MINISTRY OF ISLAND DEVELOPMENT AND INDUSTRY
THE REPUBLIC OF NAURU

No. 1

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF COMMUNITY BOAT HARBOUR AT ANIBARE
IN
THE REPUBLIC OF NAURU

OCTOBER 1998

JAPAN INTERNATIONAL COOPERATION AGENCY

TETRA CO., LTD.

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PREFACE

In response to a request from the Government of the Republic of Nauru, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Community Boat Harbour at Anibare and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Nauru a study team from October 27 to December 1, 1997.

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

October, 1998

Kimio Fujita
President
Japan International Cooperation Agency

October, 1998

Letter of Transmittal

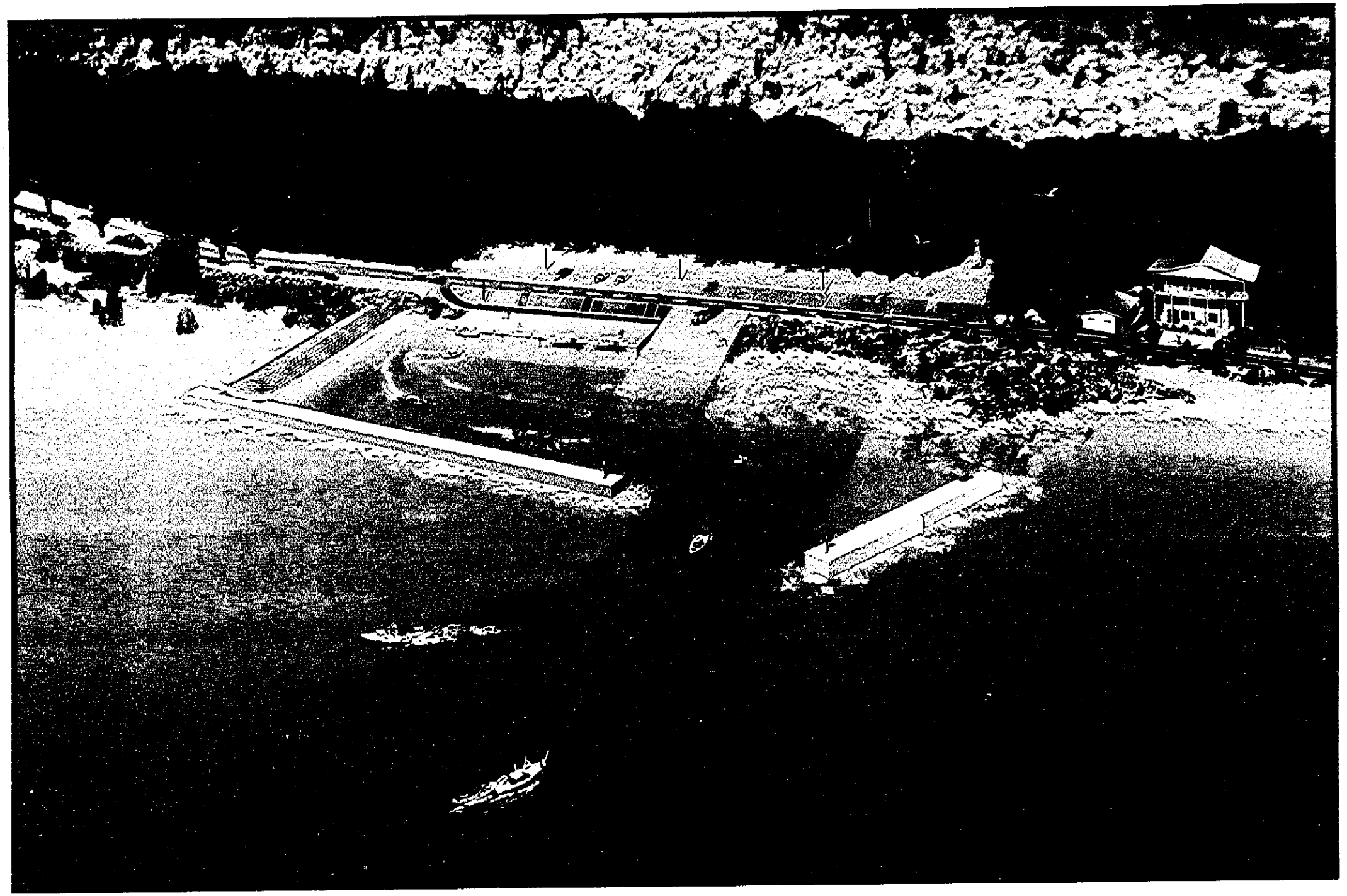
We are pleased to submit to you the basic design study report on the Project for Improvement of Community Boat Harbour at Anibare in the Republic of Nauru.

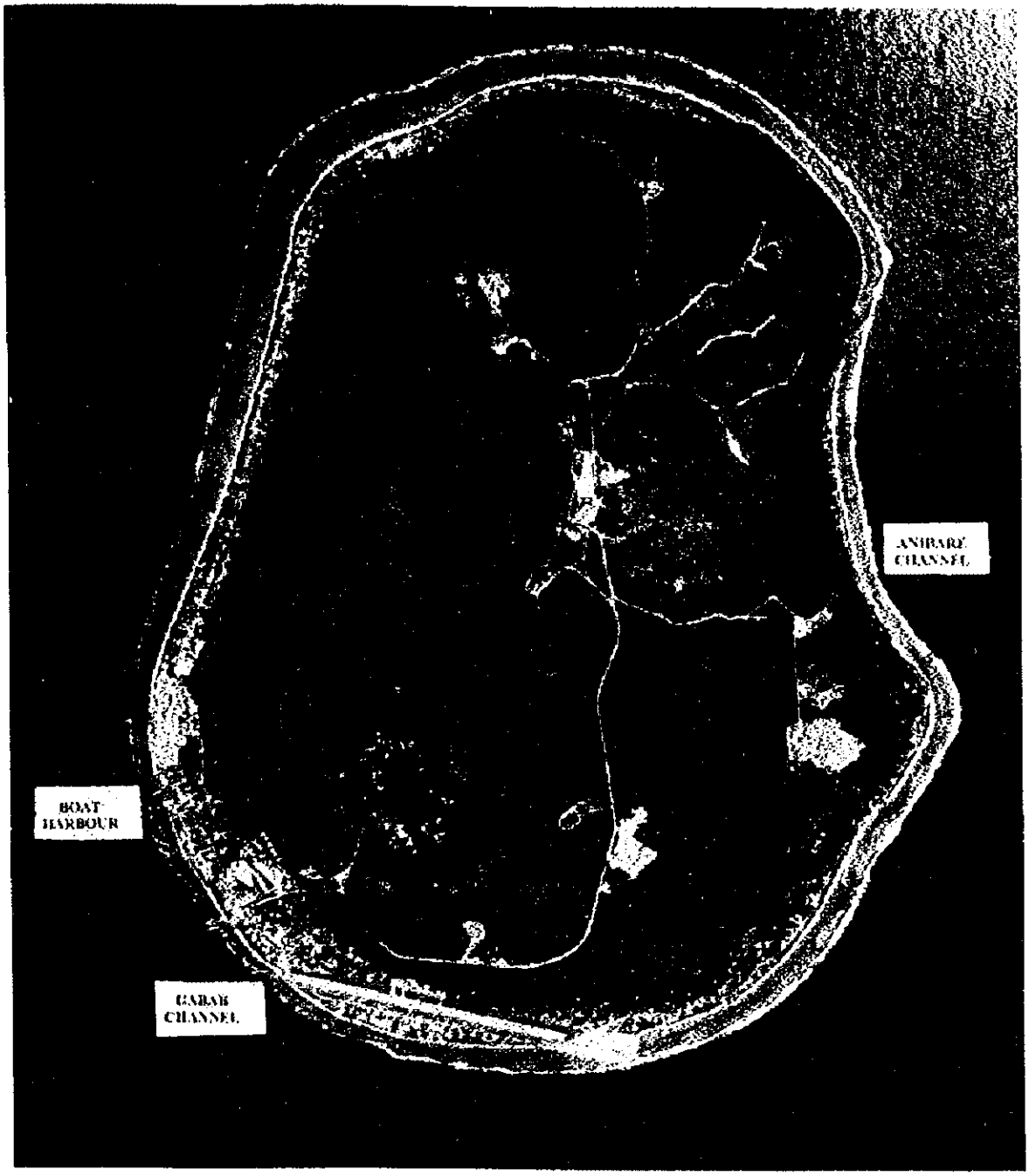
This study was conducted by TETRA Co., Ltd., under a contract to JICA, during the period from October 22, 1997 to October 9, 1998. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Nauru and formulated the most appropriate basic design for the project under Japan' s grand aid scheme.

