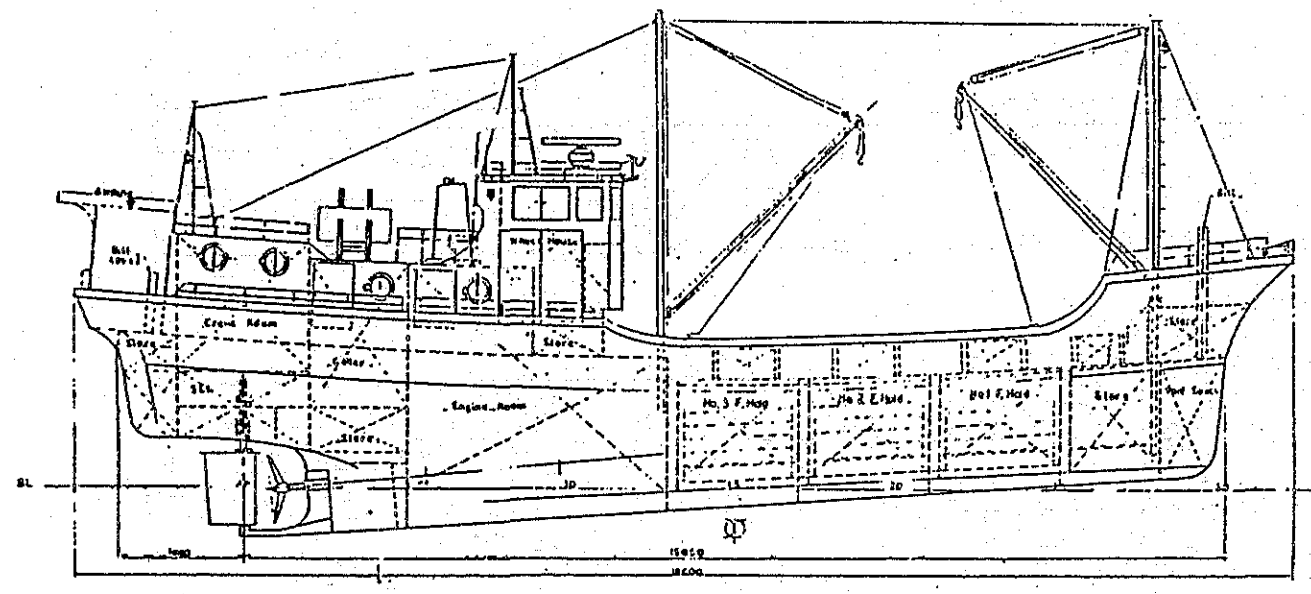
(4) Fish Carrier Vessels

There are no shipbuilding regulations in Tonga and, therefore, it is the custom to apply the corresponding Japanese regulations. The application of this practice has been confirmed in regard to the present Project.

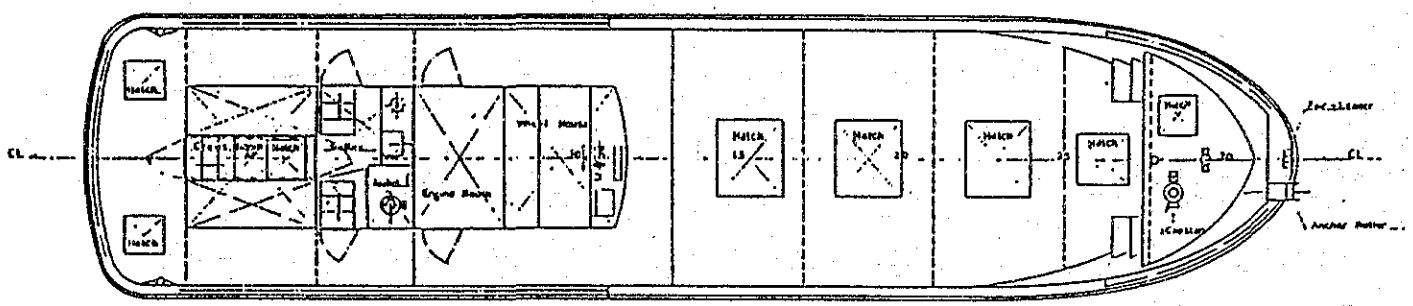
4-3-5 Drawings

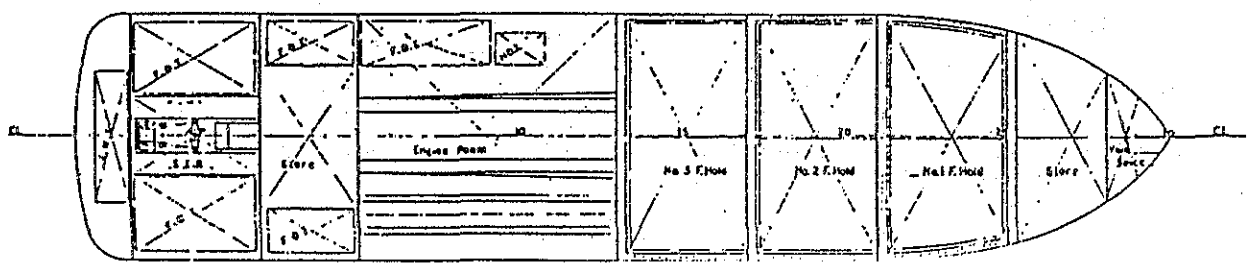
Drawing Titles

1. General Arrangement 17 G.T. Type FRP Fish Collection Vessel
2. General Arrangement 5 G.T. Type FRP Fish Collection Vessel
3. Icemaking Plant, Cold Storage and Service Centre for NIUATOPUTAPU, HA'AFEVA and NOMUKA
4. Cold Storage in Service Centre for NIUATOPUTAPU, HA'AFEVA and NOMUKA
5. Cold Storage for NIUATOPUTAPU, HA'AFEVA and NOMUKA
6. Service Centre for NIUATOPUTAPU, HA'AFEVA and NOMUKA
7. Icemanking Plant for NIUATOPUTAPU, VAVA'U, LIFUKA, UIHA, HA'AFEVA, NOMUKA, TONGATAPU and 'EUA
8. Cold Storage for VAVA'U
9. Cold Storage and Icemaking Plant for VAVA'U
10. Icemaking Plant for LIFUKA
11. Icemaking Plant for UIHA
12. Icemaking Plant and Cold Storage for TONGATAPU
13. Cold Storage for TONGATAPU
14. Icemaking Plant and Service Centre for 'EUA

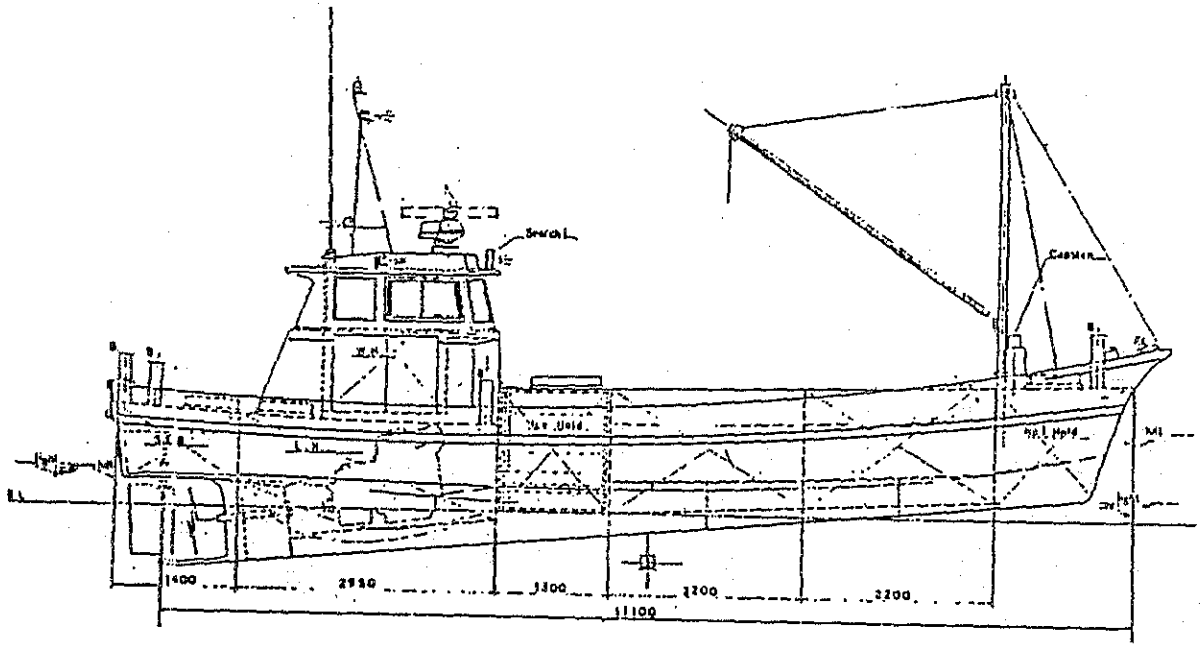


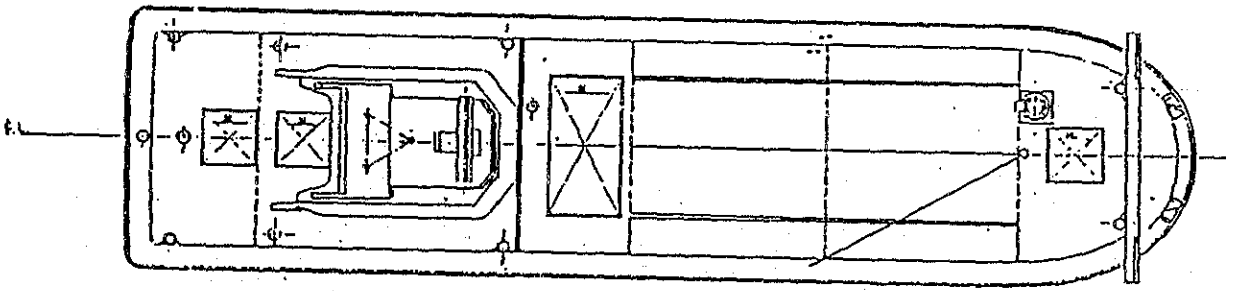
L.O.A.	abt	16 m
BREADTH	"	4 m
DEPTH	"	1.5 - 1.8 m
GROSS TONNAGE ...	"	17 ton
MAIN ENGINE	"	150 - 180 HP
AUX ENGINE	"	30 HP
FISH HOLD	"	3 - 5 m^3
FRESH WATER	"	1,000ℓ
FUEL OIL	"	5,000ℓ
DESINED SPEED (MAX)	above	6 kt

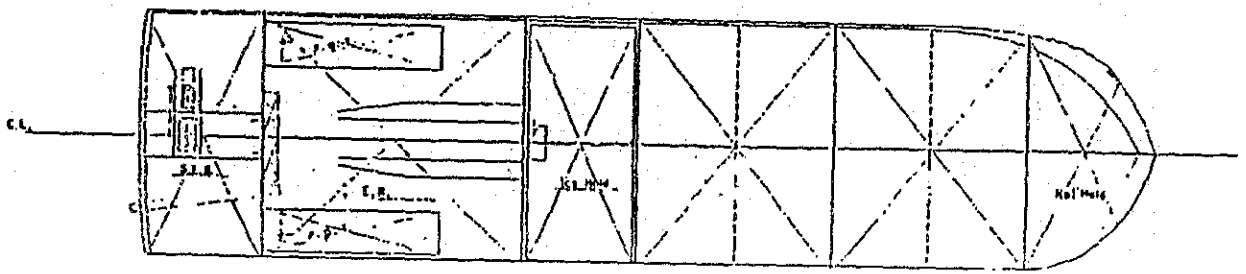




GENERAL ARRANGEMENT
17 G.T. TYPE FRP
FISH COLLECTION VESSEL

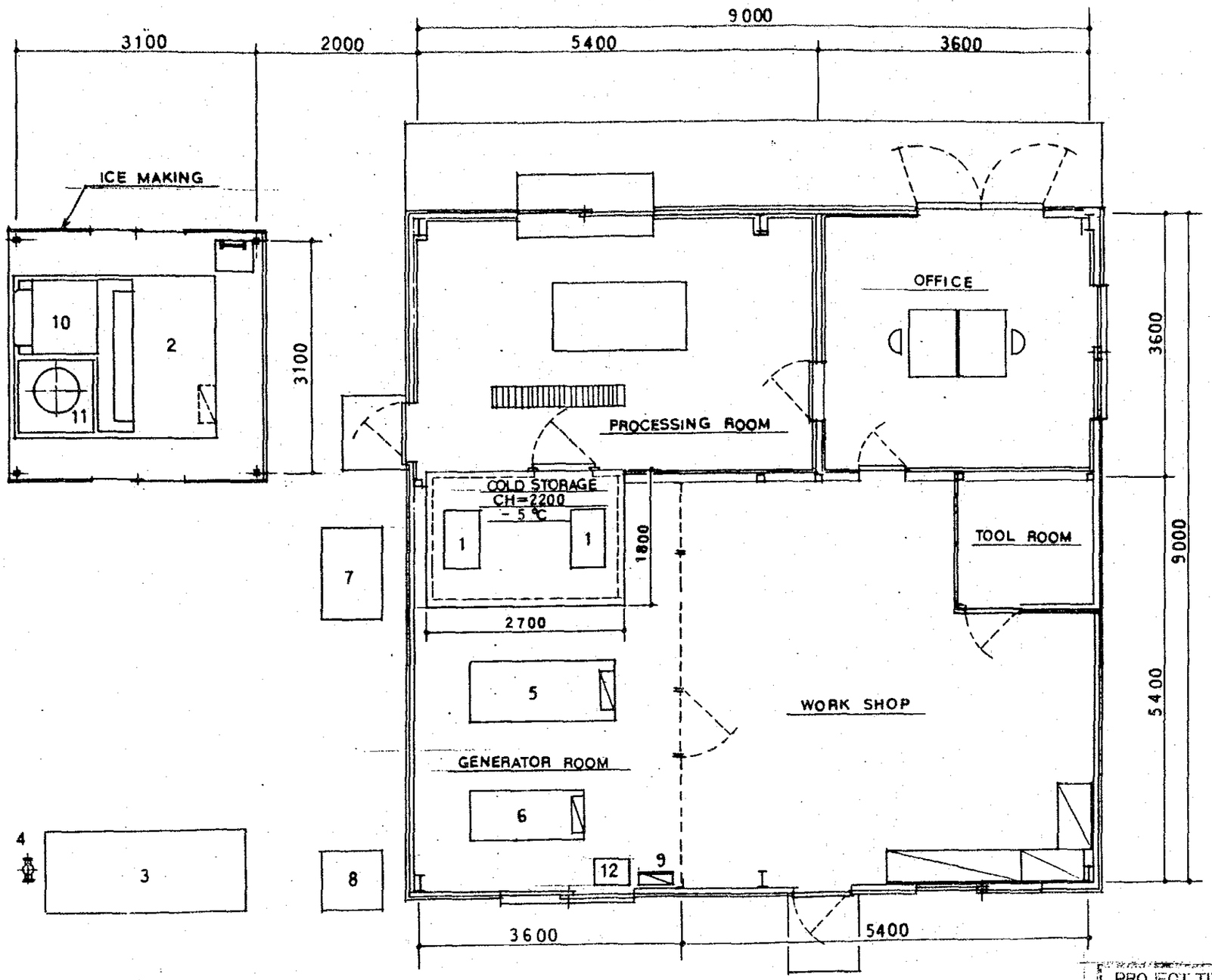






L.O.A.	abt	10 m
BREADTH	"	16 m
DEPTH	"	1.0 - 1.5 m
GROSS TONNAGE ...	"	5 ton
MAIN ENGINE	"	60 - 90 HP
FISH HOLD	"	3 - 5 m^3
FRESH WATER	"	200ℓ
FUEL OIL	"	1,000ℓ
DESIGNED SPEED (MAX)	above	6 kt

GENERAL ARRANGEMENT
5 G.T. TYPE FRP
FISH COLLECTION VESSEL



FLOOR PLAN

No	DESCRIPTION	QUT	REMARK
1	COOLING UNIT	2	AFL-2C×1.5KW
2	ICE MAKING MACHINE	1	1T/D PLATE ICE
3	RAIN WATER TANK	1	4M³ FRP
4	RAIN WATER PUMP	1	40SQN×0.4 KW
5	DIESEL GENERATOR	1	38KVA
6	〃	1	10KVA
7	FUEL OIL TANK	1	700ℓ
8	〃	1	390ℓ
9	POWER BOARD	1	
10	CONDENSER	1	AIR-COOLED
11	DEFROST TANK	1	1.5TON
12	TRANSFORMER	1	10KVA

PROJECT TITLE
The Fish Marketing Development Project in TONGA

DRAWING TITLE
Icemaking Plant, Cold storage and Service Centre for NIUATOPUTAPU, HA'APAI and NONUKA

DATE 11, NOV. 85.

