MINISTRY OF AGRICULTURE
JAMAICA

No. 1

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR DEVELOPMENT OF SMALL SCALE FISHERIES IN JAMAICA

JANUARY, 1998

JAPAN INTERNATIONAL COOPERATION AGENCY
OVERSEAS AGRO-FISHERIES CONSULTANTS CO., LTD.

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PREFACE

In response to a request from the Government of Jamaica, the Government of Japan decided to conduct a basic design study on the Project for Development of Small Scale Fisheries in Jamaica and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Jamaica a study team from September 7 to October 1, 1997.

The team held discussions with the officials concerned of the Government of Jamaica, 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 Jamaica 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 Jamaica for their close cooperation extended to the teams.

January, 1998

Kimio Fujita
President
Japan International Cooperation Agency

January 1998

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Development of Small Scale Fisheries in Jamaica.

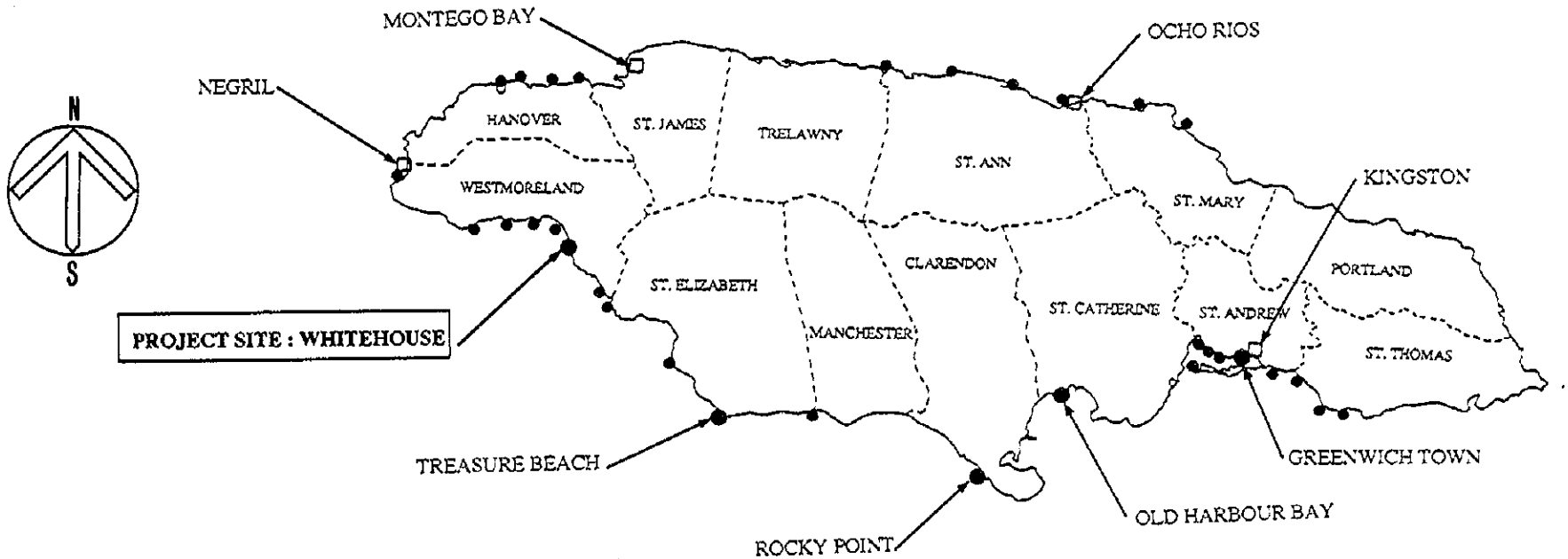
This study was conducted by Overseas Agro-Fisheries Consultants. Co., Ltd., under a contract to JICA, during the period from 3 September, 1997 to 30 January, 1998. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Jamaica and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

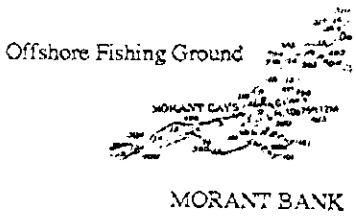
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Nobuo Itoi
Project Manager,
Basic design study team on
the Project for Development of Small Scale
Fisheries in Jamaica
Overseas Agro-Fisheries Consultants Co., Ltd.

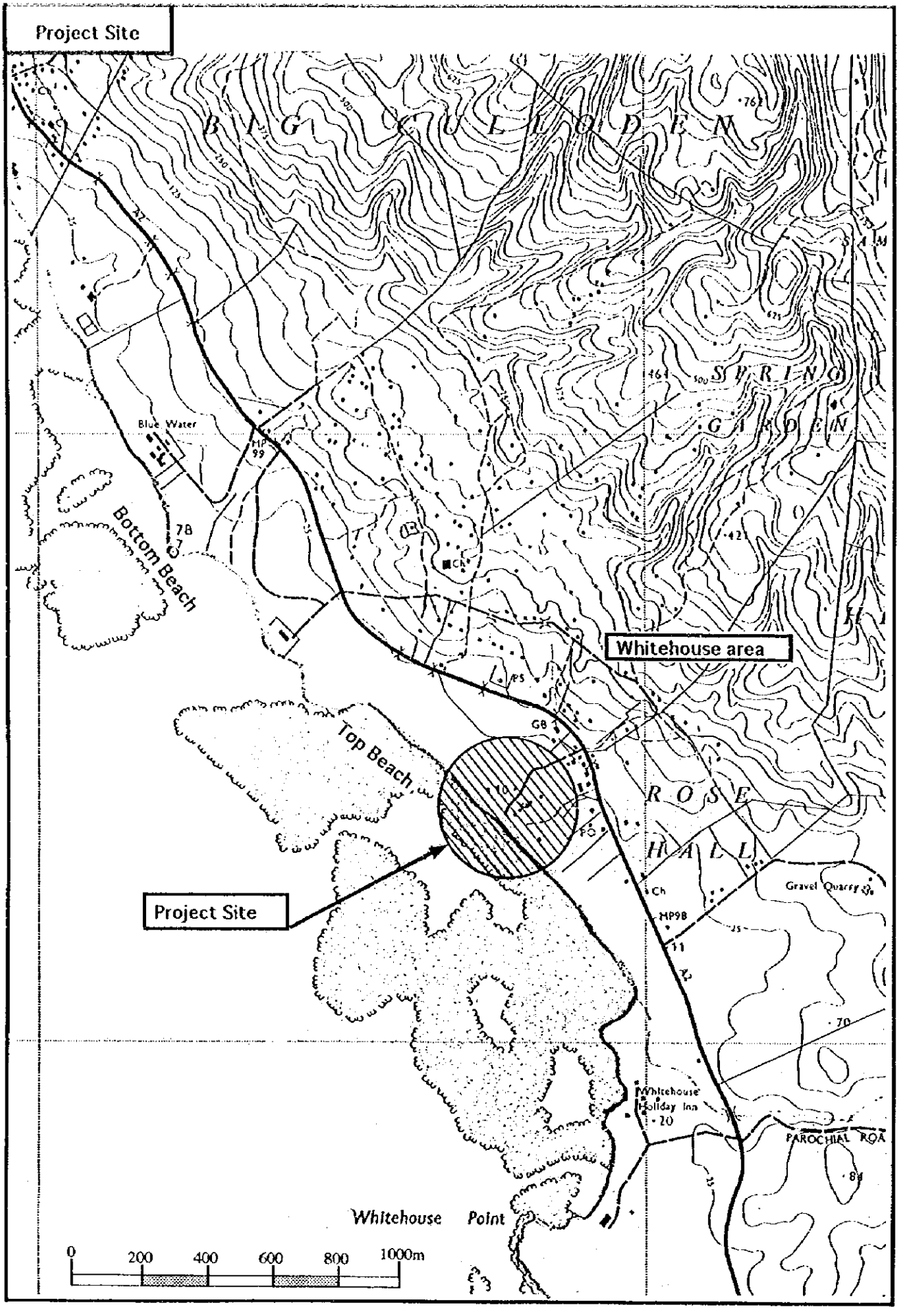
LOCATION MAP

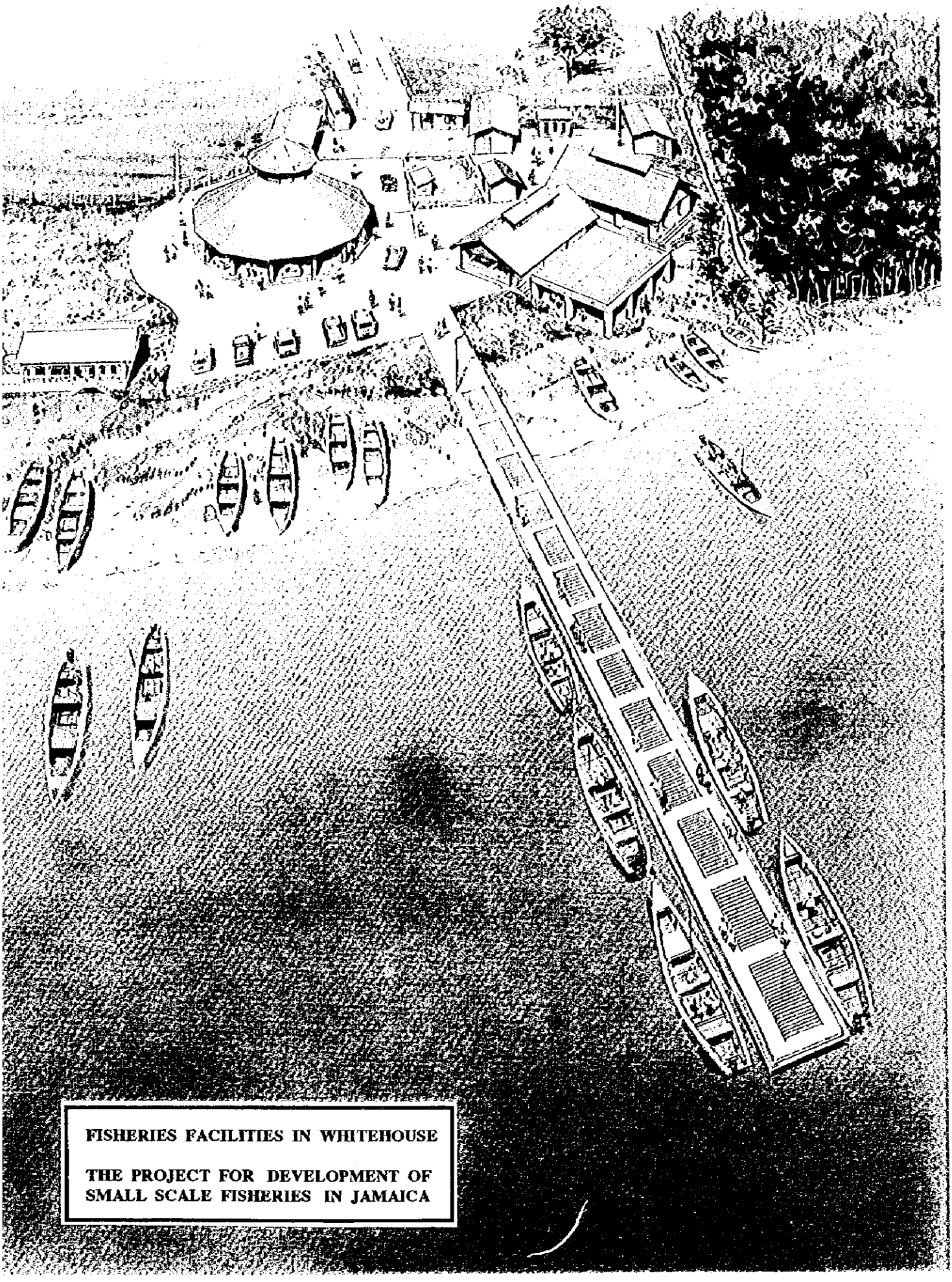




● : Major Fishing Village

● : Beach with 30 boarts and over


Project Site
BIG GULLY DEM
SPRING GARDEN
Blue Water
MP 99
7B
Bottom Beach
Whitehouse area
PS
GB
Top Beach
ROSE HALL
Project Site
Ch
Gravel Quarry
MP98
Whitehouse Holiday Inn
PAROCHIAL ROA
Whitehouse Point
0 200 400 600 800 1000m



FISHERIES FACILITIES IN WHITEHOUSE

THE PROJECT FOR DEVELOPMENT OF SMALL SCALE FISHERIES IN JAMAICA

Abbreviations

Abbreviation	English Name
[English General]	
EIA	Environmental Impact Assessment
G.G.F.S.	Gillings Gully Fishermen's Cooperative Society
LG & MOW	Local Government & Ministry of Works
NRCA	Natural Resources Conservation Authority
PAJ	Port Authority of Jamaica
PIOJ	Planning Institute of Jamaica
UDC	Urban Development Corporation
W.M.P.	Westmoreland Parish
[Construction Terms]	
ASTM	American Society for Testing and Materials
BCJ	Building Code of Jamaica
B.S.	British Standard
B.M.	Bench Mark
CDL	Chart Datum Level
CUBIC	Caribbean Unified Building Code
HHWL	Highest High Water Level
HWL	High Water Level
J.S.	Jamaican Standard
LLWL	Lowest Low Water Level
LWL	Low Water Level
RC	Reinforced Concrete
UBC	Uniform Building Code
[Exchange Rates]	
Exchange rates that appear in text, except for Project cost (J$: Jamaica dollar)	
	1 pound = 1 (lb.) = 453.6 (g: grams)
	1 gallon = 1 US (gal.) = 3.785 (l: liters)
	M/T = metric ton • ton = 1,000 Kg

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{APPENDICES}

CHAPTER 1

BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

Jamaica is an island nation located in the Greater Antilles in the Caribbean Sea south of Cuba, and it gained its independence from the United Kingdom on August 6, 1962. The national land area is 10,946 km^2, the total population is 2,527,700 (1996 estimate) which grows at the rate of 1.1% per year (1996).