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

Very truly yours,

Eiichi Matsuura
Project manager,
Basic design study team on the Project for
Improvement of Community Boat Harbour
at Anibare
TETRA Co., Ltd.





Panoramic View of Nauru Island

Anibare Channel commanding a Panoramic View from Sea

Anibare Channel at Low Tide

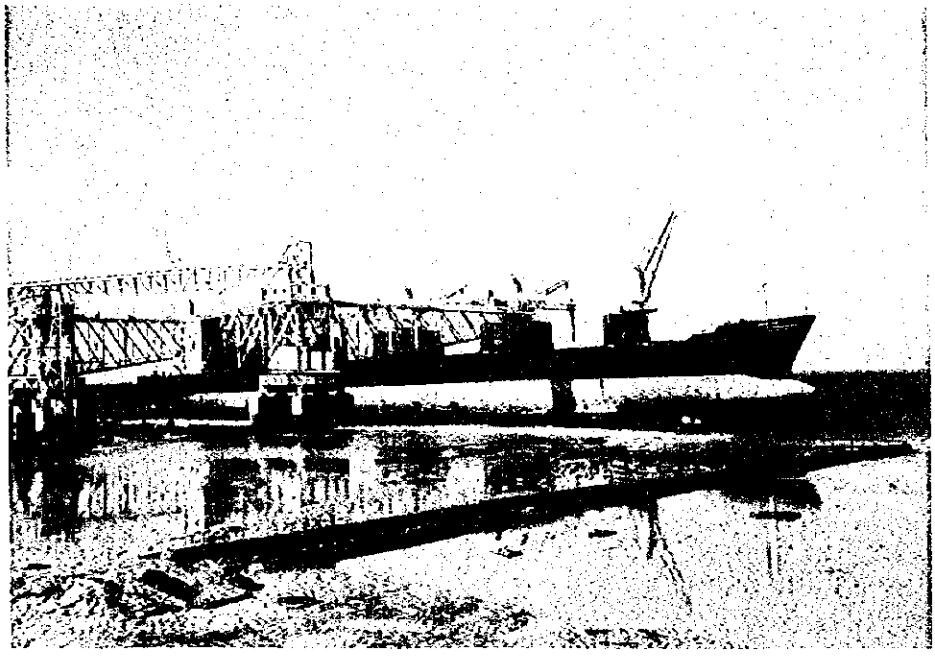
Entrance of Anibare Channel commanding a distance view of Sea

Existing Beach behind Anibare Channel at Low Tide

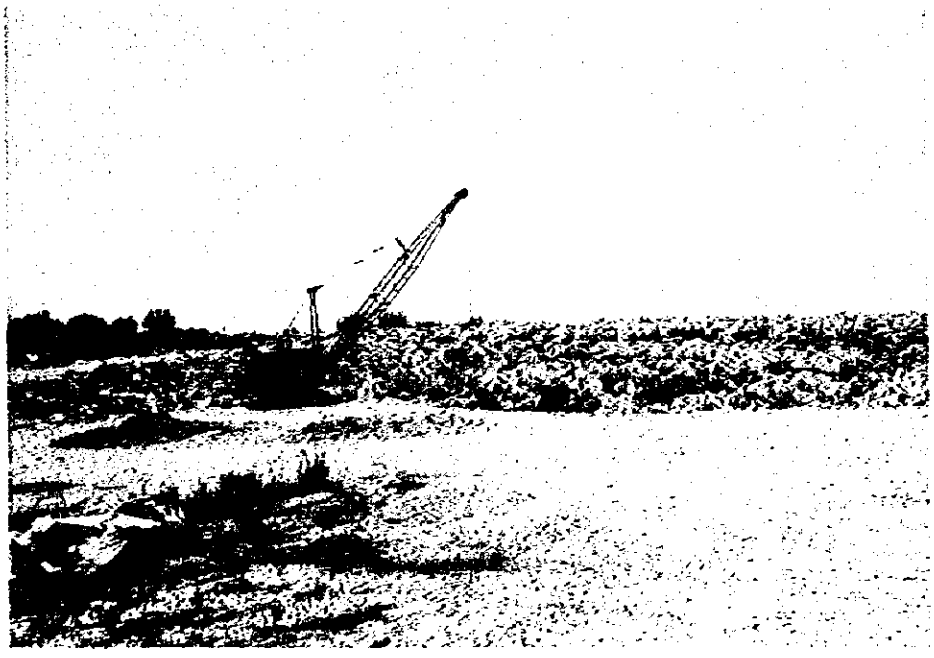
Launching System of Anibare Channel

Living Creatures on Tide Pool at Anibare Channel

Main Island Road behind Anibare Channel



Launching System of Phosphate Ore



Mining Site of Phosphate Ore

Contents

[APPENDICIES]

Chapter 1 Background of the Project

1-1 Background of the Project

The Republic of Nauru is a single raised limestone island and an ultra mini-nation with a total area of 22square kilometer located on 42km south of the Equator in the Central Pacific. The population of Nauru was 9,919 in 1992 according to Nauru National Population Census. Nauru has an equatorial monsoon climate with an average rainfall of about 2,400mm per year although this was very variable in the past. There is a little air temperature change throughout a year and a day and night. The wet season with southwesterly monsoon is from November to February and the dry season with Easterly trade wind is from March to October.

Nauru became independent as the first republic country among many South Pacific countries in 1968. The people of Nauru have been exposed to lifestyle influenced by the economical and environmental aspects of phosphate mining industry since the mining was first commenced in 1907. The introduction of monetary wealth through the payment of phosphate royalties to the landowners prior to and after Nauru gained independence. The Government of Nauru, since gaining independence in 1968, has utilized and invested much of the money earned from the phosphate industry to secure long term funding for the people and the Government of Nauru. Once the phosphate deposits in Nauru are exhausted. The quantity of export decreased to 6.421million ton per year in 1993. It is about a quarter of the golden age from 1973 to 1974. The governmental financial condition retreated greatly. The State Planning Office of Finance (SPF) statistics reports that GNP per capita decrease from US$10,230 in 1987, US$4,640 in 1992 to US$3,400 in 1996. The Government of Nauru exhausts the effective deposits of phosphate in Nauru within 8 to 10 years.