SCALE 1/50

APPROVED BY

CHECKED BY

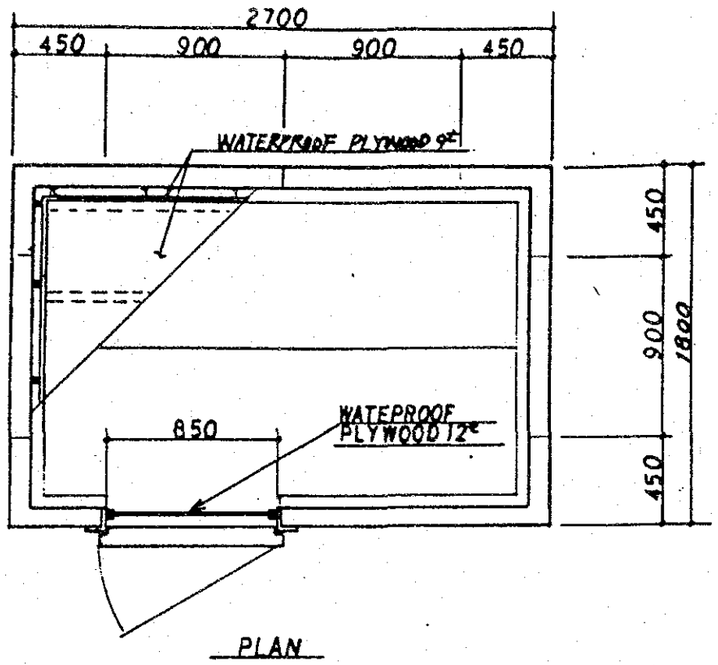
DESIGNED BY

DRAWING BY

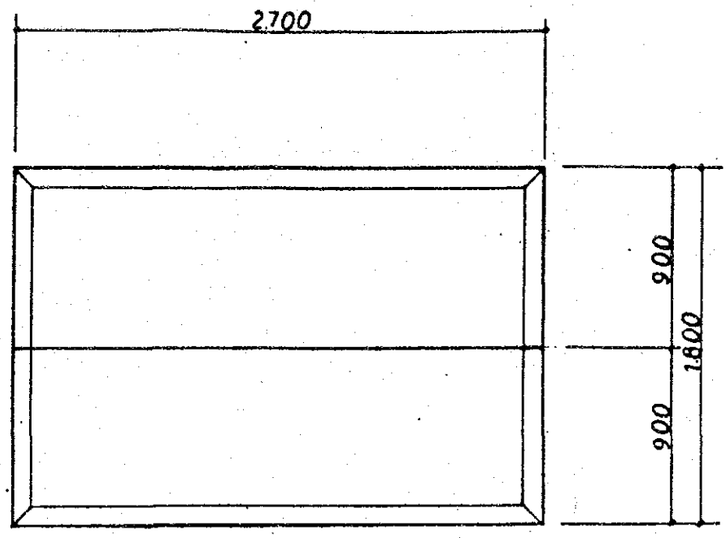
DRAWING NO.

㈱ TAIYO FISHERY CO., LTD

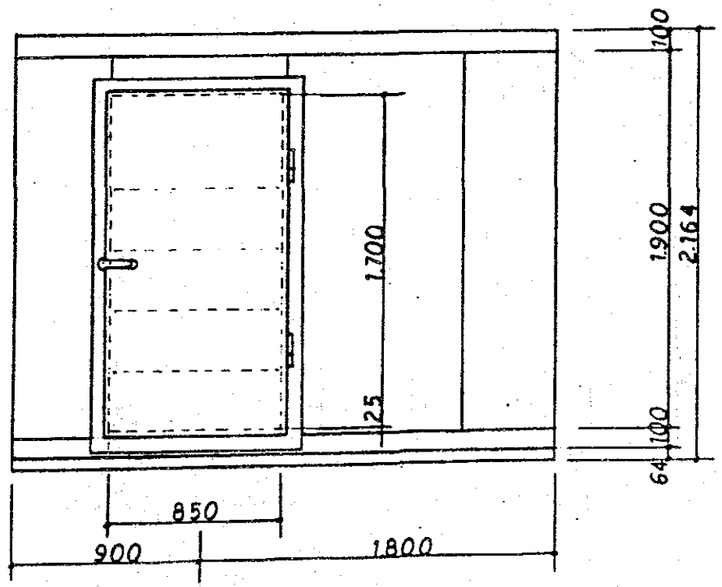
ICE STORAGE



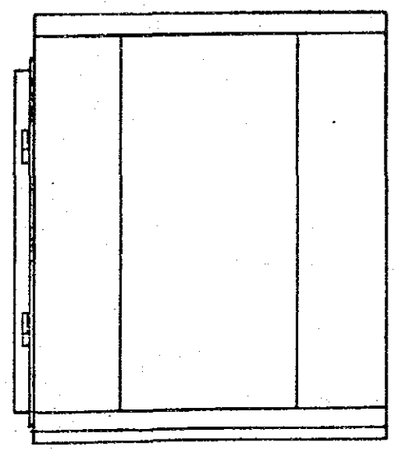
PLAN



PLAN

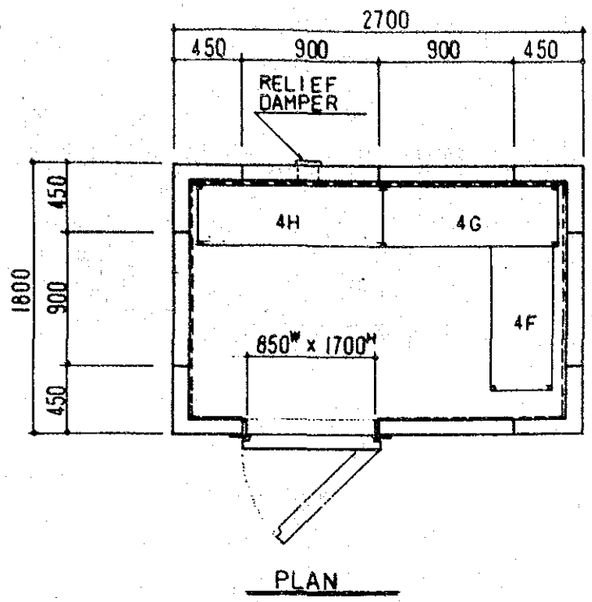


ELEVATION

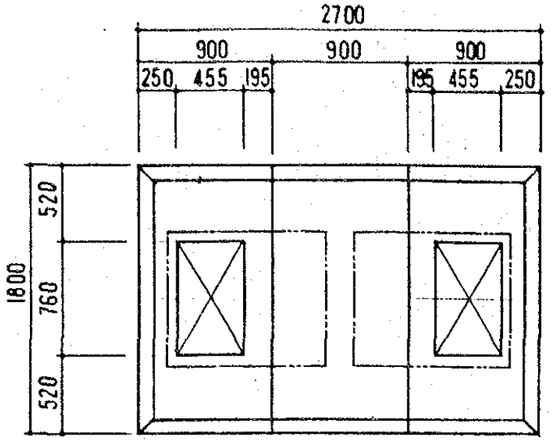


ELEVATION

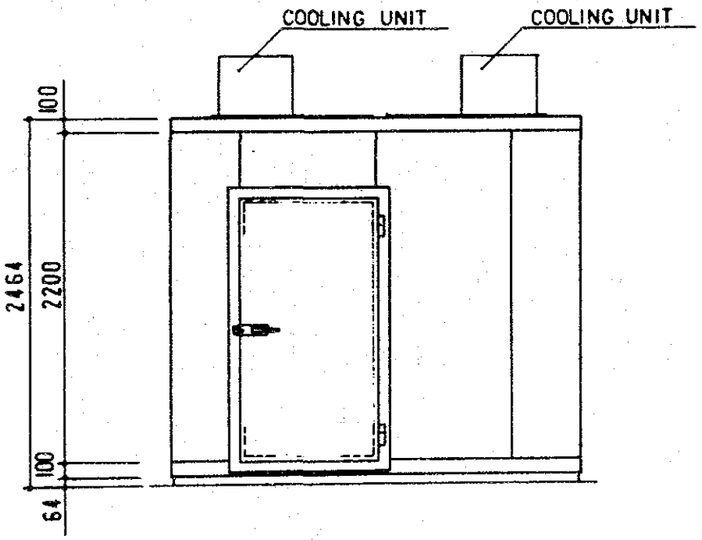
PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Cold Storage in Service Centre for NIUATOPUTAPU, HA'AFEVA and NOMUKA	DESIGNED BY
	DRAWING BY
DATE: 11 NOV. '85 / SCALE: 1/30	DRAWING NO.
TAIYO FISHERY CO., LTD.	



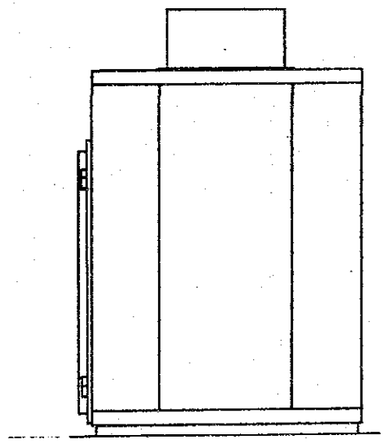
PLAN



CEILING PANEL



FRONT VIEW



SIDE VIEW

SPECIFICATION

WALL PANEL
OUTSIDE : COLOUR COATED ALUMINIUM SHEET
INSIDE : CORRUGATED COLOUR COATED ALUMINIUM SHEET

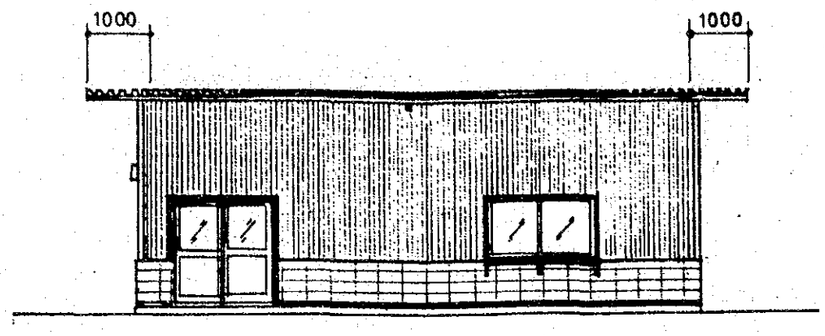
CEILING PANEL
OUTSIDE : COLOUR COATED ALUMINIUM SHEET
INSIDE : COLOUR COATED STEEL SHEET

FLOOR PANEL
OUTSIDE : COLOUR COATED ALUMINIUM SHEET
INSIDE : COLOUR COATED ALUMINIUM SHEET

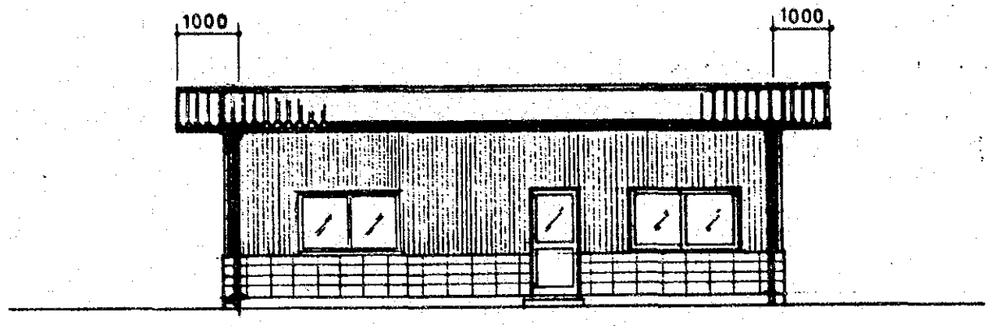
ACCESSORY
SHELF & DRAIN BOARD
COOLING UNIT AFR-28 x2 (1.5 kw)

DOOR HEATER 82 W
RELIEF DAMPER HEATER 40 W

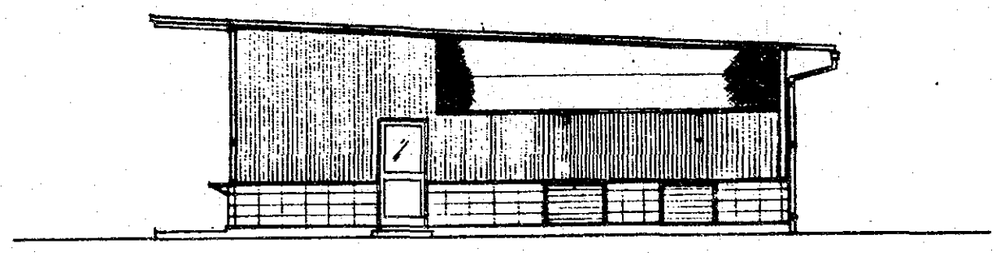
PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Cold Storage for NIUATOPUTAPU, HA'AFEVA and NOMUKA	DESIGNED BY
	DRAWING BY
DATE 11, NOV. '85 / SCALE 1/40	DRAWING NO.
㈱ TAIYO FISHERY CO., LTD.	



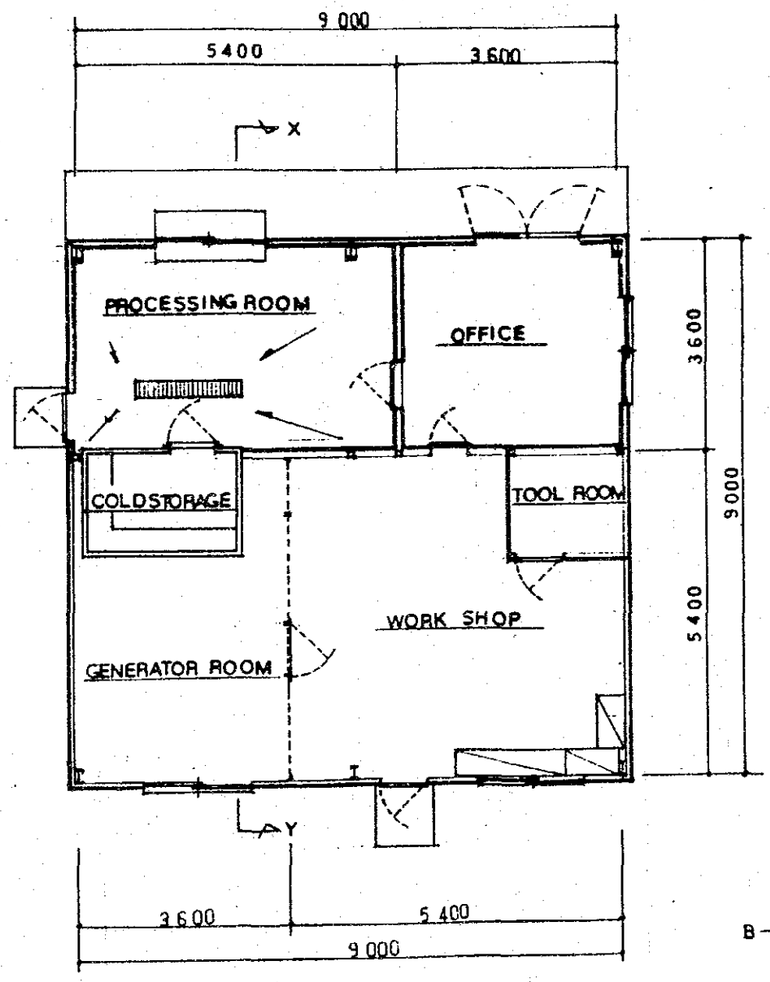
"A" VIEW

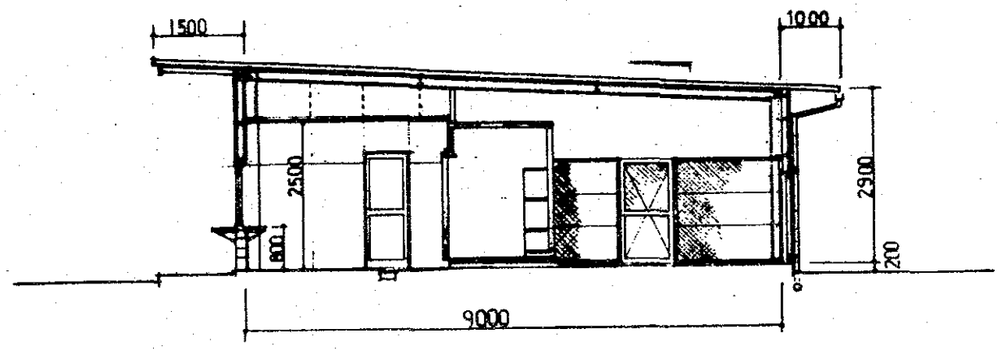


"C" VIEW

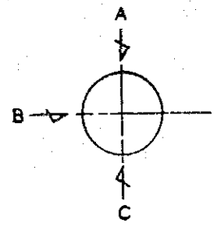


"B" VIEW

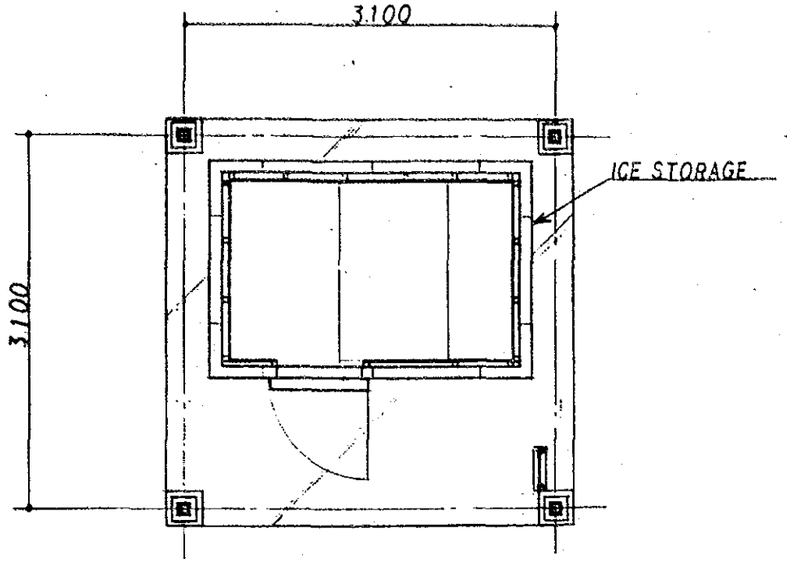




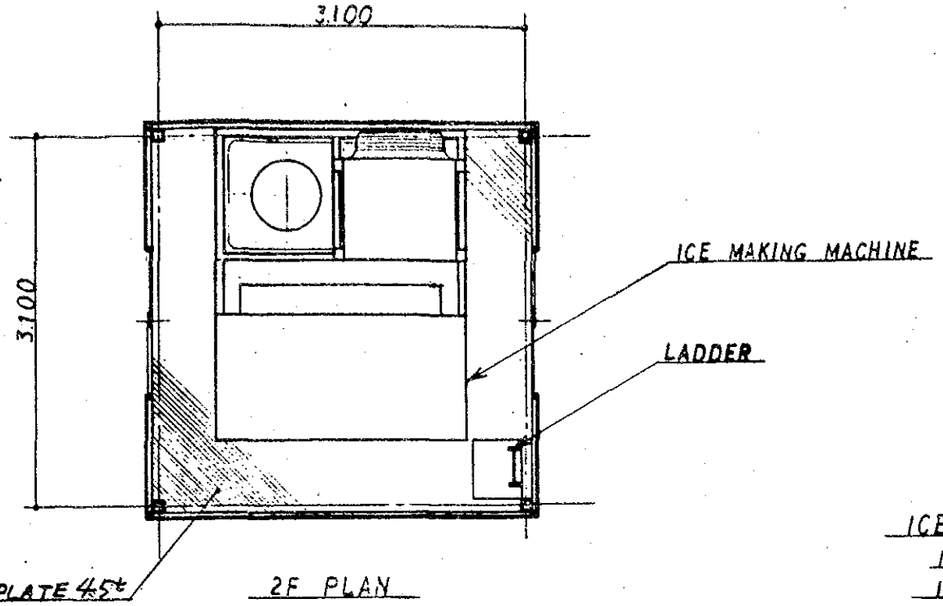
"X–Y" VIEW



PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
	DESIGNED BY
DRAWING TITLE: Service Centre for NIUATOPUTAPU, HA'AFEVA and NOMUKA	DRAWING BY
DATE: 11, NOV. '85 / SCALE: 1/100	DRAWING NO.
TAIYO FISHERY CO., LTD.	