The state of its economy deteriorated to a critical level as a result of the implementation of socialist policies in the period between 1972 and 1980. Following that, as part of the policy of economic reconstruction, the country accepted IMF measures to restrain total demand and a World Bank Plan for structural adjustment, etc., and reconstruction has been advanced based around a liberal economic system. The progress, however, has been sluggish : the GDP in 1995 was US $ 3,800,000,000 (GDP per capita US $ 1,510) and the net growth rate vis-à-vis the previous fiscal year was 1.5% in 1992, 1.4% in 1993, 1.1% in 1994, 0.5% in 1995 and 1.7% in 1996 (according to the Planning Institute of Jamaica). The balance of payment is in the red, with the trade balance and the current account showing a deficit of US $ 902,000,000 and US $ 245,000,000 respectively in 1995. The external debt in fiscal 1993 was US $ 4,500,000,000. As for the rate of inflation, this has continued to remain high : 40.2% in 1992, 30.1% in 1993, 26.9% in 1994, 25.5% in 1995, and 15.8% in 1996. As a result of fiscal stringency measures taken as part of the currency policy to counter the deteriorating balance of payments, the level of interest rate on loans has also been high - 56.1% in December 1994, and 55.3% in December 1995. Moreover, the unemployment rate and number of the unemployed in 1995 were 16.2% and approximately 187,000 respectively, and it can thus be seen that the economy of Jamaica is faced with a great deal of problems.

Concerning industry, in addition to the traditional industrial sectors of bauxite mining, aluminum smelting, sugar cane and rum refining and coffee and banana production, etc., the tourism and textile and wearing apparel industries have been developed in recent years and indeed the tourism industry is now the top in earning foreign currency. In regard to its industrial structure (ratio of GDP), the service sector (including the public service sector) accounts for 55.3%, the manufacturing sector accounts for 18.5%, the mining industry accounts for 9.3%, the construction industry accounts for 8.9%, and the agriculture, forestry and fisheries sector accounts for 8.0%.

The five-year development plan for agriculture, forestry and fisheries aims to raise the production efficiency and export level of agricultural products that can compete in international markets, to raise levels of production in order to satisfy the internal demand for foodstuffs, and to prevent outflow of foreign currency brought about by the surplus of imports over exports. In the fisheries sector, there is a need to transform from the still prominent traditional form of

fishing into a modern form of fishing, in order to increase catches that are suited to domestic consumption and rectify the current large excess of imports. Moreover, in the country's approximately 139 fishing villages, since there is in adequate basic infrastructure (jetties, wharf and other landing facilities, fish sorting areas, fish markets, etc.), caught fish are handled by methods that are both inefficient and insanitary. In addition, the working environment for fishermen is poor and the development of new fishing grounds and introduction of new fishing methods are slow. Consequently, fishing is concentrated in limited fishing grounds in coastal areas, which means that the depletion of fisheries resources in such areas is extreme and that the effective and appropriate utilization of the fisheries resources possessed by the country is not being realized.

It is against this background that the Government of Jamaica in September 1996 made a request to the Government of Japan for the provision of grant aid, with the aims of a) constructing fisheries-related facilities in Whitehouse fishing village, b) promoting the establishment of intensive, organized managed fishing centering around the fishermen's cooperative society in the said area and, c) achieving the modernization of small-scale fisheries and the phased transformation to commercial fisheries in all Jamaica.

CHAPTER 2

CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Objectives of the Project

The Government of Jamaica has compiled a model project intended to achieve the modernization of small scale fisheries. This involves first selecting a model fishing village, constructing fisheries support basic facilities, at the same time organizing fishermen around the fishermen's cooperative society, and thus encouraging the establishment of managed fisheries where the initiative is taken by people who are actually involved in the sector.

As the target area for the said model project, the Government of Jamaica selected Whitehouse fishing village (the Project site). Whitehouse fishing village is located some 200 km west of the capital Kingston and is the main fishing village in the southwest part of the country, being a center for offshore fisheries carried out around the offshore bank (shallows) that stretches some 100 km south of Jamaica Proper.

The some 700 fishermen who are based in Whitehouse have a strong desire to work and possess 109 medium-sized wooden fishing boats used for offshore fishing and 30 small wooden fishing boats used for coastal fishing, and fish landed in this area amount to approximately 900 tons per year. Moreover, Whitehouse is a center for the landing of fresh fish which are supplied to Montego Bay (the second largest tourist city in Jamaica), Negril and other surrounding cities. Gillings Gully Fishermen's Co-operative Society Ltd. (established 1971) in Whitehouse is continuing sound operations centering around the sale of fishing gear, outboard engine parts and general building materials and the provision of mutual aid services, and it also provides various conveniences for fishermen and retailers through allowing the joint use of fishing gear store rooms in the area, carrying out the operation and maintenance of local public toilets and the common-use water supply system, and other matters.

In this way, because Whitehouse fishing village is used by a large number of fishermen, possesses a base for the organization of fishermen centering around Gillings Gully Fishermen's Co-operative Society Ltd. (G.G.F.S.), and has also displayed a pioneering spirit in the development of medium-sized wooden fishing boats, and so on, it is a suitable site for the model project.

However, because Whitehouse possesses no fisheries support facilities, the modernization of small-scale fisheries that is being aimed for by the government is not advancing and the following problems are faced. Therefore, the construction of infrastructure is urgently required.

- Much time and effort are expended on setting out for and arriving back from fishing trips because of the absence of a proper jetty and mooring facilities.
- Since there are no outboard engine, fishing gear and fishing boat maintenance and repair facilities to allow proper maintenance and repair to be carried out, this leads to a decline in fishing boat operating efficiency and an increase in operating expenses.
- There is a shortage of facilities for storing fishing gear and outboard engines, etc.
- Since there are no facilities for sorting landed fish, hygiene control and quality improvement cannot be achieved.
- Since landing points are dotted around, fish remains are disposed over a wide area, leading to contamination of landing beaches and the nearby sea bottom, which in turn leads to marine pollution.

The Project aims to achieve the phased modernization of small-scale fisheries, which has so far been carried out in an inefficient and non-hygienic manner in Whitehouse, and in order to ensure the continuation and development of small-scale fisheries that harmonizes with the natural environment, it intends to construct fisheries support facilities consisting of a jetty, fishing gear store rooms, workshop and fish sorting facilities. As medium-term and long-term objectives, in addition to resolving problems directly relating to fishery operation through construction of the said support facilities, it is important for the Project to promote the organization of fisheries-related workers centering around the fishermen's cooperative society in order to stabilize the business and livelihood of fishermen and at the same time to promote and establish resource management-based fisheries whereby fishermen themselves take the initiative in effectively utilizing the country's fisheries resources and preserving the fishery environment, etc.

2-2 Basic Concept of the Project

2-2-1 Basic Concept

In the Project target area of Whitehouse, offshore fishing in fishing grounds located around the offshore bank is widely carried out by mainly medium-sized wooden fishing boats of 14 m in length. There are 109 medium-sized wooden fishing boats which carry out two fishing trips per week or on average approximately 80 fishing trips per year, each of which lasts two nights and three days. Approximately 21 such fishing boats enter and leave the port every day. Departing fishing boats prepare for fishing in the afternoon and leave for fishing between around 6.00 and 9.00 p.m. in the evening. Boats return and land their catches mostly between 6.00 and 9.00 a.m. in the morning and around noon at latest.

The medium-sized wooden fishing boats catch around 150 kg of fish on average in each fishing trip, and the time spent on sorting, weighing and trading caught fish is approximately 40 minutes.
In addition, 30 small fishing boats of 7 m in length carry out coastal fishing and return from fishing trips the same day they leave. The small wooden fishing boats do not operate according to a fixed pattern and their catches are extremely small compared to those of the large wooden fishing boats. Many of the medium-sized wooden fishing boats are fitted with two outboard engines possessing an output of 40-60 HP, while the small wooden fishing boats are fitted with one outboard engine of 15-25 HP, and almost 300 outboard engines are used in the Whitehouse area in all.

In carrying out the design of the Project facilities and equipment, in line with the aforementioned conditions, the contents that will allow all areas of work from fishing trip preparation through to port return, sorting and selling of landed fish and storage of fishing gear, etc. to be carried out in an efficient and effective manner.

Regarding the jetty, the effective mooring length is determined to be 40 m so as to enable the simultaneous mooring of four 14 m fishing boats and two 7 m fishing boats. Assuming the average fishing trip preparation time per boat and caught fish landing time per boat to be 50 minutes and 40 minutes respectively in accordance to the results of the current state study, the jetty shall be of a size that allows use by on average 20 departing boats and 20 returning boats per day.

The fish sorting area shall possess sufficient area and spaces to enable simultaneously sorting the catch of equivalent to six medium-sized fishing boats. And six work tables and water supply outlets shall be installed to allow sorting and washing to be performed. Regarding fishing gear lockers, enough shall be provided to make up for the shortage that exists in the existing lockers that have been constructed by the government. The workshop shall be of a scale required for the general maintenance and repair of outboard engines used in the target area. As for the general tools and special tools to be installed in the workshop, the tools with which fishermen with general levels of knowledge and experience can work under the guidance of service engineers shall be provided. However, tools used in the work requiring high level technical skill shall not be installed. In order to raise the efficiency of fishing gear and fishing boat repair and maintenance work, a tent shall be put up in the open space adjoining the outboard engine maintenance area to enable work to be carried out in the hot sun or at times of rain.

Furthermore, under the basic concept of minimizing the economic burden placed on users of the Project facilities, only the exact quantity of facilities required to achieve the Project objectives

shall be constructed. The project shall be planned in such a way that current conditions are not greatly changed, the natural environment and social conditions in and around the Project area are considered, and operation and maintenance can be carried out through the self-effort of local fisheries personnel.

2-2-2 Appropriateness of the Project

The fisheries sector in Jamaica can broadly be divided into the marine fisheries and the inland fisheries. The need for development of the marine fisheries based on the sustainable and maximum effective utilization of marine resources, which are possessed by Jamaica as a result of ratification of the "exclusive 200 mile economic zone" raised in the United Nations Law of the Sea, is growing rapidly.

The large proportion of sea fishing is dependent on traditional petty fisheries carried out using small wooden canoes and wooden fishing boats with outboard engines. As for corporate fisheries, this is limited to the catching and export of mostly conch and lobster by a few private companies in Kingstone, and there is much room left for the development of the offshore fisheries sector.

The fisheries in Jamaica is concentrated in extremely limited fishing grounds and uses small-scale fishing gear and fishing methods centering on traditional trap fishing and including gill net, casting net and spear fishing, etc., and there has not yet been any real move to offshore fishing. A major factor preventing the promotion of offshore fishing has been the lack of fisheries basic infrastructure development. In particular, there has been no construction of fisheries production support facilities such as fishing harbor facilities including jetties, wharf and fish sorting areas, etc., which are necessary in order to promote the modernization of fisheries (i.e. the adoption of larger fishing boats, the development of offshore fishing grounds, the diversification of fishing techniques, and so forth). As a result, the depletion of resources in recent years in coastal areas and in waters around Pedro Bank to the south-west has been particularly conspicuous. At the same time, in coastal areas, a balance needs to be achieved between small-scale fisheries promotion plans and tourist development, through the regulation of fishing grounds, prevention of marine pollution and countering of other problems.

Among the requested facilities the priority levels of 1) the jetty, 2) workshop, 3) Gear Lockers and, 4) Fish sorting facility are high. All of facilities will raise the level of convenience for local fishermen and are urgently required as to effectively utilize fisheries resources to the full, in due course the objects of the Project are attained. At the same time the Project is deeply linked to national development plans, and the facilities are the minimum requirement to achieve the phased modernization of small-scale fisheries in Jamaica without placing too great a burden on

the subsistence fishermen while improving the living environment of fishermen in Whitehouse area. In particular the facilities are considered to contribute to the improved living standard of fishermen in the area and residents in surrounding areas who are greatly reliant on offshore fisheries.

In view of the above points and as a result of surveys, consultations and study carried out up until now, it is judged that the objectives, contents and direction of the Project are appropriate for implementation under the grant aid scheme of the Government of Japan.

2-2-3 Study of Project Components

The Project facilities are roughly classified into either 1) facilities to improve fishing village environment or 2) facilities to support fishermen's activities and achieve the modernization of small-scale fisheries and qualitative improvement of commercial fishing in Whitehouse area.