The new Government, which started with such critical situation in 1995, developed the fishery and tourism industries that have not been cultivated as the key fundamental industries instead of phosphate industry. And the Government is also proceeding the large reduction of finances, the promotion of governmental enterprises with the system of the privatization and the wide reduction of various subsidies. The Government of Nauru is compelled to undergo a major structural reform and to determine and secure alternative sources of income for the post-phosphate economy

era. In particular, the industry of marine fisheries could be focused upon the source of national revenue, the creation of employment and the improvement measures of Nourishment State of people. The Government of Nauru has established the Long–Term National Fisheries and Marine Resources Development Strategy (1996-2001) which aim to promote the fisheries industry into an important and valuable industry in both the short and long term plan. In October 1997, Nauru Fisheries and Marine Resources Authority (NFMRA) was established as the implementing agency of this plan, which has nine development plans to overcome the national economic crisis.

The Government of Nauru regards improvement of the Anibare channel that was built about 30 years ago as a top priority project of the basic infrastructures. Thus, the Government of Nauru has requested to the Government of Japan to construct the Community boat harbour at Anibare under the grand aid program. During the remainder of the year, the prevailing winds blow from South- East. Wave surges are very common in Nauru and particularly strong on the west side of the island which is not suitable for sea cargo vessels until it is safe to load and unload cargoes at the boat harbor on the west side of the island. Community boat harbour at Anibare is also expected to take a charge of the substitution function of container handling during the Southwest monsoon season.

In the light of the above-mentioned situation and problems, the Government of Nauru requested the grand aid assistance to the Government of Japan at April of 1997. This is the first time request for the grand aid assistance.

Chapter 2 Contents of the Project

2-1 Objectives of the project

2-1-1 Existing Condition of Anibare Channel

Existing Anibare channel has the narrow width (10m), elbow-shaped bend, shallow water depth (0.5 to 1.0m) and the boat ramp of 6.0m width. The parking area of boat trailers is located behind the road. Anibare channel has low usable rate because of the limitation of going-out and coming in of the fishing boats due to the elbow-shaped bend. Figure 2-1-1 shows the existing condition of Anibare channel.

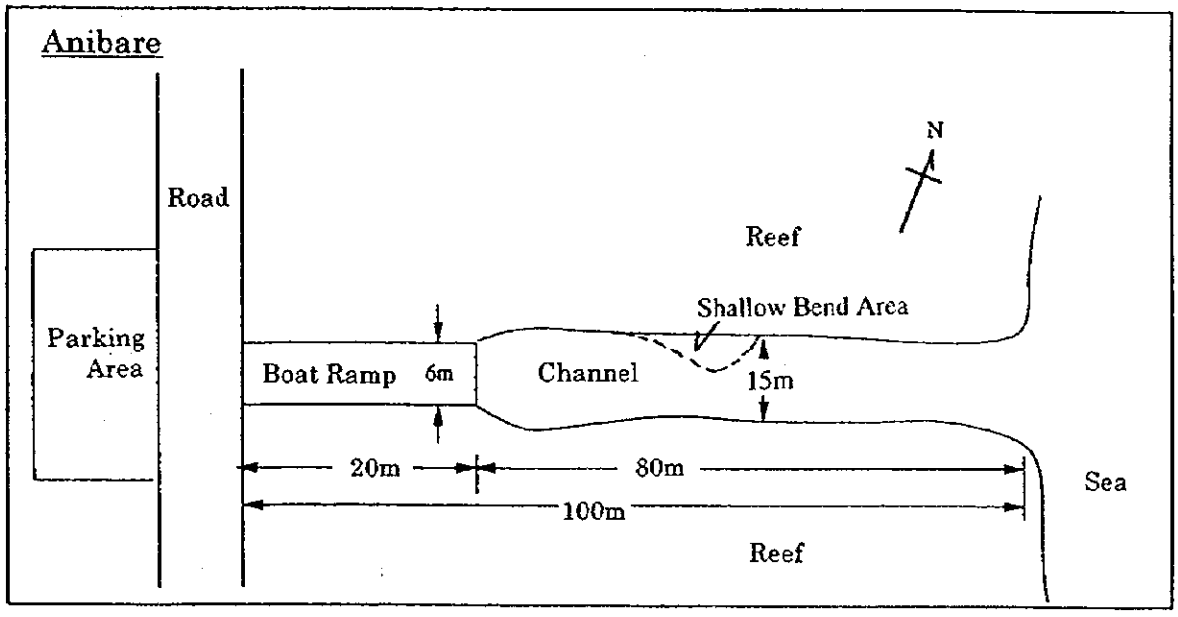


Figure 2-1-1 Existing Condition of Anibare Channel

2-1-2 Estimated Volume of Annual Catch by Fishing Methods

Nauru Government has formulated and enforced the boat from the fiscal year 1997. All fishing boats in Nauru have not been completely registered, however, various laws and regulations of fisheries have been formulated. The fishing boats and canoes belonged with migrant workers are also not filed in the boat registry. Boat

numbers including the migrant worker' s fishing boats and canoes in Nauru have not been accurately recorded. The total number of fishing boats in Nauru in 1992 was estimated based on the boat registry, the result of accounting survey of migrant worker' s boats and the statistics of the population census. According to the Boat Registry of Department of Fisheries & Marine Resources, 71 Nauruan fishermen' s power skiffs registered in 1996/7. NPC migrant fishermen owned boats were accounted to be 53 power skiffs and 95 canoes in 1997 based on the report conducted by NFMRA. 46 powered skiffs were also counted by the Census in 1992 except the registered 71 skiffs. There were total 117 powered skiffs owned and operated by Nauruans, where as 53 powered skiffs and 95 canoes were counted under the migrant workers. The estimated number of actual operating vessels in Nauru indicated in Table 2-1-1.

NPC migrant workers have been decreasing step by step with slow production of phosphate rock mining.

Table 2-1-1 Estimated Number of Skiffs and Canoes on Nauru

	Nauru Fishermen	Migrant fishermen
Power skiff	71(registered) 46(by Census)	53(counted)
No. of canoe		95(counted)
Total(skiffs)	117	53
Total(canoe)		95

Source: Registered Note by NFMRA
Census Report 1992
Result of Counting Survey by Study Team

SPC in 1993 conducted the survey for the production of the coastal fisheries production in Nauru. According to the result of this survey, a fish production on Nauru was estimated to about 374 tons per year as shown in Table 2-1-2. This survey was carried out by contact interviews with fishermen at Gabab Channel and the Boat Harbor.

Table 2-1-2 Estimated Annual Fish landing Volume on Nauru

Fishing method And vessels type	Number of Observations	Mean CPUE	Average number of gears deployed	Average fishing time (hrs)	Annual landings (t)	Percent sold
Trolling(Nuruan Skiffs)	38	4.5 kg/line-hr	2.0 troll lines	3.7	75	55.5
Trolling(Migrant Workers skiffs)	18	5.8 kg/line-hr	2.0 troll lines	4.6	164.8	76.9
Demersal Handlining (Nauruan skiffs)	7	3.0 kg/line-hr	1.7 Handlines	4.9	9.9	71.4
Demersal Handlining (Migrant worker Skiffs)	1	3.0 kg/line-hr	1.7 Handlines	4.9	4.9	76.9
Demersal Handlining (Migrant worker Canoes)	8	3.0 kg/line-hr	1.0 Handline	5.1	15.5	75.5
Mid-water Handlinig (Migrant worker Canoes)	22	6.6 kg/line-hr	1.0 Handline	4.7	98.6	100.0
Spearfishing	5	8.1 kg/hr	4.0 Spears	1.0	2.4	100.0
Cast neting	3	2.8 kg/hr	1.0 cast net	1.3	0.8	0.0
Beach seinig	3	3.9 kg/hr	1.0 beach seine	3.0	1.7	0.0
Total					373.6	

Source: Coastal fisheries production on Nauru by P. Dalzell & Allan Debao March 1994
South Pacific Commission Noumea, New Caledonia

The estimated average daily frequencies of each fishing activity in a week are shown in Table 2-1-3.