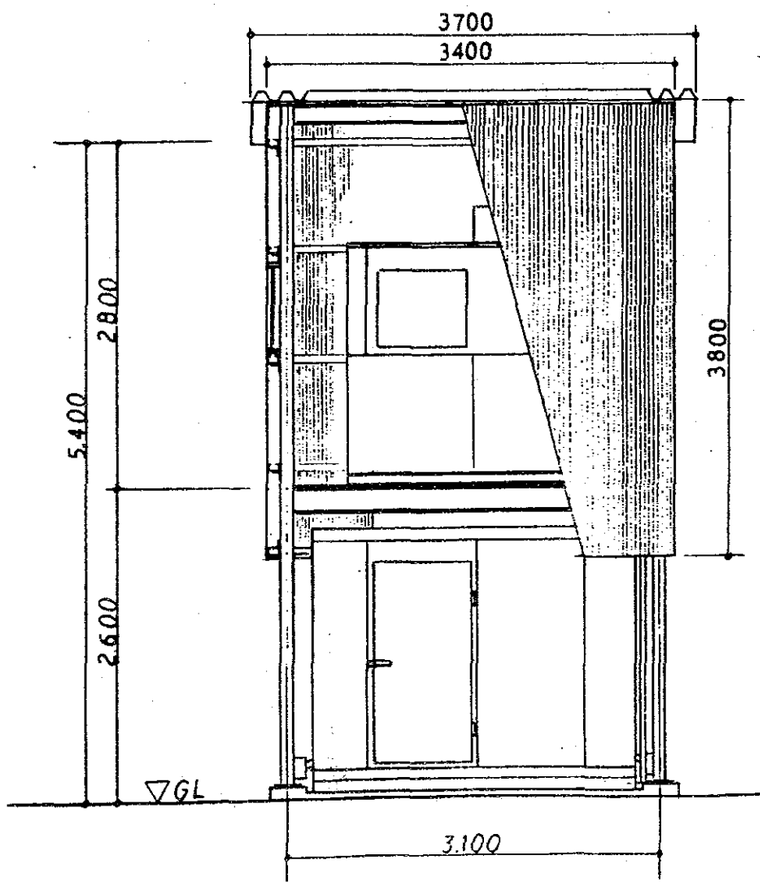


1F PLAN

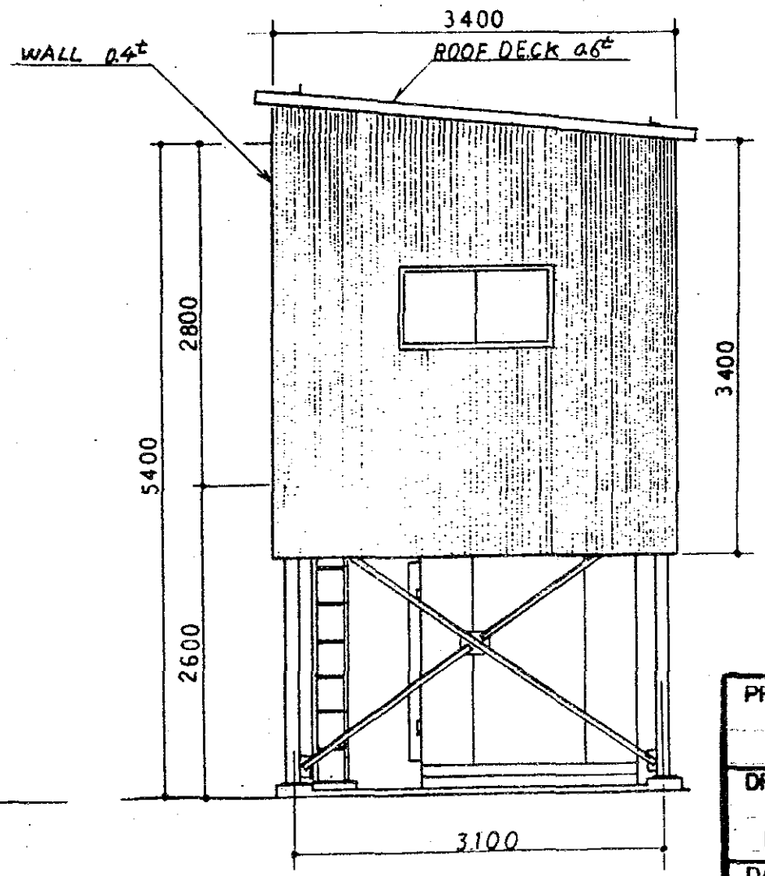


2F PLAN

ICE MAKING PLANT
ICE MAKING CAPACITY 1 TON DAY
ICE STORAGE CAPACITY 3 TON

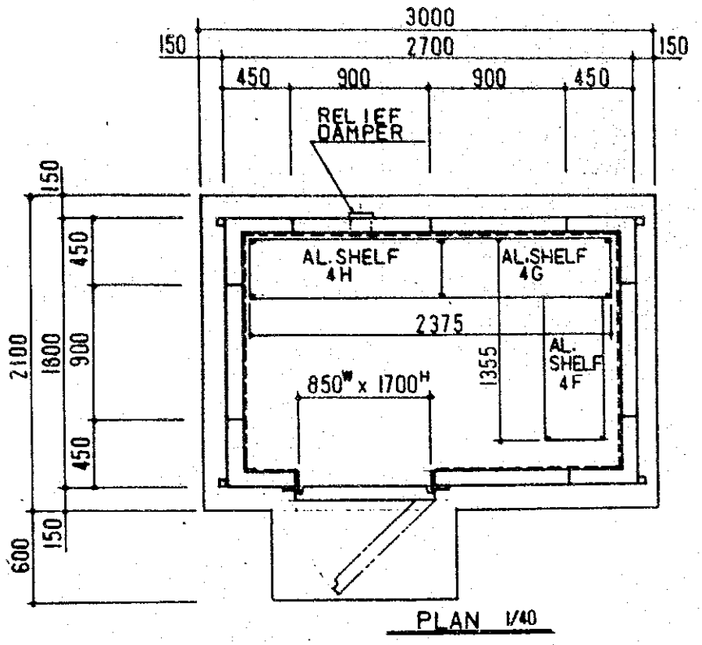


ELEVATION

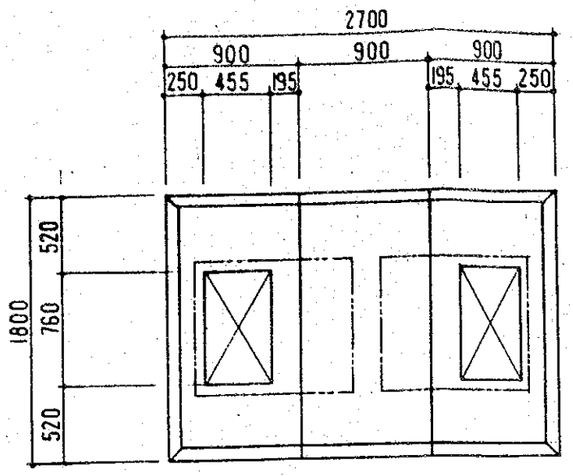


ELEVATION

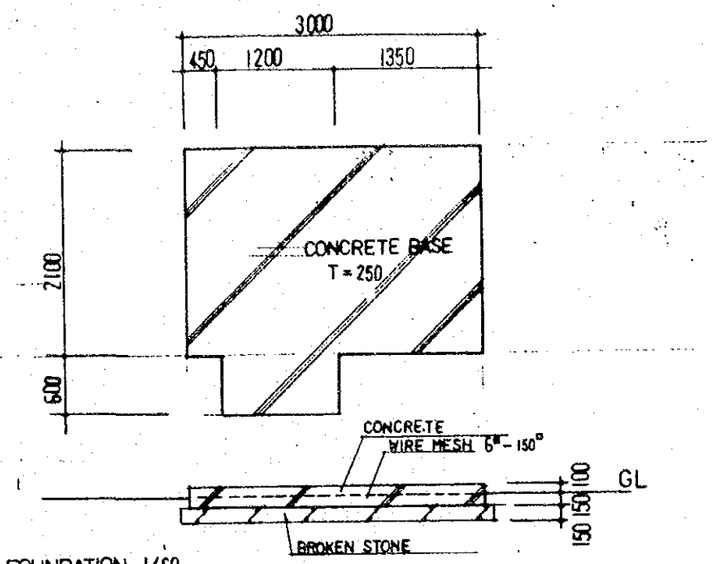
PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Icemaking Plant for NIUATOPUTAPU, VAVA'U, LIFUKA, UIHA, HA'AFEVA, NOMUKA, TONGATAPU and 'EUA	DESIGNED BY
	DRAWING BY
DATE: 11, NOV. '85 / SCALE: 1/50	DRAWING NO.
㈱ TAIYO FISHERY CO., LTD.	



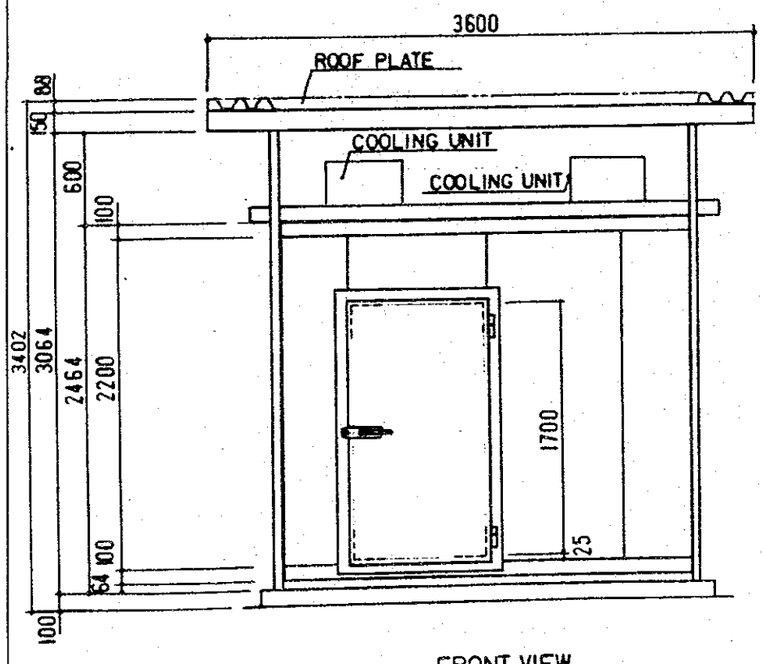
PLAN 1/40



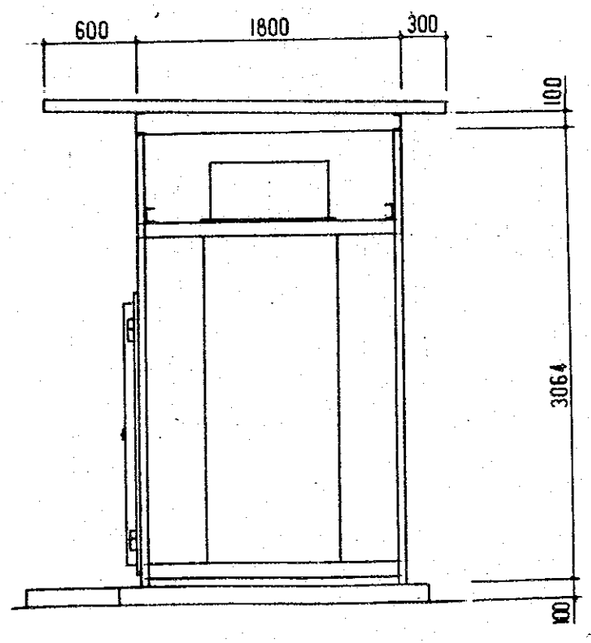
CEILING PANEL



FOUNDATION 1/60



FRONT VIEW



SIDE VIEW

SPECIFICATION

WALL PANEL
OUTSIDE : COLOUR COATED ALUMINIUM SHEET
INSIDE : CORRUGATED COLOUR COATED ALUMINIUM SHEET

CEILING PANEL
OUTSIDE : COLOUR COATED ALUMINIUM SHEET
INSIDE : COLOUR COATED STEEL SHEET

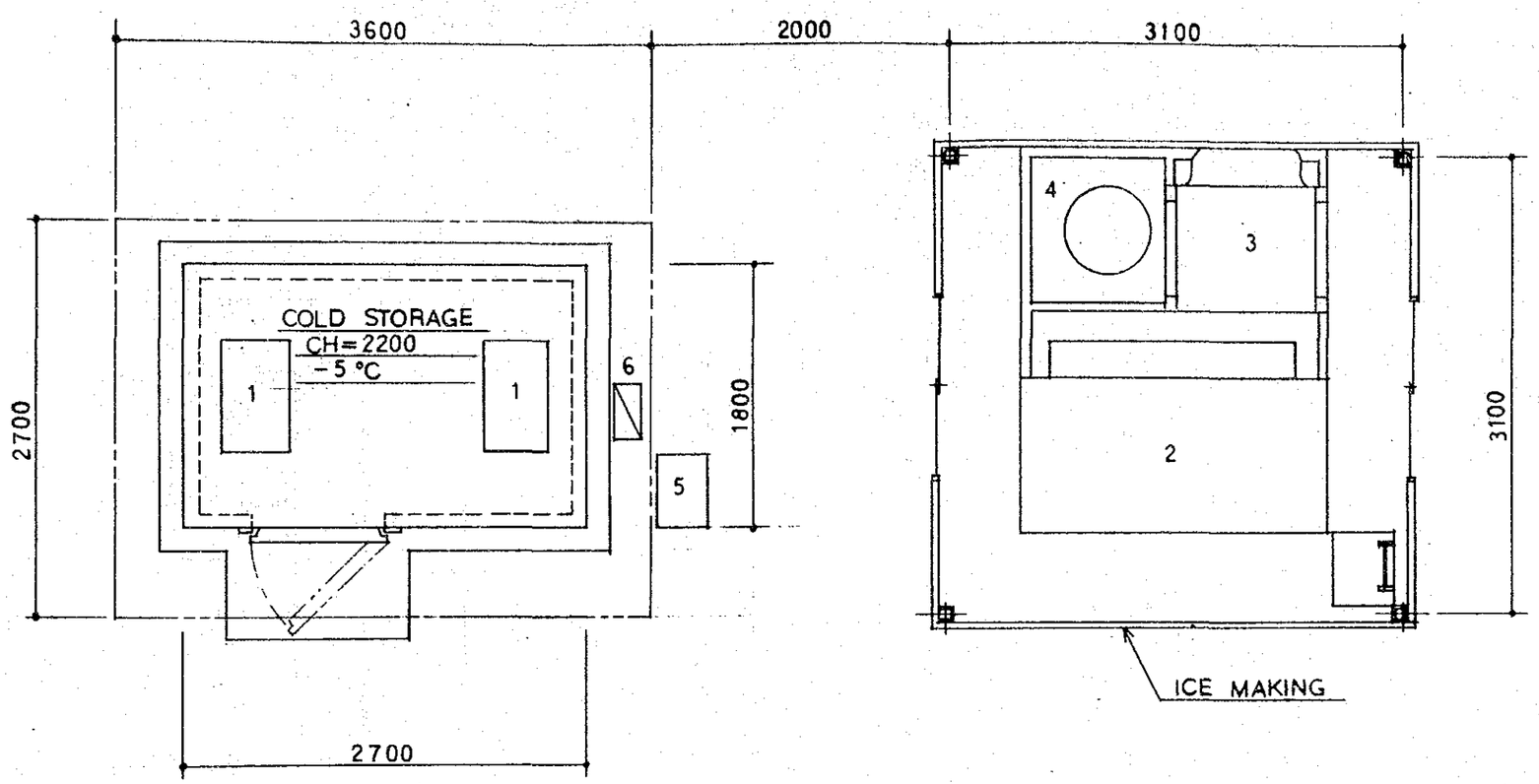
FLOOR PANEL
OUTSIDE : COLOUR COATED ALUMINIUM SHEET
INSIDE : COLOUP COATED ALUMINIUM SHEET

ACCESSORY
SHELF & DRAIN BOARD
COOLING UNIT AFL-2C X2 (1.5KW)

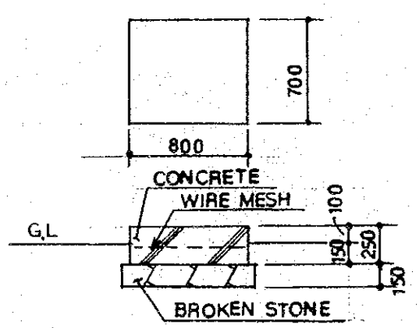
DOOR HEATER : 82 W
RELIEF DAMPER HEATER : 40 W

PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Cold storage for VAVA'U	DESIGNED BY
	DRAWING BY
DATE 11, NOV. '85 / SCALE 1/40	DRAWING NO.
TAIYO FISHERY CO., LTD.	