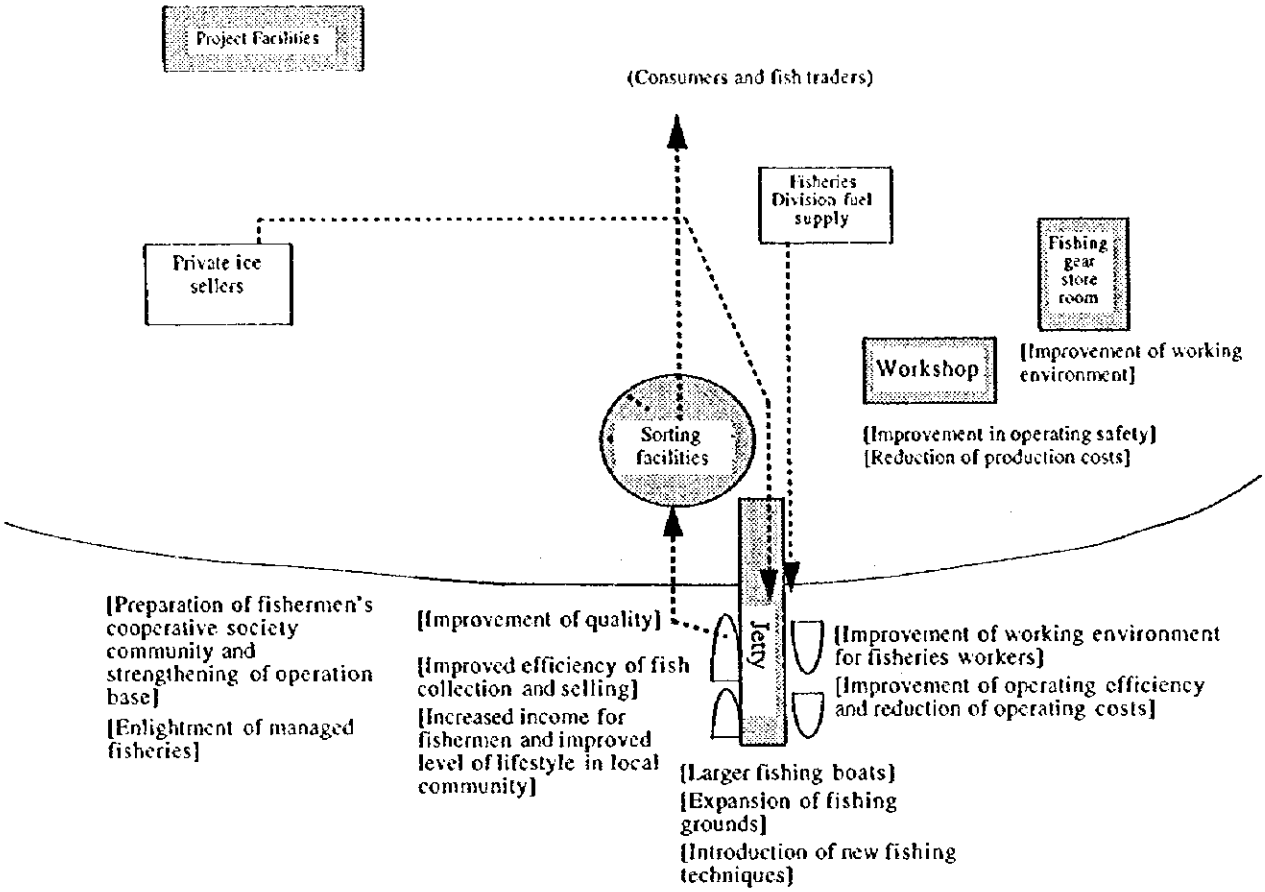


Figure 2-1 Composition and Functions of Project Facilities

Table 2-1 Outline of Project Facilities

Facilities Type	Functions	Contents	Outline Scale and Purpose of Use
Civil engineering facilities	Fishing village environment development	Jetty and access road	Jetty: length 65 m (effective length on sea 40 m + 25 m) Road: length 15 m Jetty: total width 5.0 m (main body 5 m + steps 0.3 m x 2) Road: width 5 m (concrete paving)
Building facilities	Fishing village environment development	Fish sorting facility	Building floor area (approx. 350 m^2) Site paving (approx. 2,000 m^2: including Gear Lockers, workshop and surrounding area)
	Activities support	Gear Lockers	24 rooms (approx. 200 m^2)
	Activities support	Workshop	Building floor area (approx. 125 m^2): tools and parts store room, small office, outboard engine test tank, repair stand, repair table, Fishing gear and fishing boat repair area: (approx. 200 m^2; only columns for putting up tent)
Equipment		Workshop tools	One set of special tools, one set of general tools, tools boxes

2-2-4 Study of the Contents and Scale of Facilities and Equipment

(1) Jetty and Access Road

1) Outline of Fisheries in Whitehouse Area:

Whitehouse area is divided into Top Beach on the southeast side and Bottom Beach on the northwest side, and the fishing village facilities (fishing boat offshore mooring areas and landing beaches) are concentrated in Top Beach. Consequently all the facilities that have been constructed by the government such as the Gear Lockers, fuel stand run by the Fisheries Division, the fishermen's co-operative society office and shop, open-air market and fishermen's club house, etc. are all located in Top Beach. Approximately 70% of fishing boats are based in Top Beach and the rest in Bottom Beach.

There is no exclusive possession or designation of fishing boat landing beaches and offshore mooring sites, but fishermen are free to use areas that are open. However, the usual practices have been established among fishing boat owners and captains over the years to allocate sites to each for use.

[A] number of target fishermen: 700 (of which 139 are members of G.G.F.S.)

[B] number of target fishing boats: 139 (of which 109 are 12-14 m in length and operate around Pedro Bank, and 30 are 7.6-10 m in length and operate in coastal waters)

(Most fishing boat owners only own one boat and only a few own two boats or more (the most is four boats). Moreover, most fishing boat owners also act as boat captains).

[C] Main dimensions of target fishing boats

Table 2-2 Main dimensions of target fishing boats

	Total Length	Width	Depth	Draft
12-14 m boats	12-14 m (+ outboard engine)	2.6~3.0m	1.2~1.4 m	0.6~0.8m
7.6-10 m boats	Approx. 7.6 m (+ outboard engine)	1.2~1.5m	Approx. 0.8 m	Approx. 0.5 m

[D] Form of fishing trips

The 12-14 m fishing boats usually load ice, fuel and water, etc. onboard in daytime, leave harbor between 6.00 and 9.00 in the evening, spend two nights and three days fishing and return to harbor between 6.00 and 12.00 in the morning. However, fishing trips last three nights and four days when catches are poor, and fishing boats return to port earlier when

catches are good or weather is stormy.

The 7.6 m fishing boats carry out single-day fishing trips. Times for trap placement and raising are not set, but the basic pattern is for traps to be set in the evening and collected the next morning.

[E] Loaded items when leaving harbor

Table 2-3 Loaded items when leaving harbor

	Number of Crew	Ice	Fuel	Water	Food
12-14 m boats	6-8	680 kg	208 *l* on average	Approx. 150 *l*	(3-day supply)
7.6-10 m boats	2-3	None	20 *l* on average	Little	None

Source: G.G.F.S.

Fishing trips are instructed by the fishing boat owners and carried out by the owners themselves or boat captains.

- Fishing boat owners pay for ice and fuel, but crews as a rule have to take their own water and food onboard. The loading of ice and fuel is carried out by the crews under the instructions of fishing boat owners or captains. There is no set division of work, but it is general for loading work to be carried out in a joint effort by the crews not including captains.

2) The functions required of the Project jetty are as stated below:

   - Mooring of 12-14 m fishing boats
   - Loading of ice, fuel, fishing gear and water, etc. for fishing trips made by the 12-14 m fishing boats
   - Landing of fish caught by the 12-14 m fishing boats
   - Mooring, fuel loading and fish landing for the 7.6-10 m fishing boats

   (However, the jetty shall not be able to allow entry by vehicles. Loading and landing work shall be carried out manually and using wheelbarrows, etc. Also, lighting facilities shall be installed to enable nighttime loading and landing work to be carried out).

3) The scale of the jetty was calculated as follows using 1) past sales of fuel for outboard engines and 2) the number of days in which fishing can be carried out based on form of operations and wind speed data (= 80%: number of days when wind speed is 8.6 m/sec. or less).

1. Calculation based on past sales of fuel for outboard engines

Based on sales of fuel by the Fisheries Division in the past three years, the following can be estimated with respect to the operating conditions of fishing boats in Whitehouse area.

Table 2-4 Calculation of Fishing Trips Per Month

	1995			1996			1997		
	[A] Liters	[B] Boats	[C] Boats	[A] Liters	[B] Boats	[C] Boats	[A] Liters	[B] Boats	[C] Boats
January	105,275	19	22	134,753	24	28	142,507	26	30
February	111,249	20	23	122,150	22	25	108,210	20	23
March	131,707	24	27	122,411	22	26	106,477	19	22
April	104,220	19	22	146,768	26	31	97,695	18	20
May	114,004	21	24	126,763	23	26	103,823	19	22
June	93,558	17	19	112,821	20	24	102,981	19	21
July	110,552	20	23	106,088	19	22	110,433	20	23
August	110,306	20	23	127,333	23	27	110,402	20	23
September	135,276	24	28	123,416	22	26			
October	115,628	21	24	110,701	20	23			
November	114,107	21	24	104,225	19	22			
December	132,443	24	28	126,223	23	26			
Average	114,861	21	24	121,971	22	25	110,316	20	23

Source: Fisheries Division

[A] =monthly fuel sales (unit: liters)

[B] =total number of fishing trips per day in case where 12-14 m fishing boats purchase 90% of [A]

[Example] 38 month average = 116,391 x 0.9 ÷ 208 ÷ 24 = 21 boats

(provided the fuel purchase per boat is 55 gallons (208 litters), the monthly fishing days (80%) is 24)

[C] =total number of fishing trips per day, where 7-10 m fishing boats purchase 10% of [A]

[Example] 38 month average = 116,391 x 0.1 ÷ 20 ÷ 24 = 24 boats

(However, this assumes that each boat purchases 20 l of fuel and fishes for 24 days per month)

Note 1): The amount of fuel load by large fishing boats per fishing trip varies depending on the fishing ground, from 60-70 US gallons for boats operating around 96 nautical miles offshore to 40-50 US gallons for fishing boats operating around 52 nautical miles offshore, therefore 55 gallons is loaded on average. The amount of fuel purchased by small fishing boats was calculated based on the average of 5 US gallons per boat per trip.

Note 2): The fuel stand in Whitehouse is also used by fishing boats from Savannah La Mar, but

since these boats are few in number (38 registered fishing boats) and small in size and also refuel at Negril, they have not been included in the above calculations.

In estimating the scale of the jetty, the average number of fishing boats using the jetty at the same time was calculated as follows using the above estimate values relating to operating conditions.

[a] Average number of medium-sized fishing boats (12-14 m) operating per day over the past 32 months = 21 boats

: Boats using jetty at the same time (for fishing trip preparation times = 4.3 boats, for landing times = 3.5 boats, average = 4 boats)

[b] Average number of small fishing boats operating per day over the past 32 months = 24 boats

: Boats using jetty at the same time (at fishing trip preparation times = 3 boats, at landing times = 1.3 boats, average = 2 boats)

Table 2-5 Jetty Utilization Plan

		Afternoon	Morning
[a] Medium-sized fishing boats (12-14 m)	Boats using jetty per day = 21 boats	Fishing trip preparation time: 1.00 - 5.00 p.m. (4 hours) Time required for fishing trip preparation = 50 minutes/boat (*1 ice loading time: 20 minutes, *2 fuel loading time: 20 minutes, other: 10 minutes)	Return to harbor and fish landing time: 6.00 - 12.00 a.m. (6 hours) Time required for landing: 40 minutes/boat (Average landed quantity = 150 kg, sorting, washing, selling negotiations)
Scale of jetty = number of boats moored at same time		Total time of use = 50 minutes x 21 boats = 1,050 minutes = 17.5 hours Boats using at same time = 17.5 ÷ 4 hours = 4.3 boats	Total time of use = 40 minutes x 21 boats = 840 minutes = 14 hours Boats using at same time = 14 ÷ 6 = 2.3 boats
[b] Small fishing boats (7.6-10 m)	Boats using jetty per day = 24 boats	Fishing trip preparation time: 1.00 - 5.00 p.m. (4 hours) Time required for fishing trip preparation = 30 minutes/boat (fuel loading time: 20 minutes, other: 10 minutes)	Return to harbor and fish landing time: 6.00 - 12.00 a.m. (6 hours) Time required for landing: 20 minutes/boat
Scale of jetty = number of boats moored at same time		Total time of use = 30 minutes x 24 boats = 720 minutes = 12 hours Boats using at same time = 12 ÷ 4 hours = 3 boats	Total time of use = 20 minutes x 24 boats = 480 minutes = 8 hours Boats using at same time = 8 ÷ 6 = 1.3 boats

*1): Ice from the Santa Cruz Ice Making Company is delivered for sale once in the morning at normal times and once each in the morning and afternoon during the fishing season. Ice

from Matrix Co. is planned for sale 24 hours a day and, therefore, ice procurement in the afternoon will not present any problems.

*2): As a rule, the operating time of the Fisheries Division fuel stand is from 9.00 a.m. to 5.00 p.m., Mondays through Fridays. Since there is only one refueling stand, some time loss for waiting must be taken into account.

2. Calculation of operating days based on form of operations and wind speed data

Calculating the daily number of fishing trips from the form (cycle) of fishing boat operations and total number of fishing boats in Whitehouse area as reported in the Preliminary Survey, it works out that 109 boats ÷ 3 groups = 36 boats operate 6 days per week and that operations can be carried out on 80% of the available days. Using these data to carry out trial estimation, it works out that 36 x (6/7) x 0.8 = 24 boats operate per day, giving a figure that is almost the same as that calculated using past sales of fuel.

Table 2-6 Number of Days when Fishing is Possible

(Days when Wind Speed is 8.6 m/sec. or Less) (Unit: m/sec.)

Wind speed	0.0 - 0.4	0.5 - 2.0	2.1 - 3.1	3.6 - 5.6	5.7 - 8.6	8.7 - 11.2	11.3 - 14.3	≥ 14.4
Ratio (%)	14.8	4.3	17.5	23.4	17.9	11.0	9.3	1.8

Source: Meteorological Centre (annual average 1981-1990: Manley International Airport, Kingston)

(2) Gear Lockers

The booths of the Gear Lockers shall be provided with hangers for outboard engines and a rational layout of hooks and shelves for storing nets, etc. in order to keep size to a minimum. However, the hangers for outboard motors shall be made bigger than is immediately necessary so that they can store larger outboard engines in the future. This is because the 40 HP outboard engines used by almost all the fishing boats based on this beach balance badly with the boats and it is desirable to replace them with engines in the 60-70 HP class. Since each outboard engine hangar needs to be just under 1.5 m in length, the opening to each booth shall be made approximately 2.5 m (twice the size of booths constructed by the government in the past). The depth of each booth shall be approximately 1.5 m and the height of booths shall be approximately 2.5 m (higher than booths constructed by the government in the past).

The doors of each booth shall open widely with respect to the openings to enable storing and removal work to proceed smoothly, and consideration shall be taken to ensure that problems do not arise in passing through or because of deformations in equipment.

Fishing gear is carried into store rooms manually and even a 40 HP outboard engine, which requires the greatest effort, is carried by one man. When larger outboard engines are introduced in the future, these will need to be carried into the store rooms by two men. To ensure that light work in front of the booths such as the arrangement and carrying of fishing gear is not obstructed, corridors shall be given a width of approximately 3 m.

The store rooms shall measure 16.2 m by 12.3 m, giving a total area of approximately 200 m^2.

Moreover, regarding the functions of the test tank placed in front of private Gear Lockers for inspecting and washing engines, it shall be possible to use the test tank that is installed in the adjoining workshop.

(3) Workshop

The workshop shall be partitioned into a repair tools and parts store, a management room (not necessarily always stationed by managers and repair engineers), a repair space fitted with working table, and an outboard motor maintenance space fitted with an engine test tank and engine hangars.

