ANTIGUA AND BARBUDA

BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
THE REHABILITATION OF THE ARTISANAL FISHERY
IN
ANTIGUA AND BARBUDA

NOVEMBER 2000

JAPAN INTERNATIONAL COOPERATION AGENCY
ECOH CORPORATION

PREFACE

In response to a request from the Government of Antigua and Barbuda, the Government of Japan decided to conduct a basic design study on the Project for Rehabilitation of Artisanal Fishery and entrusted the study to the Japan International Cooperation Agency (JICA).

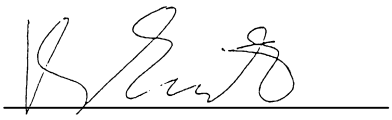
JICA sent to Antigua and Barbuda a study team from April 1 to May 4, 2000.

The team held discussions with the officials concerned of the Government of Antigua and Barbuda, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Antigua and Barbuda in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Antigua and Barbuda for their close cooperation extended to the teams.

November, 2000



Kunihiko Saito
President
Japan International Cooperation Agency

November, 2000

Letter of Transmittal

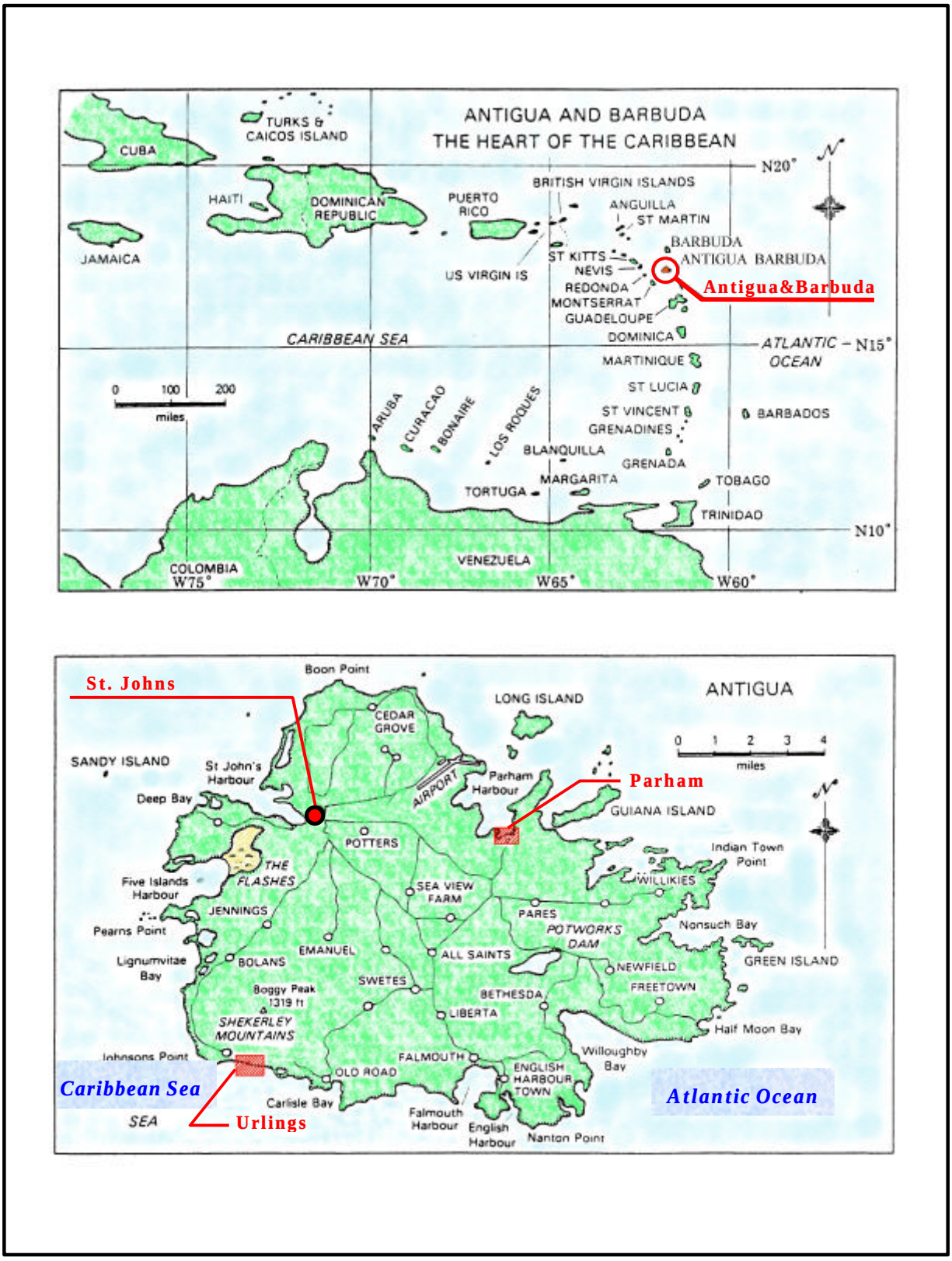
We are pleased to submit to you the basic design study report on the Project for Rehabilitation of Artisanal Fishery in Antigua and Barbuda.

This study was conducted by ECOH Corporation, under a contract to JICA, during the period from March 27, 2000 to November 30, 2000. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Antigua and Barbuda and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Kozo Matsumura
Project Manager,
Basic design study team on
the Project for Rehabilitation of
Artisanal Fishery
ECOH CORPORATION



Location Map of Antigua and Barbuda, Project Sites

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Urlings Site

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Abbreviations

ACI	American Concrete Institute
AEP	Acryl Emulsion Paint
AFL	Antigua Fisheries Ltd.
AISC	American Institute of Steel Construction
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BOD	Biochemical Oxygen Demand
BSCP	British Standards Institution
BS	British Standards
FAO	Food and Agriculture Organization of the United Nations
CIDA	Canadian International Development Agency
CARICOM	Caribbean Community
C.S.F	Caribbean Sea Food
CUBIC	Caribbean Uniform Building Code
D.F.	Demand Factor
D.L.	Datum Level
E/N	Exchange of Notes
FEP	Fluorinated ethylene propylene resin
FRP	Fiber Reinforced Plastic
GDP	Gross Domestic Product
GDP/C	Gross Domestic Product per Capita
GT	Gross Tonnage
HACCP	Hazard Analysis and Critical Control Point
H.W.L	High Water Level
ISO	International Organization for Standardization
JIS	Japan Industry Standard
JICA	Japan International Cooperation Agency
kva	kilovolt ampere
Loa	Length overall
L.W.L	Low Water Level
lx	lux
MSY	Maximum Sustainable Yield
M.W.L	Mean Water Level
NHC	National Hurricane Center

NEC	National Electrical Code
OAS	Organization of American States
PSI	Pound per Square Inch
PVC	Poly Vinyl Chloride
SGPW	Hot-dip zinc-coated steel pipes for water supply piping
SPG	Carbon steel pipes for ordinary piping
UBC	Uniform Building Code
USA	United States of America
USGS	United States Geological Survey
WFM	White Fish Market

Chapter 1

Background of the Project

Chapter 1 Background of the Project

1.1 Background of the Project

Antigua and Barbuda, which the capital is St. John's, became independence from the United Kingdom in 1981, has a population of approximately 71,500 (1988), is located at around 17 degrees of north latitude in the Lesser Antilles in the Caribbean Sea.

The climate is subtropical with a high annual mean temperature of 29℃. The location is in the path that most hurricanes take after originating in the Atlantic Ocean near the equator. Two or three hurricanes every year hit and damage infrastructures as well as fishery sectors every time. Recently, they were damaged by hurricane "Hugo"(1989), "Luis"(1995), "Georges"(1998) and "Lenny" (1999).

The country has GDP per-capita of US$7,570 in 1998 and it is ranked higher among Caribbean countries. However, tourism together with other service industries become 45% share of GDP and that makes its fragile nature of being affected by economic conditions in other countries. Its economy is also heavily influenced by damage caused by hurricanes hitting the country.

The Government of Antigua and Barbuda has formulated a 10-year national development plan (1996 - 2005) for making effective use of fishery resource as only one resource in the country as well as planning of other variety of industries considering such natural environment and economic circumstance. Furthermore, a 5-year fishery development plan was made to develop the fishery industry for making use of exclusive economic zone putting it as the country's second most promising industry after tourism.

It is estimated that the country's annual fish catch amount is more than 2,000 tons, however, another 700 tons or more in a year has to import to meet a domestic demand. Most of the fish catch is by traditional fish pot fishing method in the reefs and on the continental shelf around the islands, but the fish pot are heavily damaged by hurricane. The Government is therefore, trying to increase the scale of fishing boats and to change fishing methods, but a factor hampering those efforts come from insufficient fishery infrastructure in terms of berthing facilities, landing facilities and other fishery supporting facilities. In addition to that, those engaged in fishing activities suffered enormous damage to their buildings, fishing boats and fishing gear caused by Hurricane Luis in 1995 and Hurricane George in 1998. For lack of funds, many fishermen are unable

to resume their fishery activities after those hits. Antigua and Barbuda does not have any facilities for safe evacuation of fishing boats during hurricane hit. Currently, they refuge in mangrove thickets and sandy beaches. Storm surge and severe waves generated by hurricanes damage to their basic means of fishing and their boats, which are their asset.

Fishery infrastructures like landing facility of the catches are not well furnished except the landing and distributing facilities in the Capital St. John's. Therefore, fishing boats can not berth to shore line in such areas and fishermen spend a lot of works to land and board the fishes, fuels, and gears carrying them by walking in the water.

The Urlings site area on the south side of Antigua Island has seven landing points, 137 persons engaged in fishery activities and 95 fishing boats in operation. Another of the plan, Parham area on the east side has three landing places, 65 persons engaged in fishery activities and 54 fishing boats. Those south and east areas in particular are in behind for the countermeasure like slipway for the use of hurricane evacuation nor landing facilities of the fish catches.

The particular circumstances of Urlings and Parham site area are;

1. area of well concentration of fishing boats
2. sufficient fish catches
3. good natural conditions for safety evacuation of fishing boats under hurricane
4. easy access to infrastructure like main road, electricity and water supply
5. significant fishing village with sufficient resided fishermen

In addition to these circumstances of advantageous conditions to construct a new fishing port, there are no facilities for safe evacuation, this area is particular area where fishing boats were severely damaged by the hit of the past hurricanes and the location of this area is important as supply base of the fish catches to the capital and other local areas.

Under the circumstance, Antigua and Barbuda has requested a grant aid to Japan concerning provision of fishery-related facilities in the Urlings and Parham sites so as to minimize a damage from hurricanes, earlier solution of insufficient supply of fishery products and raising of the living standard of artisanal fishermen.

The initial requests are mentioned on Table 1.1.

Table 1.1 Contents of the Request

Project Site / Facilities	Parham	Urlings	Remarks
1. Mooring Basin	― ― ―	3,900m^3 , Dredging Vol.	Dredging
2. Revetment	― ― ―	L=93m	
3. Wharf	L=90m	L=60m	
4. Finger Jetty	W3.0×L90m	― ― ―	
5. Pavement	1,050m^2	2,300m^2	
6. Main Building	Total Area: 286m^2	Total Area: 286m^2	
(1) Managing Office	W 6.0×L 8.5×H 2.8m	W 6.0×L 8.5×H 2.4m	
(2) Meeting Room	W 6.0×L 8.0×H 2.8m	W 6.0×L 8.0×H 2.4m	
(3) Shower/Toilet	W 6.0×L 4.5×H 2.0m	W 6.0×L 4.5×H 2.0m	
(4) Fish Market	W 8.0×L10.0×H 2.8m	W 8.0×L10.0×H 2.8m	
(5) Work Shop	W 5.0×L 6.0×H 2.8m	W 5.0×L 6.0×H 2.8m	
(6) Parts Shop	W 6.0×L21.0×H 2.8m	W 6.0×L21.0×H 2.8m	
(7) Dry Storage	W 6.0×L21.0×H 2.8m	W 6.0×L21.0×H 2.8m	
(8) Ice Making Machine Room			
(9) Cold Storage Machine Room			
7. Kiosk	W3.0×L3.0×H 2.8m ×10units	― ― ―	
8. Bus Shed	W 3.0×L15.0×H 2.8m	― ― ―	
9. Gear Lockers	W 4.0×L20.0×H 2.8m W 2.0×L 2.0×H 2.8m per unit ×20 units/house	W 4.0×L20.0×H 2.8m W 2.0×L 2.0×H 2.8m per unit ×20 units/house	
10. Cold Storage	W 3.0×L 3.0×H 2.5m =22.5m^2	W 3.0×L 3.0×H 2.5m =22.5m^2	+/- 5
11. Ice Making/Storage Plant	0.5t/8 hr ×2 units	0.5t/8 hr ×2units	
12. Standby Generator	25KVA × 2	25KVA × 2	
13. Slipway	W10×L20m Capacity： 4 t	W10×L20m Capacity： 4 t	
14. Oil Supply Facility	10kl	10kl	
15. Backup Vehicles	2 units	2units	

L: Length, Extension W: Width H: height

1.2 Situation of the Project Sites

1.2.1 Natural Conditions

(1) Meteorological Conditions

Antigua and Barbuda, located at east-southeast of Puerto Rico, has a tropical oceanic climate. Past local meteorological data are collected at the Antigua Airport (V. C. Bird International Airport) Weather Station.

1) Wind Direction and Wind Speed

Table 1.2.1-1 shows the mean wind speed and predominant wind directions for each month. The island is in the low latitude of northeastern trade winds zone, and the annual mean wind speed is approx. 6 m/s. The predominant wind direction is from E to ESE.

Table 1.2.1-1 Monthly Mean Wind Speed and Wind Dir ection

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max. Wind (knot/h)	12.8	12.4	12.1	11.9	12.0	13.4	14.2	13.0	10.8	9.6	10.5	11.7
Max. Wind (m/sec)	6.5	6.3	6.2	6.1	6.1	6.8	7.2	6.6	5.5	4.9	5.4	6.0
Direction	E	E	E	E	ESE	E	E	E	E	E	E	E

Source：Antigua Air Port Meteorological Office (1969～1995)

Table 1.2.1-2 Wind Direction and Frequency

JAN 1, 1993-DEC 31, 1996 ANTIGUA&BARBUDA V.C.BIRD AIRPORT

Direction / Velocity	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	TOTAL
0.0- 0.9	5	3			1	1		1				1	1		2	3	18
m/sec	0.0	0.0			0.0	0.0		0.0				0.0	0.0		0.0	0.0	0.1
1.0- 1.9	198	48	23	13	12	7	8	4	14	25	20	35	73	55	63	103	701
m/sec	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	2.1
2.0- 2.9	85	36	13	15	15	14	10	15	28	54	69	80	191	104	92	86	907
m/sec	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.6	0.3	0.3	0.3	2.7
3.0- 3.9	57	18	11	13	15	9	8	6	43	117	125	272	448	170	88	71	1471
m/sec	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.8	1.3	0.5	0.3	0.2	4.4
4.0- 4.9	43	14	10	13	11	1	2	15	48	67	166	482	725	284	101	65	2047
m/sec	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.5	1.4	2.2	0.9	0.3	0.2	6.2
5.0- 5.9	74	38	8	9	7	3	5	11	41	137	317	1139	2048	685	209	129	4860
m/sec	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	3.4	6.2	2.1	0.6	0.4	14.6
6.0- 6.9	43	15	6	13	5	4	1	5	22	109	365	1409	3290	995	202	75	6559
m/sec	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.1	4.2	9.9	3.0	0.6	0.2	19.7
7.0- 7.9	28	8	4	5	3	1	1	1	13	76	268	1419	4050	882	141	41	6941
m/sec	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	4.3	12.2	2.7	0.4	0.1	20.9
8.0- 8.9	8	2	1	2					8	40	135	874	3553	618	89	28	5358
m/sec	0.0	0.0	0.0	0.0					0.0	0.1	0.4	2.6	10.7	1.9	0.3	0.1	16.1
9.0- 9.9	2	3	2	1					3	15	41	453	2102	266	27	7	2922
m/sec	0.0	0.0	0.0	0.0					0.0	0.0	0.1	1.4	6.3	0.8	0.1	0.0	8.8
10.0-10.9	2	2							4	7	15	145	830	76	12	5	1098
m/sec	0.0	0.0							0.0	0.0	0.0	0.4	2.5	0.2	0.0	0.0	3.3
11.0-11.9	1			1					2	1	5	61	165	19	6	3	264
m/sec	0.0			0.0					0.0	0.0	0.0	0.2	0.5	0.1	0.0	0.0	0.8
12.0-12.9			2		1	1		2		1	2	7	36	5	2	3	62
m/sec			0.0		0.0	0.0		0.0		0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2
13.0-13.9	2	1		2				2	3	1	1	2	3	1			18
m/sec	0.0	0.0		0.0				0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.1
14.0-14.9			1										4			2	7
m/sec			0.0										0.0			0.0	0.0
15.0-			5		2	2	2	2		1		1	1				16
m/sec			0.0		0.0	0.0	0.0	0.0		0.0		0.0	0.0				0.0
TOTAL	548	188	86	87	72	43	37	64	229	651	1529	6380	17520	4160	1034	621	33249
(%)	1.6	0.6	0.3	0.3	0.2	0.1	0.1	0.2	0.7	2.0	4.6	19.2	52.7	12.5	3.1	1.9	100.0

Source：Antigua Air Port Meteorological Office (1969～1995)

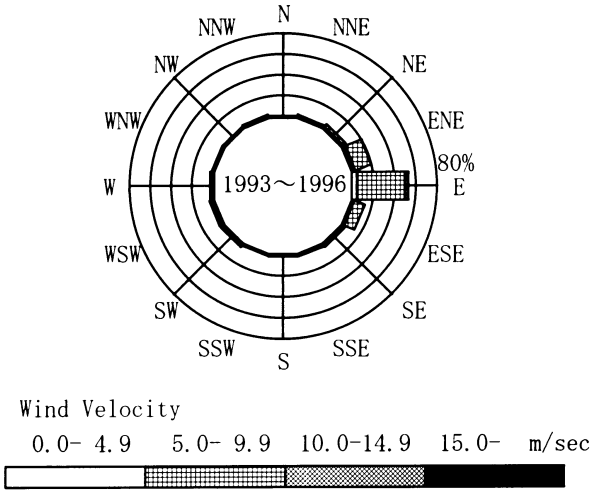


Figure 1.2.1-1 Wind Rose

2) Temperature

The difference between the annual mean high and mean low in air temperature is small like approx. 6 degrees as shown in Table 1.2.1-3, and the mean high is above 30 degrees from June to October. It becomes below 30 degrees from November to May, but the temperature differential is not very much.

Table 1.2.1-3 Monthly Mean Temperature

(Centigrade)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Max.	28.2	28.3	28.6	29.2	29.8	30.5	30.7	30.9	30.7	30.4	29.5	28.6
Mean Min.	22.3	22.1	22.5	23.3	24.3	25.3	25.4	25.4	24.8	24.3	23.7	22.8
Max. Temp.	31.0	31.0	33.0	32.0	33.0	33.0	34.0	33.0	33.0	33.0	32.0	31.0
Min. Temp.	17.0	17.0	18.0	18.0	20.0	22.0	21.0	22.0	21.0	20.0	19.0	16.0
Mean Temp.	25.2	25.2	25.6	26.2	27.1	27.9	28.1	28.2	27.8	27.3	26.6	25.7

Source：Antigua Air Port Meteorological Office (1969～1995)

3) Humidity

The mean humidity through the year as observed at 7:00 A.M. in the morning is 85-81% and the mean humidity at 3:00 P.M. in the afternoon when the air temperature has risen is stable as 72-78% throughout the year as shown in Table 1.2.1-4.

Table 1.2.1-4 Monthly Mean Humidity

(%)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hum. 7 AM	81	81	81	81	82	82	83	83	84	85	85	83
Hum. 3 PM	72	72	72	72	74	74	74	77	77	78	78	77

Source：Antigua Air Port Meteorological Office (1969～1999)

4) Precipitation

The monthly mean precipitation of more than 100 mm appears from August to November, which means a hurricane season, and it is particularly high precipitation. It exceeds 100 mm in May as well, the month with the highest precipitation as indicated in Table 1.2.1-5.

Table 1.2.1-5 Monthly Mean Precipitation

(mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.Monthly	159.	110.	179.	198.	459.	193.	244.	279.	410.	358.	393.	198.
Min.Monthly	20.1	9.9	14.5	12.2	5.8	5.8	14.2	24.1	27.7	12.4	22.6	12.2
Mean	56.9	37.6	46.7	67.6	112.	49.5	86.6	100.	140.	130.	134.	87.4
Max Daily	41.9	22.1	79.2	91.7	179.	65.5	73.9	135.	188.	211.	161.	147.

Source：Antigua Air Port Meteorological Office (1960～1995)

5) Hurricane

Information on hurricanes is collected from the Meteorological Station at Antigua's V.C. Bird International Airport and the U.S. Nation al Hurricane Center. The hurricanes that have affected Antigua and Barbuda are listed in Table 1.2.1-6.

In particular, at the time of approach of Hurricane Luis in 1995 (10:30 hours on September 5) the mean wind speed was 105 knots (about 54 m/s), the maximum wind speed was 127 knots (about 65 m/s), and total precipitation was 254 mm. As for Hurricane Lenny in 1999, its course was not the same as the usual path. She was born in the Caribbean and moved eastward across it. When she approached Antigua and Barbuda her mean wind speed was 30 knots (about 15 m/s), her maximum wind speed was 50 knots (about 26 m/s), and her precipitation was recorded at 465 mm.

Table 1.2.1-6 Record of Hurricanes affected in Antigua and Barbuda

Year	Name of Hurricane	Wind Speed (knots)		Terms of Affect
		Average	Maximum	
1950	Baker			Aug. 20 – Sept. 01
	Dog			Aug.30 – Sept. 16
1989	Hugo			Sept. 10 – Sept. 22
1990	Klaus			Oct. 03 – Oct. 09
1995	Luis	105	127	Aug. 27 – Sept. 11
	Marilyn			Sept. 12 – Sept. 22
	Iris			Aug. 22 – Sep.04t
1996	Bertha			July 05 – July 15
1998	Georges		100	Sept. 15 – Sept. 29
1999	Jose	70	89	Oct. 17 — Oct. 25
	Lenny	30	50	Nov. 13 – Nov. 22

Source：Antigua International Air Port Meteorological Office

Of the hurricanes mentioned in Table 1.2.1-6, the courses of the major four hurricanes that caused particularly heavy damage to Antigua and Barbuda, i.e. Hugo (1989), Luis (1995), George (1998) and Lenny (1999), are indicated in Figure 1.2.1-2.

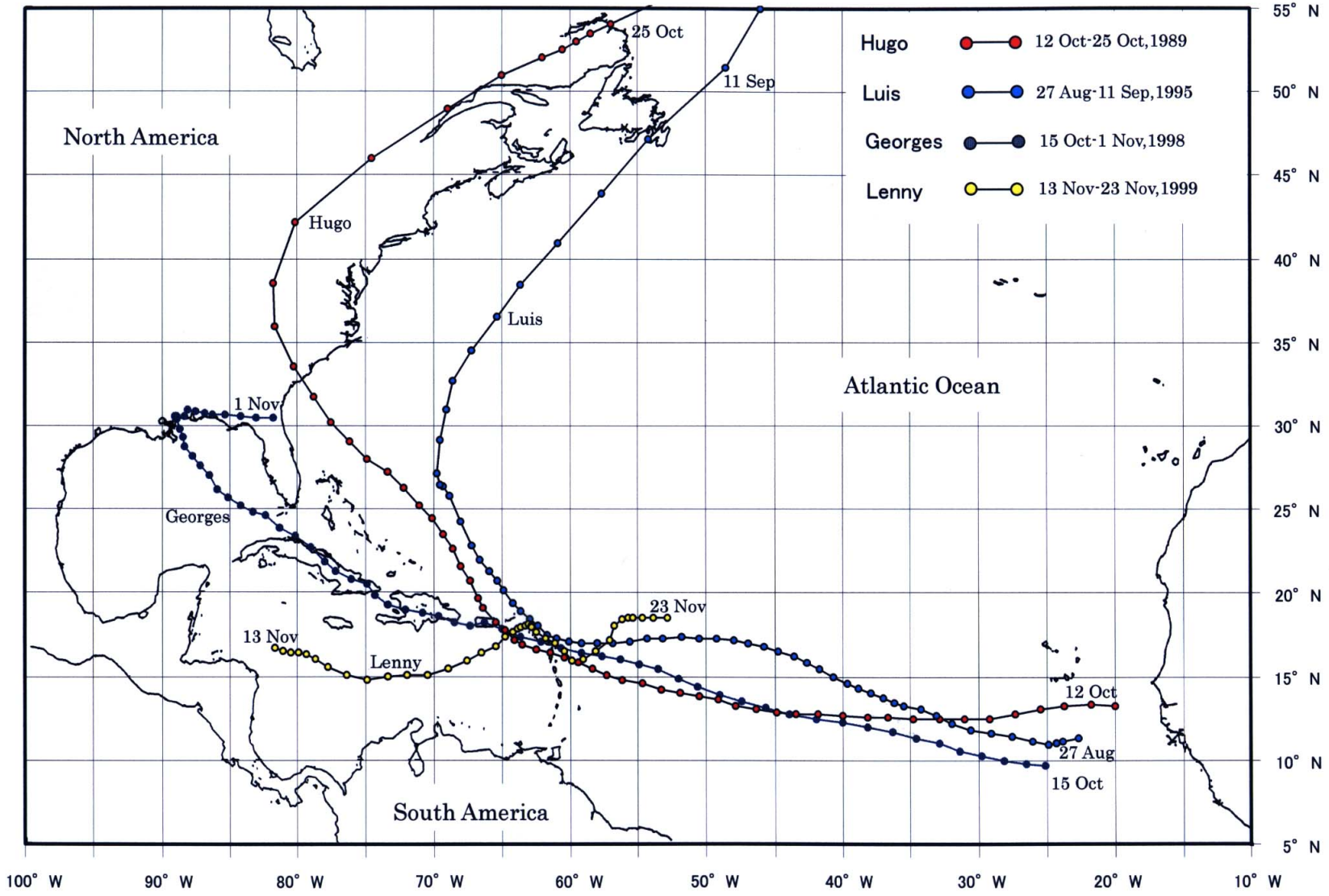


Figure 1.2.1-2 Hurricane Track

1-8

(2) Sea Conditions

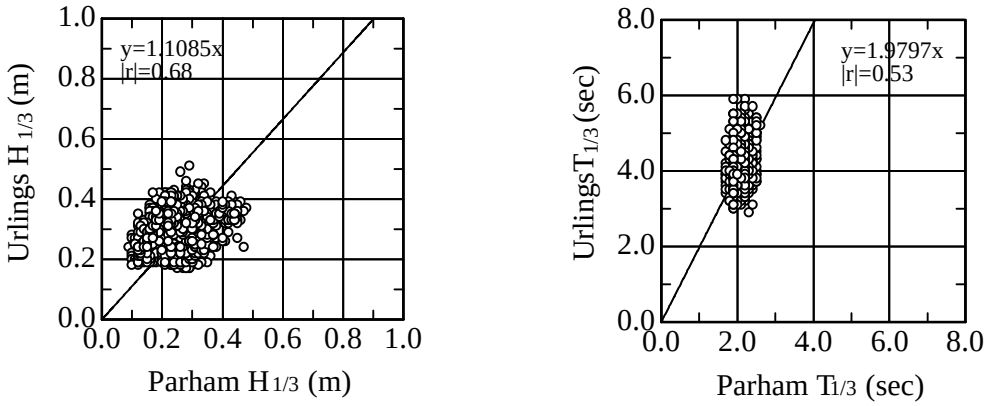
1) Wave

Ultrasonic hydrographic meters were installed at the project sites, i.e. at Parham on the north of the island of Antigua and at Urlings on the south side (Parham: -11m, Urlings: -12.5m), and wave height, period and the direction were observed in 10 minutes having interval of every 20 minutes during 15 days. Table 1.2.1-7 shows the maximum values of the wave data during the observation period, and Figure 1.2.1-3 shows co-relation of wave height and period at the two sites.

Table 1.2.1-7 Wave Dimensions Observed during Field Survey

	Significant Wave		Maximum Wave	
	$H_{1/3}$(m)	$T_{1/3}$(s)	H_{max}(m)	T_{max}(s)
Parham	0.48	2.6	0.79	6.1
Urlings	0.51	5.9	0.83	11.8

(April 8～22, 2000)



(April 8～22, 2000)

Figure 1.2.1-3 Co-relation of Wave between Parham and Urlings

The observation results show that wave height was about 0.5 m in both sites during the period, but the wave height figures were a little higher at Urlings, and the wave period was also about twice as long at Urlings. As for wave direction, the predominant direction was north-northeast to north-northwest and these was hardly any waves

from the northwest direction at Parham, whereas waves from the south-southeast were predominant at Urlings as shown in Figures 1.2.1-4 (1) and (2).

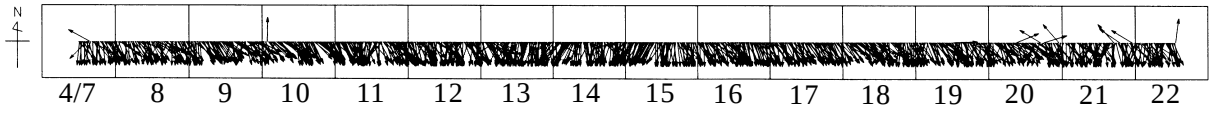


Figure 1.2.1-4(1) Wave Direction Observed at Parham

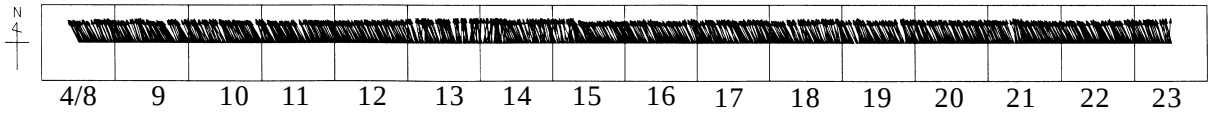


Figure 1.2.1-4(2) Wave Direction Observed at Urlings

2) Tide

Ultrasonic hydrographic meters were installed at the two project sites (at the same points as in the above-mentioned wave observation), and tide level was observed in 10 minutes having interval of every 20 minutes during 15 days. The harmonic analysis results of the tide level observation records at Parham and Urlings are shown in Tables 1.2.1-8 (1) and (2) and Figures 1.2.1-5 (1) and (2). At both points the tidal amplitude was about 20 cm, and it was just about matching the figures for the four main component tides (St. John's) shown in the "Admiralty Tide Tables, Volume 2, 2000."

Table 1.2.1-8(1) Main Tide Components by Harmonic Analysis

Site		Parham		Urlings		Admiralty Tide Table Volume 2, 2000	
Observation period		April 7, 2000～（15days）					
Location	Latitude	17 ° 08 ′ 20 ″		17 ° 01 ′ 13 ″			
	Longtitude	61 ° 45 ′ 56 ″		61 ° 52 ′ 26 ″			
Component Tide		Amp.(cm)	Lag(°)	Amp.(cm)	Lag(°)	Amp.(cm)	Lag(°)
K1		8.2	161.8	8.7	161.9	7.0(H')	175.0
O1		6.6	164.1	6.7	167.3	6.0(Ho)	177.0
P1		2.7	161.8	2.9	161.9	—	—
Q1		0.7	154.2	0.6	178.2	—	—
MS4		0.1	244.6	0.2	101.3	—	—
M2		6.6	143.5	4.5	135.7	4.0(Hm)	150.0
S2		2.3	154.3	1.8	142.1	2.0(Hs)	173.0
K2		0.6	154.3	0.5	142.1	—	—
N2		1.3	147.4	0.1	208.1	—	—
M4		0.1	244.1	0.2	355.5	—	—

Note: Amp.; Amplitude, Lag; Lag Angle

Table 1.2.1-8(2) Tide Level Calculated by Harmonic Analysis

Harmonic Constant	Parham	Urlings	Remarks
Mean Sea Level (M.S.L=+Z_0)	23.7cm	21.7cm	$Z_0=H_m+Hs+H'+Ho$
Mean High Water Interval（M.H.W.I）	4h56m	4h41m	Km/29
Nearly Highest High Water Level（N.H.H.W.L）	47.4cm	43.4cm	Z_0+Hm+Hs+H'+Ho
High Water Level of Spring Tide（H.W.O.S.T）	32.6cm	28.0cm	Z_0+(Hm+Hs)
High Water Level of Neap Tide（H.W.O.N.T）	28.0cm	24.4cm	Z_0+(Hm-Hs)
Low Water Level of Neap Tide（L.W.O.N.T）	19.4cm	19.0cm	Z_0-(Hm-Hs)
Low Water Level of Spring Tide（L.W.O.S.T）	14.8cm	15.4cm	Z_0-(Hm+Hs)
Chart Datum Line（C.D.L）	0.0cm	0.0cm	M.S.L- Z_0
Spring Range	17.8cm	12.6cm	2(Hm+Hs)
Mean Tidal Range	13.2cm	9.0cm	SR+NR/2
Neap Range	8.6cm	5.4cm	2(Hm-Hs)

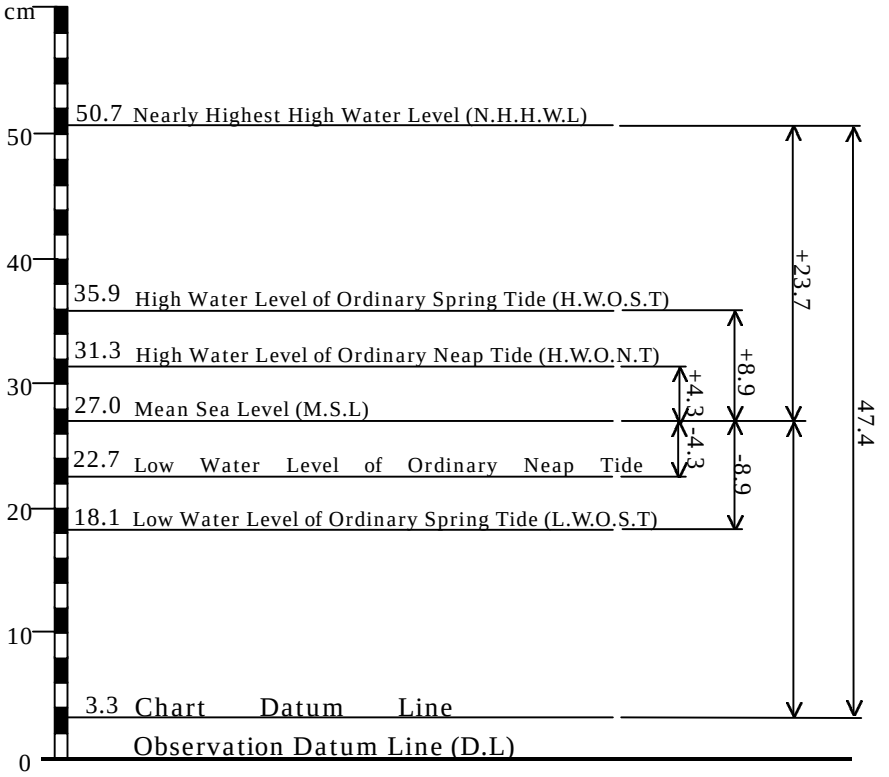


Figure 1.2.1-5(1) Tide Condition at Parham

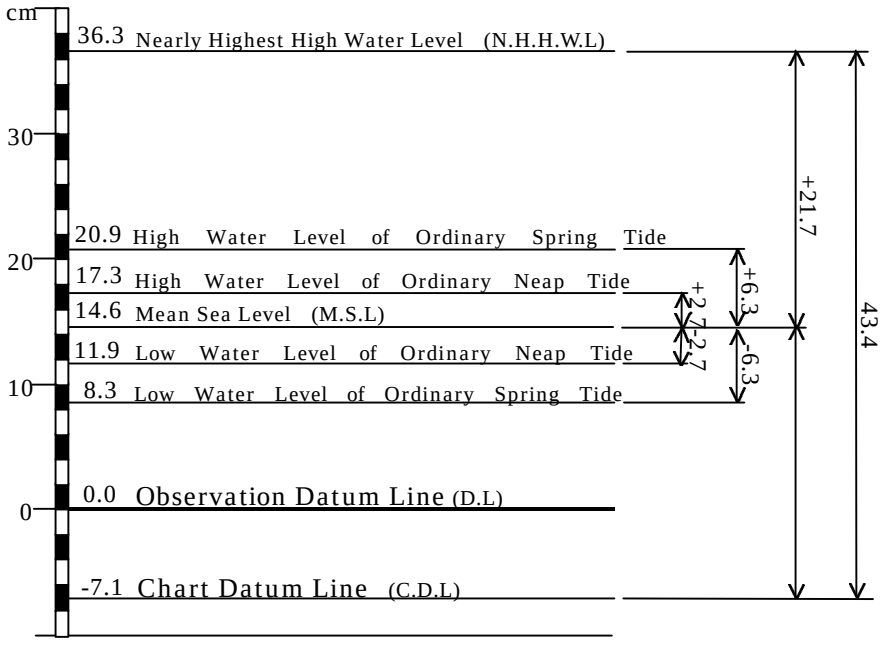


Figure 1.2.1-5(2) Tide Condition at U rlings

3) Tidal Current of Bottom Layer

As same as the wave observation, ultrasonic hydrographic meters recorded tidal currents of bottom layer at both points 0.7 m above the bottom were observed in 10 minutes having intervals of every 20 minutes during 15 days. Figures 1.2.1-6 (1), (2) show the series of tidal current over the observation period.

At Parham currents in the NNE direction were generally predominant. At 8:20 a.m. on April 14 a current speed of 7.5 m/s (NNE) was recorded.

At Urlings, on the other hand, the predominant direction of flow was to the NW, a current speed of 12.8 m/s (WNW) having been registered there at 0:00 a.m. on April 9.

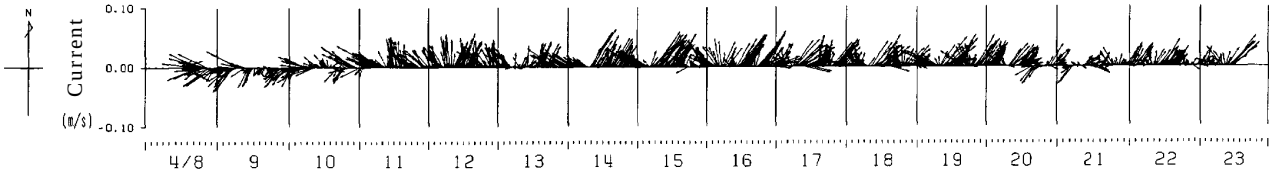


Figure 1.2.1-6(1) Bottom Tidal Current Observed at Parham

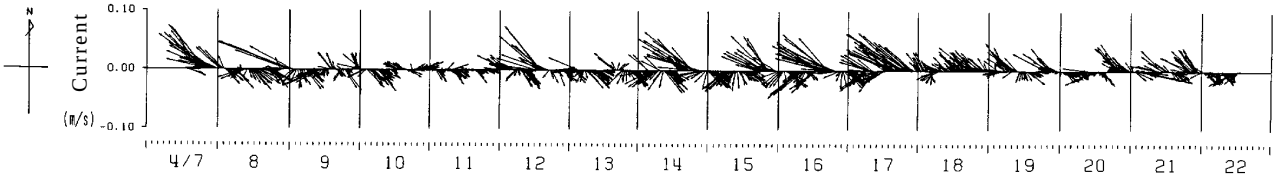


Figure 1.2.1-6(2) Bottom Tidal Curr ent Observed at Urlings

4) Tidal Current of Surface Layer

At both Parham and Urlings pole type floats for the 0.5 m long were appropriately thrown into the water, and the current conditions were observed at that depth below the water level. On the day of observation there was strong influence of easterly winds, and the indicated current direction was about the same as the wind direction.

At Antigua the tidal current of surface layer is influenced by wind and wind driven current is predominant, because tidal range which generate a tidal current is relatively small.

5) Littoral Drift

In both the Parham and the Urlings sites, a field survey and an interview survey on littoral drift were carried out. Since the project site in the Parham area is at the innermost part of the bay, where is very calm water surface area, and since there are no sources of sediment supply in the vicinity, no place in the adjacent area is recognized for erosion or sedimentation phenomena. There were no places that are noted for significant erosion or sedimentation phenomena at Urlings.

6) Topography and Bathymetry

The land topography survey in on-land and maritime area at the both sites was carried out, the results thereof being shown in Figures 1.2.1-7 (1) and (2).

Regarding the seabed bathymetry of the Parham site, the water depth is shallow by 2 - 3 m continuing all the area to 400 m offshore, and the seabed gradient is generally about 1/100. On the other hand, at Urlings there is a coral reef of 0.5 m depth to about 100 m out of the shoreline, the seabed gradient is generally about 1/10 from there.

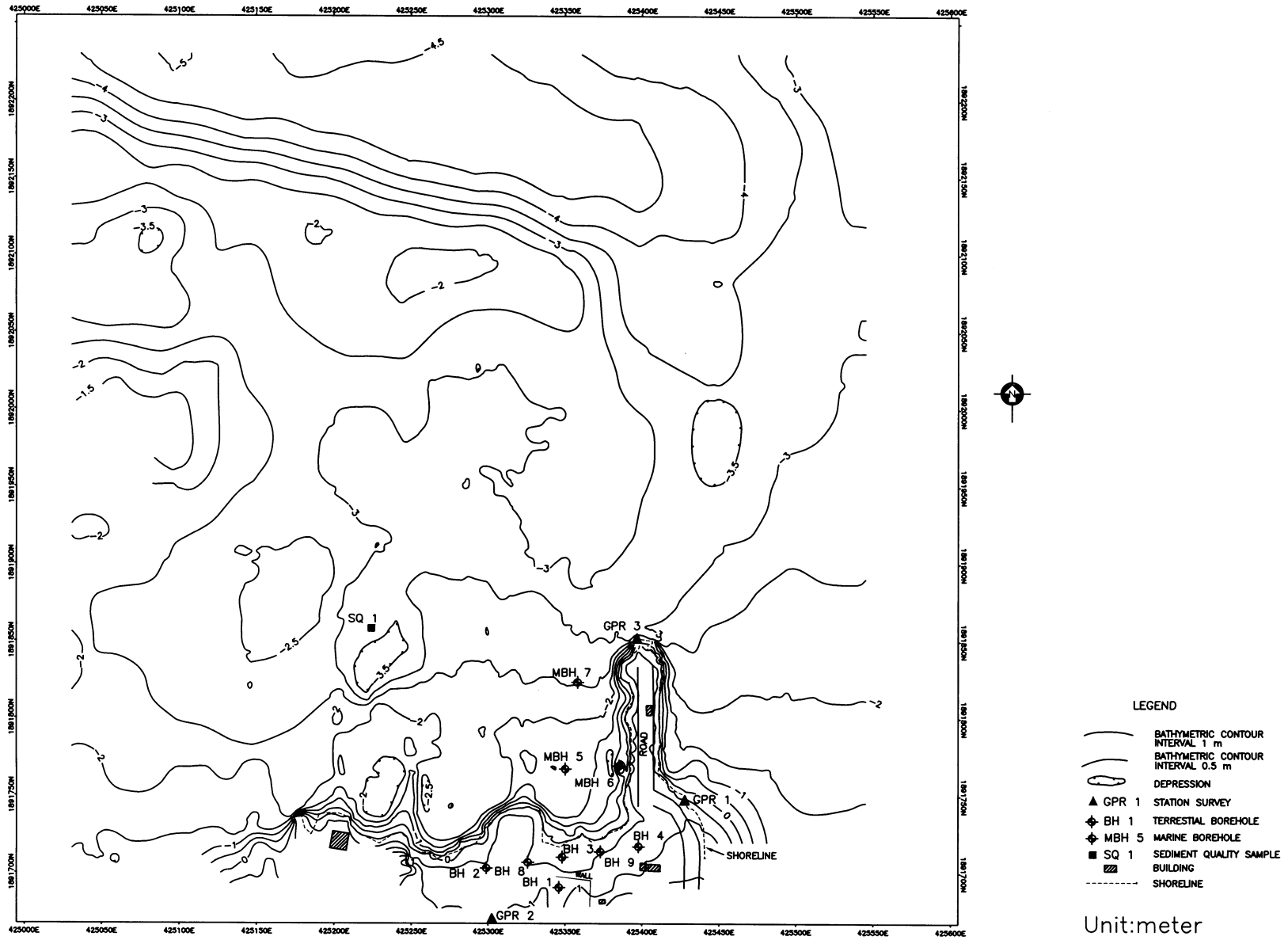


Figure 1.2.1-7(1) Topography at Parham Site

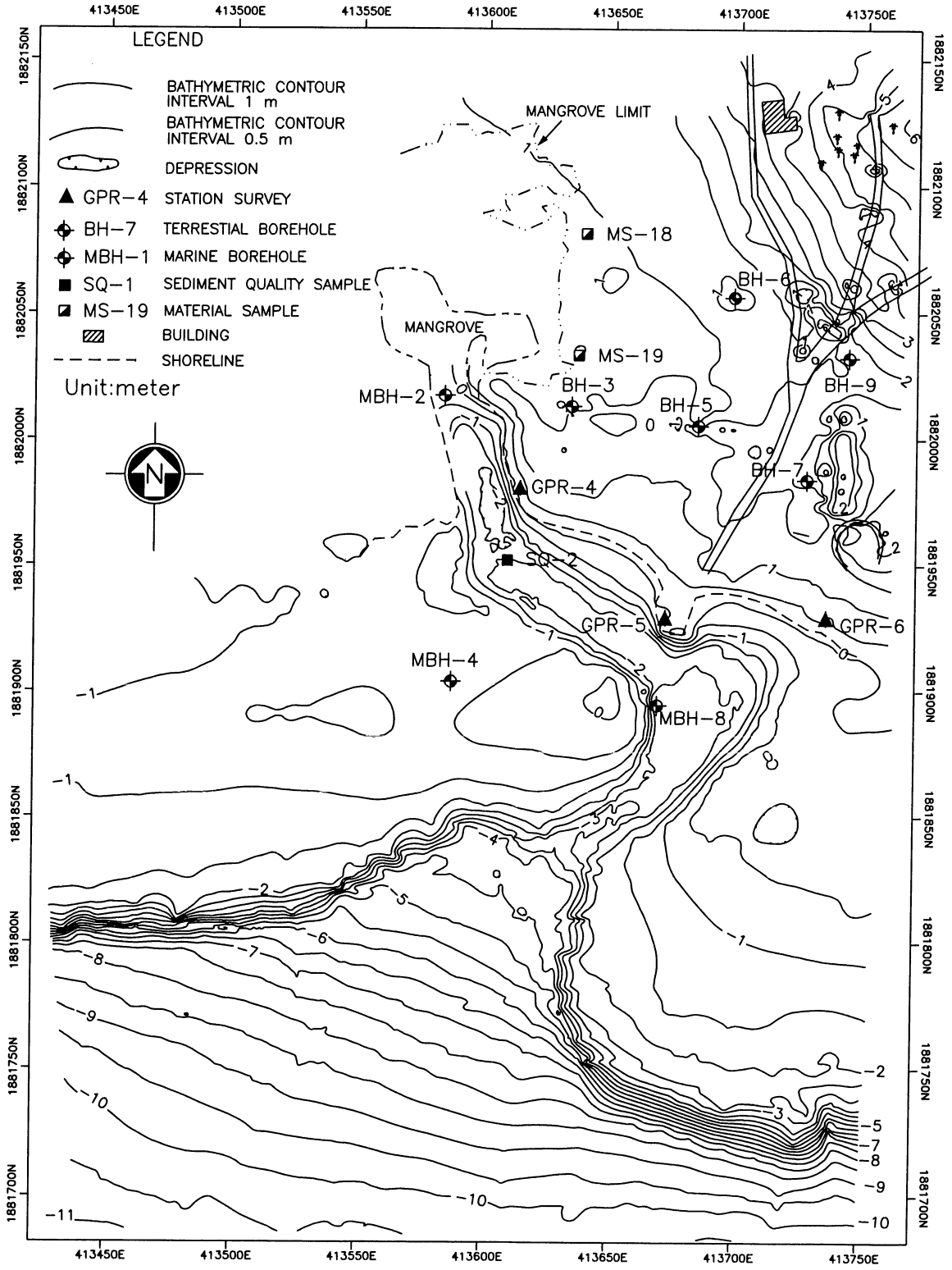


Figure 1.2.1-7(2) Topography at Urlings Site

7) Soil Condition

The soil investigation was conducted by maritime borings and on-land borings at the both sites. The boring logs are shown in Figures 1.2.1-8 (1) and (2), respectively. The soil conditions of the project sites as based on those survey results can be described as follows.

a) Parham

On land there is a layer of organic material in the shallow ground near the surface that has a thickness of 1.0 - 1.5 m and N value of 0 and equivalent. Regarding the offshore area, there is a silty soft layer with a thickness of 3.0 - 4.0 m from the seabed and a N value of about 0. The bedrock appears directly under the land and sea soft layers. As for the depth of the bedrock, in the land boreholes BH-1, 2, 3, 4, 8 and 9 and in the seabed boreholes BH-5 and 7 the bearing stratum of bedrock (N value>50) appears at a comparatively shallow 4.0 - 7.0 m.

The main sub-soil components include organic soil, clay, silt and limestone.

b) Urlings

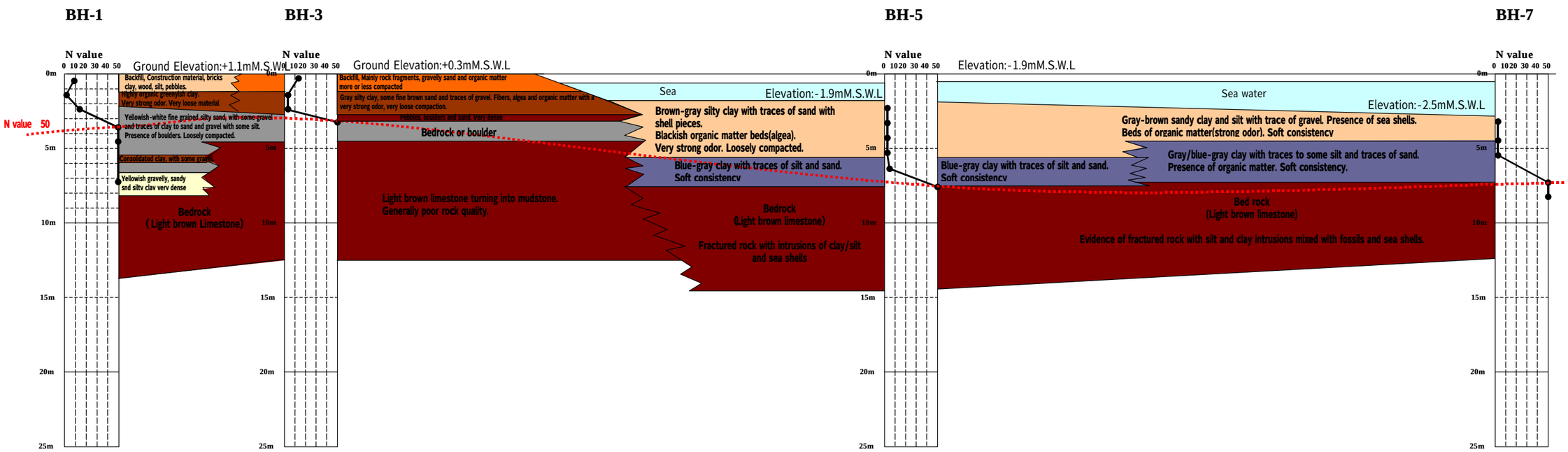
In the shallow soil layers, there are silty and sandy layers, many of them containing seashells and other similar materials. The bearing stratum of bedrock appears in the vicinity of 15-20 m in all of the boreholes. Furthermore, besides the bedrock, layers with a large N value (N = 20 - 50) appear at comparatively shallow depths of 5 - 10 m as well. The main sub-soil components include silt, boulders, gravel and clay, and they have lots of seashells in them.

8) Seabed Material

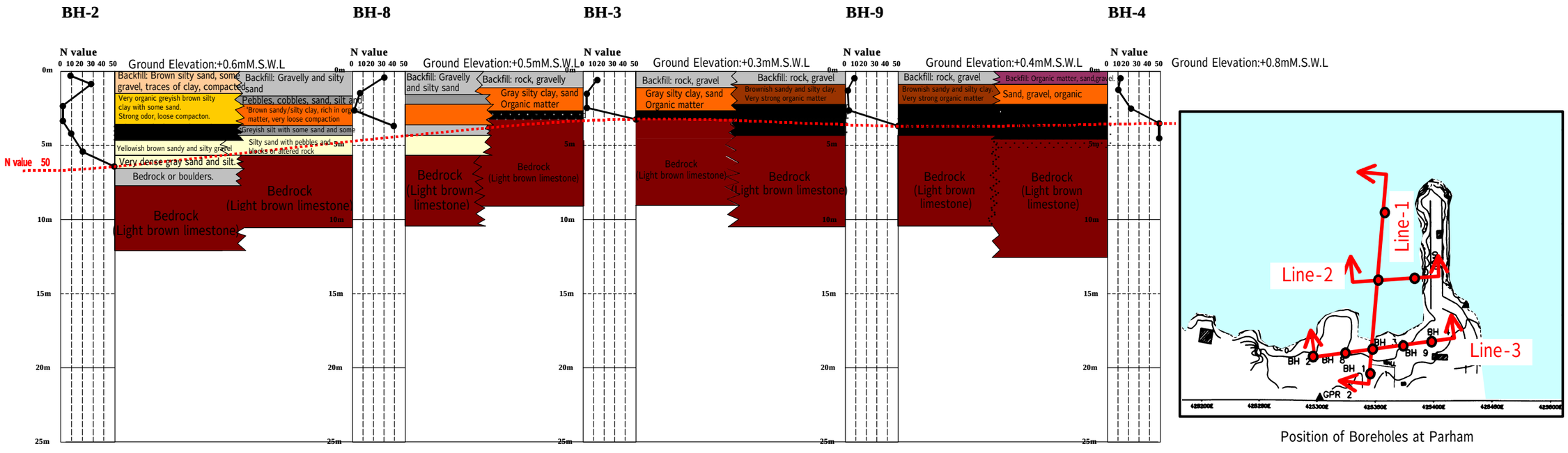
Five samples of sea bottom materials were taken from seabed offshore of both sites, the components of sediment material are shown in Figures 1.2.1-9 (1), (2) and (3).

At sampling points SQ-1, 3 and 4 in Parham Area sandy material occupy a comparatively high percentage, but clayey and silty material represent more than 50% of the total composition. On the other hand, at sampling points SQ-2 and 5 there was 70-80% sand.

As for Urlings Site, sandy material accounted for more than 50% of the total composition of the bottom materials at all sampling points.



Parham Site Line-1/ BH-1 - BH3 - BH-5 - BH-7



Position of Boreholes at Parham

Parham Site Line-2 / BH-2 - BH8 - BH-3 - BH-9 - BH-4

Figure 1.2.1-8(1) Result of Soil Investigation at Parham

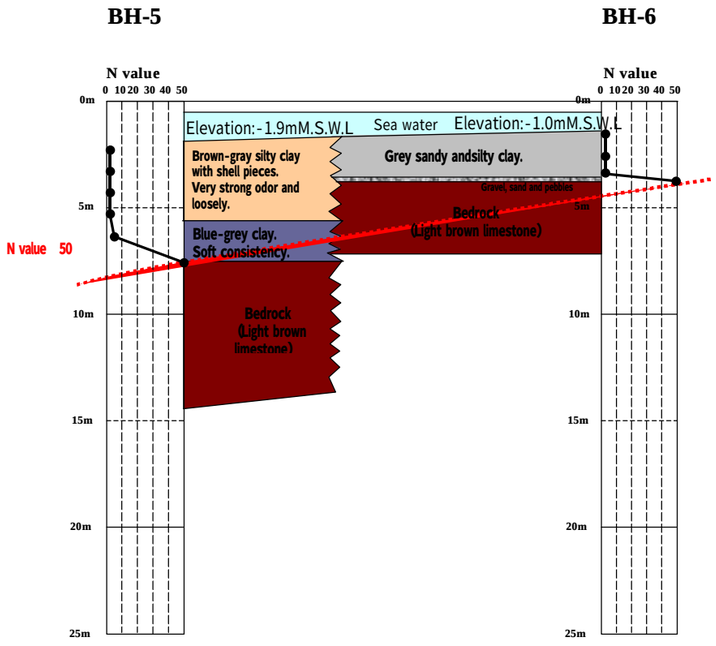
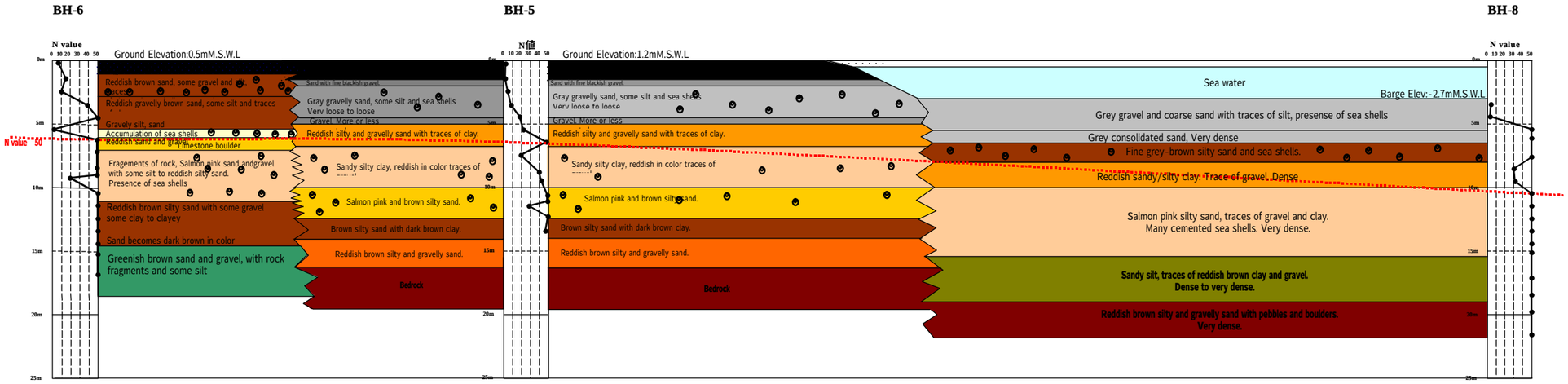
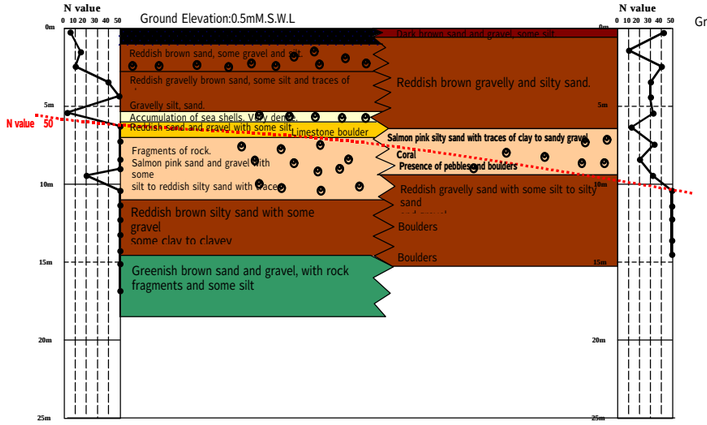


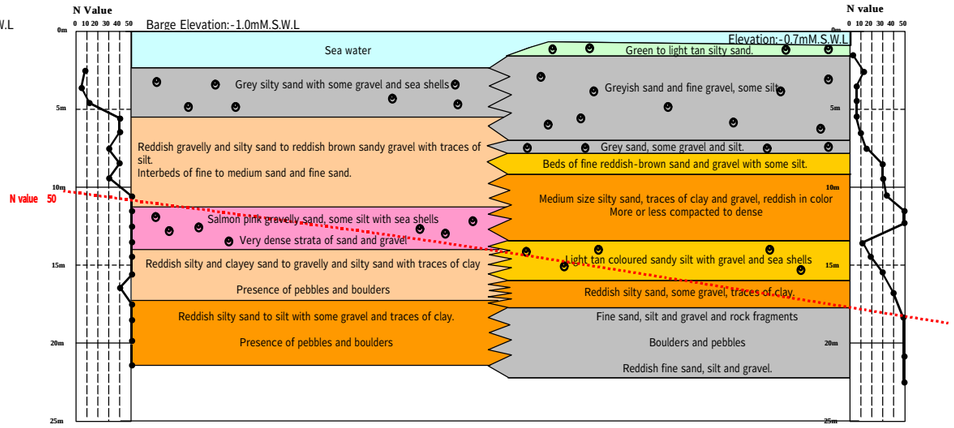
Figure 1.2.1-8(2) Result of Soil Investigation at Parham



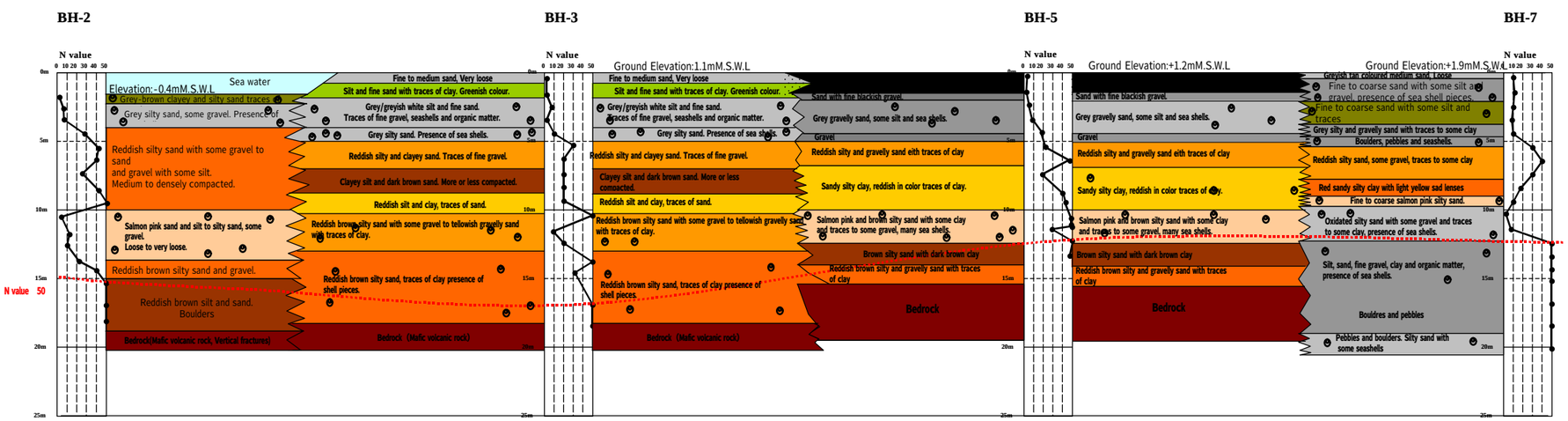
Urling Site Line-1 / BH-6 - BH5 - BH-8



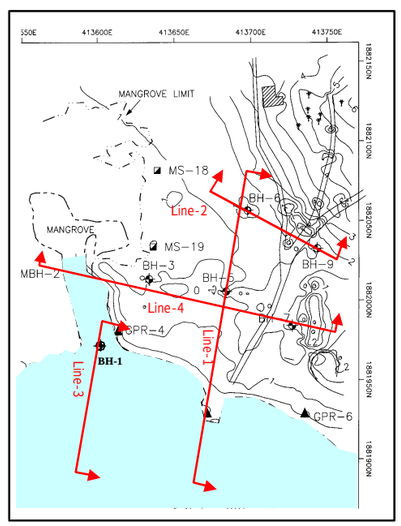
Urling Site Line-2/ BH-6 - BH9



Urling Site Line-3 / BH-1 - BH4



Urling Site Line-4 / BH-2 - BH3 - BH-5 - BH-7



Position of Boreholes at Urlings

Figure 1.2.1-8(3) Result of Soil Investigation at Urlings

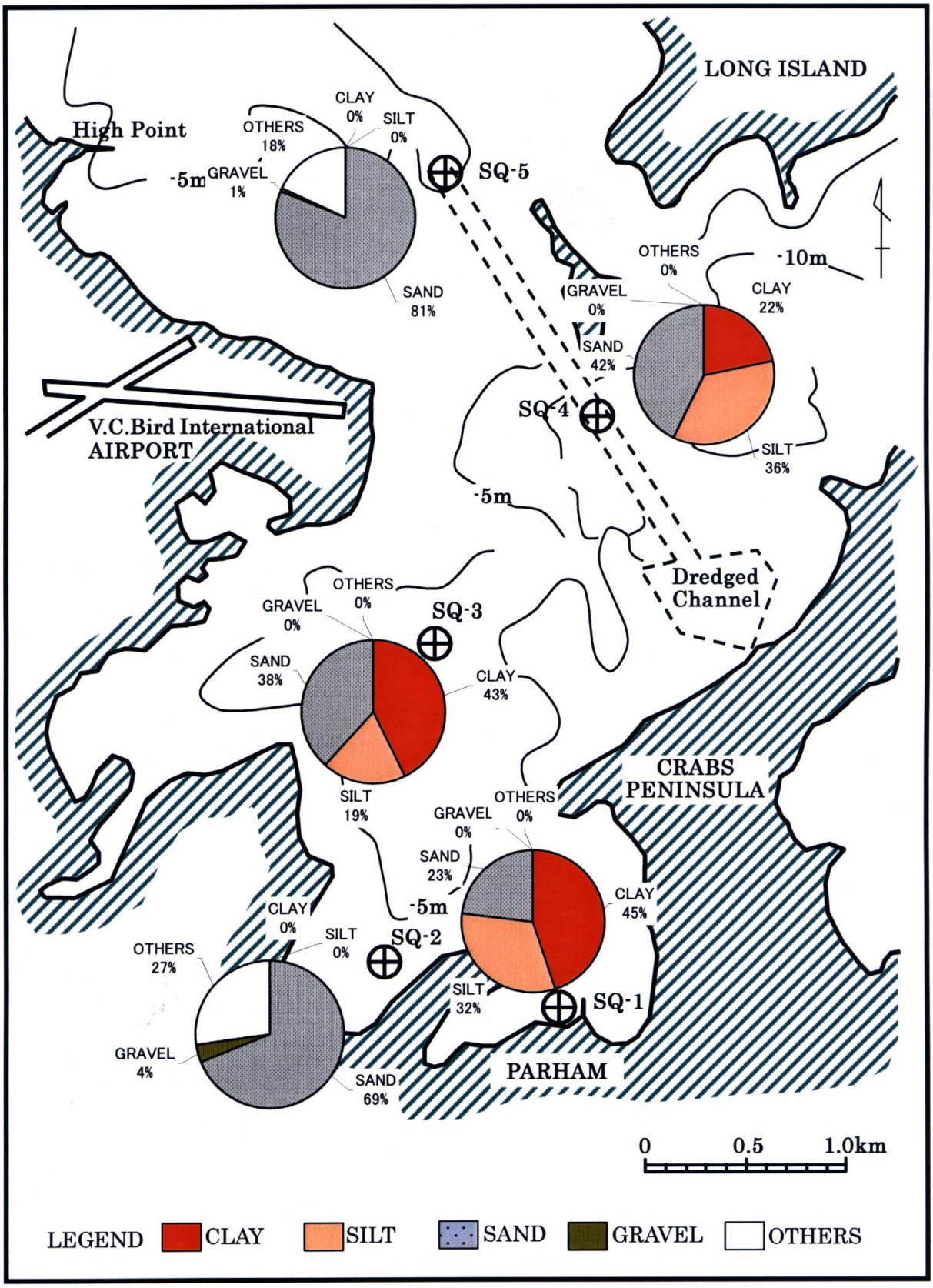


Figure 1.2.1-9(1) Seabed Material at Parham Site

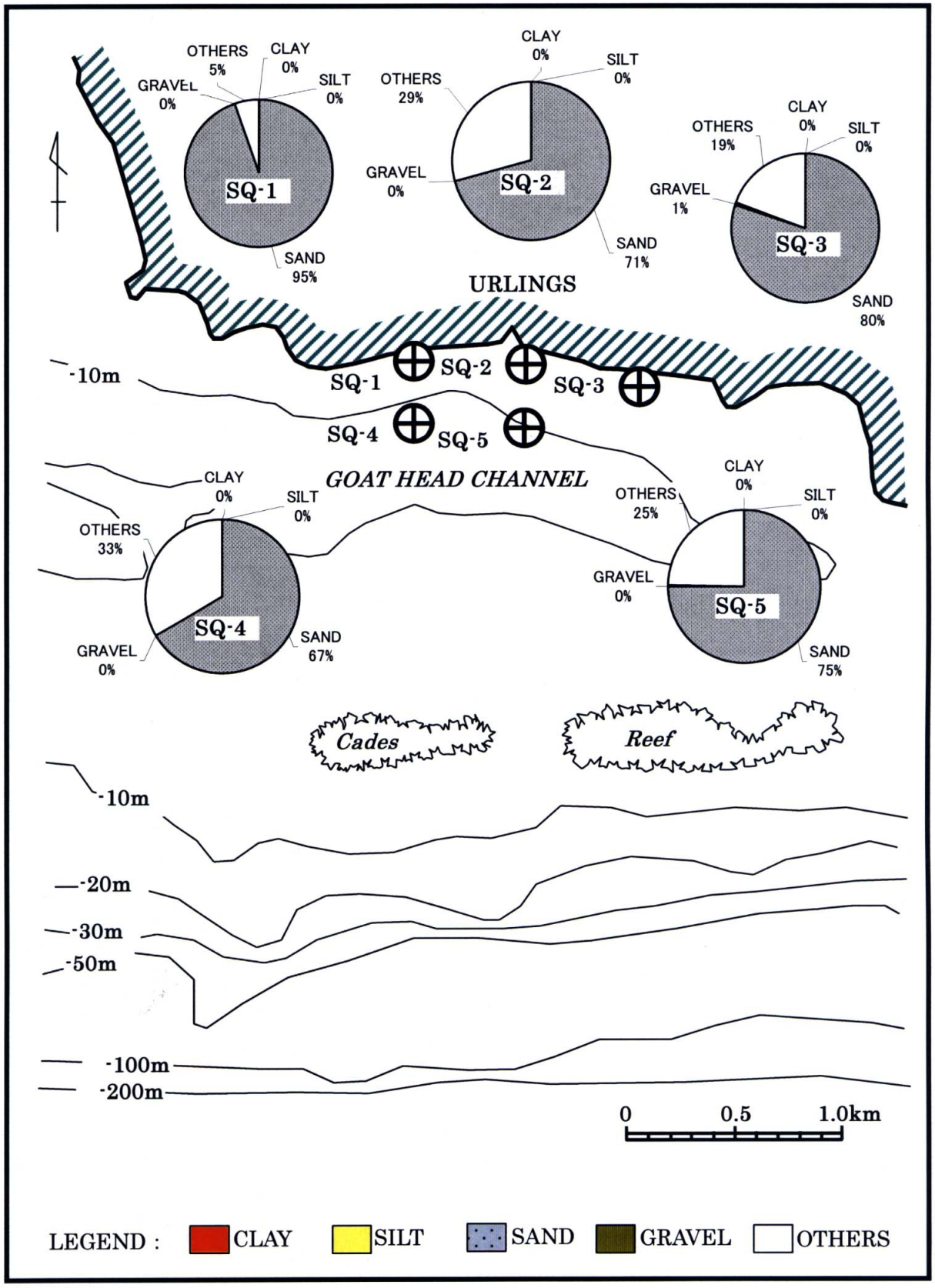


Figure 1.2.1-9(2) Seabed Material at Urling Site

(3) Wave and Storm Surge Forecasting

To determine a design wave condition, it is necessary to carry out many different kinds of studies on the basis of long-term wave observation data or results of wave forecasting. However, no regular observation of waves in the vicinity of Antigua and Barbuda is available, and therefore it is not possible to acquire the past wave data. In this study, we estimated the stormy waves propagated to the two project sites and the storm surge on the basis of past data on hurricanes.