No	DESCRIPTION	QUT	REMARK
1	COOLING UNIT	2	AFL-2C x 1.5^{KW}
2	ICE MAKING MACHINE	1	1 T/D PLATE ICE
3	CONDENSER	1	AIR-COOLED
4	DEFROST TANK	1	1.5^{TON}
5	TRANSFORMER	1	10^{KVA}
6	POWER BOARD	1	

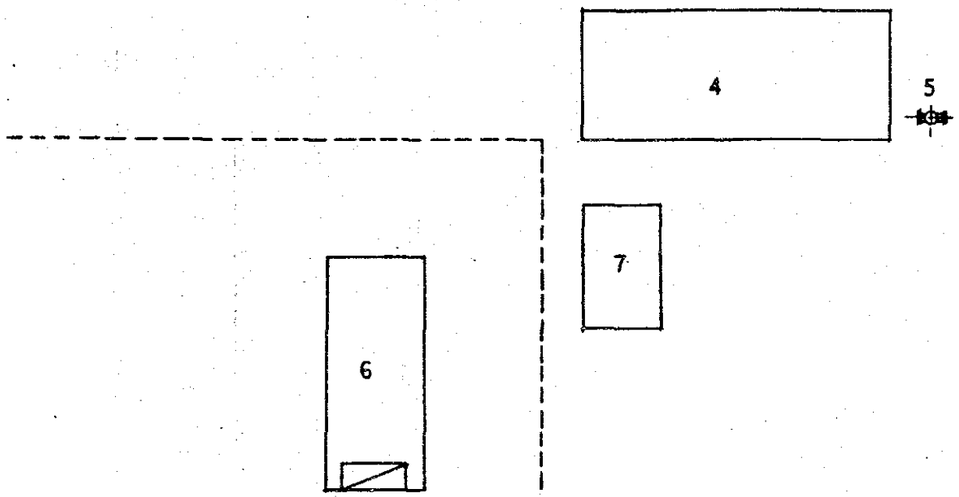


TRANSFORMER FOUNDATION

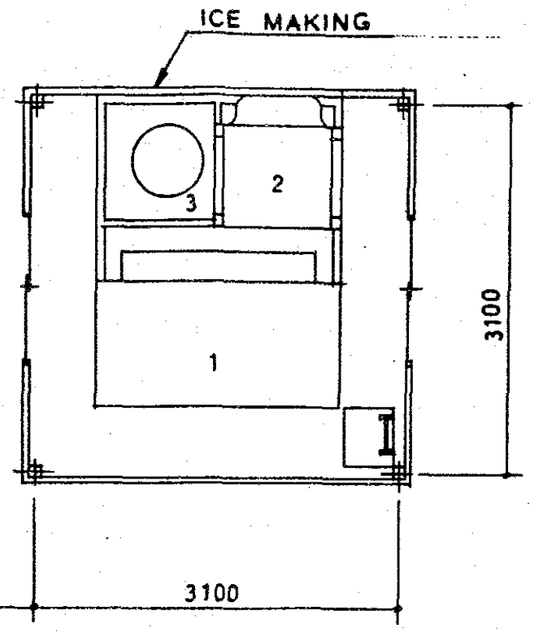


PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Cold storage and Icemaking plant for VAVA'U	DESIGNED BY
	DRAWING BY: Koji Higuchi
DATE: 11, NOV. '85 — SCALE: 1/40	DRAWING NO.
TAIYO FISHERY CO., LTD.	

No	DESCRIPTION	QUT	REMARK
1	ICE MAKING MACHINE	1	1T/D PLATE ICE
2	CONDENSER	1	AIR-COOLED
3	DEFROST TANK	1	1.5 TON
4	RAIN WATER TANK	1	4 M³ FRP
5	RAIN WATER PUMP	1	40SQN x0.4 KW
6	DIESEL GENERATOR	1	38 KVA
7	FUEL OIL TANK	1	700 L

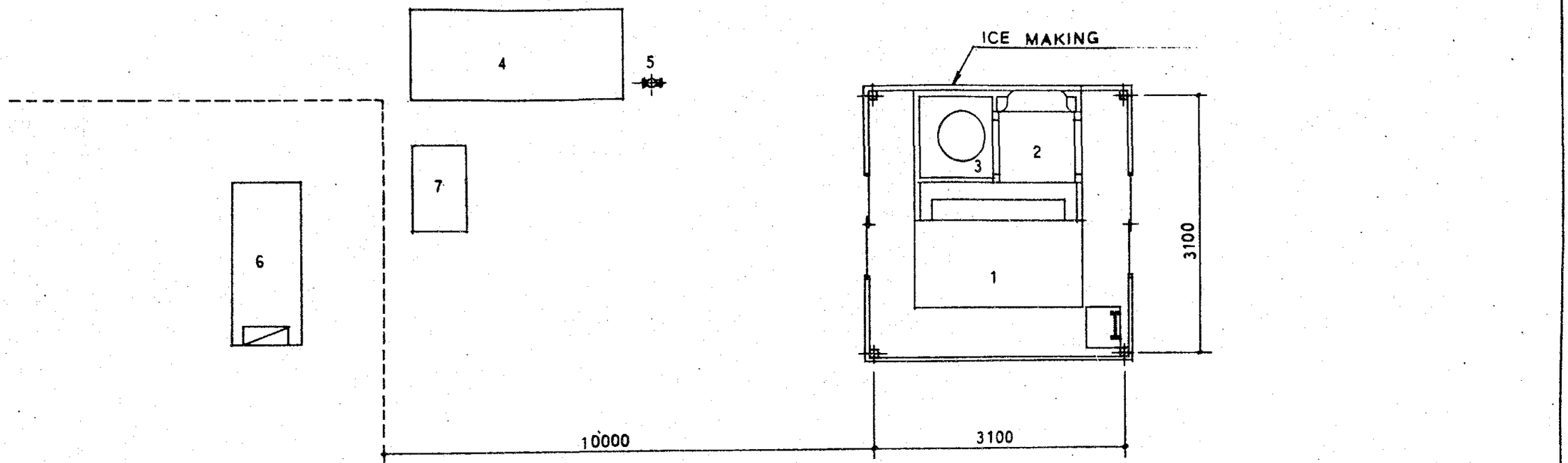


EXISTING OFFICE



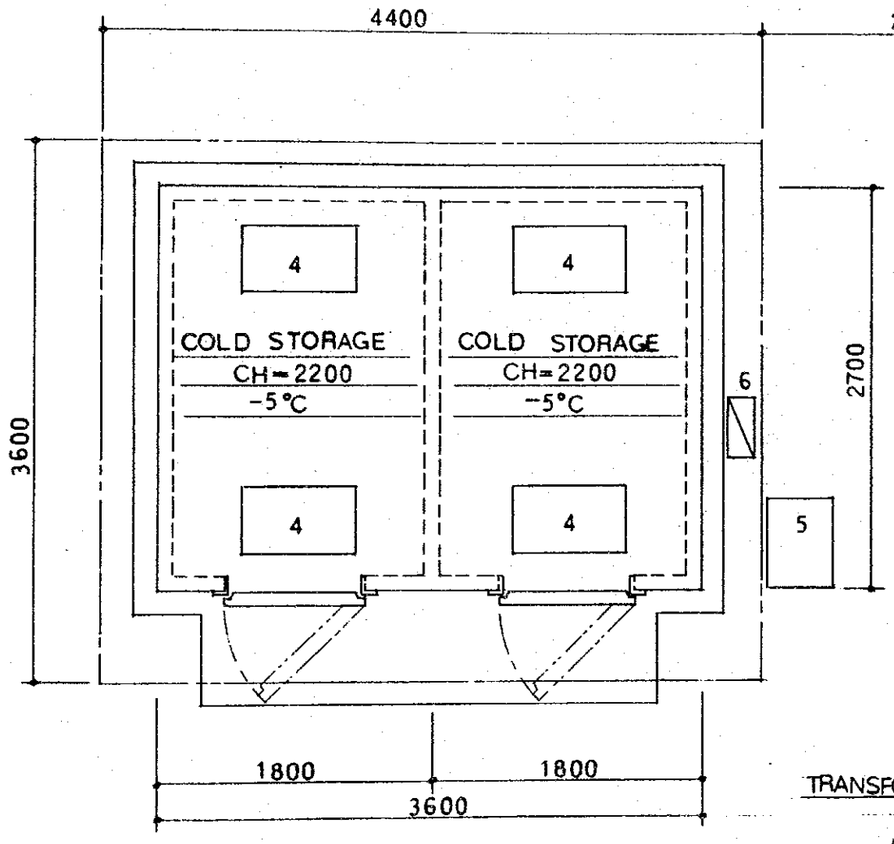
PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Icemaking Plant for LIFUKA	DESIGNED BY
	DRAWING BY
DATE 11, NOV.'85 — SCALE 1/50	DRAWING NO.
TAIYO FISHERY CO., LTD.	

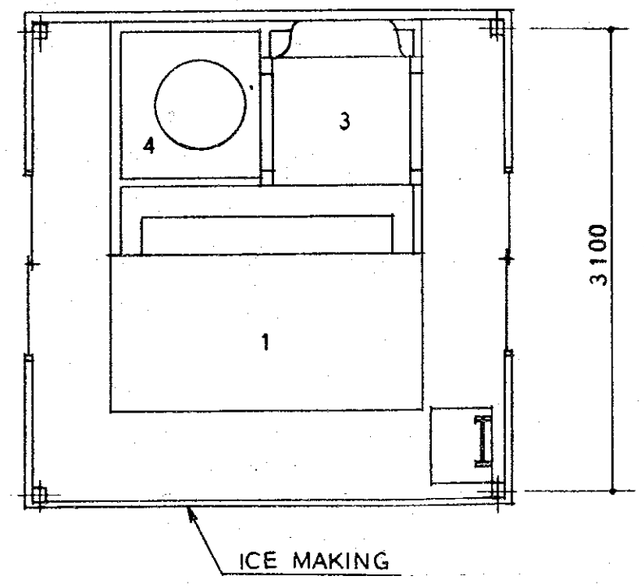
No	DESCRIPTION	QUT	REMARK
1	ICE MAKING MACHINE	1	1 TON PLATE ICE
2	CONDENSER	1	AIR-COOLED
3	DEFROST TANK	1	1.5 TON
4	RAIN WATER TANK	1	4 M³ FRP
5	RAIN WATER PUMP	1	40SQN x0.4 KW
6	DIESEL GENERATOR	1	38 KVA
7	FUEL OIL TANK	1	700 L



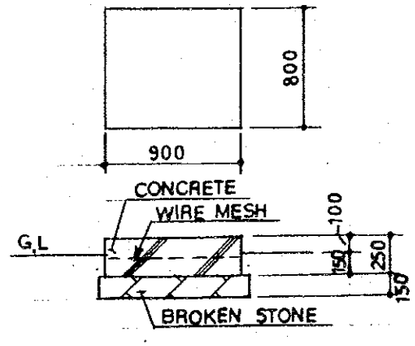
PROJECT TITLE: The Fish Marketing Development Project in TONGA.	APPROVED BY
	CHECKED BY
	DESIGNED BY
DRAWING TITLE: Icemaking plant for UIHA	DRAWING BY: Eiji Higuchi
DATE: 11, NOV. '85 / SCALE: 1/50	DRAWING NO.
⑫ TAIYO FISHERY CO., LTD.	

No	DESCRIPTION	QU'T	REMARK
1	COOLING UNIT	4	AFL-2C×1.5KW
2	ICE MAKING MACHINE	1	1TON PLATE ICE
3	CONDENSER	1	AIR-COOLED
4	DEFROST TANK	1	1.5TON
5	TRANSFORMER	1	20 KVA
6	POWER BOARD	1	

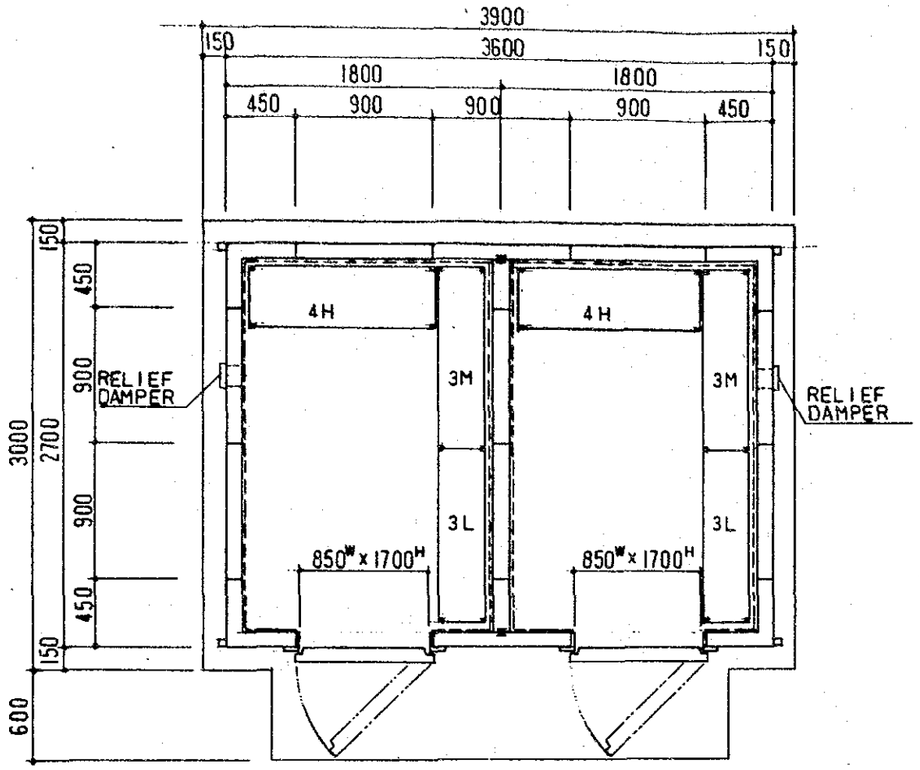




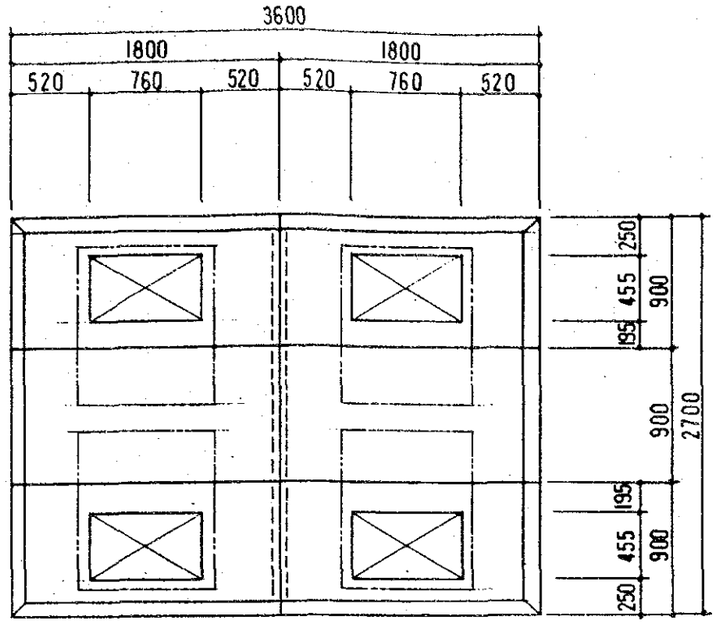
TRANSFORMER FOUNDATION



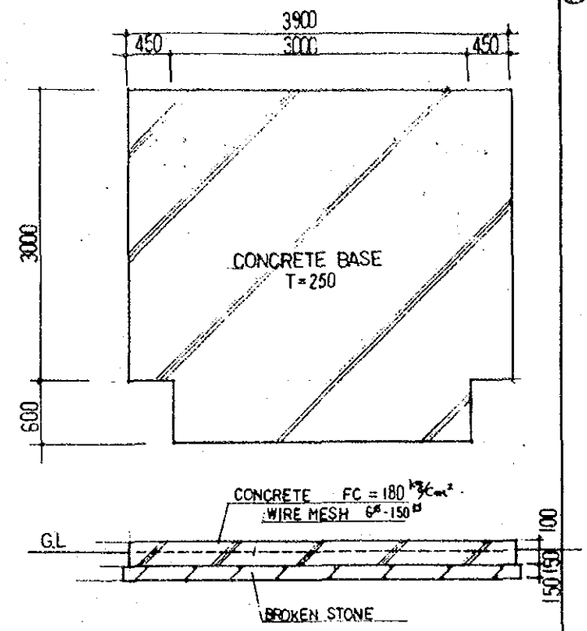
PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Icemaking plant and Cold storage for TONGATAPU	DESIGNED BY
	DRAWING BY
DATE: 11, NOV. '85 / SCALE: 1/40	DRAWING NO.
TAIYO FISHERY CO., LTD.	