The repair tools and parts store and management room shall be enclosed by walls. The repair tools and parts store shall be approximately 2.5 m by 4.8 m and fitted with simple built-in shelves in the longitudinal direction for storing tools and parts. The management room shall be placed between the repair tools and parts store and the repair space. It shall measure approximately 2.5 m by 2.7 m and be fitted with simple built-in desks and shelves so that it is able to manage the lending and sale of tools.

It shall be possible to enclose the repair space by steel mesh fence and doors at nighttime. This enclosure shall contain the entry/exit and corridor to the management office and working tables for carrying out repairs. It shall measure approximately 2.5-3 m by 7.5 m and it shall be possible at normal times to open the door leading to the maintenance space.

The maintenance space shall be an open, non-enclosed area fitted with an engine test tank and engine hangars and it shall be used to carry out not just maintenance but also repairs and inspections. The engine test tank shall be divided into two tanks - as a rule one for use when conducting inspections during repairs and one for use when washing engines before storing in the store rooms - however, it shall be possible to always use one of the tanks even when the tank is being washed. Two engine hangars shall be installed - as a rule one for repair purposes and one for pre-storage inspection purposes. The maintenance space,

including the engine test tank, shall measure approximately 11 m by 7.5 m.

The multi-purpose structure consisting only of columns and girders on the beach in front of the workshop shall measure approximately 16.5 m by 12 m and be used for temporarily putting up a tent. As was mentioned previously, the sandy beach shall act as the floor so that fishing boats can be landed in this area to undergo repairs.

(4) Fish Sorting Facility

1) Sorting Area

As was indicated earlier, the average number of fishing boats landing each day in Whitehouse area is 21 large fishing boats and 24 small fishing boats. Roughly 80% of landing fishing boats return from fishing trips between 6.00 and 9.00 a.m., and approximately 12 fishing boats return each hour during this period.

The sorting work that is currently carried out on the beach lasts between 40 and 50 minutes for each fishing boat, however, using the Project facilities will enable fishing boats to reduce this work time to around 30-35 minutes. The sorting spaces to be provided will number enough for six fishing boats in the case where sorting work is reduced to 30 minutes and enough for seven fishing boats in the case where sorting work is reduced to 35 minutes. Sorting spaces for six fishing boats shall be provided under the Project and, in cases where these do not prove sufficient, the sorting time period will have to be lengthened slightly. Needless to say, it is anticipated that the Fisheries Division and G.G.F.S. will provide guidance and education to users to ensure that sorting work is carried out in a rational and speedy manner.

2-3 Basic Design

2-3-1 Design Concept

The following concept shall be adopted in carrying out design to ensure that, based on full consideration of conditions in Jamaica and against the background of the plan, the optimum facilities for responding to the issues upon which the request has been founded are provided, and the optimum scale of facilities allowable within the bounds of the grant aid scheme of the Government of Japan is set.

(1) Formulation of Appropriate Project scale

1) Each facility shall be designed based on proper forecast of demand.

2) The contents of facilities shall be within the allowable bounds of the grant aid scheme.

3) Facilities shall be designed in a manner that ensures operation and maintenance costs following completion are kept to a minimum. At the same time, the unpredictable caused by natural disasters are taken into consideration so that the recipient government agencies could restore the damage with less efforts in terms of technique and financing.

4) The scale of civil engineering works shall be designed in a manner that ensures no loss in terms of work duration and cost over requirement.

(2) Design that gives full consideration to natural conditions

1) Design shall be carried out upon first fully surveying and considering the local meteorological conditions, topographical conditions, geological conditions, tides and wave conditions.

2) Design shall be carried out in a manner that not only minimizes impact on the environment during and after work but indeed contributes to environmental improvement.

3) Design shall give full consideration to the special conditions of the Project site including effluent and waste disposal of the facilities.

(3) Structures, equipment and materials that are suited to the construction site shall be selected.

1) Structures shall be made as simple as possible so that maintenance management is easy.

2) Construction methods and construction materials that are general in Jamaica shall be selected.

3) Design shall have sound resistance against hurricanes and durability against salt conditions.

4) Consideration shall be given to preserving the natural landscape. No tree will be felled in principle within the Project site. Arrangement shall be conducted in attempt not to diminish the number of beaches being used.

2-3-1-1 Project Basic Concept

(1) Establishment of functional facilities in fishing villages

Whitehouse area is the best regional fishing village in Jamaica and many of its residents base their livelihoods around fisheries. However, the fisheries sector is faced with an imbalance of resources and it is necessary to achieve a more diversified forms of resource utilization while at the same time promoting surveys of new resources. Moreover, it is necessary to aim for improved quality and raise the value added of fish as commodities while improving the profitability.

Design must be conducted, therefore, on the prerequisite to minimize the maintenance and operation cost of the planned facilities so that not much burden will posed on the local fishermen.

(2) Harmonization with nature environment

Whitehouse area, too, forms the central area of an action plan referred to as the South-west Coastal Area Promotion Plan. In view of the fact that tourism development has already reached saturation point on the north coast of Jamaica, this plan is intended to advance observation and research while preserving the natural environment on the south-west coast, with a view to carrying out development of this area in the future. Consequently, it is necessary for the Project to also take preservation of the beautiful sea and green environment into account. The Natural Resources Conservation Authority has established effluent standards as part of its policy of natural environmental conservation.

The Project shall involve the installation of a septic tank for purifying the treated water that is generated by the Fish sorting facility and the overflow water that comes from the engine test tank in the workshop, in order to contribute to environmental conservation in the area concerned. Also, the latent capacity of the septic tank shall be put to use in treating wastewater from processing work that is mainly carried out on fish privately consumed by the fishermen.

(3) Compatibility with the state of construction

The construction of the planned facilities shall be of reinforced concrete because of the following reasons :

Hardly any buildings of steel framed structure can be seen in the inland areas of Jamaica.

In particular, not one building of lightweight steel framed structure was observed during the study. Most of the steel framed buildings that were observed in inland areas had exterior finishing and none were untreated. This situation where steel frame is avoided is thought to be concerned to the sea winds blowing off the beach areas. Also, relied on and, except for major building projects, it is not economically feasible to use such materials.

1) The Project site is located on the beach and directly receives trade winds from the sea. Due to the desire to prevent salt damage, this area is thus particularly averse to using steel framed structures.

2) In view of the fact that hurricanes has in the past hit Jamaica, the main structures of facilities need to be robust.

3) Since cement is domestically produced in Jamaica and concrete aggregate can easily be obtained near the Project site.

4) No domestic production of steel frame materials is found in Jamaica, thus, have to be imported.

Concerning the form of facilities roofs, because the Project site is not an area of light rainfall (roughly 1,500 mm per year) and sometimes experiences torrential rain and technical levels in the regions are not necessarily high, sloping roofs shall be adopted rather than flat roofs which require a high degree of water proofing.

The placement of sloping roofs using reinforced concrete generally requires a high level of technology. In particular, because girder sections are subject to shearing stress and bending stress, there is a strong possibility that internal reinforcing steel will be corroded from flaws if the construction work is not performed properly. Consequently, it is considered best to select structures made from either wooden (large section) girders or heavy steel framed girders that can use factory processed materials.

Comparing the said two methods, steel framed girders are heavy and more vulnerable to salt damage and, since they would need to be procured from a third country, it would be necessary to carry out local full size inspections, and so on. Wooden girders shall thus be adopted because their lighter weight makes it relatively easier to carry out detailed corrections on site.

Regarding partition walls that are not directly related to the overall structural strength of the facilities, lightweight concrete blocks shall be used to cut down on costs.

2-3-1-2 Study of Design Conditions

(1) Concept Regarding Natural Conditions

1) Design criteria that consider meteorological conditions shall be set.

1. <Temperature> The daily temperature variance within 10 °C and the yearly temperature variance within 25 °C are considered to be sufficient. However, since the yearly difference is large, care will be required in setting the joint openings of concrete paving. Moreover, because the daytime temperature on fine days exceeds 30 °C, work standards that ensure care is taken for the outside storage of concrete materials shall be adopted.

2. <Wind direction and wind force> Because the yearly frequency of strong winds affects the rate of fishing boat use at both candidate sites, this shall be studied for each wind direction. Moreover, because unusually high waves will affect the sea facilities, the maximum wind speed experienced around once every 30 years (32.5 m/sec.) shall be used for estimating waves within the reef. In the BCJ, a maximum wind speed of 56 m/sec. (caused by sudden gusts once every 50 years) is given as standard, but this is too high.

3. <Rainfall> Because showers fall even during the dry season, work standards that ensure care is taken for concrete works and the outside storage of concrete materials shall be adopted.

2) Design criteria that consider marine conditions shall be set.

1. <Tide level> Looking at the high water level (0.50 m) and low water level (+0.20 m), the maximum tide level difference is 0.30 m. The standard for height is the mean sea level (MSL = CDL +0.36 m), however, CDL standard shall be adopted here to match with water depth indications.

2. <Currents> Because sea currents have little impact within the reef and tidal currents are small, these shall be ignored.

3. <Siltation> Even though tidal currents may be small, there is still a possibility that silt from dried rivers may accumulate in front of the site over time. Therefore, this shall be taken into consideration.

4. <Marine environment> Because facilities will be constructed in a marine environment where concrete and steel are prone to corrosion, materials shall be selected with consideration given to this.

3) Design criteria that consider topographical, geological and soil conditions shall be set.

1. Findings of the field survey shall be referred to in considering topographical, geological and top soil conditions. Because the foundation bed on the land side (BH/1) is shallow, care shall be taken when carrying out works.

2. <Earthquakes> Zone-3 of the UBC (Unified Building Code) is required with respect to earthquakes, however, a seismic coefficient of K = 0.10 is judged to be sufficient.

4) Rolling crushes method is adopted for constructing jetty. Design shall give consideration to environmental impact, and standards regarding marine pollution shall be taken into account.

(2) Concept Regarding Construction Conditions and Special Situation in the Construction Sector

1) Application for Design Inspection

Regarding application for design inspection, it is necessary to present detailed design drawings for advance inspection to the Natural Resources Conservation Authority (NRCA), the Port Authority of Jamaica, the Ministry of Works, the Town Planning Department, the Environmental Coordination Department (ECD) of the Ministry of Welfare, the Westmoreland Parish Council, the Westmoreland Water Commission and the Ministry of Public Utilities. This procedure usually takes three months, however, in the case of the Project, officials concerned with the Project within the Urban Development Corporation (accompanied by the Fisheries Division) will personally take the detailed design drawings to each concerned office to speed up the granting of construction permits by each.

The implementation schedule of the Project shall be set with consideration given to the time required in undergoing drawings inspection and obtaining construction permits, etc.

Incidentally, permits for construction of the jetty need to be obtained from the NRCA, PDAJ and MOW.

2) Quality and Design Standards

The following standards are referred to regarding the facilities on land:

1) Main construction materials : the Jamaican Standard

2) Building : the Building Code of Jamaica

3) Wastewater from facilities : the NRCA

Concerning items that are not prescribed by local standards in Jamaica, the quality and design standards used by the United Kingdom, CARICOM nations and the United States of America are applied as appropriate. These standards are applied at the discretion of parties undergoing construction inspection.

Although laws and regulations related to harbor facilities do exist, there is nothing specific that may restrict the Project implementation (and it appears that the application of Japanese design standards is also recognized), thus Japanese standards (Post and Harbor Standard, JIS, etc.) shall be applied for the purposes of the Project.

Engineering standards for design and works implementation comply with the BCJ and also British and American standards (BCJ applies to construction, JS and BS apply to materials, and BS applies to civil engineering facilities).

3) Construction Contractors and Consultants

There are very many construction contractors in Jamaica and a large number are capable of undertaking the Project works. There is also a general contractors organization with a membership of around 200 companies. The large majority of such contractors are concentrated in the capital Kingston, but there are around 20 member companies are located in Mandeville on the south-west coast.

General construction machines is owned by contractors and special items of the machines can be leased.

Jamaica also possesses numerous construction consultants and two consultants recommended by the Port Authority to carry out the design and supervision of harbor facilities. These consultants are considered to be capable of carrying out support of the design and supervision involved in the Project works.

It is possible to utilize local specialist contractors so that the advantages can be realized in terms of performance and rates.

4) Regional Works and Transportation Plan

The Project site of Whitehouse area is located some 200 km from the capital Kingston and can be reached in around four hours by car. The state capital of Savannah La Mar is located some 30 km away and can be reached by car in just under an hour. A plan that allows time for carrying out meetings and coordination with agencies such as the Fisheries Division and Urban Development Corporation, etc. and the offices of the Water Supply Commission, etc. will be required.

Except for concrete aggregate, the construction materials to be used in the Project works, including items procured in Japan and third countries, shall be transported from Kingston. The means to transport materials are either by sea or by land. The shallows around the coast in Whitehouse area mean that materials transport barges are unable to dock. There is a docking quay at Black River some 15 km away, but there is no unloading machine. Then, the contractor shall prepare not only unloading machine themselves and also carrier to the site. Transportation cost by sea should be higher than by land. Therefore, the domestic transportation of the materials required for the plan shall be done by land.

(3) Concept Regarding Utilization of Local Engineers and Materials

1) Local Engineers

It is necessary to use large section, wooden girders in some of the roof works. In carrying out the detailed design, care shall be taken to minimize areas such as connections, joints, tension bars and other connections that require technology from Japan. Care shall also be taken regarding pre-cutting at production and processing sites.

2) Steel Pipe Piles

As indicated in section 2-3-2-2 (7), steel pipe piles shall be used for the jetty structure. Steel pipe piles in Jamaica are imported from third countries but shall be procured from Japan for the purposes of the Project in view of the quality of product inspection and anti-corrosion treatment.

3) Septic tank

Effluent standards in Jamaica are of an high level judging from current standards in the said country.

The BOD discharge standard is 20 ppm maximum and the removal of nitrogen is also required. Septic tanks that comply with this standard are not produced in Jamaica, nor

has it been confirmed whether such Septic tanks are imported from third countries. Nevertheless, since the Project is a bilateral assistance project and much is expected from it as a model undertaking, the above-mentioned effluent standard shall be closely complied with. As in other assistance projects carried out in Caribbean countries, the Septic tank shall be procured in Japan (under the same condition as other Japan's grand aid projects in the Caribbean).

4) Locally Procured Construction Materials

All other construction materials except the above mentioned shall be procured as much as possible from items that are procurable in Jamaica. Items that possess excellent durability and make it possible to utilize local technology shall be selected.