1) Deepwater Wave Forecasting

Forecasting of stormy waves was carried out using atmospheric pressure and wind speed of the hurricane center, hurricane constant and other parameters with respect to the hurricanes indicated in Figure 1.2.1-1 (hurricanes Hugo, Luis, Georges and Lenny), the hurricane data being obtained from the U.S. National Hurricane Center (NHC). The estimated deepwater waves at Parham and Urlings are shown in Tables 1.2.1-9 (1) and (2). The maximum figures in the wave forecasting results were obtained with a wave direction of NNE, H_o = 9.98 m and T = 11.3 s in the case of Parham and a wave direction of ESE, H_o = 9.50 m and T = 10.5 s in the case of Urlings.

Table 1.2.1-9(1) Deepwater Waves Forecasted by Hurricane at Parham

		SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	S
Hugo	Wave Height	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.48	1.31	7.54	11.10	9.30	6.57	0.00	0.00
	Period	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	4.9	10.9	12.1	11.0	9.7	0.0	0.0
Luis	Wave Height	0.00	0.00	0.00	6.27	7.26	7.76	7.96	8.44	9.98	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	Period	0.0	0.0	0.0	9.1	9.6	9.8	10.0	10.3	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Georges	Wave Height	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	1.09	3.09	8.91	4.11	0.00	0.00	0.00	0.00
	Period	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	4.4	8.2	11.3	7.6	0.0	0.0	0.0	0.0
Lenny	Wave Height	5.74	7.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.34	2.36
	Period	9.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	6.3
Maximum	Wave Height					7.26	7.76	7.96	8.44	9.98	3.09	8.91					
	Period					9.6	9.8	10.0	10.3	11.3	8.2	11.3					
	Wave Steepness					0.05	0.05	0.05	0.05	0.05	0.03	0.04					

Table 1.2.1-9(2) Deepwater Waves Forecasting by Hurricane at Urlings

		NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N
Hugo	Wave Height	0.74	3.38	10.11	9.35	9.50	8.44	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02
	Period	3.2	7.7	11.5	10.9	10.9	10.5	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Luis	Wave Height	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.20	8.10	8.52	8.49	9.28
	Period	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	9.9	10.1	10.1	10.6
Georges	Wave Height	3.56	7.25	4.56	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
	Period	7.9	10.1	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5
Lenny	Wave Height	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.84	2.57	7.87	3.07	0.00	0.00	0.00	0.00	0.00
	Period	0.0	0.0	0.0	0.0	0.0	0.0	2.7	3.6	7.4	10.4	6.9	0.0	0.0	0.0	0.0	0.0
Maximum	Wave Height					9.50	8.44	3.32	0.84	2.57	7.87	3.07					
	Period					10.9	10.5	7.8	3.6	7.4	10.4	6.9					
	Wave Steepness					0.05	0.05	0.04	0.04	0.03	0.05	0.04					

2) Storm Surge Forecasting

Storm surge during the period of approach of hurricanes are forecasted by using the same hurricane data as the deep water wave forecasting. The water level rise caused by storm surge are estimated as indicated in Table 1.2.1-10. Furthermore, water level change due to storm surge in the maximum values of the high tide estimation is indicated in Figures 1.2.1-9 (1) and (2).

Table 1.2.1-10 Forecasting of Storm Surge

Hurricane	Height of Storm Surge	
	Parham	Urlings
Hugo	0.99m	0.55m
Luis	0.99m	0.66m
Georges	0.85m	0.48m
Lenny	0.26m	0.22m

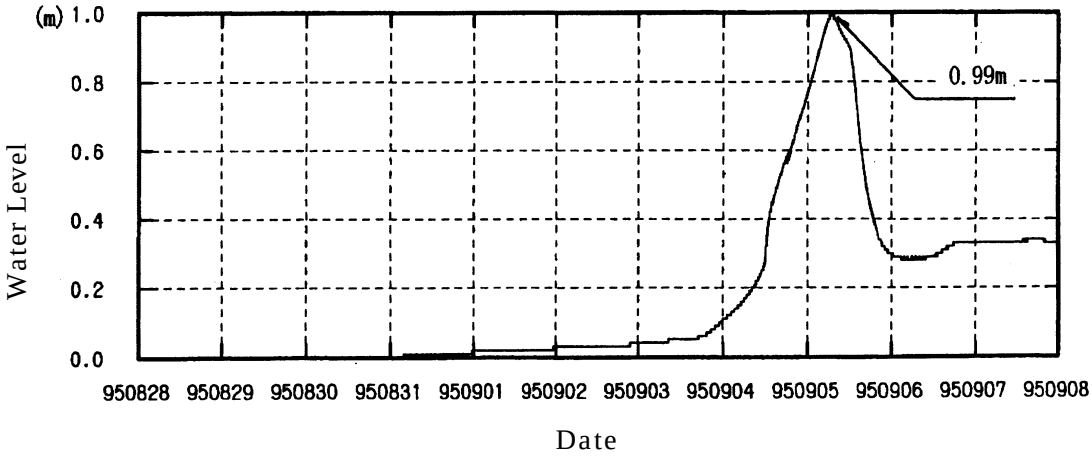


Figure 1.2.1-9(1) Storm Surge Generation at Parham Site

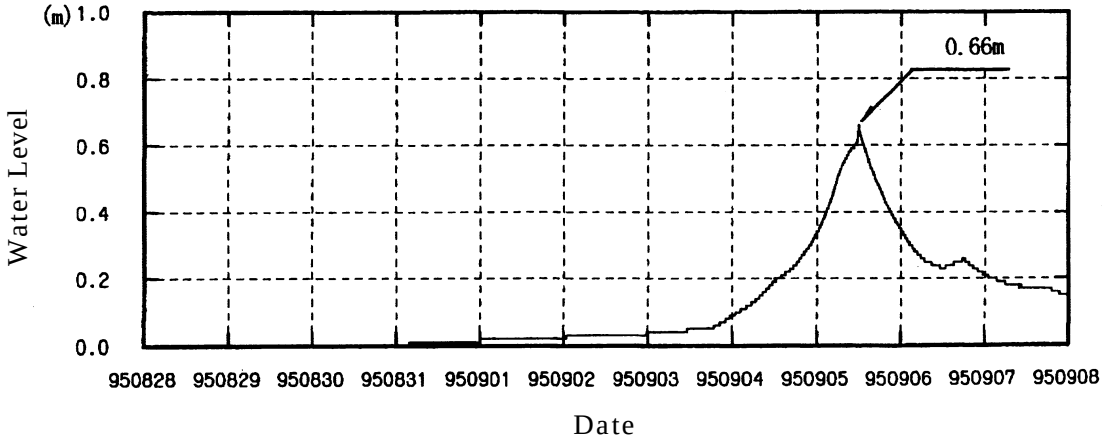


Figure 1.2.1-9(2) Storm Surge Generation at Urlings Site

(4) Earthquake

Earthquake data obtained from the U.S. Geological Survey was sorted out with respect to past earthquakes in the Caribbean Sea area. The island of Antigua is located near the boundary between the Caribbean plate and the North American plate and in an old volcanic belt. Not far from it is the island of Montserrat, which since 1995 has seen repetition of growth and collapse of a lava dome at the mountain top and frequent occurrence of pyroclastic flow.

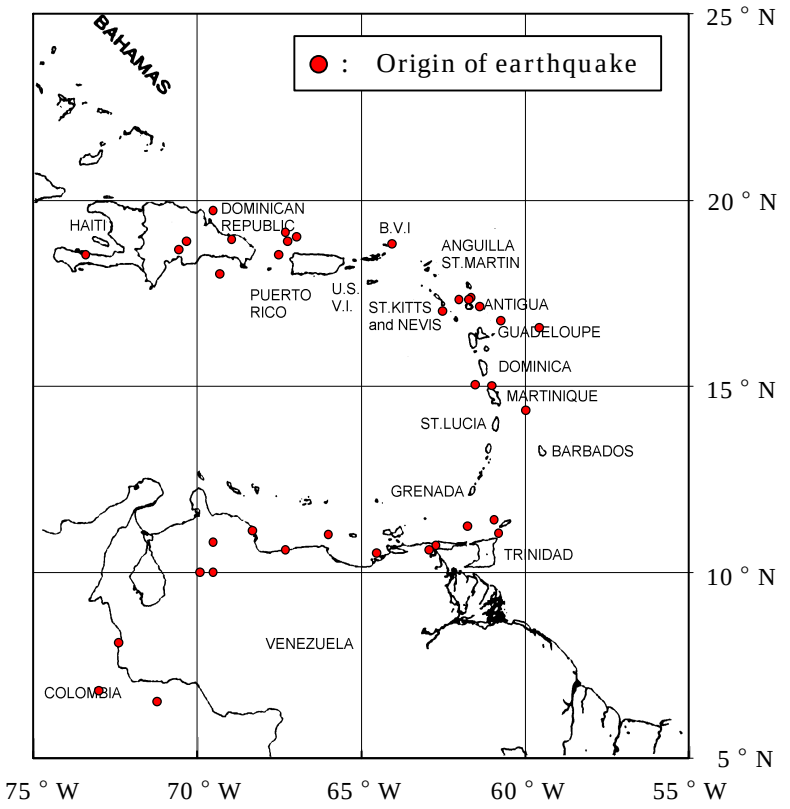
Figure 1.2.1-10 plots earthquakes in the area with a magnitude of 5.0 or higher that occurred between 1900 and 1999. Four of them took

place near Antigua. Data on them is given in Table 1.2.1-11. The one with a magnitude of 7.5 that occurred on October 8, 1971, (epicenter: north latitude 17.3 degrees, west longitude 62.0 degrees; depth of center: 47 km) is reported to have caused damage on Antigua, including destruction of a part of a church building in St. John's.

Table 1.2.1-11 Major Earthquake adjacent to Antigua

Year	Latitude (N)	Longitude (W)	Magnitude
October 8, 1974	17.30	62.00	7.5
January 14, 1997	17.37	61.62	5.4
August 28, 1999	17.12	61.36	5.4
December 29, 1999	17.31	61.71	5.6

(Over M=5.0)



(Over M=5.0, 1990～1999)

Figure 1.2.1-10 Earthquake Map in Caribbean Sea

1.2.2 Current Fishery Situation

An interview survey was carried out with respect to the fishermen at the two project sites, Urlings and Parham, and fishermen in the surrounding areas to get a picture of the fishery activities situation there and to determine the possibilities of utilization of the new fishing ports after they are constructed and what facilities are needed by the fishermen. The scope of the survey was the fishermen using the landing points from Jolly Harbor to Old Road in the case of Urlings and its surroundings and those using the landings from Beach Comber to Willikies in the case of Parham.

Table 1.2.2-1 shows the numbers of registered fishermen in both areas and the numbers of registered fishing boats using the different landing points in them. The numbers of registered fishermen include those that do not give their profession, and the numbers of registered fishing boats include those for which the length is not given. The overall figures obtained as a result of the survey are given in Table 1.2.2-6.

The following points were determined on the basis of the interview survey.

Table 1.2.2-1(1) Registered Boat and Fisherman at Parham Area

Landing Site	Parham Area	
	Number of Fisherman	Number of Fishing Boat
Beach Comber	14	19
Crab Marina	20	18
Fitches Creek	7	10
Parham	38	26
Shell Beach	36	27
Seatons	21	18
Willikies	43	28
Total	179	146

Source: Fishery Department

Table 1.2.2-1(2) Registered Boat and Fisherman at Urlings Site

Landing Site	Urlings Area	
	Number of Fisherman	Number of Fishing Boat
Carlisle Bay	14	5
Crab Hill	5	7
Jolly Harbor	46	45
Johnsons Point	2	1
Morris Bay	12	7
Urlings	52	27
Valley Church	6	3
Total	137	95

Source: Fishery Department

(1) Fish Catch Amount by Fishing Boat Length

The results of the average volume of catch by length of fishing boat, i.e. small fishing boats with a length under 20 feet and medium-size fishing boats with a length of 20 feet to under 40 feet, are as follows. The fishing boats with a length of 40 feet or more were not included in the calculation.

Table 1.2.2-2 Average Fish Catch by Fish ing Boat Size

	Number of Boat	Fishcatch (lbs)	Average (lbs)	Average (kg)
Small Sized Boat	18	1,192	66	30
Med. Sized Boat	15	2,445	163	74
Total	33	3,637	110	50

(2) Fishing Operation Categorized by Fishing Boat Length

The results of the average number of days of fishing operations by length of fishing boat are as follows

As one can see, the medium-size fishing boats are many in the number of days that the fishing boats go out for fishing than small fishing boats. It is considered that that is true because of the fact that the larger boats are not as much affected by wind and wave and the fact that the fishermen with larger boats are more enthusiastic above going out for fishing work. The pattern of fishing operations is basically one

in which the day before going out is spent in preparatory work such as procuring ice and fuel oil, the boats leave early in the morning the next day and come back in port by around 2 PM in the afternoon after 4 - 6 hours of fishing operation, and the fish that are caught are sold in the morning of the following day. Because of that, the fishing boats usually make 2 - 3 fishing operations a week. Large-scale fishing boats also engage in fishing operations in fishing grounds on the continental shelf between Barbuda Island and Antigua Island, and the duration of their operation is much longer. Furthermore, it is thought that some fishing boats are able to make more operations than others, because they need to spend less time selling their fish catches in view of the fact that they either notify retailers when they go out and sell their catches to them as soon as they arrive back in landing point or sell their catches directly to local consumers.

Table 1.2.2-3 Average Weekly Operation Days

	Number of Boat	Total Operation Days / Week	Average Operation Days / week
Small Sized Boat	19	45.5	2.4
Med. Sized Boat	18	54.0	3.0
Total	37	99.5	2.6

(3) Fishing Method

According to the results of the interview survey, only 14% of the fishermen engage only in fish pot fishing method which is the traditional method of Antigua and 41% of fishermen engage in fishing operations using 3 to 5 different fishing methods.

Table 1.2.2-4 Number of Fishermen by Fishing Method

Fishing Method	L	T	GN	H	R	D	FP
Number of Fisherman	10	2	24	17	17	3	32

L: Long line, H: Hand line, GN: Gill net,
R: Rod & Lining D: Scuba dive, T: Trawling, FP: Fish Pot

(4) Distribution of Fishery Product

In the survey the fishermen of the Urlings area that gave an answer to the question where they sold their catches said that 80% of the fish catch is distributed to St. John's, 7% is consumed locally, and 13% is distributed to hotels and restaurants. In the Parham area they said that 64% is sold in that area or where they live, 2% is sold to hotels and restaurants, and 34% is distributed to St. John's.

Those results show that the Urlings area is more strongly characterized as a production area for supply of fish to the capital, St. John's, and that the Parham area is more characterized as an area of supply of fish within the vicinity area.

(5) Current Situation of Ice Use

The percentage of the interviewed fishermen that said that they do not use ice was 9%, as opposed to 61% who said that they do use it. The remaining 30% did not respond. There is a great variation in the quantity of ice used, but the fishing boats that go out for fishing most frequently (such as large-scale boats that go out to sea four days a week) use a quantity of ice more than three times the volume of the fish catch amount. The average ratio of fish catch to amount of ice used determined in the interview survey is 1 : 1.33.

The fishermen are keen on getting more ice easier and are very dissatisfied with the inconvenience of having to go all the way to St. John's to buy it. In the Parham area, the fishermen use more expensive ice for drinking use purchased from nearby gasoline station in the course of buying fuel instead of going to St. John's for ice purchase for fishing.

Use of ice is an important factor in supply of high-quality fish with preserved freshness in connection with the needs of general consumers who put stock in freshness and not just the tourist industry (hotels and restaurants purchase fish only from particular fishermen because of the need to protect their customers from sanitation problems) and in connection with the problem of production loss after landing and food poisoning and other sanitary problems.

In the survey, it was made clear that because of the inconvenience of having to go to St. John's to buy ice (which takes a

whole day in preparations for going out for fishing) most of the fishermen at Willikies, Seatons and other areas with easy transportation access to Parham want to buy ice at Parham, and that is therefore a factor to be taken into account in determination of the scale of the facilities at a new fishing port.

(6) Facilities Expected by Fishermen

In general, the following points should be considered concerning demand for the fishery facilities of the present project.

Since Antigua's economy is dependent on the tourist industry, development of the different areas has taken place with precedence given to tourist development, and because of that fisheries have been considerably affected as regards use of landing points (Jolly Harbor, Crab Hill, Johnsons Point, Catamaran Beach, Falmouth Harbor, Shell Beach, Beachcomber, etc.). Because of such tourism development fishing boats are being forced to move to areas with poorer conditions. Jolly Harbor, English Harbor, Falmouth Harbor, Catamaran Beach, etc. are major marinas of Antigua, and although fishing boats are still allowed to use the facilities there considering their vested rights of having made long use of those places as landing points, the fishermen are uneasy about the possibility of someday being no longer allowed to use the facilities there. The Crab Marina in the Parham area used to be open to fishing boats as well, but it now can no longer be used by them after ownership change thereof.

In such a situation of competition between tourism development and fishery activities the Parham and Urlings project sites are places not yet subject to the pressure of tourism development, and as such the fishermen have high expectations regarding provision of fishing port facilities there exclusively for their benefit.

The facilities that the fishermen need as reflected in the interview survey are shown in Table 1.2.2-5.

Table 1.2.2-5 Fishing Port Facilities Expected by Fishermen

Facility	Parham	Urlings
1. Landing Wharf	100%	100%
2. Slipway	95%	100%
3. Mooring Basin	45%	94%
4. Water Supply Facility	100%	94%
5. Ice Supply Facility	100%	94%
6. Cold Storage	90%	94%
7. Fuel Supply Facility	90%	88%
8. Fishing Gear Repair Yard	50%	94%
9. Gear Locker	75%	94%
10. Meeting Room	75%	94%
11. Toilet & Shower Room	95%	94%
12. Workshop	100%	82%
13. Bus Stop Shed	15%	12%
14. Kiosk	20%	12%

Note: Number of Fishermen who replied to always use the new fishing port is29

From the survey it can be considered that most of the fishermen expect that the facilities mentioned in the request for the Japanese Government's grant aid as being necessary are in fact needed. The fishermen did not, however, show much interest in the kiosk and bus stop shed requested for Parham Site. It is necessary to take into account the fact that there is a difference there from the government's idea about what kind of project areas should be developed. In other words, the government considers it importance to link provision of fishing port infrastructure with tourism development considering the importance of Parham as an access point to Long Island and Bird Island and would seem to want to (use this as an opportunity to) impart vitality to Antigua's oldest town.

(7) Target Fishing Boat for Utilization of New Fishing Port

The fishing boats of Fitches Creek, Parham and Crab Marina will make constant use of the new fishing port at Parham, and the fishing

boats of Beachcomber and Shell Beach will be using it for repairs. In addition, although the fishing boats of Seatons and Willikies will not be using the new fishing port, the fishermen at those landing points want to get ice there. As for the new fishing port at Urlings, the fishing boats at Jolly Harbor are not interested in using of it, with the exception of one large one, but the fishermen at the other landing points from Valley Church to Old Road said that they intended to use it on a regular fishing basis.

The results of the interview survey indicated above will be used in the present project as basic information.

Table 1.2.2-6 Summary of Interview to Fishermen

Boat	Dimension of boat			Fishing method							Ope. Days	Operation hour			Catch	Ice	Landing	Destination of catch (%)						Type of useof fishing port
name	L (ft)	B (ft)	D (ft)	L	T	GN	H	R	D	FP	Trip/week	Dep.	Arriv.	Hours	lbs/trip	lbs/trip	site	Self	Local	R / H	St.John's	W.F.M.	AFL	
Issa-B	54	17	6	★			★			★	2	2am	6pm	4days	1,250	4,000	Jolly Harbour			15%	80%		5%	Always use
EOIS	15									★	2-3	5am	10am	4hr	100		Jolly Harbour				100%			Sometimes use for reparing
Proffeser.P	21	4	3			★	★	★	★		2			24hr	350		Jolly Harbour					100%		Sometimes use for reparing
Sea Eagle	26	7	3	★		★	★	★		★	3	9am	1pm	28hr	200	400	Jolly Harbour							Sometimes use for reparing
	22	7	1.5			★	★	★		★	2	5am	10am	5hr	65		Crab Hill		★				★	Always use
SHEBA	16	5	1			★	★			★	2-3	5am	10am	5hr	50	200	Crab Hill				★			Use for hurricane shelter
Capllah	16									★	2	6am	10am	4hr	80		Crab Hill				★			Always use
Cavina	21	7	2							★	4	5:30am	9am	3.5hr	100	200	Urlings							Always use
Dtopsin	30	9						★			4	6am	9am	3hr		0	Urlings			★				Always use
Watch Me	12	4	flat			★	★	★			7	5am	6pm	13hr	80		Urlings							Always use
-	-	-	-							★	3	5am	10:30am	5.5hr	50		Urlings							Broken of fishing boat by hurricane
M.Accomplish	29	9	1	★		★	★	★			1			96hr		400	Urlings			30%	20%		50%	Always use
SHOES-II	17	6		★		★	★				3	3pm	8:30pm	5.5hr	100	200	Urlings	5%	15%		80%			Always use
Nack a Boat	25	7		★		★					2	3pm	9pm	6hr	150	80	Urlings		25%		75%			Always use
LC-1	20	7	1							★	3	5am	10am	5hr	100	40	Urlings			100%				Always use
Tri Star	20					★			★	★	5	6am	12pm	6hr	150	100	Urlings			20%	80%			Always use
Rising Sun	20	8	1.5				★			★	2-3	6am	6pm	12hr		40	Old Road	10%			90%			Always use
Chirps-B	21	8	1.8				★	★		★	2-3	6am	6pm	12hr	170	60	Old Road	5%			95%			Always use
										★	2	5am	11am	6hr	50		Old Road			★				Always use
Lady Roy	14	5	2					★		★	2-3	6am	11am	5hr	50	-	Beachcomber							Sometimes use for reparing
Pett	14	6	1			★				★	2-3	6am	11am	5hr	50	-	Beachcomber							Sometimes use for reparing
Faith	27	6	3	★			★	★		★	1	4am	10am	64hr	250	160	Shell Beach							Sometimes use for reparing
Sea Queen	23	6	2	★	★		★	★		★	4	6am	2pm	8hr	100	-	Shell Beach							Sometimes use for reparing
Red	22	8	3	★						★	2	7am	5pm	10hr	200		Fitches Creek							Always use
God Truth	12	6	2							★	2	6am	2pm	8hr	40	40	Fitches Creek			85%	2%	2%		Always use
Chilinie	18	4	2			★		★		★	2	5.5pm	9.5pm	4hr	22		Fitches Creek	★						Sometimes use for reparing
Tyrone	27		3					★			2	7am	1pm	6hr	150	240	Parham		★					Always use
Brothers	14					★				★	1.5	6am	2pm	8hr	350	160	Parham		★					Always use
The Rock	12	5	flat			★		★		★	2	9am	5pm	8hr	200	25	Parham				★			Always use
Hail Mary	14	-	-					★	★		3	6am	11am	5hr	40	3	Parham		★					Always use
John	21	7		★		★	★	★		★	4	4pm	3am	11hr	60	80	Parham				★			Always use
Reeg Cat	14	5	0.6			★	★			★	5	10pm	6am	8hr	50	40	Parham		★					Always use
Devine Mercy	12	5	0.6			★					2	7pm	6am	8hr	50	Homemade	Parham		★					Always use
French weed	14	4	0.6			★					3	5am	11pm	6hr	70		Parham		★					Always use
GimJam	19	6				Net					3.5	4am	11am	7hr	140	40	Parham		★		★			Always use
Slasher	14	5	1			★				★	2	7am	11am	4hr	40	300	Parham		★					Always use
New Generation	35	12	4		★			★		★	5	6am	2pm	8hr	300	80	Parham		50%		50%			Always use
Princess Liza	16	8	1			★				★	2	8am	1pm	5hr	50	80	Parham		★					Always use
Little Sparow	16	5	2							★	2	7am	12pm	5hr	80	80	Parham		★		★			Always use
Briwee	16	3	1			★				★	3	5am	12pm	6hr	225	Homemade	Parham		★		★			only use for ice supply
Jamelic	20			★		★	★			★	5	9am	2pm	5hr	100	-	Seatons							only use for ice supply
							★					7am	11am	4hr		1.5EC	Seatons							only use for ice supply
DALE	16					★				★	2-3	7.5am	2pm	6.5hr	100		Willikies							only use for ice supply
Miiss Rae	45	15	4.6			★	★	★		★	2	5am	9pm	12-17	1,400	480	Willikies			85%	2%	2%		only use for ice supply

Chapter 2

Contents of the Project

Chapter 2 Contents of the Project

2.1 Objectives of the Project

The landing of fish catches in Antigua Island are presently done at 31 landing points scattered through out the island. The landing and distributing facilities that were constructed by the grant aid of Japanese Government in the St. John's, sandy beaches and calm inlets all over the island, and a part of resort bases by the reason of vested right of common are utilized as landing places now.

Fishery infrastructures like landing facility of the fish catch are not well furnished except the fishery complex in the Capital St. John's. Therefore, fishing boats can not berth to shore line in such areas and fishermen spend a lot of works to unload and load the fishes, fuels, and fishing gears carrying them by walking in the water. It takes a lot of cost and labor for restoration from damages of landing facilities such as small jetty and pier that were constructed by individual fisherman caused by hurricane hit. Fishing boats are often damaged by the reason that there are no docking facilities (slipway) to land fishing boats when hurricane hits. It is the present situation that is damaged ropes cutting-off by stormy wind and severe wave although they refuge into mangrove thicket or hauling up onto sandy beach with very difficult and tough works when hurricane hits. Under the circumstance, some fishermen are giving up their fishery work since they can not buy a new fishing boat substituting the damaged boat due to hurricane.

What is worse, fishermen are losing their vested rights concerning use of beaches where are good places as fish landing places but are occupied by tourism facilities, since local landing places have come to be developed with the priority of the tourist industry having even used by fishermen. That is considered to be a factor in stagnation of fishery industry and therefore, improvement of the local fishery facilities can be said to be an urgent task.

In order to solve the current problems that fishery industry of Antigua and Barbuda are facing to, this project is now aimed as followings

1. to construct facilities for safe refuge of the fishing boats against hurricanes hit that is their valuable asset of fishermen and,
2. to construct local core of fishing port facilities to concentrate landing points which are now scattered in many area, by which the revival of fishing operations can be expected through the advantage of the

concentration.

Parham as the base of east area and Urlings as the base of south area of Antigua Island are to be selected to construct fishing port in each area as port of refuge and as base port of local fishery base.

2.2 Basic Concepts of the Project

Fishing ports are junction points of fishing operations of fishing boats and the on-land activities of processing and distributing the fish. In planning a fishing port, it is necessary to make sure that the following basic port roles and function adequately:

1. to secure facility to take refuge of fishing boats when hurricane hit,
2. to have functions of landing fish catches, preparation for fishing operation, handling and market transaction of fish having a role of productivity and distributing base, and to transport fishes effectively to consumption area, and
3. to have functions as core of local community, base of the livelihood of fishermen and base for development of local economy in terms of fishing industry.

The fishery industry of Antigua and Barbuda consists mainly (92%) of artisanal fisheries based on fishing boats with a length of under 40 feet. Furthermore, except for the fishery complex constructed in the capital, St. John's, with Japanese Government grant aid, the country does not have any well-furnished fishery infrastructure, and that is a major impediment to promotion of development of its fishery industry. Therefore, this project addresses the need to provide support to smaller fishing boats used in small fishing operations.

The Parham and Urlings project sites have neither landing facilities nor safe fishing boat mooring facilities nor grounding facilities, which means that fishermen there have a very hard time of landing their catches and find it very difficult to adequately protect their main property, their fishing boats. In this project, it is intended to construct local fishery activity bases in the Parham and Urlings areas that can function as new fishing ports serving as centers of local fishery activities. In this project there will be consideration of provision of public facilities representing necessary facilities for fishery

activities that are capable of very efficiently functioning as new fishing ports, including basic fishing port facilities such as a wharf for safe and efficient landing of catches and a slipway, boat yard, etc. for safe evacuation of fishing boats, fishing port function facilities that support preparations for fishing operation such as ice-making plant, ice storage, gear repair shop and fisherman's locker, fishery product distribution facilities such as facilities for handling the fish catches after landing and cold storage and fishing port administration office.

Bearing the above points in mind, the this project will be formulated for creation of local fishery activity and distribution bases on the island of Antigua on the basis of the following concept items:

1) Content of provided facilities that is consistent with the purposes of fishery development plans,
2) Securing of safety of fishing boats in access channel and basin,
3) Raising of fishing efficiency like reduction of labor at unloding and loading works,
4) Keeping catches fresh,
5) Prevention of water pollution at the fishing ports from processing of catches,
6) Prevention of silting up of fairways and anchorages by sand drift,
7) Establishment of appropriate management and operation systems, and
8) Determination of all facilities according to need, priority, effectiveness and appropriate scale.

In formulation of the plans, it is intended to make them as appropriate as possible as a project of Japanese Government grant aid by studying the current condition of their fishery industry and fishing activities.

2.2.1 Project Components

It has been agreed in the process of discussion of each component requested by the Government of Antigua and Barbuda to exclude the back up vehicle such as extension service car and marine mechanical mobile car from the scope of basic design study. The government of Antigua and Barbuda came to agreement after explaining the difficulty of consideration of the necessity judging from the fact that there have been few recent examples of adoption of those items in Japanese Grant Aid, the fact of not much of a past

record of fishing educational services and engine repair services in the country and the fact of lack of any implementation plan concerning with those vehicles.

It is confirmed that a jetty requested for Parham is not necessary to construct in case that existing Jordan jetty is widened to use as a landing wharf. It also has been agreed that Japanese side will study only for securing the necessary space of fuel tank and plumbing work in fuel supply facility.

All of the other components were confirmed as being within the scope of this survey and study. The Government of Antigua and Barbuda put the order of the priority of functional facilities in the main facilities building as shown at Table 2.2.1-1.

Table 2.2.1-1 Components of the Request

Component \ Site	Parham	Urlings	Remarks
1. Dredging	—	○	
2. Revetment	—	○	
3. Wharf	○	○	
4. Finger Jetty	○	—	Excluded in case of extension of Jordan Jetty
5. Pavement	○	○	
6. Main Building	○	○	Number of the facilities means a priority order by the Antiguan Side
(1) Ice Making Machine Room	○	○	
(2) Freezing Machine Room	○	○	
(3) Work Shop	○	○	
(4) Fish Retail Area	○	○	
(5) Shower/Toilet	○	○	
(6) Meeting Room	○	○	
(7) Managing Office	○	○	
(8) Dry Storage	○	○	
(9) Parts Shop	○	○	
7. Kiosk	○	—	
8. Bus Shed	○	—	
9. Gear Locker	○	○	
10. Freezing Storage Facility	○	○	
11. Ice-Making / Storage Facility	○	○	
12. Standby Generator	○	○	
13. Slipway	○	○	
14. Fuel Supply Facility	○	○	Installation of Pipe only Secure space for fuel tank
15. Backup Vehicles	×	×	Cancelled by discussion

2.2.2 Justification of the Project

(1) Justification of Fishing Port Development

Presently on the island of Antigua there are no wharves, piers and other landing facilities other than at the capital, St. John's, Jolly Harbor on the west side and English Falmouse Harbor on the southeast side. Under present conditions fishing boats accomplish landing of their catches using sandy beaches where they exist. That entails a lot of hard work, including carrying the heavy catches while wading through the water. The same hard work is necessitated for loading fuel and fishing gear on board.

Where there are no sandy beaches, the fishermen themselves have built simple piers or stone jetties, as can be seen between the market wharf at St. John's and Keeling Point, in the vicinity of Crab Marina in the Parham area and at the Seatons, Willikies and other fish landing points, but they are damaged every time by a hurricane attack, and their restoration requires a great deal of labor and expense.

At the Urlings project site a stone made small jetty with a length of about 4 m had been built in the excavated access channel, but it was damaged by Hurricane Lenny last year, and at Parham there is the existing Jordan Jetty, but the depth of the water in front is less than 40 cm, which means that it cannot be come alongside of and used as a fish landing facility even by small boats.

Questioning of fishermen concerning what facilities are needed also showed that they think that landing facilities are indispensable as a basic function. In view of the lack of fishing port facilities at both project sites as seen above, it is considered that provision of fishing port facilities in this project is consistent with the following goals among those set forth in the fishery development plans and is very appropriate:

1) Keeping fish catches fresh by efficient landing, handling, division into consignments and shipment
2) Improvement of working conditions
3) Provision of infrastructure at artisanal fishing bases

(2) Justification of Project Sites

The following items can be cited as requirements that must be considered in development of local fishery bases.

1) Fishing Boat Aspect

One of the conditions for appropriateness of a site is that there be a certain degree of concentration of fishing boats in it. The numbers of registered fishing boats in the two selected project sites are: 24 boats at Parham and 27 boats at Urlings. In Japan the criterion for receiving government subsidies as fishing port is 20 fishing boats. Other landing sites on the island of Antigua meeting that criterion are St. John's, Jolly Harbor, Falmouse Harbor, Shell Beach, Willikies and English Harbor. Of those, St. John's, Jolly Harbor, Falmouse Harbor and Shell Beach are pleasure boat bases, but fishing boats are able to make use of the wharf or jetty there. At Willikies there are several fish landing points, but fishing boats make use mainly of Emerald Cove. Emerald Cove is suitable for construction of a fishing port from the viewpoint of its natural conditions, but that suitability is negated by the fact that tourist development has progressed there and the fact that the land is privately occupied.

2) Fish Production Aspect

Both of the project sites are already areas with brisk fishery activity and large production volume that serve as supply bases for St. John's, a major consumption area. In addition to that both have high probability of increase in volume of production in case of development of fishing port facilities and consequent further concentration of fishing boats.

Interviews with fishermen in the Parham and Urlings areas concluded in the findings that the fishing boats of Fitches Creek and Crab Marina in the Parham area and those using the six fish landings points from Valley Church to Old Road in the Urlings area would make use of the new fishing ports.

3) Natural Condition under Huricane

It is necessary that fishing boats be safely evacuated and protected when hurricanes hit, and in that connection it is necessary that it be possible to build inexpensive facilities for that purpose making the most of the natural topography.

The Urlings project site has out in front of it a two-coral reef structure consisting of Cades Reef and Middle Reef, which makes it a more protected place than the other six landing points in the Urlings area. As for the Parham project site, it is situated in the innermost part of the bay of the same

name, and Long Island at the mouth of the bay prevent stormy deep water waves access to it. Thus, it is considered that both project sites are very advantaged as regards natural protection from waves.

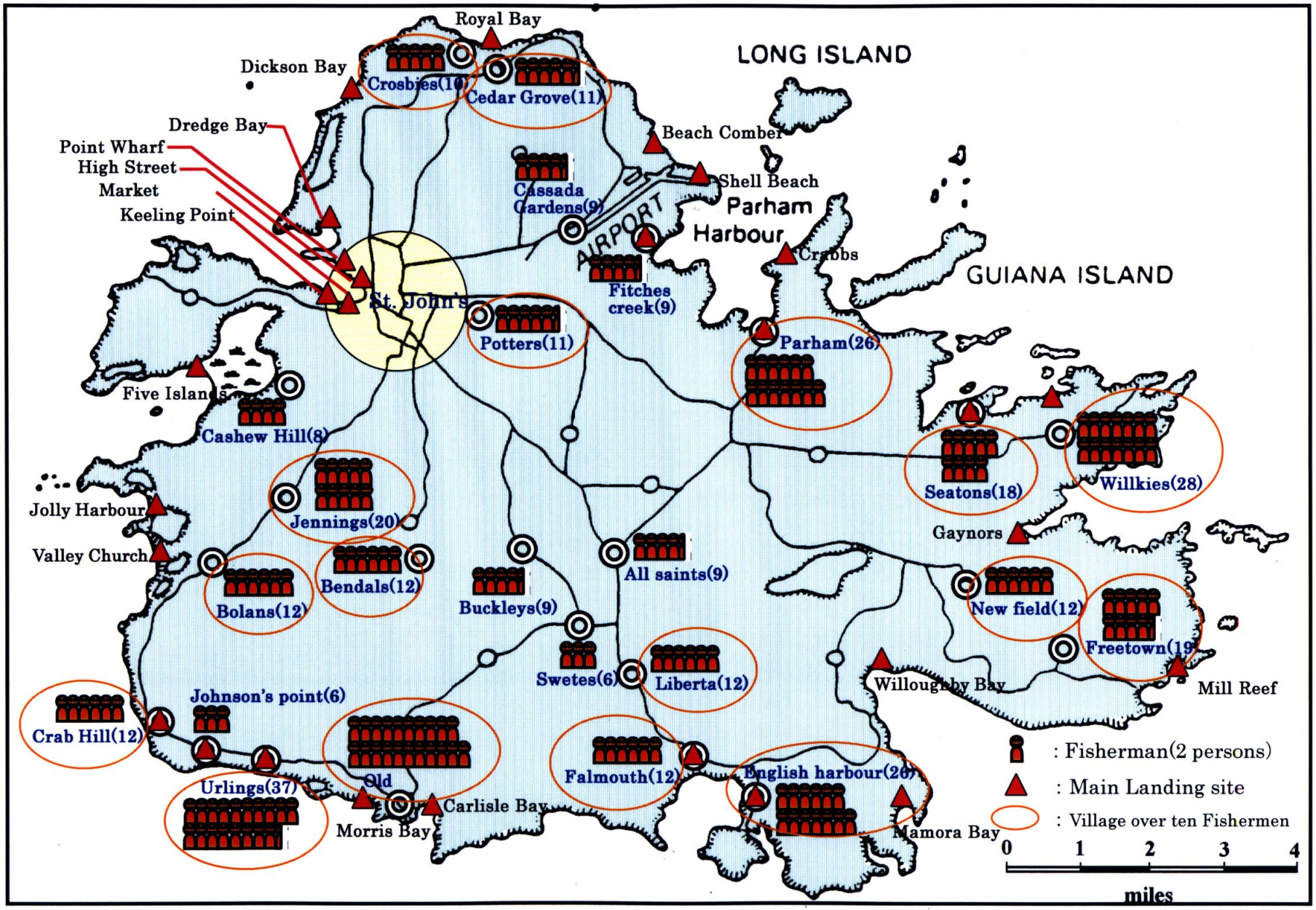
4) Accessibility Aspect

Both the Parham and the Urlings area are close to main roads and have easy access to electricity, water supply and other infrastructure. On the other hand, the Seatons and Willikies landing points are remote from main roads and have poor access to infrastructure.

5) Nature of Adjacent Fishing Village

Figure 2.2.2-1 gives the total figures for number of fishermen residing at each landing point plus those who come there from other areas. For example, looking at the figures for Shell Beach, one sees that there is no village in the hinterland of the landing point and that the fishermen come from the St. John's area. On the other hand, in the case of the landings of the Parham and Urlings areas fishing operators reside in villages in the hinterland of the landings and can be said to form fishing villages. That being the case, both the Parham and the Urlings areas are closely related with both the fishing port as a place of production and the hinterland village as a place for living and therefore can be considered to be places where it will be possible to work for development of both the fishing port and the community.

Judging from the above, both sites are considered to be appropriate places for development of fishing ports.



Figure－2.2.2-1　Number of Local Fisherman and Commuted Fisherman at each landing site

2.2.3 Examination of the Project

The results of consideration of the appropriateness of the content of the request as regards civil work facilities, architectural facilities and affiliated facilities, respectively, are shown in the following.

(1) Basic Port Facilities

1) Dredging

Since Urlings is an excavated type of fishing port, construction of the access channel, basin and wharf and other fishing port facilities will be based on dredging of the land part to the extent that is necessary. At Parham, as well as, dredging will be necessary for securing the necessary water depth in view of the shallowness of the waters out front.

2) Jetty

In the project area at Parham there is already an existing jetty (Jordan Jetty). In this study the intention was not to adopt a new jetty method in case of adoption of the wharf method based on widening of the existing jetty. Actually it was understood impossible to construct a new jetty judging from the study result of the soil and wave condition.

3) Wharf

Landing of fish catches at Parham is supposed to be taken place at Jordan Jetty on the project site, but that jetty is not really functioning as a landing wharf since even small fishing boats are unable to berth alongside in view of the extreme shallowness (less than 40 cm) of the waters in front. That being the case, fishermen are unable to land their catches onto the jetty directly from their boats and instead have to carry them as heavy loads wading through the water. Furthermore, when the fishing boats are not operating, they are moored on the downwind eastern side of Jordan Jetty and offshore of the vicinity beach around that jetty. The fishermen cannot board their boats directly from the jetty or the shore and have instead to wade through the water to reach them.

There are no fish landing facilities at Urlings. For that purpose fishermen make use of a simple stone made jetty made by reclamation of the sandy beach coast. But since is only a small temporary jetty with insufficient

water depth at the end, even small fishing boats cannot come alongside it and are able only to touch it at the end, making it necessary to land their catches under unstable conditions. In the case of medium-sized fishing boats, it is necessary to carry the fish catch to the jetty wading through the water. To make loading condition worse, Hurricane Lenny damaged that jetty last year. Some of the fishing boats are moored at the small jetty with their keels touching the bottom, but most of them are moored inside an artificially excavated inlet and inside the reef on the west side of the jetty. Fishermen have to wade through the water in order to board their boats.

A Wharf is needed at both those project sites from the viewpoint of both landing catches and mooring fishing boats.

4) Revetment

Since the Urlings project site is to be a fishing port of the in-land excavated type, revetment will be required around the basin where it is not used as a wharf or in the access channel part.

5) Slipway

For refuge from hurricanes at Parham small fishing boats are brought onto the beach on the west side of the jetty (Jordan Jetty). Medium-size and large fishing boats, however, which cannot be brought onto the beach, have to seek shelter in nearby mangrove thickets. The waves and strong winds brought by the hurricanes make those boats rock and roll, causing damage to them by collision with the trees, particularly when they are not firmly tied down.

At Urlings small fishing boats are brought onto the beach around Jordan Jetty when hurricanes attack. Larger fishing boats that cannot be brought onto the beach seek refuge inside the artificially excavated inlet. The same kind of damage to them also occurs as at Parham.

A slipway and a boat yard are needed at both sites considering the present situation regarding evacuation during hurricanes.

6) Site Pavement

At Parham the project site ground level is not high enough considering the waves under high storm surge that occur when hurricanes hit. Waves

come in, and the ground is inundated. The same is true of the project site ground height at Urlings.

Since new fishing ports are to be constructed at both sites, the ground will have to be raised in the ground preparation, and the necessary paving will have to be provided for entry of vehicles.

(2) Functional Facilities

1) Main Facility Building

a) Ice-making Plant and Ice Storag e Room

Interviews with fishermen carried out in the study revealed that although many of them in the areas in question use ice in their operations, about one-half of them are not able to use the necessary amount of it. Furthermore, about one third of them do not yet use any ice at all. That being the case, ice supply facilities need to be installed to maintain the quality of fresh fish and reduce post harvest loss.

Presently fishermen making use of local fish landing points have to go to the AFL in the capital to purchase ice, and it takes them an hour to an hour and a half one way to get there by truck because of constant traffic congestion in St. John's resulting from concentration of population and rapid transition to motorized society.

Furthermore, from what we saw at the St. John's fishery complex, it appears that many fishermen carry the ice in approximately 20 kg bags because they do not have cold insulation boxes.

Since it can be surmised that many fishermen keep the ice in inappropriate places before going out for fishing, the loss of ice through melting can be considered to be considerable.

In particular, the operation style of small fishing boats is for the most part that of going out early in the morning and coming back in the afternoon. Because of the circumstances explained above, they have to get their ice the day before. In Antigua and Barbuda fishing boats generally go out to sea at most every other day (2 or 3 times a week). Such inability to go fishing everyday can be ascribed at least in part to the time and effort spent in procuring ice and fuel.

Such a situation regarding purchase of ice is a factor hindering wider and more thorough use of ice by fishermen, and the interviews with them also revealed their dissatisfaction with the situation regarding ice supply. Ice-making plants are therefore one of the most important facilities for the

new fishing ports.

b) Cold Storage Room

Distribution of fish catches includes direct sale by the fishermen themselves to residents on the beach after landing, sale to nearby residents after storage at home, delivery to hotels and restaurants on a contract basis and delivery to public markets and the AFL and WFM in St. John's. (The interviews in the study revealed that the percentage breakdown of the above-mentioned forms of transaction differs between the Parham area and the Urlings area. That is due to the fact that in the case of the Parham area there are a higher percentage of fishermen living inland in the middle of the island.)

Sale of the caught fish to nearby residents some time after landing and to hotels and restaurants on a contract basis takes place both the same day as the catch and on days thereafter. It was confirmed in the interviews that in most cases the fish are taken to St. John's for sale when some of the catch is left over after local sales. Since medium-size fishing boats, which have comparatively large fish catches, return to port late in the afternoon, one can surmise that their fresh fish is transported to the capital the next day at the earliest.

The fish that are not sold on the same day as they are caught have to be preserved one way or another, i.e. in fish boxes containing ice left over from fishery operations or in home refrigerators. Some of the catch is kept in buckets and other containers at room temperature, and in the interviews it was reported that there are cases in which half of the landed catch is wasted.

There is therefore great necessity for cold storage at the fishing ports that can be used by fishermen in common for reduction of post harvest loss after landing and for prevention of deterioration of freshness.

c) Administration Office

Administration office will be provided in the present project for the project areas to address such needs as management of wharf use and use of basin, slipway and boat yard areas, management of sale and supply of ice, fuel, water, fishing gear, parts, bait, etc., management of cold storage, meeting rooms and fishermen's lockers, taking care of fishery consumers and other visitors and other similar purposes.

d) Fishing Gear (bait) Shop

The fishing gear, materials, parts and bait, etc. necessary for fishery operations are now almost all procured in St. John's. That being the case, it is necessary that the new fishing ports be provided with sales facilities for such items in order to reduce unnecessary expenditure of time and effort by fishermen so that they will be able to put out to sea more often.

e) Storage

Most of the facilities included in the present project need storage facilities for various purposes. That being the case, study will be given in the project to possibilities of joint use, and the storage facilities will be laid out as reasonably as possible from different viewpoints, including that of management and control needs.

f) Meeting Room

The Fishery Department carries out activities aimed at enlightening fishermen regarding improvement of fishery activities and protection of fishery resources, but there are no particular local facilities for that purpose, the fishermen being assembled for that purpose at community facilities next to the different landing points.

Since there are many diverse themes that should be discussed and studied by fishermen, including safety management of fishing operation and rationalization, improvement of fishing methods, the necessity and methods of quality control, protection of fishing ground resources, nature protection of beaches, protection of the rights and interests of fishermen and methods of facility operation and management, and in view of the acutely felt need for guidance and enlightenment by the government and experts regarding such themes, it is necessary to provide gathering facilities as forums of exchange of opinions between fishermen to be used by the fishermen of the areas in question when they are not busy with their work.

g) Toilet and Shower Room

Provision of toilets and showers for fishermen who will be at the port

facilities for considerable lengths of time in making preparations for going out to sea, landing catches and other work after returning to port, repair work on engines and fishing gear, participation in meetings, etc. is important not only from the standpoint of health control but also from the standpoint of facility sanitation control and environmental control.

That being the case, it is necessary to install toilets and showers mainly for the fishermen who will use the facilities and the people who will manage them.

2) Fish Retail Shop

It is customary for the residents of the project site areas to purchase fishery products directly from the fishermen by mutual agreement, such transactions taking place on the nearby beach and within the community. When the fishing boats are concentrated at Parham and Urlings as a result of the present project, they will lose the opportunity to do so. It is therefore necessary to provide places within both ports where such transactions can take place.

It is not desirable that such transactions take place on the basis of placement of the landed catches directly on the wharves under the hot sun. It is necessary, instead, to provide suitable places with a sanitary environment away from the direct rays of the sun for handling the fishery products. Furthermore, facilities that are suitable from the viewpoint of facility sanitation control and environmental protection will be provided as regards the primary processing (scaling, gutting, etc.) that is now done on the beach in connection with such transactions.

As for the primary processing facilities meeting HACCP standards (food processing plants) that Antigua and Barbuda wants from the viewpoint of quality control although it was not requested this time. It is considered that the burden of management of such facilities (by AFL) would be too great and that the volume of the catches that will be landed at the two ports and the actual situation concerning local distribution of fishery products are not enough in line with such plans. That being the case, at the present stage only open (public) markets will be installed, and space will be secured in the layout plans for possible future construction of fish processing plants meeting HACCP requirements that the AFL is thinking of using, such future construction to take place on the basis of the country's own efforts when it becomes necessary and financially feasible along with change in the country's

fishery product distribution situation.

3) Workshop

Presently assembling and repair of fishing pots, repair of fishing nets and the like and simple repair work of fishing boats and their outboard engines are accomplished at the sites and on road surfaces and the like. In cases in which more difficult repair work on outboard engines is necessary, engineers are ordered to come to the fishermen's homes to do it, or the engines are taken to repair shop in St. John's or English Harbor.

At the new fishing ports there should be regular repair facilities to lessen the repair work burden on fishermen. That is the reason why the present project has to include installation of workshops. If repairs are accomplished on a daily basis at those workshops, the service life of engines and fishing gear will be lengthened, which will contribute to improvement of the household balances of income and expenditures of fishermen.

With realization of the two new ports, having as grounding facilities, it will be possible to do repairs such as repainting of fishing boats and simple FRP repairs at them that are now being done at the different landing points. In the port site layout plans a part of the boat yard for use at the time of hurricanes will be utilized as regular fishing boat repair yard of slipway to serve such purposes. The same applies concerning fishing net repair yards, which have come into much wider used in recent years.

4) Fishing Gear Locker

Since the fishermen presently do not have any storage facilities at the landing point, they have to take materials and equipment like engines, fishing nets, fuel and water tanks back home with them. For lack of berthing wharf, most of the fishing boats anchor offshore, and most of the small boats with outboard engines leave their fishing gear and engines unattended on the beach nearby the landing point. When these facilities to be provided in the project will be completed, many fishermen will move to them from nearby beaches.

Fishing gear locker for fishermen is not only one of the important types of facilities for improvement of labor conditions in the fishery works but also essential facilities for good maintenance of engines, fishing gear, etc., and provision thereof is necessary also for the sake of reducing the labor burden

up to now on fishermen constituted by management of fishing gear etc.

Regarding number of fishing gear locker compartment the fishermen themselves are divided in their opinions as to whether such storage facilities should correspond to the fishing boats using them or to the fishermen using them. But if they are made to correspond to the fishermen, the scale will be too excessive in relation to the request, so in this project it has been decided to have them correspond to the fishing boats using them.

Since in Antigua and Barbuda the residences of the fishermen are not geographically near to the beaches that they use, fishing gear storage facilities will be provided for all of the fishing boats covered by the plans.

5) Kiosk

In this project Antigua and Barbuda has requested kiosk as mini markets for articles of daily use in line with the Parham Tourism Development Plan, formulated in 1995.

Presently the lack in the Parham area of shops or stores selling essential articles of daily use makes for an inconvenient situation, and one can appreciate the need for such a store or group of stores, but it is also a fact that the Antigua and Barbuda side has not surveyed the demand and does not have any concrete plans regarding that. That makes it difficult to estimate the degree of need, and therefore kiosks have not been included as facilities covered by the present project.

6) Bus Stop Shed

Although there is a bus stop shed at the end of the existing Jordan Jetty for the hotels, etc. on the tourist islands located offshore of Parham, public transportation for commuting employees does not go as far as that bus stop, and the Antigua and Barbuda side now has plans to extend a public bus route to that bus stop in view of the fact that public bus service presently extends only to the inland area, but although one can appreciate the need to provide public transportation for the sake as well of local fishery product consumers and other visitors to the facilities, that has not been included in the present project since too many unclear points remain, such as when extension of the bus route should be implemented and how many users can be expected.

(3) Affiliated Machinery and Equipment

1) Main Facility Building

a) Ice-making Plant and Ice Storage Room

See the previous section "Ice-making Machine Plant and Ice Storage Rooms".

b) Refrigeration room

See the previous section "Cold Storage Room".

c) Standby Generator

All of Antigua and Barbuda's electric power supply, including that for fishery facilities, is provided by a single power plant operated by Antigua Public Utilities Authority (APUA). Large-scale facilities are supplied with high-voltage electric power, and after transformation by transformer of the land type installed at those facilities the necessary electric power is supplied within the facilities.

In our study it is determined that the records of the emergency generator installed at the St. John's fishery complex in 1998 show that it has had 23.7 hours of use, and in interviews in the study concerning the electric power supply situation it was determined that the power outages usually are for 30 minutes to one hour and that they occur 4 to 5 times a month on the average. In addition to the ordinary power failure of relatively short term, long-term power down has been occurred often in the local area such as Parham and Urlings by the damage of main power cable due to hurricane attack. That being the case, in this project it is planned to have installation of standby generators sufficient to cope with ordinary short-term power failures and long-term power down due to hurricane attack so as to enable to secure stable supply of ice to fishermen and stable operation of cold storage.

2) Fuel Supply Facility

Securing of fuel oil for fishing operations is one of the most crucial works of fishermen. But in the case of both the Parham project site and the Urlings project site the nearest fuel station is approximately 8 km away. In the interviews it was found that those supply station do not have stable

business hours, which sometimes makes it necessary to search for fuel all over before fishing operation, at times even having to go as far as St. John's.

The required capacity of the requested fuel tanks will be considered on the basis of such occasions as the number of boats that will be using them and their frequency of going out for fishing, and the study will include consideration of the system including the location of dispensers and fuel tank for future installation. It should be noted, however, that only installation of the distribution pipes will be directly included in the present project, installation of the fuel tanks and dispensers being done by the Antigua and Barbuda side.

2.2.4 Basic Orientation of the Project

The following facilities and equipment will be provided on a reasonable scale in line with the actual current conditions of local fisheries.

i) Support facilities and equipment for safe and rational operation of medium and small sized fishing boats
ii) Support facilities and equipment for sanitary distribution of fishery products
iii) Support facilities and equipment for convenient repairs
iv) Boat landing facilities such as slipway for safe evacuation from hurricanes
v) Support facilities and equipment for meetings and other group activities and educational and enlightenment activities of artisanal fishermen
vi) Administration facilities

The scale of the facilities and equipment involved will be determine on the basis of the findings of the field survey taking into account the content of Antigua and Barbuda's request and making sure that it is appropriate for a Japanese Government grant aid project.

In view of the concept of having the facilities and equipment of the two fishing ports serve the objective of supporting the operations of medium and small sized fishing boats it is appropriate that large-scale fishing boat be excluded from the scope of the present project. Another reason for not including large-scale fishing boats in the scope of the present project is that their inclusion would entail increase of wharf length and water depth and

considerable increase in the scale of facilities incommensurate with the number of fishing boats of the areas in question, which would detract from cost efficiency.

Below is explained the basic idea on the facility plans for the respective areas.

(1) Parham Area

The request for the Parham area covers six fish landing points from Shell Beach to Willikies. As a result of the field survey it has been determined to include in the project coverage the fishermen making use of the landing points from Fitches Creek to Crab Marina. That is because it is considered that the fishermen at Seatons and Willikies cannot be treated together with the others in terms of an integrated land community in view of their geographical separation by Crab Peninsula and Guiana Island in terms of marine transportation. However, it is necessary to include the fishermen of those zones in use of the ice and fuel supply facilities, the repair supply facilities and others considering the convenience of overland transportation.

(2) Urlings Area

From the findings of the field survey in the Urlings area the landing points from Valley Church to Carlisle Bay have been included in the scope of the project on the basis of the judgment that it is appropriate to consider them to represent an integrated fishery community. Furthermore, the fishermen living in the Urlings area and operation in Jolly Harbor with small and medium size fishing boat will be included in use of the fishing port.

2.3 Basic Design

2.3.1 Basic Design Concepts

(1) Remarks on Project Sites

1) Parham Site

Although the site remarked for construction of the fishing port represents a narrow space restricted between the existing village and the waterfront, site preparation by reclamation within a scope that does not have a big impact on the natural environment is considered to be possible. There is an existing jetty that is being used for ferryboat service to resort island hotels. Furthermore, buildings and surrounding walls dating from the days of British rule are to be found next to the site as possible future tourist resources although they have not yet been restored. In view of that the project planning must be in harmony with the daily life of the existing village and the jetty as well as the memorial buildings.

2) Urlings Site

The site earmarked for construction of the fishing port lies at a distance of about 200 m from a main local road, but there is no access road from there. That being the case, it is necessary for the Antigua and Barbuda side to provide such an access road by the end of the construction work of the project so as not to cause any impediment of the activities of the facilities included in the project. Since the surrounding area consists of pasturage, there should not be much of an influence on existing villages.

The planning must take into account, as environmental factors, the mangrove forests around the project site and the coral reef and the seaweed grounds in offshore area.

(2) Basic Facility Design Concepts

In design of the facilities the following points are to be taken into account:

1) Compatibility between the construction work and existing fishery activities and village daily life
2) Careful attention to ease of use of the project facilities by the fishermen so as not to cause drastic change in long-standing fishing operation practices and form of distribution of fishery products

3) Structural design that appropriately reflects natural conditions and planning in harmony with the local natural environment, surrounding vegetation, etc. in a trade wind zone
4) Adoption of appropriate specifications and structures, simple equipment, etc. so as not to burden maintenance and management of facilities
5) Appropriate construction method selection, efficient project cost planning and construction scheduling
6) Planning in harmony with the surrounding natural environment and village environment so as not to cause any drastic change in them
7) Observance of Antigua and Barbuda's laws, regulations and standards concerning construction

2.3.2 Basic Concept of Facility Design

(1) Basic Design Concept of Basic Port Facility

1) Content of Basic Port Facility

a) Parham Site

In the field study it was decided to rule out the requested finger jetty and alternatively was requested to locate the wharf alongside of the Jordan Jetty on the east side of the project site. Furthermore, it will be necessary to dredge the shallow water area in front of the project site so as not to hamper boat navigation. As for a breakwater for ensuring water calmness of the port basin, it is considered not to be necessary in view of local natural conditions.

Considering the fact that the project site has a low ground elevation since it is located on the seashore, the ground will be raised in ground preparation of the site for protection against waves and storm surge, particularly at the time of hurricanes.

b) Urlings Site

In the case of the new fishing port for this area, the wharf and basin will be constructed by excavating the seashore area. That being the case, not only a wharf and a basin as basic fishing port facilities but also shore protection forming the perimeter of the basin and protecting the access channel will be needed. Also necessities as ancillary works are dredging of the basin and access channel. But a breakwater for ensuring calmness of waters in the port will not be needed since in the case of the excavated type of

fishing port the seashore on the sea side of the facilities acts as a breakwater.

Furthermore, although there is no trouble with waves at normal times, the lowness of the ground level of the project site because of its location on the seashore poses a problem regarding stormy waves attacking the facilities during hurricanes, and it is therefore necessary to raise the project site ground level in preparation of the ground and to provide shore protection (such as shore protection) on the perimeter of the site on the sea side for protection of the site and prevention of outflow of soil.