PLAN 1/40

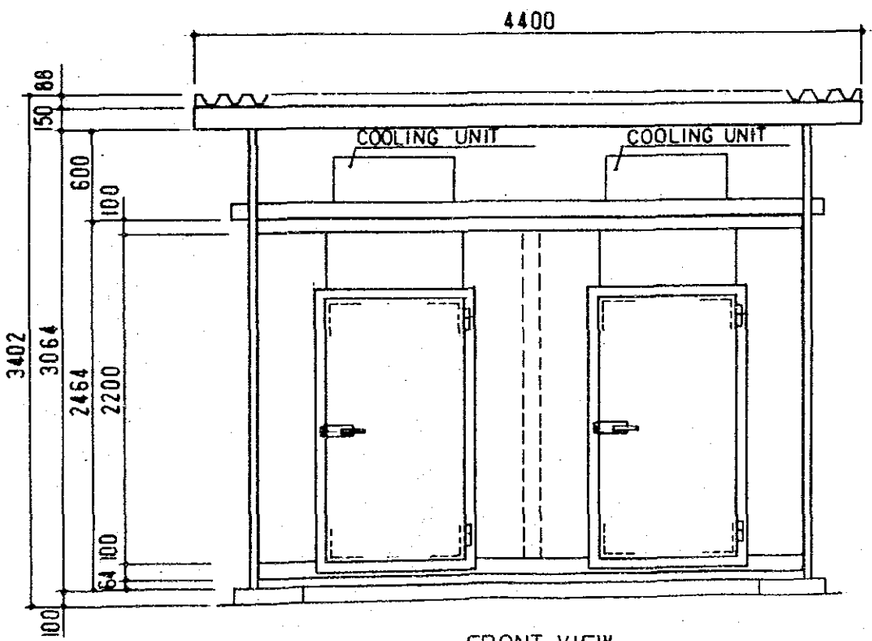


CEILING PANEL

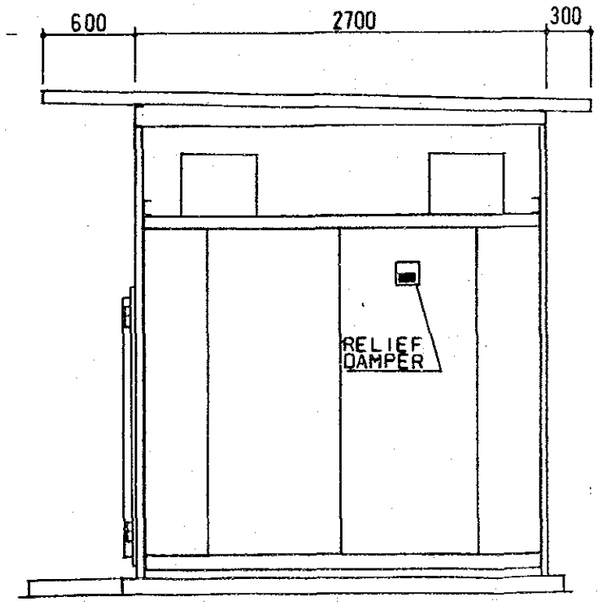


FOUNDATION 1/60

SPECIFICATON	
WALL PANEL	
OUTSIDE	COLOUR COATED ALUMINIUM SHEET
INSIDE	CORRUGATED COLOUR COATED ALUMINIUM SHEET
CEILING	
OUTSIDE	COLOUR COATED ALUMINIUM SHEET
INSIDE	COLOUR COATED STEEL SHEET
FLOOR PANEL	
OUTSIDE	COLOUR COATED ALUMINIUM SHEET
INSIDE	COLOUR COATED ALUMINIUM SHEET
ACCESSORY	
SHELF & DRAINBOARD	
COOLING UNIT	AFL - 2C x 4 (1.5 KW)
DOOR HEATER	82 W
RELIEF DAM PER HEATER	40 W



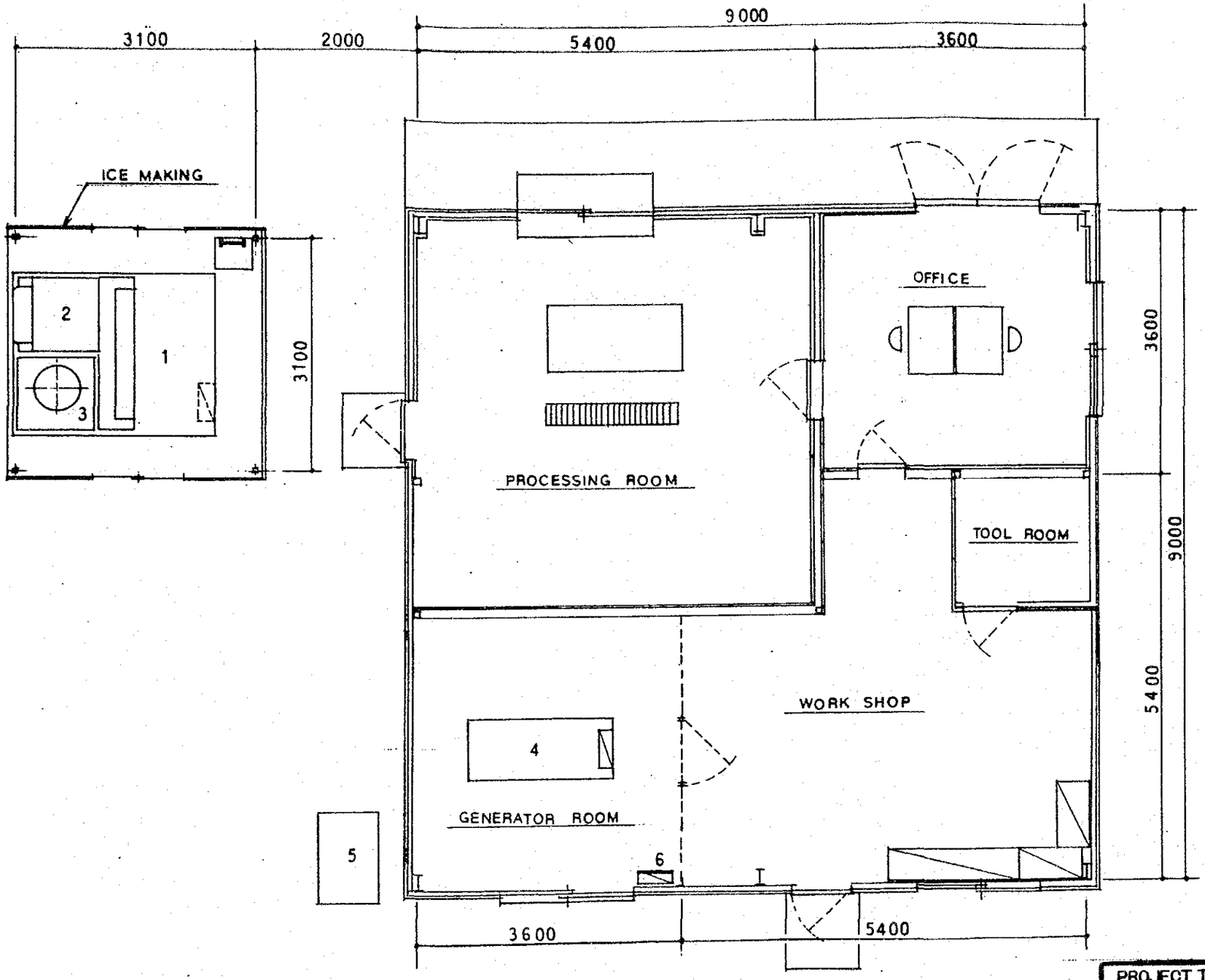
FRONT VIEW



SIDE VIEW

PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Cold storage for TONGATAPU	DESIGNED BY
	DRAWING BY
DATE: 11, NOV. '85 / SCALE: 1/40	DRAWING NO.
TAIYO FISHERY CO., LTD.	

No	DESCRIPTION	QU'T	REMARK
1	ICE MAKING MACHINE	1	1T/D PLATE ICE
2	CONDENSER	1	AIR-COOLED
3	DEFROST TANK	1	1.5TON
4	DIESEL GENERATOR	1	38KVA
5	FUEL OIL TANK	1	700ℓ
6	POWER BOARD	1	



PROJECT TITLE: The Fish Marketing Development Project in TONGA	APPROVED BY
	CHECKED BY
DRAWING TITLE: Icemaking plant and Service centre for 'EUA	DESIGNED BY
	DRAWING BY
DATE: 11, NOV.'85 — SCALE: 1/60	DRAWING NO.
㈱ TAIYO FISHERY CO., LTD.	

4-4 Construction Programme

4-4-1 Implementation System

The ministry responsible for the present Project in the Kingdom of Tonga is the Ministry of Agriculture, Fisheries and Forestry. The detailed design and the supervision of the construction work are commissioned to Japanese consultants and a Japanese company is contracted to carry out the actual construction work with some of the work being subcontracted by a local construction company.

4-4-2 Scope of Grant-Aid

(1) The construction work and the basic facilities to be implemented within the scope of the grant-aid from the Government of Japan are as follows.

a. Cold Storages
b. Ice Making Plants
c. Service Centres
d. Supplementary Facilities (generators and ice boxes, etc.)
e. Fish Carrier Vessels
f. Fixtures (tools, etc.)

(2) Scope of construction to be carried out by the Government of Tonga is as follows.

1) The leveling of construction sites,

2) Power and water extension to the sites. Drainage from the sites.

3) The provision of accommodation for the Japanese supervisor where no hotel facilities exist.

4) To prompt unloading and custom clearance in the Kingdom of Tonga of imported materials and equipment and to facilitate their interial transport.

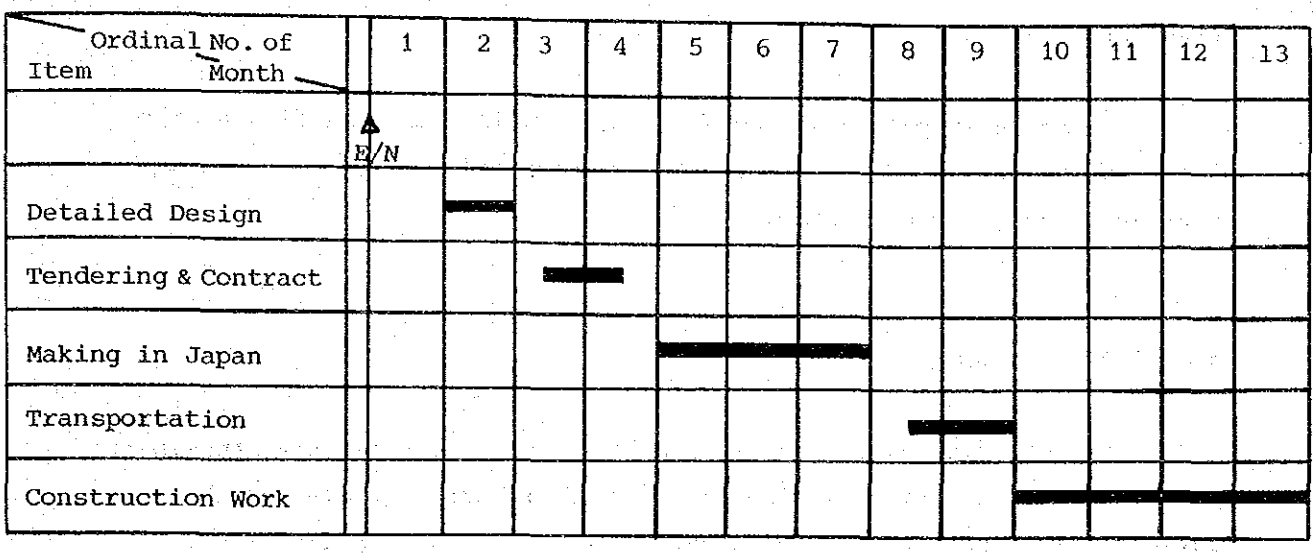
4-4-3 Procurement of Equipment and Materials

Concrete for the foundations and concrete blocks for the cold storage, ice making plants and service centres will be procured locally. All other equipment, machinery and materials will be brought in from Japan.

4-5 Outline of the Construction Schedule

The Project will be carried out by the contract system based on open tenders following the qualification assessment of possible contractors. The detailed design by the consultants is expected to take approximately 1 months and the construction period by the contractor is expected to be 3 months for preparatory work in Japan and approximately 4 months for work in Tonga. An outline of the construction schedule is given below.

Outline of Construction Schedule



4-6 Maintenance and Management Policies

4-6-1 Shore Facilities

Since such shore facilities as cold storages and ice making plants, etc., granted by the Government of Japan to the Government of Tonga, are to be located on islands over a wide sea area, service centres will also be provided where required for their maintenance.

Engineers at these service centres and the equipment, machinery and materials for maintenance, will be under the control of the Fisheries Division.

As the regular maintenance of the facilities is indispensable, local engineers who have had adequate training will carry out machine overhauls and parts exchanges.

4-6-2 Fish Carrier Vessels

Both fish carrier vessels will be operated under the management of the Fisheries Division. The prospect of securing captain and chief engineer class officers is positive, while the simple repairs of the hull and engines can be sufficiently carried out by local engineers. However, the overhaul of the main engine, etc. should be carried out in Suva, Fiji, some 450 nautical miles from Tonga. As the slipway will be constructed at the new fishing port at Fuau on Tongatapu Island, which is expected to be completed in 1986, ships upto 30GT can be placed there, making the cleaning of ship bottoms, as well as repair work, much easier.

4-7 Approximate Project Cost

4-7-1 Estimated Preparation Expenses to be Borne by the Kingdom of Tonga

1)	Leveling of the respective construction sites	320 T$
2)	Water supply and drainage water	1,450 "
3)	Primary electric power supply	700 "
4)	Accommodation for Japanese supervisors	1,200 "
	Total Amount	3,670 T$

CHAPTER 5

PROJECT ASSESSMENT

CHAPTER 5 PROJECT ASSESSMENT

5-1 Summary

As grant-aid is expected from the Government of Japan for this Fish Marketing Project, a financial analysis is carried out in this chapter to examine the feasibility of the management of the shore facilities, as well as the fish carrier vessels, after they have been granted.

The assessment is made by comparing the income generated by the Project with the expenditure of the operation and management of the Project. The following items are considered as possible income.

1) Income from fish transportation and sales

2) Income from sale of ice

3) Storage fees from cold storages

The possible expenditure is considered to be as follows.

1) Operation costs of shore facilities and fish carrier vessels.

As the shore facilities on Niuatoputapu Island are subject to the independent Remote Island Promotion Measures by the Government of Tonga and, therefore, financed by the Government budget from the beginning, they are excluded from the financial assessment of the Project.

5-2 Financial Effects

5-2-1 Income

1) Income from Fish Transport and Sales

The unit fare of T$ 0.05/kg is employed, as in the case of 'Olovaha' described in 2-2-2. With regard to the unit purchase cost, the 1984 unit cost of T$ 0.85/kg estimated by the Fisheries Division, is employed while a rough margin of 21%, the actual result of the Tonga Cooperative Foundation in 1984, is also employed.

The handled subject is the fish transported to Tongatapu by carrier vessels, excluding the fish sold at production areas.

Ha'apai - Tongatapu 12.6 tons x 49 trips = 617 tons
Vava'u - Tongatapu 14.0 tons x 27 trips = 378 tons
(skipjack season)
Vava'u - Tongatapu 7.0 tons x 22 trips = 154 tons
1,149 tons

Operating Income

1,149,000 kg x T$ 0.85 x 0.21 = T$ 205,096

2) Income from Ice Sales

As half of the ice produced is for use by carrier vessels, etc. the remaining half will be sold. However, in the case of Tongatapu, $\frac{2}{7}$ will be used for land marketing and $\frac{5}{7}$ for sales.

5 plants x 270,000 kg x $\frac{1}{2}$ x T$ 0.08 = T$ 54,000

1 plant x 270,000 kg x $\frac{5}{7}$ x T$ 0.08 = T$ 15,429 (Tongatapu)

Total T$ 69,429

3) Storage Fees from Cold Storages

The subject of the analysis is the stored amount of fish minus the amount for sale described in 1) above and the storage
fee at Tongatapu for 1 day each week.

Lifuka	270 days ÷ 5 days x	10 tons	= 540 tons
Nomuka	270 days ÷ 5 days x	3 tons	= 162 tons
Ha'afeva	270 days ÷ 5 days x	3 tons	= 162 tons
Vava'u	150 days ÷ 5 days x	4 tons	= 120 tons (skipjack season)
Vava'u	120 days ÷ 5 days x	3 tons	= 72 tons
		Total	1,056 tons

1,056 tons - 1,149 tons = -93 tons (no income generated)
Tongatapu 270 days ÷ 5 days x 6 tons = 324 tons (income generated)

Storage Income from Cold Storages

$$324{,}000 \text{ kg} \times \frac{\text{T\$ } 0.15}{11 \text{ kg}} = \text{T\$ } 4{,}418$$

Therefore, the annual gross income will be T$ 278,943.