Table 2-1-3 Average Daily Frequency of Observation of Fishing Craft and Fishermen in Nauru, (July 1992 – February 1993)

Day	Nauruan Skiffs	Migrant Worker Skiffs	Migrant Worker Canoes	Spear - Fishing	Cast - Netting	Beach - Seining	Reef - Walking
Mon	3.3	4.4	8.9	0.8	1.1	0.8	1.7
Tue	3.1	6.0	9.0	0.8	0.5	0.8	1.0
Wed	5.8	7.9	11.8	0.8	0.1	0.6	0.3
Thu	5.3	7.2	13.0	0.0	0.5	0.0	0.1
Fri	6.9	9.2	10.2	0.5	0.3	0.0	0.0
Sat	16.4	19.5	24.0	1.5	1.0	0.4	3.3
Sun	8.2	0.0	0.0	1.5	0.7	0.0	7.3
Mean	7.0	9.0	11.0	0.8	0.6	0.4	2.0

Source: Coastal Fisheries Production in Nauru by P. Dalzell & Alan Debao, SPC, March 1994.

The summary of average landing per trip in 1993 is presented in Table 2-1-4. For line fishing, the CPUE was indicated in kg/line-hr, whilst for the other gears of CPUE was expressed as kg/hr.

The annual fisheries production in 1993 was estimated to be about 374 ton as shown in Table 2-1-2. About three-quarters of the total fisheries production are generated from the activities of migrant workers. The calculated amount of fisheries production in 1993 was 38kg per capita. This figure indicates that marine product is very important to the life of Nauruan people who has to import their whole foods a year.

Table 2-1-4 Summary of Fishing Activities of Coastal Fisheries in Nauru, 1993

Fishing method And vessels type	Number of Observations	Mean CPUE	Average number of gears deployed	Average fishing time (hrs)	Average landings per a trip	Percent sold
Trolling(Nuruan Skiffs)	38	4.5 kg/line-hr	2.0 troll lines	3.7	33.3	55.5
Trolling(Migrant Workers skiffs)	18	5.8 kg/line-hr	2.0 troll lines	4.6	53.36	76.9
Demersal Handlining (Nauruan skiffs)	7	3.0 kg/line-hr	1.7 Handlines	4.9	24.99	71.4
Demersal Handlining (Migrant worker Skiffs)	1	3.0 kg/line-hr	1.7 Handlines	4.9	24.99	76.9
Demersal Handlining (Migrant worker Canoes)	8	3.0 kg/line-hr	1.0 Handline	5.1	15.3	75.5
Mid-water Handlinig (Migrant worker Canoes)	22	6.6 kg/line-hr	1.0 Handline	4.7	31.02	100.0
Spearfishing	5	8.1 kg/hr	4.0 Spears	1.0	32.4	100.0
Cast neting	3	2.8 kg/hr	1.0 cast net	1.3	3.64	0.0
Beach seinig	3	3.9 kg/hr	1.0 beach seine	3.0	11.7	0.0
Total					230.7	

Source: Coastal Fisheries Production in Nauru by P. Dalzell & Allan Debao March 1994

South Pacific Commission Noumea, New Caledonia

2-1-3 Fishing Ground

The reef and shelf area around Nauru is very limited. The narrow fringing reef flats has an area of about 3.5 square km. The reef flats consist of tide-pools and pinnacles lava rocks. There is a transition zone with coral outcrops and fishes that descend to about 60m from the edge of reef flats. At low tide, the reef flats are completely dried up due to its ground level (+1.5m). Seawater covers about 2m or more above the reef flat during high tide but a poor area in fishes. Migrant fishermen who usually work in the phosphate-mining site operate their skiffs around out side of 100 m off the reef flats

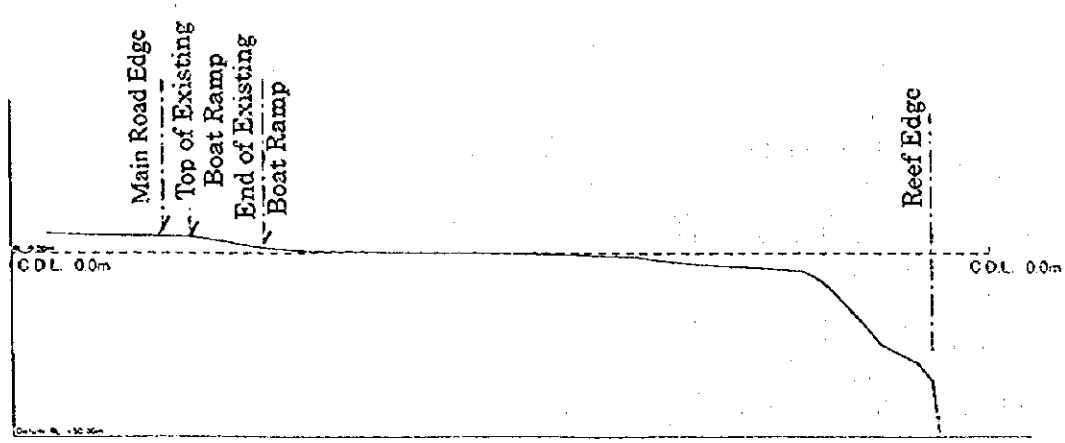


Figure 2-1-2 Topographical Condition of Reef Flat

According to the reports (Fishing Master Mead & Cusak 1990, Watt 1993) studied by South Pacific Commission (SPC), the continental shelf of Nauru descends to 1,000m depth between 1.2 km and 1.7 km off the shore. The 200m depth contour line is between 100 and 300 m off the shore. It is reported that the fishable area for bottom fish amounts to about 7.4 square km. The total continental shelf of Nauru has very limited fishing grounds and bottom fishes are about 10 per cent of total catch volume and the remainders are large pelagic fishes. Therefore, it can be said that pelagic resources such as Yellow fin Tuna and Skipjack are mainly targeted fishes of Nauru in the future.

Nauruan fishermen who use small skiffs with outboard engines are operating for deep sea fishing mainly by the vertical long line in the water of 200 m depth (about 300 m off the shore). This area is very shaped stairway like a 45 degree slope. Further more, they are trolling larger pelagic migratory fishes such as Tuna, Dolphin-fish, King Mackerel and Barracuda etc., in the water having the depth of 500m to 1,000 m.

Based on the investigation conducted by study team, major fishing grounds in Nauru are located North East and East off shore from Anibare bay. These major fishing grounds are abundant with a large variety of fish species. Therefore, all outboard powered skiffs launched from both Anibare and Gabab channels operate these areas as shown in Figure 2-1-3.