2) Design Standards

In Antigua and Barbuda there are no particular design standards for civil engineering facilities, the implementing entity setting them itself for design of structures. That being the case, in this project for design of the fishing port structures use will be made of "Standard Design Methods for Fishing Port Structures," and, supplementary, " Technical Standards for Port Facilities and Explanation" as design standards for Japanese fishing port structures.

3) Natural Condition Aspect

The design of the respective project sites is to be based on the following matters to be taken into account as regards the natural conditions aspect:

a) Parham Site

i) Storm Surge Condition

Since there are reports of occurrence of storm surge in the Parham area at the time of hurricanes, high tides due to storm surge will be taken into account in design of the project facilities at the Parham project site. The Meteorological Office has a brief manual for storm surge forecasting covering the Caribbean area from the hurricane's course and size. The forecasted storm surge for Hurricane George in 1998, a Category-3 or medium-size hurricane, were 1.8 - 2.7 m, but actually nothing like that was reported. It would therefore not be realistic to use such forecasted values in the design storm surge. That being the case, the high tide conditions will be set on the basis of past survey findings and the results of study of the conditions of surrounding buildings or interviews.

ii) Wave Condition

The Parham project site is well shielded from stormy waves and swells. It mainly being waves that generate in the bay by strong wind has an effect. That being the case, those latter waves will be taken as predominant for the wave conditions in design of the structures.

iii) Land Conditions

Historical buildings dating from the days of British rule is there directly behind the project site, which puts a restriction on securing space for the site in the hinterland. That being the case, it is necessary to secure space for the site by reclamation work in the waters in front. The appropriate face line of reclamation will be determined on the basis of the results of depth measurements and required land area for the on-land facilities.

iv) Littoral Drift Condition

The project site is a site contiguous to the Jordan Jetty on the west side with a total length of about 100 m. The beach in front of it is a gravely sandy beach. There is no particular phenomenon of deformation thereof since the incoming waves are relatively small. Furthermore, since facilities of a smaller scale than the jetty are planned next to the bottom part of the jetty, it is considered that the facilities provided in the present project will have hardly any effect on littoral drift in the vicinity.

v) Soil Condition

Soft silty layer exists allover the project site not only land area but also offshore area. That being the case, in planning and design of the facilities structural design that is both economical and stable with respect to external forces will be sought on the basis of boring results.

b) Urlings Site

i) Wave Condition

The Urlings project site is located on the beach, and there are coral

reefs in front of the beach and farther out offshore. Since waves that come in are broken and attenuate their energy by those coral reefs, the waters in front of the site are relatively calm. At the time of stormy waves, however, even after breaking on the reefs the waves are still significant, and average water level rises by storm surge as well. That being the case, such phenomena have to be taken into consideration in planning the ground height and the revetment and shore protection structures.

ii) Drainage Condition

The terrain surrounding the project site is conical, with mildly sloped land in the hinterland. There is a possibility that rainwater that falls on the hinterland during a hurricane will flow into the vicinity by way of a small river on the east side of the project site. The planning will therefore have to take into account not only the waves that might come in but also possible inflow of river water.

iii) Littoral Drift Condition

Since in the present project there is to be construction of an artificially excavated fishing port on the sandy beach shore, it is necessary to take into account both siltation of the port entrance and basin and the impact on the seashore in the vicinity. At the place in question there has been excavation of an artificial inlet to serve as refuge anchorage at the time of heavy seas condition, and there is a small jetty that has been constructed for landing of fish catches, but there has been no siltation of the inlet or significant beach change due to these manmade structure. As for sand drift, it is not considered to be very pronounced. But in view of the possibility of the access channel and basin becoming shallower in the future, the need for maintenance dredging will be suggested to the Government of Antigua and Barbuda.

iv) Soil Conditions

The project site encompasses both a sandy beach and a mangrove marshland with a soft ground condition. That being the case, in planning and design of the facilities structural design that is both economical and stable with respect to external forces will be sought on the basis of boring

results.

4) Maintenance and Management Aspect

Regarding the maintenance and managerial aspect, at the Urlings project site, where the port is of the excavated type, it will be necessary to pay attention to disturbance and pollution of in-port waters and to siltation of the port basin and access channel, but those concerns are something that all fishing ports of that type have to cope with. As for disturbance of in-port basin, it can be countered by reducing multiple wave reflection through such measures as laying out of revetment/riprap shore protection for absorption of wave energy.

As for port pollution, seawater exchange between inside and outside of the port basin by tide level change cannot be counted on in view of small differential tide level in the waters in question. It will therefore be necessary to take measures such as severe prohibition of processing of fish catches and dumping of oil in the port basin.

Regarding siltation of the port basin, not much is expected, but it is suggested that dredging be undertaken expeditiously in case it occurs as a result of entry of waves and currents.

5) Construction Work and Schedule Aspect

Regarding ease of execution of the basic port facilities and construction period, wharf facility structural types that are advantageous from those viewpoints will be selected judging from the ground foundation conditions of each site.

Construction schedule will be set on the basis of the instructions of the entities concerned and the factors such as the scale of the facilities, when the construction work is to be done, construction cost estimates, etc are considered as well.

Since the project sites will be operating as fishing ports during execution of the construction work, great care will have to be taken in planning of temporary facilities for carrying forward the construction work, and careful attention will have to be given to minimization of interference with fishing activities and ensuring of the safety thereof. Particular care will also have to be taken in implementation of plans for bringing in and taking out construction equipment and materials, temporary yard installation and

operation plans, construction plans, etc. Furthermore, since at Parham the existing jetty is being used for passenger boat terminal and as parking space that will have to be taken into account in formulation of the construction plans.

6) Environmental Aspect

From the viewpoint of the environment aspect the plans for each project site will have to be formulated taking into account the matters indicated below.

a) Parham Site

In the case of this site no particular care has to be taken regarding impact on mangrove thickets since at the site itself such growths are too few to constitute thickets and since nearby mangrove thickets are located at a sufficient distance not to be affected. The same holds for coral reefs.

However, adequate consideration has to be given to the historical buildings immediately behind the project site in formulating the facility layout plans and the work execution plans.

b) Urlings Site

Since in this case the project site is an area of withered mangroves and mangrove thickets are to be found to the west of it, in the planning it is necessary to consider the impact on them during both construction and subsequent use of the facilities. Furthermore, since there are coral reefs and seaweed grounds in the waters in front of the site, the dredging of the port entrance of the access channel must be planned in such a way as to prevent turbidity due to dredging works thereof.

(2) Basic Design Concept of Functional Port Facilities

1) Design Standards

As in the case of design of civil engineering works, Antigua and Barbuda does not have its own standards and norms for structural design. Therefore in this project CUBIC, which is based on U.S. and U.K. standards and norms, will be used for architectural design. As for electricity and water

supply, the electricity and water supply corporations use the U.S. standards NEC and ASME. Since Japanese standards and norms guarantee performance at least as good as them, the design work will be done using the Japanese standards and norms while also taking into consideration of the above-mentioned standards and ACI, AISC, AWS, ASTM, UBC, BSCP, BS and ISO standards.

2) Natural Condition Aspect

Considering the influence of storm surge and high waves at the time of hurricanes as in the case of consideration of the ground height of the wharf and aprons of the fishing ports, the plots of the functional on-land facilities will be determined in such a way as to provide protection against such influence. In that connection, since in the particular case of the Parham project site the ground level of the facility area will be set higher than the ground level of the hinter area behind the project site, the planning will have to ensure that there will be no obstacle to drainage of surface and other water from that hinter area at such times as heavy rains.

From that same viewpoint the foundation design of the buildings will have to be safe, but with consideration also being given to reasonableness of cost on the basis of comparison of different foundation work methods.

3) Maintenance and Management Aspect

Since Antigua lies in the trade wind zone (at a low latitude) it differs from Japan in terms of such environmental conditions as prevailing winds and angle of elevation of the sun. That being the case, such environmental conditions have to be fully considered in the design of which way buildings face and design of building apertures so as not to detract from building functions as considered on the basis of architectural principles.

The facilities in question, the like of which there has not been before on Antigua, will be local base facilities for artisanal fishing activities. Because of that, they will be facilities that the islanders have not had any experience in using. Hence the need for particular care in considering what functions will be necessary.

Furthermore, in the construction materials and the construction methods that do not require much labor and expense for maintenance and management will be selected.

4) Construction Work and Period Aspect

In both areas the on-land facilities have to be built on plots prepared in the project construction work. The construction work must therefore be planned mutually with the civil works, including the temporary work yard, so that both can be executed without any hitches.

Particularly important in that respect is construction foundation planning, for which there must be planning coordination, including construction planning, in both areas between the building lot preparation and the necessary excavation work as regards the needed filling materials.

For the project as a whole reduction of construction period will have the effect of rational reduction of project cost. Therefore in architectural design it will be necessary to select construction methods on the basis not only of comparison of direct construction costs but also comprehensive viewpoints that includes the factor of the amount of time that the work will take.

5) Environmental Aspect

Regarding the sanitary facilities and markets for direct sale of fish included in the request items by the Government of Antigua and Barbuda, it will be necessary to install septic tanks meeting the CUBIC wastewater discharge standards (BOD value: 45 ppm) as well as to ask its Government to do what is necessary regarding proper maintenance and management of such septic tanks.

2.3.3 Layout Plan

(1) Layout Plan of Parham

The layout plan of the following different project facilities at Parham needs to be established taking into account the restrictive conditions indicated below:

* Basic port facilities: wharf, slipway and boat yard
* Functional facilities: main building, fish retailshop, gear locker, and workshop, etc.

1) Securing of Required Land

Since there is only a very limited space for the on-land facilities on the west side of Jordan Jetty and since it is impossible to secure space on the land side behind it due to the presence there of historical buildings, it will be necessary to obtain some of the necessary space for the land facilities by reclamation work on the maritime area. The boundary of the space on the west side is only 125 m from the boundary of the jetty. Since the necessary area for the land facilities is approximately 3,200 m^2 (about 40 m x 80 m), it is necessary to provide revetment for shore protection on the sea side. Furthermore, since considerable space in the inland direction is needed for the slipway and boat yard, the land only in front of the historical buildings can be assigned to that purpose.

2) Layout of Wharf

The results of the boring at this project site show that the soil conditions are very soft and poor, there being on the land part distribution of clay layers or silty clay layers with organic material and an N value of 0 in the surface layers below the thickness of approximately 1 to 1.5 m of reclamation materials. Below that distributes bedrock stratum, its distance from the present ground level presently being 3.0 to 4.0 m below. The geological structure of the sea area is, as in the case of the land area, bedrock below a clay layer with an N value of 0. The bedrock layer becomes deeper in the direction of the sea, and the position of the bedrock in the sea area is about 7 m below the surface of the water. Therefore, for the wharf structure in this project area it is necessary to adopt a type of structure that has high reliability and easy supervision of execution of the work after dredging the soft layer and replacing the good filling materials. Since the Jordan Jetty will have mad sliding in case of use of the space in front of the jetty as a wharf, construction of the wharf in front of the jetty must be avoided. Because of that it is necessary to use the site shore protection part (revetment) as a wharf.

For the above-mentioned reasons the idea of widening the Jordan Jetty trunk is given up in the present project. The area westward of the jetty base will undergo the minimally necessary reclamation for the land facilities, and a wharf will be located in front of that. The land facilities will be given the layout indicated in Figure 2.3.3-1 taking into account the movement line of fish, people and vehicles.

(2) Layout Plan of Urlings

It is necessary for the following planned facilities at Urlings to have a layout that is planned taking into account the restrictive conditions indicated below:

* Basic port facilities: wharf, slipway and boat yard, channel and revetment
* Functional on-land facilities: main building, retail shop, gear locker and workshop, etc.

1) Mangrove Distribution

Because of the presence of mangrove thickets at the Urlings site it is necessary to do the facility layout planning on the basis of the premise of protection of them in terms of environmental aspect.

The mangrove thickets are located to the west and the north of the project site (mangroves on the way to recovery there) at 100 m from the shoreline. That means that mangrove thickets constitute the boundary of the project site on the west side and on the north side.

Furthermore, the port basin will not be excavated more than 100 m northward from the shoreline. Another restriction on the planning of the project site is a private house on the north side.

2) Wave Ruunup Aspect

At the time of rough waves reach the land in this area, the estimated wave height being approximately 1.50 m (describe detail later on). Construction of structures within the zone extending 30 m from the shoreline on the shoreline side will therefore be avoided. Furthermore, the ground level is about +1.50 m up to about 30 m from the shoreline, and that will be the boundary of the site on the sea side.

3) Access Channel

Fishing boats will enter the excavated basin by way of the access channel between the reefs. Since the shape of the existing channel is an "S"

shape, it is necessary to plan a channel for easy entry to the basin involving excavation from the boundary of the mangrove thickets on the west side so as to have easy boat maneuverability at the channel boundary.

4) Wharf

Judging from the predominant wind direction, a longitudinal berthing wharf is suitable, but if there is only a vertical junction wharf the anchorage will have to be excavated inward on the north side. Considering such matters as providing waters for turning basin, it is necessary to build in part a parallel mooring wharf.

5) Layout of On-land Facilities

The required area for land facilities is about the same as the Parham project site, but since the north side part of the project site is mildly sloped, that restricts extension to the east. It is therefore necessary to plan the facility layout taking into account the height differential between the facility plots and the surrounding area as well as drainage of land water.

Furthermore, on the east side of the project site there is a place where rainwater that gathers in the vicinity during strong rains accumulates and also the historical ruin, that representing the eastern boundary in the site planning.

The layout plan of the facilities in the Urlings site will be planned as indicated in Figure 2.3.3-2 under the above-mentioned restrictive conditions and taking into account the movement lines of fish, people and vehicles.

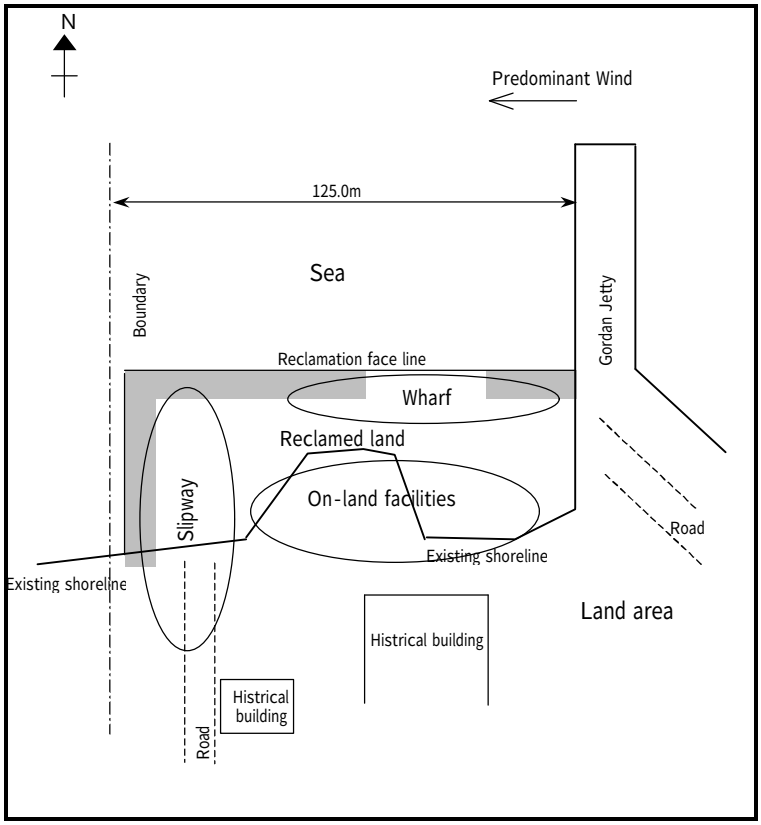


Figure-2.3.3-1 Layout Plan in Parham Site

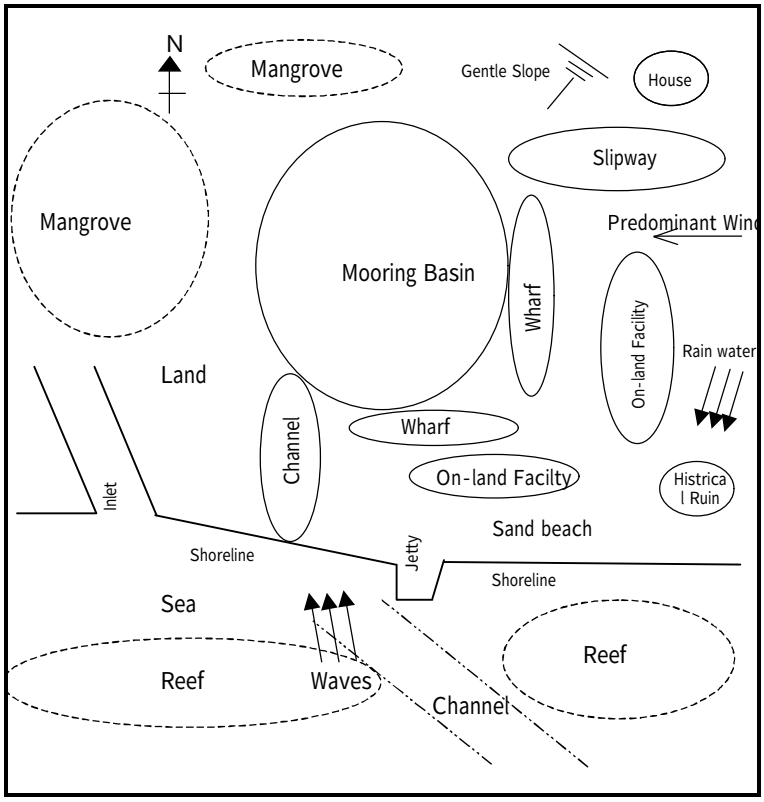


Figure 2.3.3-2 Layout Plan in Urlings Site

2.3.4 Basic Design Condition for Planning

(1) Number of Fishing Boats

1) Fishing Boats in Antigua

The numbers of registered fishing boats on the island of Antigua are 497 as indicated in Table 1.4.2-4. According to the inquiry of the Fisheries Department, maybe 10 of them are not in operation so it can be considered that almost all of them are in operation. However, considering the fact that a registration fee of 5 EC$ is charged per foot of boat length, in our judgment the 37 boats without indication of length in the records have been decommissioned, and we have concluded not to consider them as fishing boats in operation. That makes the total number of fishing boats on the island of Antigua in operation 460 (the registered number of 497 minus those 37).

2) Number of Fishing Boats

a) Number of Fishing Boats adjacent to Project Sites

The request was for it to be considered that after implementation of the present project the fishing boats presently using the landing points from Shell Beach to Willikies will utilize the new fishing port in the Parham area and that those presently using the landing points from Jolly Harbor to Carlisle Bay will utilize the new fishing port in the Urlings area. The respective numbers of registered fishing boats in those two areas with a length of under 40 feet (excluding those whose length is not clear) are indicated in Tables 2.3.4-1 and 2.3.4-2.

Table 2.3.4-1 Number of Registered Fishing Boats in Parham

Loa(ft) / Landing Site	Loa<20'	20'≦ Loa<40'	40'≦ Loa	Total
Shell Beach	11	12		23
Fitches Creek	4	6		10
Parham	18	6		24
Crab Marina	2	13	3	18
Seatons	11	5	1	17
Willikies	14	9	1	24
Total	60	51	5	116

Table 2.3.4-2 Number of Registered Fishing Boats in Urlings

Loa(ft) / Landing Site	Loa<20'	20'≦ Loa<40'	40'≦ Loa	Total
Carlisle Bay	2	2		4
Moriss Bay	2	4		6
Urlings	12	11		23
Johnsons Point	1			1
Crab Hill	2	3		5
Valley Church	2			2
Jolly Harbor	4	37	1	42
Total	25	47	1	83

In order to determine more specifically the numbers of fishing boats that will be using those two new fishing ports we carried out interviews of the fishermen in those areas concerning that question. For the Parham area it was determined in that way that the fishermen now using the landing points of the Fitches Creek, Crab Marina and Parham will make regular use of the new fishing port there. As for the fishermen now using the Shell Beach, it was determined that they would use the new fishing port only for repairs but not on a regular basis. The answer from those now using the Seatons and Willikies landings was that they would not use it, except for procurement of ice and fuel in view of easier land access to it than to St. John's.

In the Urlings area the fishermen other than those of Jolly Harbor (among the fishermen not residing in the Urlings area) indicated that they would make regular use of the new fishing port.

In view of the above, the planning of the new fishing ports in the two areas covered by the present project will be based on the assumption that the fishing boats now using the Fitches Creek, Parham and Crab Marina landing points will make use of the new fishing port in the Parham area and that the fishing boats now using the six landing points from Valley Church to Carlisle Bay and the fishing boats less than the medium-sized ones now using the Jolly Harbor will make use of the new fishing port in the Urlings area as regards the wharf and other basic fishing port facilities of those two ports.

2) Number of Fishigng Boat for Wharf Planning

The present project does not concern those engaged in large-scale commercial fishery operations. Rather, its basic policy is restoration and promotion of artisanal fishery using medium and small-sized fishing boats.

In spite of that it would appear that three fishing boats with a length in excess of 40 feet registered at the Crab Marina in the Parham area and one large-scale fishing boat using Jolly Harbor in the Urlings area would like to make use of those respective new fishing ports, but it is necessary to exclude them from the present project and stick to the limitation of fishing boats under 40 feet in length because inclusion of even that small number of larger boats would make it necessary to make the scale of the facilities larger, including increase of wharf water depth, increase of maneuvering baisn and widening of access channel.

That being the case, the numbers of fishing boats covered by the present project will be 49 for the Parham fishing port and 43 for the Urlings fishing port as indicated in Tables 2.4.4-3 and 2.3.4-4 (with inclusion, however, in the case of the Urlings fishing port of fishing boats under medium-size now using Jolly Harbor but the fishermen of which reside in the Urlings area).

Table 2.3.4-3 Design Number of Fishing Boats in Pa rham

Loa(ft) / Landing Site	Loa<20'	20'≦ Loa<40'	Total
Fitches Creek	4	6	10
Parham	18	6	24
Crab Marina	2	13	15
Total	24	25	49

Table 2.3.4-4 Design Number of Fishing Boat in Urlings

Loa(ft) / Landing Site	Loa<20'	20'≦ Loa<40'	Total
Carlisle Bay	2	2	4
Morris Bay	2	4	6
Urlings	12	11	23
Johnsons Point	1		1
Crab Hill	2	3	5
Valley Church	2		2
Jolly Harbor		2	2
Total	21	22	43

3) Number of Fishing Boats for Ice Supply

The numbers of such boats are set as the numbers obtained by adding to the numbers of fishing boats covered by the wharf, rest facilities and other

basic port facilities the respective numbers of boats with a length in excess of 40 feet and, in the case of the Parham area, the number of registered fishing boats now using the Seatons and Willikies landing points.

Table 2.3.4-5 Design Number of Fishing Boats for Ice Supply in Parham

Loa(ft) / Landing Site	Loa<20'	20'≦ Loa<40'	40'≦ Loa	Total
Fitches Creek	4	6		10
Parham	18	6		24
Crab Marina	2	13	3	18
Seatons	11	5	1	17
Willikies	14	9	1	24
Total	49	39	5	93

Table 2.3.4-6 Design Number of Fishing Boats for Ice Supply in Urlings

Loa(ft) / Landing Site	Loa<20'	20'≦ Loa<40'	40'≦ Loa	Total
Carlisle Bay	2	2		4
Morris Bay	2	4		6
Urlings	12	11		23
Johnsons Point	1			1
Crab Hill	2	3		5
Valley Church	2			2
Jolly Harbor		2		2
Total	21	22		43

During the period of the local survey the numbers of fishing boats at the landing points of the Parham area (except for those of Shell Beach, which will not be using the new port) and the Urlings area (except for those of Jolly Harbor) were observed. Table 2.3.4-7 shows the relationship between those findings and the numbers of registered fishing boats.

More small fishing boats in numbers were observed in both the Parham area and the Urlings area than the number registered in them, which means that fishing boats registered at other landing points make use of those two areas. As for medium-size fishing boats, the number of them observed in the Urlings area just about matched the number registered there, but the number observed in the Parham area was less than the number registered there.

The smaller number observed there is probably due to the fact that some were out at sea throughout the period of observation since that class of fishing boats is out at sea fishing most of the time. Another possible reason is that medium-size and larger fishing boats registered at Crab Marina, which was closed down at that time, were using other landing points. By checking that matter, we got confirmation that fishermen making use of Crab Marina, too, were desirous of using the new port.

Overall, 93% of the registered fishing boats were observed in the Parham, and 102% of them were observed in the Urlings area, and taking into account, among other things, those that were not observed because they were in operation at sea, it is considered appropriate to plan the two new fishing ports for the numbers of fishing boats indicated in Tables 2.3.4-5 and 2.3.4-6.

Table 2.3.4-7 Number of Observed Fishing Boats

Project Site	Loa(<20ft)			Loa(20ft - 40ft)			Total		
	Obs.	Reg.	%	Obs.	Reg.	%	Obs.	Reg.	%
Parham Area	55	49	112	27	39	69	82	88	93
Urlings Area	22	21	105	20	20	100	42	41	102

Obs.: Observed Boats Reg.: Registered Boats

(2) Estimation of Fish Catch Amount

1) Fish Catch Amount per One Fishing Operation

Dividing the fishing boats into two categories according to boat length, i.e. those under 20 feet (small sized fishing boats) and those between 20 and 40 feet (medium-sized fishing boats), in this project we have calculated 50 kg as the basic quantity for the overall average catch per sortie per boat, which figure will be used for planning of the facilities of the new fishing ports.

Table 2.3.4-8 Fish Catch Amount per Fishing Operation

Boat Size	Number of Fishing Boat	Total Fish Catch (lbs)	Average in lbs/boat	Average in kg/boat
Small Boat	18	1,192	66	30
Medium Boat	15	2,445	163	74
Total	33	3,637	110	50

2) Number of Fishing Operation Days

The average number of days at sea engaged in fishing operations has been calculated as follows on the basis of the same classification by length as above.

The medium-size fishing boats are out at sea engaged in fishing operations more often than the small ones. That is due both to the fact that the medium-sized boats are not so adversely affected by strong winds and waves and to the fact that their fishermen are more strongly motivated to go fishing as often as possible.

The basic pattern of operation is that of spending the day before on preparatory work, including procurement of ice and fuel, setting out to sea early the next morning, fishing for 4 - 6 hours, coming back to port before noon or by around 2 PM and spending the morning of the day after that trying to sell the fish. That means that the possible number of fishing operation per week in only 2 - 3.

Table 2.3.4-9 Operation Days per Week

Boat Size	Number of Fishing Boat	Total Operation Days/Week	Average Operation Days /Week
Small Boat	19	45.5	2.4
Medium Boat	18	54.0	3.0
Total	37	99.5	2.7

Source：The Result of Questionnaire to Fishermen

That frequency becomes even lower if one takes into account days with strong winds that make it impossible to fishing operation. A rule of thumb as regards sea conditions that stop fishermen from going out to sea is days on which there is considerable occurrence of white-capped waves (Class 4 wind force with wind speeds of 8.0 - 10.7 m/s). The annual mean frequency of wind speeds not in excess of 8 m/s obtained from wind observation data for the island of Antigua is 71% of the time, and it is 87% of the time for wind speeds under 9 m/s. The number of days a year that fishing boats are not prevented by strong winds from putting out to sea is set as follows on the basis of a limit wind speed of 8 m/s for small boats and 9 m/s for medium-size ones.

Table 2.3.4-10 Annual Operation Days

Boat Size	Number of Fishing Boat	Operation Days /Week	Average Operation Days/Week	Annual Operation Days
Small Boat	19	45.5	2.4	2.4×48Weeks×0.71 =2Days(1.7Days/Week)
Medium Boat	18	54.0	3.0	3.0×48Weeks×0.87 =125Days(2.6Day/Week)
Total	37	99.5	2.7	Average 103 Days/Year

3) Estimated Fish Catch Amount

The annual catch volumes can be estimated as follows on the basis of the above numbers of fishing boats in question, the catch per operation and the annual number of days operating at sea. The individual fish catch and the number of days engaged in fishing differ from category of fishing boat, but in this project the average figure have been used for estimation of the total annual fish catches expected to be landed at the two new fishing ports.

a) Estimated Annual Fish Catch Amount at Project Sites

For the numbers of fishing boats indicated in Tables 2.3.4-5 and 2.3.4-6, the catches expected to land at the new fishing ports are estimated as follows:

*** Fish Catch landed at Parham Fishing Port**

Average catch/boat = 50 kg/boat/day
Average annual number of operating days = 103 days/year
Number of fishing boats involved = 49
Total annual catch = 50 kg/boat/day × 103 days/year × 49 boats
= 252 tons

*** Fish Catch landed at Urlings Fishing Port**

Average catch/boat = 50 kg/boat/day
Average annual number of operating days = 103 days/year
Number of fishing boats involved = 43
Total annual catch = 50 kg/boat/day × 103 days/year × 43 boats
= 221 tons

From the above the planned annual landed catch volumes for the two

fishing ports are set at 252 tons and 221 tons, respectively.

b) Distribution of Fishery Product from Sites

From the findings of the interviews it is considered that the respective sales distribution breakdowns for the fish catches of the two new fishing ports will be as follows:

Parham Fishing Port: 64% distributed in the Parham and neighboring areas, 2% distributed to hotels and restaurants and remaining 34% distributed to St. John's

Urlings Fishing Port: 7% distributed in the Urlings area, 13% distributed to hotels and restaurants and 80% distributed to St. John's

The findings cleared through the interviews are shown in Table 2.3.4-11.

Table 2.3.4-11 Distributed Place of Catch

Site	St. John's		Hotel and Restaurant		Local and Vicinity Area		Total	
Parham	86 t	34%	5 t	2%	161 t	64%	252 t	100%
Urlings	177 t	80%	29 t	13%	15 t	7%	221 t	100%

(Source：Questionnaire to Fishermen)

For reference the total annual catch for the whole island is estimated at 2,369 tons as follows:

Average catch/boat = 50 kg/boat/day
Average annual number of days operating = 103 days/year
Number of fishing boats involved = 460
Total annual catch = 50 kg/boat/day × 103 days/year × 460 boats
= 2,369 tons

The Fishery Department's estimate is obtained as 2,089 tons/year based on the average catch per boat determined in a sample survey and the assumption of 2 operations a week 48 weeks a year. On the other hand ,in the method used in the request, the total annual fish catch amount is estimated as 2,121tons/year. The estimated figure for the total annual catch of the whole island is not much different from these shown above for reference.

That being the case, the figure of 2,369 tons/year is considered to be appropriate.

(3) Dimensions of the Fishing Boats

The average and maximum dimensions according to category of boat length for the registered fishing boats at Parham and Urlings are indicated below.

Table 2.3.4-12 Dimensions of Fishing Boat in Parham Site

Dimensions \ Loa (ft)		Loa<20'	20'≦ Loa<40'	Average	Max.
Length (L_{oa})	ft	15.3	26.2	20.9	35.0
	m	4.7	8.0	6.4	10.7
Width (B)	ft	5.5	8.9	7.1	13.5
	m	1.7	2.7	2.2	4.1
Draft (D)	ft	1.3	2.5	1.8	4.0
	m	0.4	0.8	0.6	1.2

Table 2.3.4-13 Dimensions of Fishing Boat in Urlings Site

Dimensions \ Loa (ft)		Loa<20'	20'≦ Loa<40'	Average	Max.
Length (L_{oa})	ft	16.0	24.3	20.3	31.0
	m	4.9	7.4	6.2	9.4
Width (B)	ft	5.9	8.1	7.0	12.0
	m	1.8	2.5	2.1	3.7
Draft (D)	ft	1.5	1.9	1.8	4.0
	m	0.5	0.6	0.6	1.2

2.3.5 Basic Planning of Basic Port Facilities

(1) Basic Planning of Wharf

The different categories of wharves according to function are "landing wharf" for efficient landing of fish catches, "preparation wharf" for preparations for going out for fishing such as loading of fuel, water, fishing gear, etc. on board and "idling wharf" for berthing. In Japan separate wharves are provided for each of those functions and planned so that in each case the work can be done efficiently without congestion. However, besides the space limitations of the project sites, in the case of the present project it is considered that planning of separate wharves for the different functions would entail too excessive in view of the local conditions, in which, for instance, at the St. John's fishery complex landing is accomplished by longitudinal mooring to leave space for the "preparatory" and "idling" functions at the same wharf.

Therefore in this project the plans will call for all of the different functions to be accomplished at the same wharf instead of providing a separate wharf for each function. Furthermore, wooden boats will be docked for idling at boat yard instead of including that function in calculation of the wharf length since it is problematic from the viewpoint of maintenance and preservation of such fishing boats to keep them moored in the water at all times.

It should also be added that the lengths of the wharf will have to be confined within the limits of the spatial extent of the respective project sites.

1) Required Wharf Length

a) Parham Site

As indicated in the section concerning layout plan, there is only the limited space of 90 m for extension of the wharf from the base of the Jordan Jetty. That being the case, the wharf will be planned on the basis of three rows of parallel-berthed fishing boats. Table 2.3.5-1 shows the number of fishing boats covered by the plan.

Table 2.3.5-1 Number of Fishig boat covered by the Project in Parham

No. of Boat / Loa (ft)	Total	Wooden Boat	FRP Boat
Loa<20'	24	8	16
20'≦Loa<40'	25	8	17
Total	49	16	33

As it can be seen in the table above, the number of fishing boats considered for moorage at the Parham wharf is 33, wooden boats are not being included.

The necessary length of the wharf in Parham for the case of parallel mooring of all of the FRP fishing boats is set as follows:

Required Wharf Length = $\Sigma n \cdot B$

Where:
- n: daily number of boats moored
- B: required parallel berthing space per boat
  = boat length + allowance (boat length × 0.15)

Table 2.3.5-2 Required Length of Wharf in Parham (for all FRP Boat)

Items \ Loa(ft)	Loa＜20'	20'≦Loa＜40'	Total
Average Loa (m)	4.7	8.0	
Berth Length / Boat (m)	5.4	9.2	
Planned Number of boats	24.0	25.0	49.0
Number of FRP Boat	16.0	17.0	33.0
Rows of Parallel Berthing	3	3	
Caluculated Number of Berth	5.33	5.67	11.0
Requiered Number of Berth	5.0	6.0	11.0
Requiered Length (m)	27.0	55.2	82.2

Length of the wharf in meters
= Required length (82.2m)+allowance (0.8m) = 83.0 m
Mooring width of the wharf (m)
= Maximum boat width × number of rows + allowance between boats (boat width × 0.5) × (number of rows - 1)
= 4.1 m × 3 + 4.1 m × 0.5 × (3-1) = 16.4 m
Necessary water surface area
= Length × mooring breadth = 83.0 m × 16.4 m = 1,361.2 m^2

From the above calculations the necessary wharf length shall be 83 m. That figure just about fits in the site space limitations. That being the case, the length of the wharf of the Parham Fishing Port is set at 83 m.

b) Urlings Site

As indicated in the section concerning layout plan, at the Urlings Fishing Port wharf, which will be located on the north side of the site, the mooring will be longitudinal instead of parallel because of the predominant winds from the east. Furthermore, because of the limited space of the site the length of the wharf can be only about 50 m since space must be used for a slipway and a boat yard as well. Therefore, the fishing boats which cannot be accommodated at that side of wharf will use the other side of parallel wharf setting up at south side. The numbers of fishing boats to be accommodated by berthing longitudinally and by parallel berthing are shown in Table 2.3.5-3. Furthermore, as in the case of the Parham Fishing Port, the wooden boats will be put for idling in the slipway part and are not included in calculation of the length of the wharf.

Table 2.3.5-3 Number of Boat for Longitudinal and Parallel Berthing in Urlings

Number of Boat / Loa(ft)	Covered Number of Boat	Wooden Boat	FRP Boat for Parallel Berthing	FRP Boat for Longitudinal Berthing
Loa<20'	21	7	3	11
20'≦Loa<20	22	7	6	9
Total	43	14	9	20

The length of the wharf for longitudinal berthing of boats is set as follows.

Table 2.3.5-4 Required Wharf Length of Longitudinal Berthing in Urlings

Loa(ft) / Items	Loa<20'	20'≦Loa<40'	Total
Average Width of Boat(m)	1.8	2.5	
Berth Length / Boat(m)	2.1	2.9	
Planned Number of Boat	11	9	20
Required Wharf Length of Longitudinal Berthing(m)	23.1	26.1	49.2

Length of wharf for longitudinal wharf (m)

= Required length (49.2 m) + allowance (0.8 m) = 50.0 m

Berthing length of wharf for longitudinal berthing (m)

= Maximum boat length + allowance (boat length>1.1)

= 9.4m + (9.4m × 1.1) = 19.7m, approx. 20.0 m

Necessary water surface area

= Length of wharf × mooring breadth

= 50.0 m × 19.7 m = 985 m^2

If the length of the wharf for longitudinal mooring is set at 50 m, there will 9 remaining boats to be accommodated by the wharf for parallel mooring. The length of parallel wharf can possibly accommodate 9 remaining boats with one berth of three rows mooring for small boat and two berths for medium-size boat. The length of that wharf is obtained as per the following table.

Table 2.3.5-5 Required Wharf Length for Parallel Berthing on Urlings

Items \ Loa(ft)	Loa＜20'	20'≦Loa＜40'	Total
Mean Loa (m)	4.9	7.4	
Reauied Berth Length / Boat (m)	5.6	8.5	
Required Number of Berth	1.0	2.0	3.0
Required Length of Wharf (m)	5.6	17.0	22.6
Accommodated Number of Boat	3	6	9

Length of the wharf for parallel wharf (m)

= Necessary length (22.6 m) + allowance (0.4 m) = 23.0 m

Berthing breadth of the parallel wharf (m)

= Maximum boat width x number of rows + allowance between boats (boat width × 0.5) × (number of rows - 1)

= 3.7 m × 3 + 3.7 m × 0.5 × (3-1) = 14.8 m

Necessary water surface area

= Wharf length × mooring breadth = 340.4 m^2

From the above the necessary wharf length at the Urlings Fishing Port will be set at 50 m for longitudinal wharf and 23 m for parallel wharf, and the wharf layout plan is shown in Figure 2.3.5-3. That makes it possible to accommodate the wharf space within the site space limits.

2) Crown Height of Wharf

Wharf crown height is set according to tidal range and size of the boats in question.

The crown heights are set as follows in view of the fact that in the case of both fishing ports the tidal range is less than 1.0 m and the gross weight tonnage (GT) as calculated by conversion from boat length is less than 10 GT as shown below:

Wharf crown height = H.W.L. + 0.7 m
= 0.4 m + 0.7 m = D.L. + 1.1 m

Table 2.3.5-6 Setting of Crown Height of Wharf （over H.W.L）

Fishing Boat (GT) / Tidal Range	0～20	20～150	150～500	500 over
0.0～1.0m	0.7 m	1.0 m	1.3 m	1.5 m
1.0～1.5m	0.7 m	1.0 m	1.2 m	1.4 m
1.5～2.0m	0.6 m	0.9 m	1.1 m	1.3 m

3) Water Depth of Wharf

It is intended to secure a water depth such that the boats using the port can berth in front of the wharf and in the basin fully loaded without any problems, and for that the anchorage water depth shall be the maximum displacement of the fishing boats plus the following allowances, the planning being in increments of 0.5 m:

Planned water depth of the wharves and anchorages
= Maximum displacement + allowance
Allowance in the case of hard seabed foundation: min.0.5 m
Allowance in the case of soft seabed foundation: 0.5 m

That being the case, the water depths of the wharf and basin of the Parham and Urlings are set as follows:

Parham: Design water depth=1.2m+0.5m
=D.L.-1.7m →D.L.-2.0m

Urlings: Design water depth =1.2m+0.5m
=D.L.-1.7m →D.L.-2.0m

4) Width of Wharf Apron

The apron width is set as follows according to the use of the wharf (on the basis of "Guidelines for Planning of Fishing Ports")

Landing wharf	a. In the case of conveyance of the catch to a shed	3.0m
	b. In the case of sending the catch from the apron to outside the area directly by motor vehicle	10.0m
Preparation wharf		10.0m
Idling wharf		6.0m

Since in the case of the present project all of the functions "landing", "idling" and "preparation" are to be accomplished at the same wharf and since the fish catches will be taken out and water and fuel will be taken on board directly by truck, the apron width is set at 10.0 m.

(2) Basic Planning of Slipway

Such slipway are planned for the purpose of safely docking and undocking of fishing boats for evacuation during hurricane attack. Furthermore, the boat yard will be planned for the purpose of idling wooden boats on a regular basis for the sake of efficient utilization of the wharf and anchorage facilities.

1) Required Width of Slipway

The slipway will be planned and docking of the fishing boats and launching to the water manually, but since some of the medium-size boats will have to be handled by trailer, one lane without installation of boat pulling upper, where a trailer can be introduced, will be installed besides the part of the slipway.

The necessary slipway surface area is calculated by the following formula:

$$L = \frac{\acute{O}\, B + b(n+1)}{m}$$

Where:

L: length of slipway
B: boat breadth
b: allowance between boat (0.5 - 1.0 m)
n: number of fishing boats utilizing slipway on a standard day
m: number of fishing boats lined up in their longitudinal axis

The lengths of the slipway at the Parham and Urlings fishing ports are set as follows:

Table 2.3.5-7 Required Length of Slipway in Parham

Items \ Loa(ft)	Loa＜20'	20'≦Loa＜40'	Toatal
Average Width of Boat (m)	1.7	2.7	
Required Length / Boat (m)	2.2	3.2	
Planned Number of Boat	24	25	49
Number of Boat for Normal Use (Wooden Boat)	8.0	8.0	16
Number of longitudinal rows	2	2	
Number of Rows	4.0	4.0	8.0
Required Number of Lane	4	4	8
Required Length (m)	8.8	12.8	21.6

Length of the slipway (m)

= Length based on manual operation (22.0 m) + length based on use of trailer (5.0 m) = 27.0 m

Length of slipway stage based on manual operation (m)

= Necessary length + side part + allowance
= 21.6 m + 0.5 — 0.1 m = 22.0 m

Length of slipway based on use of trailer =

Width of largest fishing boat + side parts × 2 + allowance
= 4.1 m + 0.5 m × 2 + 0.0 m = 5.1 m, approx. 5.0 m

The extension of boat yard (m)

= Max. boat length (m) × 2 rows + space of boats × (2 — 1) rows + allowance
= 10.7 × 2 + 2 × 1 + 0.6 = 24.0 m

The required area (m^2) of the boat yard

= Required length × extension
= 27 × 24 = 648.0 m^2

Table 2.3.5-8 Rquired Length of Slipway in Urlingss

Items \ Loa(ft)	Loa＜20'	20'≦Loa＜40'	Total
Average Width of Boat (m)	1.8	2.5	
Required Length / Berth (m)	2.3	2.8	
Number of Boat for use (Wooden Boat)	7.0	7.0	14
Number of longitudinal raws	2	2	
Number of raws	3.5	3.5	7.0
Required Number of Lane	3	4	7
Required Length (m)	6.6	11.2	17.8

The length of the slipway (m)

= Length based on manual operation (19.0 m) + length based on use of trailer (5.0 m) = 24.0 m

Length of slipway based on manual operation (m)

= Required length + side parts + allowance

= 17.8 m + 0.5 m + 0.7 m = 19.0 m

Length of slipway based on use of trailer

= Max. fishing boat breadth + side part × 2 + allowance

= 3.7 m + 0.5 m × 2 + 0.3 m = 5.0 m

Extension of boatyard (m)

= Max. length of the fishing boats (m) × 2 rows + space between boats × (2 − 1) rows + allowance

= 9.4 × 2 + 2 × 1 + 0.2 = 21.0 m

Required area of boatyard (m^2)

= Required length × extension

= 19 × 21 = 399.0 m^2

2) Required Space of Boat Yard

Since the use at the time of stormy weather is for the purpose of safe refuge from hurricanes and waves, emphasis is placed on securing the surface area of the boatyard. The required surface area is obtained by multiplying the number of fishing boats that will make use of the slipway for the purpose of refuge in stormy weather by the occupied surface area per boat.

Required area

= Number of fishing boats using the facility × surface area occupied per boat

Table 2.3.5-9 Required Length of Boat Yard in Parham

Items \ Loa(ft)	Loa＜20'	20'≦Loa＜40'	Total
Mean Loa of Boat (m)	4.7	8.0	
Mean Width of Boat (m)	1.7	2.7	
Required Area / Boat (m^2)	8.0	21.6	
Planned Number of Boat(m^2)	24	25	49
Required Area	192.0	540.0	732

The surface area of the boatyard for boat refuge from hurricanes is 732.0 m^2. Since the surface area needed for regular use by wooden fishing boats is 399.0 m^2, the use will be made of the surface area of the boatyard for use in hurricanes, where the required surface area is larger. The length is obtained as follows by seeking the length satisfying the required surface area on the basis of the length of the slipway shown below.

Surface area of the boat yard (m^2)
= Distance from front to back × length, length
= 732.0 m^2/27.0 m = 27.1 m, or approx. 28.0 m.

Table 2.3.5-10 Required Length of Boat Yard

Items \ Loa(ft)	Loa＜20'	20'≦Loa＜40'	Total
Mean Loa of Boat(m)	4.9	7.4	
Mean Width of Boat (m)	1.8	2.5	
Required Area / Boat (m^2)	8.8	18.5	
Number of Boat	21	22	43
Required Area (m^2)	184.8	407.0	591.8

The surface area of the boat yard area for refuge in hurricanes is 591.8 m^2. Since the boat placement area surface area needed for use by wooden fishing boats on a regular basis is 399.0 m^2, the boat yard area surface area for hurricanes, the required surface area of which is greater, will be used. On the basis of the length of the slipway the length satisfying the required surface area is obtained as follows:

Area of boat yard (m^2)

= Distance from front to back, length

= 591.8 m^2/24.0 m = 24.6 m, or approx. 25.0 m.

(3) Basic Planning of Access Channel and Basin

1) Required Water Depth of Access Cha nnel

The water depth of the access channel and basin in both sites has calm water , therefore, it is regarded as same as the water depth of wharf as below.

Parham: Planned water depth = D.L.-2.0m

Urlings: Planned water depth = D.L.-2.0m

2) Required Wi dth of Access Channel

With a boat breadth of the fishing boats (B), the access channel width will be 5 B for two-way traffic and 3 B for one-way traffic. Since at the Urlings fishing port there will not be many boats moving, the access channel will be for one-way traffic and will have a width of three times of the maximum boat breadth, or 12.0 m.

Access Channel Width

= 3 × max. fishing boat breadth (B)

= 3 × 3.7 m=11.1 m > 12.0 m

3) Required Area of Turning Basin

The water basin for boat maneuvering is a space in the port with adequate room and water depth for the fishing boats to change direction for berthing and leaving berth, etc. The necessary diameter for turning the boat around and boat maneuvering width for berthing at the wharf and leaving berth is considered to be three times the boat length.

Required width (W) = 3 × boat length (L)

Table 2.3.5-11 Required Turning Space

Fishing Port	Loa (m)	Required Space (m)
Parham	10.7	32.1
Urlings	9.4	28.2

(4) Schematic Layout Plan

Based on the above planned dimension and their length of facilities of ports, Figure2.3.5-1 & 2 are shown the layout plan of basic facilities taken the data from the clause 2.3.3.

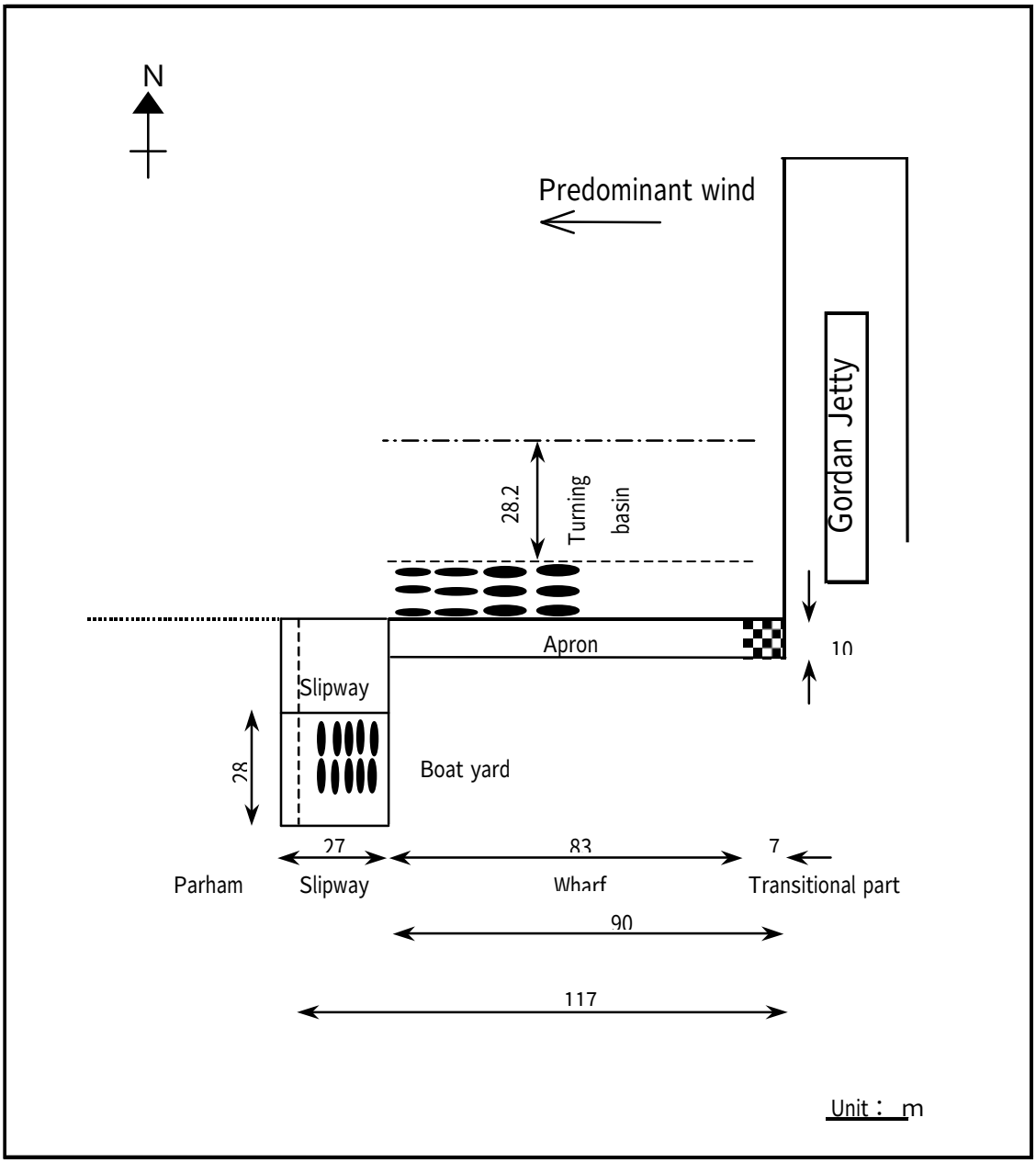


Figure 2.3.5-1 Schematic Layout Plan in Parham

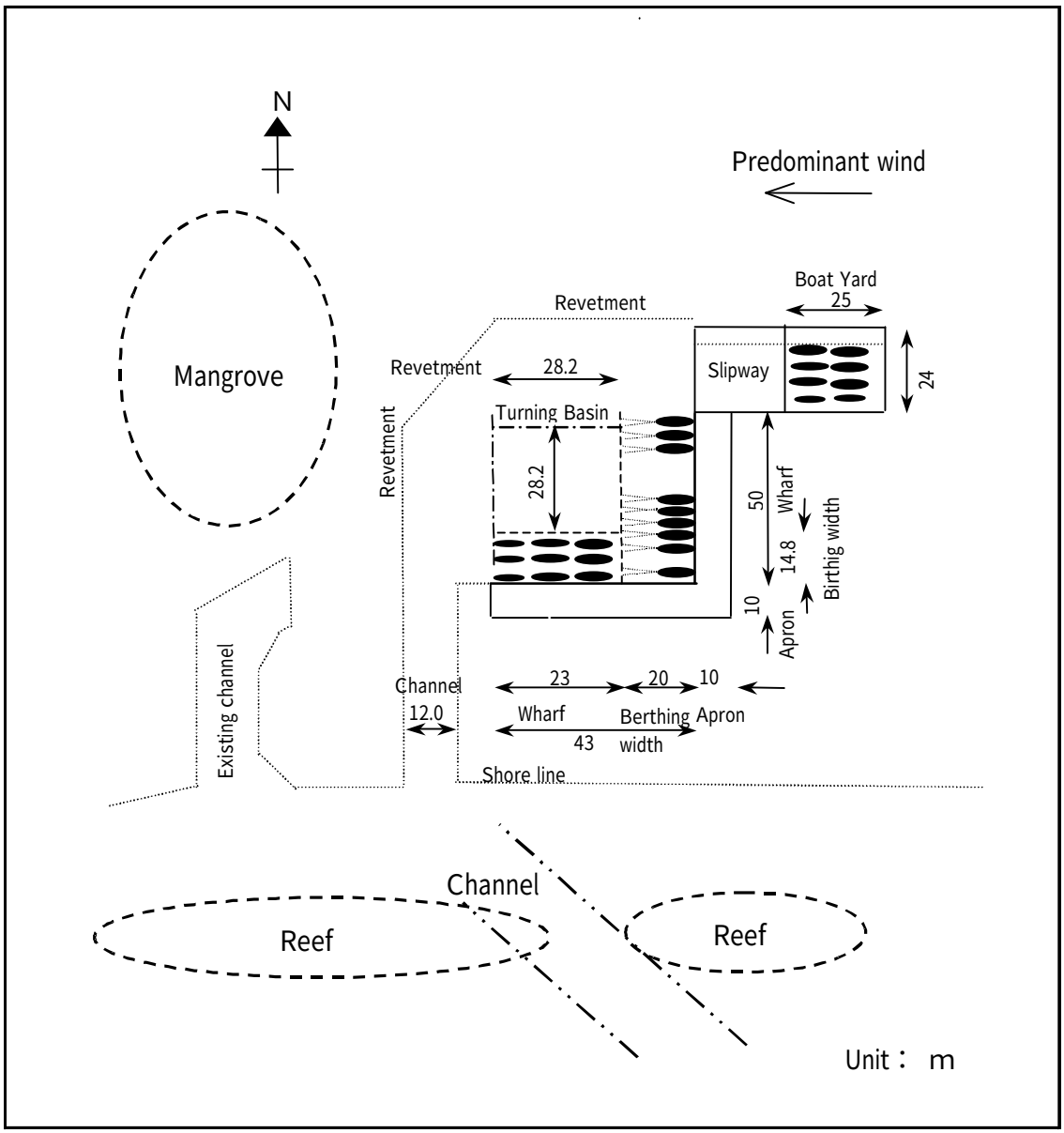


Figure 2.3.5-2 Schematic Layout Plan in Urlingts

(5) Examination of Wave Agitation in Port Basin

1) Parham Site

As a result of forecasting of the waves that occur in Parham Bay on the basis of wind observation records, it has been determined that waves with a height under 20 cm constitute 99.6% of the total in the waters in front of the project site. Those water area in front of the wharf can be considered to be quite clam as regards waves since the wave height there is almost always below 30 cm, the limit value for landing of fish catches and making preparation works.

2) Urlings Site

The waves in the maritime area in front of the Urlings project site have been forecasted on the basis of correlation of the wave data observed during the study period and the wind data observed by the Antigua Airport Meteorological Office. The frequency of wave heights below 40 cm and below 50 cm is found to be 95.68% and 99.83%, respectively.

Figure 2.3.5-3 shows the results of calculation of the values of wave height distribution in the port basin and access channel in the case of 50 cm incident wave height. From the wave height distribution in the basin the wave height at both the east side wharf and the south side wharf is below 10 cm, which is considerably below the allowable limit of 30 cm for fishing boats' landing and preparation works, which means that the wave condition of the Urlings fishing port can be considered to have adequate calm.

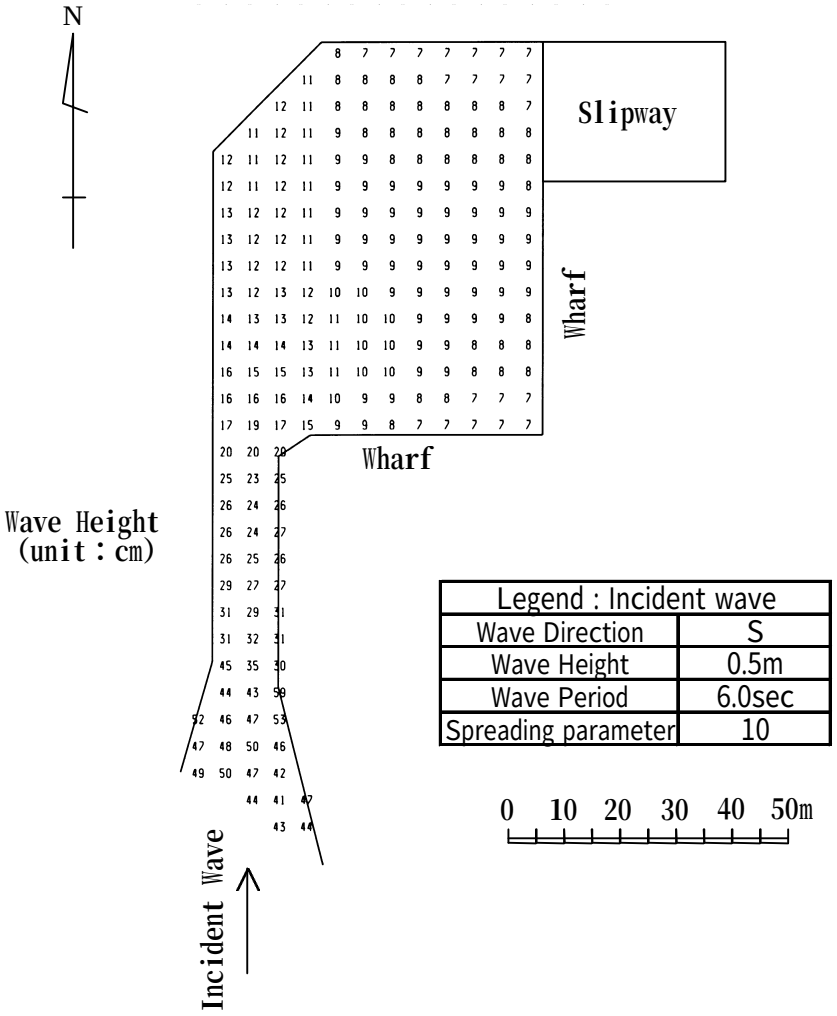


Figure 2.3.5-3 Distribution of Wave Height in Urling Fishing Port

2.3.6 Basic Design of Basic Port Facilities

(1) Design Conditions

1) Dimension of Fishing Boats

The dimensions of the fishing boats concerned by the design are indicated in Table 2.3.6-1.

Table 2.3.6-1 Dimension of Fishing Boat for Design

	Parham	Urlings
O.A. Length	10.7m	9.4m
Breadth	4.1m	3.7m
Draft	1.2m	1.2m

2) Design Water Depth and Tide Level

Table 2.3.6-2 indicates the design water depth and tide level for both sites, storm surge due to hurricanes being taken into consideration in setting of the tide level conditions.

Table 2.3.6-2 Design Water Depth and Tide Level

	Parham	Urlings
Design Depth	D.L.-2.0m	D.L.-2.0m
Tide Condition		
H.W.L.	D.L.＋0.4m	D.L.＋0.4m
M.W.L.	D.L.＋0.2m	D.L.＋0.2m
L.W.L.	D.L.±0.0m	D.L.±0.0m
Storm Surge	0.99m	0.66m

3) Design Wave

For the design waves at Parham we obtained a synthesis of the waves reaching the waters in front of the project site as a result of propagation into Parham Bay, of the design deep water wave (Ho) generated in the deep water sea as a result of hurricanes and of the waves generated in the bay itself as a result of hurricane winds. Furthermore, the design waves for Urlings have been set as including the surf beat generated as a result of breaking of waves on the coral reefs. The figures for the design waves in the two sites are shown in Table 2.3.6-3.

Table 2.3.6-3 Dimension of Design Wave

		Parham	Urlings
Design Deep Water Wave	Height (H_0)	9.98m	9.50m
	Period (T)	11.3s	10.9s
Bay Generated Waves	Height (H_w)	0.87m	——
	Period (T_w)	2.53s	——
Design Wave (in front of Facility)	Height (H)	0.94m	1.10m
	Period (T)	2.79s	10.9s

3) External Force

Surcharge:	1.0 tf/m^3 (normal condition),
	0.5 tf/m^3 (earthquake condition)
Berthing speed of fishing boats:	0.5 m/s
Seismic factor:	0.15

4) Specific Gravity of Construction Materials

Reinforced concrete:	2.45 t/m^3 in air, 1.42 t/m^3 in water
Plain concrete:	2.30 t/m^3 in air, 1.27 t/m^3 in water
Rock:	2.60 t/m^3 in air, 1.57 t/m^3 in water
Filling material:	1.80 t/m^3 in air, 1.00 t/m^3 in water
Seawater:	1.03 t/m^3

(2) Wharf

1) Parham Site

a) Structural Type of Wharf

The sub-soil condition at Parham consists of a distribution of a soft layer with an N value of 0 that consists of clayey and silty stratums that include humus, a layer of better-quality clay below that and bedrock below that. The bedrock distributes between D.L. - 4.0 m and D.L. - 7.0 m.

The possible types of wharf structure are the steel sheet piling type and the gravity type of concrete block. As a result of a design comparison of the ordinary steel sheet pile type and the concrete block gravity type on the basis of the premise of ground foundation improvement by replacement of the weak soil layer, it has been determined that the steel sheet piling type is more advantageous than the gravity type in terms of ease of execution and construction cost since its affords structural stability without having to improve the good-quality clay layer above the bedrock. That being the case, the type of wharf structure that will be adopted is the steel sheet pile type.

Regarding improvement of the soft soil layers at the position of construction of the wharf, the replacement construction method in which the soft soil ground layers below the foundation of the wharf will be replaced with good-quality substitution materials will be adopted considering various factors, including ease of execution at the site and reliability. As for the extent of

ground improvement, on the basis of stability calculation of the wharf structure it will be kept within what is minimally necessary to prevent occurrence of circular sliding failure of the ground.

b) Crown Height of Retaining Wall behind Wharf Apron

Since storm surge occurs in Parham Bay at the time of hurricanes, there is possibility of inundation of the wharf and the apron in case of simultaneous occurrence of high tide and such storm surge. Therefore there will be raising of the ground level of the facilities behind the wharf apron and installation of a retaining wall at the boundary between the facilities area and the wharf apron so that those facilities will not be affected by the waves under the high tide condition.

Considering the location of fishing port facilities behind the retaining wall, its height will be set on the basis of the quantity of wave overtopping. The allowable quantity of wave overtopping (q), indicated in Table 2.3.6-4, is 0.01 $m^3/m/s$, as based on the fishing port standard. Furthermore, on the basis of the results of the survey of natural condition, the design waves and design tide level for the water basin in front of the wharf are set as indicated below. The situation of the wharf and the retaining wall at the time of occurrence of storm surge is indicated in Figure 2.3.6-1.

Design waves:

Wave height (H') = 0.94 m, cycle (T) = 2.79 s

Design tide level:

H.W.L. + high tide deviation

= D.L. + 0.4 m + 0.99 m = D.L. + 1.4 m

Table 2.3.6-4 Allowable Overtopping for Hinter Area

Condition	Allowable Overtopping (q) ($m^3/m/s$)
Very Important Area:Exist of Important Public Facilitis or Residential Area	Approx. 0.01 (Equivalent to one bucket of water)
Important Area	0.02
Other Area	0.02～0.06

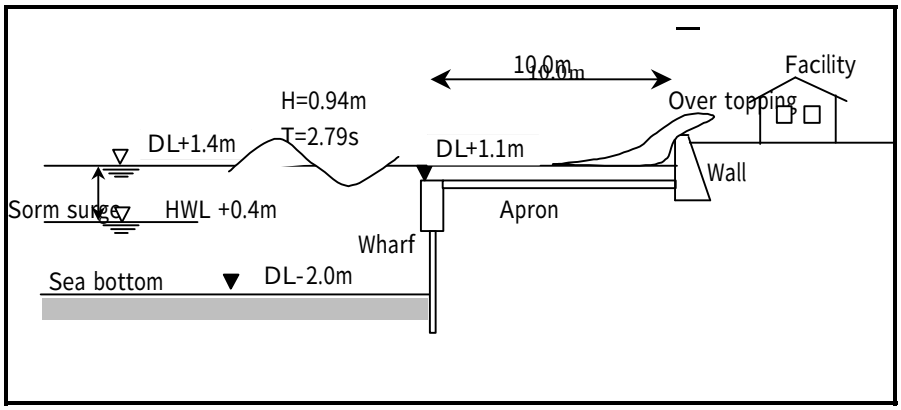


Figure 2.3.6-1 Overtopping Situation during Sotrm Surge

Since the retaining wall will be located behind the wharf apron with a width of 10 m, the apron will attenuate the waves that come over the wharf. That attenuation factor can be set as a function of wave height and the distance between the retaining wall and the wharf front and it becomes approximately 0.5. Therefore the required crown height will be obtained on the basis of a allowable quantity of wave overtopping of 0.02 $m^3/m/s$ (0.01 $m^3/m/s$ divided by 0.5).

With a quantity of 0.02 m^3 /m/s of wave overtopping, the ratio of crown height to wave height (hc/H') is obtained as follows, and the required crown height of the retaining wall is D.L. + 2.01 m. In order to give some allowance to the design crown height of the retaining wall it will be set at D.L. + 2.20 m in view of the fact that the results of the calculations are very disperse and that the fluctuation is considered to be between 0.4 and 2.0 times against the true value.