5-2-2 Expenditure

(1) Shore Facilities

Niuatopuatapu

Fuel Consumption

Generator for Refrigerator

Fuel Consumption	: 0.62ℓ/hour
Operation Ratio at 50%	: 12 hours/day (24 hours/day x 0.5)
Annual Operation Days	: 365 days
Annual Consumption of Heavy Oil	: 2,715.6ℓ ≒ 2,716ℓ

Generator for Ice Making Plant

Fuel Consumption	: 2.2ℓ/hour
Operation Ratio at 90%	: 21.6 hours/day
Annual Operation Days	: 270 days/year
Annual Consumption of Heavy Oil	: 12,830.4ℓ ≒ 12,830ℓ

Total: 15,546ℓ

Cost of Heavy Oil @63 ¢/ℓ, approx. T$ 9,793.98/year

Well Water Consumption (270 tons/year for ice making)

Annual Rainfall	: 2,160 mm
Roof Area of Service Centre	: 126.5 m^2
Collectable Water Quantity	: 237.24 tons/year
Collection Ratio at 50%	: 136.62 ≒ 130 tons/year
Well Water Consumption	: 270 - 130 = 140 tons/year approx. 30,800 gallons

(1 British Gallon = 4.5459ℓ)

Water Cost @ T$ 1/1,000 gallons, approx. T$ 30.8/year

Lifuka

Fuel Consumption

Generator for Ice Making Plant

Fuel Consumption	: 2.2ℓ/hour
Operation Ratio at 90%	: 11 hours x 0.9 ≒ 9.9 hours/day
Annual Operation Days	: 270 days
Annual Consumption of Heavy Oil	: 5,880.6ℓ ≒ 5,881ℓ/year

Cost of Heavy Oil @63 ¢/ℓ, approx. T$ 3,705.03/year

Electricity Consumption

Electricity for Ice Making	: 7.15 kW
Operation Ratio at 90%	: 13 hours x 0.9 = 11.7 hours/day
Annual Operation Days	: 270 days
Annual Electricity Consumption	: 22,586.85 ≒ 22,587 kWH/year

Electricity Cost 25 ¢/kWH, approx. T$ 5,646.75/year

Water Consumption : 59,400 gallons/year

Water Cost @ T$1/1,000 gallons, approx T$59.4/year

Ha'afeva and Nomuka

Fuel Consumption

Generator for Refrigerator

Fuel Consumption	: 0.62ℓ/hour
Operation Ratio at 50%	: 12 hours/day
Annual Operation Days	: 365 days
Annual Consumption of Heavy Oil	: 2,715.6ℓ ≒ 2,716ℓ

Generator for Ice Making Plant

Fuel Consumption	: 2.2ℓ/hour
Operation Ratio at 90%	: 21.6 hours/day
Annual Operation Days	: 270 days/year
Annual Consumption of Heavy Oil	: 12,830.4ℓ ≒ 12,830ℓ

Total: 15,546ℓ/year

Cost of Heavy Oil @63 ¢/ℓ, approx. T$ 9,793.98/year

'Uiha

Fuel Consumption

Generator for Ice Making Plant

Fuel Consumption	: 2.2ℓ/hour
Operation Ratio at 90%	: 21.6 hours/day
Annual Operation Days	: 270 days/year
Annual Consumption of Heavy Oil	: 12,830.4ℓ ≒ 12,830ℓ

Cost of Heavy Oil @63 ¢/ℓ, approx. T$ 8,082.9/year

Water Consumption : 59,400 gallons/year

Water Cost @ T$1/1,000 gallons, approx T$59.4/year

Vava'u

Electricity for Refrigerator	: 1.5 kW
Operation Ratio at 50%	: 12 hours/day
Annual Operation Days	: 365 days
Annual Electricity Consumption	: 6,570 kWH/year
Electricity for Ice Making	: 7.15 kWH
Operation Ratio at 90%	: 21.6 hours/day
Annual Operation Days	: 270 days
Annual Electricity Consumption	: 41,698.8 ≒ 41,699 kWH/year

Total: 48,269 kWH/year

Electricity Cost @26 ¢/kWH, approx. T$ 12,549.94/year

Water Consumption : 270 tons/year (59,400 gallons/year)

Water Cost @ T$1.2/1,000 gallons, approx. T$ 71.28/year

Tongatapu

Electiricty for Refrigerator	: 3 kW (1.5 kW x 2)
Operation Ratio at 50%	: 12 hours/day
Annual Operation Days	: 365 days
Annual Electricity Consumption	: 13,140 kWH
Electricity for Ice Making	: 7.15 kW
Operation Ratio at 90%	: 21.6 hours/day
Annual Operation Days	: 270 days
Annual Electricity Consumption	: 41,698.8 ≒ 41,699 kWH

Total: 54,839 kWH/year

Electricity Cost @22 ¢/kWH, approx. T$ 12,064.58/year

Water Consumption : 270 tons (59,400 gallons/year)

Water Cost @ T$1/1,000 gallons, approx. T$ 59.4/year

'Eua

Water Consumption

Annual Rainfall	: 1,733 m
Roof Area of Service Centre	: 126.5 m^2
Collectable Water Quantity	: 219 tons
Collection Ratio at 50%	: 109.5 tons ≒ 110 tons/year
Well Water Consumption	: 270 - 110 = 160 tons/year = 35,200 gallons

Water Cost @ T$ 1.2/1,000 gallons, approx. T$ 42.24/year

Electricity Consumption

Electricity for Refrigerator	: 7.15 kW
Operation Ratio at 90%	: 21.6 hours/day
Annual Operation Days	: 270 days
Annual Electricity Consumption	: 41,698.8 ≒ 41,699 kWH

Electricity Cost @ 26 ¢/kWH, approx. T$ 10,841.74/year

Personnel Cost

(For engineers at Service Centres, excluding Niuatoputapu)

Nomuka	1 engineer	
Ha'afeva	1 engineer	
'Eua	1 engineer	
Total	3 engineers	3 x T$2,575 - T$7,725

Repair Cost

To be accounted at 2% of the total sales. T$5,600 will be evenly distributed to the following 7 places: Vava'u, Lifuka, Uiha, Ha'afeva, Nomuka, 'Eua and Tongatapu.

7 x T$800 = T$5,600

(2) Fish Carrier Vessels

1) Inter-Islands Carrier Vessels

Distance Table ... Refer to the Distance Tables in 4-3-2 (1)

Planned Operation (170' means 170 nautical miles)

Tongatapu 170' Vava'u 170' Tongatapu

Tongatapu 90' Lifuka 90' Tonga

Maximum Loading Amount ... Based on the assumption that 5 hours are required to load 14 tons, the weekly programme is as follows.

Total Trips Distance	520'
Total Trips Duration	520' ÷ 7'/hour = 74 hours
Total Loading Duration	5 hours x 6 = 30 hours

Table 5-2-1 Operation Programme

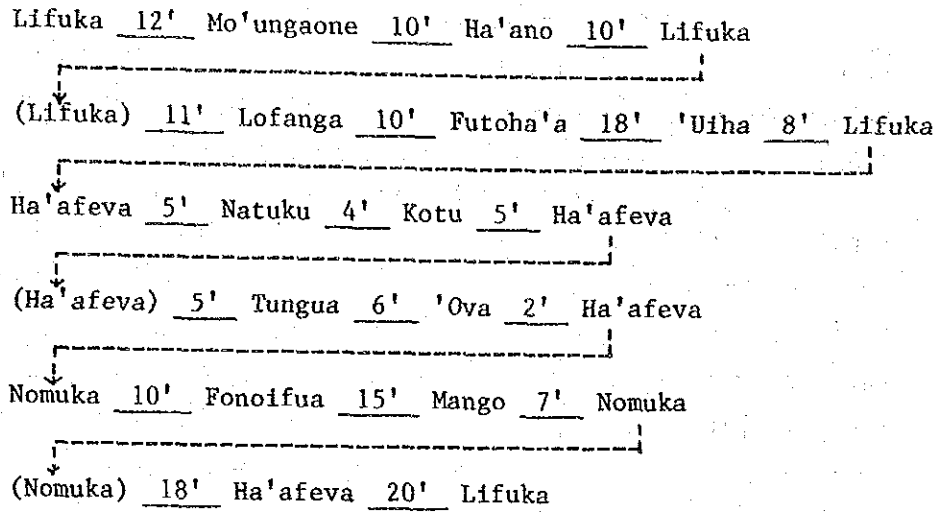
	Per Year	Remarks
Days-Off	95 days	Voyage Duration: 245 days/5 x 74 hours = 3,626 hours
Repairs, etc.	25 days	
Operation Days	245 days	Loading Duration: 245 days/5 x 30 hours = 1,470 hours
Total	365 days	

Annual Operation Cost (Unit: T$)

Crew Wages	: Captain: T$2,575 Chief Engineer: T$2,575 Ordinary Crew: T$1,100 x 2 = 2,200	7,350
Food	: T$428 x 4	1,712
Drinking Water	: 49 times x 2 tons x T$0.2	19
Fuel	: (Main Engine) 150 x 0.2 x 3,626 x T$0.55	59,829
	(Aux-Engine) 30 x 0.2 x 5,096 x 0.5 x T$0.55	8,408
Lubricant Oil	: (59,829 + 8,408) x 0.1	6,823
Ship Insurance	:	5,000
Communication	:	200
Repairs	:	4,000
Expendables	:	900
		T$94,241

2) Inter-Ha'apai Area Small Carrier Vessel

Planned Operation



Note: There is no operation at the place in parentheses

The loading duration will be 1 hour at sub-stock points and 2 hours at major stock points. The weekly programme is as follows.

Total Voyage Distance	176'
Total Voyage Duration	176' ÷ 6'/hour = 26 hours
Total Loading Duration	11 x 1 hour + 10 x 2 hours = 33 hours

Table 5-2-2 Operation Programme

	Per Year	Remarks
Days-off	95 days	Voyage Duration: 245 days/5 x 26 hours = 1,274 hours
Repairs, etc.	25 days	
Operation Days	245 days	Loading Duration: 245 days/5 x 33 hours = 1,617 hours
Total	365 days	

Annual Operation Cost (Unit: T$)

Crew Wages:	Captain: T$ 2,575 Chief Engineer: T$ 2,575 Ordinary Crew: T$ 1,100	6,250
Food:	T$ 428 x 3	1,284
Drinking Water:	49 times x 1.5 tons x T$ 0.2	14
Fuel:	(60 x 0.2 x 1,274 + 60 x 0.2 x 1,617 x 0.5) x T$ 0.55	13,744
Lubricant Oil:	13,744 x T$ 0.1	1,374
Ship Insurance:		5,000
Communication:		200
Repairs:		2,000
Expendables:		700
Total		T$ 30,566

(3) Total Annual Opeartion Costs

1) Shore Facilities (Unit: T$)

Lifuka	9,411
Ha'afeva and Nomuka	19,946
'Uiha	8,141
Vava'u	12,620
Tongatapu	12,123
'Eua	10,883
Personnel Cost T$ 2,575 x 3	7,725
Repairs	5,600
Sub-total	86,449

2) Fish Carrier Vessels

Inter-Islands	94,241
Inter-Ha'apai Area	30,566
Sub-total	124,807
Grand Total	T$ 211,256

5-2-3 Balance of the Operation

Since it is assumed that the balance of the operation after completion of the Project will not change by year, as described previously, the finanial balance can be assessed for each fiscal year. It is estimated that the opeartion profit will be T$ 67,687 a year.

Total Income (A)	T$ 278,943
Total Expenditure (B)	T$ 211,256
(A) - (B)	T$ 67,687

Based on the above assessment, the operation of shore facilities after completion of the Project by the Fisheries Division is considered to be fairly vialbe.

As the grant-aid from Japan is expected to provide the funds for the Project, the depreciation cost is not included in the above calculation.

5-3 Estimated Effects of the Project

The following effects can be expected as a result of the implementation of the Project.

(1) Promotion of Fishery

As the current catch in the shallow waters inside reefs has almost reached to the M.S.Y. level, conventional fishing predominantly relying on shallow water fishing cannot meet the people's demand.

The objective of the Boat Building Project currently in progress is to increase the catch by extending the fishing grounds from the shallow waters to the outer slopes of reefs, and further to offshore waters, by means of the improved capacity of fishing vessels and their well planned proper performance of fishing effort by the vessels.

In addition, the Government of Tonga intends to develop the unutilized resources in remote island areas where the means of marketing barely exist at present.

The Fish Marketing Project is expected to increase the yield and, therefore, greatly contribute to the promotion of fishery in the Kingdom of Tonga.

(2) Increased Employment Opportunities

The Project will have a direct effect in regard to increasing employment opportunities in terms of employees for shore facilities and fish carrier vessels and also an indirect effect in terms of vitalizing commercial activities. The number of those directly employed will be 3 for shore facilities and 7 for carrier vessels.

(3) Economic Promotion of Remote Areas

Due to the adequate consolidation of the marketing network, fishery activities will be much more vitalized, thus stimulating the promotion of local economies.

(4) Adequate Supply of Animal Protein

Animal protein will be adequately supplied by the increased catch and the complete utilization of fish (see 2-2-2 Distribution and Demand for Marine Products).

(5) Import Reduction of Animal Protein

As the import volume of mutton flap will be reduced, a saving of foreign currency can be expected.

(6) Export of Excess Marine Products

Foreign currency earnings can be anticipated by exporting those marine products exceeding the domestic demand. Demarsal fish can be exported to such tourist places as Guam, Fiji and Hawaii, etc., while skipjack and tuna can be exported to Samoa and Fiji. The blast freezer to be constructed at Fuau will play a crucial role in terms of quality control.

CHAPTER 6

CONCLUSION AND SUGGESTIONS

CHAPTER 6 CONCLUSION AND SUGGESTIONS

The basic design study commenced with studying and recognizing the importance and positioning of the Fish Marketing Project in view of the socio-economic condition of the Kingdom of Tonga, of the current situation of fishery and of the Fourth Five-Year Development Plan. The basic design was made on the basis of this recognition and the pertinence of the Project was then examined by assessing the project plans based on the basic design.

As a result, it was concluded that the implementation of the Project, intended to establishment of a comprehensive marketing system for marine products, would be indispensable for the provision of the required supply of marine products and the promotion of local development with rational utilization of fishery resources. It was also concluded that, if implemented, the Project would bring about tremendous effects in regard to all the above-mentioned aspects.

The Project is, therefore, judged to qualify for grant-aid from the Government of Japan. Since the Fisheries Division is responsible for the management of the Project, no problems concerning the operation and management of the Project are foreseen. However, the following suggestions are made for smooth progress of the Project and prevention of such occurrences as a long suspension of operation due to bad maintenance.

(1) As the Project's grant-aid facilities are to be located on islands scattered over a wide sea area in the Project, service centres will be built where necessary for the purpose of providing these facilities with maintenance services. It is recommended that a Japanese specialist, especially in regard to freezing and ice making machinery, be sent to Tonga for technological transfer in order that Tongan engineers can be trained to work at these service centres.

(2) The Artisanal Fisheries Development Committee, which is planned to be in charge of the management of marketing facilities, equipment, machinery and materials, should exercise its managerial functions to the proper extent, reporting on the managerial situation to the Government of Japan at specific times.

(3) Since the local construction work should be completed before the cyclone season, the leveling of project sites to be carried out by the Government of Tonga must be completed before the construction of marketing facilities begins.