However, most construction materials in Jamaica are imported and a mixture of materials from various countries of origin can be seen as a result of the desire to purchase cheaper items. It is difficult to identify the quality of many of these materials. Since the Jamaican Standard (JS) is generally compliant with the BS and ASTM, care shall be taken concerning the quality of items that are procured from countries other than the United Kingdom and the United States of America. As the JS is similar to the CUBIC (Caribbean Unified Building Code), it is thought that materials imported from CARICOM countries can be used.

5) Local Materials

1. Cement produced in Jamaica can be purchased in bags, but only cement that is confirmed the manufacturing plant, the date (year and month) of manufacture and quality assurance shall be selected.

   The standard allows the use of crushed limestone for concrete aggregate, which is common practice in Jamaica. However, since this is not favored in Japan and it is necessary to prevent salt damage caused by coastal trade winds, concrete strength and the thickness of reinforcing steel protective covering shall be designed at a set level above the standard.

2. Reinforcing steel made in Turkey is available on the local market. In the same way as with cement, however, only reinforcing steel that has good quality assurance shall be selected.

3. Locally procurable stone and aggregate shall be utilized. Because good quality stone cannot be obtained close to the Project site, limestone-based stone will have to be used.

4. The testing of materials (cement, reinforcing steel, soil quality) can be carried out locally and shall be performed (Kingston).

(4) Concept Regarding the Operation and Maintenance Capacity of Implementing Agencies

The Fisheries Division of the Ministry of Agriculture and Mining, which is the responsible supervisory agency, has had no experience of supervising and providing guidance on the running of fisheries basic infrastructure facilities like those to be constructed under the Project. However, because the Whitehouse Fisheries Management Committee, consisting of officials from the Fisheries Division, NRCA, UDC and G.G.F.S., will be established and will obtain wide-ranging expert advice in operating the facilities, it is considered that the operating setup will be sufficient.

Having said that, the G.G.F.S., which will directly carry out operation and maintenance of the facilities, possesses a good past record but lacks the know-how and experience needed to provide guidance on self-managed fisheries. Therefore, it is thought that guidance and training will need to be provided by the Fisheries Division and on the state level.

(5) Concept Regarding Setting of the Range and Grade of Facilities and Equipment, etc.

The grade of civil engineering facilities : In accordance with the Port and Harbor Standard of Japan

: To the level that slightly strengthen local construction methods

(6) Concept Regarding the Implementation Period

Since the Project site is located far from the capital, the equipment and materials transportation plan shall be carefully formulated and construction methods that require short periods shall be adopted to ensure no delays arise.

2-3-1-3 Design Precision

(1) Surveying of Site Position, Shape and Height (Depth)

Site surveying was carried out using a laser surveying device and drawings were prepared by CAD. As there is no reliable benchmark close to the Project site, a temporary benchmark (TBM) was set and used to survey height and depth.

As a result, the precision of surveying can be expected to be ±10 cm/10 m = ±1% for shape dimensions around the site, ±1 m/100 m = ±1% for site position, and ±1°/90° = 1% for azimuth.

The height and depth of construction sites has been expressed based on CDL. In reality, the height above the TBM as based on sea level was measured at successive intervals (every 30-60 minutes), the high tide level was set at CDL +0.5 m, and readings of height or depth from the sea level were corrected based on CDL.

As a result, it is thought that precision for height is within ±5 cm/ 1 m = ±5% and that for depth is within ±10% (due to fluctuations in the tide level).

(2) Precision and Reliability Concerning Natural Conditions

As meteorological conditions (wind direction, wind speed, rainfall, humidity, temperature) and are measured based on the British Standard, an error of around ±2% can be expected, however, it is necessary to consider lateral changes in the wind direction of approximately 30°.

Moreover, regarding wind velocity (two-minute average in Jamaica), because there is a distinction between the instantaneous gust and the maximum wind speed (one-minute average), care will be required since wind speeds will be higher than measured wind speeds in Japan (three-minute average).

Judging from past statistics, the design maximum wind speed (32.5 m/sec.) has a probability of recurrence of once every 30 years and is considered to be an extreme value well on the safe side for the purposes of the Project facilities. The BCJ standard value of 56 m/sec. was judged to be too large as a design criterion for the Project site.

The in-reef wave value (H 1/3 = 1.5 m) was estimated based on the above-mentioned maximum wind speed and blowing distance in front of the site (standard value) and is approximately 1.2 times larger than this when the influence of the reef is considered. In consideration of the state of damage to existing facilities around the site, this value has been adopted as the design criteria. The estimated value is thought to be around +20% on the safe side (danger side with respect to the facilities).

Regarding earthquakes, in Jamaica UBC specify Zone-3 (maximum) Z = 0.3 as standard.

As for soil conditions, since figures are based on the findings of four-point boring, the accuracy of soil condition as estimated between two points (approximately 90 m apart) drops.

Regarding materials loads, since the value for stone was based on data from past testing of crushed limestone and crushed sand from the Hodges quarry and coral gravel and sand found on the beach, values are at least 20% on the safe side (heavy side).

Moreover, ferries carrying goods and people can be expected to call in at the facilities and it is imagined that barges carrying construction materials will also call in during the works.

Table 2-7 Design Conditions

		Site	Notes
Natural conditions	Max. wind speed (m/sec.)	34.0S～SW、W	One hurricane approach every 30 years
	Design wave height H 1/3 (m)	1.5	Offshore waves Ho = 8 m when hurricane approaches
	Rise in water level (m)	0.6	During hurricane approach
	Tide level: HWL LWL	+0.5m +0.2m	CDL=±0
	Earthquake	0.10	Seismic intensity/UBC/Zone-3
Meteorological conditions	Temperature	Max. 35 ℃	
	Daily/Yearly difference	10/25℃	
	Humidity	60～80%	(Yearly average)
	Rainfall	1,500mm	Whitehouse

See Table ?-? for soil conditions.

Table 2-8 Materials Loads

	Type	Density (ton/m³)		Angle of internal friction (ø)	Notes
		In air	In water		
Load	Rubble-mound (crushed stone)/Andesite	1.80	1.00	40	After compaction
	Rubble-mound/Limestone 30 (imagined)	1.60	0.90	30 (supposed)	
	Back-fill stone (crushed stone)	1.80	1.00	40	
	Back-fill sediment (coral)	1.60	0.90	35 (supposed)	No sieving
Movable load	Non-reinforced concrete	2.30	—	—	
	Reinforced concrete	2.45	—	—	
	Stone	2.60	—	—	
	Live load	1.00	—	—	Boat and goods landing area

2-3-1-4 Study of Design Conditions

(1) Limiting Conditions

Limiting condition 1: Laws and Ordinances

1) The Beach Control Act (established June 1st, 1956)

<Adjoining land>	Up to 100 yards from the land side boundary (HWL) on the foreshore
<Nationally owned sea>	From the foreshore low tide level (LWL) out to territorial waters
<Foreshore>	There are no specific definition, however, judging from the above, the foreshore is the beach land on the boundary line (LWL-HWL) sandwiched between the sea and the adjoining land. Having said, the rights of fishermen to use the beach are protected.
<Protected area>	Foreshore and nationally owned sea Permits or licenses are required in order to use this area for the building of structures.

2) Permit Granting Offices

NRCA, PAJ (Port Authority of Jamaica), MOW (Ministry of Construction)

3) Environmental Impact Assessment (EIA)

This is thought to be unnecessary provided that structures which greatly deform the beach are not constructed. Pollution control will be required during the course of the works.

Limiting condition 2: Building Standards and Materials Specifications

1) There is the Building Code of Jamaica.

2) Since there is no standard concerning civil engineering and beach structures, the safest standard among Japanese, British and American standards shall be used. (PAJ)

3) Materials and materials testing specifications (JS) exist for cement, aggregate and reinforcing steel, but these are not complete.

4) In cases where applicable design standards and materials specifications do not exist, British standards and specifications (BSI) are adopted in Jamaica, however, Japanese standards are also sufficient.

5) Concrete samples used for testing are prisms (10 cm) BSI and cylinder (ø 15 cm x 30 cm) in JIS. Since the strength ratio (γ) of prisms to cylinder is 1.2-1.3, caution is required.

Limiting condition 3: Local Site Characteristics

1) Wind and hurricanes: discussed in the section on Design Conditions

2) Earthquakes: ditto

3) Flooding: see the section on Natural Conditions

4) Compatibility with other development plans (UDC development plans):

Since the site has been designated as a fishing village development area, no particular problems exist regarding compatibility.

5) Other: there are no ancient remains or rare wildlife that require special protection.

(2) Study of Design Conditions

1) Waves Caused by Low Pressure and Hurricanes

[1] Of the 27 hurricanes (400 km radius) that approached Jamaica between 1963 and 1992, a 5 hurricanes took the most dangerous courses were analyzed using the Wilson method. As a result, offshore waves of Ho ≥ 2 m were found not to have occurred.

[2] Upon combining observed past highest wind speed and statistically processing these data (incomplete data), the 30 year probability maximum wind speed works out to be U = 34.0 m/sec. (the same value as that observed during Hurricane Gilbert in 1988).

From the number of data (N = 10), assuming wind speed for the m'th largest to be Xm,N, the probability that wind speed (w) will not exceed Xm,N is as follows:

$P [w \leq Xm,N] = 1 - \{m - a / (N + B)\}$

Assuming the Gumbell distribution a = 0.44, B = 0.12, and converting the excess probability P into variable $Y = [(X - B) / A]$:

$Y = \ln [- \ln P (w \leq X)]$

Upon totaling the contents of Table 3-9, the following is obtained: $X = AY + B$, A = 26.65 (m/sec), B = 6.50, and correlation coefficient (r) 0.981.

Moreover, assuming the analysis period to be K = 100 years and the wind speed reoccurrence period (Rp) to be Rp = 30 years, the following is obtained:

$P [w \leq X] = 1 - (K/N - Pp) = 1 - 100 / (10 \times 30) = 0.667$

Therefore:

Y = 0.9039, X = 34.1 m/sec

[3] Prediction of offshore waves using the SMB method gives the following results:

10 m/sec. wind area during Hurricane Gilbert, F = 200 km

1. Site wind speed 32.8 m/sec. - average value U = (10 + 34.0) / 2 = 22.0 m/sec.

   Ho = 5.5 m, To = 8.5 sec.

2. Assuming the blowing time t = 12 hr (6 hr):

   Ho = 11.0 m (Ho = 7.5 m)

   To = 12.0 sec. (To = 9.5 sec.)

[4] The fetch length (F) and blowing time (t) of a seasonal wind 20 m/sec. in a S-SE direction (the most common wind direction on site) are as follows:

F = 10 (x 3) km - Ho = 7.5 m (To = 11.5 sec.)

t = 24 hr - Ho = 6.5 m (To = 10.5 sec)

Table 2-9
Maximum Wind Speed Data (100 Years Between 1880-1990)
N = 11 (Kingston)

Ranking	Date of Occurrence	Maximum Wind Speed (m/sec.)	Hurricane
1	1951 AUG	44.7	Charlie
2	1880 AUG	37.5	Allie
3	1916 AUG	33.9	Allie
4	1980 AUG	32.4	ALLEN
5	1988 SEP	32.4	GILBERT
6	1886 AUG	28.3	Allie
7	1944 AUG	28.3	HAZEL
8	1917 SEP	25.7	Allie
9	1993 MAR	20.0 (N)	Seasonal wind
10	1995 AUG	18.5 (ENE)	Seasonal wind
11	1994 JAN	17.5 (E)	Seasonal wind

[5] Considering the effect of the reef to the front of the site, the fall in the wave height due to the opening (46° opening from end) is only Kd = 0.72.

[6] As a result of the above study, Ho = 8 m and To = 10 sec. are considered to be amply safe values for design offshore waves of 30 year probability.

[7] Even if the reef is ignored, the wave height in front of the jetty, where the water depth is 2 m, will only be H = 1.5 m, and the rise in water level caused by breaking waves will be η = 0.6 m.

2) Seismic Coefficient

The BDJ (Building Design Standard of Jamaica) refers to the California concept (UBC).

UBC/SEC 1634 - Non Building Structure

34.3 Rigid Str. V = 0.7 Ca IW

34.5 Other Non Building Str. V = 0.56 Ca IW

Table 2-10 The table of seismic by soil types

SOIL	Type	Z=0.15	Z=0.3／Jamaica
SD	15≦N≦50	0.22	0.36
SE	soft clay	0.30	0.36
SA	SOLID	0.12	0.24

V=0.56×0.36×1.0=0.2 W

Therefore, the seismic coefficient for port and harbor facilities given in Japanese standards (0.2/2 = 0.1) is sufficient.

2-3-1-5 Design Standards

The Building Code of Jamaica (BCJ) is applied for conditions, in particular meteorological and sea conditions (wind, waves, earthquakes), that are peculiar to Jamaica. The Jamaica Standard (JS) is applied when setting the specifications of materials that are produced in Jamaica (cement, sand, gravel, roadbed material, back-fill material, stone). In cases of imported materials, JIS, BS or ASTM are applied.

In cases where local design standards and materials specifications do not exist, the BS is generally adopted in Jamaica.

Since JIS and Japanese design standards are based on reference to standards and specifications in Europe and America and give full consideration to natural conditions peculiar to Japan (typhoon waves, earthquakes), the design standards for the Project structures shall be set in accordance with the Japanese standards given below.

Moreover, since this is a Project for 'Small-Scale Fisheries Development,' full consideration

has been given to make sure the design does not become too large and complicated.

BCJ: Building Code of Jamaica (1992)

BS 6349: Design Standard for Maritime Structures (1984)

Part 1: General Criteria

Standard Design Method for Fishing Harbor Structures: The Japan Fishing Harbor Association (1990)

Design Guide for Fishing Harbor Structures: The Japan Fishing Harbor Association (1996)

Guidelines for Cement Concrete Pavement: The Japan Road Association (1984)

Standard Specification for Reinforced Concrete : The Japan Society of Civil Engineers

Soil Testing Method: The Japan Society of Soil Mechanics and Foundation Engineering

JS: Jamaica Standard

JIS: Japan Industrial Standard

UBC: Unified Building Code (USA)

2-3-2 Basic Design

2-3-2-1 Site Selection and Facilities Layout Plan

(1) Comparison between Top Beach and Bottom Beach

Whitehouse fishing village has two beaches: Top Beach and Bottom Beach. IN comparison, the former is narrow with less fishing boats, thus less landed fish volume. Moreover, the access road from the national road which runs through residential area is of insufficient width, not suited for trucks. On the other hand, Top Beach has better access and finds the G.G.F.S. which will manage the Project facilities, the Fisheries Division-run fuel stand, the ice storage container and its retailers concentrated in the area.