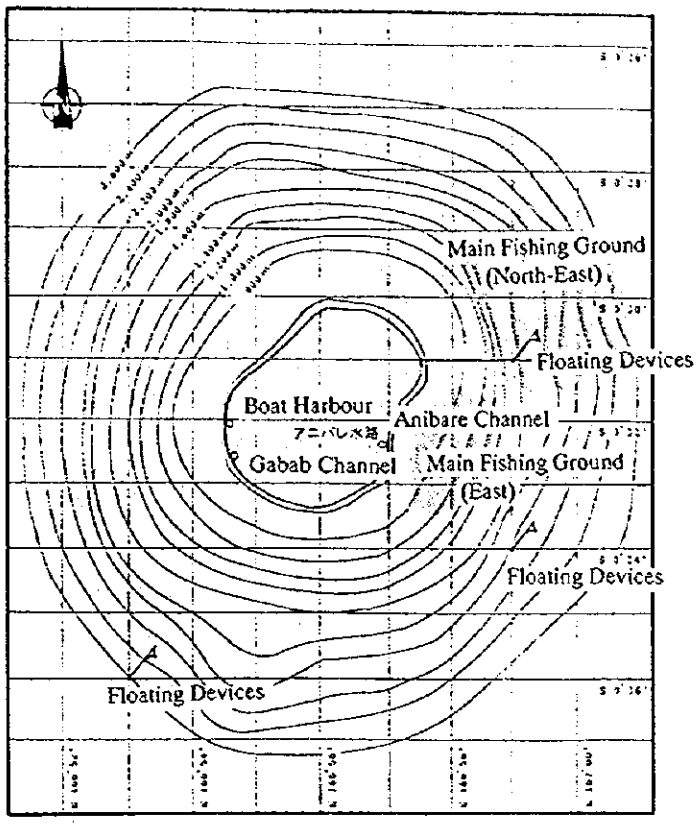


Figure 2-1-3 Main Fishing Ground in Nauru

2-1-4 Fishing Gears and Methods

All fishing boats are stored and maintained at own house of the fishermen due to lack of sufficient fishery port and wharf. Because of the main road of Nauru Island is only 20 km long, the fishing boats with trailer can easily transport to any places in the island within 20 minutes.

Past and presently, there were many different fishing methods that were used to catch both fish and invertebrates from the water of Nauru. Coastal fishing is mainly around Nauru, but the commercial fishing using large fishing boats have not been developed. Coastal fishing is conducted with small (4 to 6 m lengths) Aluminum or FRP outboard powered (75HP to 115HP) skiffs or canoes with out-rigger, or by people walking and diving on the reef. Gabab and Anibare channels have been using as the basic fishing terminal. The Gabab channel which is the most frequently used, is situated at the south west of island and allows the skiffs to access to sea for about 9 to 10 months of the year, when the prevailing easterly winds blow. During the prevailing winds blow is from the West, skiffs are launched from another channel in Anibare Bay, which is facing the east of this island. The main fishing activities carried out from powered skiffs are trolling for pelagic fishes such as yellow fin tuna, and bottom fishing with vertical long line for snappers and groupers. Large Carangoides and

Caranx are caught by hand line. More than 80 per cent of total fishing boats in Nauru are not equipped with navigation and fishing apparatus (Fish finder etc.), and the fish holds. Therefore, catches are kept on boat deck until back to the channel.

Presently, coastal fishing around Nauru is conducted with three types of fishing gears and methods; i.e. (1) Trolling using rod (Large pelagic fishes), (2) Vertical long line and (3) Hand line. Bottom fishing is carried out with vertical long lines and hand lines with a device known as a Christmas Tree that is a T shaped or cruciform wire framework with 18 to 32 hooks. The most favored bait for bottom fishing is skipjack and imported milkfish bought from local stores. Catches from the Nauru fishermen are mainly migratory fish such as Skip-jack, Yellow-fin Tuna, Dolphin-fish, King Mackerel and Barracuda etc. and coral fish such as Carangidae spp. (Scad, Horse Mackerel, Crevalle etc.), Groupers spp. and lutjanidae spp.

2-1-5 Preservation of Freshness of Catches

Catches are kept on the boat deck without any arrangements. Deterioration of freshness is not appeared seriously because of the short operation periods of fishing and large size of fishes. In case of bottom fishing, the fishermen often use about 100 kg of cubic ice, which is obtained from the ice making machine (Capacity 500 kg/day Cube ICE - Price A$3.5/Kg) of the Nauru Phosphate Corporation, for protecting the deterioration of freshness.

2-1-6 Marketing of Fisheries Products

Fisheries marketing systems have not been developed in Nauru. And, very limited quantities of catches are sold to the local shops. Remainders of catches are given to family, friends and neighbors without any compensation. There is no structure of marketing systems of fish catches to major consumers such as the restaurants and hotels. However, NFMRA will establish the Fish Market on October 1998.

Migrant workers of Nauru Phosphate Corporation (NPC) who operate skiffs and canoes on their holidays, they sell all fish catches to the local shops and consumers. All these transactions have been carried out by so called " personnel negotiate." The price is quoted by size and freshness not related to weight. Yellow-fin Tuna (about 18kg) is usually sold at around AS$100, which is about double than the indicated fish-buying price by NFMRA and also seems to be very costly for the average income people of Nauru.

2-1-7 Shore Facilities related to Fisheries

There are no facilities such as the ice making, freezing and cold storage for the fisheries products. There is a small ice making machine in the market for the workers of NPC and also utilized for the fisheries whenever necessary. The capacity of daily production of ice making machines of 500kg was built under the technical assistance program by Overseas Fisheries Cooperation Foundation of Japan (OFCF).

2-1-8 Purpose of the Project

(1) Importance of Small Scaled Coastal Fishing

The Exclusive Economic Zone (EEZ) of Nauru is well known as the fishing ground of Skipjack and Tuna. Therefore, Tuna purseiner fleets of Japan and United Sates are operating these fisheries, year round under the treaty of the fishing agreement. Especially within the territorial waters of 12 nautical miles, there is abundant with migratory large species of tuna-like fish, such as, Skipjack and Yellow Fin Tuna. When territorial water is considered for offshore fishing ground, these waters (more than 2,000m depth) can be assumed to the excellent fishing grounds which is also within the same EEZ where Skipjack and Yellow fin Tuna are migrating.

Therefore, the development of these waters is the most important target for promoting the development of fishery industries in Nauru. These waters of more than 2,000m depth is, generally, defined to be the off-shore fishing ground, however small scaled coastal fisheries in Nauru should be included these waters for the reason of geographical distance (several nautical miles) from shore. By promoting the development of small-scale coastal fisheries in above-mentioned water is the fundamental for the formation of the fisheries sector as the basic industries of the Republic of Nauru, where the related technologies and experiences of the fishery industries have not been accumulated. It is important to develop the small-scale coastal fisheries on the way to develop the fishery industries in Nauru.

For the development of the off-shore fishing, the Government has a plan of introducing medium size fishing boats (Gross Tonnage about 15 - 19 GWT, Boat Length 15 - 19 m including crew space) with pole and line and long line under the respect of safety navigation and feasible operation for several days. Nauruan Government has approved the budget for buying these fishing boats, which will be

used for fishing large size of Skipjack and Tuna.

(2) Placing the Project in the National Fisheries Development Strategy

Through above discussions, it is very important to promote the small-scale coastal fishery industries for the social and economic stability of Republic of Nauru. This promotion plan is feasible in Nauru. The government of Nauru is actively planed to promote the deep-sea fishery industries in future. As the measures of the human resources and taking the technologies, the various training programs for transferring to the fishermen of the deep-sea fishery industries are carrying out. The aim of the National Fisheries Development Strategy (1996 – 2001) is to promote the fishery industry as the key industry for the post phosphate economy era in Nauru. The role of this project is the development of the infrastructure for promoting the small-scale coastal fishery industry under the National Fisheries Development Strategy (1996 – 2001). And three FADs(Fish Aggregate Devices) have been installed in the water of Nauru by NFMRA for developing the fishing ground.