Ratio of crown height to wave height (hc/H') = 0.65
Required height of retaining wall
= Design tide level + required crown height (hc) + allowance
= D.L. + 1.4 m + 0.65 × 0.94 + 0.19 = D.L. + 2.20 m

From the above, it is considered that there will be protection by the retaining wall against the waves overtopping from the wharf apron and reach the facility area. Therefore, the ground height of the facilities area will be D.L.+2.0m.

2) Urlings Site

a) Structural Type of Wharf

Regarding the sub-soil conditions of the Urlings site, there is inclusion of soft soil layers at the basin in the central part of the site, but the wharf is located with comparatively good sub-soil conditions around it. The wharf structure at Urlings could be of the steel sheet pile type or of the gravity type using concrete block. From the results of comparison of those two designs, the steel sheet pile type is most suitable for the sub-soil conditions and construction work conditions at Urlings, and it also makes for lower construction cost. That being the case, the steel sheet pile type will be adopted as the Urlings wharf structure.

Furthermore, from the soil conditions along the wharf alignment, there is an area with distribution of soft soil layers. Regarding the wharf structure for that area, the soft soil layers will be replaced with good-quality material and the steel sheet piles will be shortened for prevention of subsidence of the apron portion by that replacement.

b) Crown Height of Wharf Apron

Figure 2.3.6-2 shows the wave height distribution inside the port basin at the time of intrusion of the design waves. As it can be seen from that figure, the wave height in front of the east side and south side wharf is under 20 cm, meaning a very clam wave condition inside the port. But the wharf crown height is D.L. + 1.1 m, and the water level will be D.L. + 1.06 m in case of simultaneous occurrence of the high tide (H.W.L.: D.L. + 0.4 m) and storm surge (deviation: + 0.66 m). Therefore there is possibility of intrusion of waves onto the apron. However, in view of the fact that the wave height in front of the wharf is under 20 cm and the fact that the height on the facilities site side of the apron is D.L. + 1.4 m with consideration of 3% slope for water on apron part. There is not expected to be any influencing of the facilities there by that, and it should not be a problem.

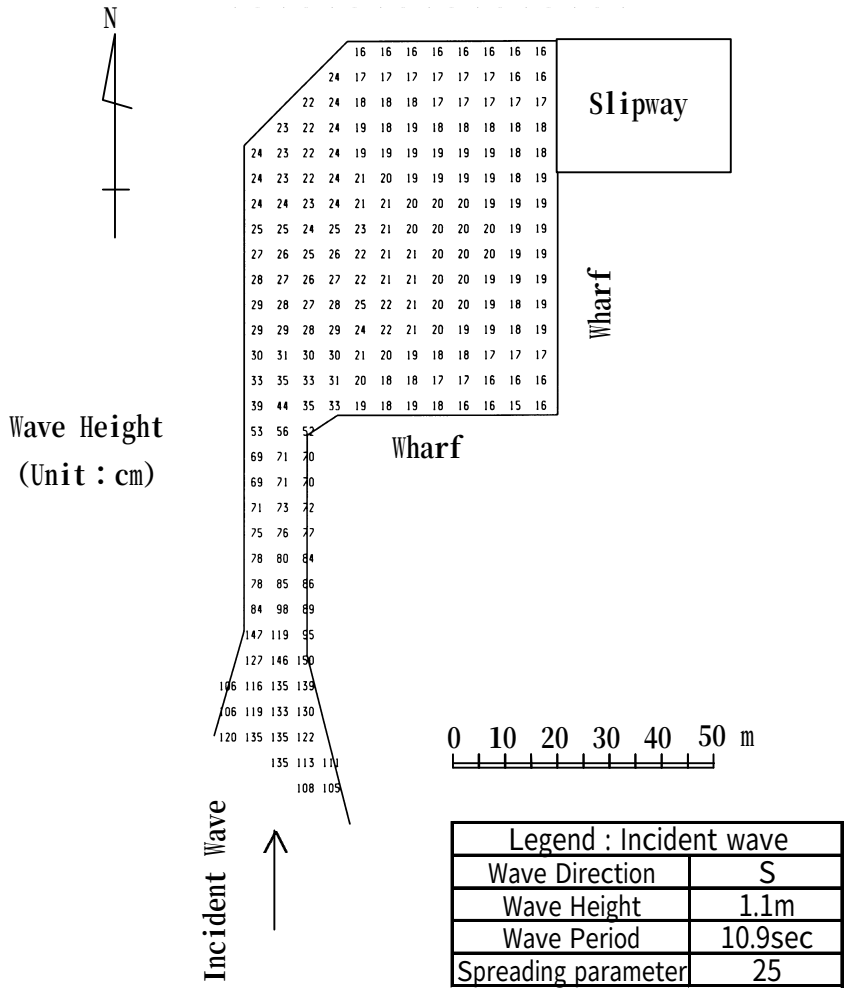


Figure 2.3.6-2 Wave Height Distribution at Action of Design Wave

(3) Slipway

1) Parham Site

A slipway slope of 1:6 to 1:10 is generally is applied to be desirable. Considering the fact that there is to be manual docking and undocking works of fishing boats in this project, it is desirable for the slipway slope to be as gentle as possible, but it will have to be 1:8 because of the space restrictions of the slipway.

The crown height of the slipway is set on the basis of the run-up height of waves since waves will act directly on the slipway. Run-up height of waves on the slope (R) is obtained by the method introduced by the design standard of

fishing port. It is calculated with the tide level conditions obtained by adding the storm surge deviation to the design high tide level (H.W.L.) and with the design waves (H = 0.94 m, T = 2.79 sec) as the wave conditions.

The result is a ratio of the run-up height of waves and the wave height (R/H) of 0.506, the run-up height of waves at the slipway and the crown height of the slipway being calculated as follows:

Wave run-up height (R) = 0.506 × 0.94 = 0.48 m
Crown height of slipway
= Wave run-up height (R) + design tide level (H.W.L) + storm surge deviation + allowance
= D.L. + 0.48 m + 0.40 m + 0.99 m + 0.13 m
= D.L. + 2.00 m

From the above we get slipway crown height of D.L. + 2.00 m, the ground elevation in the area of the on-land facilities and the crown height of the slipway end being the same so as not to have any inconvenience in functional aspect.

As for the structural type of the slipway, since it is situated where there are soft soil layers as in the case of the wharf, there is to be implementation of soil improvement by the replacement method at the parts requiring it so as to avoid possible subsidence in the future.

2) Urlings Site

At the Urlings fishing port the crown height of the slipway will be D.L. + 2.00 m considering, in terms of use, the existing ground elevation of the surroundings area and the ground elevation of the on-land facilities. Furthermore, the slope of the slipway part will be the same as for Parham, i.e. 1:8, because of the space restrictions concerning the slipway.

(4) Revetment

1) Parham Site

Transitional part of revetment will be installed between the wharf and Jordan Jetty. The transitional part of revetment will be rubble-mound sloped revetment. The front slope of the revetment will be 1:2.

The required weight of armor rock of the revetment is calculated by the

Hudson's Formula. The result is 87 kg per piece of rock with a design wave height (H) of 0.94 m at the position of installation of the structure. That being the case, armor stone with a piece weight of about 100 kg will be used.

$$W = \frac{\rho_r \rho_0^3 H^3}{K_D (\rho_r - \rho_w)^3 \cot\theta}$$

$$= \frac{2.6 \times 1.03^3 \times 0.94^3}{3.5 \times (2.6 - 1.03)^3 \times 2} = 0.087 \text{ t}$$

Where:

- W : minimum weight of the armor stone (t/pc)
- ρ_r : density of the armor stone (2.6 t/m^3)
- ρ_w : density of the seawater (1.03 t/m^3)
- θ : angle of the slope with horizontal (cot θ = 2)
- H : design wave height (m)
- K_D : stability coefficient of armor stone (K_D = 3.5)

2) Urlings Site

From the layout plan of the Urlings site it can be seen that the existing ground elevation in the front of the facilities area facing on the seashore is D.L. + 1.0 m to D.L. + 1.7 m, and since intrusion of waves into the facilities area is possible in case of action of design waves, revetment for protection of the facilities from waves will be installed on the front side of that area.

The crown height of the revetment is set on the basis of the wave conditions and tide level conditions indicated below and the allowable quantity of wave overtopping. The allowable rate of wave over topping (q) is set as 0.01 m^3/m/s from among the standards for fishing ports indicated in Table 2.3.6-5 since public facilities will be located behind the shore protection.

Furthermore, although the existing ground elevation is D.L. +1.0 m in front of the shore protection, it is taken as D.L. +0.5 m because of the possible beach erosion, the amount of such deformation in ground elevation being estimated at 0.5 m. The schematic view of the revetment during the design wave condition is indicated in Figure 2.3.6-3.

Design waves: Wave height (Ho') = 1.1 m
Period (T) = 10.9 s
Design tide level: H.W.L.+ Storm Surge
= D.L. + 0.4 m + 0.66 m = D.L. + 1.1 m

Water depth in front of revetment (h)

= Design tide level - (ground elevation - ground height change)

= D.L. + 1.1 m - (D.L. + 1.0 m - 0.5 m) = 0.6 m

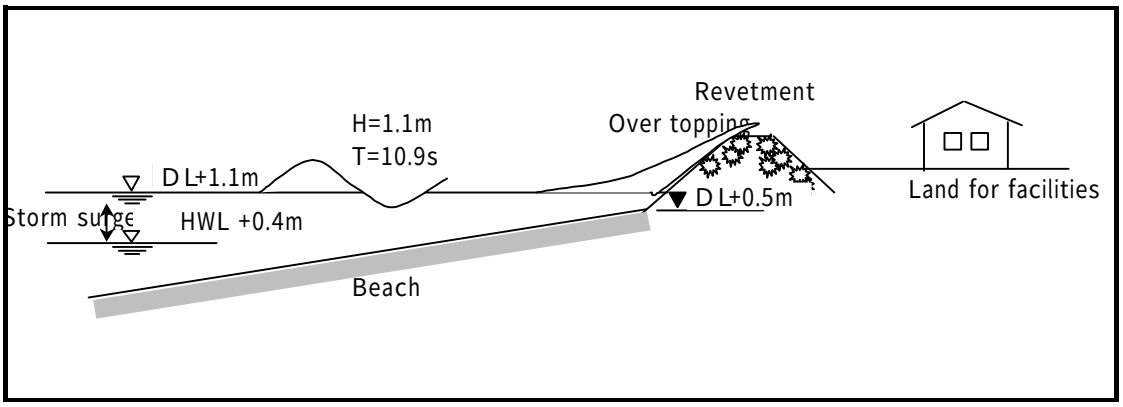


Figure 2.3.6-3 Wave Overtopping Situation

If, the allowable overtopping rate is set as 0.01 $m^3/m/s$, the ratio of the shore protection crown height to the wave height (hc/H') is as follows, and the required crown height of the revetment is D.L. + 1.76 m. Since there is considered to be fluctuation of the calculated overtopping rate equivalent to 0.4 to 2 times of the true value, some allowance will be given to the design crown height of the revetment by setting it at D.L. + 2.00 m.

Ratio of crown height of revetment to wave height (hc/H') = 0.60

Design crown height of revetment

= Design tide level + calculated crown height (hc) + allowance

= D.L. + 1.1 m + 0.60 × 1.10 + 0.24 = D.L. + 2.00 m

Furthermore, since the on-land facilities area behind the revetment will be protected by the shore protection from intrusion of waves, its level will be set a little lower than otherwise at D.L. + 1.50 m on the basis of the planned crown height of D.L. + 1.10 m for the wharf from the aspect of ease of use.

The structural type of the revetment will be the rubble-mound sloped type, and the front slope will be 1 : 2.

The required weight of the pieces of armor stone of the revetment is calculated by the Hudson's formula. The value of 140 kg/piece is obtained with a design wave height (H) of 1.10 m at the position of installation of the structure. But since there are corner parts in the case of this revetment, the

required weight will be set higher than that. The weight of armor stone (W') is therefore set at 1.5 times the required weight (W), meaning use of stone with a weight per piece of about 200 kg.

$$W = \frac{2.6 \times 1.03^3 \times 1.1^3}{3.5 \times (2.6-1.03)^3 \times 2} = 0.14\ t$$

$$W' = 1.5W = 1.5 \times 0.14 = 0.21\ t = 210kg$$

(5) Wharf Auxiliary Facilities

1) Fender

For selection of the fender its energy absorption is calculated on the basis of 5 GT of fishing boats with a berthing speed of 0.5 m/s. The fender piece height obtained is 130 mm. Its length will be 1,000 mm in view of the wharf's crown height D.L. + 1.10 m and the mean low tide level D.L. + 0.10 m.

Therefore the specification used for the pieces of fender will be the 130 (H) ×1,000 (L), the fishing port type.

As for the interval between pieces of fender, it is usually taken as 1/6 of the maximum boat length. Since the maximum boat length at the two new fishing ports will be 10.7 m, the interval is set at 2.0 m.

2) Bit

At both new fishing ports the mooring bit will be the straight type. They will be selected on the basis of 5 GT for the fishing boats and the tensile force of those boats.

A basic interval of 5.0 m, corresponding to a wharf water depth of less than -3m, from the fishing port technical standards indicated in Table 2.3.6-5 will be taken as the installation interval of the mooring bits.

Table 2.3.6-5 Interval Length of Mooring Post

Depth of Wharf	Interval Length
−3.0m<	5.0m
−3.0m≦Depth<−5.0m	7.5m
−5.0m≦Depth	10.0m

2.3.7 Basic Design of Functional Facilities

(1) Layout Plan of Functional Facilities

Since at both sites the areas for the functional (architectural) facilities are deformed and also not sufficiently spacious, the facilities will be located in separate buildings according to their functional requirements: a Main Facility Building, a fish retail shop building, a workshop building and two fishing gear locker buildings.

The main facilities building will place the ice-making plant, ice storage and cold storage facilities, the administration office, the meeting room, the toilet/shower facilities, etc. It will be located at a position near the entrance to the site where it will form the core of lines of movement concerning all of the facilities of the site. Since it places the ice-making plant, ice storage and cold storage facilities, it has to be placed near the wharf. Furthermore, in cases of difference in adjacent ground levels in the facility area, there will have to be slopes or other means of easy conveyance of ice and fish handling.

The fish retail shop will be located near the entrance to the facilities at a position that has easy access to the ice-making plant, ice storage and cold storage facilities.

The workshop building will be located at a position near the slipway and boat yard so that it can also be used for the purpose of maintenance of docked fishing boats.

In order to reduce the daily work loads on the fishermen the fishing gear locker room building for FRP boats will be located near the wharf, and that for wooden boats near the slipway.

The buildings will be placed so that the open space among them can be used as an outdoor yard for repair of fish pots and fishing nets. In the case of Parham, that yard will be between the two fishing gear locker room buildings, and at Urlings it will be the space surrounded by the workshop building, the main facility building and the fish retail shop building.

The layout plan of functional facilities will be such as to enable access to all of the buildings by vehicles and to have a main parking area. The main parking area will be near both entrances and surrounded by the main facility building, the fish retail shop building and the fishing gear locker building(s) at both Parham and Urlings.

(2) Main Facility Building

1) Ice-making plant, Ice Storage and Cold Storage Room

a) Design Concept

This part of the building, placing the ice-making plant, ice storage and cold storage facilities, will be planned for convenience of use thereof. Furthermore, a part of it will be used as a machinery corner for the maintenance purposes of the facility as a whole where electrical distribution panels, a standby generator set, the water supply main valves, etc. will be located. Facility management convenience will be ensured by securing lines of movement connecting with the administration office.

b) Required Space

Calculation of the scale of the ice-making plant, ice storage, cold storage facilities and standby generator set installed in this part of the building is indicated later in the section on equipment and machinery.

c) Room Layout

Here will be installation of the ice-making plant, ice storage and cold storage facilities, space for the work of taking ice out and the work of putting fish in the cold storage facility and taking fish out of it and a machinery corner for facility control and operation.

The workspace in front of the ice storage facility and cold storage facility will be secured indoors for protection from the sun rays, wind and rain. The workspace is to have a large entrance/exit opening for facility of taking ice out to the wharf and bringing fish in from the handling area of the fish retail shop. The floor of the workspace will be raised about 15 cm above the other parts so that in and out work to and from the ice storage facility and cold storage facility will be easier.

The space behind the ice storage facility and cold storage facility will serve as the machinery corner, through which there will be access to the administration office. In it will be installed a standby generator for emergency use, electrical panels and gate valves for water supply to each building.

The accessory equipment for the ice-making plant, ice storage and cold storage facilities will be placed behind the shed on steel frames for effective use of space.

For facility management a manually operated shutter will be installed at the opening for workspace entry/exit. Its slat thickness must be sufficient for safety even when hurricanes attack. In the walls of that part there will be appropriate installation of hollow blocks for discharge of the waste heat from the air-cooled condensers of the ice-making plant, ice storage and cold storage facilities even at night. On the other hand, the walls of the machinery corner are to be concrete block walls so as to prevent entry of rainwater, and they are to have aluminum sash windows for natural lighting.

The exhaust funs for air from the shed are to be installed on the roof.

2) Administration Office

a) Design Concept

It is necessary for the administration office to be placed at the center of the various lines of movement between the different functional facilities of the project and to serve the purpose of smooth operation, maintenance and control of the facilities. Particular attention is to be given regarding the management lines of movement of the ice-making facility, the cold storage facility and the fuel and water supply facilities.

Furthermore, it is necessary to take special care in planning of apertures of the building so as to be able to easily monitor from the administration office the situations at the wharf and slipway, the workshop, the fish retail shop, etc.

b) Required Space

All of the facilities provided in the present project are, as already mentioned, scheduled to be managed by Antigua Fisheries Limited (AFL). For the time being, our plans call for assignment of a manager, a person in charge of administration (including accounting and general officer) and a person in charge of taking care of ice making facility and cold storage facility.

Since the administration office will be small scale, it will be of the collective type without partitioning off of individual rooms. The respective floor spaces set for those three persons will be as follows:

* Space for the manager: about 10-15 m^2
* Space for the person in charge of administrating and the person in charge of operation: about 15 m^2 (total for both)

* Space for information materials of the fishing gear, parts and bait sales outlet and for the person employed temporarily for that purpose (described hereinafter) and space for temporarily employed cleaning and other similar personnel: about 10-15 m^2 (total)
(The above spaces include the space needed for keeping management documents and materials, etc.)

There will also be a reception counter for visitors. A front-to-back distance of 2 m, including 0.5 m for the counter itself, will be reserved for that purpose.

c) Room Layout

The administration office will be provided with office work space for the facility management personnel, a corner for small meeting with people from outside the office, a small corner for supply of hot water for coffee, tea, etc. and washing up utensils and a reception counter for sales of ice, fuel, water and fishing gear, parts and bait.

The reception counter will be provided on the side facing the wharf for easy access by users.

There will be a large opening in the wall to make it possible to have a view of all of the important parts of the facilities of the fishing port from the administration office. Besides the entrance/exit for the reception counter, there will be entrances/exits for securing management lines of movement regarding the machinery corner of the ice-making, ice storage and cold storage facility rooms, the fishing gear, parts and bait storeroom building, the general storeroom and the fish retail shop.

The hot water corner will be simple, with only a small stainless steel sink and out-let for electric range.

3) Fishing Gear (Bait) Shop

a) Design Concept

It is not possible to provide all of the fishing gear, repair parts, etc. needed by the fishing boats at the sales space for those items in this facility. For instance, as can be seen from the nature of the workshop in this facility described later on, it would be senseless to try to make available at this facility engine repair parts over and above those needed for routine maintenance and

simple repairs.

Those always available at this facility will be limited to those needed to meet everyday demand and emergency demand.

b) Required Space

In planning the St. John's Fishery Complex in the 1997 project it was considered that by concentrating the fishing gear, parts, etc. that were kept at different facilities up to then in a single warehouse and by rationalizing the method of keeping them available by installation of the necessary shelf space, it would be possible to meet the demand of all of the fishing boats of the island. In the visual observation undertaken during the basic design survey it was considered that everything necessary in the fishing gear and parts sales space planned in that way was to be easily found on its shelves and that no stock deficiencies would occur.

That means that, except for everyday or emergency demand in local, the fishing gear and parts sales space (warehouse) in the capital at the St. John's Fishery Complex ought to be able to meet the demand of all of the fishing boats of the entire island. The main part of that sales outlet has a floor space of 144 m^2, and the entire figure, including the nearby joint-use warehouse, comes to 174 m^2.

If, as mentioned above, that floor space corresponds to the 460 fishing boats of the island, since the numbers of fishing boats covered by the new fishing ports at Parham and Urlings are 49 and 43, the necessary floor spaces for meeting all of their respective demands for fishing gear and parts would be, respectively, 15.3 m^2 (or 18.5 m^2) and 13.5 m^2 (or 16.3 m^2).

Since this facility is only for the purpose of meeting everyday and emergency demand, its floor space is set at about 10 m^2 as requested, and it will be provided with fixed shelves in the same way as the fishing gear and parts sales space (warehouse) of the St. John's Fishery Complex.

c) Shop Layout

The reception counter of the administration office will also serve the purpose of the reception counter for the fishing gear and parts sales space. That being the case, the fishing gear and parts storeroom will be located contiguous to the counter space of the office. In the storeroom three tiers of display shelves with a front-to-back distance of about 60 cm will provided on

both sides of the corridor.

4) Storage Room

a) Design Concept

The request regarding storage room space by the Government of Antigua and Barbuda in this project is only 10 m^2. Considering the size of the facility as a whole and the planned main facility building, it is considered to be appropriate to strive for simplification of management by concentrating the storeroom space in one place next to the administration office.

b) Required Space

Since a total space of about 20 m^2 will be provided including the requested fishing gear and parts sales space, it will be a storage room for diverse facility management and control.

c) Room Layout

The storage room will be provided as an accessory to the administration office. In the storage room will be kept the several management document materials and those needed for functioning of the meeting room as well as the basic tools lent out for use in the workshop (to be procured by the Antigua and Barbuda side) and other articles.

Therefore besides its entrance/exit with respect to the administration office, it will be provided with entrances/exits with respect to the meeting room and outside the building.

5) Meeting Room

a) Design Concept

This is a place for guidance by the Fisheries Department for furthering and improvement of fisheries, fishing ground environmental protection and other enlightenment activities and seminars and exchanges between fishermen. It will therefore be a place partitioned off by walls or other means so as to provide a pleasant environment for meeting activities, shutting out the noise of the various activities within the fishing port facilities. However, in view of the fact that fishermen are only starting to become aware of the

necessity for such exchanges, appropriate apertures will be provided in order to make the activities inside more open to the outside for better awareness of and accessibility to them.

b) Required Space

The number of fishing boat owners is 49 at Parham and 43 at Urlings. Assuming the number of fishermen, including the fishing boat owners, to be 2.0～2.5 times that number, it will be about 100～120 at Parham and about 90 ～100 at Urlings.

In the case of meetings in the form of lecturer and audience or course participants approximately 1.2 ～ 1.5m^2 of space per person is needed. Therefore, assuming that approximately 80% of all of those participate in the meetings, about 45～60 m^2 at Parham and about 40～50 m^2 at Urlings will be needed for meetings of fishing boat owners.

In the case of round-table seminar type meetings the space requirement is about double that indicated above (i.e. about 2.5 m^2 per person), which means that a meeting room with about 50 m^2 of space can accommodate some 20～25 persons in such meetings

In this project in view of the fact that the Government of Antigua and Barbuda has requested a space of approximately 50 m^2, the size of this facility at both of the project sites will be set at that figure, a meeting facility capable of holding not all of the fishermen but being included only in the content of the project. With that size the facility at each of the project sites will be able to accommodate a little under 40 persons in the case of meetings of the lecture type and a little over 20 persons in the case of meetings of the seminar type.

Since the Government of Antigua and Barbuda is strongly desirous of using this facility as a place for education and enlightenment activities, permanent blackboards will be furnished. However, in the spirit of Japanese Government grant aid tables, chairs and the like will not be included in the present project.

c) Room Layout

The meeting room will be provided with an accessory joint-use storeroom as a place for storing furniture and fixtures. Comparatively large aluminum sash windows will be provided in the wall of the meeting room to make it open to the outside and to provide good ventilation.

6) Toilet and Shower Room

a) Design Concept

The persons to be covered by the toilets in this facility are the fishermen of the fishing boats covered by the project, the personnel of the fish retail shop and the personnel the administration office. Community residents visiting the fish retail shop will not be taken into account in determination of the scale of such equipment.

Since only the personnel of the administration office will be using this facility all day, it will be located inside the Main Facility Building, where the administration office is located, for convenience of use thereof by them and ease of maintenance and management of the facility. Both a men's room and a ladies' room will be provided considering the fact that the personnel of the fish retail shop and the administration office can be expected to include women.

A shower room will be provided for the fishermen of the fishing boats covered by the project, and it will be located contiguous to the toilet rooms for convenience of joint control thereof.

b) Required Space

For determination of the number of toilet bowls and urinals needed, the number of fishermen that will be making use of them is calculated by multiplying the number of fishing boats by the average crew size (2.5 persons), the number of fishing boats being taken as the number of fishing boats that go out for fishing and return to port on Mondays or Fridays, when the number is greatest.

The number of sales personnel of the fish retail shop is taken as the number of sales booths, and the number of personnel of the administration office is calculated as the number of regular personnel planned by the AFL plus one temporary employee.

It has been assumed that fishermen and the sales personnel of the fish retail shop making use of this facility make use of it only a half a day and that their use of it is evenly distributed over the whole day. In calculation of the number of personnel to be covered by the facility, only the personnel of the administration office have been considered to make use of the facility the whole day.

Table 2.3.7-1 shows the required number of toilet bowls and urinals at Parham and at Urlings as based on those numbers of persons for which they are meant. The planned numbers for Parham are 2 toilet bowls and 1 urinal in the men's room and 1 toilet bowls in the ladies' room, plus 1. The planned numbers for Urlings are the same.

Table 2.3.7-1 Required Number of Toilet Bowls and Urinals

	Number of Fishermen	Number of Bender	Administration office Stuff	Design Number	Required Bowls and Urinals
Parham	100	5	4	56.5	3.5
Urlings	87.5	5	4	50.3	3.1

For the relationship in the table above between the number of persons covered and the number of toilet bowls and urinals the item "Public Toilets" in the JIS table of number of persons covered by facilities was used (i.e. a total number of one toilet bowl/urinal for every 16 persons covered).

The number of showers is set limiting those making use of them to the fishermen. Use of the shower facilities is expected to be chargeable. Therefore it is estimated that the number of those qualified to make use of the showers will be a half. Assuming also that they make use of them after their work is finished after returning to port, it should be considered that the length of time of use thereof will be only as long as the time of use of the catch landing wharf. Assuming an average time in the shower of 10 minutes, the estimated cycle time of one shower booth is six times an hour.

Since the calculated figures for the number of required shower booths are $100/2/(3\times6) = 2.8$ booths at Parham and $87.5/2/(3\times6) = 2.4$ booths at Urlings, three shower booths will be installed at each project site.

c) Room Layout

The main users of these facilities will be fishermen, almost all of who are men. Therefore only a men's shower room will be provided. Besides the men's toilet, a ladies' room with a separate entrance will be provided for the women working in the administration office and at the fish retail shop. There will be a common entrance for the men's toilet room and the shower room, and clothes changing shelves will be provided in a corner of the shower room.

The toilet room will also be provided with a wash bowl counter.

Mirrors and other fixtures will not be installed because of difficulty of managing them. Besides the entrance/exit there will be a small aluminum sash window of the raised and lowered type for natural lighting.

(3) Fish Retail Shop

1) Design Concept

This facility consists of a yard for handling the fish catch landed from the fishing boats according to place of delivery and a fish retail shop facility for community residents. Since there will be visitors to this facility from outside the fishing port, it will be located for easy access from the fishing port entrance.

Its location will also be such as to minimize crossing of the movement lines of the work activities of fishermen who will be the main users of the facility as a whole. Particular attention will be given to avoiding crossing of the movement line for taking the fish from the fish handling yard to the cold storage.

Furthermore, since it is a place handling fresh fish, the direction that its apertures face and their shading will be planned in such a way as to keep out the rays of the sun in the early morning and in the late afternoon.

2) Required Space of Fish Handling Area

Table 2.3.7-2 indicates the daily landed catch as calculated from the estimated annual catch.

Table 2.3.7-2 Daily Fish Catch Landing

	Annual Fish Landing	Weekly Fish Landing	Monday & Friday	Wednesday	Others day
	48wks/yr	(a)	30% × (a)	20% × (a)	5% × (a)
Parham	252 t	5.25 t	1,575kg	1,050kg	262.5kg
Urlings	221 t	4.60 t	1,380kg	920kg	230kg

The figures given in the above table are the annual averages, and as such they do not take into account fluctuation between best fishing period, the ordinary fishing period and the off-season. In this study the seasonal trends regarding fish catches were not determined, but according to the Basic Design Study Report of the 1997 St. John's Municipal Fish Landing and Market Complex Construction Project the percentage differences regarding the

monthly annual mean catch volumes between the seasons are 144.8% in the best fishing season, 120.5% in the ordinary season and 58.1% in the off-season.

From the findings of the local interview survey and what we saw ourselves it is clear that it is customary in Antigua and Barbuda to go out for fishing on Mondays, Wednesdays and Fridays. The fishing boats that operate only twice a week go out on Mondays and Fridays. However, for weather and other reasons the fishing boats sometimes go out to sea the next day instead, but in this calculation it is assumed that the percentages regarding going out to sea are those given in the table.

According to Table 2.3.3-10 above concerning the annual number of fishing operation days determined in the interviews, the present scheduled average number of days on which the fishing boats go out to sea is 2.7 days a week, but it is estimated that the actual number of days a week is 2.15 because of weather and other circumstances. That being the case, the actual number of days on which the fishing boats go out to sea is considered to be more than the figures estimated in the table above. (The daily average landed catch based on the assumption that all of the fishing boats go out to sea on 103 days of the 48-week operation period is 2,450 kg for Parham and 2,150 kg for Urlings, and in the case of the assumption that all of the fishing boats go out to sea on any 288 days during that 48-week period (6 days a week, 48 weeks a year) the figures are 875 kg/day for Parham and 767 kg/day for Urlings.

Assuming that all of the catches consist of approximately 0.75 lb/fish red snappers or snappers for conversation purposes, one obtains the figures 33 fish = 11 kg = 1 m^3. (At the time of planning of the St. John's Fishery Complex the figure was 12 kg/m^3.)

The required fish handling space for the Parham and Urlings fishing ports are given in Table 2.3.7-3. They are approximately 48 m^2 for Parham and approximately 42 m^2 for Urlings.

Table 2.3.7-3 Calculation of Fish Handling Space

	Landing Amount Mon. & Fri.	Landed Volume One box per cycle	Required Space (Working Space included)
			Two times of fish display space
Parham	1,575kg	262.5kg	47.7 m^2
Urlings	1,380kg	230.0kg	41.8 m^2

※Required space is calculated having same area of corridor and working space as the spaceof fresh fish display.

3) Required Space of Fish Retail Shop

The volume of fish catches delivered to the different destinations as based on the interviews with fishermen has already been given in the section on design conditions. The percentage of the fish catches distributed in the local areas, including hotels and restaurants, is 66% for Parham and 20% for Urlings.

As mentioned above, there is considerable difference between the two project areas as regards fishery environment. That is to say, on the one hand there are many fishermen that reside in the inland part of Antigua Island who use the landing points of the Parham area, whereas almost all of the fishermen in the Urlings area live in that same area. In that connection, the above-mentioned big difference between the two areas as regards places of distribution of the catch can be considered to be the result of the fact that many of the fishermen residing inland who land their catches in the Parham area have the communities in which they live as the place of distribution of their catches.

Table 2.3.7-4(1) Population in the Vicinity Area of Parham

	Number of	Average Persons	Population
Parham	369	3.2	1,181
Fitches Creek	60	3.4	204
Pares	133	3.5	465
Sub-total	562		1,850
Freemans Village	176	3.2	563
All Saints	679	3.6	2,444
See View Farm	368	3.2	1,178
Buckleys	130	3.5	455
Piggots	370	3.2	1,184
Potters	657	3.2	2,102
Sub-Total	2,380		7,926
Total	2,942		9,776

(estimated from 1991 Sensus)

Table 2.3.7-4(2) Population in the Visinity Area of Urlings

	Number of	Average Persons	Population
Urlings	246	3.3	812
Old Road	289	3.6	1,040
Johnsons Point	76	3.0	228
Crabb Hill	61	3.0	183
Sub-total	672		2,263
Bolans	447	3.2	1,430
Jennings	274	3.2	877
Ebenezer	111	3.4	377
Sub-total	832		2,684
Total	1,504		4,947

(estimated from 1991 Sensus)

Furthermore, the above percentage breakdown of the places of distribution of fish catches obtained in the interviews was that for when the two main fishing ports to be provided in this project were not existed, so it can be expected that after provision of regular fresh fish retail space in this project there will be some decline in the percentage of the fish sold in the capital, St. John's, and rise in the percentage sold locally, i.e. at those two fishing ports.

Since, however, in the case of Parham the percentage sold locally is already a high 66%, it is not assumed that that figure will rise, and therefore the percentage of sales taking place locally is set at 65%. But for Urlings it is estimated that the local percentage will rise from the present low 20% to 40%.

Table 2.3.7-5 gives the figures for the calculated volumes of distribution to the capital and local distribution (including hotels and restaurants) as based on those estimates.

Table 2.3.7-5 Distribution Ratios and Destination of Fish Catch

	Weekly Fish Catch	For St. John's Area		For Local Area		Self Consumption
		Ratio	Amount	Ratio	Amount	
Parham	5,250kg	35%	1,873kg	65%	3,413kg	424kg
Urlings	4,604kg	60%	2,762kg	40%	1,842kg	372kg

※Self consumption of fisheman is estimated by 0.15kg/person/day (75% of 0.2kg/person). Average Fisherman's Crew members are 2.5 persons. Average Household size are 3.3 persons.

- Parham ：0.15×7×49×2.5×3.3＝424kg
- Urlings ：0.15×7×43×2.5×3.3＝372kg

Table 2.3.7-6 verifies the volumes of fish catch distribution to local areas indicated in the above table on the basis of the populations of the local areas.

Table 2.3.7-6 Estimated Fish Consumption in Parham and Urlings Area

	Population	Average Consumption per day	Estimated Ratio of Purchase	Average Consumption per day	Average Consumption per week
Parham	1,850× α	0.09kg	1.00	202.9kg	48%
Adjacent Area	7,926× α	0.09kg	0.25	217.3kg	52%
Total				420.2kg	2,941kg
Urlings	2,263× α	0.09kg	1.00	248.2kg	89%
Adjacent Area	2,684× α	0.09kg	0.10	29.4kg	11%
Total				277.6g	1,943kg

※ Population in 2000 is estimated 72,311 of 1.12851 times in 1991. Therefore, α=1.12851 is used for estimation of population of each area

※Annual average fish consumption is estimated 0.09kg/day/person from the total catch of 2,375tons.

※Ratio of purchase within the Area is estimated from the population living in the project sites and the adjacent area.

Comparing the two tables above, if one estimates for Parham a percentage of 65% for local delivery as per the findings of the interviews, the estimated volume of consumption is only about 50 kg/week in excess, i.e. just about the same. On the other hand, even assuming a rise in the percentage sold locally to 40% in the case of the Urlings area, there will be a shortage of a little over 470 kg of fish a week. That is a reflection of the fact that many of the residents of the Urlings area presently buy fresh fish in St. John's. If a fresh fish sales facility is established in the Urlings area, it can be expected that there will be more people buying fresh fish there, and therefore it can be said that the estimated percentages of the table of calculation of volumes of delivery to the different areas are appropriate as revisions of the findings of the interviews.

The required fresh fish sales space is calculated on the basis of the assumption that the distribution to areas nearby the respective project areas will be accomplished by the fishermen themselves and middlemen that are beginning to become established and that the volumes of fresh fish sold at the facilities for that purpose to be provided in the present project represent about

90% of the part distributed locally as indicated in the above table.

Therefore what we get is that in the case of Parham 43% of the volume distributed locally, with exclusion of the volume consumed by the fishermen themselves, will be sold at the fish retail shop at the new fishing port and that in the case of Urlings the figure for the same is 80%.

Table 2.3.7-7 Destination of Fish Catch per Day

	Fish Catch Landing Amount		Destination to Local and Suburbs (a)		Self-consumption (b)	Local Distribution (c)= (a) – (b)	Sold fish at retail shop
	Mon./Fri.	Tue./Sat.	Ratio	Volume	Volume	Volume	Volume
Parham	1,575kg	262.5kg	65%	597kg	74kg	523kg	225kg
Urlings	1,380kg	230.0kg	40%	322kg	65kg	257kg	206kg

Table 2.3.7-7 gives specifically the estimates of the distributions to the local areas on the days of return to port, which are concentrated on Mondays, Wednesdays and Fridays. The sales amounts at the facilities for that purpose at the new fishing ports are the averages for the two days Monday and the day after or Friday and the day after, Monday and Friday being the days with the biggest catches, obtained by multiplying by the above-mentioned percentages of sale, assuming that sales there take place everyday.

The sales facilities will be about the same as those of the public market of the St. John's Fishery Complex. There each booth consists of a fresh fish display counter with a length of about 1.5 m and a front-to-back distance of about 0.8 m and an accessory rectangular sink for primary processing measuring 0.8 m×0.6 m.

On the basis of the above-mentioned conversion to red snappers 11 kg of fresh fish can be displayed per square meter of counter. That gives a display capacity of about 12 kg per counter. Assuming 4 cycle times a day with keeping of the fresh fish in boxes containing ice with 0.5 - 1.0 times the weight of the fish, the vendors will be able to sell 48 kg (approximately 100 lbs) of fish a day.

Therefore, both Parham and Urlings will have five sales booths. For each booth a front length of 1.5 m and a front-to-back distance of 2.5 m are needed as space for placement of such a fish box, and the total space requirement will be a front length of 7.5 m and a front-to-back distance of 2.5 m. Another 1 - 1.5 m of space for customers will be provided in front of the display counters.

4) Shop Layout

At this facility five fresh fish display booths (display counter, sink and place for putting the fish box) will be installed on the land side, and the space on the wharf side will be left as floor space for fish handling.

This building will not have walls, but at both Parham and Urlings a screen block wall for blocking the rays of the sun and wind will be provided on the east side of the building.

(4) Workshop

1) Design Concept

This facility is planned as a place for daily routine maintenance and also for simple repairs, now being done by the fishermen themselves at their homes and elsewhere and repairs by engineers making their rounds of the area.

Therefore, it will be provided with worktables and engine hangers but not with an exclusive storage facility for tools and fixtures.

2) Required Space

In this project the engines of registered fishing boats with a length of less than 30 feet are considered to be outboard engines.

Besides repairs after returning to port, outboard engines need regular maintenance once a month. Assuming that such regular maintenance is undertaken on days without fishing operations (coming to 3.3 days a week or 13 days a month after subtraction of Sundays and the average weekly number of fishing operation days of 2.7), the number of engines a day that have to undergo regular maintenance can be calculated as follows:

* Parham : 43 outboard engines ／ 3.3 engines/day
* Urlings : 39 outboard engines ／ 3.0 engines/day

Adding to those figures the simple repairs that are needed, one obtains the figure of 4 engines a day to be handled at the workshop at both Parham and Urlings.

It is assumed that a length of 1.0 m is needed for the hanger of each engine as well as 1.25 m of workspace on each side of the hanger. With a work table measuring 2.0 m×1.0 m for each engine, the work space secured is 2.0 m, it being assumed, however, that the time required for regular maintenance or

repairs of each engine is a half a day. Therefore the workshops at both fishing ports will be provided with the following equipment:

* Work tables:	4.0 m (W)×1.0 m (L)
	with 2.0 m (L) of work space
*Engine hangers:	4.0 m (L) with 2.5 m of work space

This facility will be made as open as possible so as to make it possible to also flexibly attend to repairs of such fishing gears as fish pots that have to be taken home for repair besides its main purpose of regular maintenance and repair of outboard engines.

3) Shop Layout

This facility will be provided with worktable, engine hangers and engine test tank.

A concrete-block wall will be provided on the east side, the side from which the constant trade winds blow from east, for protection against wind and rain, but as far as possible walls will not be constructed so as to enhance the openness of the facility. The area including the open space on the north side of this facility at Parham and on the south side at Urlings will be used as an area for repairing not only outboard engines but also fishing gears, etc.

Steel rails will be hung for the chain block under the reinforced-concrete beams, and a lightweight chain block will be installed.

(5) Fishing Gear Locker

1) Design Concept

This facility is only for use by fishermen. Therefore rational linkage of movement lines between it and the wharf, the slipway, the boat yard, etc. will be secured in the layout plan.

Furthermore, since sometimes it will be necessary for the fishermen to take home fishing gear and ice remaining in the fish boxes from this locker facility, access from outside by vehicle must be possible.

In this locker room facility for fishermen will be placed such things as outboard engines, fish boxes, fish pot repair materials (wire mesh, re-bar and wooden rods as well as branches), fishing nets, polyethylene fuel tanks, drinking water tanks, etc. It will be planned for rational accommodation

capacity through effective layout of engine hangers, fixed shelves, etc.

2) Required Space

It is clear that there is great difference in such things as volume of catch, quantity of fishing gear owned, fishing methods, etc. depending on the size of the fishing boats. Therefore in this project there will be provision of two separate fishing gear storage units-one for medium size boats and one for small boats.

According to the interview survey, the medium size boats have several similar fish boxes (approx. 3ft×4ft×3ft (H)), but the small boats usually have only one box. The result of the interview is regarded as correct since their fixed box can store fresh fish of maximum 75 to 100kg based on the ratio 1 : 1.1 for fish and ice respectively.

Representative fishing gear fixtures to be accommodated respectively in those two units are fish boxes and engine hangers for outboard engines. Since there are similar sizes of fish boxes in Antigua and Barbuda, it is desirable in the case of the unit for small boats for them to be stored on one side of a two-side opening door or a double-sliding door. In the case of the unit for medium-size boats, for the sake of putting in and taking out 2 fish boxes and engine hangers, respectively, it is necessary to have a combination of a triple-sliding door or a double-sliding door with a single-sliding door. The longer side of the fish boxes should be arranged in the direction from front to back in order to make such doors as small as possible. An engine hanger with a length of at least about 1.0 m is to be installed in the door part for accommodation of outboard engines. The remaining fishing gear will be rationally accommodated in the space between the fish boxes and the engine hangers on fixed shelves above them.

The small boat and medium size boat units will be respectively as follows:

Small size boat unit:

* Front length direction : approx. 2.4 m
* Direction from front to back : approx. 1.5 m
* Floor space of 1 unit : 2.4m×1.5m =3.6m^2

Medium size boat unit:

* Front length direction : approximately 3.6 m

* Direction from front to back : approximately 1.5 m
* Floor space of 1 unit : 3.6 m × 1.5 m = 5.4 m²

Table 2.3.7-8 Required Area of Fishing Gear Locker

	For small sized boat		For medium-sized boat		Total Area
	Unit	Area/unit	Unit	Area/unit	
Parham	24	3.6 m²	25	5.4 m²	220 m²
Urlings	21	3.6 m²	22	5.4 m²	195 m²

Furthermore, if the fishing gear lockers are installed outdoors, they will be exposed to the sun rays and the heat thereof as well as wind and rain, and therefore in view of the fact that, in particular, the doors, latches and locks are easily deformed, they could very well be deteriorated within a matter of years. That being the case, the doors are to be located so as to face the indoor corridor exposed to the wind.

3) Facility Layout

Each fishing gear locker unit is to be located along the inner corridor so as not to be exposed to the direct sun rays and wind and rain. That inner corridor will be exposed to the wind, and since it will also be workspace, its width will be about 2.5 m.

Each unit will have a ceiling from the standpoint of prevention of theft and in order to prevent incursion of rats. Although there is the disadvantage of not being able to open wide the doors for putting things in and taking them out, there will be adoption of a sliding door system with as large a degree of restriction as possible for prevention of deformation and falling. Although the folding door system is most outstanding in functional terms, it will not be adopted in view of expected frequent trouble with it.

(6) Garbage Depot

1) Design Concept

Although not included in the request, a garbage collection facility will be installed at the entrance to each new fishing port for collection of the remains of fish processing (scales, gills, intestines, etc.) and other waste produced inside the fishing port. Such waste will be handed over to the public garbage disposal system for disposal.

2) Required Space

The garbage generated within the site will be kept in polyethylene containers at the refuse collection facility to check dispersion of foul odors along with decomposition thereof. The number of polyethylene containers will be 5 per building, those for the fish retail shop being used to keep garbage that easily rots. The area of the garbage collection facility will be about 1.5 m × 2.0 m.

3) Facility Layout

This facility will not have a roof and will have concrete walls and a concrete floor in order to make it easy to keep it clean. On one of the walls there will be a door with a lock on it to keep the facility usually closed except dumping.

(7) Sectional Plan of Buildings

In both project areas the roofs of the buildings will be the simplest sloped gable roofs to ensure safety as regards waterproof. With the sloped roofs the heat load from the strong sunshine will be concentrated in the part below the sloped roof and will be appropriately discharged by ventilator.

As for roof gradient, the eaves will extend considerably outward to avoid rain coming in and adverse effect of the sunshine coming in, but in order to make the eaves height as low as possible and also in connection with the construction method mentioned.

The floor elevation of each building will be the average outdoor works level + 15 cm to prevent direct intrusion of rainwater, and the height from the floor below the reinforced-concrete beams will be 2,100～2,300 mm.

Since the administration office will be air-conditioned, it will be given a ceiling, but elsewhere the roof board and trusses will be left visible without any ceiling.

(8) Structural Plan of Buildings

1) Foundation Plan

a) Parham Site

At the Parham site all of the building facilities will be constructed on the land by filling or reclamation (crushed rock layer with thickness of at least

1.5 m) accompanied by the wharf and relevant construction works. Assuming that the project construction work will be divided into two phases for implementation, the building work will start more than six months after the earthwork.

There is a high probability that as a result of frequent passing of earthwork vehicles during that previous phase and the long-term load of the filling the soft ground layer 1.0 to 2.5 m below the existing ground level with an N value of about 0 will by then have been sufficiently compacted and that consolidation settlement will have been about completed. Therefore it is considered that that foundation bed will be able to support a building weight equivalent to the earth (below the surface of the ground foundation to be prepared) that was removed in preparation of the foundation for the planned building.

However, in actuality compacting and consolidation settlement due to filling load is considered to progress unevenly, and therefore there is considerable possibility of continuation of consolidation settlement at places even during the construction period and after completion of construction, and such uneven ground subsidence will result in differential settlement of the building. That being the case, in the present project locally procurable PC piles will be adopted for the building foundation work taking into account process planning, material procurement plans, construction cost, etc. As for the workshop located inshore area of better sub-soil condition, a mat foundation will be applied for the building foundation.

b) Urlings Site

The foundation condition at the Urlings project site differs between the area of the sea side, where building site preparation will be just about at the existing ground foundation level, and the area on the land side, where the existing ground will be excavated to secure the facility site.

At the part on the sea side it is thought that the existing ground level will have a bearing capacity of about 3 t/m^2 since there is a weak sandy layer with admixture of silt to a depth of about 1 to 4m. The foundation design will be reinforced-concrete mat foundations. After backfilling of the floor concrete will be poured as floor concrete.

On the landside, as well, the ground foundation is sandy with some inclusion of silty material, but it is more compacted and has an N value in excess of 10. Even if the bearing capacity is set at about 7 t/m^2, the building

foundations there will be reinforced-concrete strip footings

However, it will be necessary to undertake local soil bearing tests on both the sea and land sides to confirm the actual situation before making a final decision concerning building foundation size.

2) Superstructure Plan

Up to the horizontal beam part the superstructure will be a reinforced-concrete rigid-frame structure. In design of the upper concrete body although the mix design will be 210 kg/cm^2 considering local work execution precision and material used (use of sea sand), yield will be take into account on the assumption that only 180 kg/cm^2 can be ensured as the design value. Furthermore, in order to ensure the covering thickness of the re-bars about 20 mm of extra concrete will be installed in view of the fact that it is a seashore area.

The roof trusses will be concrete trusses from the viewpoint of reduction of construction time and the affection of severe wind generated by hurricane.

As an antirust measure considering the seashore location, the thickness of the steel hardware of the trusses and joints will be increased by one rank above what is determined by calculation to be required.

As already mentioned, in principle Japanese structural design standards will be applied, but in cases in which there are relevant stipulations in CUBIC, that standard will be used instead. Regarding wind pressure for the building design, a hurricane wind speed of 80 m/s will be coped with, and regarding seismic force, the standard shearing force coefficient will be set as 0.2.

(9) Finishing Plan

The following finishing plans will be the same specification for both project sites. In selection of finishing materials such factors as ruggedness for standing up to hurricane conditions, endurance against the effects of a salty atmosphere, ease of management and control and facility of local procurement will be considered.

Exterior Finishing:

Roofs	1.5 inch lumber roof boards, asphalt roofing, galvalium steel sheet (thickness 0.35)

Eaves fascia/Verge	Western red cedar with wood preservative paint
Soft board	206 lumber roof board with wood preservative paint
Wooden trusses	Southern yellow pine with wood preservative paint
Columns and beams	Fair rein forced concrete, water repellent coating
Walls	Light weight concrete block with cement mortar (thickness 25mm) steel trowel finish
Baseboard	Fair faced rein-forced concrete, cement mortar (thickness 25) steel trowel finish
Berm (fish retail shop)	Ceramic mosaic tile (25 square)
Berm (in general)	Fair faced concrete steel trowel finish, with epoxy resin floor hardner
Exterior opening (main entrance of administration office)	Western red cedar half-glazed panel door with clear wood preservative paint and allumium sash door with cross wired sheet glass (thickness 6.8) imbedded
Exterior openings (doors in general)	Western red cedar panel door with clear wood preservative paint
Exterior openings (windows)	Western red cedar panel window shutter with clear wood preservative paint; welded wire net (9 dia.×100), with silver paint; aluminum sash horizontally sliding window or double-hung window with insect screen, cross wired glass (thickness 6.8) imbedded

Interior Finishing:

Ceiling (administration office)	Suspended ceiling; broadleaf tree surface laid plywood, with hollow joint, with clear wood preservative paint
Ceilings (in general)	Exposed 206 lumber roof board with clear wood preservative paint
Wooden trusses	Southern yellow pine with wood preservative paint
Columns and beams	Fair faced rein-forced concrete with water repellent coating
Walls (toilets and shower room)	Earthenware tiles (150 square)
Walls (in general)	Lightweight concrete block with cement mortar (thickness 25) steel trowel finish
Baseboard	Fair faced concrete with cement mortar (thickness 25) steel trowel finish
Floors (toilets and shower room)	Ceramic ware tiles (150 square)
Floors (in general)	Fair faced concrete steel trowel finish with epoxy resin floor hardner coating
Interior openings	Western red cedar panel doors

(10) Machinery and Equipment Plans

1) Water Supply Facility

Public Water supply is conducted by Antigua Public Utility Authority (APUA). It has a diversity of water sources, including deep wells, reservoirs and seawater desalination plants, and it supply capacity is more than adequate.

The water sources are wells at nearby Seatons for the Parham site and within the area and at Cades Bay for the Urlings site, the water being distributed by supply main pipe lines buried under the main roads. Those main pipes have a diameter of 6 inches in the vicinity of both sites, and the nominal water pressure is 100 psi (approx. 7 kg/cm^2) at Parham and 80 psi (approx. 5.5 kg/cm^2) at Urlings. That is entirely adequate for the present project. (The nominal water pressure at the St. John's Fishery Complex is said to be 40 psi, but it is actually only 1.5 - 2.0 kg/cm^2, or 50-60% of the nominal figure.)

At both sites the water will be taken from the nearest points of the mains by distribution lines with a diameter of about 1.5 inches to water tanks at the sites. Although there is no problem concerning the volume of water that can be supplied, it will be made sure that the fishing port facilities are not affected by supply interruptions due to power failures and other reasons. In that connection the water tank capacities will be equivalent to approximately one day's demand.

There will be no elevated water tank at either site because of space limitations and, particularly at Parham, the difficulty of making a foundation for such a tank in view of the low ground bearing capacity. Instead, the water will be supplied directly from the reservoir tanks using pressurizing pump.

The capacity of the pressurized water delivery pumps will be 230 liters/min. taking into account the water demand in the table below and the pipe resistance to the farthest point of the piping, with a head differential equivalent to 10 m high and automatic alternating operation.

Table 2.3.7-9 gives the volumes of water that will be consumed at each sites.

Table 2.3.7-9 Water Supply Plan

	Parham		Urlings	
		(liter)		(liter)
Ice-making Plant	Cap. 1.5 ton	1,650	Cap. 1.0ton	1,100
Cleaning of Cold Storage	5 min./day	100	5 min./day	100
Fish Retail Shop	5 booth	2,500	5 booth	2,500
Fish Handling Area	47.7m^2	715.5	41.8m^2	627
Fish Processing	1.5ton/day	1,570	1.38ton/day	1,380
Toilet	56.5 Persons	5,650	50.3 Persons	5,030
Shower	50 Persons	3,000	44 Persons	2,640
Engine Test Tank	30 min./day	600	30min./day	600
Water for Fishing Boat	49 boats	294	43boats	258
Total		16,080		14,235
Dimensions of Water Reservoir Tank	4m×3m×2m (h)		4m×3m×1.5m (h)	

Consideration was given to utilization of rainwater for such purposes as cleaning of the facility area, but the conclusion was reached that it would not be reasonable to install rainwater tanks since in no month of the year are there even four days on the average with precipitation in excess of 10 mm/day and there are only about 25 days through the year and mean daily precipitation is only about 2 mm. Since both sites are very close to the shoreline, well's water there would only yield seawater. From the viewpoint of maintenance, as well, considering occurrence of waterweed in the water reservoir tanks if such water were to be used, that also is not considered an appropriate solution.

In addition to the APUA meter a separate branch meters will be installed on the water supply line to the ice-making plant, ice storage and cold storage facilities room and on the one to the fish retail shop from the facility management viewpoint. But no separate meters will be installed on the water supply lines to the other facilities, including the administration office, since that water consumption is considered to be common use by the facility users.

As a rule the water supply lines will consist of PVC pipes, but at places were they run underground and motor vehicles can be expected to cross over

them above they will be concrete lining pipe or use be made of SGPW (white gas) pipes and lining steel pipes.

2) Sewerage and Sanitary Facility

a) Sewage Equipment Facility

Sewage and miscellaneous wastewater will be treated in treatment tank to a BOD level of under 45 ppm as the water quality for discharge on the basis of the CUBIC standards used in Antigua and Barbuda.

The water treatment tanks used will be those of the forced aeration type, the treated water being directly discharged outside. It will not be possible, though, to install seepage trench at either site because of the space limitations. Nor would seepage pits be suitable places for discharge in view of the silty nature of the soil.

Catch basins are to be installed at required points of the drainage system. As a rule they will be of the invar type. In case of the collection type of catch basin, measures will be taken to prevention rise of foul odors from the drainage pipes. In principle the drainage pipelines will consist of PVC pipes. They will be protected by concrete lining pipe at places where motor vehicles can be expected to cross over them above. As for the remains (scales, gills, guts, etc.) from processing of fishes expected to be discharged by the fish retail shop, stainless baskets will be installed in the drainage catch basins to trap them, and the contents will be collected and sent to the garbage depot on the site to be disposed to the public garbage collection system.

The overflow water from the engine test tanks installed in the workshop will be sent to a water treatment tank after processing through a gasoline trap. The water treatment tank capacities will be decided on the basis of Table 2.3.7-10.

Table 2.3.7-10 Capacity of Septic Tank

	Parham		Urlings	
		(liter)		(liter)
Cold Storage	5 min./day	100	5 min./day	100
Fish Retail Shop	5 booth	2,500	5 booth	2,500
Fish handling Area	47.7m^2	715.5	41.8m^2	627
Fish Processing, etc.	1.5 ton/day	1,570	1.38 ton/day	1,380
Toilet	56.5 persons	5,650	50.3 persons	5,030
Shower	50 persons	3,000	44 persons	2,640
Engine Test Tank	30 min./day	600	30 min./day	600
Total		14,116		12,877
Capacity of Septic Tank	14 m^3		13 m^3	

Since the hold water of the fishing boats has a BOD level of as high as 10,000 ppm, it would be unreasonable to include to treat it in the treatment tanks to be provided at the fishing ports and will therefore not be covered by the present equipment. There will have to be thorough guidance of fishermen to make sure to get rid of it offshore while still in the offing.

b) Drainage Facility

At both sites there will be no special measures taken concerning rainwater. It will be allowed to flow off into the port waters and elsewhere as a result of the water slope of the paving area on the site.

However, in the land preparation for the facilities at both sites it will be necessary to install rain water drainage facilities for any level differentials that are created with the land behind the site.

At Parham the site ground level is more than 1.0 m higher than that of the hinterland. Therefore it will be necessary to install trenches behind the site for smooth drainage of the rainwater from the land behind the site, which up to now has flown naturally into the sea. The drainage channel design of the trenches must include a gradient on their bottom such as not to create any puddles. Furthermore, box culverts will be provided at road crossings.

At the Urlings site it will be necessary to prepare the ground for facility plots by excavation of the half of the site on the landside. It will therefore be necessary to install drainage trenches at the top or bottom end of the

excavated surface to prevent rainwater from flowing into the site from the hinterland. Such rain water will be discharged to the low-lying land to the east of the site that still serves as a reservoir basin for seepage into the ground there.

c) Water Supply and Drainage and Sanitation Equipment

Water faucets will be installed for water supply to the fishing boats, the individual booths of the fish retail shop, the fish handling area for washing and cleaning purposes, the ice making plant, ice storage, cold storage room and other facilities for washing purposes, the administration office for the sink of the hot water facility, the toilets and showers and the refuse collection facility for washing and cleaning.

The supply line to those faucets will in principle be routed through a corner (the machinery space) of the ice-making plant, ice storage and cold storage room, where a shutoff valve will be provided for control and prevention of unauthorized use of the water. The individual faucets will in principle be provided with locks. As for the engine test tank in the workshop, no faucet will be provided for it. It will be supplied with water from its bottom by operation of a water supply valve located in the machinery space.

The shower room will be provided with showerheads, water supply valves and imbedded soap holders.

The toilet will be provided with western-style toilet bowls of the low-tank type, toilet paper holders, wall urinals and flush valves for the wall urinals.

4) Air Conditioning and Ventilation Equipment

a) Air Conditioner and Ceiling Fan

As in the case of the administration office of the St. John's Fishery Complex, the administration office used by AFL in this project will have installed in it an air cooling package unit of the separate, heat-pump type. The size will be determined on the basis of the criterion 160 - 180 kcal/m^2.

The other spaces will not be provided with air conditioning, but the meeting room will be provided with 6 ceiling fans with a fan radius of about one meter for a breeze of at least 0.3 m/s at the floor level.

b) Ventilation Equipment

Since a cold storage air-cooled condenser will be installed in the ice-making plant, ice storage and cold storage room, that will have to be coped with in architectural terms, including installation of a air exhaust duct to ensure the required volume of exchange of air. But at night, when the temperature of the top part of the ventilation duct declines, the volume of natural ventilation by the ventilation duct also declines. Therefore a pressurized exhaust fan will be installed in the ventilation duct to ensure the required amount of ventilation. Operation of the pressurized exhaust fan is controlled by a temperature sensor for the sake of maintaining the heat exchange function of the air-cooled condenser (off at 33℃ and on at 38℃).

Supply of the air will be accomplished by installation of a hollow block at the bottom part of the side wall of the work space in front of the ice storage and cold storage facilities.

Calculation of volume of air supply required

* Required volume of supply of air when the generator is operating (amount needed for combustion): approx. 10,600 m^3/h
* Volume of air discharged from the air-cooled condenser of the cold storage facility: approx. 45,000 kcal/h (equivalent to 16,000 m^3/h)
* Volume of air exchange required by ice-making and cold storage facilities (for three exchanges) : approx. 1,500 m^3/h

  Total: approx. 28,000 m^3/h
* Pressurized exhaust fan: with fan radius of 80 cm, 200 V, 3-phase, about 750 W, 2 units

Area of exhaust opening (exhaust duct)

* Wind speed of exhaust opening partial surface: to be 3 m/s(assumed)
* Exhaust opening surface area : 28,000/3/60/60 = approx. 2.6 m^2
* Exhaust duct cross section (effective): about 1.15 m×1.15m, 2 units

Air supply opening area (hollow block made wall)

* Air supply opening wind speed: 1.5 m/s, void ratio 60% (assumed)
* Air supply opening area: 28,000/1.5/60/60 = approx. 5.2 m^2

The air-cooled condenser could be installed outdoors, but it has been determined to install it indoors in view of the shortage of space at both sites, the fact that the possibility of wave spraying with seawater from the shore cannot be excluded and danger of its becoming engulfed in high waves during a

hurricane. In installation indoors since there is available space at the height level of installation of the ice-making machine, a steelwork frame will be installed to make use of that space, and the air-cooled condenser will be installed on that frame.

In the toilets and shower rooms, too, natural ventilation will be aided architecturally by installation of a ventilator. If it proves to be necessary to also install an exhaust fan for forced ventilation, it will be provided with a weather cover and electrical shutter to withstand the local strong trade wind and hurricane wind forces.

5) Fuel Supply Equipment

Basically, the equipment for fuel supply to the fishing boats is a portion to be undertaken by the Government of Antigua and Barbuda side.

However, because of concerns regarding construction works and time of installation, the fuel oil distribution piping will be included in the project construction work. It will therefore be necessary to thoroughly discuss with the Government of Antigua and Barbuda the positions of installation of the fuel tanks, tank capacity, the positions of installation of the dispensers and the use of the dispensers.

The expected capacity is 10 m^3 tanks. Since at both sites the groundwater level is relatively high for complete burial of a tank of that size, the tanks will be semi-buried.

The limit distance between the positions of installation of the tank and the dispenser to ensure that the suction pump load will not be too much is about 50 m. SGP (black gas) pipes will be used for the fuel distribution pipe-line.

6) Garbege Disposal Equipment

The garbage generated by both sites will be disposed of using the public garbage disposal system. And, a water faucet will be installed at the garbage depot for the purpose of cleaning the floor.

7) Electrical Equipment

a) Service and Main Line

Both sites will have a lead-in line to the lead-in circuit breaker installed

in this project from the step-down transformer stations (to 415V / 240V, 60 Hz, 3-phase, 4-wire) connected with the high-voltage (12,000V) power transmission lines running along main roads in their vicinity. The Government of Antigua and Barbuda is responsible for both the work of installation of the step-down transformers and integrating wattmeters and construction of the lead-in electric poles.

The distribution board will be located in the machinery space in a corner of the ice-making plant, ice storage and cold storage room for easy management and control from the administration office. Both the distribution board and the subdistribution boards will be of waterproof and salt-resistant specification to ensure safety.

The distribution power capacity will be as per Table 2.3.7-11. The distribution capacity is therefore set at 75 KVA.

Table 2.3.7-11 Electricity Destribution Capacity

	Approx.Total Load (KVA)	Demand Factor	Transformer Capacity (KVA)
Lighting	11.50	@ D.F.0.8	9.30
Out-let	11.45	@ D.F.0.1	1.15
Air Conditioner	15.76	@ D.F.0.8	12.61
Fan, Pump, etc.	24.57	@ D.F.0.6	14.74
Ice-making Plant, Ice Storage	11.69	@ D.F.0.8	9.35
Cold Storage	7.63	@ D.F.0.8	6.10
Total			53.25

The fishing ports will also be provided with emergency generation equipment to safeguard the facility functions at the time of power down. The incoming power panels will therefore each be equipped with a main switch that manually switches between the APUA mains supply and standby generator supply.

The heavy-current circuits will be provided with heavy-current distribution panels, and the lighting circuits with lighting subdistribution panels. In such electrical equipment full consideration will be given to protection against salt and rust and risk of flooding in the cold storage facility.

It should be noted that Antigua and Barbuda is in a transitional period regarding terminal electric equipment. The standard low-voltage power is 240 V, but recently, with advent of use of computer-related equipment and equipment with U.S. specifications, the voltage range 100-120 V is becoming

necessary. That being the case, besides the standard single-phase 240 V power, a 120 V power supply will also be provided.

At the sites the distribution ducts and wiring, including the distribution duct and wiring work from the distribution board to the different buildings, will be laid underground, with provision of hand holes when necessary. The distribution ducts will all consist of FEP tube, and their depth under the ground will be at least 900 mm.

The distribution duct and wiring standards will be the U.S. standard of NEC and the standards of the International Electrical Standards Conference.

b) Standby Generator

A standby generator will be installed for both Parham and Urlings site to secure the function of the project facilities during electric power failure. A capacity of the standby generator is determined to cover the ice making plant, the ice storage, the cold storage, the water treatment tank blowers, the gasoline dispensers, the administration office electric lights and out-lets, the meeting room electric lights and out-lets, the toilet and shower lighting and the outdoor lightings. The fuel tank capacity of the standby generator will be as small as possible, under 400 liters, which is enough for one day's operation. However, regarding the 120 V power supply, since the system will be too complicated with separate power transmission, there is to be transmission to the workshops, too.

The load of the generator will be based on the figures tabulated in Table-2.3.7-12, and its generation capacity will be decided on the basis of the assumption of a power factor of 75-80 percent. It will be provided with a device for inhibiting the starting current of the different equipment.

Therefore, from the table above, the load of the standby generator will be 75 KVA, with 415 V / 240 V, 60 Hz, 3-phase, 4-wire. With the above-mentioned service tank capacity of 400 liters, the total operating time will be about 25 hours.