Consequently, the Top Beach district of Whitehouse fishing village shall be selected as the Project site, as requested.

(2) Outline of Top Beach

The district has the fishing tool storage built by the fishing boat owners and small scale restaurants for local use (these building were constructed by a tacit consent among the fishing village community, though without government's permission. The number of the constructions is small, thus it is possible theoretically to remove and transfer them. No

other facility is built except those constructions, therefore the scope of freedom for construction of the planned facility is extremely large.

There are two access roads that lead to the beach from the national road. One is located within residential land and runs almost straight through to the northwest part. For convenience, this site shall be referred to as 'Northwest Beach.' The other access road runs from the national road to an area approximately 60 m from the Southeast edge of Top Beach. The intersection with the national road and area running along this access road are in the center of Whitehouse fishing village and are the home of the public market, various shops, restaurants and office buildings, etc. This site shall be referred to as 'Southeast Beach.'

Both beaches are 70-80 m long and 70-80 m wide and stretch over an area of 5,000-6,000 m^2 In terms of area, both beaches are equally suitable for construction. In accordance with Planning Manual of Jamaica, both beaches have an available site area for land facilities construction of 3,000-3,500 m^2 . In regard to the traffic that comes in and out of the planned facilities, such as vehicles loading ice or landed fish, the area that has not directly connected access road is inappropriate for the construction site.

The two suggested sites for the construction plan, Northwest Beach and Southeast Beach are further compared as follows.

(3) Suitability of Northwest Beach as the Construction Site

Advantages of Northwest Beach :

1) provides equal services to all the fishing boats that use the Beach.

2) Proximity to ice storage containers and convenience for loading ice (The loading of ice is one of the hardest jobs of fishing trip preparation and, if the jetty is constructed here, the difficulty incurred by this work will be largely relaxed).

Disadvantages of Northwest Beach :

1) A belt of trees grows at the exit area to Northwest Beach of the access road, and should the area be the construction site, trees in the area would have to be felled, which is not appropriate in view of preservation of nature and landscape (These trees contribute to the attractive landscape of Top Beach as well as acting a protection for the residential area against trade winds).

2) Remoteness from the office and the shop belonging to the G.G.F.S., and the fuel stand as well as the suggested site for a open-air fish retail market.

(4) Suitability of Southeast Beach as the Construction Site and Remove of the Open-air Market

Advantages of Southeast Beach :

1) Good access road and proximity to the relevant facilities such as the office and the shop belonging to G.G.F.S., the fuel stand and existing fishing gear storage as well as the suggested site for a open-air fish retail market.

2) Its *de facto* functions as the fish sorting area and the foothold of fishery retail

3) Proximity to the existing open-air fish retail market, suitable for its further development and scale expansion

4) The site is separated from general housing and education facilities, etc.

5) It would not involve any major changes to the landscape in Whitehouse area and would allow the scenic trees (sans block trees) to be conserved.

It would be desirable to remove the open-air market to a site that is located next to the Project Fish sorting facility and is convenient for traffic. Fortunately, the land located between the private Gear Lockers and restaurants on the Northwest side of the supposed construction site and the cricket field behind the beach forms a flat open space of around 40 m by 15 m and is considered to be ideal for remove of the open-air market.

The removal of the existing buildings has been discussed between G.G.F.S. and fish retailers of the open-air market, whose consent has been gained. Moreover, as a result of the thorough dialog with the recipient country and the concerned agencies through a basic design study and its presentation, the remove will be executed under the supervision of the Government of Jamaica with regard to the existing buildings prior to the implementation of the Project.

Disadvantages of Southeast Beach :

1) The fuel stand is located in a wedge-shaped site within the suggested construction site and divides the area into two almost equal portions. (However, only three facilities alone are planned in the plan, thus it is fairly possible to allocate them properly leaving

the fuel stand in the present position).

2) As was touched on in the section discussing Central Beach, the distance from the ice storage is another problem that faces Southeast Beach.

With regard to this point, there is a hardened community road between these two points and this is acting as a bottleneck to passage, however, this problem can be overcome through building a simple bridge over the storm water drainage ditch (through the effort of the Government of Jamaica) and providing Carts under the Project for carrying ice.

In consideration of the above points, the area of just over 5,000 m^2 on Southeast Beach in the Top Beach district around the outboard engine fuel stand run by the Fisheries Division and the sea part of the same area shall be selected as the site for construction of the Project facilities.

As a countermeasure against high waves caused by hurricanes, etc., the land facilities shall be moved approximately 30 m back from the coastline to higher ground of approximately 2.5 m elevation in accordance with the aforementioned Planning Manual of Jamaica, meaning that the construction site for the land facilities will cover an area of approximately 3,000 m^2.

(5) Layout Plan

The jetty (the key facility of the Project) shall be located in the sea in a position almost directly extended from the access road that leads onto Southeast Beach from the national road. The line leading from the access road to the loading jetty shall be the central axis of the group of facilities to be constructed under the Project.

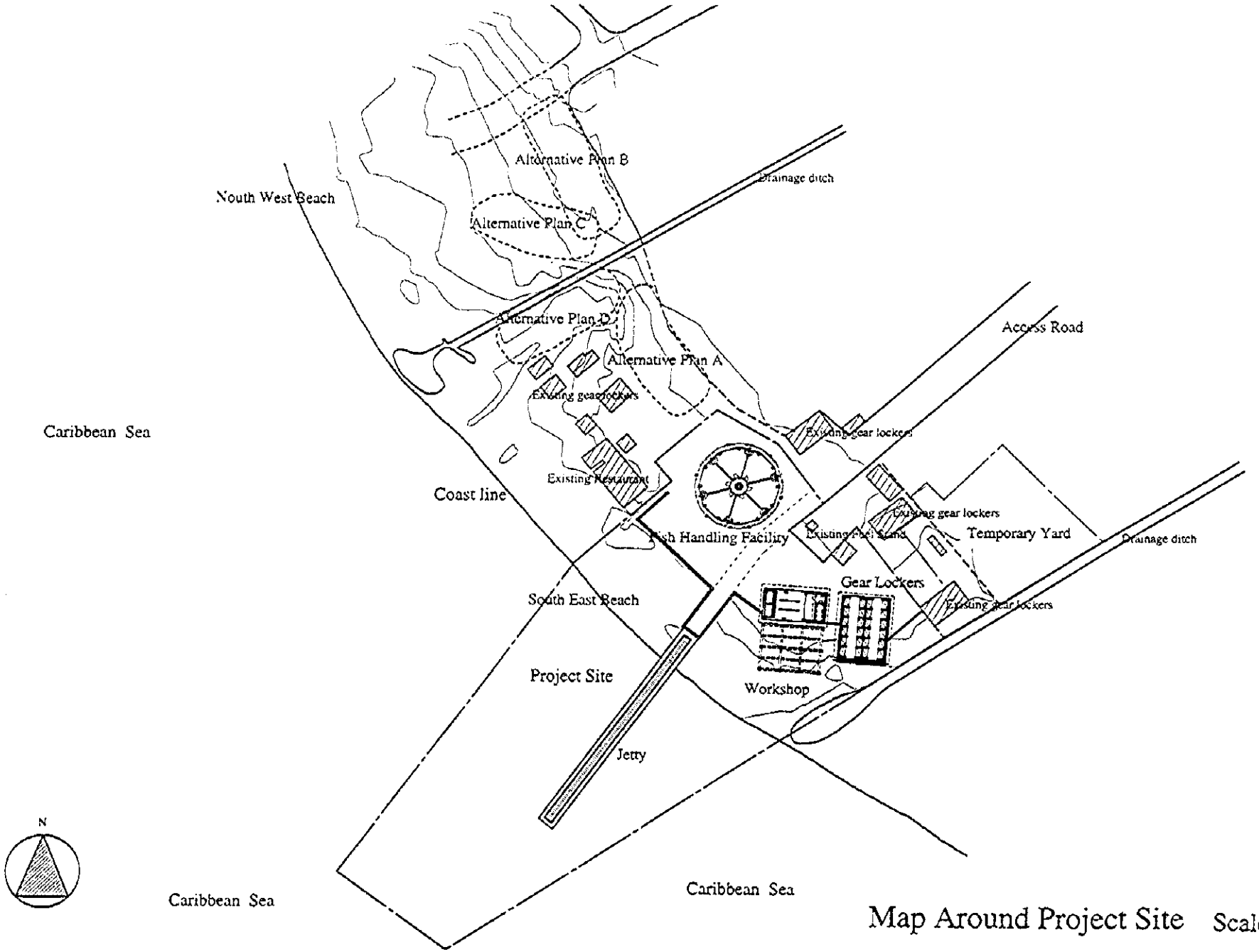
Southeast of the central axis shall be located the workshop and the common Gear Lockers and this zone, also containing the existing outboard engine fuel stand, the G.G.F.S. shop and Gear Lockers, etc. shall provide mechanical and physical support for fishing boats.

Northwest of the central axis shall be located the Fish sorting facility and this shall be made the fish marketing zone.

Vehicles carrying ice and other materials for loading onto fishing boats, vehicles carrying outboard engines requiring repair and tools and parts, etc. to the workshop, vehicles carrying materials to and from the Gear Lockers, vehicles carrying fish from Bottom Beach, etc. and vehicles used by fish buyers will need to gain access to this site. It is thought that

major confusion can be avoided because these differing vehicles are expected to use the site at different times and the facilities are located in separate zones according to their purpose of use as stated above, however, careful traffic circulation planning (including the ordering of parked and passing vehicles) will still be required. Moreover, ice, water, fish, outboard engines and mixed fuel, etc. are still carried often by mule and manual labor in this area, and those conditions are taken into account for proper consideration.

Incidentally, because there is a storm water drainage ditch of around 2 m in width on the boundary of the south side zone for providing mechanical and physical support to fishing boats and this creates a deep valley in the area approximately 50-60 m away from the strand line, the workshop and the common Gear Lockers shall be placed at a slope of roughly 45° to the beach.



Map Around Project Site Scale=1/1,000

2-3-2-2 Jetty Plan

(1) Plan Outline

Two sites (Northwest side and Southeast side) were considered as suggested sites for the jetty, followed by a dialog based on the result with the recipient government and its relevant agencies as well as G.G.F.S.. Consequently Southeast side site has been decided to be suitable for its rear land condition and the form of use of beaches. The conditions of both suggested sites are summarized in Table 2-11:

Table 2-11 Selection of Jetty Location

	Front of Access on Northwest Beach Side	Front of Access on Southeast Beach Side
<Rear Land>		
1) Access road	6 m wide, rough paving	6 m + wide, rough paving
2) Land use on roadside	Housing	Shops, etc.
3) Access edge (connection point)	Housing	Central area (shops, etc.)
<Foreshore>		
1) Usage	80 m to the shore line Many trees, but west side is vacant land/ Fishing boat landing area	70 m to the strand line Many shops in use and unwanted buildings, but little land is vacant/ Fishing boat landing area
2) Existing facilities	Ice storage and container (Matrix)	Fuel stand, locker rooms, GGFS office
3) Water and power supply	Possible.	Possible.
<Location>	Near center of Top Beach	Near east edge of Top Beach
<Beach>		
1) Form of use	Fishing boat mooring, loading, fish landing	Same as left
2) Natural conditions (waves)	Slightly favorable (water is deep)	Close to channel and prone to directly receiving offshore waves
Reason for selection		1) Redevelopment and beautification of frontal beach

(2) Form of land use and Scale

		L x B x D	(Dd: draft) (Df: freeboard)
Fishing boat dimensions:	Large	14 x 3 x 1.5 m	(0.7 m : 0.8 m)
	Small		
Number of fishing boats:	Large	109	] 139 boats
	Small	30	

Fishing boats moored at same time: 6 boats (4 large boats + 2 small boats)/one side

Mooring section

Necessary length:	2 x 14 m + 1 x 7 m + a = 40 m (-Lo)/one side
Necessary depth:	0.7 + 0.3 = 1.0 m
Access length (La):	→ 10 ~ 20m (La)
	Total length: Total 60 ~ 70m
Head height:	Df+0.5 → 1.2m / LWL=+0.2m
	HWL=+0.5m
Width:	5m

(3) Cross-sectional Plan

The width of jetty shall be 5m so as to allow docking of fishing boats to the both sides and their loading and unloading works at the same time. The center part of the jetty shall be of wooden floor drain board in order to reduce the upward pressure of waves when rough weather strikes. The broadside (0 - 1.0m) of small fishing boat with low freeboard shall be equipped with steps for the convenience when loading and unloading.

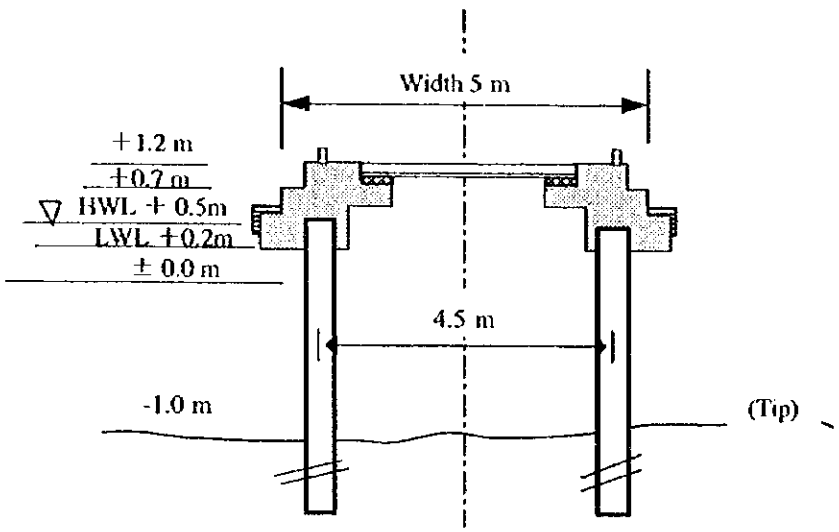


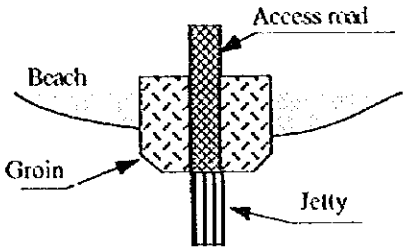
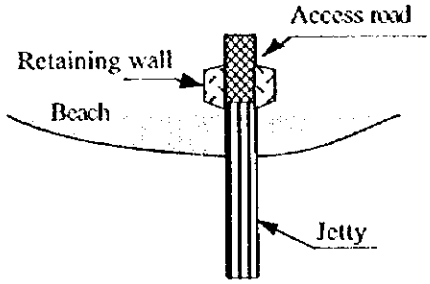
Figure 2-2 Outline of Jetty Structure and Scale

(4) Location of Connecting Section Between Jetty and Access Road

Table 2-12 shows the nature of the jetty when the road end is on the sea and on land.