(3) Purpose of the Project

Republic of Nauru has been decided on the national policy that the fishery industries will be promoted as a basic industry. The condition of the fishery industries in the Republic of Nauru has not been developed including the type of fishing boats. However Nauruan fishermen with a side job are operating 170 out-board powered skiffs and 95 canoes and catching the large pelagic and bottom fishes around 3 to 4 nautical miles of the water in the territory.

The purpose of this project is to increment of fish catch volume and number of full time fishermen, to well manage the marine resources and to modernize the fishing methods for one of the triggering devices of development of fishery industries based on the policies of fishery improvement in Nauru.

2-2 Basic Concept of the Project

2-2-1 Examination of the Requested Items

(1) Solved Problems of the Fishery Industry in Nauru

In Nauru, the existing and solved problems of the fishery industry are briefly presented as below.

1) Limitation of Operating Hours

The fishing boats which mainly use the fishing methods such as trolling and longline concentrate to depart and return at the specific time of early morning and evening or the age of moon and the time of tide. Therefore, the fishing boats show a tendency to concentrate within the short periods. Existing Anibare channel has the elbow-shaped bend, shallow depth and narrow width (10.0m). The fishing boats have to go out at the interval of wave breaking and come back prior to the time of ebb tide due to insufficient depth of the channel. For these reasons, the fishermen of Nauru have to operate their boats for only 4 to 5 hours a day.

2) Increase the Number of Out-going Fishing Boat

In the neighboring countries, the rate of out-going fishing boat is about 20 per cent of total number of fishing boats where as this rate still remains 6 per cent, 10 boats in a day, of total existing fishing boats in Nauru. If above mentioned measures to solve the limitation of operating hours will be done, the rate of out-going fishing boat will be increased by the condition of out-going to the sea at any time. As the rate of out-going fishing vessels is increasing, it is expected that the professional fishermen will be increased and established the fishery resources and methods.

3) Establishment of the Rescue and Safety Operating System

Nauru Fishery and Marine Resources Authority has two rescue boats. However, those boats are stored at the area of the land of NFMRA because these are no suitable mooring area and wharf in Nauru. In the event of rescue activities, these boats will be transported with the boat trailer to the Boat Harbour in the west of Island and be ranched for start to rescue. Nauru has not the proper rescue system for operating of fishing boats. Therefore, the proper rescue system will be needed for increasing the number of out-going fishing boat.

4) Capability of Night Operating of Fishing Boat

The fishing boats have to go out at the interval of wave breaking and come back prior to the time of ebb tide due to insufficient depth of the channels, elbow-shaped bend and the narrow width. Especially, the fishing boats can not be operated at night time for this situation.

(2) Necessity of the Required Items

The reasons of required items in the project are presented below to overcome on the above mentioned matters.

1) Necessity of Dredging of Channel and Basin

Present Anibare channel is an elbow-shaped bend with shallow depth (0.5 to 1.0m depth) and narrows width (10.0 to 150m). The bottom height of the site is about 1.5 meter above C.D.L. The channel and turning basin in front of the boat ramp need to be dredged for ensuring the required water depth.

The beach of the planning site is made with the coral sand. The thickness of sediment at the landside of the existing channel is observed more than 20 cm by the study team. This sedimentation is supposed to be transported by the strong stream of the channel, which gather the water from the surrounding area at the low tide. Therefore, the extra dredging depth of the channel and basin is about 20 cm.

2) Necessity of Boat Ramp

The fishermen transport their owned boats to the channel of Gababu and Anibare by the boat trailer and launch them through the existing ramp. It is not real solution that 170 existing powered skiffs berth in the water of community boat harbour at Anibare because of the narrow space of the reef flats. The implementation of boat ramp need for keeping the existing launching system. The existing ramp of Anibare channel was constructed about 30 years ago and there are some structural problems, such as collapse of foundation and the deterioration of concrete slab.

3) Necessity of Breakwaters

Anibare bay is lied with a gentle curved coast between the cape of northern and southern part. Anibare channel was dredged at the area of three-quarter south of the bay. This area is the narrowest point in this bay and the reef flats is about 100m width. The southern part of the reef flats from this channel is gradually extended. This reef

flats are the shelter for South to Westerly wave.

The incoming wave is braked by the abrupt change of water depth in the end of the reef flats and after then, this wave run up on the reef flats to the shore. The wave force is accumulated to the enormous power by the observed results of wave run-up in Okinawa. Thus, the strong breakwaters need to protect the boat ramp. At the north side of channel, the breakwater will be installed for preventing Northeast and Easterly incoming waves. (The result of calmness analysis in front of boat ramp with the breakwaters is presented in section 2-3-5.)

4) Necessity of Sand Barriers

The tidal motion will cause the strong current to offshore in the channel and basin. The coastal sand will be drifted to community boat harbour at Anibare by this strong current. The sand barriers at the end of south and north of community boat harbour at Anibare for preventing the sand drift.

5) Necessity of Parking Area for Boat Trailers

The boat trailers after launching the fishing boats has to park near the ramp during the time of operating. The parking area will be planned to the backside or near the launching ramp because of conveniences and shorten the time of preparation of out-going.

6) Necessity of Wharf

Present fishing boats are transported with the boat trailer to the existing channels from the garage. The fishing boats are launching through the channel of Anibare and Gabab and the crews are riding on the boat by walking through the water of channel. After the crews ride on the deck, the fishing boats haul the interval time of wave breaking at the mouth of the channel. It is long time from launching to haul compare with the time of other fishermen in the neighboring countries. The wharf for preparing and landing of catches is needed to improve because the average number of out-going fishing boats are increased up to the same level of 20 per cent as the neighboring countries. If the wharf will be installed, the average number of out-going boats will be increased because of shortening the preparing time for haul.

For safety fishing activities, rescue boats owned by NFMRA must be able to haul at any time. It is necessary to construct the wharf for mooring the rescue boats. The wharf need to the capability of container handling during the south-west monsoon

season.

7) Necessity of Navigational Aids

This project will be the capability of fishing activities at night and day. The area of fishing activities in Nauru is 3 to 4 nautical miles. Because of the safety haul at the mouth of channel at nighttime, the light beacons need to set on the top of breakwaters and the navigational markers that fishermen will be watched along the center of channel also need to install on the land. The visual distance of light beacon is needed five nautical miles.

8) Necessity of Lighting Apparatus

For the activities in the night and early morning, it is necessary to install lighting apparatus at the parking of boat trailers, wharf and slip-way.

2-2-2 Basic Concept of the Project

(1) Planning Purposes

Following three subjects as a planning purposes will be examined in regard to above discussions for the design of basic plan of this project.

Subject-1: To secure the safety and easy operating at the mouth of port

Existing Anibare channel has an elbow-shaped bend, the shallow depth (0.5 to 1.0m depth) and the narrow width (10.0m). The fishing boats have to go out at the interval of wave breaking and come back prior to the time of ebb tide due to insufficient depth of the channels. This condition restricts on the large size fishing boat, increment of the average number of out-going boats and safety measures for the fishermen. Therefore, it is necessary to enlarge the width and depth to straighten the existing Anibare channel.

Subject-2: To improve the operating ratio of fishing boats

It is the first step for promoting the small-scaled coastal fishing in Nauru to increase the operating rate of fishermen. It is the prerequisite that the basic infrastructures to be able to out-going and return at any time will be implemented. Based on the existing condition of Anibare channel, it is also necessary to expansion of width and depth and to straighten the existing Anibare channel. Navigational aids such as the light beacon and channel markers will also be implemented for night navigation.