Table 2.3.7-12 Required Load of Standby Generator

	Total Load (KVA)	Demand Factor	Transformer Capacity (KVA)
Ice Storage, Cold Storage	7.63	@ D.F.0.8	6.10
Ice Making Plant	11.69	@ D.F.0.8	9.35
Ceiling Fan	2.82	@ D.F.0.6	1.69
Water Supply Pump	3.75	@ D.F.0.6	2.25
Septic Tank	1.65	@ D.F.0.6	1.01
Fuel dispenser	0.75	@ D.F.0.6	0.45
Lighting of Main Facility Bldg	3.48	@ D.F.0.8	2.78
Outlet of Main Facility Bldg	2.40	@ D.F.0.1	0.24
Exterior Lighting	2.25	@ D.F.0.8	1.80
Down Transformer	2.00		0.80
Supplemental Electric Source **A**	2.00	@ D.F.0.1	0.20
Supplemental Electric Source **B**	1.20	@ D.F.0.6	0.72
Outlet in Main Facility bldg.	2.40	@ D.F.0.1	0.24
Outlet in Workshop	0.45	@ D.F.0.1	0.05
Supplemental Electric Source	1.20	@ D.F.0.1	0.12
Total			27.80

c) Heavy Current, Lighting and Outlet Apparatus

The heavy current will be supplied from the heavy-current board to the control panel of the ice-making plant, ice storage and cold storage facilities and the heavy-current outlets of the workshop.

Duct and wiring work will be done from the lighting board to the water treatment tanks, the air conditioners, the exhaust fans, the general outlet and the different lighting fixtures and also to the gasoline dispensers. The administration office, the meeting room and the workshop will be supplied with both 240 V and 120 V electricity.

The wiring materials and socket outlets will be made to meet the BS or NEC standards. Where necessary, the socket outlets will be of the waterproof and grounded earth type. In buildings the buried wiring ducts will consist of VE tube, and the hidden part of wiring to the wooden shed rear will be in ducts.

The indoor luminance will not be at a very light level. It will be designed as 300 lx in the administration office, the meeting room and the

workshop, 200 lx at the fish retail shop and fishing gear storeroom facilities and in the corridor part of the ice storage and cold storage facilities and 100 lx in the machine corner of the ice-making, ice storage and cold storage room, the toilets and shower room and the storerooms.

For safe and smooth incoming and outgoing of the port and preparatory work for fishing and prevention of theft the outdoor lighting at both sites is to include four 250 W mercury lamps along the wharf apron of 30 m intervals. Furthermore, three of those same lamps are to be installed at each of the other parts of both sites for the same reasons, including the grounding stage. They are to be placed at a height of about 7.5 m.

In principle a Florescent Light of 10 - 15 W rainproof exterior lamp is to be installed at the entrance of each facility.

All such lighting fixtures are to have salt-resistant and waterproof specifications, and, except for the mercury lamps, they are to be fluorescent lamps of the high power factor, rapid start type.

In the wiring to the ice-making plant, ice storage and cold storage facilities and to the fishing gear storeroom facilities there is to be installation of submeters for separate control of amount of electricity used. Furthermore, the high-level and low-level alarms of the water reservoir tank, the low-level alarm of the fuel tanks and the low level alarm of the standby generator fuel tank are to be controlled by an alarm panel installed in the administration office.

8) Telephone Duct

Telephone service will be provided only the administration office. The scope of the work will be only installation of the ducts, the wiring work and telephone apparatus installation work not being included in the scope of this project.

The telephone duct work will be a underground buried duct by FEP from the lead-in electric power pole to the terminal board installed in the administration office.

9) Lightning Pole

Both sites will be provided with lightning rod equipment. The structures and specifications of the lightning rods, the conductors and the

grounding electrodes are to be based on JIS or CUBIC or BS standards, and the design is to be for a total grounding resistance of under 10 ohms.

2.3.8 Basic Design of Equipments

(1) Ice-Making And Ice-Storage Plant

1) Current Situation of Ice-Making Plant

Presently ice for fishery activities including distribution of fishery products is being supplied on the basis of the ice-making plant of the two companies Antigua Fisheries Limited (A.F.L.) and White Fish Market (W.F.M.) located in St. John's.

The production capacities of the ice-making plant presently supplying ice to fishermen are indicated in the following table.

Table 2.3.8-1 Capacity of Ice-making Plant in Antigua

Company	Capacity
A.F.L.	3.5t* + 7.0t** = 10.5 t/day
W.F.M.	1.0 t/day
Total	11.5 t/day

* AFL 3.5t/day: Old Ice-making Plant (Flake Ice Type)

** AFL 7.0t/day: New Ice-making Plant (Plate Ice Type)

Of the above-mentioned ice making plant, A.F.L.'s flake ice making plant (capacity of 3.5 tons/day) is not only run down after 19 years in service but also poses a problem in that it makes use of a Freon gas (R-502) as a coolant, and that freon gas has become a problem since they cause destruction of the ozone layer, and use of them is now controlled. Such plant has to be put out of operation sooner or later because neither replenishment of the gas nor supply of parts is possible in view of discontinuation of production of such coolant and of refrigerating devices making use of this kind of freon gas. Furthermore, since WFL supplies to fishermen only the amount of ice left over after it meets its in-house consumption needs, it can be considered that the stable production capacity of ice for supply to fishermen will be 7.0 tons/day (nominal).

2) Ice Supply and Demand Plan

The above ice-making plant of 7 tons production of plate ice is set for the

purpose of supplying ice to reduce post catch loss after landing and to maintain the quality of the fish catch by the grant aid of Japanese Government in 1997.

The plan condition is estimated at 1,895tons as the volume obtaining at the rate of 1.1 times of 1,723tons that is total annual catch volume in Antigua Island. The ice for the purpose of fish distribution to maintain fish quality is planned at 381 tons as the quantity being used at the rate of 0.5 times of 762 tons that is total volume distributed within the city of the capital St. John's. In addition to these , the ice to be used in AFL, public fish market and general consumption become 2,400tons in total per year. The ice making facility having capacity to produce daily 7tons has been set. Table 2.3.8-2 shows the supply plan figures for the previous project.

Table 2.3.8-2 Supply Plan of 7ton Ice Making Plant

(Unit :ton)

	For Fishing Operation	For Distribution in St.John's	For AFL	For Fish Retail Shop	For General Consumer
Fish Catch Volume	1,723	762			
Required Ice Amount	1,723×1.1 = 1,895	762×0.5 = 381	30	67	28

Source： Basic Design Study Report on St.John's Fish Landing and Market Complex Construction Project

The plan does not include the ice for the catch distributing in provinces and the distributing to the capital from provinces but includes the ice for the catch distributed in the capital.

It is found in this study plan that the fish catch has increased because of diversification of fishing methods and increasing the number of fishing boats. The estimated figure is now approximately 2,369 tons and this is approximately 646 tons more in quantity than previous record. The table 2.3.8-3 below shows the necessary quantity with the same conditions as previous project.

Table 2.3.8-3 Required Ice Amount (Unit:ton)

	For Fishing Operation	For Distribution in St.John's	For Distribution in provinces
Catch Volume	2,369	948	1,421
Required Ice Amount	2,369×1.1 = 2,606	948×0.5 = 474	1,421×0.5 = 711

Note： Distribution Volume in St.John's is calculated as same ratio against total catch in the previous Report

Therefore, with that increase in fish catch 3,080tons of ice are now needed for fishery and for distribution in the capital, the annual shortage becomes 804 tons (3,080－(1,895+381)=804) against previous study plan. And it is also considered to use ice for fish distribution in provinces under the circumstance of higher need of fish freshness then, total annual ice consumption now become 3,791 tons and the annual shortage would be 1,422 tons (3,791－(1,895+474)).

The estimated landing volume in Parham and Urlings are 252 tons and 221 tons respectively and the calculation of the necessary quantity of ice (without including quantity of ice distributed in provinces same as previous plan) deducting these catch volume will be as follows.

V=(2,369-473)×1.1 + 948×0.5= 2,559.6 tons

The value obtained in the previous study plan was 2,400 tons that is about 94% of this value. This value is about to cover necessary volume for the catch other than Parham and Urlings and this means that the necessary ice in these two areas can not be covered. Therefore, the construction of fishing ports in this plan needs to provide ice-making facilities in Parham and Urlings. As described above, the annual shortage of ice will be 1,422 tons or 3.9 tons daily including the ice volume distributed in provinces. It is clear that the plate ice-making machine of AFL (7.0ton/day) is insufficient to cover enough for all.

3) Objective and Necessity of Ice-making Facility

In recent years, the awareness of the importance of fish freshness control become substantially higher, so the consumption of ice after catch is increasing a lot. There are fishermen to buy expensive ice (1.5 times more than the ice for fishery use) selling at gas stand for drinking and eating purpose and another fishermen use the ice producing by home refrigerator. That is because that they worry about losing fish freshness while going to and from the capital spending 1.5 hours to buy the ice for keeping the freshness. In Antigua and Barbuda, it is general practice for fishermen to go out for fishing in the early morning and to come back to port in the afternoon, and because of that they have to buy ice the day before and keep it in ice storage boxes at home or on board of their fishing boats. That means they can go out to sea at most every other day, and that constitutes a limiting factor on the number of days of operation of their boats. In the interviews with the fishermen most of them said that they would like to go out to sea every day if only the weather conditions permit, and so resolution of that limiting factor should result in

considerable increase in operation. Presently local fishermen have to go to the capital to buy ice. Therefore, if ice-making machine is installed in the project areas, efficiency should increase from the view point of convenience, and fishery activities shall become much more brisk.

As it was mentioned in the above Ice Supply and Demand Plan. the demand of ice is increased going with increase of the catch. Although, plate ice-making machine of AFL can cover the demand of ice for fish landing and distributing in the capital however, the ice for fish in other provinces is not enough at all.

From the above it is decided to have ice-making facilities in Parham and Urlings for the purpose of improvement of local distribution and productivity.

4) Required Capacity of Ice Making Plant and Ice Storage

The scale of the equipment is set on the basis of the following conditions.

a) Design Concept

i) Fish Catch Amoun t

***Parham Site**

Coverage of a fish catch volume of 252 tons/year (5.25 tons/week).

Fishermen will also be coming overland from Seatons and Willikies to that port to buy ice, and the coverage is set not at all of the catch volume of the area but only 50% of it. The catch volume of Seatons and Willikies is as follows:

44 boats×50 kg×103 fishing days×0.5 = 113 tons, or 2.35 tons a week.

*** Urlings Site**

Coverage of a landed catch volume of 221 tons/year, 4.60 tons/week

Since the fishing boats go out to sea mainly on Monday and Friday, the fish catch volume figures according to the day of the week are set as per Tables 2.3.8-4 and 2.3.8-5.

Table 2.3.8-4 Fish Catch Volume at Parham and Urlings

(Unit:ton)

Fish Catch Volume (Yearly, Weekly, Daily)				Daily Fish Catch		
	Year	Averag./ week	2.145days/ week	Mon., Fri.	Wed.	Other days
	48 wks	(a)	103days/48wks	(a)×0.3	(a) ×0.2	(a) ×0.05
Parham	252	5.25	2.45	1.58	1.05	0.26
Urlings	221	4.60	2.15	1.38	0.92	0.23

Table 2.3.8-5 Estimated Fish Catch at Seatons and Willikies

(Unit:ton)

	Fish Catch Volume			Mon,Fri	Wed	Other days
	t /year	t/week (a)	t/day	(a) × 0.3	(a) × 0.2	(a) × 0.05
Seatons Willkees	227	4.72	2.20	1.42	0.94	0.24

Annual Fish Catch Amount

= Number of Boat×Average Fish Catch×Annual Operation Days

= 44 boats×50 kg/day×103 days/yr = 227 ton/yr

iii) Ice and Fish Ratio

*Fishery: 1.1 times of the catch volume

*Distribution: 0.5 times of the volume distributed

iv) Distribution of Fishery Products

	Parham	Seatons, Willikies	Urlings
To St. John's	35%	75%	60%
To Local	65%	25%	40%

Note: Figures of Seatons and willikies are estimated by population of those area and their consumption.

v) Conditionn of Ice Use

There are the objects for the fishery and the local distribution as ice usage. However, any catch distributed to the capital is also the object of ice usage of the fishery.

b) Required Ice Quantity

The capacity of the ice-making plant at the Parham and Urlings fishing ports is calculated as follows on the basis of the above conditions.

i) Required Ice for Fishing Operation

The required quantity of ice is calculated on the basis of the form of distribution, the volume of the fish catches landed on Mondays and Fridays and the average volume of catches the day after (Tuesdays and Saturdays). Of the volumes of catches of the different areas, the part that is distributed to the capital is indicated by the figures given in Table 2.3.8-6.

Table 2.3.8-6 Fish Catch Distributed to St. John 's

(Unit: kg/day)

	Ratio to St.John's	Landed Volume		Volume to St.John's		Ave. Volume to St. John's
		Mon / Fri	Tue / Sat	Mon / Fri	Tue / Sat	
Parham	35%	1,575	263	551	92	322
Seaton Willikies	75%	1,416	236	1,062	177	(620 × 0.5) 310
Urlings	60%	1,380	230	828	138	483

Therefore the necessary quantity of ice for use in fishery is obtained as follows on the basis of subtraction of the object of the catch distributed to the capital as shown in Table 2.3.8-7.

Table 2.3.8-7 Required Daily Ice Volume for Fishing

(Unit:kg)

	Landed Volume (a)	Landed Volume (b)	Average Volume (c)	Distributed to St. John's (d)	Landed to Local (e)	Required Ice Volume (Ice-1)
	Mon / Fri	Tue / Sat	(a+b)/2	Average	c – d	e × 1.1
Parham	1,575	263	919	322	597	657
Seaton Willikies	708	118	413	310	103	113
Urlings	1,380	230	805	483	322	354

b) Required Quantity of Ice for Fish Distribution

On the basis of coverage of 50% of the quantity of fish distributed, the figures for the necessary quantities of ice for use in local distribution in each area are shown in Table 2.3.8-8.

Table 2.3.8-8 Required Daily Ice Volume for Distribution

(kg/day)

	Distributed to St.John's (a)	Required Ice Volume (Ice-2)	Distributed to Local (b)	Required Ice Volume (Ice-3)
	Average	(a) × 0.5	Average	(b) × 0.5
Parham	322	161	523	261
Seaton Willkees	310	155	70	35
Urlings	483	242	257	128

c) Required Capacity Ice-Making Plant

From the above calculations the necessary quantity of ice at Parham is 1,383 kg/day considering also demand from Seatons and Willikies, and at Urlings it is 724 kg/day.

That being the case, the ice-making plant capacity is set at 1.5 t/day at Parham and 1.0 t/day at Urlings.

Table 2.3.8-9 Total Required Ice Volume at Parham and Urlings

	Ice-1	**Ice-2**	**Ice-3**	Total	Total
	×1.1 (a)	×0.5 (b)	×0.5 (c)	a+ b+c	a+ b+c
Parham	657	161	261	1,079	
Seaton, Willikies	114	155	35	303	**1,383**
Urlings	354	242	128	724	**724**

6) Basic Design of Ice-Making Plant

a) Specification of Refrigerant

Of the refrigeration and ice-making plant in operation in Antigua and Barbuda, the older equipment uses the freon (chlorofluorocarbon) R-502, and the newest uses R-22. In this project it has been decided to use R-22 as in the previous project.

b) Type of Ice

The different types of ice presently being generally used in the fishery industry include block ice, plate ice, flake ice, etc. Since the time to melting of the ice is inversely proportional to the surface area of the ice, the descending order of it is "block ice > plate ice > flake ice".

Block ice, with the longest time for melting, is most suitable for fishery

activities, but it involves larger scale of equipment and requires ancillary equipment such as ice crushing equipment. Presently in Antigua and Barbuda for fisheries there are two plate ice production units and one flake ice production unit. Considering the degree of skill of the technical personnel as regards ice-making plant, the situation regarding contact with the bodies of the caught fish, keeping time, degree of prevalence of use, etc., the ice-making plant to be provided in this project is to be of the same type as in the previous project: that for making plate ice.

c) Specification of Ice-Making Plant

From the above, the specification shall be the design conditions indicated below.

i) Design conditions:

* Ambient temperature	+ 34℃ or below
* Humidity	90% or below
* Electric Source	AC415/220V 60 Hz×3φ 4wire
* Refrigerant	Freon R-22
* Raw water	City water
* Type of ice	Plate ice
* Machine type	Tropical & salt resistant type

ii) Specification

Parham fishing port

* Ice-making capacity	1.5 tons/day: 1 set
* Type of machine	Automatic plate ice type
* Refrigeration system	R-22 (freon) direct expansion dry type
* Compressor	Type : Semi hermetic reciprocating type Capacity : 19.1KVA (16,500kcal/hr) (At+32℃/Et-15℃) Motor : 7.5KVA / AC200V/60Hz×3φ
* Condenser	Air-cooling type
* Accessory	Raw water treatment apparatus

Urlings fishing port

* Ice-making capacity	1.0 tons/day, 1 set
* Type of machine	Automatic plate ice type
* Refrigeration system	R-22 (freon) direct expansion dry type
* Compressor	Type : Semi hermetic reciprocating type Capacity : 19.1KVA (16,500kcal/hr) (At+32℃/Et-15℃) Motor : 7.5KVA / AC200V/60Hz×3φ

* Condenser	Air-cooling type
* Accessory	Raw water treatment apparatus

7) Ice Storage

The ice-making plant to be introduced in the present project will operate continuously 24 hours for supply of ice whenever needed. However, supply of the ice will take place only during short periods of time during preparations for going out to sea and after landing of catches, meaning consumption during limited periods of time.

Ice storage facilities are needed for stable supply of ice when needed even in excess of current production capacity of the ice-making plant in view of considerable difference in volume of landed catches according to the day of the week.

Furthermore, the fishermen must continue to be supplied with ice even when the ice-making plant stops operating because of maintenance work or checks.

Hence the need to provide ice storage facilities to temporarily keep and accumulate the ice after it has been produced in order to facilitate fishing activities.

a) Required Capacity of Ice Storage

The capacities of the ice storage facilities in the present project have to be geared to the production capacities of the ice-making plant at the respective fishing ports: 1.5 tons of ice a day at Parham and 1.0 t/day at Urlings.

Since the hour of setting out to sea to fish and that of returning to port are close to one another, consumption of ice is concentrated in a short period of time. Moreover, the values used this time for the catch volumes are only average values, and there is considerable fluctuation in the landed catches according to the day of the week. But still it is necessary to have a stable supply of ice even on days when demand exceeds production capacity.

Therefore, ice storage facilities with capacities equivalent to two days' production of the respective ice-making machines will be provided at the two new fishing ports: 3-ton ice storage capacity at Parham and 2-ton ice storage capacity at Urlings.

b) Specification of Ice Storage

i) Parham Site

* Dimension :2,400mm(L)×2,400mm(W)×2,400mm(H)
* Storage capacity :3.0 t
* Storage Specification
  - Room temperature:0 ℃
  - Ceiling & floor :Stainless steel
  - Wall :Stainless steel outside surface with 100mm thickness
  - Door :1,000mm(W)×1,700mm(H)
  - Accessory :Thermometer, wooden liner board and attachment

* Unit cooler :1 set
  - Type :Ceiling hunger type
  - Cooling Area :11.1 ㎡
  - Fan :0.1KVA×1set (AC200V/60Hz×3φ)
  - Defrost :Electric heater(2.0kW)

ii) Urlings Fishing Port

* Dimension :2,400mmL×2,400mmW×2,400mmCH
* Storage capacity :2.0 t
* Storage Specification
  - Room temperature : 0 ℃
  - Ceiling & floor:Stainless steel
  - Wall :Stainless steel outside surface with 100mm thickness
  - Door :1,000mm(W)×1,700mm(H)
  - Accessory :Thermometer, wooden liner board and attachment

* Unit cooler :1 set
  - Type :Ceiling hunger type
  - Cooling Area :11.1 ㎡
  - Fan :0.1KVA×1set (AC200V/60Hz×3φ)
  - Defrost :Electric heater(2.0kW)

(3) Cold Storage

1) Objective of Cold Storage

In Antigua and Barbuda fishermen generally go out for fishing in the early morning and come back to port in the afternoon, and sale of fishery products to consumers also takes place mainly in the early morning, usually ending by noon.

The landed catch is usually sold the next day after being kept in the boat or at the fishermen's homes for about 18 hours. The method of keeping it involves use of ice remaining from that used at sea or none at all until sale the next morning. The fish that is kept using ice do not suffer much loss of freshness, but there is marked loss of freshness in the case of the fish kept overnight at ambient temperature.

By the time the fish is sold the next morning there is considerable loss due to the need to throw some of the fish away, and that constitutes a negative factor in the economic aspect of fishermen's lives. For that reason it is planned in the present project to provide cold storage facilities for temporary storage of the catch until it is sold so as to prevent loss of freshness and reduce the post harvest loss from need to throw spoiled fish away.

2) Required Capacity of Cold Storage

It will be the part of the catch at the two new fishing ports that is transported to the capital for sale that is put in those cold storage facilities and not the part distributed in the local areas in question.

a) Design Fish Catch Amount

The catch is usually biggest on Mondays and Fridays. That being the case, the cold storage facilities will be designed for the size of the catch on those days. As indicated in the table below, the part of the catch that is supplied to the capital for those days is taken as 551 kg in the case of Parham and 828 kg in the case of Urlings.

In view of the fact that ice supply facilities will be provided in the project, that some of the catch will continue to be kept at the fishermen's homes and that some will be transported to the capital the same day, it is considered that only 50% of the part of the catch sent to the capital will have to be kept in the cold storage facilities. The scale of the cold storage facilities is therefore set at a capacity of 276 kg of fish for Parham and 414 kg for Urlings.

Table 2.3.8-10 Fish Catch Amount Covered by Cold Storage

	Distributed to St.John's	Distributed next day	Distributed next day
	Mon or Fri	Case-1	Case-2
	(a)	(b) = a×2/3	(c)=a×1/2
Parham	551	368	276
Urlings	828	552	414

b) Storing Method

Presently the catch is kept in individual baskets or cold-preserving boxes in the boats or at the homes of the fishermen until it is sold. Generally the fish boxes used have shelves to make it easier to take the fish out.

The dimensions of the fish boxes and the quantity of fish that they hold are as follows:

. Dimensions of the fish boxes: 450 mm×800 mm×300 mm
. Capacity: 15 kg of fish / box

c) Required Space

i) Parham Fishing Port

. Quantity of landed catch covered : 276 kg
. Number of fish boxes held : 276/15 = 18 boxes
. Dimensions of the fish boxes : 450×800×300 mm
. Number of tiers per shelf : 1,200/(300 + 100) = 3 tiers
. Number of fish boxes per shelf : 18/(3 shelves×2 rows) = 3 boxes

Taking into account work space, passageways, door opening and closing space, etc. besides the above-mentioned required surface area, the dimensions of the floor-surface cold storage facility are set at 2,400 mm×3,600 mm×2,400 mm.

ii) Urlings Site

. Quantity of landed catch covered : 414 kg
. Number of fish boxes held : 414 / 15 = 27.6 = 28 boxes
. Dimensions of the fish boxes : 450×800×300 mm
. Number of tiers per shelf : 1,200 / (300 + 100) = 3 tiers
. Number of fish boxes per shelf : 28 / (3 tiers×3 rows) = 3 boxes

Taking into account work space, passageways, door opening and closing space, etc. besides the above-mentioned required shelf surface area, the dimensions of the cold storage facility are set at 2,700mm×4,300mm×2,400 mm.

3) Specification of Cold Storage

a) Design Conditions

* Ambient temperature	:+34℃ or below
* Humidity	:90% or below
* Electric source	:AC415/220V, 60Hz×3φ 4wire
* Refrigerant	:Freon R22
* Machine type	:Tropical & salt-resistant alloy

b) Specification for Parham

* Prefabrication Type	: 1 set
* Dimension	: 2,400mm(L)×3,600mm(W)×2,400mm(H)
* Specification	
Room temperature	: -5℃
Ceiling & floor	: Stainless steel plate
Wall	: KEYSPAN and stainless steel coated
Panel Thickness	: 100mm
Door	: 1,000mm(W)×1,700mm(H)
Accessory	: Door heater, thermometer, wooden gratin
* Compressor unit	: 1 set
Type	: Semi-hermetic reciprocating type
Capacity	: 6,800kcal/hr (At +32℃/Et -15℃)
Motor	: 3.7KVA／AC200V/60Hz× 3 φ
* Air-cooled condenser	: 1 set
Type	: Floor mount outdoor type
Core materials	: Copper tube & fin type
Outside finish	: Salt-resistant coating steel plate
Motor	: 0.1KW×3 sets ／AC200V/60Hz×1φ
* Unit cooler	: 1 set
Type	: Ceiling hunger type
Cooling surface	: 21.7 ㎡
Fan	: 0.1KW×2 sets (AC200V/60Hz×3φ)
Defrost	: Electric heater(2.92KW)
* Control panel	: 1 set
Type	: Floor mount indoor type

Control : Distributing switches for each unit
Ice storage & cold storage unit control
Alarm circuit for each unit
Abnormal alarm device for each machine
Abnormal voltage circuit, etc.,

c) Specification for Urlings

* Prefabrication Type : 1 set
* Dimension : 2,700mm(L)×4,500mm(W)×2,400mm(H)
* Specification
  - Room temperature : -5℃
  - Ceiling & floor : Stainless steel plate
  - Wall : KEYSPAN and stainless steel coated
  - Panel Thickness : 100mm
  - Door : 1,000mm(W)×1,700mm(H)
  - Accessory : Door heater, thermometer, wooden gratin
* Compressor unit : 1 set
  - Type : Semi-hermetic reciprocating type
  - Capacity : 10,600kcal/hr (At +32℃/Et -15℃)
  - Motor : 5.5KVA／AC200V/60Hz× 3 φ
* Air-cooled condenser : 1 set
  - Type : Floor mount outdoor type
  - Core materials : Copper tube & fin type
  - Outside finish : Salt-resistant coating steel plate
  - Motor : 0.1KW×3 sets ／AC200V/60Hz×1φ
* Unit cooler : 1 set
  - Type : Ceiling hunger type
  - Cooling surface : 28.5 ㎡
  - Fan : 0.1KW×2 sets (AC200V/60Hz×3φ)
  - Defrost : Electric heater (2.92KW)
* Control panel : 1 set
  - Type : Floor mount indoor type
  - Control : Distributing switches for each unit
    Ice storage & cold storage unit control
    Alarm circuit for each unit
    Abnormal alarm device for each machine
    Abnormal voltage circuit, etc.,

(3) Standby Generators

As indicated in the section "Electrical Equipment", each project site is to be provided with a 75 KVA emergency generator.

2.3.9 Outline of the Project and Basic Design Drawings

(1) Outline of the Project

The Planned Facilities in the Project are shown in Table 2.3.9-1 to 2.3.9-10.

Table 2.3.9-1(1) Outline of Basic Port Facilities in Parham

Name of the Facility	Scale	Content of Plan
Dredging	2,500m^3	D.L.-2.0m
Land Reclamation	9,000m^2	D.L.+2.0m
Wharf (-2.0m) (Apron:Phase2)	83m (L)	Steel Seet Pile type
Slipway	27m (W)	Boat Yard Area 756m^2
Concrete Apron	830m^2	83m×10m

Table 2.3.9-1(2) Outline of Functional Facilities in Parham

Name of the Facility	Scale	Content of Plan
Main Facility Building	224.6m^2	7.8m×28.8m
Cold Storage Room	37.4m^2	3.9m×9.6m
Ice-making Room	37.4m^2	3.9m×9.6m
Toilet/Shower Room	37.4m^2	4.8m×7.6m
Administration Office	46.8m^2	6.0m×7.8m
Storage	18.7m^2	2.0m×7.8m
Fish Retail Shop	86.4m^2	9.6m×9.0m
Workshop	54.6m^2	6.0m×9.0m
Gear Locker	216m^2+216m^2	7.2m×30.0m×2
Pavement of In-port Area	3,960m^2	Asphalt Pavement
Installation of Lighting Facility	7 Poles	

Table 2.3.9-2(1) Outline of Basic Port Facilities in Urlings

Name of the Facility	Scale	Content of Plan
Dredging	18,600m^3	D.L.-2.0m
Wharf (-2.0m)	93m (L)	Steel Sheet Pile type
Slipway/Boat Yard	24m (W)	Boat Yard Area 600m^2
Revetment	266m (L)	Rubble Mound type
Enbankment	107m (L)	Rubble Mound type
Concrete Apron	930m^2	93m × 10m

Table 2.3.9-2(2) Outline of Functional Facilities in Urlings

Name of the Facility	Scale	Content of Plan
Main Facility Building	224.6m²	7.8m×28.8m
Cold Storage Room	37.4m²	3.9m×9.6m
Ice-making Room	37.4m²	3.9m×9.6m
Toilet/Shower Room	37.4m²	4.8m×7.6m
Administraion Office	46.8m²	6.0m×7.8m
Storage	18.7m²	2.0m×7.8m
Fish Retail Shop	80.6m²	9.6m×8.4m
Workshop	54.6m²	6.0m×9.0m
Gear Locker	172.8m²	7.2m×24.0m
	216.2m²	7.2m×30.0m
Pavement of In-port Area	4,170m²	
Installation of Lighting Facility	7 Poles	

The outline of the equipments are shown in Table 2.3.9-3.

Table 2.3.9-3 Outline of Machinery and Equipments

Name of Equipment	Scale	Number
Parham Fishing Port		
Ice-making Plant	Cap. 1.5t/day	1 Unit
Ice Storage	Cap. 3.0t	1 Unit
Cold Storage	2.4m×3.6m×2.4m	1 Unit
Standby Generator	75 KVA	1 Unit
Parham Fishing Port		
Ice-making Plant	Cap. 1.0t/day	1 Unit
Ice Storage	Cap. 2.0t	1 Unit
Cold Storage	2.4m×4.5m×2.7m	1 Unit
Standby Generator	75 KVA	1 Unit

(2) Basic Design Drawings

Parham Fishing Port

Urlings Fishing Port

GENERAL LAYOUT PLAN (PARHAM)

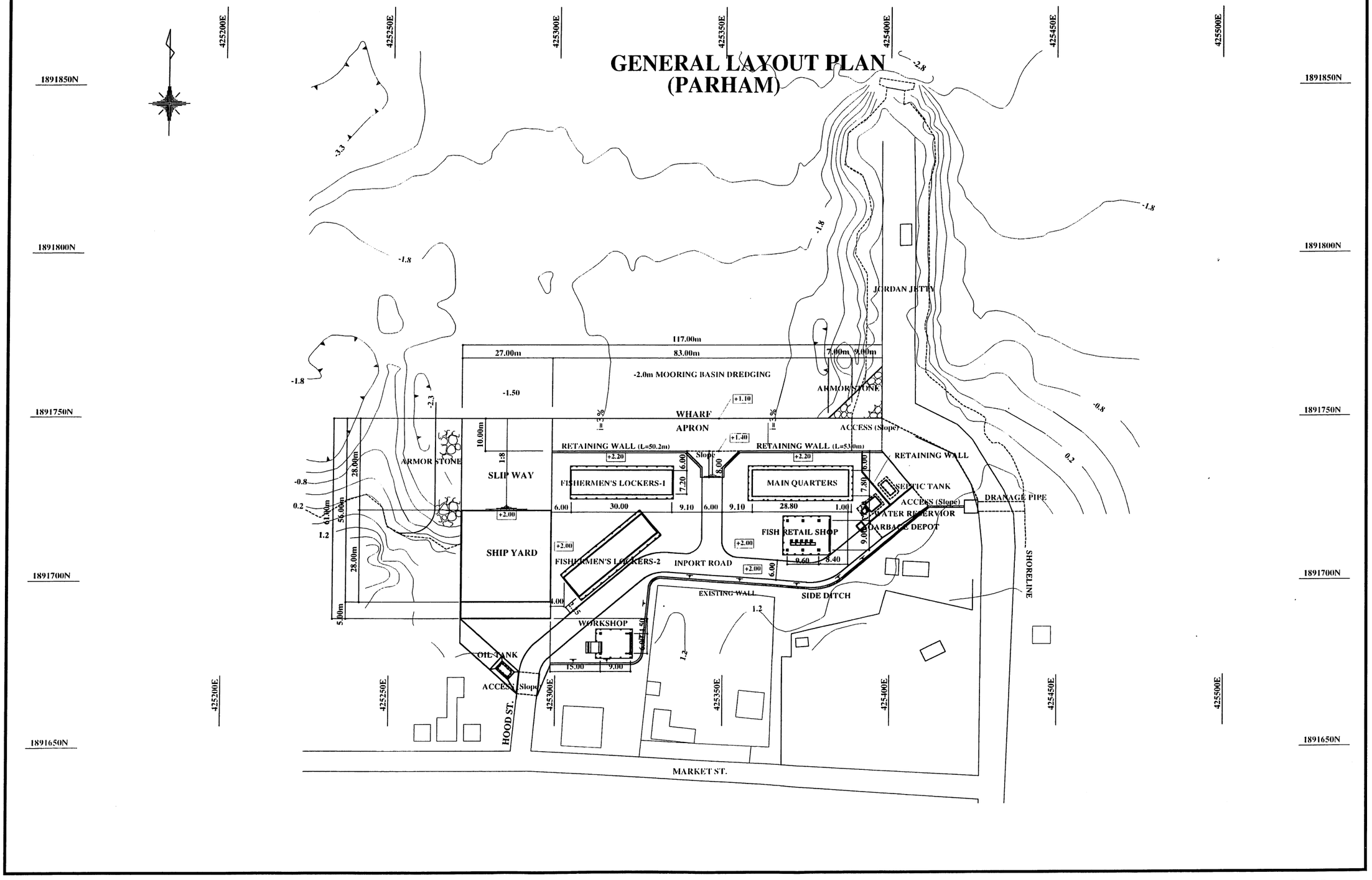


Figure 2.3.9-1 Overall Layout Plan (Parham)

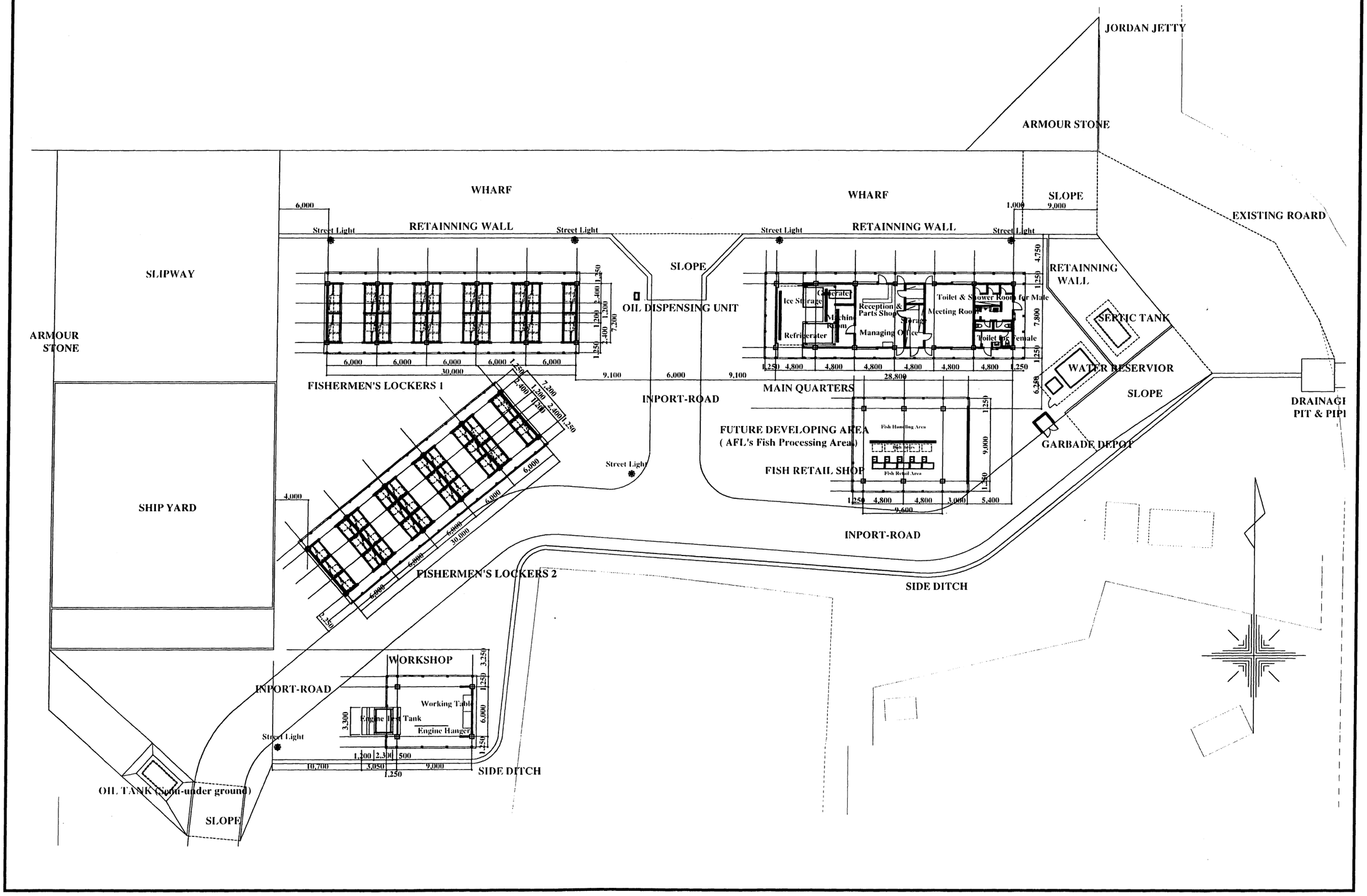


Figure 2.3.9-2 Facility Layout Plan (Parham)

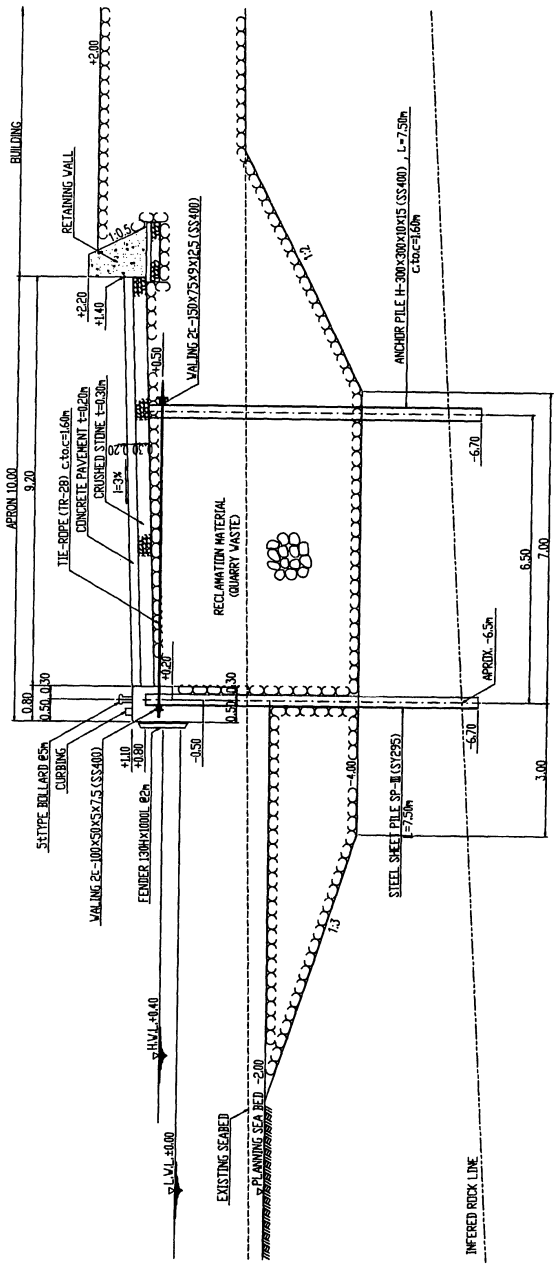


Figure 2.3.9-3 Cross Section of Wharf

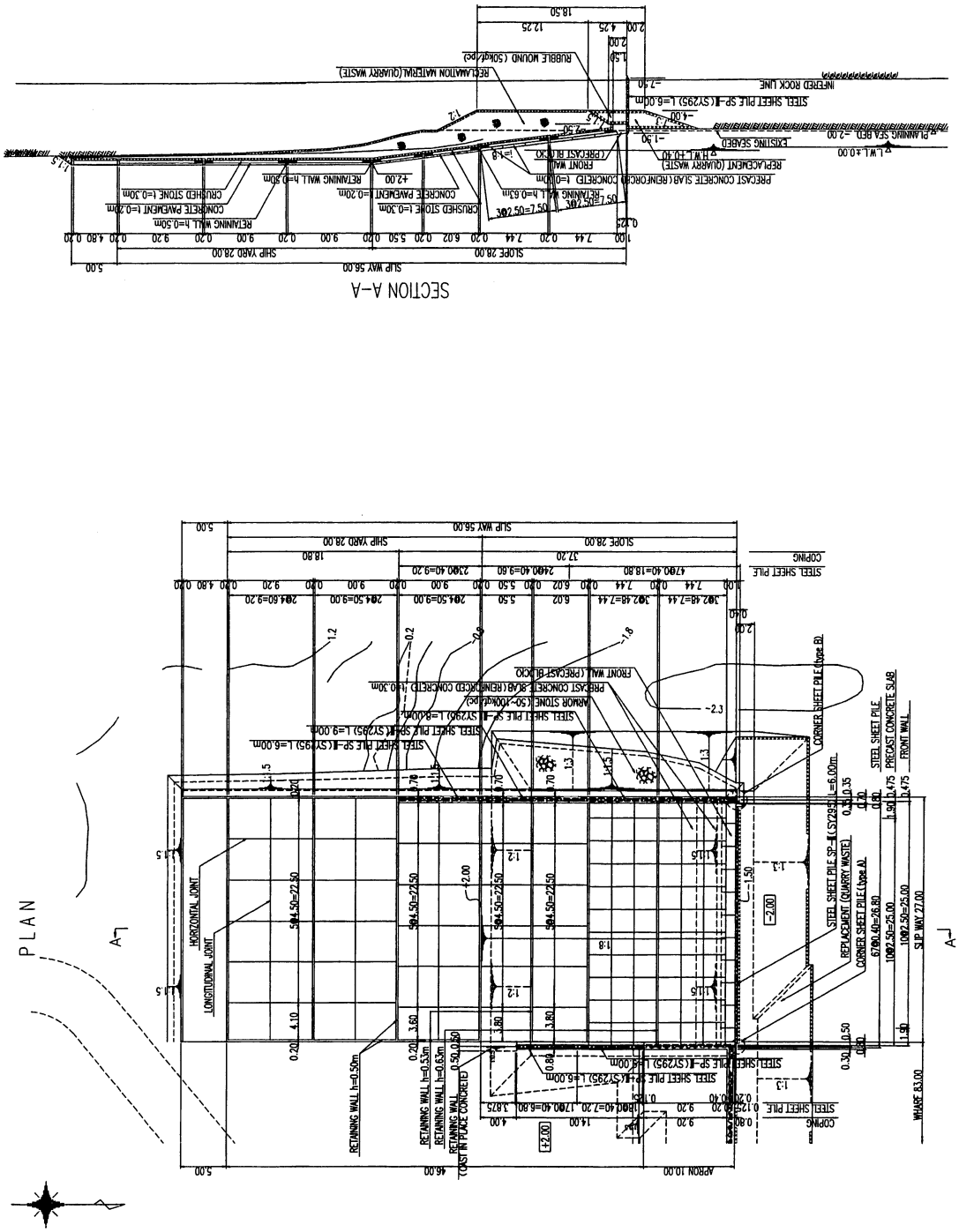


Figure 2.3.9-4 Cross Section of Slipway

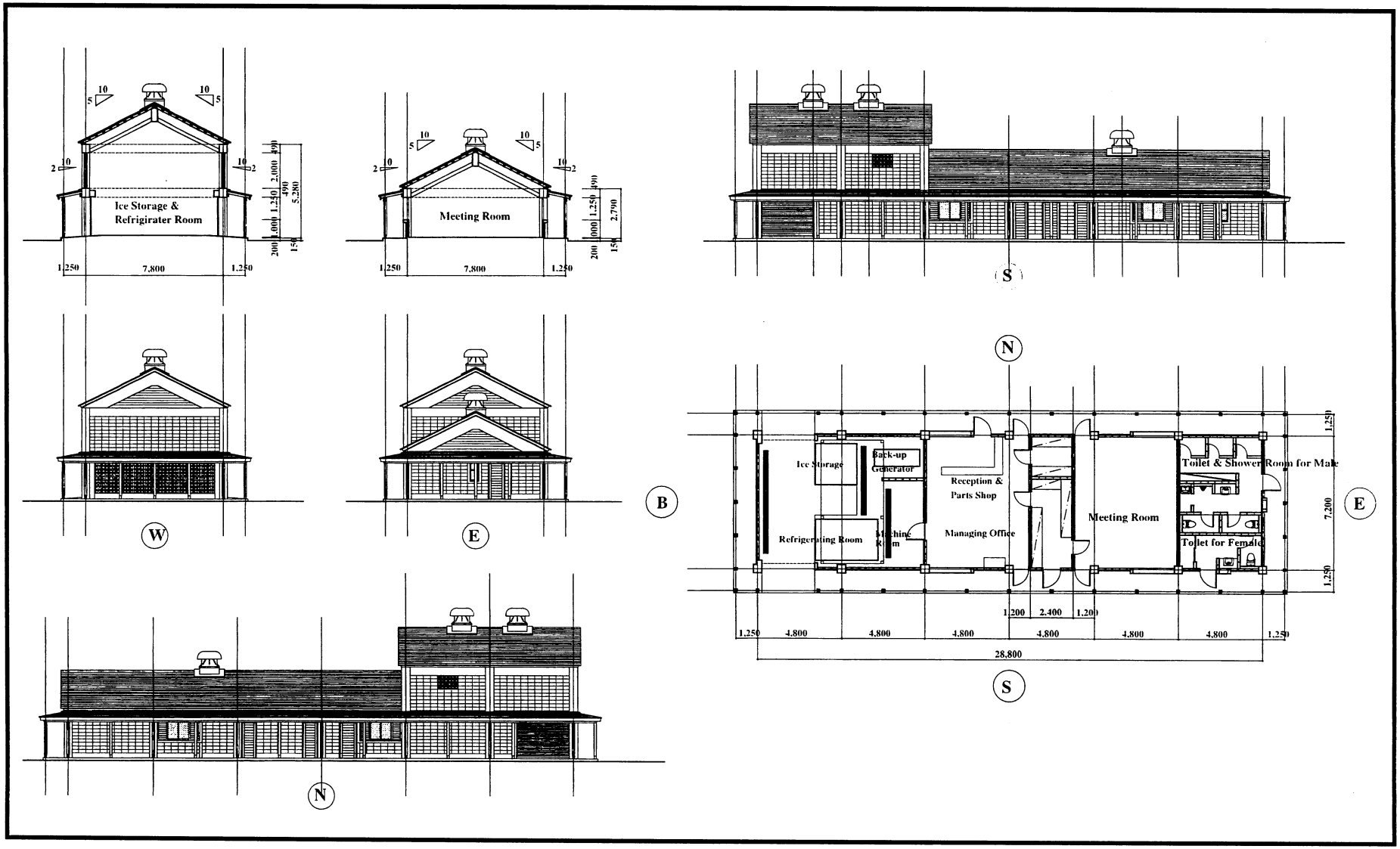


Figure 2.3.9-5 Plan / Section of Main Facility Building

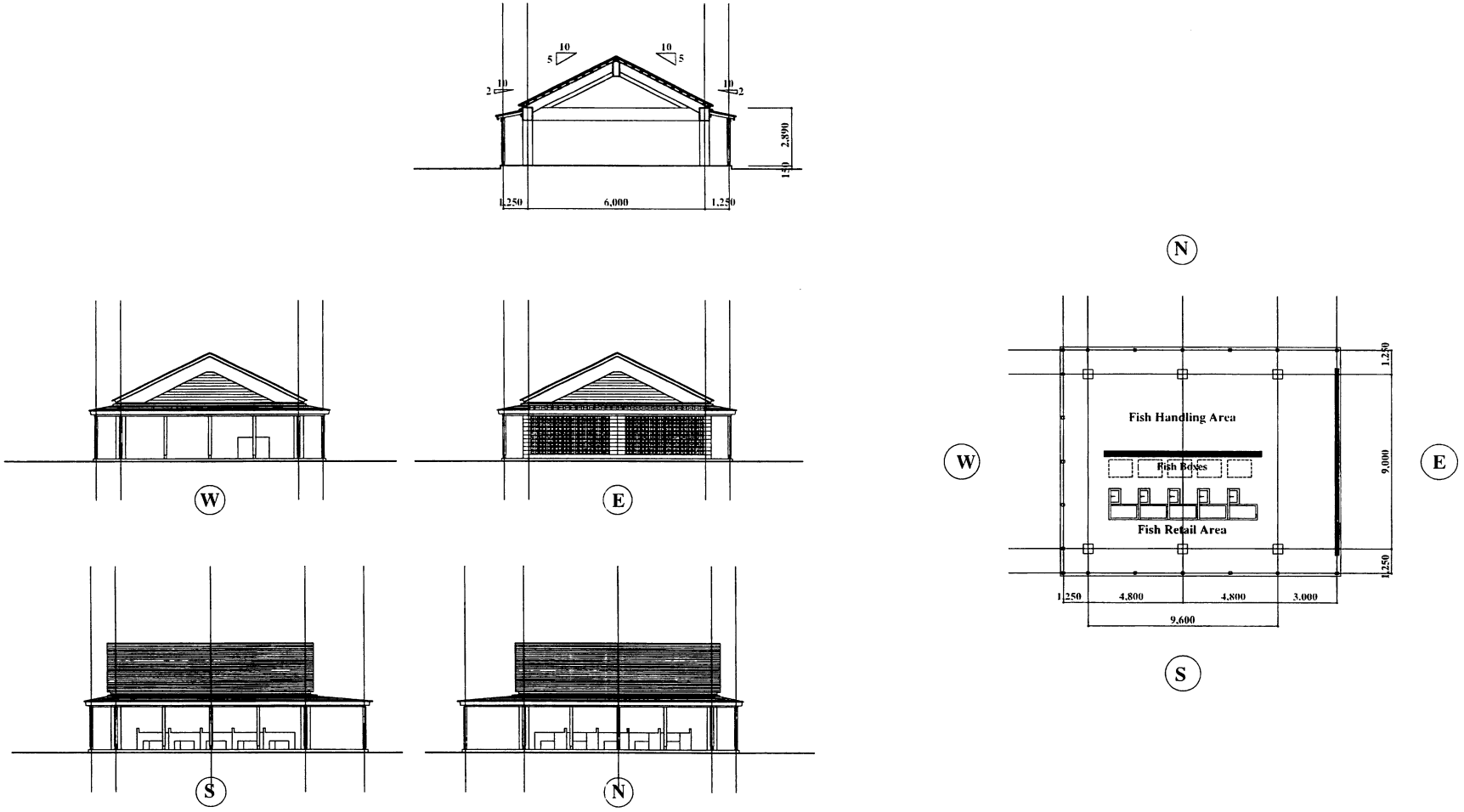


Figure 2.3.9-6 Plan / Section of Fish Retail Shop

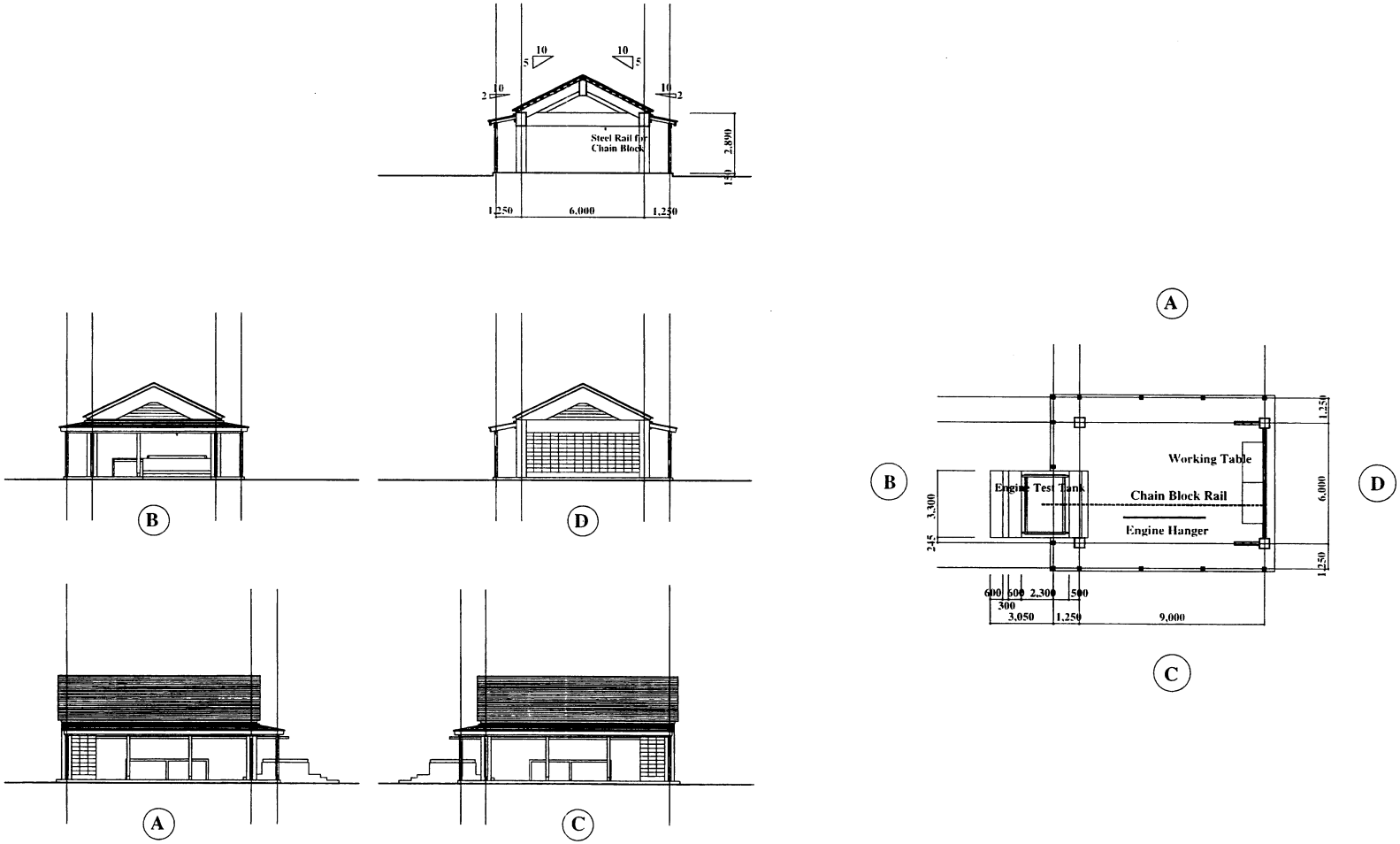


Figure 2.3.9-7 Plan / Section of Work Shop

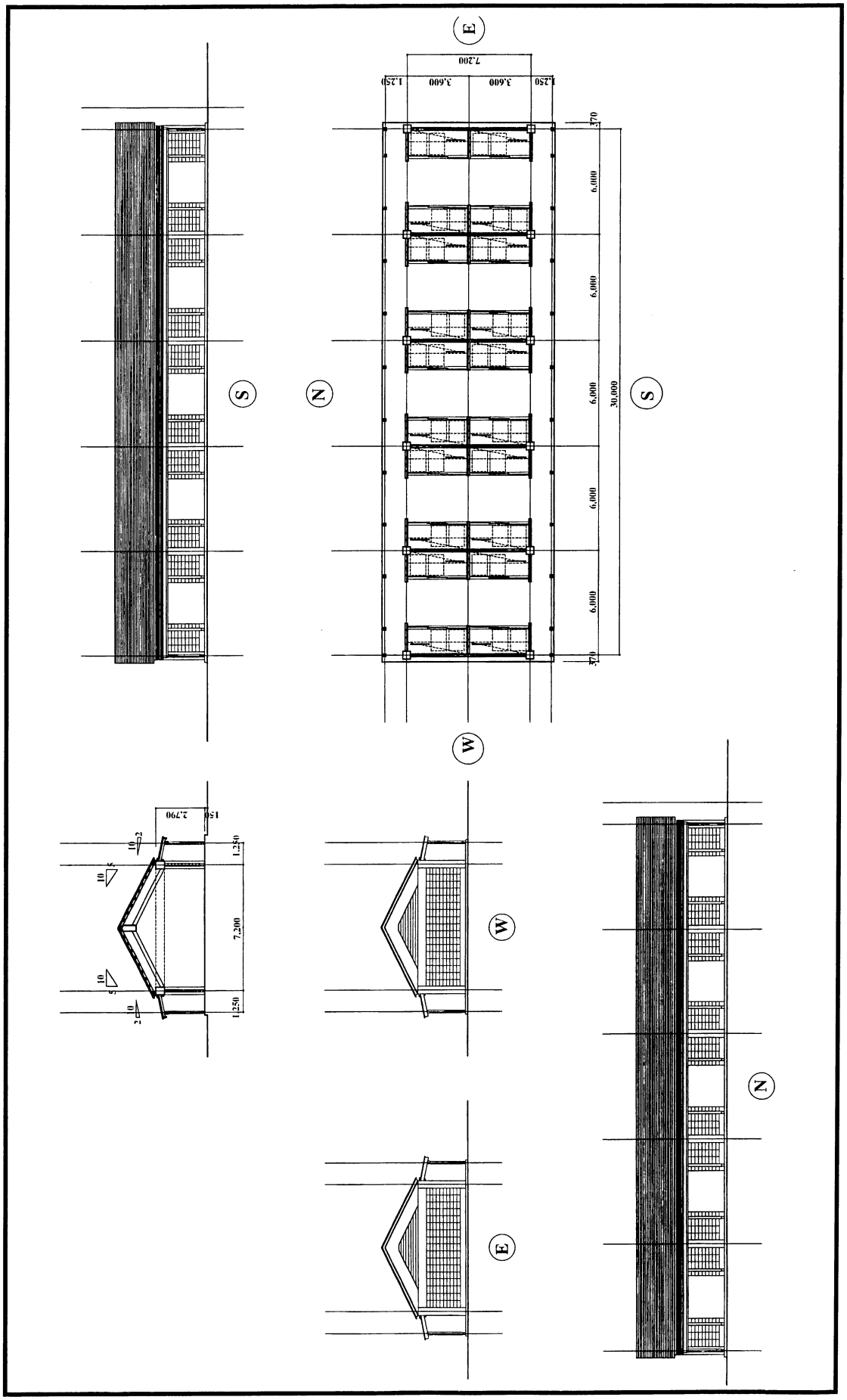


Figure 2.3.9-8(1) Plan / Section of Gear Locker

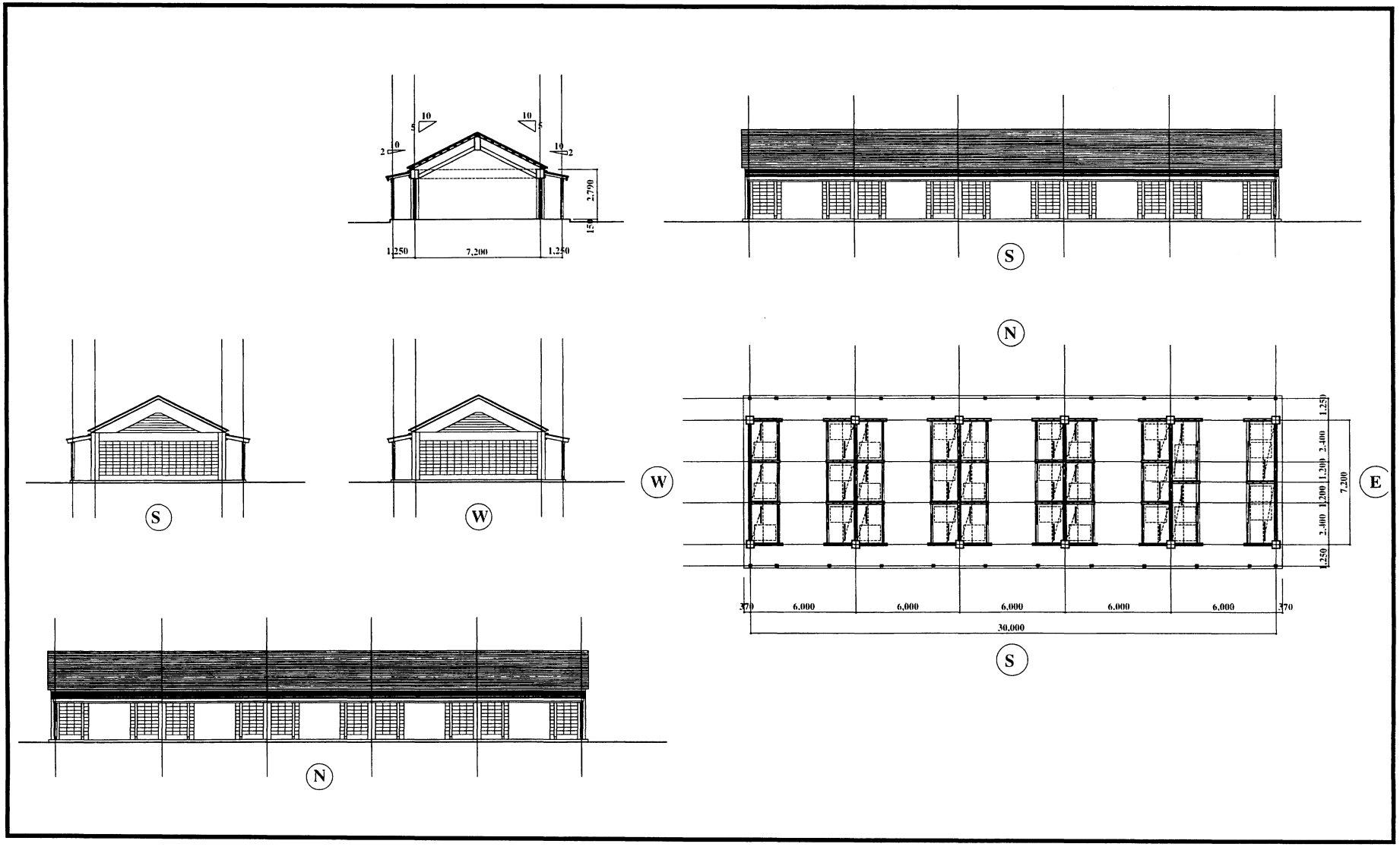


Figure 2.3.9-9(2) Plan / Section of Gear Locker

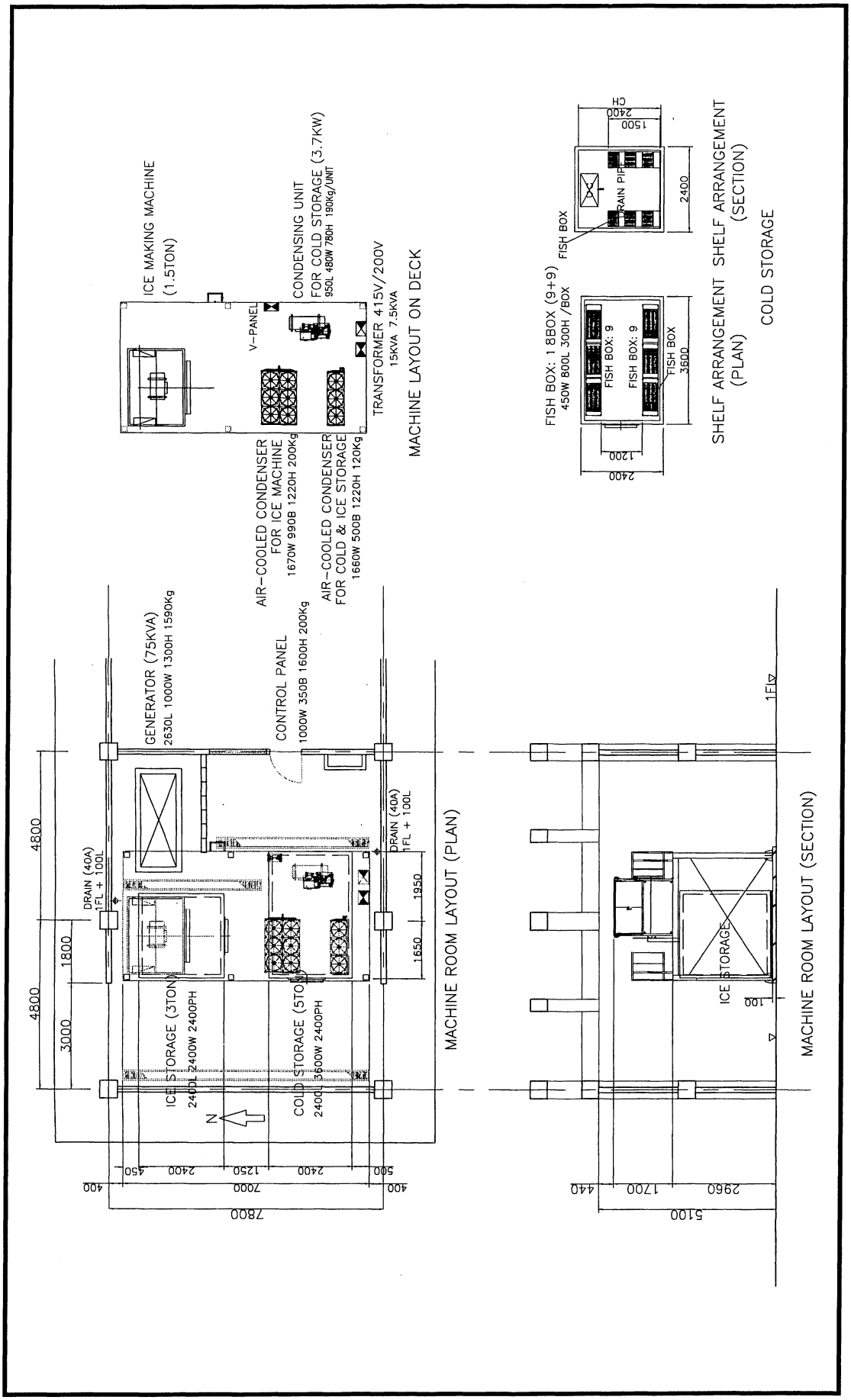


Figure 2.3.9-9 Facility Plan of Ice-making / Cold Storage

GENERAL LAYOUT PLAN (URLINGS)