As was pointed out in the section describing natural conditions, this beach is prone to erosion on the south side (maximum 13 m/24 years = 0.54 m/year) if the protection of jetty protrudes out to sea. Moreover, since this would involve a slightly higher construction cost, it has been decided to place the end of the jetty in the beach, in order to prevent beach deformation.

Table 2-12 Structural Comparison of Connecting Sections Between Jetty and Access Road

(Road tip)	(Protrusion into sea)  	(Stopping at frontal beach) 
<Necessary structures> 1) Protection of jetty 2) Scouring prevention	• Large-scale is necessary • At least 1 ton of covering rocks are necessary because it will stand directly in the sea	• Small-scale is sufficient • Only necessary to make the foundation bottom deep (1 m or more)
<Impact on beach> 1) Space 2) Beach deformation	15 m is occupied on both the beach side and sea side Sedimentation on one side and erosion on the other is apt to occur depending on the current	10 m maximum is occupied on the beach side No particular problem
<Economy>	120	100 (cost index)

(5) Jetty Direction, Form and Functions

- Functions: loading (ice, water, fuel) and unloading (fish, fishing gear)
- Usage: divided into large boats and small boats
- Extension allowance: room for future extension unnecessary
- Entry by vehicles shall not be considered (load weight = 500 kg/m^2). However, use by carts has been taken into account.
- The direction of waves perpendicular to the shore line (SW direction) has been selected as the jetty direction. As mentioned in the section on natural conditions, prevailing winds are SE/27% and land side (E/20%, NE/19%, N/16%), days when the wind speed exceeds 11.3 m/sec. are 11.1%, and days when the wind speed exceeds 8.7 m/sec. are 22.1%. Fishing boats may receive slight side winds when docking.

(6) Structural Plan (Jetty Structure)

The advantages and disadvantages of concrete and wooden jetty floor slab are summarized in Table 2-13. In order to reduce lift pressure caused by high waves when hurricanes strike, wooden floor slab have been selected because the slab can easily be kept 10% or more of opening compared to their total area. Stainless steel fixtures (bolts, nails) for fixing square timber and boards in this case shall be used for their durability.

Table 2-13 Floor Slab (upward pressure countermeasure)

	Concrete Base Plates		Escape section/
	Thick floor plates	Thin and opened (20%)	Wooden floor plates
1) Characteristics	Gravity causes resistance Site placement is possible	Difficult if not pre-cast plates	Lift pressure can be reduced by 1/3
2) Drawbacks	Too thick and uneconomic	Problems are apt to occur in fixed sections. Weakness also arises in pre-cast fabrication (high precision fabrication is necessary)	Release measures in emergencies are necessary
3) Construction effort	100	120	110
4) Economy	150	120	110
5) Durability	100	90	90

(7) Jetty Construction Method

Table 2-14 summarizes the advantages and disadvantages of steel piles and PC piles (prestress concrete piles) for use in the jetty. PC piles are better in terms of durability and economy, however, since hard ground on the land side where the piles will be placed is relatively shallow (6 m from the surface), steel piles have been selected for the sake of safety.

Table 2-14 Comparison of Steel Piles and PC Piles

Type	Steel Piles	PC Piles
1) Characteristics	Imported Corrosion protection are necessary (electrical protection, material covering, corrosion allowance)	Domestic products and durable
2) Construction characteristics	Can be used in gravel, hard ground	Cannot be used in boulder, hard ground
3) Economy	100	80

The standard countermeasure against steel pile corrosion is given as corrosion allowance or corrosion allowance combined with material covering. Since it appears that piles will need to be placed in ground on the land side with an N value of 50 or more, corrosion allowance and covering material shall be combined for the sake of safety.

Table 2-15 Steel Pile Corrosion Protection

	Corrosion Allowance	Electrical Protection	Covering Material
(Sea water environment)	(PH = 8.3, water temperature = 31 °C)		
(Pile condition)	Concrete covering to (+1.2 - +0.2 m)		
	+0.2 - -1.0 m (end)] In sea		
	- 0.0 m (land side end)] In sea		
	Below that is underground		
1) Characteristics	Maintenance is unnecessary	Anodes need to be replaced No effect in air or splash zone	Covering material is easily damaged during work
2) Durability	30 years	30 years	30 years
3) Economy	100 (+ 3 mm thickness)	80	120

Concerning the method for jetty pile placement, the following three methods were compared.

Table 2-16 Comparison of Construction Methods (1)

	Pontoon	Land Construction	
		Stone Spreading	Pre-cast (temporary)
Ease of work	○	◎	△
Safety	○	◎	△
Small environmental impact	◎	△	◎
Progress control	△	◎	○
Economy (construction cost)	△	◎	×
Economy (construction period)	△	◎	×
Future benefits	○	○	◎
Overall	△	◎	△

Table 2-17 Comparison of Construction Methods (2)

	Construction on Sea using Pontoon	Land Construction	
		Stone Spreading	Pre-cast (temporary)
Method	• Install a pile driver on a barge and place piles from the sea.	• Spread stones out over the sea to build a rock-fill embankment and place piles from there.	• Place piles from the land side. Combine the permanent PC aggregate with temporary work and carry out pile placement using a pile driver running over the permanent work.
Advantages	• Because a pontoon is used, there is little environmental impact (pollution, etc.).	• Land construction ensures high safety. • Land construction means that surveying is simple and accurate.	• Because the permanent work is used, there is little environmental impact (pollution, etc.). • Land construction ensures high safety. • Land construction means that surveying is simple and accurate. • Jetty extension works can be carried out with ease in the future.
Disadvantages	• Temporary mooring facilities must be constructed for purposes of materials loading, etc. • Lack of water depth means that the pontoon can only be used in a certain section. Dredging is necessary in order to secure the necessary water depth. • A tug is required to tow the pontoon. • At time of rough sea, work is impossible and it is difficult to secure a place of shelter.	• Construction and removal of the temporary rock-fill embankment are necessary. • Some muddiness is created when spreading and removing the stones, but the environmental impact is small. • Problems exist in treating the spreading stones.	• Since the structure size is determined by the work load, it becomes large (piles, superstructure work). • Since the permanent work is used to carry out construction, protection of the permanent work materials against damage is necessary. • Since superstructure concrete is changed from cast-in-place to pre-cast concrete, the pile driving requires a high degree of precision.
Economy (construction cost: assuming stone spreading to be 100)	140 (Pontoon hire, tug hire, high class crew, towing cost, temporary mooring facilities cost)	100 (Stone spreading and removal cost)	180 (Extra materials accompanying increase in pile diameter and concrete superstructure size, haulage, construction differential, pre-cast concrete placement, stock yard, pre-cast concrete shifting, haulage and installation cost)
Works period	• Pontoon towing time, suspension of sea placement due to rough waves, loading of materials onto pontoon, temporary mooring facilities construction period, installation of pile driver onto pontoon	• Stone spreading and removal period	• Additional period accompanying increase in pile diameter and concrete superstructure size, time taken in pre-cast concrete placement and stock yard construction

The merit-wise comparison of each method stated in Table 2-17 is summarized as in Table 2-16. The comparison indicates that the method of spreading stone from land is the alternative with overall advantage.

(8) Road End Stopping Wall

The sandy beach forms a natural gradient of i = 1/20 and, because the end of the jetty will be shifted approximately 10 m from the shore line into this sand beach, stopping walls will be required at the end of the access road connecting with the jetty and on the sides.

At times of abnormal weather conditions (hurricanes, torrential rain, flooding, etc.), the road end (height = CDL + 1.2 m) will be temporarily submerged and, at times of high waves caused by hurricanes, scouring of the beach caused by breaking waves can be foreseen. For this reason, the bases of the stopping walls shall be dug up to 1.0 m below the surface to the hard sand layer (N value ≥ 20) and, moreover, a crushed stone layer of 50 cm thickness shall be placed as a countermeasure against liquefaction of the sand layer during earthquakes.

(9) Revetment

The access road shall be placed at a gradient of approximately 1/16 from the jetty end to the revetment. Whereas to the height of the building ground to the rear, on the land side is CDL + 2.8 m it has been decided to select the top height of revetment on CDL + 2.0 m in consideration of a gradient for drainage.

Since the revetment is located on the distance less than 30 m from the shore line, as in the case of the stopping walls, the foundation base shall be placed down to the layer of hard sand (N value ≥ 20) in order to prevent scouring during hurricanes and sand liquefaction during earthquakes.

(10) Access Road

Stopping walls shall be placed at the seaside end and on the sides of the access road linking the jetty to the road, in consideration of scouring by waves a number of times each year. The paving of 5 m in width will need to possess enough strength to bear entry by sales trucks carrying 10 tons of ice. Therefore, together with raised site concrete paving, the paving shall consist of cement concrete (25 cm thickness), the expansion joint opening shall be no more than 5 m, and a row of reinforcement mesh (ø = 6 mm) shall be placed in order to prevent cracking.

2-3-2-3 Outline of the Building Facilities Plan

(1) Gear Lockers

As one part of the cooperation for the development and improvement of fisheries infrastructure in Whitehouse fishing village, Gear Lockers shall be constructed to make up for the current shortage. The new Gear Lockers shall not just imitate the existing store rooms, but shall be designed in a manner so that they can aid both current and future fishing operations.

1) Outline of the Gear Lockers Plan

The fishing boats that operate in these offshore waters are relatively large and they need to store two outboard engines, an outboard engine oil tank, compass, navigation lights, radio telephone, fishing nets, troll lines, floats and fish holds, etc. in a fishing gear store room fitted with a lock.

In Top Beach, there are currently three blocks of Gear Lockers that were constructed in the early 1970's by the government (15 booths for each block, 45 in total), and they are rented to fishing boat owners free of charge. Each booth measures 1.25 m by 1.25 m and is 2 m in height. Because these Gear Lockers were constructed prior to the development of offshore fishing grounds, the width of each booth becomes full when just two outboard engines are stored inside and they are unable to respond to current fishery operations.

The study found that 20 booths have to be shared by two fishing boat owners because the total number of Gear Locker is small, and that the owner of 40 fishing boats in total are confronted with lack of facilities for the storage and maintenance of fishing gears. Moreover, the study documented that 10 fishing boat owners are on the waiting list for Gear Lockers on the beach.

Apart from the Gear Lockers built by the government, there are 11 blocks of private Gear Lockers that have been built illegally. Most of these are for common use of boat owners or in joint operations. In the interior, between 3-3.5 m in width of wall space is used by each fishing boat. Estimating from the total area of all these store rooms, it works out that fishing gear of approximately 35 fishing boats will be potentially stored.

In response to those circumstances, the Gear Lockers of 24 booths in total shall be constructed in the plan to accommodate to suffice the needs of 20 owners of boats in common use and the 4 in urgent need out of 10 boat owners on the waiting list. The

construction will lift the capacity of fishing gear storage in the area up to serve approximately 104 fishing boats. Thus the shortage in Gear Lockers will be resolved for the immediate future.

(2) Workshop

As one part of the cooperation for the development and improvement of fisheries infrastructure in Whitehouse fishing village, a workshop shall be constructed in order to raise the quality of maintenance of outboard engines, other fishing gears and fishing boats.

1) Outline of the Workshop Plan

There are no workshop facilities, public or private, in Whitehouse area. Fishermen themselves carry out simple tasks such as outboard engine repairs and parts replacement. The fishermen also carry out maintenance when they are out to sea, however, this is not based on specialist technology and is often not done appropriately.

Engineers from outboard engine agents sometimes tour the area and carry out repairs or provide guidance at the engine hangar in front of the G.G.F.S. and the private engine hangars on the beach. However, these tours are infrequent and outboard engines often have to be carried to Kingston in cases of emergency or major repairs. Judging from the number of fishing boats based in this area, there are more than 250 outboard engines in operation. If a workshop equipped with the necessary tools and parts can be constructed in Whitehouse area, not only will it become more convenient for repairs and maintenance to be carried out by experts, but the relatively short service lives of outboard engines will be extended.

For the immediate future, the permanent stationing of expert engineers to carry out high level repairs shall not be considered for the workshop, but it shall be used to carry out guidance of general maintenance and repairs to fishermen and thus raise the general outboard engine repair level in the area. As a result, because the accessibility of this facility is more important than conservation of its working environment and stock of tools and parts, enclosures for conservation shall be minimized and design shall be drawn to make the facility as open as possible.

The fishermen's cooperative society shop sells materials such as glass fiber sheet and liquid plastic, etc. and fishermen themselves carry out repairs to their fishing boats, usually in the shade of trees on the beach. The fishermen also repair nets, and so on, under the shade of trees, and people can be seen repairing and making traps on roadsides or under trees in the residential area of the fishing village. However, since

there are hardly any trees on the beach around the Project site, such work often has to be carried out under the boiling sun.

In order to enable such work to be carried out in the shade, a column and girder structure for putting up a tent shall be provided to the front of the workshop. Since this site is close to the above-mentioned shop which sells repair items, this area including the workshop shall be made a place for carrying out a wide range of fishing boat and fishing gear maintenance activities.