Subject-3: To establish the rescue and safety operating system

Two rescue boats presently are deployed by NFMRA. Those boats are kept on the land because there is no suitable mooring area in Nauru. In the event of rescue, those boats are transported to the Boat Harbour by the trailers and launched by the crane, after then those boats depart to rescue. Nauruan fishermen have not enough safety fishing operating condition due to the said rescue system. It is, therefore, necessary to install the mooring water area for rescue boats and the navigational aids, such as the light beacon and channel markers for night navigation.

(2) Planning Conditions

The planning conditions of Community boat harbour at Anibare will be set according to the estimated number of fishing boats and fishermen as shown in section 2-1-2.

1) The Planning Dimensions of Vessels

Table 2-2-1 shows the planning dimensions of vessels. The Nauru Government has the future plan to purchase the middle sized fishing boats. The planning dimensions of the middle sized fishing boat are also shown in Table 2-2-1, but it is not included for the planning purposes.

Table 2-2-1 Planning Dimension of Each Boat

Type of Boat	Length (m)	Beam (m)	Depth (m)	Draft (m)	Gross tonnage	Number
Small Skiff	*4.55*	*1.92*	*1.00*	*0.70*	*Less than 1*	*10*
Rescue Boat	*8.10*	*2.72*		*1.45*	*2.0*	*2*
Container Barge	10.50	4.00	2.05	1.26	10.0	1
(Future Plan) Middle Size F. Boat	16.00	6.00	2.00	1.60	20.0	2

2) Number of Fishing Boats at Standard Day for Planning

SPC estimated the daily frequency rate of fishing boat in a week as shown in Table 2-1-1. Table 2-2-2 shows the estimated result of the daily frequency rate of fishing boat in a week. According to the result of SPC, it seem to be understood that Saturday is the busiest day due to the large number of fishermen having no out-side job. The standard day for planning is set Thursday that is 4th day of a week. The number of boats on the standard day is set the planning number of boats for the project.

Table 2-2-2 shows the number of boat in 1993. The recent activities of fishing seem to be busier due to the slow of economy in Nauru. Time frequency of going-out of fishing boat, basically, is within an hour in the morning. Therefore, it can be assumed that the number of fishing boat presented in Table 2-2-2 has also the frequency within an hour.

Table 2-2-1 Average Daily Frequency Observation of Fishing Boat and Fishermen in Nauru (July 1992 – February 1993)

Day	Nauruan Skiffs Daily freq. %	Nauruan daily skiffs 117	Migrant worker daily freq. %	Migrant daily skiffs 53	*Daily Total Skiffs 170*	Migrant Worker Canoes %	Migrant Daily Canoes 95
Mon	3.3	3.9	4.4	2.3	*6.2*	8.9	8.5
Tue	3.1	3.6	6.0	3.2	*6.8*	9.0	8.6
Wed	5.8	6.8	7.9	4.2	*11.0*	11.8	11.2
Thurs.	5.3	6.2	7.2	3.8	*10.0*	13.0	12.4
Fri	6.9	8.1	9.2	4.9	*12.9*	10.2	9.7
Sat	16.4	19.2	19.5	10.3	*29.5*	24.0	22.8
Sun	8.2	9.6	0.0	0.0	*9.6*	0.0	0.0
Standard	5.3	6.2	7.2	3.8	*10.0*	13.0	12.4

Remark: Daily Max of skiffs: 29.5
Number of skiff on satnndard day: 10
Daily Min of skiffs: 6.2

3) Number of Fishing Boats at Same Time

The required time from launching to depart of the fishing boats is assumed to be 20 to 30 minutes according to the observations by the study team. The time between launching at the boat ramp and sail out the port is about 60minuets. Therefore, the number of fishing boats for launching and landing at the same time will be set up 5 boats on the boat ramp.

4) Width of Boat Ramp

The actual ship preparatory time for launching and landing up, and the planning dimension of the number of boats per hour at the launching ramp in the planning standard day are briefly below.

1.Actual ship preparation time for launching and landing: 30 minutes / a boat
2. Number of boats per hour for launching at the standard day: 10 boats/ a hour
3. Number of boats per hour for launching at same time: 5 boats

The width of boat ramp will be set to be handled 10 boats per hour, and the boat ramp have to be handled 5 boats at same time. The width of launching ramp will be 16.0m calculated from the following equation.

Equation: $L = \Sigma B + b(n+1)$

$L = 5 \times 1.92 + 1.0\ (5+1) = 15.6m \fallingdotseq 16.0m$

where, L: The length of the slip way (The width of ramp)

B: The width of fishing boat (1.92m)

b: The clearance between boats(1.0m)

n: The handled number of boats at same time(5 boats)

5) Width of Channel and Basin

Existing channel will be improved by making wider and deeper. The role of channel is to facilitate the entrance from the open sea. The entrance of channel needs to make wider than the center of channel. Table 2-2-2 shows the required widths of the channel for the various types of vessels.

Table 2-2-2 Required Width of Channel by Various Types of Vessels

Type of Boat	Beam(B)	Width of Channel(6B-8B)
Small Skiff	*1.92m*	*11.52m- 15.36m*
Rescue Boat	*2.72m*	*16.32m- 21.76m*

The width of channel is set 20m based on Table 2-2-2. But the width of entrance of channel is considered to be 30m for the safety of the entering boat from the open sea.

6) The Depth of Channel and Basin

The depth of channel consist of the depth of maximum draft of boats with additional 1.0m allowance for resisting the ship cavitation in the case of hard rock bed of the sea bottom. The sands of the surrounding area will be transported to the channel and basin. The thickness of sedimentation is assumed to be 20 cm according to the results of the measurement survey at the landside of the existing channel by the study team. Therefore, 20cm for the excessive dredging will also be added to set the required depth of channel and basin. The required depth by each type of boats is calculated as follows. Thus, the depth of channel is set to 3.0m depth of L.W.L. (C.D.L. – 2.5m).

	Draft		Cavitation		Deposited sand	Req. depth
Small Powered Skiffs	0.7m	+	1.0m	+	0.2m	= 1.9m

Rescue Boats	1.45m	+	1.0m	+	0.2m	= 2.65m= 3.0m

7) The Dimension of Wharf

① Required Time from launching through boat ramp to departure

The present required time for boats from launching to departure through the boat ramp is as follow.

Launching & Landing		Preparation & Fish-catch Landing		Total
5minitues	+	25miniutes	=	30minitues

If the wharf will be implemented, the time of preparation and fish-catch landing will be shorten. Following result will be expected to the required time for boats from launching through the boat ramp to departure.

Launching & Landing		Preparation & Fish-catch Landing		Total
5minitues	+	15miniutes	=	20minitues

② Required Number of Berth

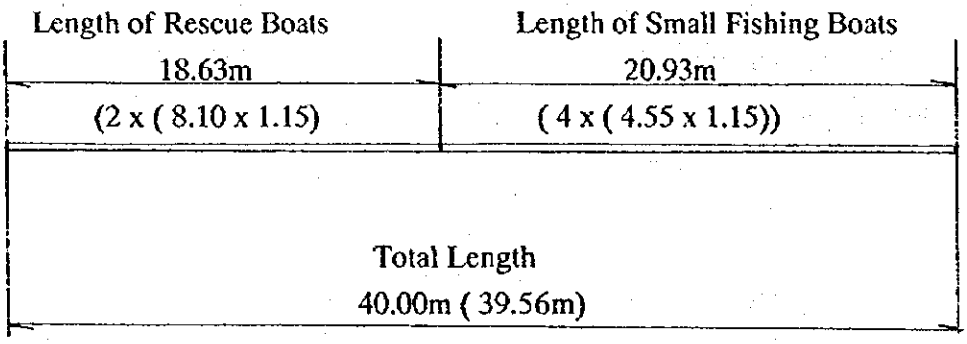
The number of launched fishing boat within an hour is 10 boats. Launched fishing boats will be moored at the wharf for preparation of out-going of fishing. The fishing boats after completion of preparation will be departed one by one. It is estimated to the required number of berth as follows. However, the estimated required number of berth is 3.3 berths, but the required number of berth will be set to 4 berths with expecting the increasing number of fishing boats in future.