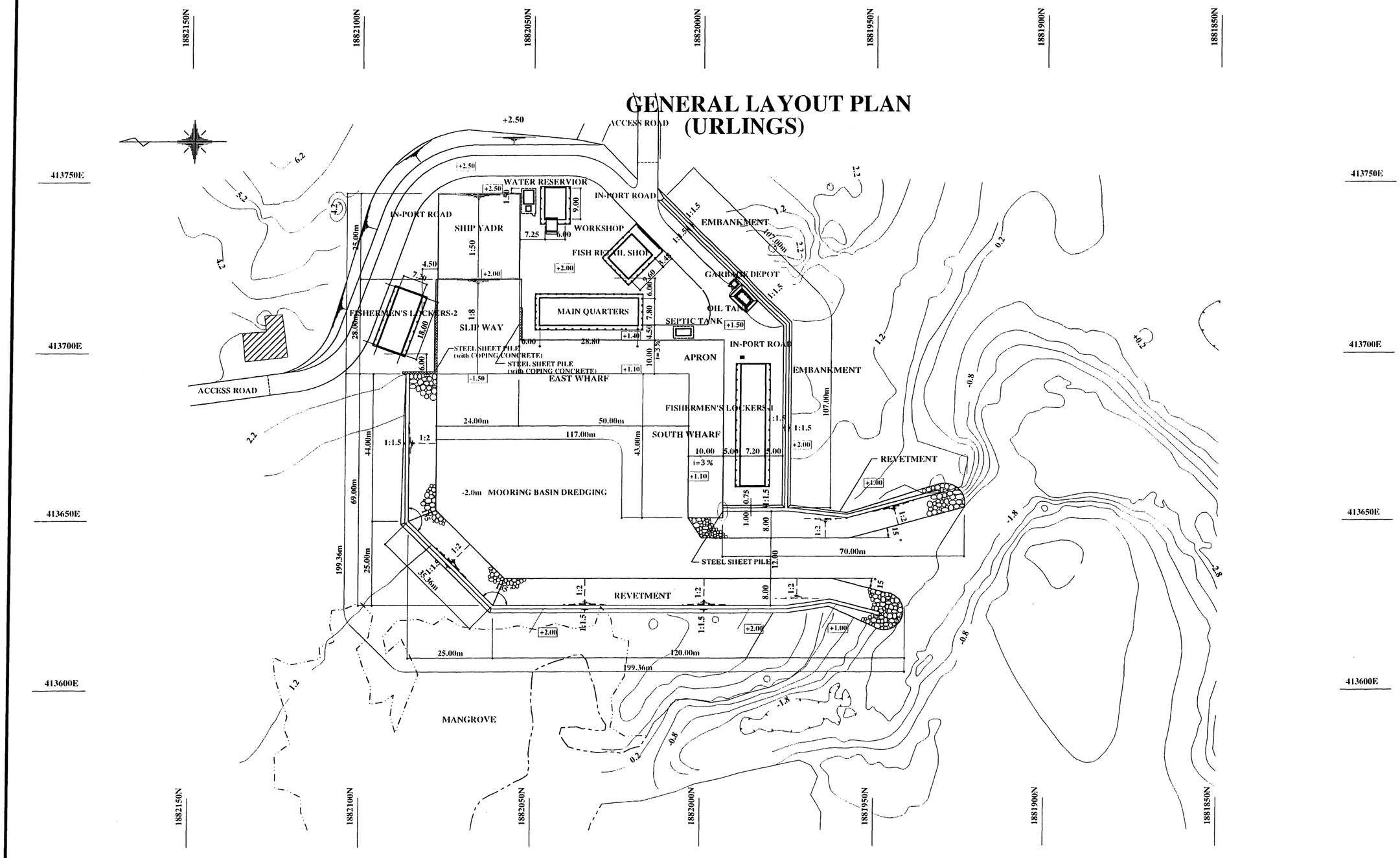


Figure 2.3.9-10 Overall Layout Plan (Urlings)

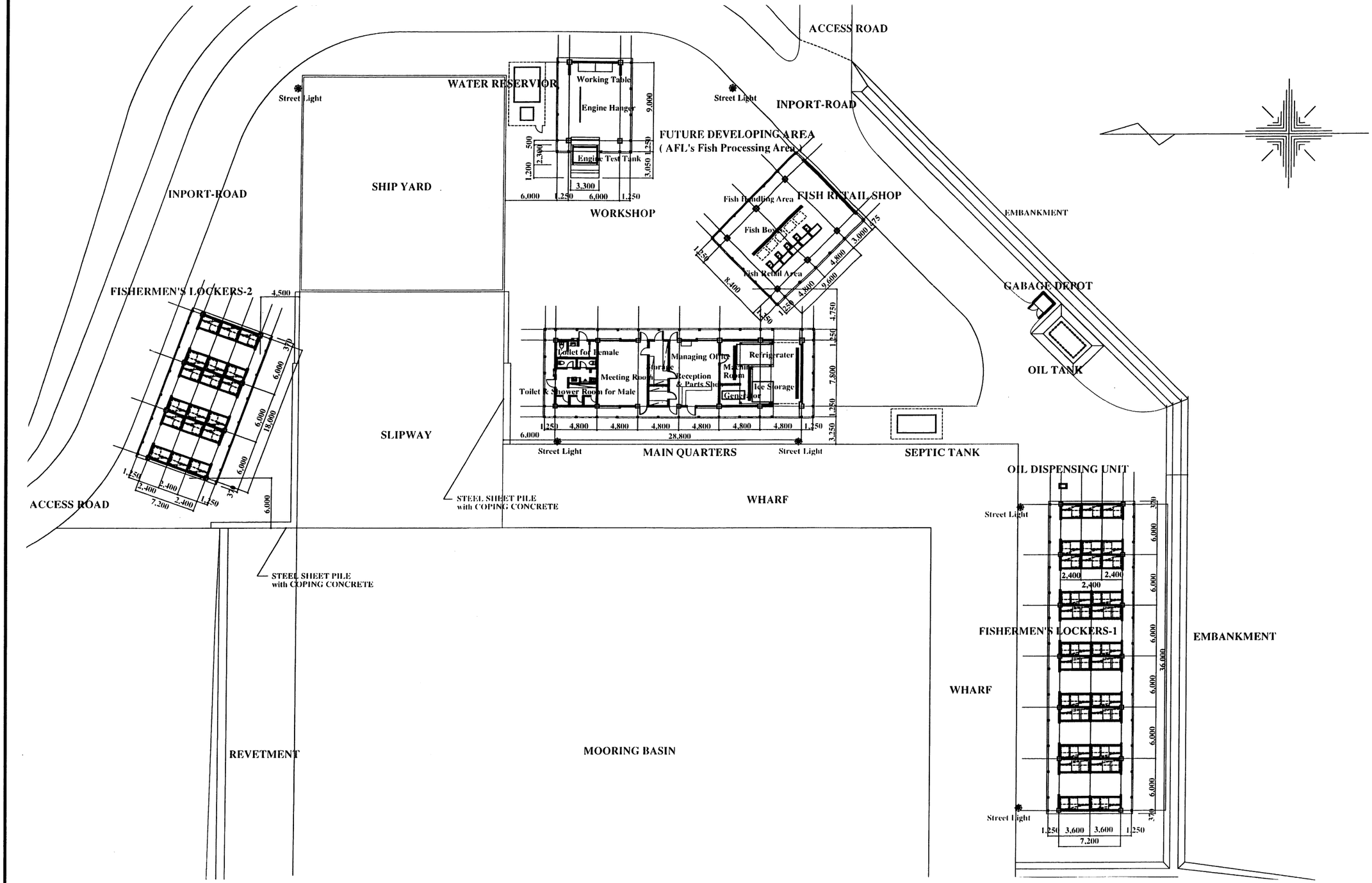


Figure 2.3.9-11 Facility Layout Plan (Urlings)

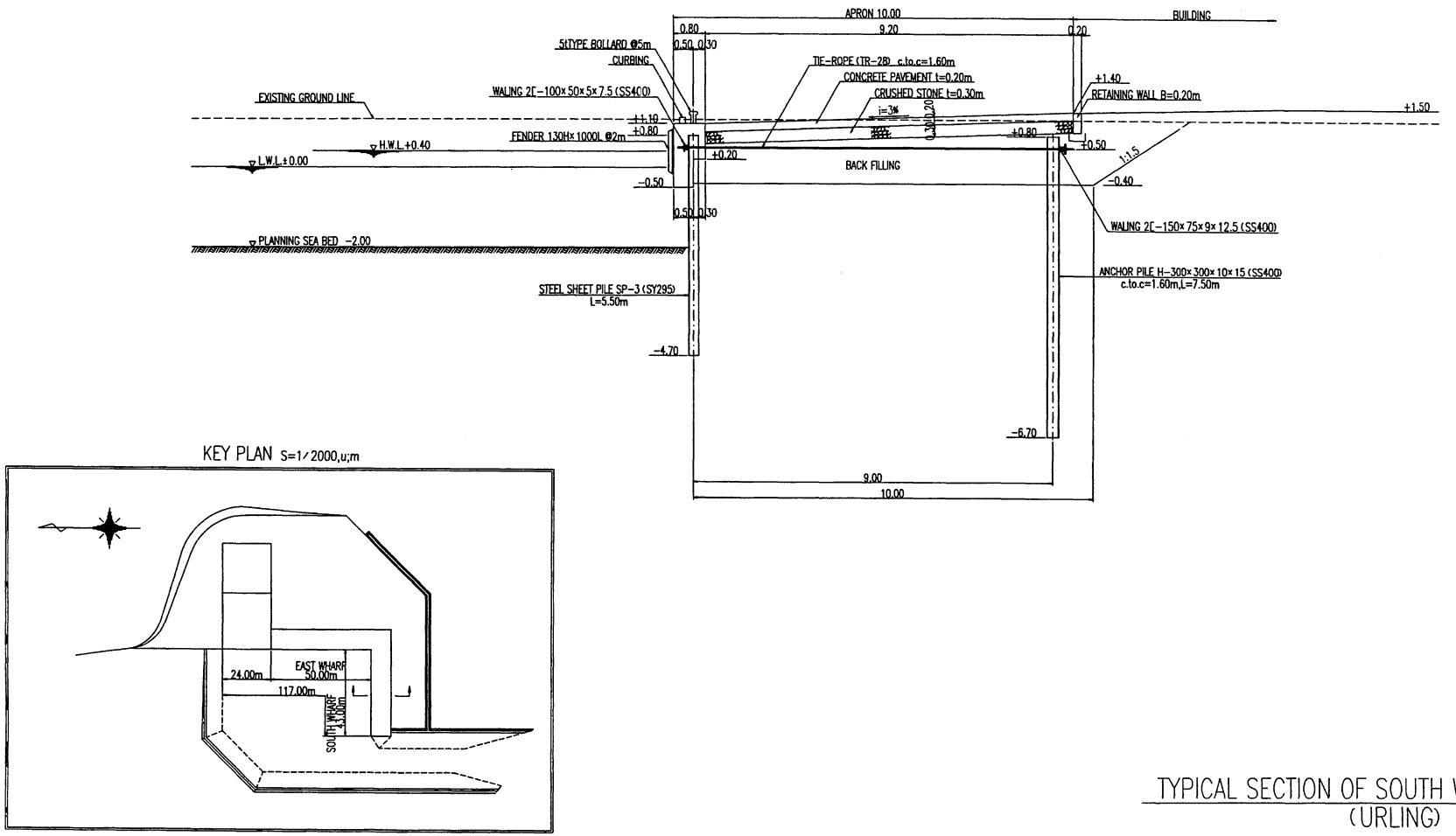


Figure 2.3.9-12(1) Cross Section of Wharf

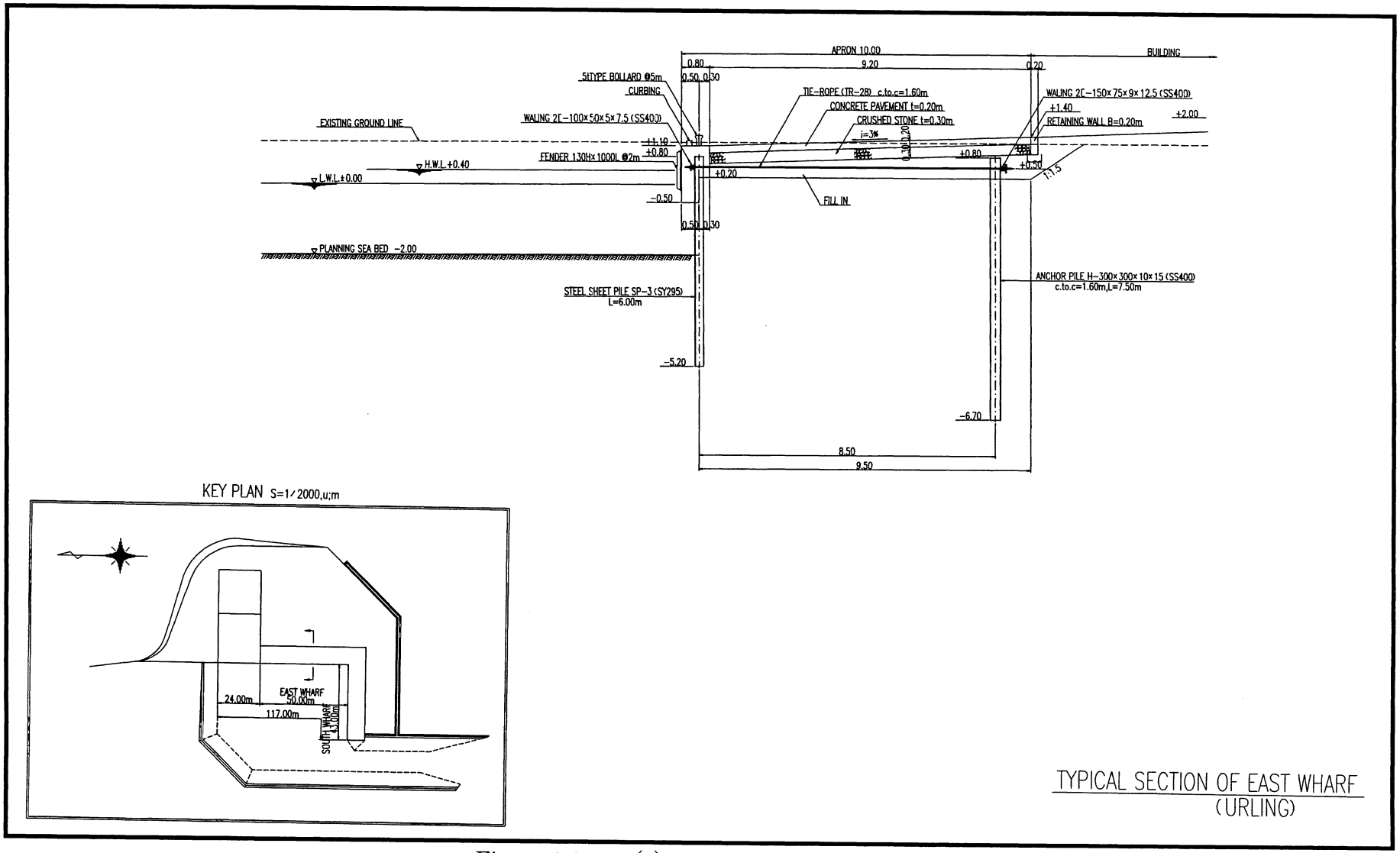


Figure 2.3.9-12(2) Cross Section of Wharf

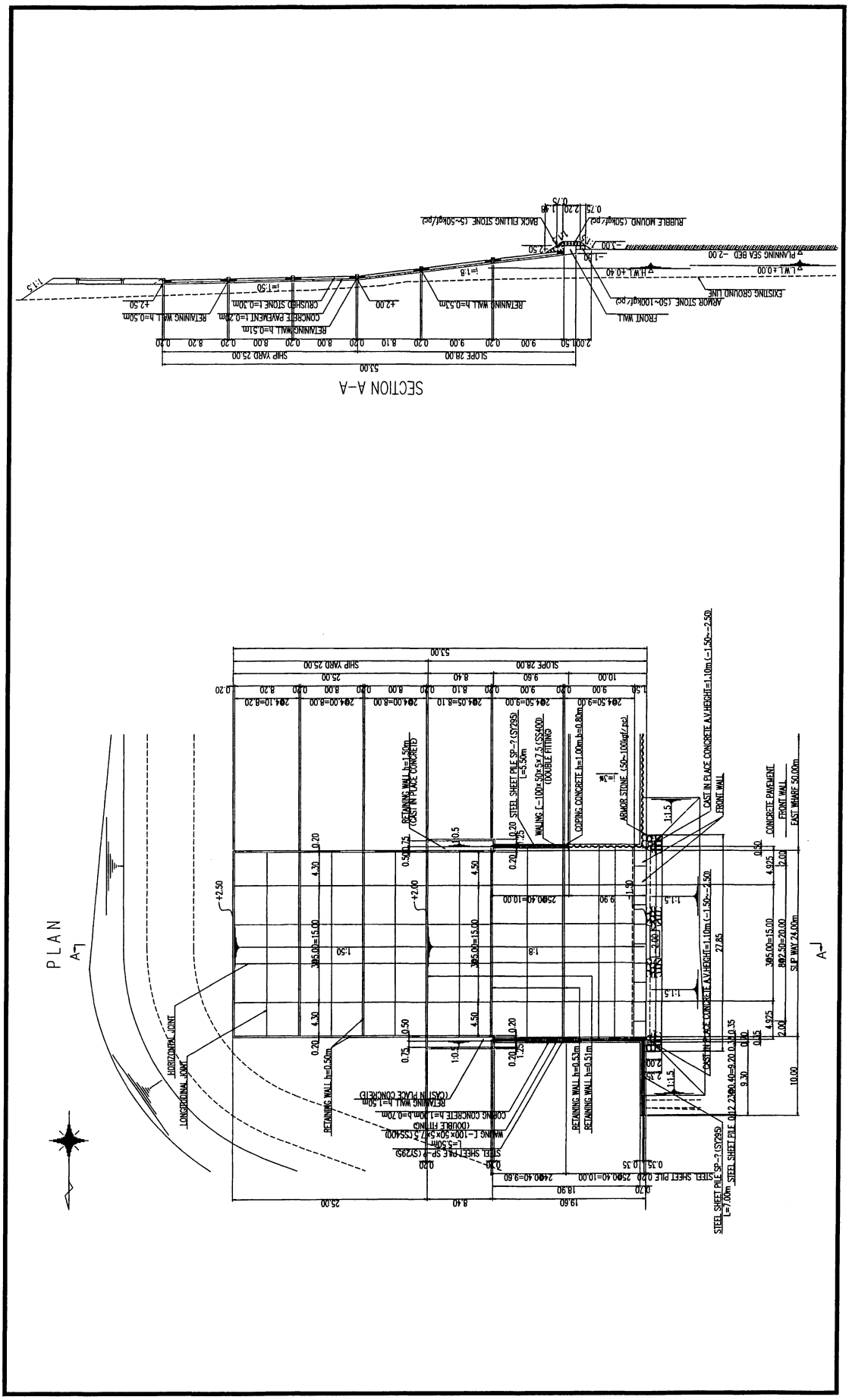


Figure 2.3.9-13 Cross Section of Slipway

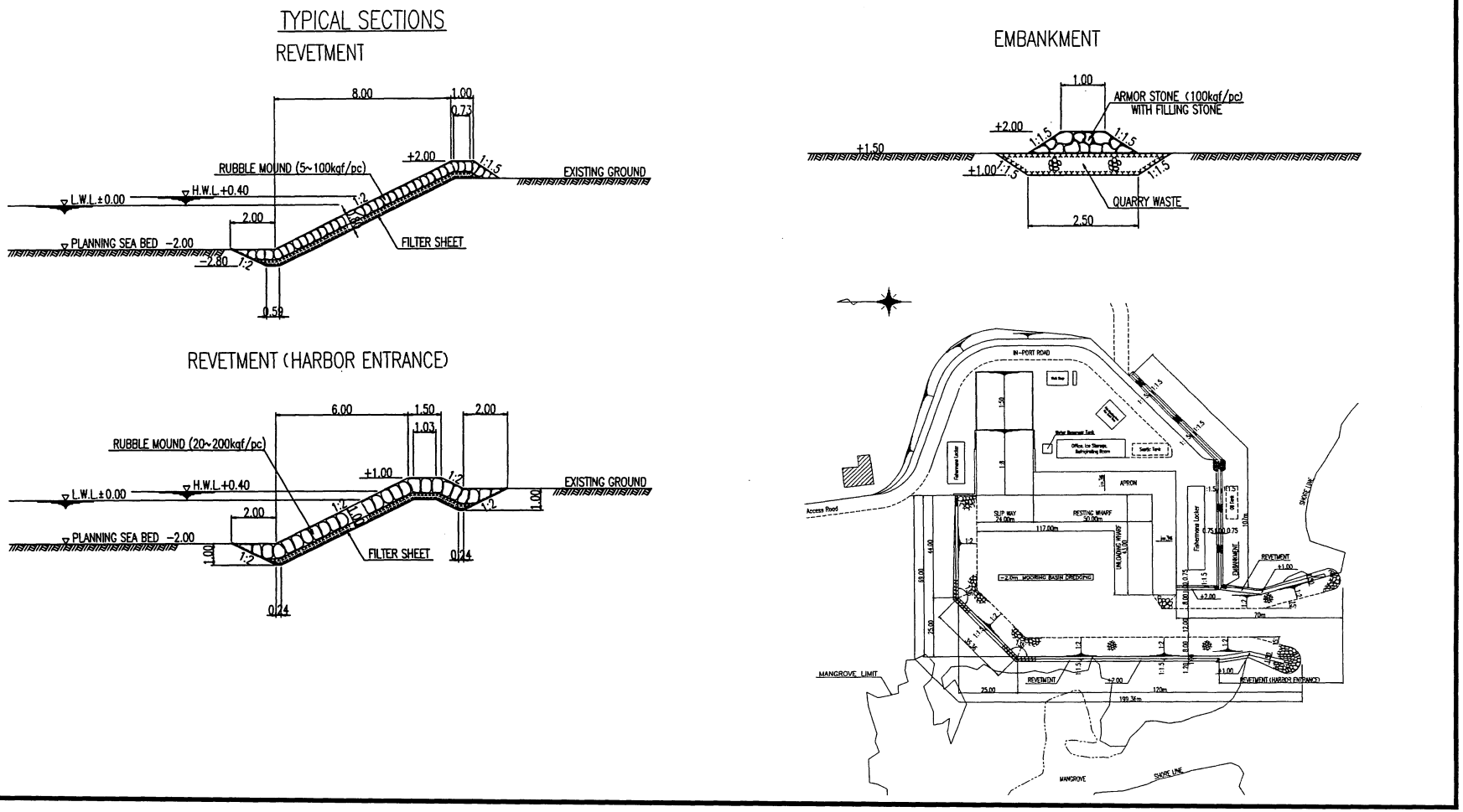


Figure 2.3.9-14 Cross Section of Revetment

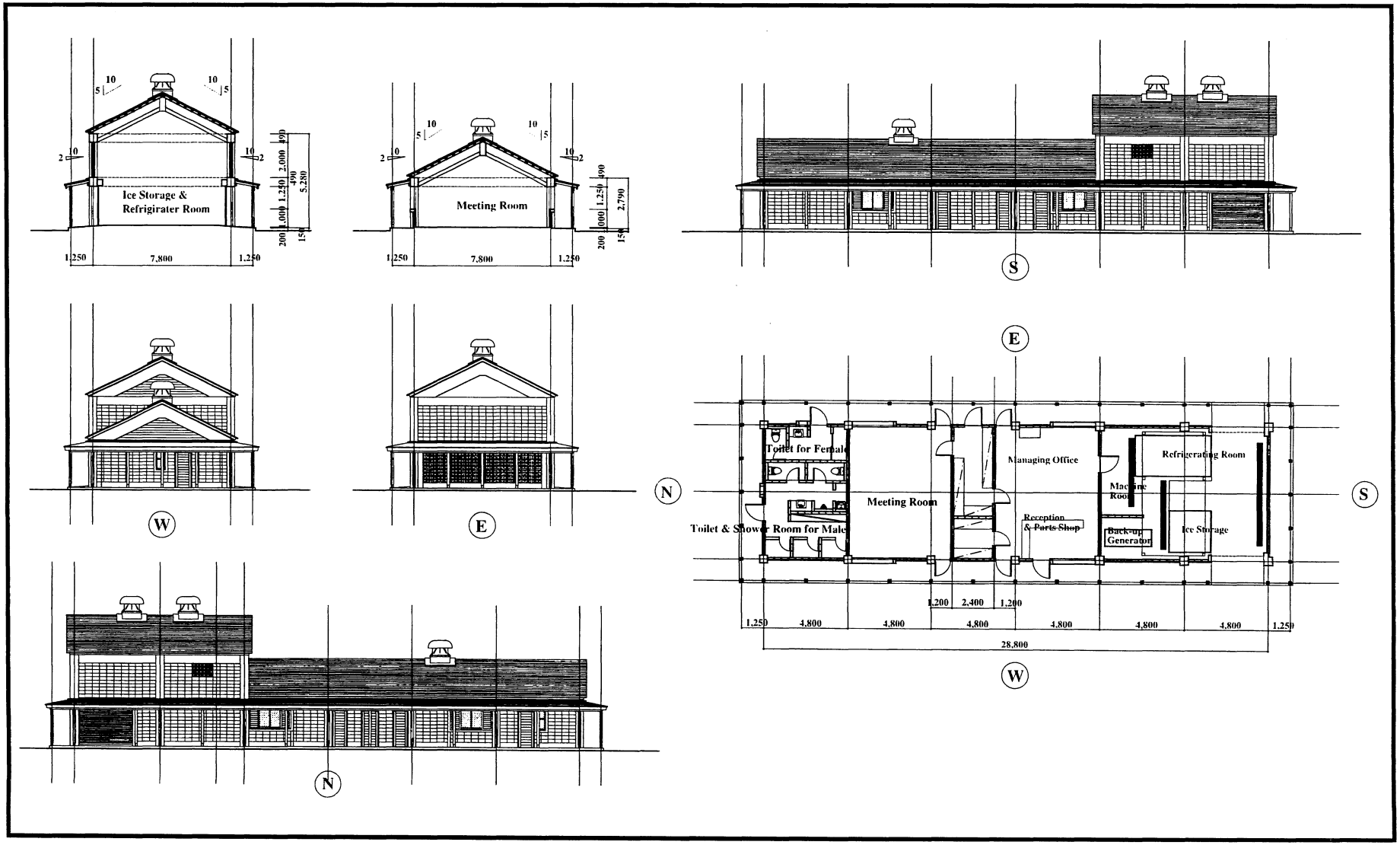


Figure 2.3.9-15 Plan / Section of Main Facility Building

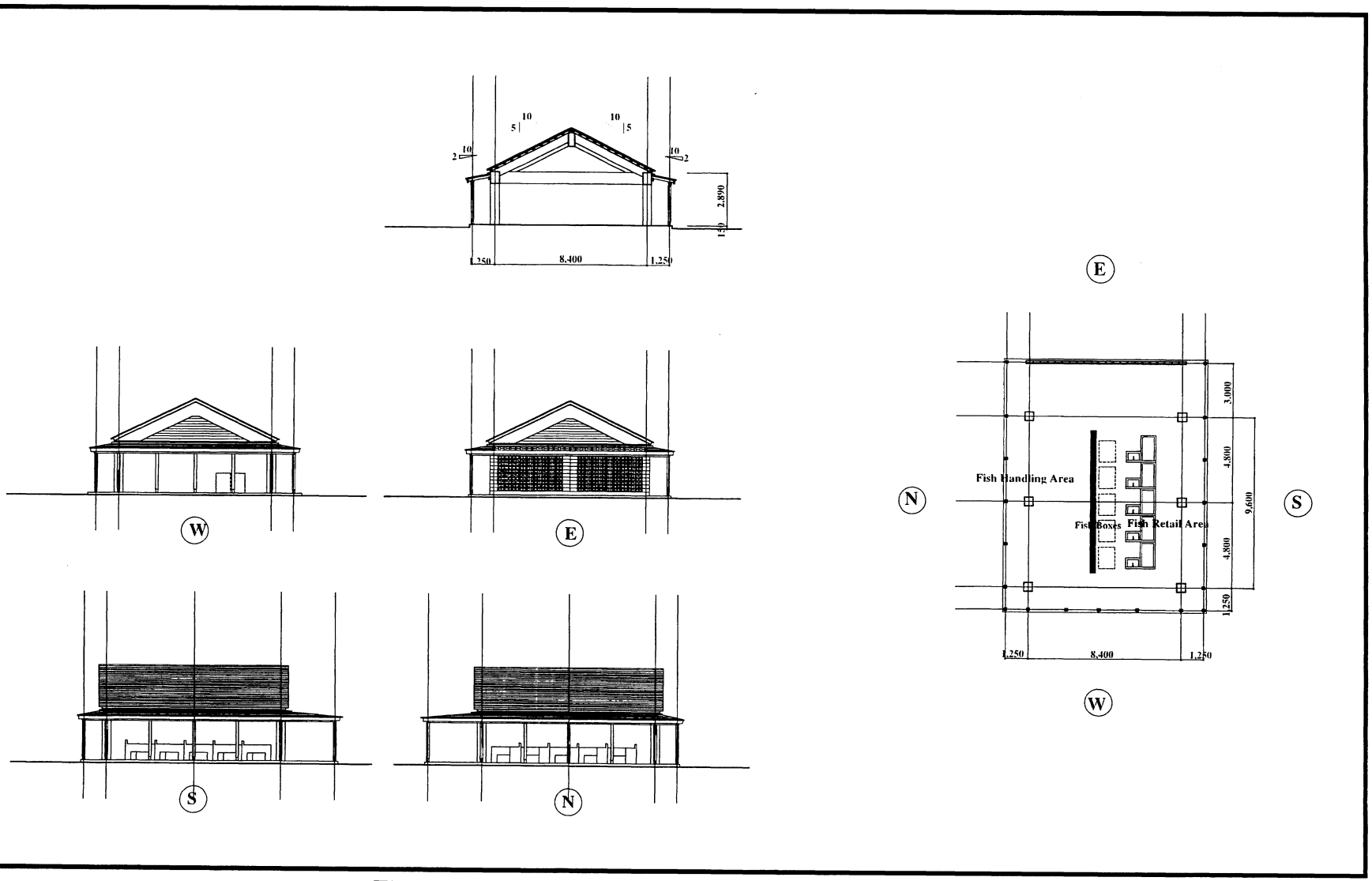


Figure 2.3.9-16 Plan / Section of Fish Retail Shop

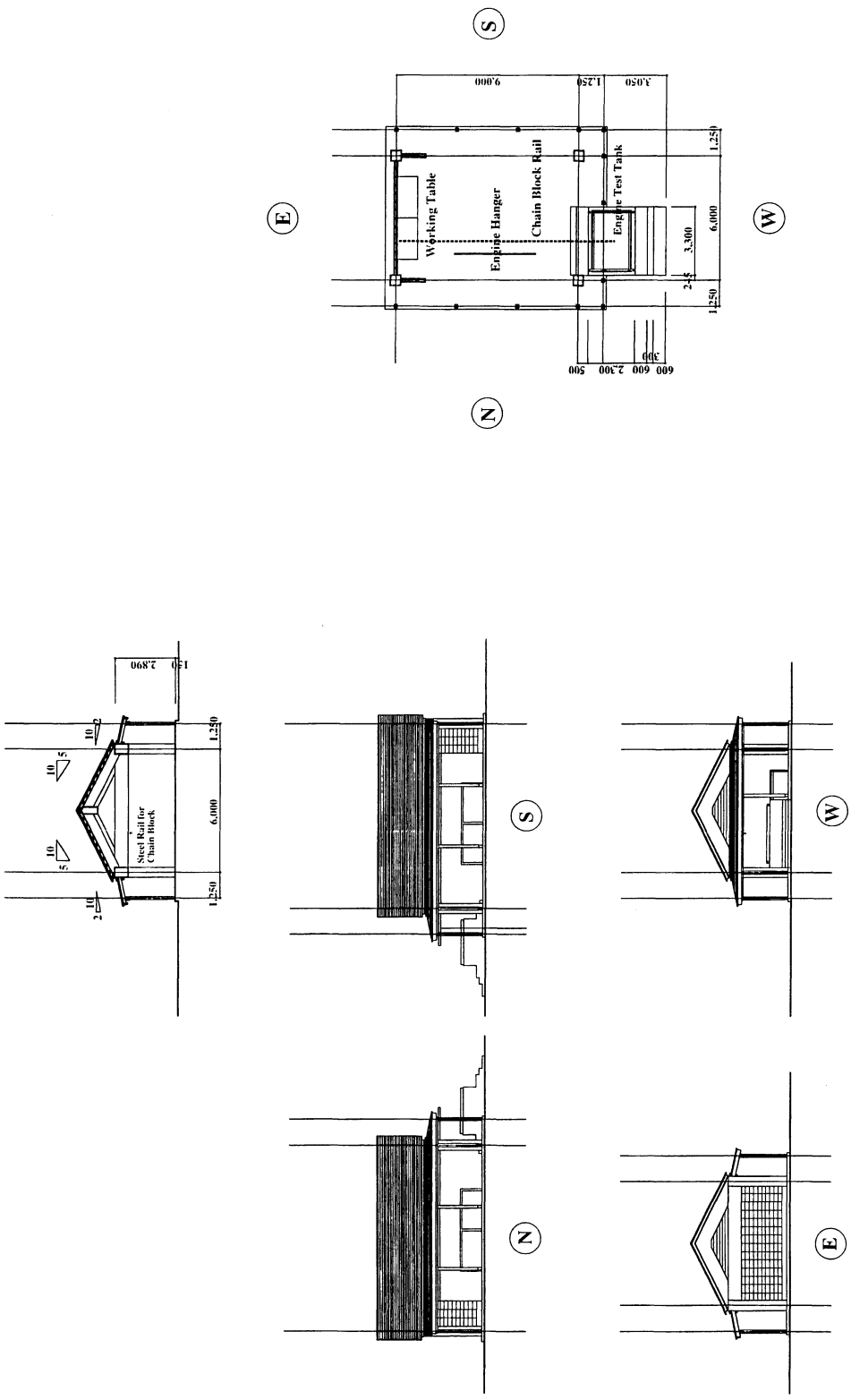


Figure 2.3.9-17 Plan / Section of Workshop

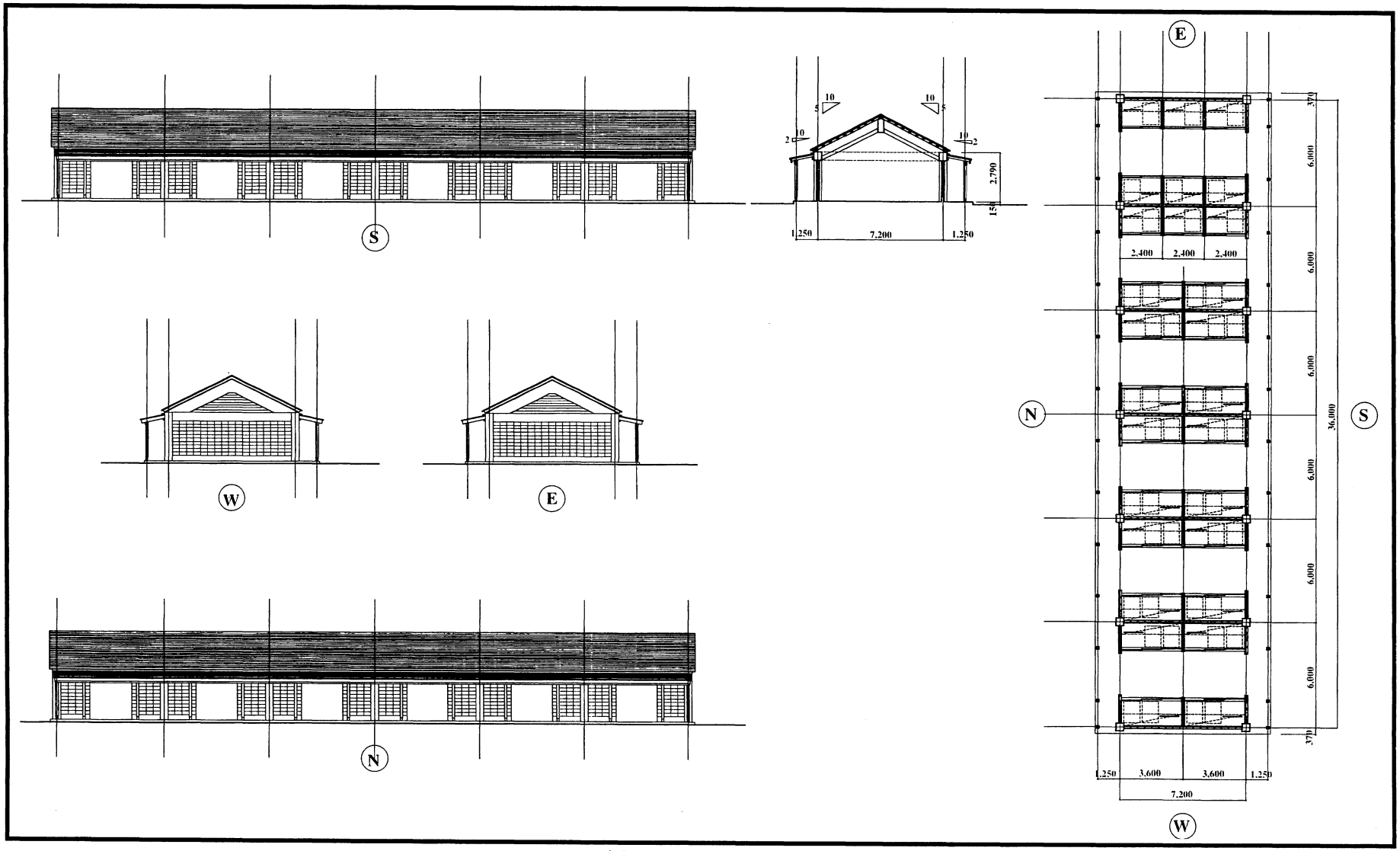


Figure 2.3.9-18(1) Plan / Section of Gear Locker

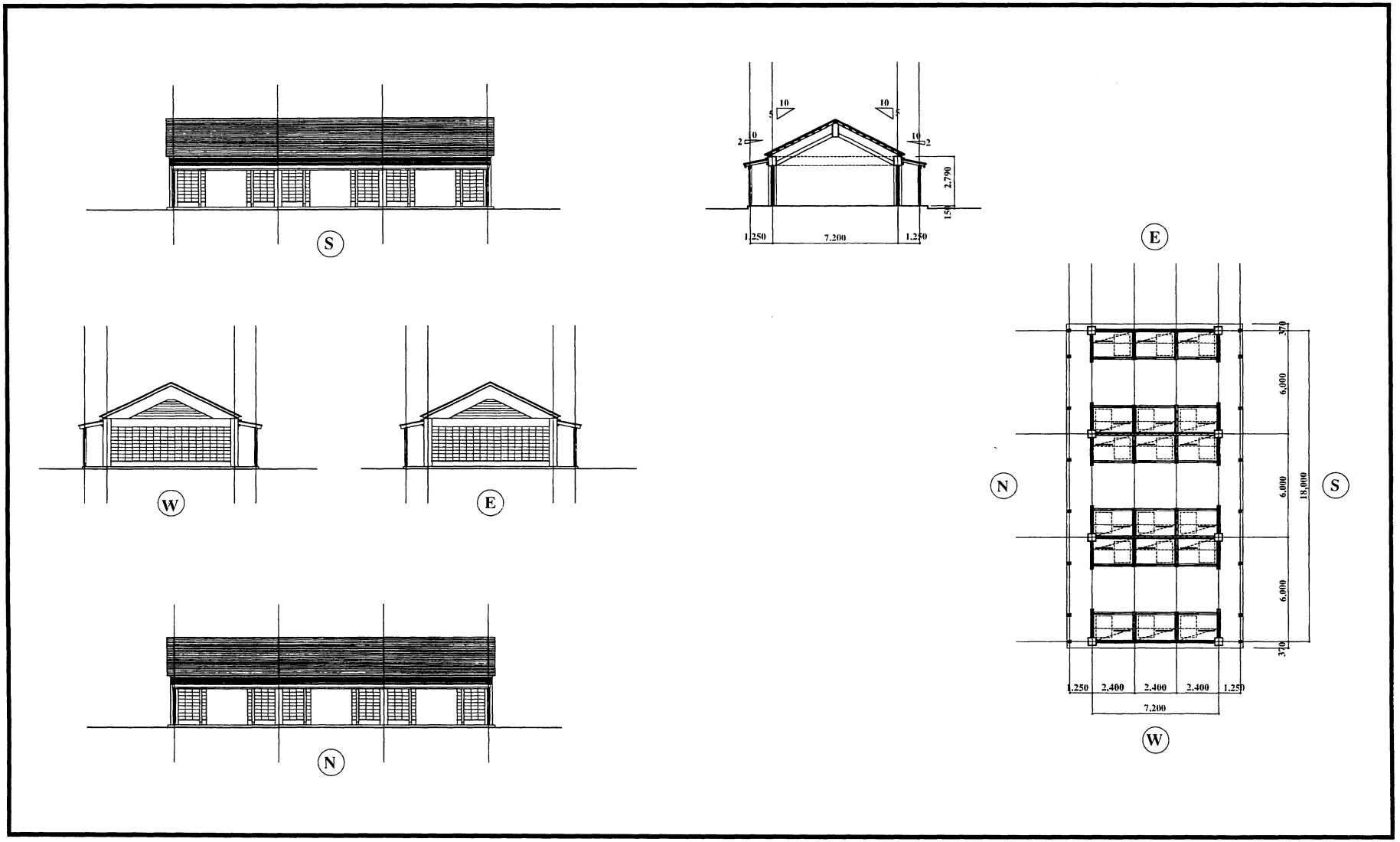


Figure 2.3.9-18(2)　Plan / Section of Gear Locker

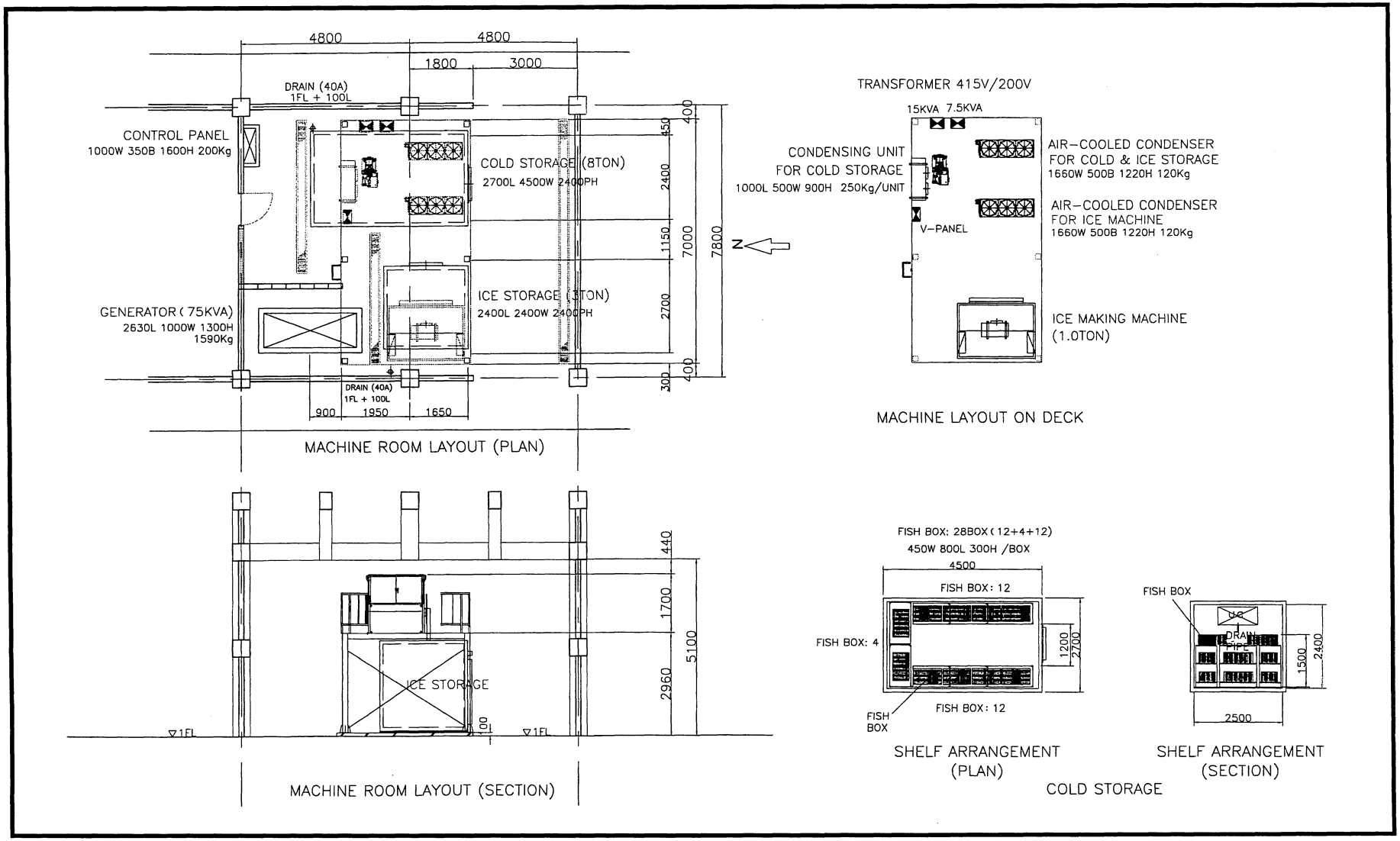


Figure 2.3.9-19 Facility Plan of Ice-making / Cold Storage

2.3.10 Environmental Consideration

(1) Parham Site

This project will require land reclamation to secure a land for port facilities and dredging to attain enough depth of DL-2.0m. Reclamation and dredging are considered to be two major factors of environmental disturbance for marine life.

Any reclamation forces marine life to lose their habitat. Undoubtedly, any habitat is useful for a certain life form. Therefore, evaluation of reclamation as an environmental impact must take into account the quality and quantity of habitat lost by it. For marine life, mangrove forest, sea-grass bed, coral high coverage area and so on are known as critical habitats. These areas provide feeding ground, spawning ground and etc. for many marine organisms.

In this case, there are no coral species on the site and surrounding areas. Sea-grass bed composed of three species such as turtle grass *(Thalassia testudinum)*, mantaee grass *(Syringodium filiforme)* and marib seagrass *(Halophilia baiollonis)* indicate patchy and huge distribution on the surrounding area but not on the project site. And mangrove forests composed of three species such as red mangrove *(Rhyzophora mangle)*, black mangrove *(Avicenia germinans)* and buttonwood *(Conocarpus erectus)* are distributed on the west and east sides relatively far from the project site. Only young trees of red mangrove and buttonwood live solely on the edge of the existing pier, a part of project site and of course dose not make a forest. After checking the quality and quantity of the critical habitat such as coral reef, sea-grass bed and mangrove forest on the project site, reclamation is not considered to make heavy environmental impact on the mangrove forest and the sea-grass bed.

Dredging on the sea-bottom disturbs a habitat especially benthos and at the same time, influences the marine organisms that tend to dislike the turbid water because of low transparency and high deposition of silt. For example, coral species living in the clean seawater can live under the circumstances of temporally turbid water and small amount of silt. However, long periods of turbid and a large amount of silt gradually weakens coral ability of cilia motion to exclude the silt on the polyp and eventually, causing coral to die. Some fish and benthos are known to take behavior of avoiding the turbid water.

The surrounding water of the project site is classified as semi-confined water and the bottom of this area are composed of fine sand and mud making

it easy to cause turbid water. Therefore, this marine ecosystem originally has a biotic component of relatively strong species to turbid such as sea-grass but weak species to turbid like coral species. And sea-grass species grows by means of extending the subterranean stem. Even though dredging area will include the part of sea-grass bed, they will be able to recover the new bottom by the way of propagation. Meaning, there will be temporary lost of function of sea-grass bed on the bare bottom.

During the reclamation and dredging work, silt protection should be continually kept as a countermeasure of environmental impact to prevent the dispersion of turbid water from the site. Marine life living in the surrounding water of the site will not be influenced by this project.

(2) Urlings Site

This project site is located just behind the existing small temporary stone made jetty. Therefore, the berth of new port should be constructed on the land by means of dredging. The new channel leading to the whrlf from the seaside also will be constructed by means of dredging and opening the sandy beach. The two types of dredging are considered to be the major factors of environmental disturbance for marine life on Urlings.

Land dredging will not directly have effect on the marine ecosystem other than the washed away of land soil, agricultural chemicals and so on. Land dredging is considered to have impact on the land ecosystem rather than the marine ecosystem. This project site is located at the outskirts of residential area of Urlings and already disturbed by the transformation to the pasture and the flood caused by the past hurricanes. So, this site does not keep the good wilderness and does not have deep impact on the nature by dredging for a new port construction.

And this project has been designed to prevent directly cutting any mangrove trees distributed on the eastern edge of the forest. This area's mangrove forests also composed of three species such as red mangrove *(Rhyzophora mangle)*, black mangrove *(Avicenia germinans)* and buttonwood *(Conocarpus erectus)* are distributed on the west and east sides of the project site.

Dredging for making a new access channel from seaside to a new whrlf will cause the lost of a part of sandy beach. However, this part of the sandy beach is already being used for a fish landing place and should be evaluated as an extremely low quality of critical habitat. This beach utilization pattern

means the experiences of human impacts such as frequent cars' and man's leisure. And the sand and gravel produced by the past dredging on the sea-bottom in front of the existing jetty have been disposed of just behind the beach. These sand and gravel have been spread out by the storms and covered the vegetation. These sand and gravel can be seen on the bottom of a part of dried and dead mangrove area near the project site. Therefore, no heavy impact is expected on the sandy beach ecosystem by the construction of this project.

The surrounding water of the project site will be getting turbid water caused by the access channel dredging. The sea-grass bed and coral high coverage area were not observed near and in front of the project site. The bottom of existing channel in front of the project site has been dredged and water is highly turbid. The bank of the channel showed the bared sand and gravel bottom. The bottom of channel composed of fine sand and mud, is dominated by the three finger leaf alga *(Halimeda incrassata)* . This area should be evaluated as a human impacted area and a low quality of habitat.

During the construction including land and access channel dredging, silt protection should be continually kept as a countermeasure of environmental impact to prevent the dispersion of turbid water from the site.

Chapter 3

Implementation Plan

Chapter 3 Implementation Plan

3.1 Implementation Plan

3.1.1 Implementation Concept

(1) Basic Concept

a) For the implementation of the Project for Construction of Parham Fishing Port and Urlings Fishing Port, after the Exchange of Notes (E/N) is signed between the Government of Japan and the Government of Antigua and Barbuda, a contract for undertaking consulting services will be concluded between the Government of Antigua and Barbuda and the Japanese Consulting Firm.

b) The Consulting Firm will prepare all the documents required for the tender and concluding the contract such as the drawings of the fishing port facilities, technical specifications, cost estimations and so forth. After the approval of these documents by the Government of Antigua and Barbuda, the contractor for this project will be selected from and among Japanese construction companies by examining their pre-qualifications and tender procedures.

c) The construction work will be performed by the selected construction company in accordance with the construction contract concluded between the Government of Antigua and Barbuda and the construction company.

d) The construction period is expected to last for phase-1 of 11 (eleven) months, and phase-2, 12 (twelve) months, i.e. totally 23 (twenty three) months are necessary site taking into considerations of the scale and complexities of the Project as well as the site conditions of each site, Parham Site and Urlings Site.

(2) Implementation Concept

a) The Parham Fishing Port to be built by the Project is a typical fishing port to be built on the reclaimed land in the waterfront. The construction of wharf and slipway with boat-yard will form the major components of the project in the port. The soil condition of this project site is so bad consisting soft clay layer which exists above on the bedrock all over the site not only on-land area but also offshore area. Therefore,

the construction work is needed to remove the bad sub-soil layer and replace to the good filling materials. Necessary attentions must be taken to prevent the affect to the environment such as to flow out turbid water to the vicinity area on the work for dredging and excavation. Also the reclaimed land will be compacted adequately against uneven subsidence of the reclaimed land area. Utmost efforts will be made to minimize the construction cost and shorten the construction period.

The Urlings Fishing Port to be constructed by the Project is a fishing port to excavate the in-land area. The construction of wharves and slipway with boat-yard and turning basin will form the major components of the project in the port. Almost port facilities such as wharves, slipway and revetment will be constructed by dry work to be made to minimize the cost and shorten the construction period. The on-land facilities will be constructed on the good soil condition area after confirmation of the bearing capacity of ground for the buildings. The port layout plan and countermeasures to protect the mangrove forest close to the site and the existing coral offshore of the site will be taken under construction works.

b) Some local construction companies in Antigua and Barbuda have had experience as a sub-contractor in undertaking large scale construction projects, for instance, the construction of Heritage Quay Project in St John's, the project for construction of Fish Landing and Distribution Facilities granted by the Japanese Government. Most of them have no experience of marine construction works. Therefore, a Japanese company will be responsible for construction works by providing skilled engineers and the relevant machinery for marine construction works. However, some on land works such as building work, pavement works, installation of electrical wiring, water supply and laying sewage pipelines will be undertaken with an assistance of local firms as much as possible.

c) Since Antigua and Barbuda has limited experience in the field of site investigation, some of the works such as sounding surveys for environmental monitoring which will be consigned to local firms, as it was already done during the basic design study. Such work will be carried out under the instruction of the Japanese consultant firms

d) The cold storage and ice making plant / ice storage equipment will be

procured from Japan and assembled in Antigua and Barbuda under the instruction and supervision of Japanese experts.

(3) Executing Agency in the Governmen t of Antigu a and Barbuda

Agencies, which will be involved in the Project on the part of the Government of Antigua and Barbuda, will be as follows.

a) Responsible agency:
Ministry of Planning, Implementation and Public Service Affairs
b) Responsible agency for project implementation:
Ditto-
c) Responsible agency for the supervision of construction work:
Ministry of Planning, Implementation and Public Service Affairs and Ministry of Agriculture, Fishery and Land
d) Management authority after completion of the Fishing Port:
Antigua Fishery Ltd.

3.1.2 Conditions for Implementation

(1) Conditions for Construction

1) Construction Company

Construction companies of Antigua and Barbuda may be assigned as sub-contractors under the supervision of the Japanese construction company.

2) Construction Machinery

Almost of construction machinery such as backhoes, tire shovels, bulldozers, dump trucks, etc. will be available in Antigua and Barbuda, but the number of machinery is limited and maintenance condition is not so sufficient. Basically, the construction machinery will be procured from Antigua and Barbuda and neighboring countries. Some machinery may be procured from Japan if they are unavailable there. And the equipment, which cannot be supplied from the neighboring countries, may be procured from Japan.

3) Labor

Skilled experts will be required for the construction of cold storage facilities and ice making plants to supervise. Japanese experts will be

dispatched to Antigua and Barbuda to undertake this responsibility. Operation of working vessels and piling work of the steel sheet piles will also be required Japanese experts. Common skilled labor will be employed in Antigua and Barbuda, and also Foreman for each construction work will be employed in Antigua and Barbuda or neighboring Caribbean countries.

4) Goods and Materials to be imported

Aggregate materials for road and concrete for construction are available in Antigua and Barbuda, while other materials such as cement, re-bars will be mainly imported from United States or Trinidad and Tobago. However cold storage equipment, ice making plant and ice storage equipment will be imported from Japan. Most of other construction and building materials will be imported from United States or Trinidad and Tobago. The quality and durability of such equipment and materials will be carefully examined when importers are selected. There might be other materials and equipment, which will be procured from local factories, agents and shops, although the stocks of these goods may not be always available and adequate. Therefore a stock control will be carefully carried out in close consultation with local agents to ensure their stable procurement.

5) Safety Control

This project will construct a new fishing port neighboring existing town, particularly for Parham. For the construction of wharf and dredging works in Parham it is necessary to clearly mark the construction area and the site with buoys and other signs to secure the safe navigation of fishing boats. For the construction of land facilities, the roads and routes, which will be used for the transport of material and equipment, should be clearly indicated to avoid any nuisance to the city residents.

(2) Care for Construction Work

a) An appropriate construction plan will be prepared taking into account the natural conditions at the sites, especially hurricane.
b) Dispatch of the Japanese experts will be planned carefully in respect of the number of persons, the timing and duration in accordance with the progress of work.
c) Local equipment and material will be used as much as possible to minimize the cost for the procurement of such equipment and material from foreign countries.

d) The project will involve a long-term construction work and therefore special attention will be paid to fishing boats navigating in the construction sites.

3.1.3 Scope of Works

Scope of work to be undertaken by the Government of Japan and the Government of Antigua and Barbuda are as follows.

(1) Scope of work to be undertaken by the Government of Japan

1) Parham Fishing Port

Basic Port Facilities

a) Dredging work and excavating work for wharf, slipway and basin
b) Construction of a wharf
c) Construction of reclaimed land
d) Construction of a slipway with boatyard
e) Construction of concrete pavement (wharf apron)

Functional (Architectural) Facilities

a) Construction of a main facility building including ice-making plant& cold storage room, administration office, etc.
b) Construction of a fish retail shop
c) Construction of a workshop
d) Construction of gear lockers
e) Installation of ice-making plant & ice storage facilities
f) Installation of cold storage facilities
g) Construction of lighting systems for security purposes
h) Pavement of fishing port area

2) Urlings Fishing Port

Basic Port Facilities

a) Dredging work and excavating work for wharf, slipway and baisn
b) Construction of a wharf
c) Construction of revetments
d) Construction of a slipway with boat yard
e) Construction of concrete pavement (wharf apron)

Functional (Architectural) Facilities

a) Construction of a main facility building including ice-making plant& cold storage room, administration office, etc.
b) Construction of a fish retail shop
c) Construction of a workshop
d) Construction of gear lockers
e) Installation of ice-making plant & ice storage facilities
f) Installation of cold storage facilities
g) Construction of lighting systems for security purposes
h) Pavement of fishing port area

3) Procurement of Equipment

a) Ice making plant and ice storage facility
Parham: 1.5t/day, storage capacity 3.0t
Urlings: 1.0t/day, storage capacity 2.0t
b) Cold storage facility
Parham: 1unit
Urlings: 1unit
c) Standby Generator
Parham: 75KVA 1unit
Urlings: 75KVA 1unit

(2) Scope of Work to be undertaken by the Government of Antigua and Barbuda

Provision of services will be made available including utilities, e.g. electricity, water, telephone lines connected to the project site and to construct access road to the fishing port ground.

3.1.4 Consultant Supervision

It is the policy of the Government of Japan that a grant aid project will be implemented under the strict supervision of the Consulting Firm which is fully aware of technical details of work during the whole period of the project. The Consulting Firm will supervise the construction work through the close contact and communications with local engineers in regard to the design, inspection and schedule of work.

(1) Supervisory Policies

a) The time frame of the work will be strictly observed by establishing

close contact and communications with the persons and organizations concerned on the part of Antigua and Barbuda to prevent any delay of work.

b) Provision of prompt and appropriate guidance and advice will be essential for the contractor as to the construction of the facilities in compliance with the drawings and specifications agreed upon.

c) High priority will be accorded to the utilization of local materials and technologies.

d) The project will ensure to promote the transfer of technology in the course of the construction and engineering work.

e) The project will ensure to provide adequate advice and guidance regarding the maintenance of equipment and material delivered for the work.

(2) Supervisory Work

a) Preparation of a contract

Provision of services will be provided by the Consulting Firm in relation to the selection of a contractor, determining the type of the contract, drafting the contract documents, evaluating the bills, and holding a contract awarding ceremony.

b) Evaluation and approval of the drawings of retail shops.

Evaluation will be carried out as to the drawings of a retail shop, materials to be used, and equipment.

c) Instruction on construction work

Reviewing construction plan and schedules, providing supervision to the contractor and reporting the progress of work to the Government of Antigua and Barbuda will be carried out.

d) Process of payment

Evaluation and approval of the bills for the payment to the contractor during the work will be carried out taking into account the progress of work and upon completion of work.

e) Inspection and witness

The Consulting Firm will inspect, when necessary, the work in progress

and give appropriate instructions to the contractor. The Consulting Firm, having confirmed that the work has been completed and the contract fulfilled, will witness the delivery of the Project and confirm the government's acceptance. The Consulting Firm will also report to the Government of Japan about the progress of work, payment procedures and status, and the delivery of facilities completed.

3.1.5 Procurement Plan

In the process of procuring materials and equipment being necessary for the project, special attention will be paid to the followings.

(1) Procurement Policy

Priority should be given to the use of locally available material and equipment if the quality and quantities will meet the need of the project work. In this way the procurement cost from Japan will be minimized.

1) Procurement from Japan

A detailed procurement and transport schedule must be prepared well in advance for the material and equipment to be procured from Japan. This normally will take a long period of time before manufacturing, packing and shipment of goods until to be completed. Construction machinery will have to be procured from Japan when they are not available in the country.

2) Local Procurement

Rubble stones and aggregates, which can be locally procured, should be carefully examined as to the quarry site, quality and transport capacities.

3) Cost

The cost is an important element to be taken into account in the selection of materials from local sources, neighboring countries and Japan. It should be borne in mind that the prices of procurement from Japan include the charges for packing, transport, insurance, while port charges and taxes are to be exempted. On the basis of the above principles and rules, the following plans will be established for the procurement of construction materials and equipment.

(2) Procurement Items

1) Materials

Table 3.1.5-1 Procurement Plan of Construction Material

Construction Material		Procurement Country			Remarks
		Local	Japan	Third	
Basic	Steel Sheet Pile		○		
Port	Steel Pile（H-Shape、Channel）		○		
Facility	Tie-wire		○		
	Rubber Fender, Bit		○		
	Filter Sheet		○		
	Silt Protector		○		
	Stone, Aggregate, Crusher run	○			
	Steel Bar		○		
	Cement	○			
	Concrete	○			
	Form Materials	○			
Functnl.	Sand, Aggregate	○			
Facility	Steel Bar		○		
	Cement	○			
	Concrete	○			
	Form Materials	○			
	PC Pile		○	○	
	Wooden Pile	○			
	Concrete Block	○			
	Timber & wood	○	○*		
	Steel furnishing	○	○		
	Wooden furnishing	○			
	Waterproofing Materials	○	○		
	Roof Materials	○			
	Glass		○		
	Paint	○			
	Resist	○			
	Tile	○			
Electric	Cable and Wire		○		
	Conduit Pipe	○	○		
	Panel boards, Switchboards		○		
	Switch, Outlet	○			
	Lighting	○			
	Light Ball	○			
	Generator		○		
Plumbing	Pipe	○			
	Valve	○			
	Sanitary Fixture	○			
	Water Reserve Tank		○		
	Water Supply Pump		○		
	Septic Tank		○		
Air Con.	Air Conditioner		○		
	Ventilating and Exhaust Fan		○		
Equip.	Ice-making equipment		○		
	Cold Storage Equipment		○		

2) Construction Machine ry

All Construction Machinery will be available through local sub-contractor. Construction Machinery used in the Project are shown in the Table.

Table3.1.5-2 Procurement Plan of Main Construction Machinery

Machinery	Country			Remarks
	Local	Japan	Third	
Bulldozer 21t	○			
Bulldozer 15t	○			
Power Shovel 0.4m^3	○			
Power Shovel 0.7～1.2m^3	○			
Damp Truck 2～4t	○			
Damp Truck 10t	○			
Truck Crane 15t	○			
Truck Crane 25t	○			
Shovel Loader 1.8m^2	○			
Blade Grader (3.1m Class)	○			
Tire Roller (12ton Class)	○			
Pontoon with Crane (40ton/200m^3)	○			
Pontoon (300m^3)	○			
Tug Boat (D200ps)	○			
Diving Boat (D70ps)	○			
Crawler Crane (40ton)	○			
Anchor Boat (D5t)	○			

3.1.6 Implementation Schedule

Japanese Government grant aid program will follow normal project implementation schedule. After the Exchange of Notes (E/N) is signed between the two countries, a Japanese Consulting Firm will be appointed by the Government of Antigua and Barbuda and the consulting contract will be concluded between the Government and the consulting firm.

E/N will provide details on the tender procedures, supervising and construction work. The project will be implemented in accordance with the conditions stated in the E/N.