(3) Fish sorting facility

As one part of the cooperation for the development and improvement of fisheries infrastructure in Whitehouse fishing village, Fish sorting facility shall be constructed. In addition to making the flow of landed fish carrying-in, fish species screening, washing, sorting, weighing, purchasing and carrying-out smoother, this will raise the level of landed fish hygiene and quality control. Moreover, by utilizing the fish screening and washing space of these facilities for carrying out simple processing work such as scale removal, gutting and cutting, the concentrated management of waste products shall be carried out to prevent the further advance of environmental pollution.

1) Outline of the Fish sorting facility Plan

Sorting functions such as the screening, weighing and trading of landed fish are currently carried out on a beach of around 1.5 m in elevation separated by approximately 15-20 m from the coastline. Whenever a fishing boat returns from a fishing trip, a sheet is spread over the sand for the fish to be put out and screened, and the fishing boat owner, purchasers and retailers gather round the sheet to carry out weighing and trading.

Most fishing boats return to the beach between midnight and the next morning, however, because there are no lighting facilities on the beach, landing and sorting work is carried out after the sun comes up. With a view to conserving the freshness of fish, simple lighting facilities shall be installed so that sorting work can be carried out at any time of fishing boat arrivals and a roof shall be provided to protect landed fish from the powerful rays of the sun during the day.

Due to a lack of water supply facilities, fish are not washed during the whole fish sorting process. The heat insulation capability of fish box of each boats is poor and there is often not enough ice left in fish boxes when fishing boats return to the beach.

In addition to educating fishermen about improving the heat insulation capacity of fish boxes, water supply facilities shall be installed in the sorting area to enable fish to be washed with clean water immediately after they are landed.

Fortunately, the Water Supply Commission of Westmoreland Parish has already secured a new water source for Whitehouse area, and it appears that a water source which is better than the previous one by more than four times in terms of pressure and 2.5 times in terms of quantity will be commenced some time this year. Assuming that the amount of water used to wash landed fish is 2-2.5 times the weight of the fish, the cost of this washing water will only come to 0.05 J $ per pound of fish, and this will not prove a great burden for either fish sellers or fish buyers.

For the immediate future, the method of using fish boxes for carrying out fish screening, weighing and trading cannot be introduced, so screening work will need to be carried out by directly laying fish out on the floor. Drainage ditches shall be provided to enable the floor of the sorting space to be cleaned by sprinkling water and every effort shall be made to keep the floor clean for the sake of fish hygiene control.

In this area, as is the general case throughout all Jamaica, the processing of fish for sale is hardly carried out at all, except for the removal of scales from small fish. However, concerning fish that are used by the fishermen and fish retailers for their own private consumption, gutting and cutting (of larger fish) are carried out. Such work is carried out next to drainage channels adjoining the open-air market or at the coast line, however, because the resulting entrails and other organic waste products are left to rot as they are, they lead to extreme pollution of the beach environment. The visibility of the sea water up to around 10 m from the coast line is so low that the sea bottom can hardly be seen. The above-mentioned organic substances are making the beach harder and the beach has started to show signs of being unable to absorb oxygen and carry out natural purification.

In view of this situation, waste collection equipment shall be provided in the fish screening and washing space of the Fish sorting facility, to enable waste scales and entrails to be treated in an integrated and sanitary manner.

2) Floor Plan of the Fish sorting facility

As was mentioned earlier, the Fish sorting facility shall be located to the Northwest of the central axis linking the access road to the jetty. On the sea side of the facilities, a parking space shall be provided for vehicles loading materials onto fishing boats and

carrying things in and out of the facilities. It is also planned to move the open-air market to the Northwest side (although the exact position is not yet decided), and access by vehicles to there will need to be taken into account. Since the available space in this zone is slightly cramped, the building floor plan shall be made round, so that entering vehicles are able to move around the building in a rotary fashion and leave smoothly. (The building shall actually have 12 sides, and roof girders shall converge on the center so that the stress placed on each girder is equal and the structure rationality is high).

Fish sorting, weighing and trading on the beach until now has been carried out by laying fish out on square sheets of roughly 2.5 m. Because it is not planned to suddenly improve this situation under the Project, a similar space shall be secured within the facilities to enable fish sellers and buyers to gather round and conduct their business. Because fish buyers bring fish boxes, heat insulated boxes and buckets, etc. with them, a round space of approximately 5 m in diameter will be required to deal with the fish landed by one fishing boat. Six of these spaces shall be provided and, in the middle of these, a space of another approximately 5 m in diameter shall be secured around the central column supporting the roof and used to store weighing scales and water sprinkling hoses, etc. In order to avoid confusion, an interval of between 1.2-1.6 m shall be secured between each fish sorting space and also the storage space. By placing the columns on the perimeter approximately 1.5 m away from each fish sorting space, the perimeter columns will form a circle of 21 m in diameter.

Drainage ditches with grating shall be provided between each fish sorting space to ensure that wastewater from floor washing is dealt with properly.

A fish screening and washing tank over a simple pool shall be provided in the area where the drainage ditches leave the outside of the building, i.e. the area that is furthest apart from the fish sorting spaces. The edge of this tank shall be made into a low table, and landed fish placed into the tank for washing will cause excess water to drain and will be washed by sprinkling water. The low table will enable fish to be screened and will also allow simple processing such as scale removal, disemboweling and cutting to be carried out.

(4) Sectional Plan of the Building Facilities

Because rainfall in the Project area, although not great in quantity, tends to be torrential, the roofs of each building shall be made sloping in order to ensure safety in water proofing. Because shingles, which possess high heat capacity for dealing with the strong rays of the

sun, will be placed on the roofs, the roof gradient shall be 4.5. Moreover, the roofs shall be monitor roofs enabling gravitational ventilation to be utilized. Apart from the fishing gear store room booths, the tools and parts store of the workshop and the management office, ceilings shall not be installed.

Gable roofs, which are the most simple and rational roof type, shall be adopted for the Gear Lockers and workshop, and the Fish sorting facility shall be given a 12-sided conical shape as mentioned earlier. The top edge height of girders shall be +3 m and the bottom edge shall be +2.4 m. Moreover, the floor in each building shall be raised roughly 15 cm off surrounding ground, in order to prevent the infiltration of stormwater.

(5) Structural Plan of the Building Facilities

Foundations shall be spread foundations using reinforced concrete, and piles shall not be used. Regarding the foundation design, in consideration of the accuracy of local concrete work, the design of mix shall be 210 kg/cm^2, but the sectional design strength shall be made 180 kg/cm^2 to secure sufficient yield. The design long-term bearing capacity of soil shall be 7 t/m^2. Regarding the bearing capacity of soil, confirmation shall first be carried out through site testing before finally deciding on the size of foundations.

Superstructure columns and girders shall be made from reinforced concrete to withstand strong winds during hurricanes, and walls shall be made using lightweight concrete blocks. The design strength of concrete shall be 180 kg/cm^2 (design of mix 210 kg/cm^2).

Roof structures shall be wooden to prevent salt damage, ensure lightness of weight and enable construction by local contractors. For roofs using reinforced concrete girders, the girders shall be clustered to support the principal rafter material, and roofs not using girders shall be made a truss structure in order to reduce the section of the principal rafter material. On joint sections and sections connecting with reinforced concrete girders, steel fittings with thickness raised by one rank shall be used in order to prevent salt damage.

The JS (Jamaica Standard) shall be used as the structural design standard, however, in cases where applicable standard are not provided under the JS, Japanese structural design standards or the BS shall be applied.

Regarding wind pressure, structures shall be able to withstand a velocity pressure of 50 m/sec. and, regarding seismic pressure, the standard sheering force coefficient shall be 0.2.

(6) Equipment Plan of the Building Facilities

Simple electricity supply equipment to enable nighttime operation of the facilities and use of workshop tools shall be installed, together with water supply facilities for use in washing landed fish at the Fish sorting facility.

The public service company of Westmoreland supplies three-phases four-wire power to the Project site, and it is possible to receive 120 V or 240 V power supplies from this source.

The Project site is also fitted with a water supply system, however, the supplied water quantity tends to be insufficient. This problem is common throughout the whole of Whitehouse fishing village, however, as was mentioned previously, the Water Supply Commission of Westmoreland Parish is already carrying out works to improve the situation. As a result, it appears that a water supply which is better than the previous supply by more than four times in terms of pressure and 2.5 times in terms of quantity will be commenced at the end of fiscal 1997.

(7) Building Finishing Plan

The finishing plan is outlined below. Each item has been selected based on consideration of building robustness against hurricanes, durability to resist salt damage, ease or maintenance management and ease of local procurement.

Exterior finish:

- Roofs: glass wool heat insulation material, concrete panel boards, asphalt roofing, asphalt shingles
- Rear side of eaves: main house rafters and concrete panel boards, anti-corrosive and ant-proof coating
- Columns and girders: exposed reinforced concrete, water repellent waterproof coating
- Walls: lightweight concrete blocks, water repellent waterproof coating
- Outer baseboards: exposed reinforced concrete, water repellent waterproof coating
- Floors: concrete placing, epoxy anti-corrosive coating

Interior finish:

- Ceilings: main house rafters, company raising, anti-corrosive and ant-proof coating
- Raised ceilings: edge assembly, company panel raising, anti-corrosive and ant-proof coating

- Columns and girders: exposed reinforced concrete, water repellent waterproof coating
- Walls : light weight concrete blocks, mortal steel trowels, water paint coating
- Fence walls: mesh fence, zinc dipping, marine paint coating
- Baseboards: exposed reinforced concrete, water repellent waterproof coating
- Floors: exposed concrete, mortar steel trowels, epoxy anti-corrosive coating
- Fish sorting facility floor: exposed concrete, mortar, mosaic tiles
- Fittings (windows): aluminum louver sashes
- Fittings (doors): wooden doors, anti-corrosive and ant-proof coating.

  : And steel frames, steel mesh, zinc dipping, marine paint coating

2-3-2-4 Equipment Plan

Tools for the workshop shall be procured under the Project.
Two sets of special tools for repairing outboard engines made by two companies, and one set of general tools shall be procured. The grade of maintenance, overhaul and repair work to be carried out in the workshop shall be of a level that can be performed by general fishermen and engineers authorized by outboard engine makers. Therefore, tools shall only be provided for carrying out general work, not including the kind of detailed measurements, adjustments and total overhauls that are carried out in the maintenance shops of agents (see the following table for a breakdown of tools).

Table 2-18 Tools List

(1) Special Tools [Y]	Q'ty	(2) Special Tools [M]	Q'ty	(3) General Tools	Q'ty
Dial Gauge Set	1	[30/40]		140 pc. Socket Set	2
Pocket Tester	1	Flushing Kit	1	5-Drawer Rollaway Tool Chest	2
Timing Light	1	Flywheel Holder	1	11 pc. Metric Combination Wrenches 7mm-17mm(11)	2
Compression Gauge	1	Flywheel Puller	1	11 pc. Standard Combination Wrenches 5/16-15/16	2
Digital Circuit Tester	1	Volt/Ohm/Ova Meter	1	3/8" Drive Speeder Wrench	2
Digital Technometer	1	Spark Gap Tester	1	11 pc. Long Arm Hex. Key Set Metric 1.5mm-8mm	1
Flywheel Puller	1	Service Tachometer	1	Hand Impact Driver Set	1
Flywheel Holder	1	Timing Light	1	12 pc. Screwdriver Set	2
Gear Puller	1	Lifting Eye	1	5pc. Adjustable Wrench Set	1
Piston Slider-1	1	Powerhead Stand	1	14 pc. Punch, Chisel, Line-up Tools Set	1
Piston Slider-2	1	Ring Expander	1	4 pc. Plier Set	2
Stopper Guide Plate	1	Locking Removal Tool	1	13" Arc Joint Pliers	2
Bearing Housing Puller Claw-1	2	Piston Pin Tool	1	4 pc. Locking Plier Set	1
Bearing Housing Puller Claw-2	2	Snap Ring Piler	1	LEG Convertible Retaining Ring Pliers	1
Center Bolt	1	Torwue Wrench (0-200 ft-lb)	1	Smaal Convertible Retaining Ring Pliers	1
Pinion Nut Holder	1	Compressor Tester	1	39 pc. Standard Tap and Die Set	1
Socket Adapter-1	1	[Power Unit Tool]		39 pc. Metric Tap and Die Set	1
Socket Adapter-2	1	Driver	1	Inch/Metric Vernier Caliper	1
Ring Nut Wrench Extension	1	Driver	1	Micrometer	1
Puller Head	1	Bearing Puller & Installer Tool	1	3/8" 10-75 FT/LB Torque Wrench	1
Slide Hammer Handle	1	Washer	1	1/2" 20-150 FT/LB Torque Wrench	1
Ring Nut Wrench-1	1	Washer	1	Thickness Gauge	2
Ring Nut Wrench-2	1	Plate	1	16 oz. Ball Pein Hammer	1
Ring Nut Wrench-3	1	Bearing Puller	1	24 oz. Ball Pein Hammer	1
Drove Shaft Holder-3	1	Mandrel	1	32 oz. Ball Pein Hammer	1
Drove Shaft Holder-4	1	Driver Hand	1	16 oz. Rubber Mallet	1
Drove Shaft Holder-5	1	Driver	1	8 Meter 1" Metric Tape	2
Terminal Kit	1	Driver Rod	1	Heavy Duty Vise	2
Power Unit Stand-A	1	Drive Shaft Holder Tool	1	Adjustable Hacksaw	2
Outboard Motor Repair Stand	1	Mandrel	1	5 pc. File Set	1
Power Unit Stand-B	1	Mandrel	1	Heavy Duty Soldering Gun Kit	1
Rest Propeller (E40J, 48C, 55C)	1	Pilot	1	3 1/2HP 15 Gallon Air Compressor	1
Rest Propeller (E40G)	1	Spring Hook	1	Blow Gun Kit	1
Rest Propeller (E75B, 75/85A, 60-90HP)	1	Driver	1	1/2HP Variable-Speed Reversible Drill	1
Rest Propeller (E25A)	1	Leakage Tester	1	3/8HP 1/2" Drill	1
		[45/50 Power Trim]		10 inch Bench Top Drill Rpess	1
		Spanner Wrench	1	Standard Drill Bit Set 21 pc.	1
		Lock-Ring	1		
		Expanding Rod	1		
		Collet	1		