APPENDICES

Appendix 1

Composition of the Study Team

STUDY TEAM

Team leader	KENICHI SAKURAI	Overseas Fisheries Cooperation Office, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries
Cooperation Planner	TADAHITO MORISAWA	International Coopeartion Division, Economic Affairs Bureau, Ministry of Agriculture, Forestry and Fisheries
Fisheries Specialist	EIJI HIGUCHI	Engineering-Consulting Office Taiyo Fishery Co., Ltd.
Facilities Engineer	KEISAKU SHIGA	- do -

Appendix 2

List of Participating Tongan Government Officials

Ministry of Agriculture, Fisheries and Forests	
Mr. Tomasi T. Simiki	Director
Fisheries Division	
Mr. Semisi Fakahau	Principal Fisheries Officer
Mr. Taniela Koloa	Fisheries Officer Grade I
Mr. Siotame Taunaholo	Senior Fisheries Assistant
Fisheries Division at Ha'apai Centre	
Mr. Peter Hurrell	Officer, lifuka Branch
Mr. Bill Trusewich	Extension Officer (U.S.A.)
Ministry of Foreign Affairs	
Miss Siaosi Taimani 'Abo	Secretary, Foreign Affairs
Central Planning Department	
Mr. David F. Abbott	Planning Officer
Mrs. Marieta Tukuafu	Assistant Secretary, Aid Coordination
Mr. Paulo Kantoke	Economist, Agriculture
Ministry of Labour, Commerce and Industries	
Mr. James William Harris	
Other Participants	
Mr. Tonousa Tuipeatau	Registar of Cooperative Societies and Credit Union
Mr. John G. Kreag	Secretary/Manager, Tonga Cooperative Federation
Mr. Akira Otaki	JICA, Tonga
Mr. Hiroki Nishizumi	JOCV, Tonga

Appendix 3

Study Schedule

Day				
1	Sept.	19	Thu.	Departure from New Tokyo International Airport (Narita)
2		20	Fri.	Arrival in Tongatapu Meeting on study schedule with Tongan Counterpart
3		21	Sat.	Meeting with Mr. Otaki of JICA
4		22	Sun.	Team meeting
5		23	Mon.	Visits and meetings at Central Planning Office and Fisheries Division
6		24	Tue.	Visits and meetings at Ministry of Foreign Affairs, Ministry of Agriculture, Fisheries and Forestry, Ministry of Labour and Commerce and Tonga Cooperative Federation
7		25	Wed.	Move from Tongatapu to Ha'apai Meeting at Lifuka Bureau of Fisheries Division
8		26	Thu.	Site survey on Lifuka, Uiha, Ha'afeva and Nomuka
9		27	Fri.	Move from Ha'apai to Tongatapu Site survey for new fishing port at Fuau
10		28	Sat.	Site survey on 'Eua (return journey from Tongatapu)
11		29	Sun.	Team meeting (preparation of Draft Minutes)
12		30	Mon.	Information gathering Meeting with Central Planning Office and Fisheries Divsion Preparation of Minutes
13	Oct.	1	Tue.	Meeting with Fisheries Division and Central Planning Office Signing of Minutes
14		2	Wed.	Visit to Vava'u abandoned due to flight cancellation Meeting on detailed with Fisheries Division Government members left Tongatapu

Day				
15	Oct.	3	Thu.	Government members reported to Japanese Embassy and JICA Office in Fiji Left Fiji Consultants members of the Team carried out survey at Fisheries Division
16		4	Fri.	Visit to Vava'u finally abandoned due to another change in flight schedule Requested Principal Fisheries Officer to carry out survey and relay survey results on 7th by SSB telephone line Meeting on detailes at Fisheries Division Government menbers left Sydney
17		5	Sat.	Government members arrived in Tokyo Consultants members tidied up materials
18		6	Sun.	Tidying-up of materials
19		7	Mon.	Mr, Semisi, Principal Fisheries Officer who was sent to Vava'u on 4th, sent survey results via telephone Departure from Tongatapu and arrival in Auckland
20		8	Tue.	Departure from Auckland
21		9	Wed.	Arrival in Tokyo

Appendix 4

Minutes

MINUTES OF DISCUSSION ON BASIC DESIGN STUDY ON THE FISH MARKETING PROJECT IN THE KINGDOM OF TONGA

In response to the request made by the Government of the Kingdom of Tonga for the Fish Marketing Project (hereinafter referred to as "the Project"), the Government of Japan has sent, through the Japan International Cooperation Agency (JICA), a team headed by Mr Kenichi SAKURAI, Fisheries Agency of Japan, to carry out a basic design study for the Project from September 19 to October 5, 1985. The team carried out a field survey, had a series of discussions and exchanged views about the Project with concerned authorities of the Government of the Kingdom of Tonga.

As a result of the study and discussions, both parties have agreed to recommend to their respective Governments and the authorities concerned the result of the study as attached herewith toward the implementation of the project.

1 October 1985

Kenichi SAKURAI
Team Leader
Basic Design Study Team
on the Fish Marketing Project

Tomasi Simiki
Director of Agriculture,
Fisheries and Forestry

On behalf of the Government of
the Kingdom of Tonga.

ATTACHMENT

1) The Objective of the Project is to provide the necessary facilities and equipments in order to improve the fish marketing system in the Kingdom of Tonga, aiming to increase production and availability of fresh fish to satisfy the local requirement at reasonable price and to increase potential for export.

2) Fisheries Division of Ministry of Agriculture, Fisheries and Forests is responsible for the implementation of the Project.

3) The Japanese study team will convey to the Government of Japan the desire of the Government of the Kingdom of Tonga that the former takes necessary measures to cooperate in implementing the Project and provide the necessary facilities and equipments listed in Annex I in order of priority within the limit of Japanese Grant Aid.

4) The Government of the Kingdom of Tonga will take the necessary measures listed in Annex II in the case that the Grant assistance by the Government of Japan is extended to the Project.

5) If and when the products, purchased by the grant from the Government of Japan, are sold or leased to the private sector, including cooperatives and fishermen, the Government of the Kingdom of Tonga shall take necessary measures to ensure the following:-

   1) to deposit the amount to be obtained by such sale or lease in a suitable account of the Government of the Kingdom of Tonga as a counterpart fund;

   2) to utilize the above mentioned counterpart fund for the purpose of fishery development and maintenance of the equipment purchased by the grant from the Government of Japan.

   3) to report to the Government of Japan upon the use of the fund.

6) Japanese Grant Aid Cooperation scheme is explained by the study team and understood by the Kingdom of Tonga side.

ANNEX I

Items, requested by the Government of the Kingdom of Tonga in order of priority.

1) Six abt 9m³ Cold Storages with Generators and spare parts in case of necessity.

2) Eight 1 ton/day Ice Making Machines with Ice Storages and Generators in case of necessity plus necessary equipment and spare parts.

3) Four Prefabricating House for Servicing Center.

4) Two Fish Collection Boats and spare parts (See Appendix)

5) Ice Box Fourteen Permanently set type
Sixty abt 160 a type
Insulation materials for ice box
abt 1 ton type - land transportation

6) Display Freezers

7) Necessary equipments for Cold Storage, Ice Making Machine and Servicing Center.

ANNEX II

Items, taken by the Government of the Kingdom of Tonga.

1) to secure the lands and clear the sites

2) to provide facilities such as distribution of electricity, water supply and drainage up to site in case of necessity.

3) to prompt unloading and custom clearance in the Kingdom of Tonga of imported materials and equipment and to facilitate their internal transport.

4) to exempt the Japanese personel concerned from custom duties, internal taxes and other fiscal levies imposed in the Kingdom of Tonga with respect to the supply for the products and services for the Project.

5) to provide and accord necessary permission, licenses and other authorizations deemed advisable for carrying out the project.

6) to provide appropriate accomodation for Japanese personel concerned, in case of necessity.

7) to bear all expenses, other than those to be borne by the Grant.

8) to maintain and use properly and effectively the facilities and equipment purchased by the Grant.

K.S

APPENDIX

Main Principal Particular of Fish Collection Boats are as follows:

1) Inter Island
   Loa abt 16m
   Main Engine 150 - 180 HP
   Fish Hold Capacity abt 20m^3
   Speed (Service) over 6 Kt
   Cruisng range 600 - 800 N. miles
   Crew - 4 person
   Derrick Mast and Boom
   Dingy
   necessary navigational equipment
   construction material FRP

2) Inter Ha'apai Island Group
   Loa abt 10m
   Main Engine 60 - 90 HP
   Fish Hold Capacity 3 - 5 m^3 + 25 - 30 Ice Boxes
   Speed (Service) abt 6 kt
   Crew 3 person
   Derrick mast and boom
   necessary navigational equipment
   Hull Construction Flat Bottom type
   Construction material FRP

Appendix 5

Names of Major Fishes

APPENDIX 5.1

EXPECTED SPECIES OF FISH FOR POLE-AND-LINE FISHING

Popular Name in English	Zoological Name
Black sea-bass	Epinephelus spp.
Drab large-eye bream	Mylis latus
Black sea-bream	Mylis macrocephalus
Crimson snapper	Pristipomoides sieboldi
Parrot fishes	Scarus spp.
Skilfish	Erilepio zonifer
Coral cod	Variola louti
Honeycomb rock cod	Epinephelus spp.
Coral cods	Epinephelus microdon
Oilfish	Ruvettus pretiosus
Red collared emperor	Lethrinus spp.
Ruby snapper	Etelis spp.
Goatfish	Upeneus spp.
Flame snapper	Aphareus rutilans
Blue snapper	Aprion virescons
Spanish mackeral	Scomberomorus spp.
Barracuda	Sphyraena picuda

Others: Big-eyes, Blue spotted grouper Rippled large-eye bream, Blue spotted snapper, Cockteilfish, Oriental sweetlip, Rufous sea-perch, Bluefish, Striped jack, Mackerel scad, Black crevalle, Allied Kingfish, Sharks and so on

APPENDIX 5.2

EXPECTED SPECIES OF FISH FOR LONG-LINE FISHING

Popular Name in English	Zoological Name
Albacore	Thunnus alalunga
Yellowfin	Thunnus albacares
Bigeye	Thunnus obesus
Black marlin	Istriomax indicus
Pacific blue marlin	Makaira mozoro
Sword marlin	Xiphias gladins
Striped marlin	Makaira audax
Short-nose spearfish	Teraptulus augustirostris
Pacific sailfish	Isotriophorus orientalis
Dolphinfish	Coryphaena hipprus
Rainbow runner	Elagatis hipinnutatus
Opah	Lampris regius
Sunfish	Mola ramsayi
Oil fish	*Erilepio zonifer*
Skipjack	Katsuwonus pelamis
Jack mackerel	Acanthocyhium solandri
Shark	
Blue shark	
Dog shark	
Hammerhead	
Fox shark	

APPENDIX 5.3

EXPECTED ANIMALS, FISH SHELL, ETC. AT COASTAL AREAS

Popular Name in English	Zoological Name
Paractopus	Octopus hongkongensis
Broad-montle squid	Sepioteuthis lessoniana
Spiny lobster	Panulirus Ornatus
Tufted spiny lobster	Panulirus Pencillatus
Red crayfish	Panulirus longipes
Striped crayfish	Panulirus versicolor
Moray eels.	Gymnothorax kidako
Ark shell	Scapharca broughtonii
Spiny top-shell	Turbo argyrostomus
-	Chicoreus ramosus
Elongate clam	Tridacna maxima
Scaled clam	Tridacna squamosa
Giant clam	Tridacna derasa
Horse-shoe clam	Hippopus hippous

APPENDIX 5.4

EXPECTED SPECIES OF FISH FOR STICK-HELD DIP NET FISHING, ETC.

Popular Name in English	Zoological Name
Sharpnose trenched sardine	Sardinella sirm
Hardy head	Pranesus duodecimalis
Striped mackerel	Rastrelliger kangurta
Big-eye scad	Selar crumenophthalmus
Anchovy	Engraulis japonica
Cardinal fish	Angyrosomus argentatus
Sprat	Sprattus antipodum
Blue-backed sprat	Sprattelloides delicatulus
Scad Spp.	Decapterus pinnulatus
Australian pilchard	Sardinops neopilchardus

Appendix 6

Finance of the Fisheries Division

1. 1983

A. Expenditure

Total expenditure on Administration and Technical Services by the Fisheries Division during 1983 amounted to T$604,750 a breakdown is shown below.

Category	Provision	Expenditure	Balance
Staff Salaries	64,785	53,114	11,671
Officers and Crew Salaries	20,200	20,200	-
Lobour Costs	15,600	15,600	-
Operational costs/Recurrent Estimates 1982/83	103,400	103,400	-
Development Estimates	1,002,436	502,436	50,000
	T$ 1,206,421	T$ 694,750	T$ 61,671

B. Revenue

General revenue 1983 - T$2,172.75
Not included in the above are sale proceeds from fish ex. Albacore and Takuo.

2. 1984

A. Expenditure

Total expenditure on Administration and Technical Services by the Fisheries Division during 1984 amounted to T$1,984 amounted to T$279,065 a breakdown being shown in below.

1984 Expenditure - Administration and Technical Services

Category			
Staff Salaries	75,256	71,256	4,000
Officers and Crew Salaries	27,959	27,959	-
Labour Costs	15,600	15,600	-
Operational costs/Recurrent Estimates 1983/84	109,750	109,750	-
Development Estimates	56,500	54,500	2,000
	T$ 285,065	T$ 279,065	T$ 6,000

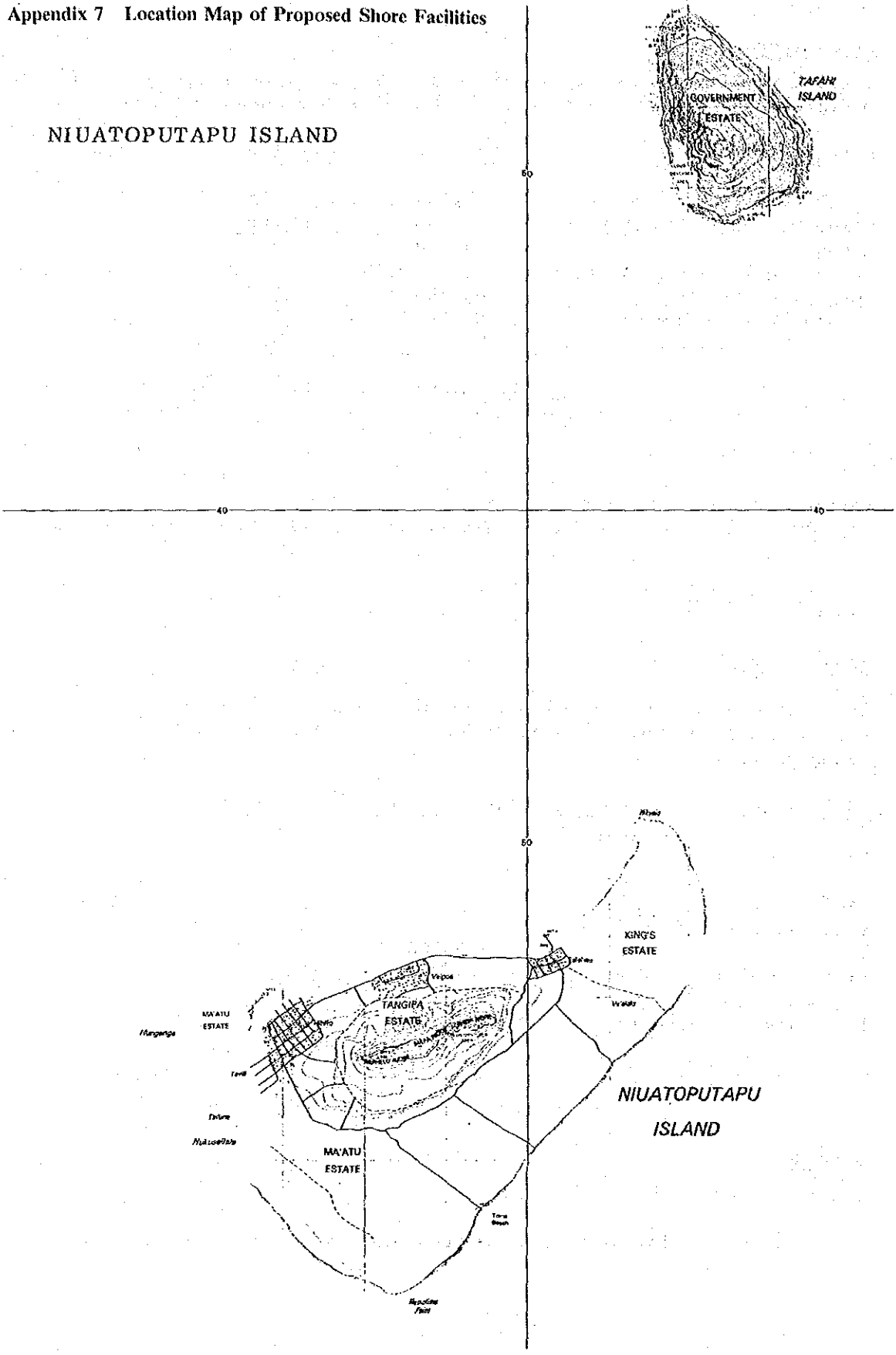
B. Revenue

General revenue 1984 - T$1,411.53

Not included in the above are proceeds ex. Gov't vessels Albacore and Takuo.