(1) Preparation of Detailed Design Document

After the consulting contract will be concluded between the executing agency of Antigua and Barbuda and the Japanese Consulting Firm, the contract will be verified by the Government of Japan and the consultant will draw up detailed designs. In the detailed design the tender documents

consisting of design drawings, technical specifications, instruction to tenderers, etc. will be prepared on the basis of the Basic Design Study. In the meantime, consultations will be held with the Government of Antigua and Barbuda regarding the details of the fishing port facilities and eventually the tender documents will be approved by the Government of Antigua and Barbuda. About 4 (four) months will be required for the preparation of a detailed design for the first and second phase respectively.

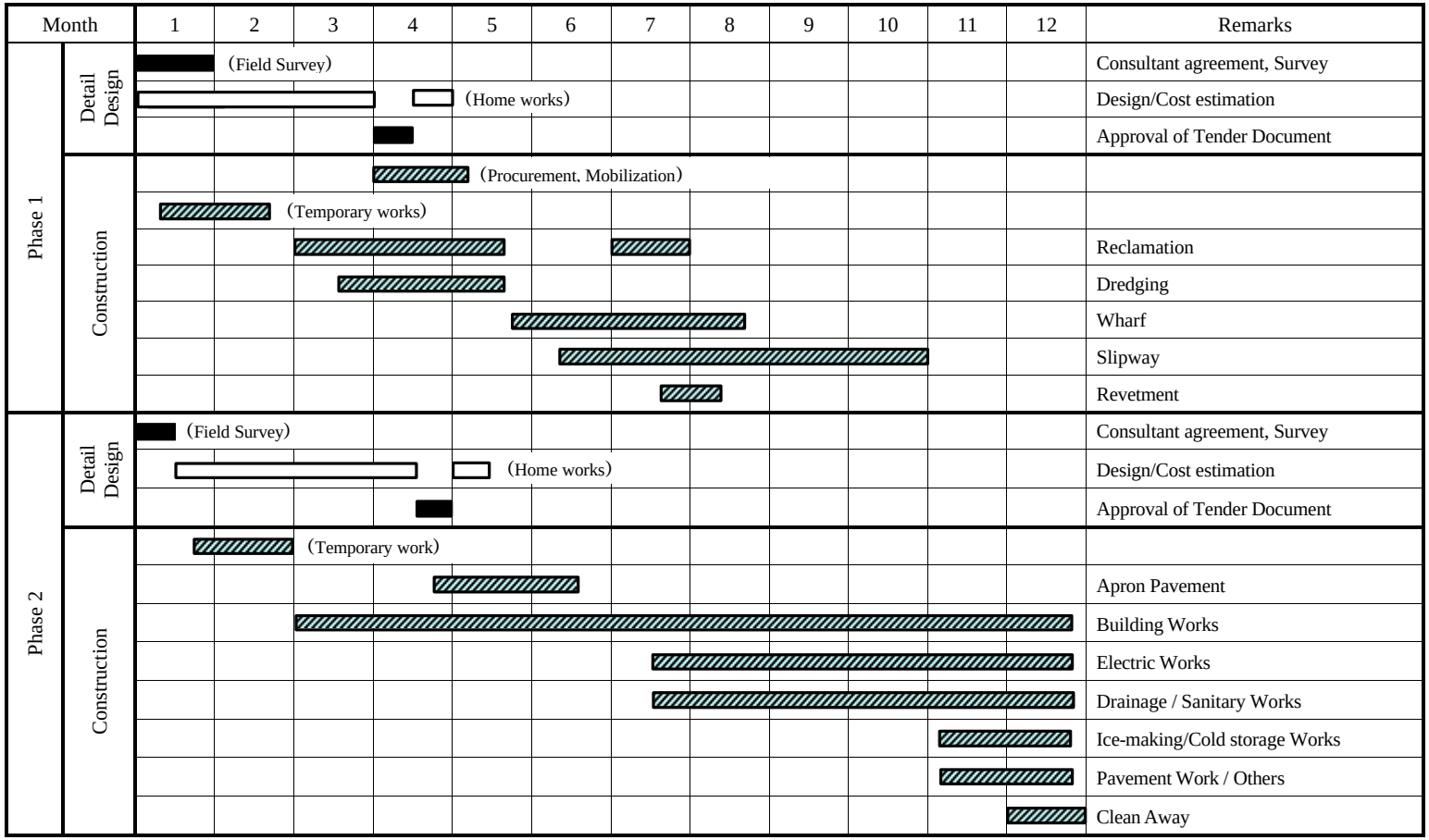
(2) Execution of Tender

The contractor (a Japanese construction company) who will be involved in the construction of the project facilities will be selected through the tender. The tender procedures will be as follows: first invitations will be extended to interested parties; acceptance of the tenders; examination of the pre-qualifications; evaluation of tender documents, submitting the tender, evaluation of the tender, designation of the contractor and conclusion of a construction contract. The whole procedure will take one and half months for each phase.

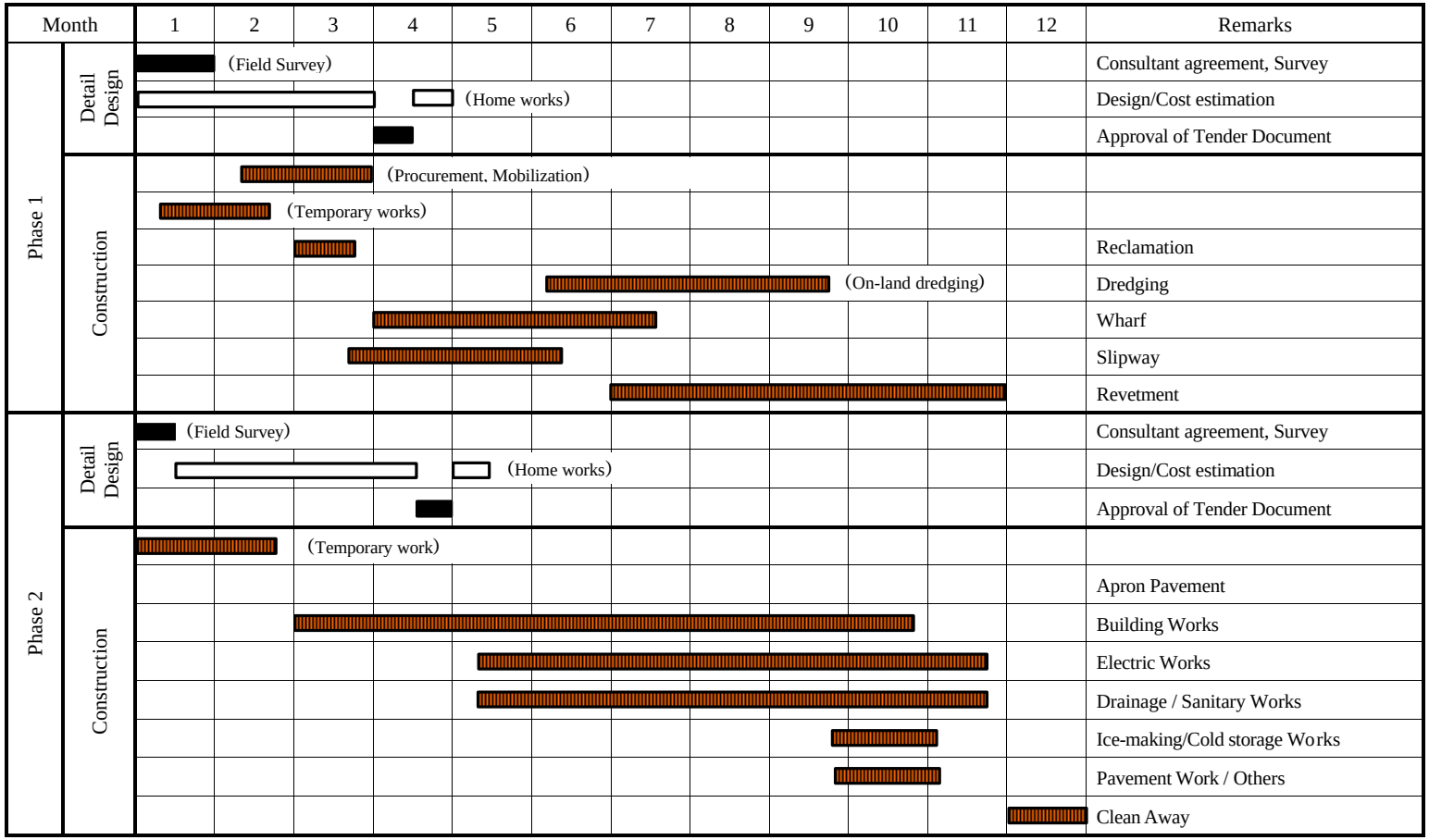
(3) Execution of Construction Work

Construction work will be started after the conclusion of the contract and verification by the Government of Japan. The construction period of each site is expected to last about 23 months (Phase1: 11months, Phase2: 12months) considering the size of the project and its complexities, including the problems relating to the local construction conditions. However, unforeseen situations, which might occur in the course of the work, are excluded.

Figure 3.1.1 shows individually the implementation schedule of each site covering from the Exchange of Notes to the completion of Project.



Figure－3.1.1(1) Implementation Schedule (Parham)



Figure－3.1.1(2) Implementation Schedule (Urlings)

3.1.7 Obligations of the Recipient Country

The obligations of the Antigua and Barbuda Government were confirmed by the Minutes of Discussions during the Basic Design Study implemented in April and August 2000.

* to secure land which is necessary for the site of the project prior to commencement of the construction;

* to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities to the site and to construct access road to the fishing port ground;

* to ensure all the expenses and prompt execution for unloading, customs clearance at the ports of disembarkation and internal transportation of the products purchased under the Grant Aid;

* to exempt Japanese nationals from customs duties, internal taxes and fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts;

* to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their works.

* to secure lands which is necessary for acquisition of construction aggregates;

* to secure lands for dumping dredged and excavated materials vicinity of both sites;

* to construct gates and fence in and around the site if necessary;

* to bear commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement, namely the advising commission of the “Authorization to Pay” and other payment commissions;

* to provide necessary permissions, licenses and other authorizations for implementing the Project, if necessary; and,

* to bear all the expenses other than those covered by the Grant Aid, necessary for the Project.

3.2 Operation and Maintenance Costs

3.2.1 Operation and Maintenance Costs

(1) Antigua Fishery Limited (AFL)

The AFL will be responsible for the operation and maintenance of all the fishing port facilities. Costs and benefits of AFL can be estimated as follows.

[Parham Fishing Port]

a) Income

Mooring fee of fishing boat:	38,220 EC$
Store fee in cold storage:	27,000 EC$
Sales of ice:	346,500 EC$
Rental fee of fish retail shop:	6,500 EC$
Rental fee of gear locker:	14,700 EC$
Total:	432,920 EC$

b) Expenditures

Personnel:	90,000 EC$
(3 staff members and temporary employees)	
Electricity:	162,162 EC$
Water:	58,102 EC$
Maintenance fee:	250 EC$
General expense:	7,000 EC$
Total:	317,514 EC$

c) Balance:

432,920 – 317,514 = 115,406 EC$	Surplus

[Urlings Fishing Port]

a) Income

Mooring fees of fishing boat:	33,540 EC$
Store fee in cold storage:	42,000 EC$
Sales of ice:	231,000 EC$
Rental fee of fish retail shop:	6,500 EC$
Rental fee of gear locker:	12,900 EC$
Total:	325,940 EC$

b) Expenditures

Personnel:	90,000 EC$
(3 staff members and temporary employees)	
Electricity:	154,183 EC$
Water:	51,405 EC$
Maintenance fee:	250 EC$
General expense:	7,000 EC$
Total:	302,838 EC$

c) Balance:

325,940 – 302,838 = 23,102 EC$	Surplus

There will be a total surplus of 138,508 EC$ from the both new fishing ports and thus, it can be financially managed by AFL without having any help from the Government.

Chapter 4

Project Evaluation and Recommendation

Chapter 4 Project Evaluation and Recommendation

4.1 Project Effect

Although Antigua Babuda's fisheries industry is accounted for only 1.58% (1998) of its GDP, it represents a high percentage of its primary industry and 44% of its agriculture and fisheries sector (agriculture, livestock raising, forestry and fisheries) as a whole. Since the country's economy does not have much in the way of natural resources other than tourist resources, the fishery industry is an industry with a high potentiality for promotion of the country's industry making use of its fishery resources.

The country's fisheries industry centers on small-scale operations by small fishing boats with a length of under 40 feet, which account for 92% of the total fishing boats fleet and the main fishing method being the traditional one using fishing pots in coral reef and continental shelf fishing grounds near the island of Antigua. There are a total of 28 catch landing points on the island, the main one being the fisheries complex at the capital St. Johns, constructed with Japanese grant aid, and the others located at sandy beaches and calm inlets all around the island's coast, some of them a part of resort facilities.

The followings are the problems that the country's fisheries industry faces:

① Damage by hurricanes

Fishing boats and fishing gear frequently suffer damage when hurricanes hit the island. Since the country does not have any facilities such as slipways for grounding fishing boats, such valuable property of fishermen, they have to seek refuge from hurricanes in mangrove thickets or haul the boats up onto the beach at the cost of a great deal of strenuous labor, and even then, they often end up suffering serious damage from strong winds and high tides. Also subjected to damage by hurricanes is fishing gear, the fishing pots often being carried away by high waves. The damage is so frequent and so serious that some fishermen decide to give up the business.

② Shortage of Fisheries Infrastructure

Shortage of wharves and other fisheries infrastructure is cause fishermen a great deal of extra work in landing of catches and other daily activities. At catch landing points away from the capital, where there are no catch landing facilities, the fishermen have to wade through the water to carry catches, fuel and fishing gear back and forth between the beach and

their boats moored offshore, and that is very tiring work. Sometimes individual fishermen make simple pier-like structures to facilitate such work, but they are easily destroyed any hurricanes and take a lot of work to restore.

③ Stagnation of the Fisheries Industry

Because of the priority being given to tourist development, beaches that are suitable for landing of catches are being taken over by tourist facilities. In Antigua and Barbuda development plans that give priority to tourist development are being carried forward, with resulting incursion of the tourist industry onto beaches which have traditionally been used for landing fishery catches, meaning progressive loss by fishermen of their vested rights in beaches. Since that is considered to be one of the reasons for stagnation of the fishery industry, it is urgently necessary for the country to build fisheries facilities on beaches around the island.

The purposes of the present project are construction of facilities in the fisheries sector, which is faced with serious problems like those cited above, providing refuge to fishing boats, that is so valuable property of fishermen at the time of hurricanes and also construction of main fishing port facilities for concentration of landing of catches outside the capital instead of being dispersed by located through out the inland for the sake of restoration and promotion of local fisheries through utilization of the advantage of concentration. Selected as the project sites have been the Parham area (3 catch landing points and a total of 49 fishing boats), a main fisheries area on Antigua's east coast, and the Urlings area (7 catch landing points and a total of 43 fishing boats), a main fisheries area on its south coast, both of them to be equipped as refuge fishing ports that can serve as fishery bases outside the capital.

Both of those areas suffer considerable damage to fishing boats by hurricanes because of lack of safe facilities for them to seek refuge at. Moreover, they rank second only to the capital St. Johns, in terms of volume of catches landed and have important positions as bases for supply of fishery products to both the capital and elsewhere. Construction of fishing ports at Parham and Urlings is therefore of very great significance from the viewpoints mentioned below. That is also in line with the country's fishery development plans and will have a big impact in terms of restoration and vitalization of the country's small-scale fishery operations.

①Securing of facilities where fishing boats can take refuge at the time of hurricanes

②Role as bases for production and distribution activities

③ Function as living bases of fishermen and bases for local economic development centering mainly on fishery-related industries.

The present project to be implemented against the background described above can be expected to have the following direct and indirect effects.

(1) Direct Effects

① Reduction of hurricane damage

With provision of facilities for bringing fishing boats up onto grounding stages, it will become possible for the total of 92 fishing boats using Parham and Urlings to be safely taken care of when hurricanes hit. Furthermore, it will become possible for fishing boats using other landing points, also, to use those facilities by means of boat trailers so as to be brought up onto the beach, thereby reducing hurricane damage to fishing boats on the island of Antigua.

② Reduction of load of labor on fishermen and enhancement of the work efficiency

With provision of wharf facilities, the efficiency of loading and unloading of fishing boats will be improved approximately three-times, and that will not only greatly reduce the work load on fishermen but also contribute to keeping the catch fresh before being sold. Not only efficiency of unloading of the fish catch but also efficiency of loading of fuel, fishing gear and ice onboard will be immensely improved, and the fishermen's work burden will be lightened in that respect as well.

③ Improvement of quality of the catches

With provision of ice-making and refrigeration facilities, the quality of the approximately 470 tons a year of catches landed at the two fishing ports will be improved, loss thereof will be reduced, and the income of fishermen will increase. Furthermore, it will be possible to supply consumers in the capital, St. Johns and local areas with fish with a high degree of freshness.

④ Increase of fishing operation

With provision of ice supply facilities, it will be no longer necessary for

fishermen to make the one through one and half hour's trip to back for ice, thus greatly reducing the time and energy wasted on that. The same holds for the time and energy now wasted in procuring fuel oil for the fishing boats, which will be eliminated when the fuel oil supply facilities are completed. Both those factors will reduce the amount of time needed to prepare to go out to sea, meaning that they will be able to fish more times a week.

(2) Indirect Effects

① Increasing Willingness of Fishermen to Stay in the Business

Provision of the fishing port facilities will greatly improve the work environment of fishermen, thus also increasing the number of days of operation to fish as well as their income, and that will make them more enthusiastic about their work.

② Energization of Local Areas

Provision of the fishing port facilities will result in greater concentration of fishermen at those two fishing ports, and installation of the fish market will result in greater concentration of local residents purchasing fish. Particularly at Parham, with progress in carrying forward the government's tourism development plans, there will be creation of a community with fishing port facilities at its core that will contribute to vitalization of the local area.

③ Modernization of the Fisheries Industry

These facilities will be exclusive facilities for fishermen that create an environment in which they can use them at any time without being affected by tourism development, and that will be result in promotion of investment in the fisheries industry and modernization thereof.

④ Foreign Exchange Savings

Provision of the ice-making and refrigeration facilities will result in less loss of catches from need to discard spoiled fish and thereof a larger volume of supply and hence in fewer fish imports and in consequent reduction of unnecessary outflow of foreign exchange reserves.

⑤ Contribution to Stable Supply of Food

With provision of these fishing port facilities, smooth fishing operations

will be possible even after hurricanes hit, making it possible to ensure a stable supply of food.

From the above considerations it is clear that this project is not only appropriate but also will be of considerable significance considering its nature and the effects that can be expected of it, and therefore early implementation of provision of the new fishing port facilities at Parham and Urlings on the basis of Japanese grant aid is desirable.

4.2 Recommendation

It is proposed that full consideration will be given to the following points for the sake of effective utilization of the fishing port facilities at Parham and Urlings after they are completed so as to contribute to solving of the problems regarding promotion of the fisheries industry cited in the Fisheries Development Plan:

① Enlightenment and Instruction to Fishermen

－Active recruiting by government organizations of people to work in the fisheries industry for the sake of effective utilization of the new fishing port facilities at Parham and Urlings by fishermen.

－The Parham and Urlings fishing ports will be managed and operated by Antigua Fishery Ltd. under the administrative control of Ministry of Planning, Implementation and Public Service Affairs and Ministry of Agriculture, Land and Fisheries, with implementation of appropriate guidance and control of fishermen to ensure that there will be no problems in such management and operation.

－For the sake of efficient use of the wharves for landing of catches and preparatory work for putting out to sea it will be necessary to instruct fishermen not to leave their boats moored there at times when they are not operational.

－For the safety of their boats fishermen should be instructed to bring them up onto the grounding stage before hurricanes hit instead of leaving them moored at the wharf if that is possible and, if that is not possible, to seek safe refuge for them elsewhere.

② Maintenance and Operation

－For the sake of prevention of pollution of the waters of the fishing port

anchorages it will be necessary to strictly control against illicit dumping of waste fuel and used fishing gear from the fishing boats and treatment of catches within the anchorages, and the water treatment tanks will have to undergo regular maintenance.

－Although silting up of the anchorages and the fairways by drift sand are not considered very likely in the two fishing ports, there is possibility of the anchorages and fairways getting shallower than design water depth as a result of high waves at the time of hurricanes. In such cases the Government of Antigua and Barbuda should proceed to expeditiously undertake dredging for maintaining fishing port functions.

③ Fishery Administration

－With provision of the ice-making and refrigeration facilities it will become possible to keep the catches fresh longer and to get them to consumers while they still have good quality. Fishermen should therefore, be encouraged to use ice so as to be able to supply fish with a good degree of freshness. Furthermore, in order to promote wider use of ice it is also necessary for such measures by Antigua Fishery Ltd. as differentiation of the price that it buys the fish at according to how fresh it is.

－It is important for the sake of drafting of future fisheries development plans and establishment of fishery industry management systems to accurately take statistics of domestic production volume. The volumes of catches are presently estimated on the basis of sample surveys, but it will be necessary to collect data for the whole island by implementing nationwide surveys concerning volumes of catches. There should be extension service activities covering such things as fishing techniques, how to handle catches and how to smoothly manage fishing operations.

－The Fisheries Bureau should also undertake enlightenment activities in forms like extension service courses for the purpose of getting fishermen to be more aware and conscious of the importance of protection and sustainable utilization of fishery resources.

－For the sake of promoting the fisheries industry and lightening the economic burden of fishermen there should be implementation of tax exemption measure for a fishing vessel fuel oil as in other Caribbean countries.

APPENDICES

[APPENDICES]

Appendix-1 Member List of the Survey Team

Field Survey

Assignment	Name and Position
Leader	Mr. Hiroshi KITANI Senior Adviser, Institute for International Cooperation Japan International Cooperation Agency
Technical Advisor	Mr. Noritaka ASAKAWA Assistant Director, Fishing Port Planning Division Fishing Port Department Fisheries Port Department Fisheries Agency
Project Coordinator	Mr. Ryutaro MUROTANI Fourth Project Management Department Grant Aid Management Department Japan International Cooperation Agency
Chief Consultant / Fishing Port Planning	Mr. Kozo MATUMURA ECOH Corporation
Civil Structure Planning	Mr. Yutaka OCHI ECOH Corporation
Fishery Facility Planning	Mr. Wataru IWASAKI ECOH Corporation
Fishery Facility / Equipment Planning	Mr. Kouichi KATSUHARA ECOH Corporation
Natural Condition Survey	Mr. Shinji OKADA ECOH Corporation
Construction Planning / Cost Estimation	Mr. Satoshi TANAKA ECOH Corporation
Environmental Research	Mr. Fuminori NISHIME ECOH Corporation

Explanation of Draft Basic Design

Assignment	Name and Position
Leader	Mr. Noritaka ASAKAWA Assistant Director, Fishing Port Planning Division Fishing Port Department Fisheries Port Department Fisheries Agency
Project Coordinator	Mr. Yoshihiro SATO Training Division Kanagawa International Fisheries Training Center Japan International Cooperation Agency
Chief Consultant / Fishing Port Planning	Mr. Kozo MATUMURA ECOH Corporation
Fishery Facility Planning	Mr. Wataru IWASAKI ECOH Corporation

Appendix-2 Survey Schedule

1st Field Survey

No.	Date		Day	Itinerary	Accommodation	Activities
1	4	1	Sat	1100Tokyo (NH010) 0930 New York 1830Tokyo (AA026) 2059 Miami	New York Miami	Mr. Kitani & Mr. Asakawa All Consultant Members
2		2	Sun	1232New York (AA2115) Miami 1542 (AA1819) 2049 Trinidad Tobago 1645 Miami (AA1819) 2029 Trinidad Tobago 1650 Miami (AA1845) 2000 Antigua	Trinidad Tobago Trinidad Tobago Antigua	Official Member (Mr. Kitani & Mr. Asakawa) Consultant Member (Mr. Matsumura) All Consultant Member (Exc. Mr. Matsumura)
3		3	Mon	1750Trinidad (BW426) 2015 Antigua	Antigua	All Official Member (Mr. Kitani, Mr Asakawa, Mr. Murotani) & Consultant member (Mr. Matsumura): Courtesy Call to the Embassy of Japan All Consultant Member (Exc. Mr. Matsumura): Site Survey and Preparation
4		4	Tue		Antigua	All Mission Members: AM. Courtesy Call to the Government of Antigua and Barbuda PM. Discussion with Fisheries Division and Relevant Authorities
5		5	Wed		Antigua	Mission Members: Discussion with Fisheries Division and Relevant Authorities Some Consultant Members: Field Study
6		6	Thu		Antigua	Mission Members: Discussion with Fisheries Division and Relevant Authorities Some Consultant Members: Field Study
7		7	Fri		Antigua	Mission Members: Discussion with Fisheries Division and Relevant Authorities Some Consultant Members: Field Study
8		8	Sat		Antigua	Site Survey
9		9	Sun		Antigua	Site Survey
10		10	Mon		Antigua	Mission Members: AM. Discussion with Fisheries Division and Relevant Authorities PM. Signature on the Minutes of Discussion Some Consultant Members: Field Study
11		11	Tue	Antigua 1100 (BW427) 1405 Trinidad Tobago	Trinidad Tobago Antigua	Official Members (Mr. Kitani, Mr. Asakawa & Mr. Murotani) Leave Antigua for Trinidad Tobago Consultant Members: Field Study & Data Collection
12		12	Wed	Trinidad 1805 (BW424) 2255 New York	New York Antigua	Official Members (Mr. Kitani, Mr. Asakawa & Mr. Murotani) Report to the Embassy of Japan and Leave for New York Consultant Members: Field Study & Data Collection
13		13	Thu	New York 1215 (NH009)-		Official Members (Mr. Kitani, Mr. Asakawa & Mr.

					Antigua	Murotani) Leave for Tokyo Consultant Members: Field Study & Data Collection
14		14	Fri	New York (NH009)-1450 Tokyo	Antigua	Official Members (Mr. Kitani, Mr. Asakawa & Mr. Murotani) Arrive at Tokyo Consultant Members: Field Study & Data Collection
15		15	Sat		Antigua	Consultant Members: Field Study & Team Meeting
16		16	Sun		Antigua	Consultant Members: Field Study & Team Meeting
17		17	Mon		Antigua	Consultant Members: Field Study & Data Collection
18		18	Tue		Antigua	Consultant Members: Field Study & Data Collection Mr. Nishime : Leave Antigua for Japan
19		19	Wed		Antigua	Consultant Members: Field Study & Data Collection
20		20	Thu		Antigua	Consultant Members: Field Study & Data Collection
21		21	Fri		Antigua	Consultant Members: Field Study & Data Collection
22		22	Sat		Antigua	Consultant Members: Field Study & Team Meeting
23		23	Sun		Antigua	Consultant Members: Field Study & Team Meeting
24		24	Mon		Antigua	Consultant Member: Field Study & Data Collection
25		25	Tue		Antigua	Consultant Member: Field Study & Data Collection
26		26	Wed	Antigua 0835 (AA1130)-1149 Miami	Antigua Miami	Consultant Members (Mr. Matsumura & Ochi) : Field Study & Data Collection Other Consultant Member: Leave Antigua for Miami
27		27	Thu	Miami 0730 (AA027) Tokyo	Antigua	Consultant Members (Mr. Matsumura & Ochi) : Field Study & Data Collection Other Consultant Members : Leave Miami for Tokyo
28		28	Fri	Miami (AA027) 1500 Tokyo	Antigua	Consultant Members (Mr. Matsumura & Ochi) : Field Study & Data Collection Consultant Members : Arrive at Tokyo
29		29	Sat		Antigua	Consultant Members (Mr. Matsumura & Ochi) : Field Study & Data Collection
30		30	Sun	Antigua 1750 (BW415) 2015 Trinidad Tobago	Trinidad Tobago	Consultant Members (Mr. Matsumura & Ochi) : Leave Antigua for Trinidad Tobago
31	5	1	Mon		Trinidad Tobago	Consultant Members (Mr. Matsumura & Ochi) : Report to the Embassy of Japan
32		2	Tue	Trinidad Tobago 0809 (AA1818) 1200 Miami	Miami	Consultant Members (Mr. Matsumura & Ochi) : Leave Trinidad Tobago for Miami
33		3	Wed	Miami 0730 (AA027) Tokyo		Consultant Members (Mr. Matsumura & Ochi) : Leave Miami for Tokyo
34		4	Thu	Miami (AA027) 1500 Tokyo		Consultant Members (Mr. Matsumura & Ochi): Arrive at Tokyo

Explanation of Draft Basic Design

No.	Date		Official Member		Consultant	
			Noritaka ASAKAWA	Yoshihiro SATO	Kozo MATSUMURA	Wataru IWASAKI
			Leader	Project Coordinator	Chief Consultant / Fishing Port Planning	Fishery Facility Planning
1	8/23	Wed			TOKYO→MIAMI （AA026:17:45→21:20）	
2	24	Thurs			MIAMI→ANTIGUA （AA1854:16:50→20:05）	
3	25	Fri			Discussion	
4	26	Sat	ST. KITTS → ANTIGUA （LI533 / 12:05 → 12:30）		Inner Meeting	
5	27	Sun	Inner Meeting		Inner Meeting	
6	28	Mon	Discussion with MOP		Discussion with MOP	
7	29	Tue	Discussion with MOP		Discussion with MOP	
8	30	Wed	Discussion with MOP		Discussion with MOP	
9	31	Thurs	Signing of Minutes of Meeting ANTIGUA → PORT OF SPAIN （BW429 / 19:20 → 20:40）		Signing of Minutes of Meeting ANTIGUA → PORT OF SPAIN （BW429 / 19:20→20:40）	
10	9/1	Fri	Reporting to Embassy of Japan PORT OF SPAIN → NEW YORK （BW424 / 17:20 → 22:10）		Reporting to Embassy of Japan PORT OF SPAIN → MIAMI （BW444 / 16:55 → 20:45）	
11	2	Sat	NEW YORK（NH009 / 12:15）		MIAMI（AA027 / 07:45）	
12	3	Sun	TOKYO（14:50）		TOKYO（15:00）	

Appendix-3 List of Party Concerned in the Recipient Country

Prime Minister

Hon. V. C. Bird	Prime Minister of Antigua and Barbuda

Ministry of Planning ,Implementation & Public Service Affairs

Hon. Gaston Broun	Minister
Mr. Daven Joseph	Technical Director
Mr. Saiid Greene	Project Coordinator

Ministry of Agriculture, Fishery and Land

Hon. Vere C. Bird Jr.	Minister of Agriculture
Mr. Rupert Sterling	Parliamentary Secretary Junior Minister
Mr. Winston Burleigh	Permanent Secretary
Ms. Angella Adams	Public Relations of Fishery for the Minister
Mrs. Cheryl Appleton	Chief Fisheries Officer
Mr. Philmore James	Senior Fisheries Officer
Mr. Eustace Reyer	Fisheries Consultant
Mr. Iron Horseford	Engineer
Mr. Keith Oscar	Engineer

Antigua Fisheries Ltd.

Mrs. Mavis George	Manager

National Office of Disaster Services, Ministry of Labour, Home & Social Improvement

Mrs. Patricia Julian	Director
Mr. Philmore Mullin	Deputy Director

Development Control Authority

Mr. Aldin Crump	Town and Country Planner

Ministry of Public Works

Mr. Lorin Francis	Senior Civil Engineer

Land & Survey Department

Mr. Rendell O'Neal	Deputy Chief Surveyor

The Meterological Office

Mr. Patrick Jeremial	Director
Mr. Keithley Meade	Meterological Officer I
Mr. Cecis Maithein	Meterological Officer II

Antigua Public Utilities Authority (APUA)

Mr. John Bradshaw	Water Manager
Mr. Ruvan Barnarde	Customer Service Engineer
Mr. Andre M. Matthias	Transmission & Distribution Manager

White Fish Market

Mr. Sylvester White	Owner

JICA Expert

Mr. Yasuharu YOSHIZUKA	JICA Expert

MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR THE REHABILITATION OF THE ARTISANAL FISHERY IN ANTIGUA AND BARBUDA

In response to a request from the Government of Antigua and Barbuda, the Government of Japan decided to conduct a Basic Design Study on the Project for the Rehabilitation of the Artisanal Fishery (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Antigua and Barbuda the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Hiroshi KITANI, Senior Adviser, Institute for International Cooperation, JICA, and is scheduled to stay in the country from 2nd April, 2000 to 30th April, 2000.

The Team held discussions with the officials concerned of the Government of Antigua and Barbuda and conducted a field survey at the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

St. John's, 7th April, 2000

Mr. Hiroshi KITANI
Leader
Basic Design Study Team
Japan International Cooperation Agency

Hon. Gaston Brown
Minister of Planning, Implementation and Public Service Affairs
Government of Antigua and Barbuda

ATTACHMENT

1. Objective of the Project

The objective of the Project is to mitigate damages from hurricanes in fisheries sector and to improve fishing activities in the rural area of Antigua, by constructing fisheries facilities.

2. Project Site

The sites of the Project are Parham and Urlings Fishing Villages in Antigua, as shown in ANNEX-1.

3. Responsible and Implementing Agency

3-1. The Responsible Agency is the Ministry of Planning, Implementation and Public Service Affairs.

3-2. The Implementing Agency is the Ministry of Planning, Implementation and Public Service Affairs in collaboration with the Ministry of Agriculture, Lands and Fishery.

4. Items requested by the Government of Antigua and Barbuda

After discussions with the Team, the items described in ANNEX-2 were finally requested by the Government of Antigua and Barbuda. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid System

5-1. The Government of Antigua and Barbuda understands the Japan's Grant Aid Scheme explained by the Team, as described in ANNEX-3.

5-2. The Government of Antigua and Barbuda will take the necessary measures, as described in ANNEX-4, for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

6. Further Schedule of the Study

6-1. The consultants will proceed to further studies in Antigua and Barbuda until 30th April, 2000.

6-2. JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around August, 2000.

6-3. In case that the contents of the report are accepted in principle by the Government of Antigua and Barbuda, JICA will complete the final report and send it to the Government of Antigua and Barbuda around November, 2000.

7. Other Relevant Issues

7-1. If the Project is found feasible, the implementation of the Project can be divided into two phases due to the construction schedule and/or budgetary constraints of the Government of Japan.

7-2. Although the Government of Antigua and Barbuda expressed a strong wish to implement both Parham and Urlings simultaneously, they prefer the Project in Parham to be implemented first if the Project is implemented in two phases.

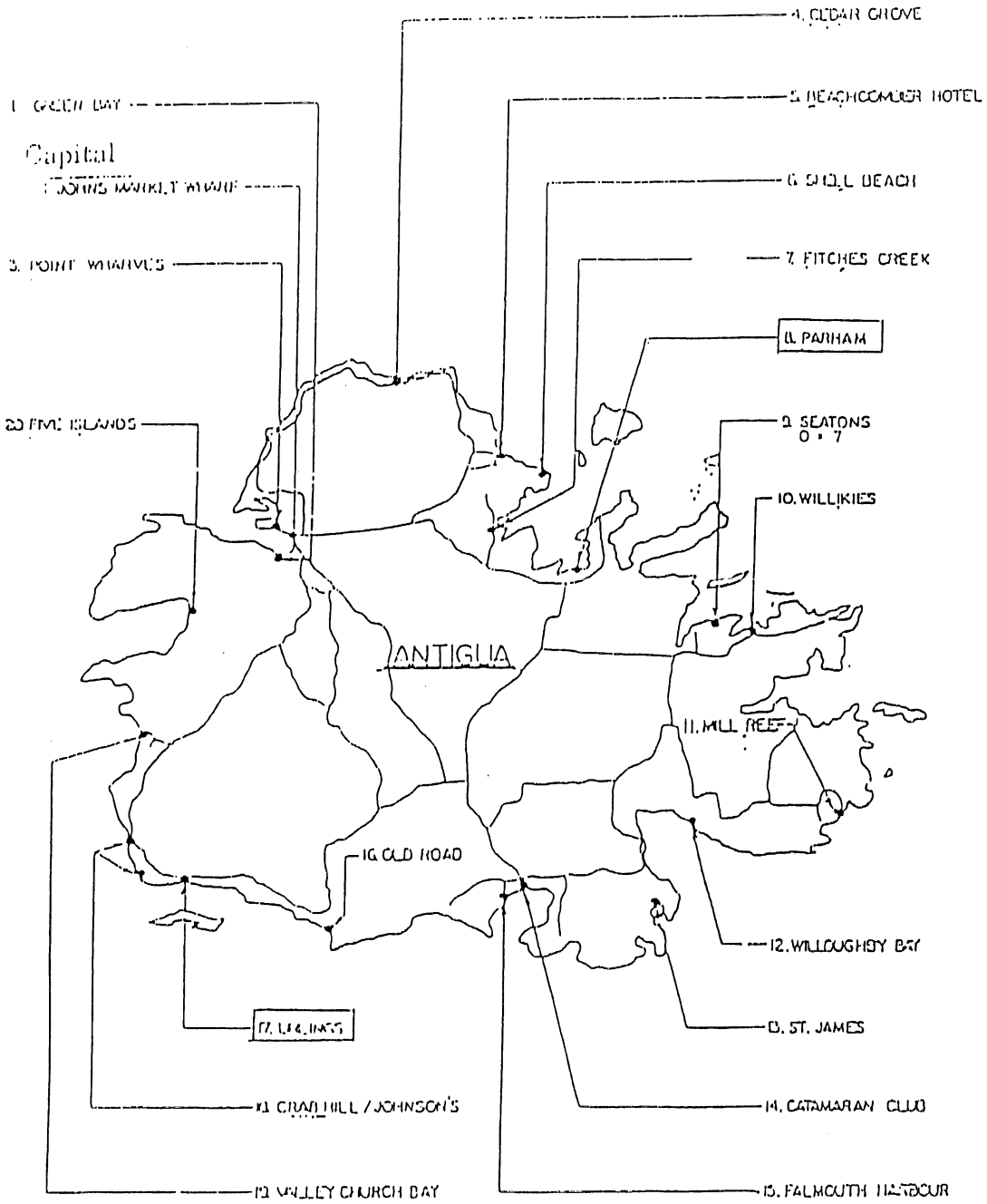
7-3. The Government of Antigua and Barbuda has clarified the priority of each requested item, and the Japanese side will make further examinations on the appropriateness of each requested item. (see ANNEX-2)

7-4. If the Project is implemented, the ownership of the facilities will be kept by the Government of Antigua and Barbuda, and the Antigua Fisheries Ltd. will carry out management and operation of the facilities.

7-5. As a condition for the Project to be implemented, the Government of Antigua and Barbuda will undertake necessary measures to remove all vessels and vehicles from the Project sites and will ensure that no activities will affect the construction work during the implementation of the Project.

7-6. In case of a need for three phase electricity supply for facilities such as an ice plant, the Government of Antigua and Barbuda will take the necessary measures to provide three phase electricity supply to the Project site prior to the commencement of the construction work.

ANNEX-I PROJECT SITE



ANNEX-2

ITEMS REQUESTED BY THE GOVERNMENT OF ANTIGUA AND BARBUDA

1. Urlings
   - Blanket Stone Revetment
   - Dredging Work
   - Sheet Piling / Coping Concrete
   - Asphalt Paving with Subbase
   - Main Building
     - Main Quarters, External Quarters
     - Sub-facilities:(in order of priorities of the Government of Antigua and Barbuda)
       1. Ice Making Machine Room
       2. Freezing Machine Room
       3. Repair Workshop
       4. Retail Area
       5. Shower / Toilet Room
       6. Meeting Room
       7. Managing Quarter
       8. Dry Storage
       9. Parts Shop
   - Gear Lockers
   - Freezing Storage
   - Ice Making / Storage Plant
   - Backup Generator
   - Slipway
   - Oil & Fuel Supply (Concrete base, piping works, and pavement)

2. Parham
   - Jetty and/or Wharf
   - Sheet Piling / Coping Concrete
   - Asphalt Paving with Subbase
   - Main Building
     - Main Quarters, External Quarters
     - Sub-facilities:(in order of priorities of the Government of Antigua and Barbuda)
       1. Ice Making Machine Room
       2. Freezing Machine Room
       3. Repair Workshop
       4. Retail Area
       5. Shower / Toilet Room
       6. Meeting Room
       7. Managing Quarter
       8. Dry Storage
       9. Parts Shop
   - Kiosks
   - Bus Shed
   - Gear Lockers
   - Freezing Storage
   - Ice Making / Storage Plant

Backup Generator
Slipway
Oil & Fuel Supply (Concrete base, piping works, and pavement)

Details of the above components will be determined in the course of the analysis of the Project by the Team and provision of the items are still subject to change.

JAPAN'S GRANT AID PROGRAM

1. Japan's Grant Aid Procedures

(1) Japan's Grant Aid Program is executed by the following procedures.

Application (Request made by a recipient country)
Study (Preparatory Study / Basic Design Study conducted by JICA)
Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
Determination of Implementation (The Exchange of Notes between the both Governments)
Implementation (Implementation of the Project)

(2) Firstly, an application or a request for a project made by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to see whether or not it is suitable for Japan's Grant Aid. If the request is deemed suitable, the Government of Japan entrusts a study to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the study (Basic Design Study), using a Japanese consulting firm. If the background and objective of the requested project are not clear, a Preparatory Study is conducted prior to a Basic Design Study.

Thirdly, the Government of Japan appraises the Project so as to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study Report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the Project approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by the both Governments.

Finally, for the implementation of the Project, JICA assists the recipient country in preparing contracts and so on.

2. Contents of the Study

(1) Contents of the Study

The purpose of the Study(Preparatory Study / Basic Design Study) conducted by JICA on a project requested is to provide basic document necessary for the appraisal of the project by the Government of Japan. The contents of the study are as follows:

a) to confirm the background, objectives and benefits of the project and also institutional capacity of the agencies concerned of the recipient country necessary for the project implementation;
b) to evaluate the appropriateness of the project for the Grant Aid Scheme from a technical, social and economical point of view;
c) to confirm items agreed on by both parties concerning the basic concept of the project;
d) to prepare a basic design of the project, and
e) to estimate cost involved in the project.

Final project components are subject to approval by the Government of Japan and therefore may differ from an original request.
Implementing the project, the Government of Japan requests the recipient country to take necessary measures involved which are itemized on the Exchange of Notes.

(2) Selecting (a) Consulting Firm(s)

For the smooth implementation of the study, JICA selects (a) consulting firm(s) registered. JICA selects (a) firm(s) through proposals submitted by firms which are interested. The firm(s) selected carry(ies) out a Basic Design Study and prepare(s) a report, based upon terms of reference made by JICA.
The consulting firm(s) used for the study is (are) recommended by JICA to a recipient country after Exchange of Notes, in order to maintain technical consistency and to ensure smooth implementation of the Project within the period.

(3) Status of a Preparatory Study in the Grant Aid Program

A Preparatory Study is conducted during the second step of a project formulation and preparation as mentioned above.
A result of the study will be utilized in Japan to decide if the Project is to be suitable for a Basic Design Study.
Based on the result of the Basic Design Study, the Government would proceed to the stage of decision making process (appraisal and approval).

It is important to notice that at the stage of Preparatory Study, no commitment is made by the Japanese side concerning the realization of the Project in the scheme of Grant Aid Program.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

(2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Exchange of Notes by both Governments, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid etc. are confirmed.

(3) The Period of the Grant Aid

"The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

(4) Purchase of Products and Services

Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country origin.

However, the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

(5) Necessity of Verification

The Government of the recipient country or its designated authority will conclude into contract in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This verification is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid, the recipient country is required to undertake necessary measures such as the following:

a) to secure land necessary for the site of the project and to clear and level the land prior to commencement of the construction work;
b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities outside the sites;
c) to secure buildings prior to the installation work in case the project is providing equipment;
d) to ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid;
e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts, and
f) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their works

(7) Proper Use

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for their operation and maintenance as well as to bear all the expenses other than those to be borne by the Grant Aid.

(8) Re-export

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangement (B/A)

(a) the Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in a bank of Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

(b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay issued by the Government of the recipient country or its designated authority.

Annex-4

Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To construct gates and fences in and around the site		●
4	To construct the parking lot	●	
5	To construct roads		
	1) Within the site	●	
	2) Outside the site		●
6	To construct the building	●	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1)Electricity		
	a.The distributing line to the site		●
	b.The drop wiring and internal wiring within the site	●	
	c.The main circuit breaker and transformer	●	
	2)Water Supply		
	a.The city water distribution main to the site		●
	b.The supply system within the site (receiving and/or elevated tanks)	●	
	3)Drainage		
	a.The city drainage main (for storm, sewer and others) to the site		●
	b.The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	●	
	4)Gas Supply		
	a.The city gas main to the site		●
	b.The gas supply system within the site	●	
	5)Telephone System		
	a.The telephone trunk line to the main distribution frame / panel (MDF) of the building		●
	b.The MDF and the extension after the frame / panel	●	
	6)Furniture and Equipment		
	a.General furniture		●
	b.Project equipment	●	
8	To bear the following commissions to a bank of Japan for the banking services based upon the B / A		
	1) Advising commission of A/P		●
	2) Payment commission		●
	To provide prompt unloading and customs clearance at the port of disembarkation in recipient country		
	a.(Sea/Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)

10	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		●
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
13	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR THE REHABILITATION OF ARTISANAL FISHERY
IN
ANTIGUA AND BARBUDA
(CONSULTATION ON DRAFT REPORT)

In April 2000, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for the Rehabilitation of Artisanal Fishery (hereinafter referred to as "the Project") to Antigua and Barbuda, and through discussions, site surveys, and technical examination of the results in Japan, JICA prepared the draft report of the study.

In order to explain and to consult the Government of Antigua and Barbuda on the components of the draft report, JICA sent to Antigua and Barbuda the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Noritaka Asakawa, Assistant Director, Fishing Port Planning Division, Fishing Port Department, Fisheries Agency, from August 26 to 31, 2000.

As a result of discussions, both sides have confirmed the main items described on the attached sheets.

St. John's, August 31, 2000

Mr. Noritaka Asakawa
Leader,
Draft Report Explanation Team
JICA

Hon. Gaston Browne
Minister of Planning, Implementation
and Public Service Affairs
Government of Antigua and Barbuda

ATTACHMENT

1. Components of the Draft Report

The Government of Antigua and Barbuda agrees and accepts in principal the components of the draft report explained by the Team.

2. Japan's Grant Aid System

The Government of Antigua and Barbuda understands the Japan's Grant Aid Scheme as explained by the Team and will take the necessary measures described in Annex I on condition that the Grant Aid by the Government of Japan is extended to the Project.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Antigua and Barbuda around November, 2000.

4. Other Relevant Issues

4-1. As a condition for the Project to be implemented, the Government of Antigua and Barbuda will be responsible for obtaining approval on construction works from Development Control Authority.

4-2. The Government of Antigua and Barbuda will also be responsible for obtaining approval on Environmental Impact Assessment in accordance with regulations of the Development Control Authority.

4-3. The Government of Antigua and Barbuda understands that the Project will be implemented in two phases and understands its process and component.

4-4. The Government of Antigua and Barbuda will take necessary measures to arrange AFL staff necessary for the management of the planned facilities.

4-5. The Government of Antigua and Barbuda will take necessary measures to allocate appropriate dumping sites within three kilometers from each Project site.

4-6. The Government of Antigua and Barbuda will take necessary measures to remove all vessels and vehicles from the Project sites and will ensure that no activities affect the construction work during the implementation of the Project.

4-7. The Government of Antigua and Barbuda has made a requirement of improving capacity of an emergency generator for the ice making machine. The Team will bring the requirement back to Japan in order that the Government of Japan can reconsider its necessity and make the final decision.

4-8. The Government of Antigua and Barbuda understands that establishment of a kiosk and a bus stop are not included in the Project.

4-9. The Government of Antigua and Barbuda understands that application of HACCP is not included in the Project because there is no regulation for HACCP in Antigua and Barbuda at present. However, certain general hygienic standard should be observed in the structure and layout of the facilities.

b) to provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,

c) to secure buildings prior to the installation work in case the Project is providing equipment,

d) to ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

e) to exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

f) to accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) Proper Use

The recipient country is required to maintain and use facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for their operation and maintenance as well as to bear all expenses other than those to be borne by the Grant Aid.

(8) Re-export

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangement (B/A)

a) The Government of the recipient country or its designated authority shall open an account in the name of the Government of the recipient country in a bank of Japan (hereinafter referred to as "the Bank") . The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the contracts verified.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay issued by the Government of the recipient country or its designated authority.

Japan's Grant Aid Program

(1) What is Grant Aid?
The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in a form of donation or such.

(2) Exchange of Notes (E/N)
The Japan's Grant Aid is extended in accordance with the Exchange of Notes by both Governments, in which the objectives of the Project, period of execution, conditions and amount of the Grant etc. are confirmed.

(3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedure such as Exchange of Notes, concluding a contract with (a) consulting firm(s) and (a) contractor(s) and a final payment to them must be completed.

(4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased.
When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country origin.
However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means Japanese physical persons or Japanese juridical persons controlled by Japanese physical persons.)

(5) Necessity of the "Verification"
The Government of the recipient country or its designated authority will conclude into contracts in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. The "Verification" is deemed necessary to secure accountability to Japanese tax payers.

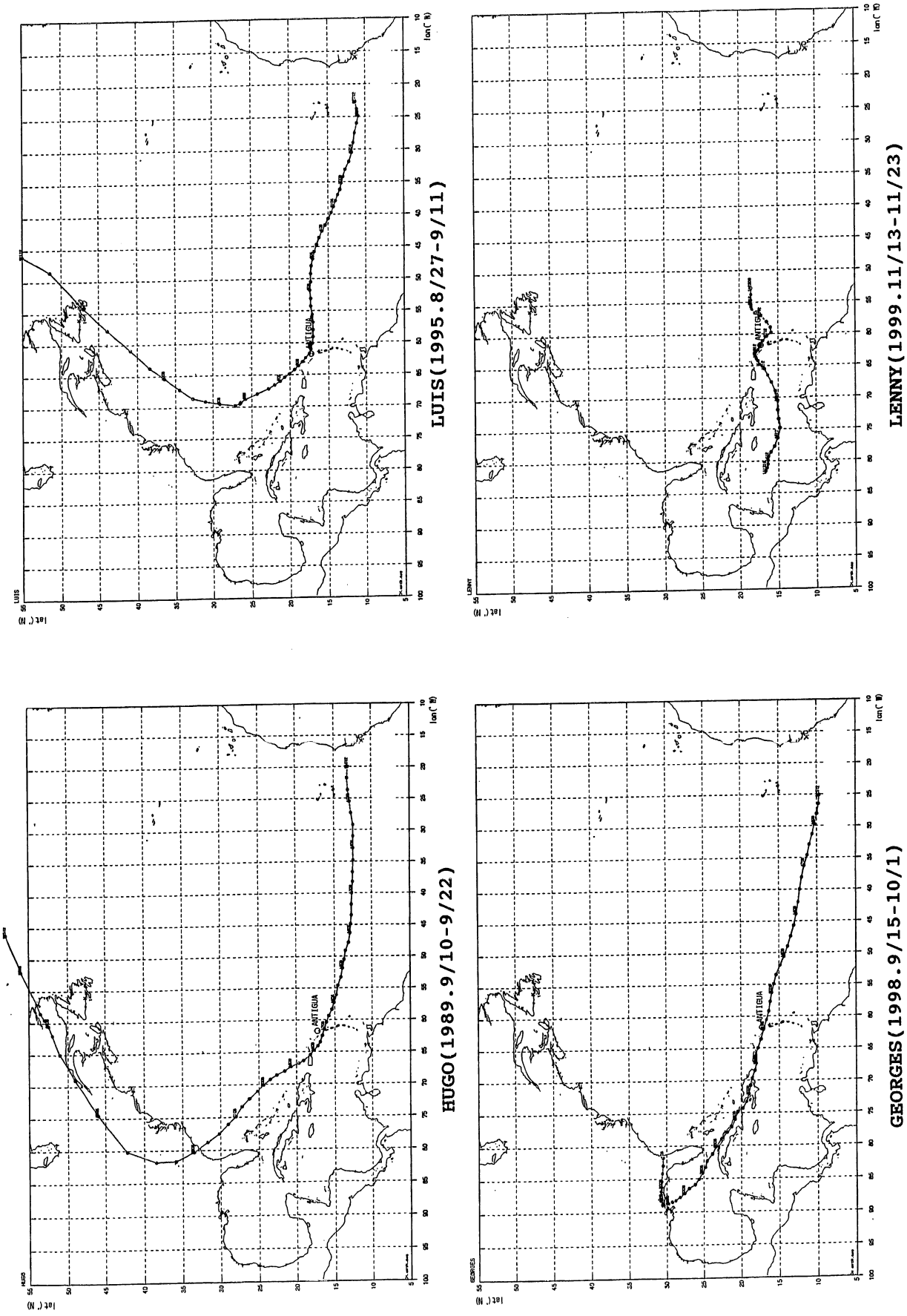
(6) Undertakings required to the Government of the recipient country
In the implementation of the Grant Aid, the recipient country is required to undertake necessary measures such as the following:

a) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work,

Major Undertakings to be taken by Each Government

NO	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To construct gates and fences in and around the site		●
4	To construct the parking lot	●	
5	To construct roads		
	1) Within the site	●	
	2) Outside the site		●
6	To construct the building	●	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1)Electricity		
	a.The distributing line to the site		●
	b.The drop wiring and internal wiring within the site	●	
	c.The main circuit breaker and transformer	●	
	2)Water Supply		
	a.The city water distribution main to the site		●
	b.The supply system within the site (receiving and/or elevated tanks)	●	
	3)Drainage		
	a.The city drainage main (for storm, sewer and others) to the site		●
	b.The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	●	
	4)Gas Supply		
	a.The city gas main to the site		●
	b.The gas supply system within the site	●	
	5)Telephone System		
	a.The telephone trunk line to the main distribution frame / panel (MDF) of the building .		●
	b.The MDF and the extension after the frame / panel	●	
	6)Furniture and Equipment		
	a.General furniture		●
	b.Project equipment	●	
8	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
9	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine(Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	●	

10	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		●
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
13	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●



Hurricane Track (1989Hugo, 1995Luis, 1998Georges, 1999Lenny)

Hurricane Data(1) 1989 HUGO

Date/Time (UTC)	Lat. (°N)	Lon. (°W)	Pressure (mb)	Wind Speed (kt)	50 Knot Radius (nm)	34 Knot Radius (nm)
9/12/00	12.5	31.0	1002	40		75
6	12.5	32.9	1000	45		50
12	12.5	34.8	998	45		100N/75S
18	12.6	36.7	996	50	25S/50N	100N/75S
9/13/00	12.6	38.2	994	55	25S/50N	100N/75S
6	12.7	40.0	992	55	25S/50N	100N/75S
12	12.8	41.8	990	60	25S/50N	100N/75S
18	12.8	43.5	987	65	25S/50N	100N/75S
9/14/00	12.9	44.9	984	70	25S/50N	100N/75S
6	13.0	46.3	980	80	25S/50N	100N/75S
12	13.2	47.8	975	85	25S/50N	100N/75S
18	13.6	49.1	970	90	100S/125N	50S/75N
9/15/00	13.8	50.5	962	100	100S/125N	50S/75N
6	14.0	51.9	957	110	75	125
12	14.2	53.3	940	125	75	125
18	14.6	54.6	918	140	100	150NE/120NW/125
9/16/00	14.8	56.1	923	135	100N/75S	125S/150N
6	15.1	57.3	927	130	100N/75S	125S/150N
12	15.4	58.4	940	120	100N/75S	125S/150N
18	15.8	59.4	941	120	100NE/75	100SW/125NW/150
9/17/00	16.1	60.4	941	120	100NE/75	100SW/125NW/150
6	16.4	61.5	943	120	100NE/75S	100SW/125NW/150
12	16.6	62.5	949	125	125NW/150NE/100	125SW/150NW/175
18	16.9	63.5	945	125	125NW/150NE/100	125SW/150NW/175
9/18/00	17.2	64.1	934	130	100S/150N	125S/175N
6	17.7	64.8	940	120	150NE/100	125S/175N
12	18.2	65.5	945	110	75SW/150NE/100	100SW/125SE/175
18	19.1	66.4	958	105	75SW/150NE/100	100SW/125SE/175
9/19/00	19.7	66.8	959	100	75S/100N	100SW/125SE/175
6	20.7	67.3	962	90	75SE/100NE/50	100SW/125SE/150NE/175NW
12	21.6	68.0	964	90	75S/100N	100SW/125SE/150NE/175NW
18	22.6	68.6	966	90	75S/100N	100SW/125SE/150NE/175NW
9/20/00	23.5	69.3	957	90	75S/100N	100SW/125SE/150NE/175NW
6	24.4	70.1	957	90	50SW/100	100SW/125SE/150NE/175NW
12	25.2	71.0	958	95	50SW/100	100SW/125SE/150NE/175NW
18	26.3	72.2	953	95	50SW/100	100SW/125SE/150NE/175NW
9/21/00	27.2	73.4	950	100	50SW/100	100SW/125SE/150NE/175NW
6	28.0	74.9	950	100	50SW/100	100SW/125SE/150NE/175NW
12	29.0	76.1	948	110	75SW/100SE/125	125SW/150SE/225
18	30.2	77.5	944	120	100SW/125SE/150	125SW/150SE/225
9/22/00	31.7	78.8	935	120	100SW/125SE/150	125SW/150SE/225
6	33.5	80.3	952	85	125SE/150NE/100	150SE/225NE/125
12	35.9	81.7	975	55	125SE/50	75W/225E
18	38.5	81.8	987	40		75W/225E
9/23/00	42.2	80.2	988	35		200E

Hurricane Data(2) 1995 LUIS

Date/Time (UTC)	Lat. (°N)	Lon. (°W)	Pressure (mb)	Wind Speed (kt)	50 Knot Radius (nm)	34 Knot Radius (nm)
8/29/00	11.6N	29.0W	1005	35		50
6	11.8N	30.5W	1000	40		50
12	12.2N	31.9W	1000	40		50
18	12.7N	33.1W	1003	40		40
8/30/00	13.0N	34.2W	1005	40		40
6	13.2N	35.2W	1005	45		40
12	13.4N	36.2W	1005	55		40
18	13.7N	37.0W	1002	65		40
8/31/00	14.0N	37.9W	998	70	30	75
6	14.3N	38.8W	992	80	50	100
12	14.6N	39.7W	979	85	50	100
18	15.0N	40.7W	971	95	50	100
9/01/00	15.4N	41.7W	965	100	75	125
6	15.8N	42.6W	958	105	75	125
12	16.2N	43.6W	950	115	75	125
18	16.5N	44.7W	948	115	75	125
9/02/00	16.8N	45.8W	948	115	75	125
6	17.0N	46.9W	948	115	75	125
12	17.2N	48.0W	948	115	75	150
18	17.3N	49.2W	948	115	75	150
9/03/00	17.3N	50.5W	948	115	75	150
6	17.4N	51.8W	948	120	75	150
12	17.3N	53.1W	948	120	75	150
18	17.3N	54.3W	945	120	75	125S/150N
9/04/00	17.1N	55.6W	942	120	100	140S/160N
6	17.0N	56.8W	940	120	100S/125N	140S/175N
12	17.0N	58.0W	945	120	100S/125N	140S/175N
18	17.0N	59.1W	943	120	100S/125N	140S/175N
9/05/00	17.1N	60.1W	940	120	100S/125N	140S/175N
6	17.3N	61.0W	939	120	100S/125N	140S/175N
12	17.5N	61.7W	945	115	90S/150N	140S/200N
18	18.0N	62.4W	944	115	90S/150N	150S/200N
9/06/00	18.4N	63.0W	942	115	90SW/125SE/150	150S/200N
6	18.9N	63.6W	939	115	90S/150N	150S/200N
12	19.4N	64.2W	943	115	90S/150N	150S/200N
18	20.1N	64.9W	940	115	100SW/120NW/150	150W/200E
9/07/00	20.7N	65.4W	938	115	100SW/120NW/150	150W/200E
6	21.3N	66.0W	936	115	100SW/120NW/150	150W/200E
12	22.0N	66.6W	941	110	150	175W/250E
18	22.8N	67.2W	938	110	150	175W/250E
9/08/00	24.3N	68.0W	935	110	MSG	MSG
6	25.8N	68.8W	939	110	150	175W/250E
12	26.4N	69.3W	941	105	150	175W/250E
18	26.5N	69.5W	944	100	120W/150E	175W/250E
9/09/00	27.1N	69.8W	945	95	120W/150E	175W/250E
6	29.1N	69.5W	949	90	120W/160E	175W/250E
12	31.0N	69.1W	952	85	120W/160E	175W/250E
18	32.7N	68.6W	955	85	110W/175E	175W/250E
9/10/00	34.5N	67.2W	959	85	110W/175E	175NW/250
6	36.5N	65.4W	963	85	100NW/175SE/150	175NW/275SE/225
12	38.4N	63.7W	961	80	100NW/180SE/150	175NW/225NE/275
18	40.9N	60.9W	966	80	50NW/180SE/150	175NW/275SE/250
9/11/00	43.9N	57.7W	965	80		
6	47.1N	54.2W	963	80	50NW/100NE/250	100NW/200NE/300
12	51.5N	48.5W	960	70	75N/150S	120N/275S

Hurricane Data(3) 1998 GEORGES

Date/Time (UTC)	Lat. (°N)	Lon. (°W)	Pressure (mb)	Wind Speed (kt)	50 Knot Radius (nm)	34 Knot Radius (nm)
10/16/12	10.6	31.3	1005	35		30S/60N
18	11.0	32.9	1003	35		30S/60N
10/17/00	11.3	34.6	1000	45		30S/75N
6	11.7	36.3	997	50		30S/75N
12	12.0	38.1	994	55	0S/30N	30S/75N
18	12.3	40.0	987	65	50	100
10/18/00	12.5	42.0	984	70	40	75S/100N
6	12.8	43.9	977	80	40	75S/100N
12	13.1	45.7	973	85	40	75S/100N
18	13.5	47.4	970	90	40	75S/100N
10/19/00	13.9	49.0	970	90	40	80SW/105NE/110
6	14.4	50.6	965	95	50	110SE/110SW/175
12	14.9	52.0	954	110	60	110S/175N
18	15.4	53.5	949	125	80	110S/175N
10/20/00	15.7	54.9	939	130	75SW/100SE/125	125SW/150SE/175
6	16.0	56.3	937	135	50SW/100	125SW/150SE/175
12	16.2	57.7	939	130	50SW/100	125SW/150
18	16.4	59.2	956	115	50SW/75NW/100	100W/150E
10/21/00	16.7	60.6	963	100	50W/100E	100W/150E
6	17.1	62.1	966	100	75SE/100NE/50	125SE/150NE/75
12	17.4	63.6	966	95	75SE/100NE/50	125SE/150NE/75
18	17.8	65.0	972	90	75SE/100NE/50	125SE/150NE/75
10/22/00	18.2	66.3	970	90	75SE/100NE/60	150NE/125
6	18.0	67.4	972	95	75SE/100NE/60	150NE/125
12	18.2	68.5	964	105	75SE/100NE/60	150NE/125
18	18.6	69.7	970	95	100NE/75	150NE/125
10/23/00	18.8	70.8	980	70	100NE/75	150NE/125
6	19.0	72.1	990	65	100NE/75	150NE/125
12	19.3	73.3	996	65	100NE/75	150NE/125
18	19.8	74.3	994	65	75SE/100NE/25	125SE/150NE/50
10/24/00	20.5	74.9	992	65	75SE/100NE/30	75SW/150NE/125
6	20.8	76.0	991	65	30W/100E	75SW/135NE/125
12	21.3	77.2	990	70	30W/100E	75SW/135NE/125
18	21.9	78.0	989	75	30SW/50NW/100	50SW/150NE/125
10/25/00	22.7	79.0	987	80	30SW/50NW/100SE/125NE	50SW/150NE/125
6	23.4	80.2	986	85	30SW/50NW/100SE/125NE	50SW/150NE/125
12	23.9	81.3	982	90	30SW/50NW/100SE/125NE	60SW/150NE/125
18	24.6	82.4	975	90	40SW/90NW/100	100SW/150
10/26/00	24.8	83.3	974	90	75SW/120NE/100	120SW/150
6	25.2	84.2	975	90	75SW/120NE/100	120SW/150
12	25.7	85.1	974	90	30SW/50NW/100SE/125NE	80NW/100SW/150
18	26.2	85.9	975	90	30SW/50NW/75SE/150NE	80NW/100SW/150SE/175NE
10/27/00	27.0	86.5	969	95	25SW/50NW/75SE/125NE	75NW/100SW/150
6	27.6	87.2	970	95	25SW/50NW/75SE/125NE	75NW/100SW/150
12	28.2	87.8	962	95	30SW/75NW/90SE/100NE	90SW/100NW/130NE/150SE
18	28.8	88.3	962	95	30SW/45NW/70NE/90SE	90SW/100NW/110NE/160SE
10/28/00	29.3	88.5	961	95	75NE/100SE/60	100NW/110NE/125SW/150SE
6	29.8	88.7	964	90	75NE/100SE/60	100NW/110NE/125SW/150SE
12	30.4	88.9	965	90	90SW/100SE/60	125SW/150SE/100
18	30.6	88.9	984	65	75SW/100SE/60	75N/125S
10/29/00	30.6	89.0	986	50		35N/75S
6	30.6	88.4	992	40		30SW/60SE/0

Hurricane Data(4) 1999 LENNY

Date/Time (UTC)	Lat. (°N)	Lon. (°W)	Pressure (mb)	Wind Speed (kt)	50 Knot Radius (nm)	34 Knot Radius (nm)
11/14/18	16.3	79.3	992	55	40	50SE/75
11/15/00	16.0	78.6	988	70	25NE/30	40NE/75NW/60
6	15.5	77.7	977	75	25NE/30	40NE/75NW/60
12	15.1	76.4	971	85	25NE/30	40NE/75NW/60
18	14.8	74.8	983	75	25NW/75NE/50	100NE/75SE/125SW/50NW
11/16/00	15.0	73.4	982	75	25NW/75NE/50	50NW/125
6	15.1	72.0	974	75	60NW/75	75NW/125
12	15.1	70.5	971	85	60NW/75	75NW/125
18	15.4	69.0	967	85	75S/60N	90NW/150SE/125
11/17/00	15.9	67.6	959	100	40NW/60NE/75	75NW/150SE/125
6	16.4	66.5	952	105	40NW/90NE/75	75NW/150SE/125
12	16.8	65.5	946	115	40NW/90NE/75	75NW/150SE/125
18	17.4	64.8	933	135	40NW/60SW/75NE/120SE	90NW/100NE/125SW/180SE
11/18/00	17.6	64.2	940	130	60NW/105SE/75	70NW/100NE/135SW/160SE
6	17.8	63.9	944	125	60NW/105SE/75	75NW/100NE/135SW/160SE
12	17.9	63.6	953	120	60NW/105SE/75	75NW/100NE/135SW/160SE
18	18.0	63.3	966	110	60NW/100SE/75	75NW/150SE/100
11/19/00	18.1	63.1	972	85	50	60NW/75NE/90SW/125SE
6	18.0	62.9	979	75	50	60NW/75NE/90SW/125SE
12	17.9	62.8	986	70	50	60NW/75NE/90SW/125SE
18	17.6	62.5	994	60	30	100SE/60
11/20/00	17.3	61.8	994	55	30	100SE/60
6	17.0	61.1	995	55	75E/0W	90NE/120SE/30
12	16.5	60.4	996	50	25E/0W	75E/25W
18	15.9	59.8	998	45		75E/25W
11/21/00	16.0	59.0	998	40		25SW/100SE/50

Results of Wave forecasting

1989 HUGO(PARHAM)

No.	Wave Dir (deg)	Swell						Wind wave					
		Height (m)	Period (sec)	Year	Month	Day	Hour	Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	0.48	2.7	89	9	15	9	0.56	2.0	89	9	17	0
2	NE	1.31	4.9	89	9	16	6	0.56	1.8	89	9	17	5
3	ENE	7.54	10.9	89	9	16	23	0.52	1.7	89	9	17	6
4	E	11.10	12.1	89	9	17	7	0.43	1.6	89	9	17	8
5	ESE	9.30	11.0	89	9	17	24	0.43	1.6	89	9	17	10
6	SE	6.57	9.7	89	9	18	15	0.43	1.6	89	9	17	13
7	SSE	0.00	0.0	-	-	-	-	0.33	1.3	89	9	17	18
8	S	0.00	0.0	-	-	-	-	0.28	1.3	89	9	18	6
9	SSW	0.00	0.0	-	-	-	-	0.11	0.9	89	9	19	5
10	SW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
11	WSW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
12	W	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
13	WNW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
14	NW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
15	NNW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
16	N	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-

1989 HUGO(URLINGS)

No.	Wave Dir (deg)	Swell					
		Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	0.74	3..23	89	9	16	0
2	NE	3.38	7.7	89	9	16	16
3	ENE	10.11	11.5	89	9	17	7
4	E	9.35	10.9	89	9	18	0
5	ESE	9.50	10.9	89	9	18	1
6	SE	8.44	10.5	89	9	18	10
7	SSE	3.32	7.8	89	9	19	9
8	S	0.00	0.0	-	-	-	-
9	SSW	0.00	0.0	-	-	-	-
10	SW	0.00	0.0	-	-	-	-
11	WSW	0.00	0.0	-	-	-	-
12	W	0.00	0.0	-	-	-	-
13	WNW	0.00	0.0	-	-	-	-
14	NW	0.00	0.0	-	-	-	-
15	NNW	0.00	0.0	-	-	-	-
16	N	0.00	0.0	-	-	-	-

1995 LUIS(PARHAM)

No.	Wave Dir (deg)	Swell						Wind wave					
		Height (m)	Period (sec)	Year	Month	Day	Hour	Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	9.98	11.3	95	9	6	6	0.00	0.0	-	-	-	-
2	NE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
3	ENE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
4	E	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
5	ESE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
6	SE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
7	SSE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
8	S	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
9	SSW	0.00	0.0	-	-	-	-	0.32	1.3	95	9	6	21
10	SW	0.00	0.0	-	-	-	-	0.30	1.4	95	9	6	16
11	WSW	0.00	0.0	-	-	-	-	0.21	1.3	95	9	6	13
12	W	6.27	9.1	95	9	7	4	0.21	1.4	95	9	6	12
13	WNW	7.26	9.6	95	9	7	22	0.31	1.7	95	9	6	11
14	NW	7.76	9.8	95	9	7	18	0.45	2.0	95	9	6	10
15	NNW	7.96	10.0	95	9	7	14	0.85	2.6	95	9	6	6
16	N	8.44	10.3	95	9	7	7	0.87	2.5	95	9	6	2

1995 LUIS(URLINGS)

No.	Wave Dir (deg)	Swell					
		Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	0.00	0.0	-	-	-	-
2	NE	0.00	0.0	-	-	-	-
3	ENE	0.00	0.0	-	-	-	-
4	E	0.00	0.0	-	-	-	-
5	ESE	0.00	0.0	-	-	-	-
6	SE	0.00	0.0	-	-	-	-
7	SSE	0.00	0.0	-	-	-	-
8	S	0.00	0.0	-	-	-	-
9	SSW	0.00	0.0	-	-	-	-
10	SW	0.00	0.0	-	-	-	-
11	WSW	0.00	0.0	-	-	-	-
12	W	7.20	9.5	95	9	7	23
13	WNW	8.10	9.9	95	9	7	12
14	NW	8.52	10.1	95	9	7	5
15	NNW	8.49	10.1	95	9	7	4
16	N	9.28	10.6	95	9	6	6

1998 GEORGES(PARHAM)

No.	Wave Dir (deg)	Swell						Wind wave					
		Height (m)	Period (sec)	Year	Month	Day	Hour	Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	1.09	4.4	98	9	20	5	0.59	2.0	98	9	21	1
2	NE	3.09	8.2	98	9	20	12	0.42	1.7	98	9	21	3
3	ENE	8.91	11.3	98	9	21	3	0.00	0.0	-	-	-	-
4	E	4.11	7.6	98	9	21	19	0.22	1.2	98	9	21	5
5	ESE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
6	SE	0.00	0.0	-	-	-	-	0.35	1.5	98	9	21	7
7	SSE	0.00	0.0	-	-	-	-	0.30	1.3	98	9	21	8
8	S	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
9	SSW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
10	SW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
11	WSW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
12	W	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
13	WNW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
14	NW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
15	NNW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
16	N	0.72	3.1	98	9	19	23	0.45	2.0	98	9	20	12

1998 GEORGES(URLINGS)

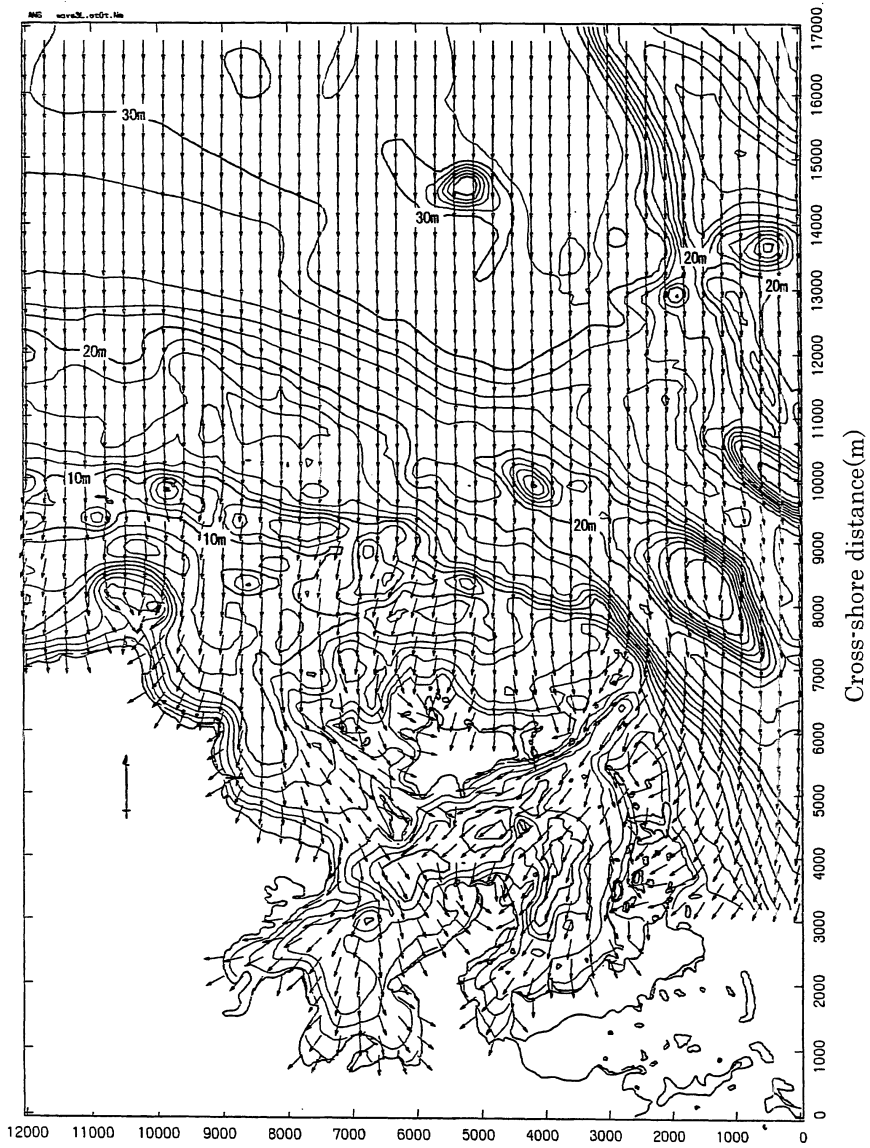
No.	Wave Dir (deg)	Swell					
		Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	3.56	7.9	98	9	20	18
2	NE	7.25	10.1	98	9	21	3
3	ENE	4.56	8.2	98	9	21	12
4	E	0.00	0.0	-	-	-	-
5	ESE	0.00	0.0	-	-	-	-
6	SE	0.00	0.0	-	-	-	-
7	SSE	0.00	0.0	-	-	-	-
8	S	0.00	0.0	-	-	-	-
9	SSW	0.00	0.0	-	-	-	-
10	SW	0.00	0.0	-	-	-	-
11	WSW	0.00	0.0	-	-	-	-
12	W	0.00	0.0	-	-	-	-
13	WNW	0.00	0.0	-	-	-	-
14	NW	0.00	0.0	-	-	-	-
15	NNW	0.00	0.0	-	-	-	-
16	N	0.80	3.5	98	9	20	2

1999 LENNY(PARHAM)

No.	Wave Dir (deg)	Swell						Wind wave					
		Height (m)	Period (sec)	Year	Month	Day	Hour	Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	0.00	0.0	-	-	-	-	0.22	1.4	99	11	20	17
2	NE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
3	ENE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
4	E	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
5	ESE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
6	SE	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
7	SSE	0.34	2.4	99	11	16	14	0.17	1.1	99	11	17	13
8	S	2.36	6.3	99	11	17	14	0.25	1.2	99	11	18	9
9	SSW	5.74	9.5	99	11	18	2	0.24	1.2	99	11	18	16
10	SW	7.68	10.0	99	11	18	16	0.02	0.5	99	11	19	24
11	WSW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
12	W	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
13	WNW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
14	NW	0.00	0.0	-	-	-	-	0.00	0.0	-	-	-	-
15	NNW	0.00	0.0	-	-	-	-	0.08	1.0	99	11	20	1
16	N	0.00	0.0	-	-	-	-	0.45	2.0	99	11	20	7

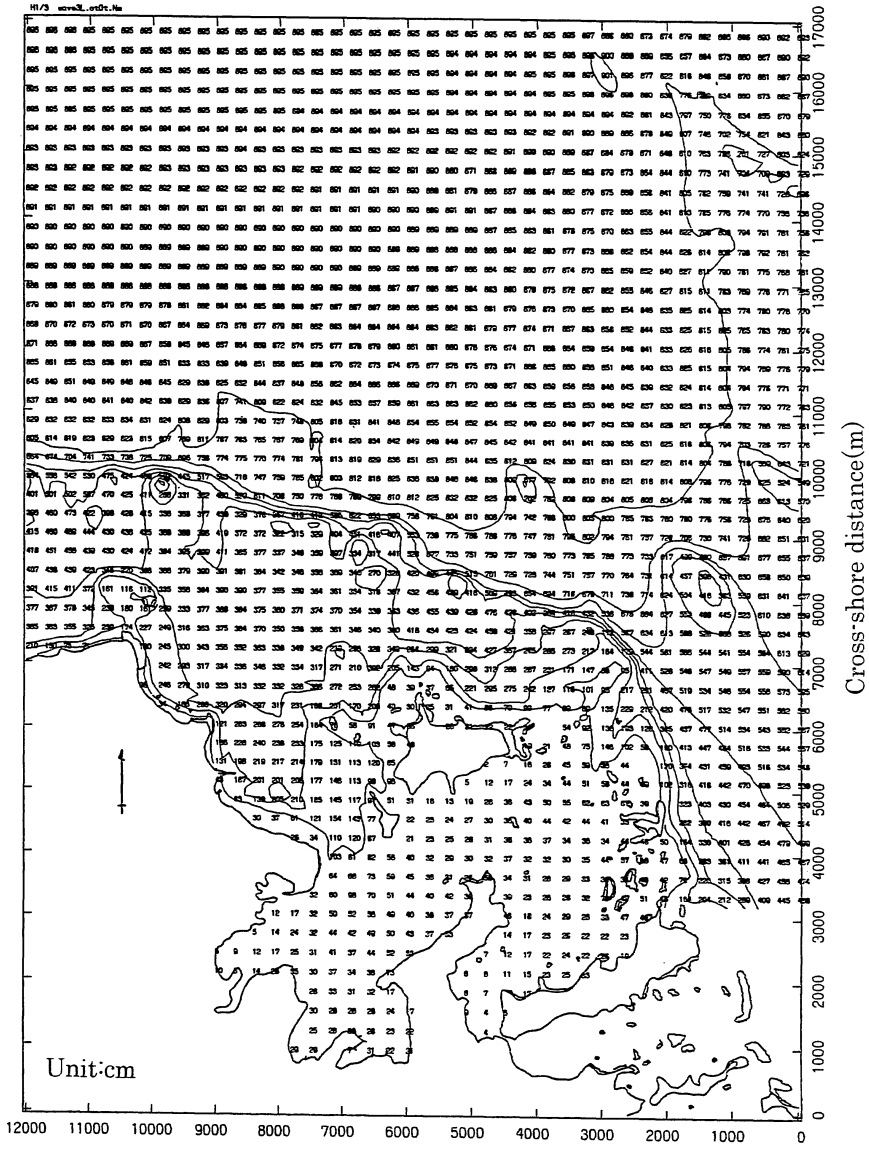
1999 LENNY(URLINGS)

No.	Wave Dir (deg)	Swell					
		Height (m)	Period (sec)	Year	Month	Day	Hour
1	NNE	0.00	0.0	-	-	-	-
2	NE	0.00	0.0	-	-	-	-
3	ENE	0.00	0.0	-	-	-	-
4	E	0.00	0.0	-	-	-	-
5	ESE	0.00	0.0	-	-	-	-
6	SE	0.00	0.0	-	-	-	-
7	SSE	0.48	2.7	99	11	16	11
8	S	0.84	3.6	99	11	17	4
9	SSW	2.57	7.4	99	11	17	11
10	SW	7.87	10.4	99	11	18	13
11	WSW	3.07	6.9	99	11	20	2
12	W	0.00	0.0	-	-	-	-
13	WNW	0.00	0.0	-	-	-	-
14	NW	0.00	0.0	-	-	-	-
15	NNW	0.00	0.0	-	-	-	-
16	N	0.00	0.0	-	-	-	-



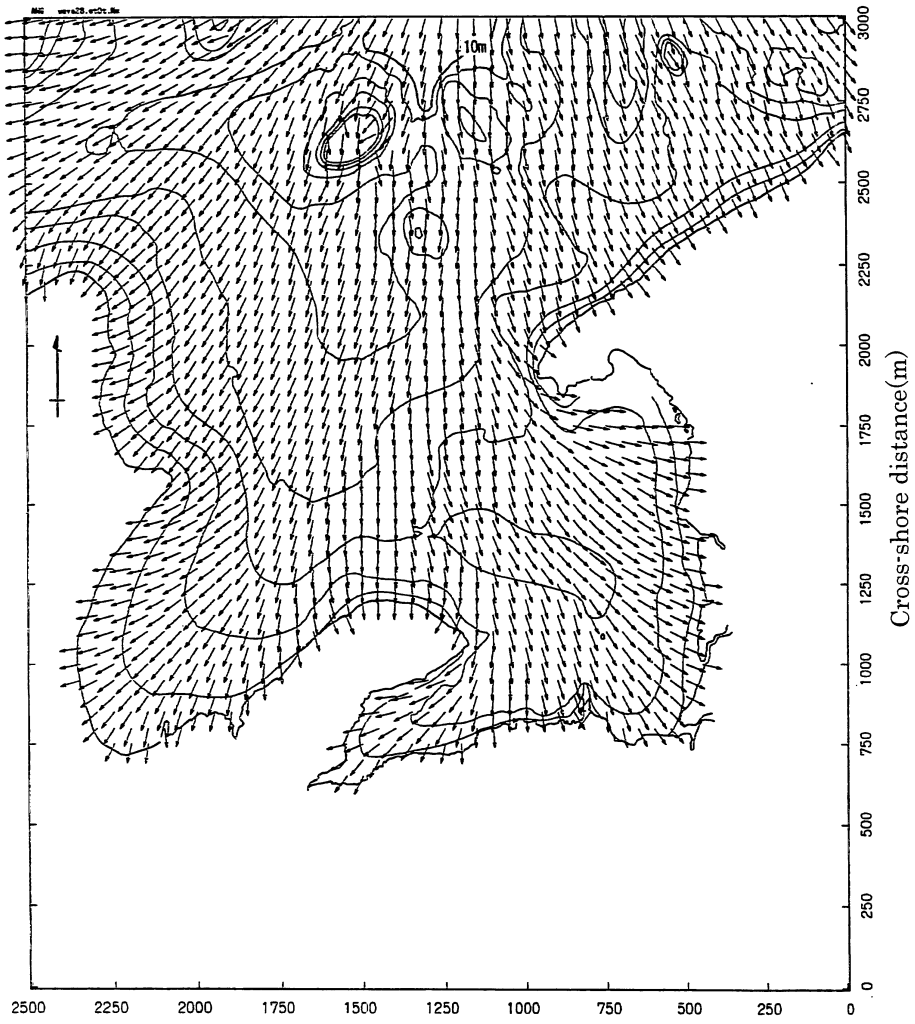
Distribution of Significant Wave Direction (Parham Site : Wide area)

(Wave Direction:N, H=9.98m,T=11.3sec)



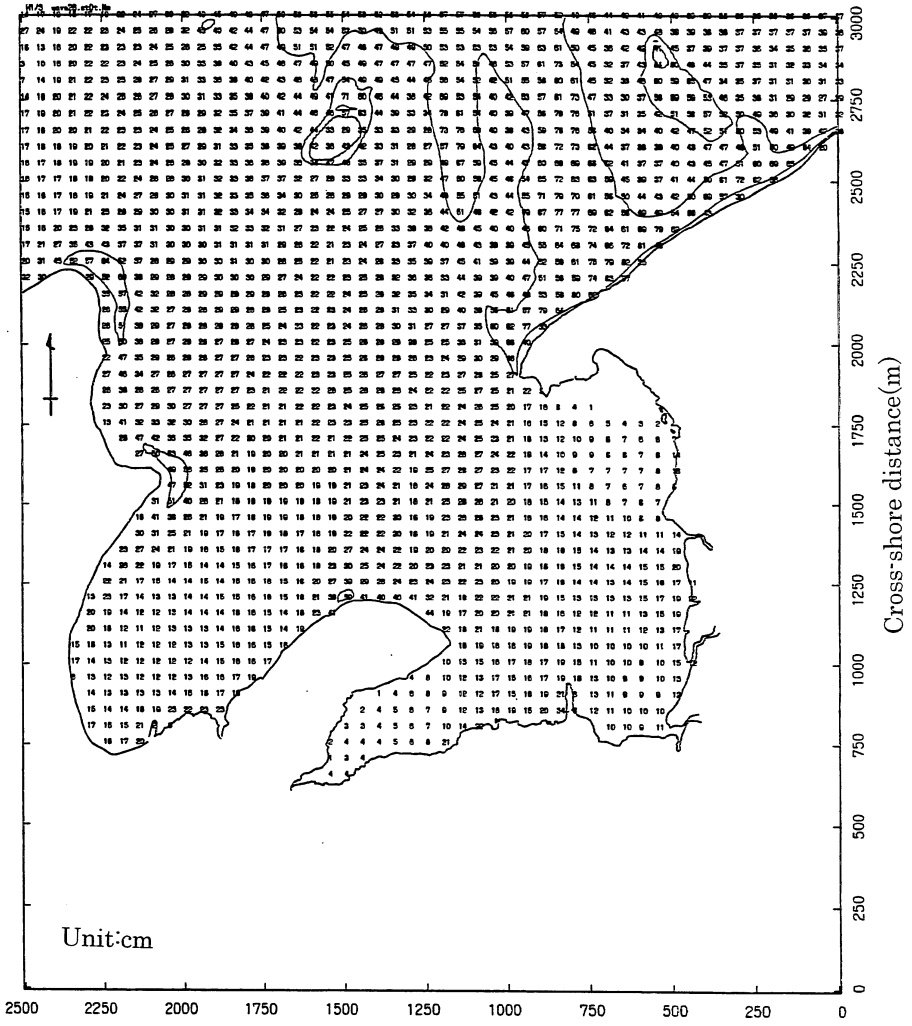
Distribution of Significant Wave Height (Parham Site : Wide area)

(Wave Direction:N, H=9.98m,T=11.3sec)



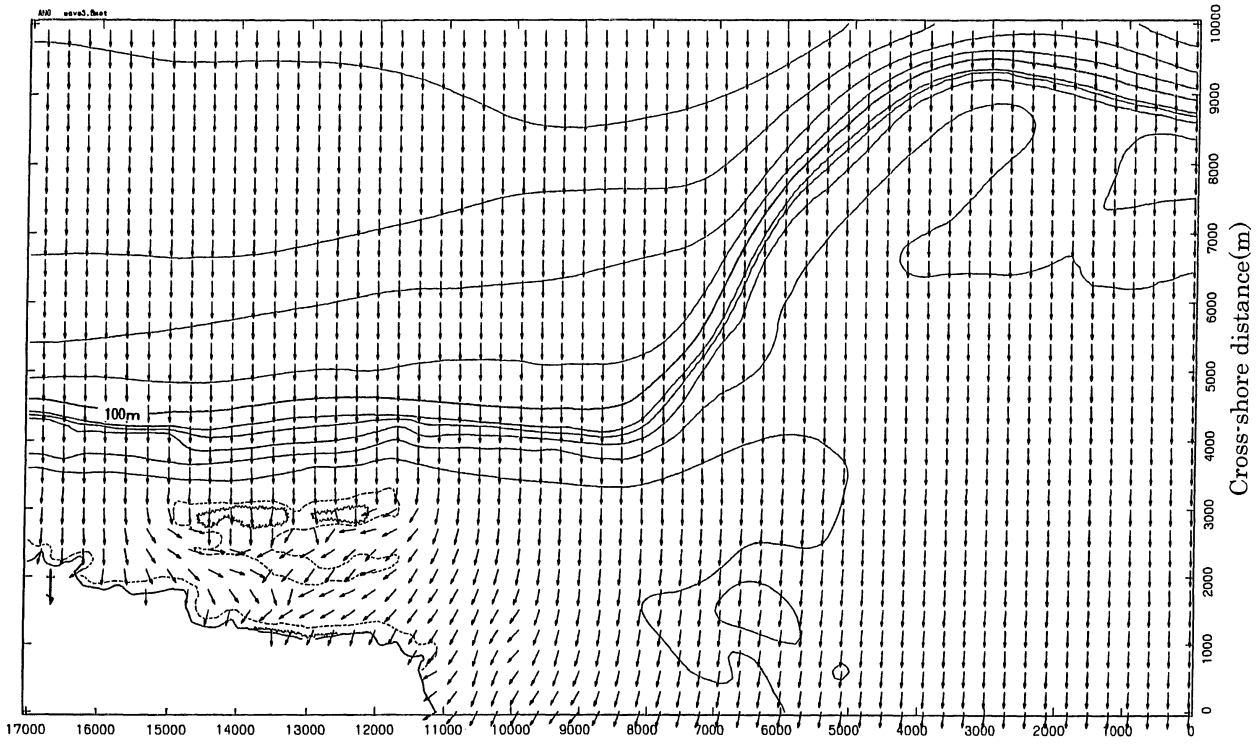
Distribution of Significant Wave Direction (Parham Site : Small area)

(Wave Direction:N, H=9.98m,T=11.3sec)



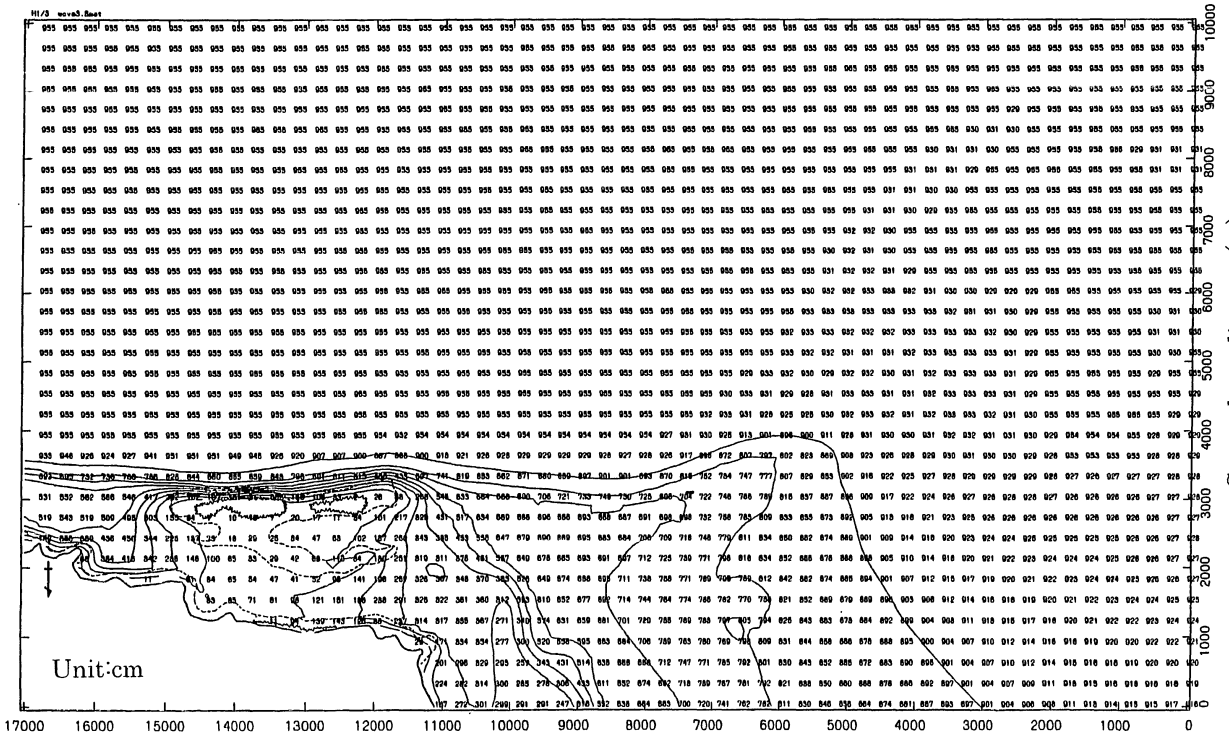
Distribution of Significant Wave Height (Parham Site : Small area)

(Wave Direction:N, H=9.98m,T=11.3sec)



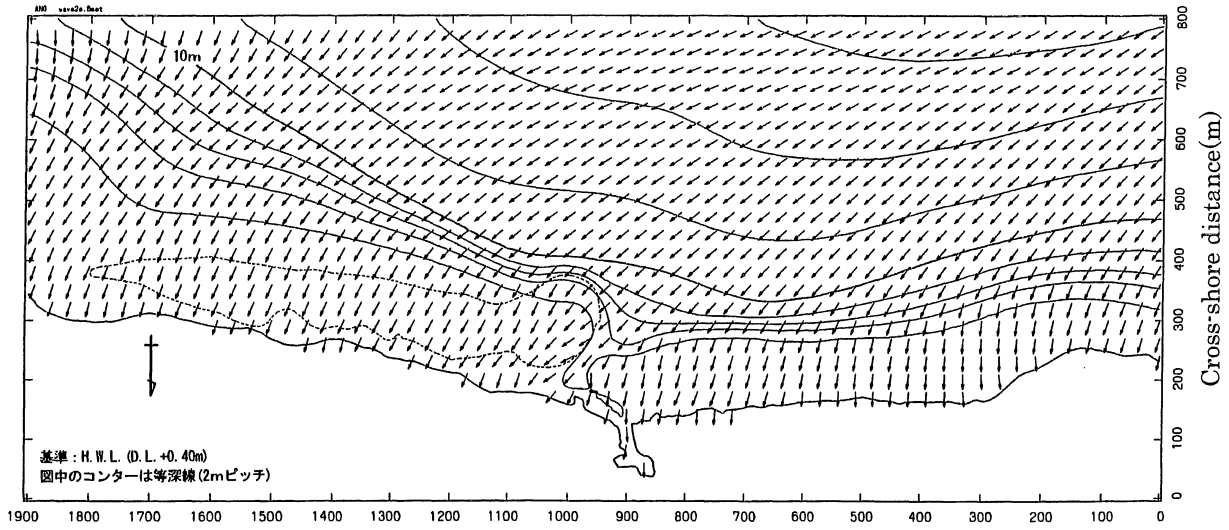
Distribution of Significant Wave Direction (Urlings Site : Wide area)

(Wave Direction:S, H=9.50m,T=10.9sec)



Distribution of Significant Wave Height (Urlings Site : Wide area)

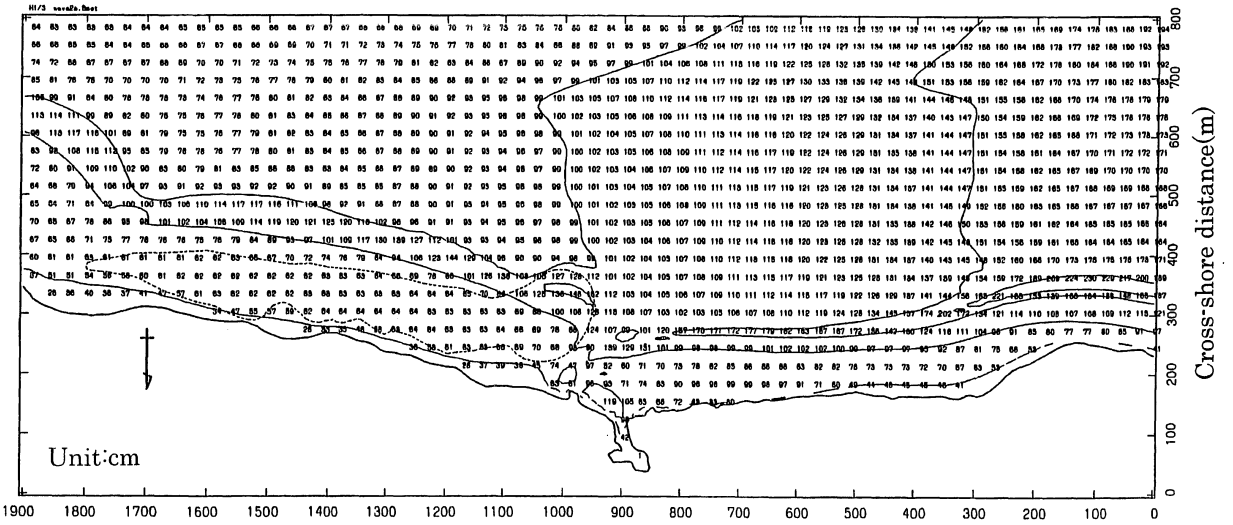
(Wave Direction:S, H=9.50m,T=10.9sec)



Long-shore distance(m)

Distribution of Significant Wave Direction (Urlings Site : Small area)

(Wave Direction:S, H=9.50m,T=10.9sec)

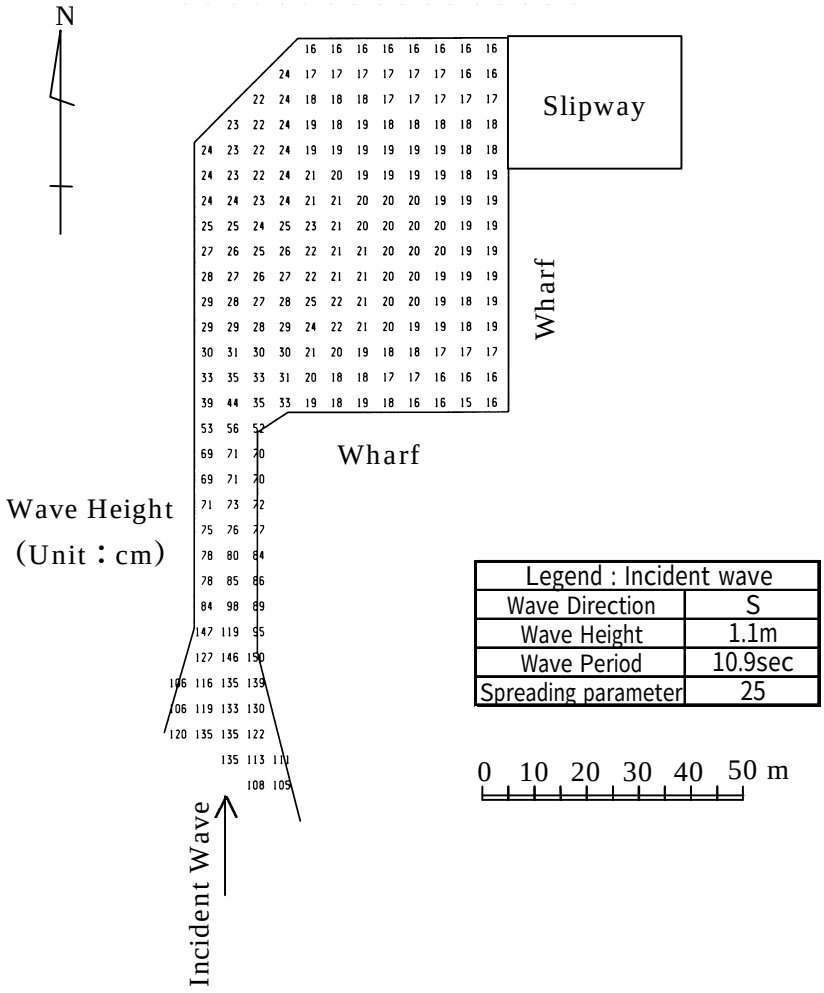


Long-shore distance(m)

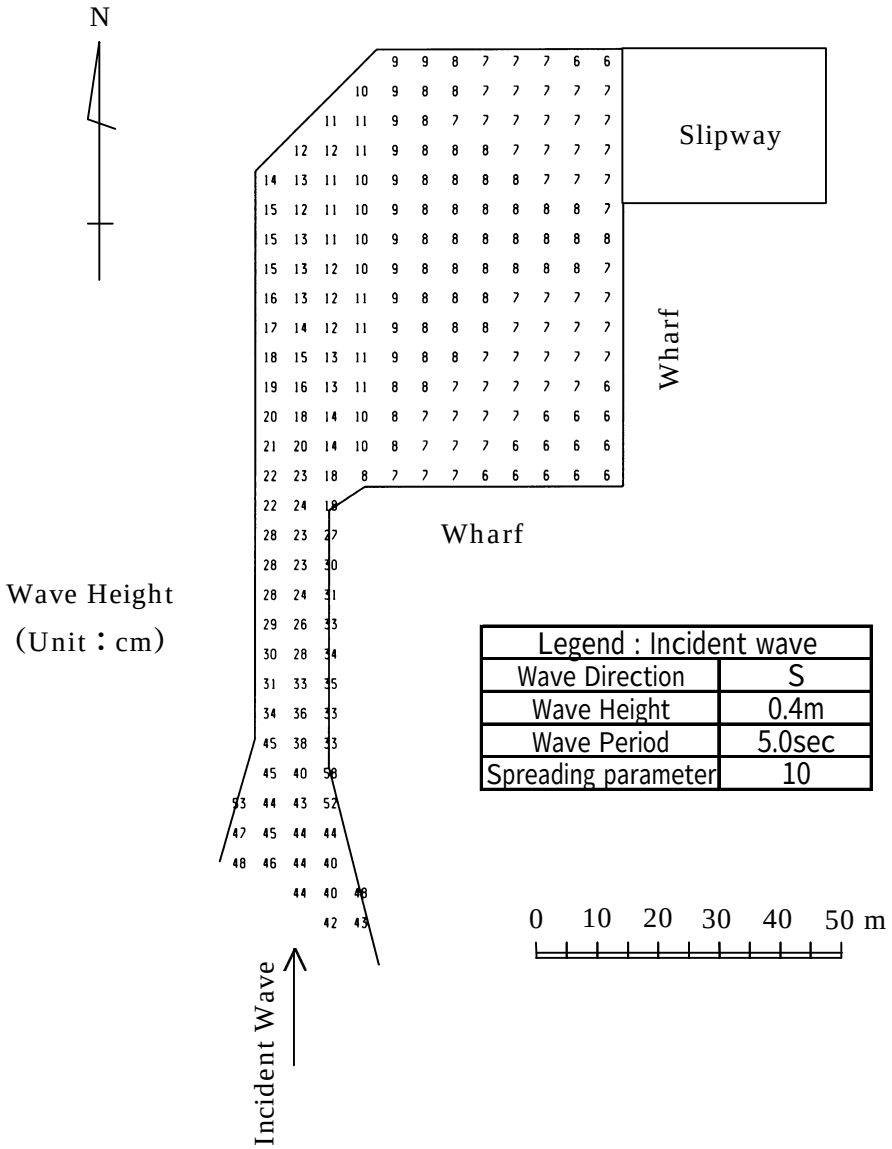
Distribution of Significant Wave Height (Urlings Site : Small area)

(Wave Direction:S, H=9.50m,T=10.9sec)

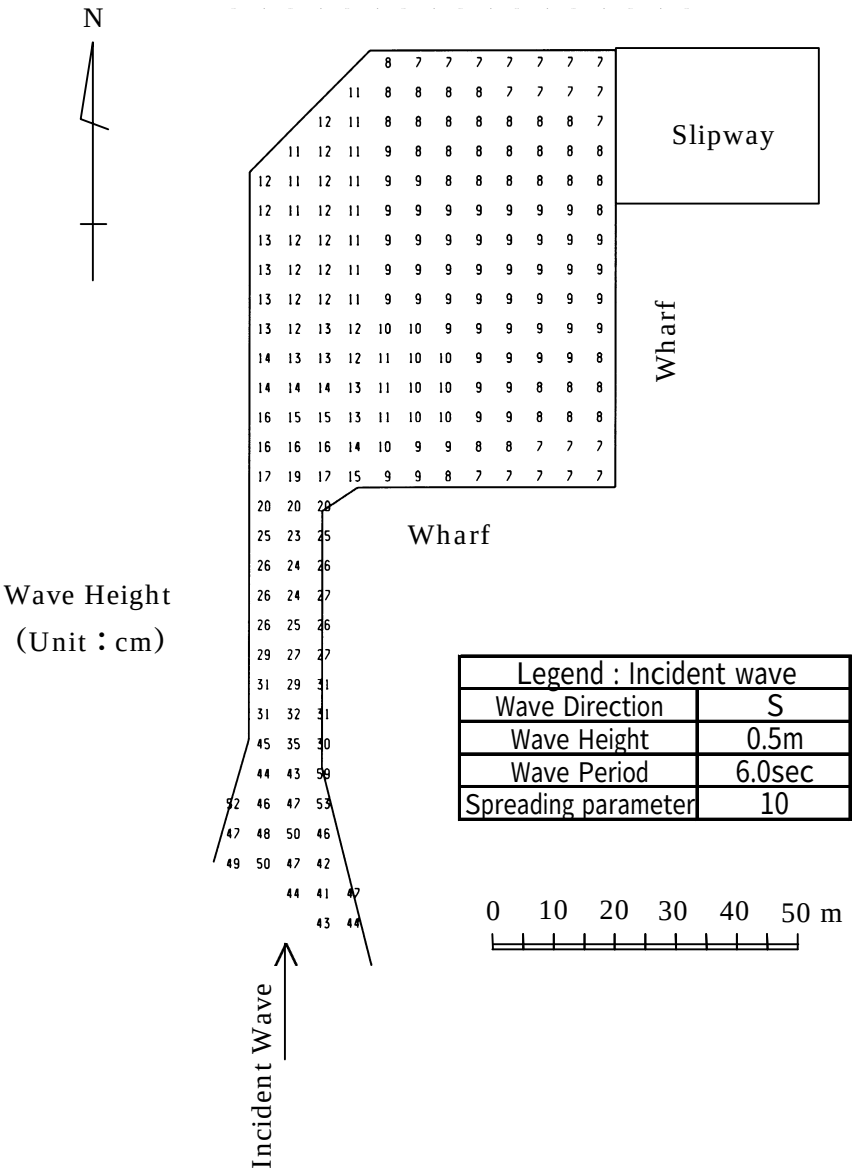
Tranquility of Basin



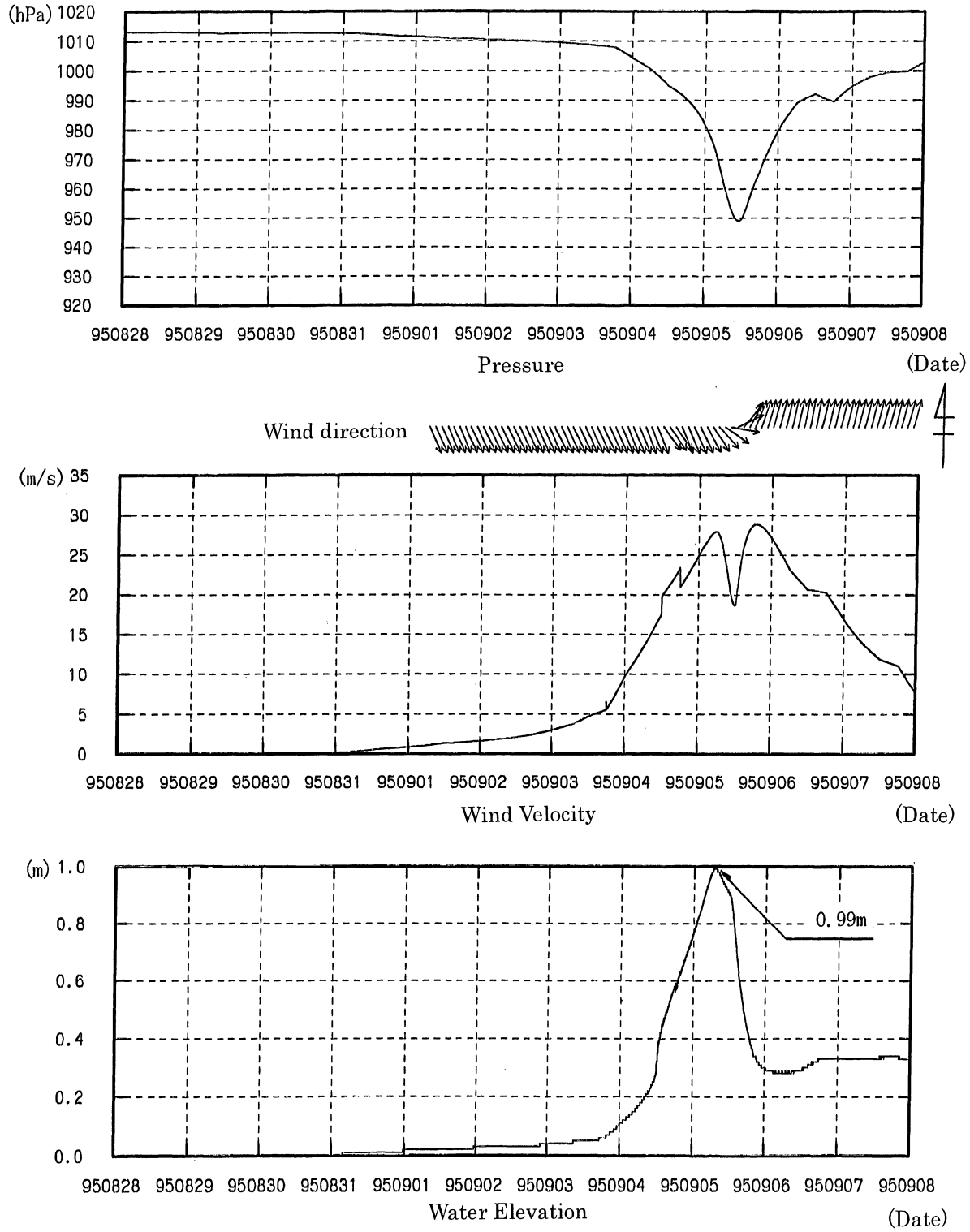
Simulation result of tranquility (Case-1)



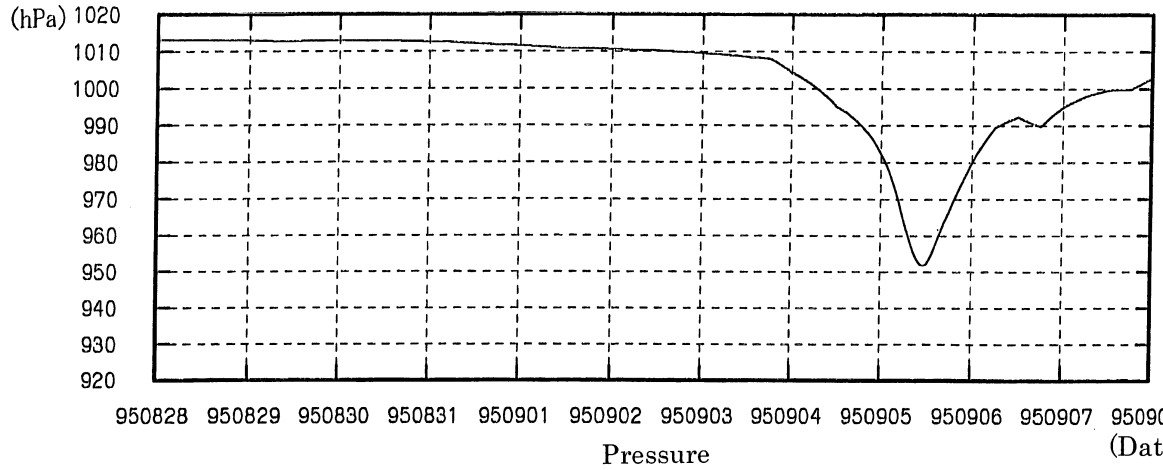
Simulation result of tranquility (Case-2)



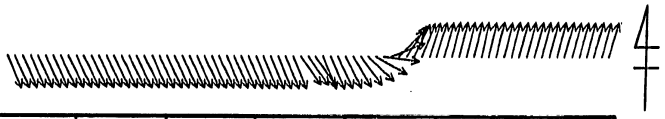
Simulation result of tranquility (Case-3)



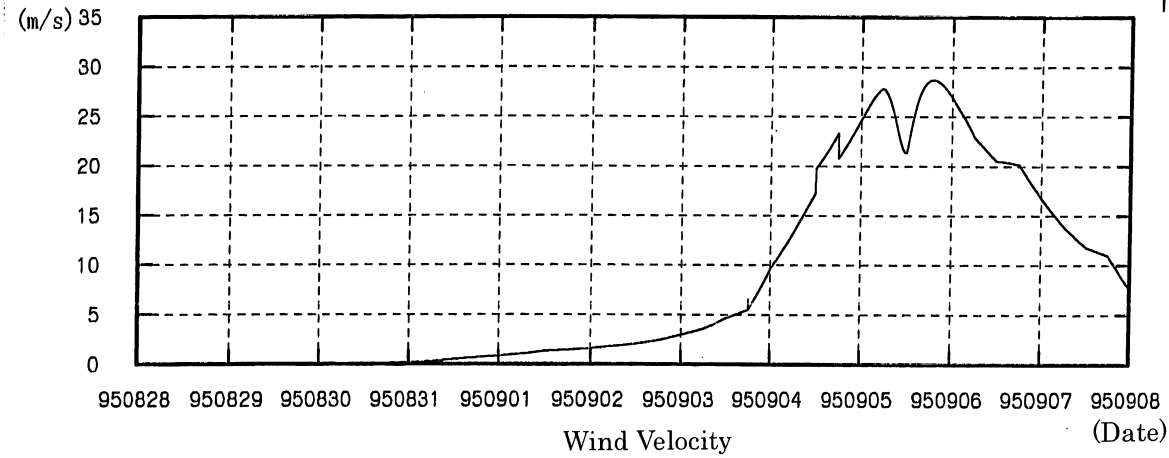
Simulation results of Pressure, Wind, Storm surge (Parhm Site, 1995Luis)



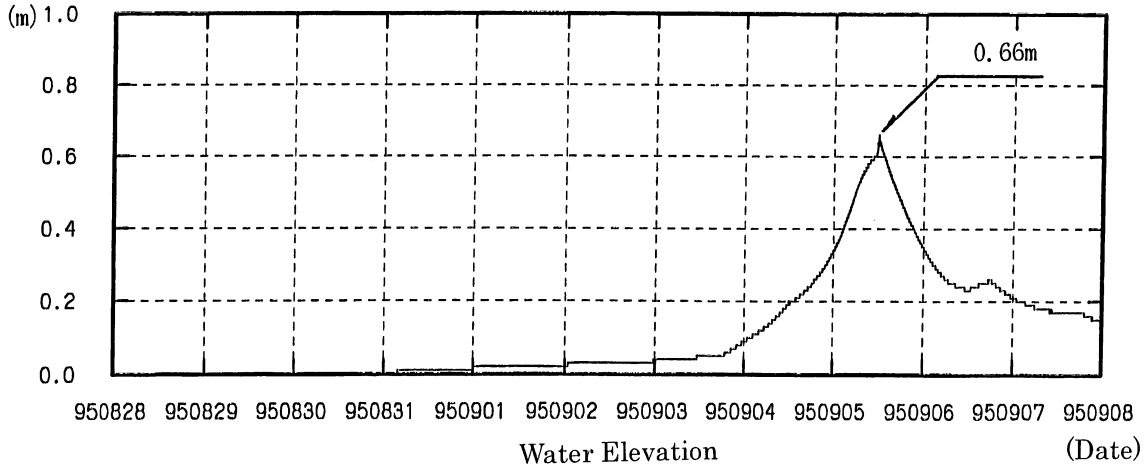
Pressure



Wind direction



Wind Velocity



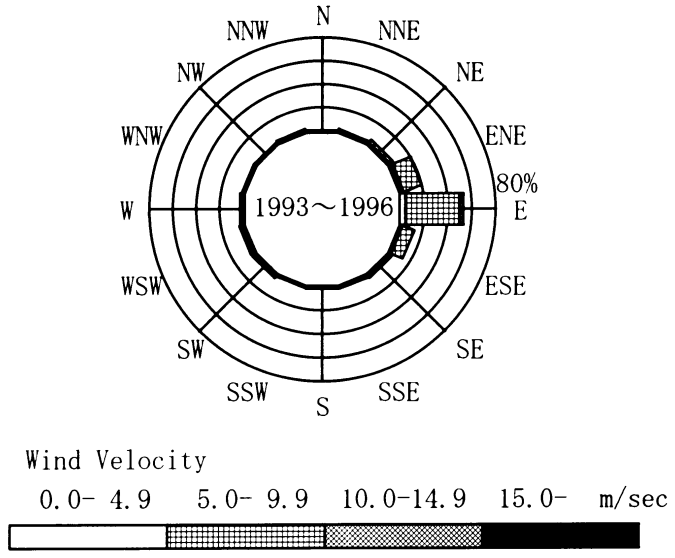
Water Elevation

Simulation results of Pressure, Wind, Storm surge (Urlings Site, 1995Luis)

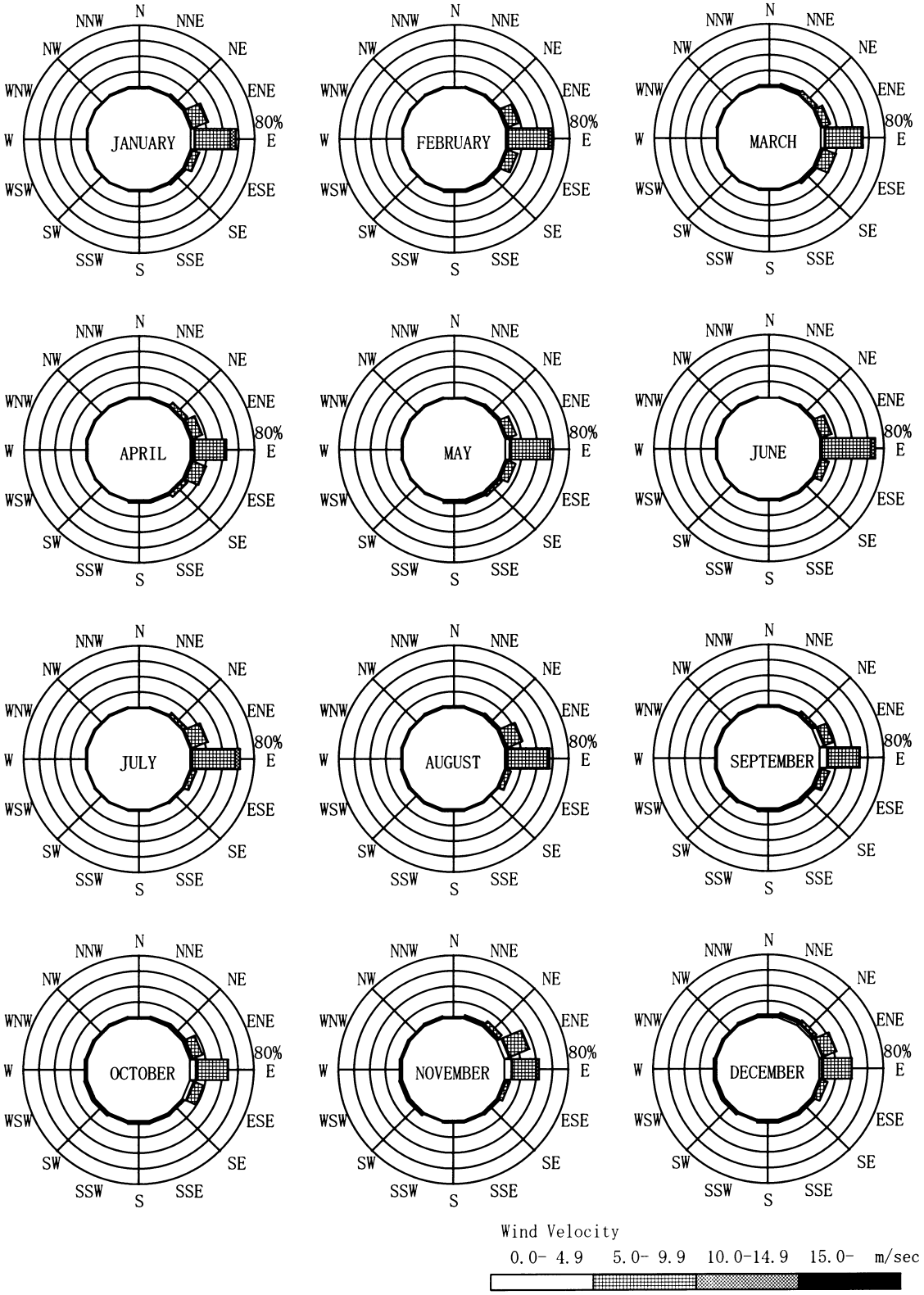
Wind data

JAN 1, 1993-DEC 31, 1996 ANTIGUA&BARBUDA V.C.BIRD AIRPORT

Direction / Velocity	S	SSW	SW	WSW	W	WNW	NW	NNW	N	NNE	NE	ENE	E	ESE	SE	SSE	TOTAL
0.0- 0.9	5	3			1	1		1				1	1		2	3	18
m/sec	0.0	0.0			0.0	0.0		0.0				0.0	0.0		0.0	0.0	0.1
1.0- 1.9	198	48	23	13	12	7	8	4	14	25	20	35	73	55	63	103	701
m/sec	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	2.1
2.0- 2.9	85	36	13	15	15	14	10	15	28	54	69	80	191	104	92	86	907
m/sec	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.6	0.3	0.3	0.3	2.7
3.0- 3.9	57	18	11	13	15	9	8	6	43	117	125	272	448	170	88	71	1471
m/sec	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.8	1.3	0.5	0.3	0.2	4.4
4.0- 4.9	43	14	10	13	11	1	2	15	48	67	166	482	725	284	101	65	2047
m/sec	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.5	1.4	2.2	0.9	0.3	0.2	6.2
5.0- 5.9	74	38	8	9	7	3	5	11	41	137	317	1139	2048	685	209	129	4860
m/sec	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	3.4	6.2	2.1	0.6	0.4	14.6
6.0- 6.9	43	15	6	13	5	4	1	5	22	109	365	1409	3290	995	202	75	6559
m/sec	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.1	4.2	9.9	3.0	0.6	0.2	19.7
7.0- 7.9	28	8	4	5	3	1	1	1	13	76	268	1419	4050	882	141	41	6941
m/sec	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	4.3	12.2	2.7	0.4	0.1	20.9
8.0- 8.9	8	2	1	2					8	40	135	874	3553	618	89	28	5358
m/sec	0.0	0.0	0.0	0.0					0.0	0.1	0.4	2.6	10.7	1.9	0.3	0.1	16.1
9.0- 9.9	2	3	2	1					3	15	41	453	2102	266	27	7	2922
m/sec	0.0	0.0	0.0	0.0					0.0	0.0	0.1	1.4	6.3	0.8	0.1	0.0	8.8
10.0-10.9	2	2							4	7	15	145	830	76	12	5	1098
m/sec	0.0	0.0							0.0	0.0	0.0	0.4	2.5	0.2	0.0	0.0	3.3
11.0-11.9	1			1					2	1	5	61	165	19	6	3	264
m/sec	0.0			0.0					0.0	0.0	0.0	0.2	0.5	0.1	0.0	0.0	0.8
12.0-12.9			2		1	1		2		1	2	7	36	5	2	3	62
m/sec			0.0		0.0	0.0		0.0		0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.2
13.0-13.9	2	1		2				2	3	1	1	2	3	1			18
m/sec	0.0	0.0		0.0				0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.1
14.0-14.9			1										4			2	7
m/sec			0.0										0.0			0.0	0.0
15.0-			5		2	2	2	2		1		1	1				16
m/sec			0.0		0.0	0.0	0.0	0.0		0.0		0.0	0.0				0.0
TOTAL	548	188	86	87	72	43	37	64	229	651	1529	6380	17520	4160	1034	621	33249
(%)	1.6	0.6	0.3	0.3	0.2	0.1	0.1	0.2	0.7	2.0	4.6	19.2	52.7	12.5	3.1	1.9	100.0



Statistical result of Wind data (January 1993 – December 1996)



Statistical result of Wind data (January 1993 – December 1996)

Rainfall

Daily maximum Rainfall(mm) 1993～1996

Month Day	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Max
1	4.0	1.4	2.3	0.3	0.0	10.9	2.6	3.4	4.5	1.2	7.2	15.8	15.8
2	14.3	3.3	0.0	0.7	2.5	10.0	5.4	4.7	3.3	0.0	10.3	4.7	14.3
3	10.4	5.4	0.2	0.7	7.5	1.8	46.6	8.4	14.5	0.0	3.4	33.2	46.6
4	1.3	5.7	0.0	0.3	0.0	20.7	6.4	2.4	6.9	6.0	0.5	5.5	20.7
5	5.0	1.9	0.2	0.0	9.9	6.3	1.0	7.0	6.9	10.2	19.4	11.3	19.4
6	2.5	13.4	16.5	0.0	15.0	17.5	1.9	0.3	2.0	4.0	5.1	2.2	17.5
7	12.3	11.5	4.1	4.6	0.5	3.5	4.7	2.2	3.7	27.7	5.0	0.0	27.7
8	8.4	1.8	5.1	1.9	42.0	0.2	30.0	5.3	3.1	0.8	0.7	1.5	42.0
9	1.3	0.1	6.4	2.8	9.2	0.0	13.2	0.9	12.0	3.0	2.2	0.1	13.2
10	1.1	1.2	2.6	37.0	17.5	0.8	34.9	2.0	63.7	7.3	13.2	2.1	63.7
11	2.9	1.1	0.4	13.4	0.3	27.2	4.3	2.0	22.5	0.0	0.5	7.0	27.2
12	4.9	2.5	9.2	0.3	9.0	2.9	3.6	0.0	0.6	0.0	10.9	3.4	10.9
13	4.7	1.8	0.3	7.2	0.1	0.6	7.3	34.9	0.0	10.9	0.7	3.3	34.9
14	1.3	5.6	0.6	0.7	7.8	22.8	29.5	14.3	0.4	0.6	2.2	11.9	29.5
15	10.5	8.8	2.2	6.4	0.5	11.4	7.6	8.1	39.1	0.0	2.3	12.7	39.1
16	2.8	0.9	14.6	36.6	0.0	6.6	0.5	3.4	27.4	1.0	1.6	15.0	36.6
17	5.8	0.6	0.1	1.0	0.0	21.5	2.9	18.2	1.1	0.9	3.1	8.3	21.5
18	0.5	7.1	2.2	0.5	2.2	10.4	6.5	43.9	1.4	14.4	39.7	14.6	43.9
19	2.1	6.8	3.5	0.6	1.4	1.9	2.1	0.0	46.5	14.4	3.1	15.6	46.5
20	1.1	17.5	0.0	4.5	0.5	1.1	0.0	2.0	0.4	25.9	10.1	0.3	25.9
21	1.1	0.8	0.0	0.0	0.0	3.7	2.9	3.9	7.1	9.8	4.7	8.9	9.8
22	0.2	5.3	3.5	5.4	0.0	14.7	13.9	6.6	10.2	27.0	2.8	1.9	27.0
23	0.6	4.7	10.8	19.1	3.9	0.1	6.1	10.7	1.2	11.9	29.7	3.1	29.7
24	2.9	0.0	0.8	0.0	8.8	0.4	5.3	18.2	1.2	37.2	23.0	22.5	37.2
25	4.2	0.0	0.1	0.0	33.8	1.3	4.1	9.9	2.1	5.5	6.1	7.2	33.8
26	11.0	0.3	1.6	4.5	38.4	0.3	3.3	0.3	1.7	5.7	6.5	0.2	38.4
27	0.0	3.6	0.5	0.3	45.8	3.1	2.4	116.4	3.1	4.4	1.8	6.2	116.4
28	5.2	3.7	1.2	3.2	3.7	1.2	4.6	29.2	4.2	8.5	1.3	4.4	29.2
29	0.0		0.8	13.8	19.5	1.9	3.5	3.2	3.2	4.4	7.6	0.7	19.5
30	2.6		5.7	0.0	37.5	0.9	25.0	9.3	1.5	3.3	10.0	1.0	37.5
31	1.2		3.2		29.2		11.1	7.2		1.7		1.9	29.2
Max	14.3	17.5	16.5	37.0	45.8	27.2	46.6	116.4	63.7	37.2	39.7	33.2	

Daily maximum Rainfall (Antigua and Burbuda, V.C. Bird Airport)

Earthquake

Date			Latitude(N)	Longitude(W)	Magunitude
1900	10	29	11.0	66.0	8.4
1906	12	3	15.0	61.0	7.5
1918	10	11	18.5	67.5	7.5
1929	1	17	10.5	64.5	6.9
1943	7	29	19.0	67.0	7.9
1946	8	4	18.9	68.9	8.1
1946	8	8	19.7	69.5	7.9
1950	8	3	10.0	69.5	6.3
1953	1	25	18.5	73.4	5.7
1966	9	19	10.8	69.5	5.4
1967	7	29	6.8	73.0	6.5
1967	7	30	10.6	67.3	6.5
1968	9	20	10.7	62.7	7.0
1974	10	8	17.3	62.0	7.5
1981	10	18	8.1	72.4	5.5
1984	6	24	18.0	69.3	6.6
1985	3	16	17.0	62.5	6.4
1986	6	11	10.6	62.9	6.2
1988	11	3	19.1	67.3	5.7
1989	5	4	11.1	68.3	5.7
1991	8	17	10.0	69.9	5.4
1993	7	22	6.5	71.2	6.1
1994	8	15	16.8	60.7	5.5
1995	3	8	16.6	59.6	6.3
1995	12	29	14.3	60.0	5.2
1996	1	1	11.2	61.7	5.0
1996	4	8	15.0	61.5	5.2
1996	4	24	18.9	70.3	5.1
1997	1	14	17.4	61.6	5.4
1997	4	2	11.4	60.9	6.1
1997	4	8	11.1	60.8	5.5
1998	8	10	18.7	70.5	5.2
1998	12	8	18.8	64.1	5.4
1999	1	18	18.9	67.2	5.0
1999	8	28	17.1	61.4	5.4
1999	12	20	17.3	61.7	5.6