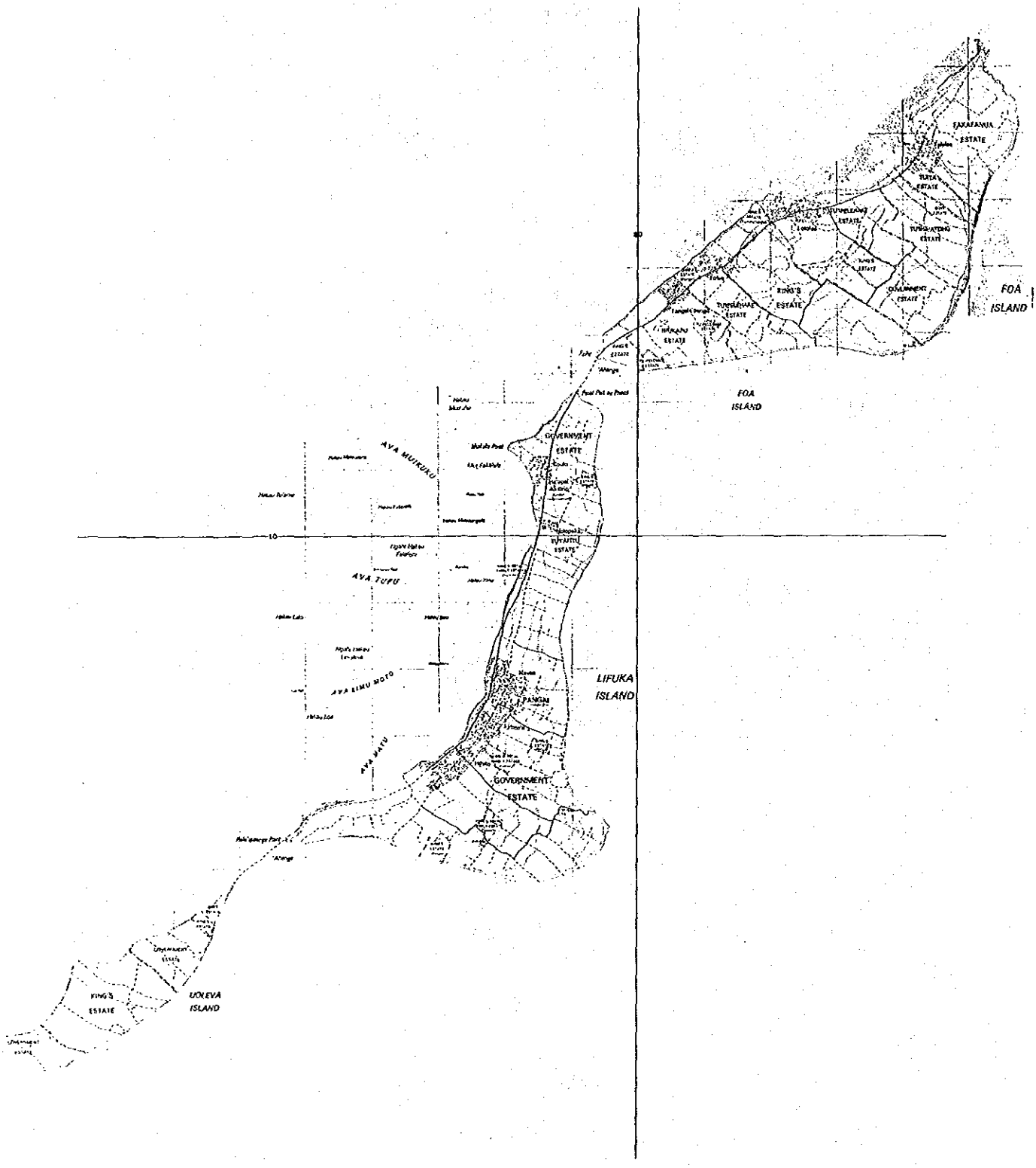
Appendix 7 Location Map of Proposed Shore Facilities

NIUATOPUTAPU ISLAND

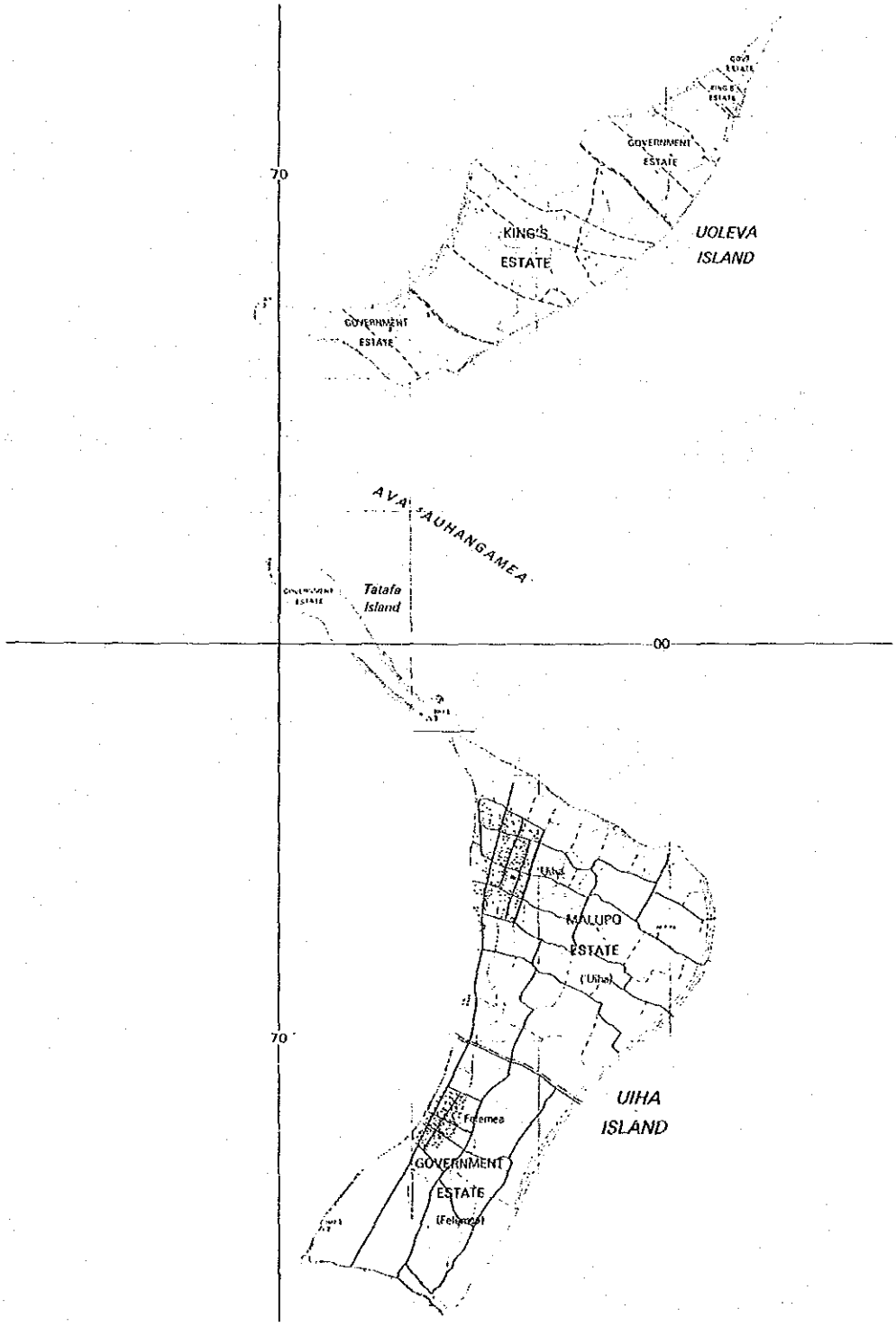


VAVA'U ISLAND
VAVA'U ISLAND
NEIAFU
KOLOA ISLAND
PANGAIMOTU ISLAND
ANO

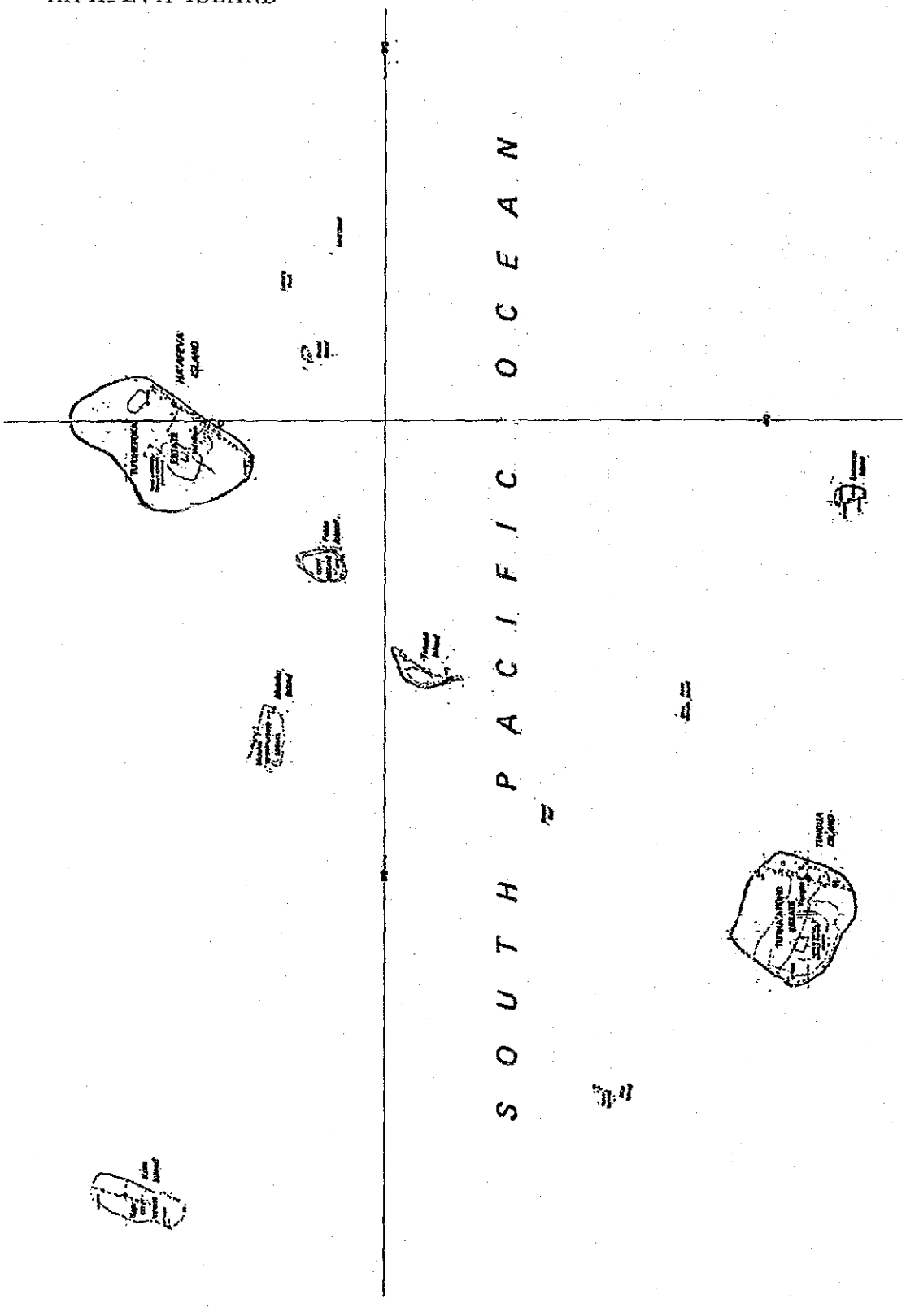
LIFUKA ISLAND



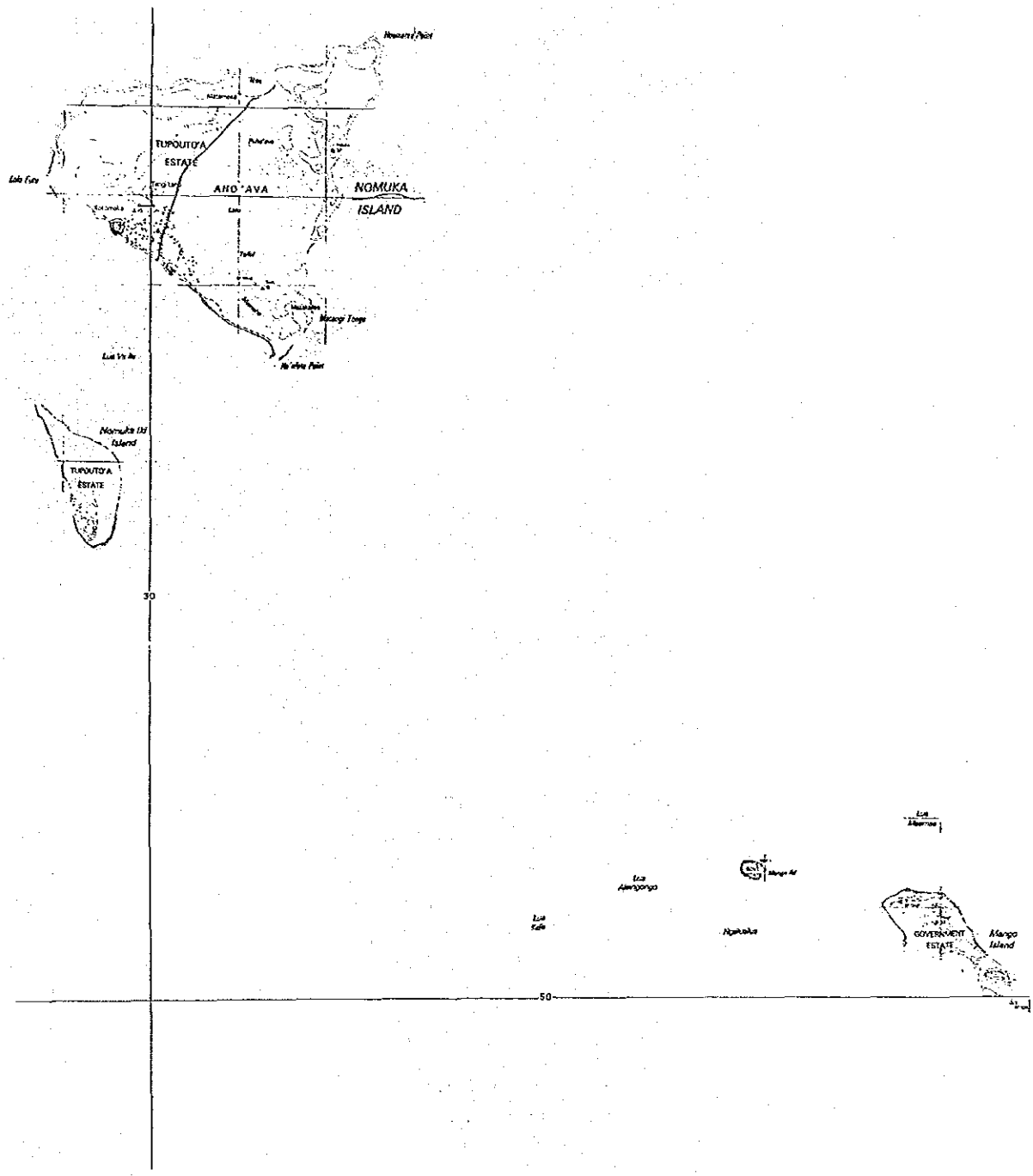
UIHA ISLAND


70
KING'S
ESTATE
GOVERNMENT
ESTATE
UOLEVA
ISLAND
AVA SAUHANGAMEA
Tatafa
Island
00
MALUPO
ESTATE
(Uiha)
70
UIHA
ISLAND
Feemea
GOVERNMENT
ESTATE

HA'AFEVA ISLAND

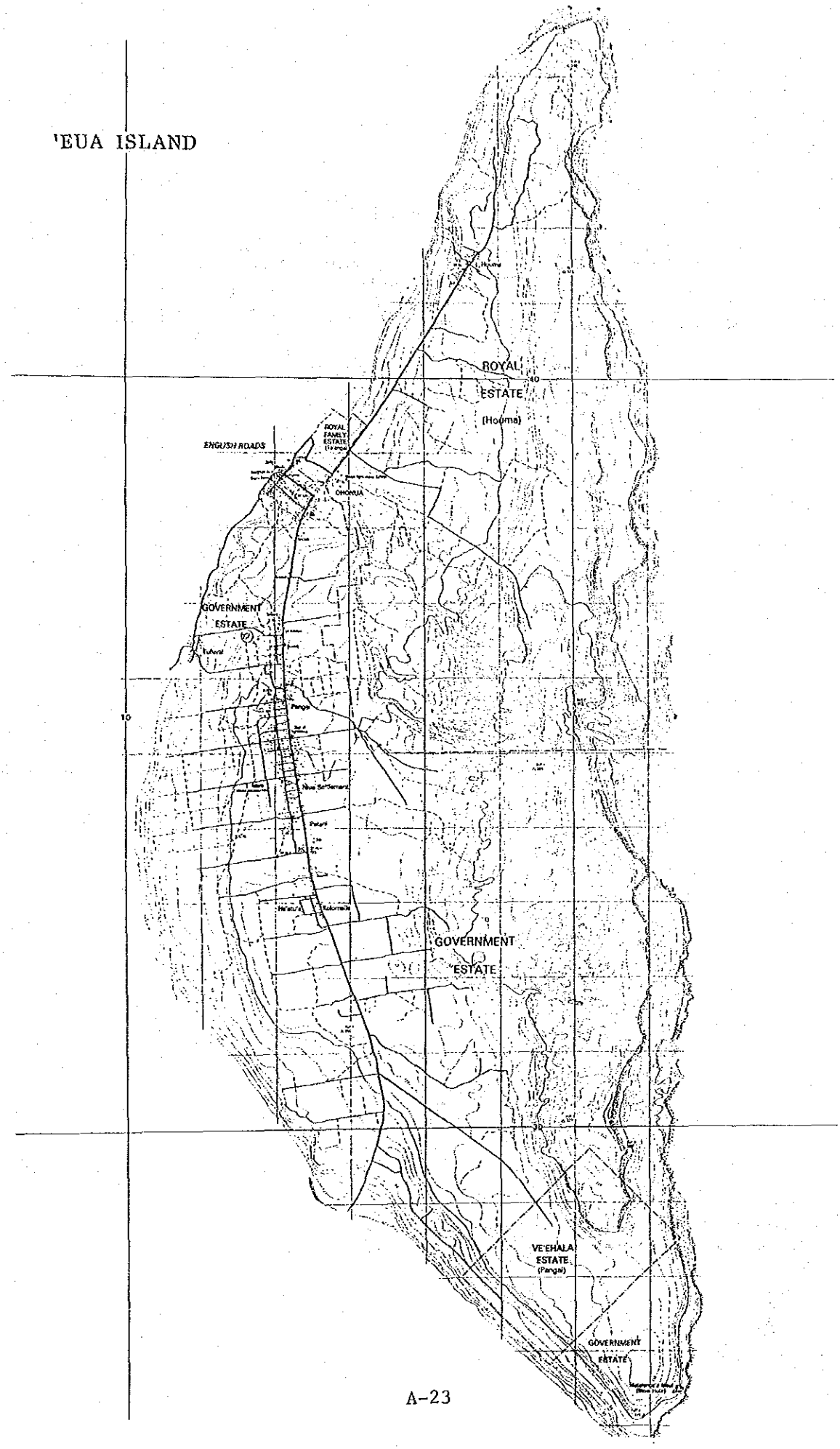


NOMUKA ISLAND



TONGATAPU ISLAND

'EUA ISLAND


ROYAL
ESTATE
(Hoama)
ROYAL FAMILY ESTATE (Havea)
ENGLISH ROADS
ONONUA
GOVERNMENT
ESTATE
GOVERNMENT
ESTATE
VE'EHALA
ESTATE
(Pangai)
GOVERNMENT
ESTATE

Location Map of Proposed Ice Boxes (Ha'apai Area)