The number of launched fishing boats per hour: 10 boats
Usable ratio of one berth: 3 times = 60 min. ÷20min. per boat
Required number of berth: 4 berths = 10 boats ÷3 times per wharf

③ Required Length of Wharf

Community boat harbour at Anibare will be able to use all days. For the safety reason, two rescue boats will be moored all days. The required length of wharf is 40.0m as calculated below.

Small Fishing Boat alongside the wharf: 4 boats (Preparation and fish-catch landing)
Rescue Boat alongside the wharf: 2 boats



④ Depth of Basin in front of Wharf

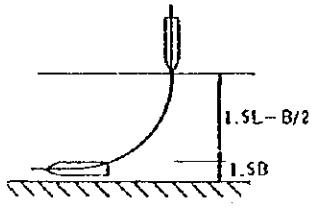
The depth of basin in front of the wharf will be examined the maximum draft of the boats and the effect of cavitation of propeller at the bottom condition. In the case of the hard rock at the bottom, 0.5m of the depth of cavitation effect will be considered based on the standard of fishery port in Japan. Maximum draft of rescue boat is 1.45m as follows. The calculation of the depth on basin in front of the wharf is 2.15m.

Depth of basin in front of the wharf: 2.15m = 1.45m + 0.5m + 0.2m
Max.Draft Cavitation Deposit sand

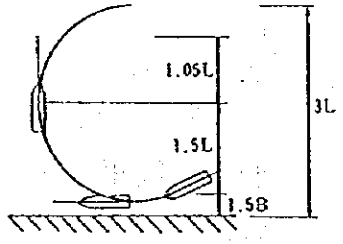
Therefore, the depth of basin in front of the wharf is set to 3.0m depth of L.W.L. (C.D.L. –2.5m).

8) Width of Mooring Basin

Fishing boats will be launched through the boat ramp and steered to the wharf using the turning basin. Fishing boats alongside the wharf will be prepared for hauling and landing the fish-catches. The width of mooring basin will be set based on the steering methods as follows.



Broadside Berthing



L: Boat Length
B: Boat Width

Departure from Broadside Berthing

Width of mooring basin will be set to 15m alongside the wharf based on the following equation.

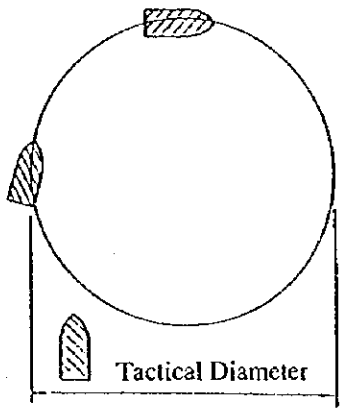
Width of Mooring Basin = 1.5 L – B/ 2 + 1.5 B
where, L: Length of Boat
B: Width of Boat

Width of Mooring Basin of Rescue Boat = 1.5x8.10m – 2.72m/ 2 –1.5 x 2.72m = 14.87m
Width of Mooring Basin of Small Fishing Boat=1.5x4.55m-1.92/2-1.5x1.92m=8.745m

Therefore, the area of mooring basin will be set 600m^2 (15m of the width of mooring basin and 40m of the length of the wharf).

9) Area of Turning Basin

The area of turning basin will be needed for steering the fishing boat that is launched through the boat ramp and channel. The area of turning basin requires radius of two to four times of the length of rescue boat as shown in following figure. The area of turning basin will be set 32m of radius at the near the mooring basin will be set to 1,144.5m^2.



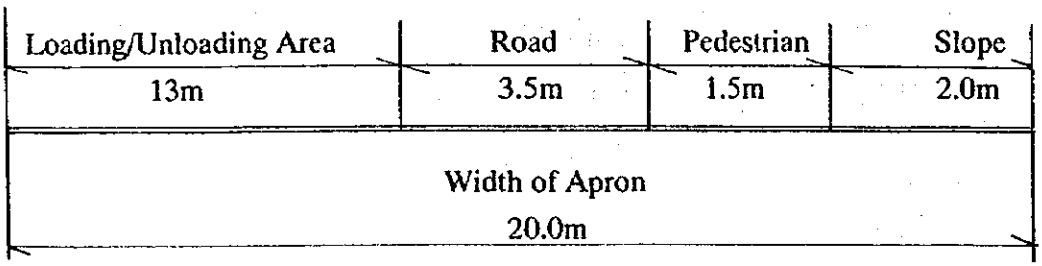
Calm: 2L-4L
Rough: 3L-5L
L: Boat Length

Tactical Diameter of Small Fishing Boat

10) Width of Apron

The apron behind the wharf is needed for the function of loading the fish-gears, fuel and ice and unloading the fish-catches. The apron is required to set the loading and unloading area and the road. The width of loading and unloading area is 10.0m to 13.0m

based on the standard of fishery port in Japan. The crane will be used for unloading at the apron. The loading and unloading area will be set 13m of width in this project. The road of 3.5m width with 1.5m of pedestrian for transporting the fish-catches will be set behind the loading and unloading area. The slope will be needed to set at the west-end of the apron due to the difference of height between the ground level of apron and the existing road. The access road to the apron will be set to the southern end of apron. The structure of apron is obtained as follows.



11) Length of Breakwaters

According to section 2-2-1 (2) 3), main and sub breakwaters need to implement at Anibare channel. The length of the breakwaters should be considered to protect the foundation of boat ramp. The length of main breakwater is required to 85m long and the length of sub breakwater is also required 40m long. The effect of breakwaters is examined by the calmness analysis, which shows in section 2-3-5.

12) Length of Sand Barrier

The tidal motion will cause the strong current to offshore in the channel and basin. The coastal sand will be drifted to community boat harbour at Anibare by this strong current. The sand barrier will be set to the southern end of community boat harbour at Anibare to prevent the sand drift. The sand barrier will be set to near the southern end of main breakwater from 3.0m of ground level at the coast. The length of sand barrier is 54m long. And also, the spending beach with the rocks at the northern end of community boat harbour at Anibare will prevent the sand drift from the northern coastline.

13) Parking Lot for Boat Trailers

The fishing boats require boat trailers for preparing to going-out and landing. The boat trailers has to be parked near the ramp during the operating time. These parking area will be set adjacent to the circled main road that is located behind the ramp. The length of a boat trailer is assumed to 10.01m as calculated below based on

the length of fishing boat.

$$2.2\ L = 4.55m \times 2.2 = 10.01m$$

The width of a boat trailer will be set 6.304m like as follows.

$$\text{The width of a boat trailer} = 1.2 \times L + 2.0m\ (1+1)$$
$$1.92m \times 1.2 + 2.0m\ (1 + 1) = 6.304m$$

Therefore, the planning dimensions of parking area for one boat trailer will be considered.

$$L = 10.0m \qquad B = 6.50m$$

Total planning area of the boat trailers park will be set 650m2 = 10m x 65m and the layout plan of the parking area is shown in Figure 2-2-1.

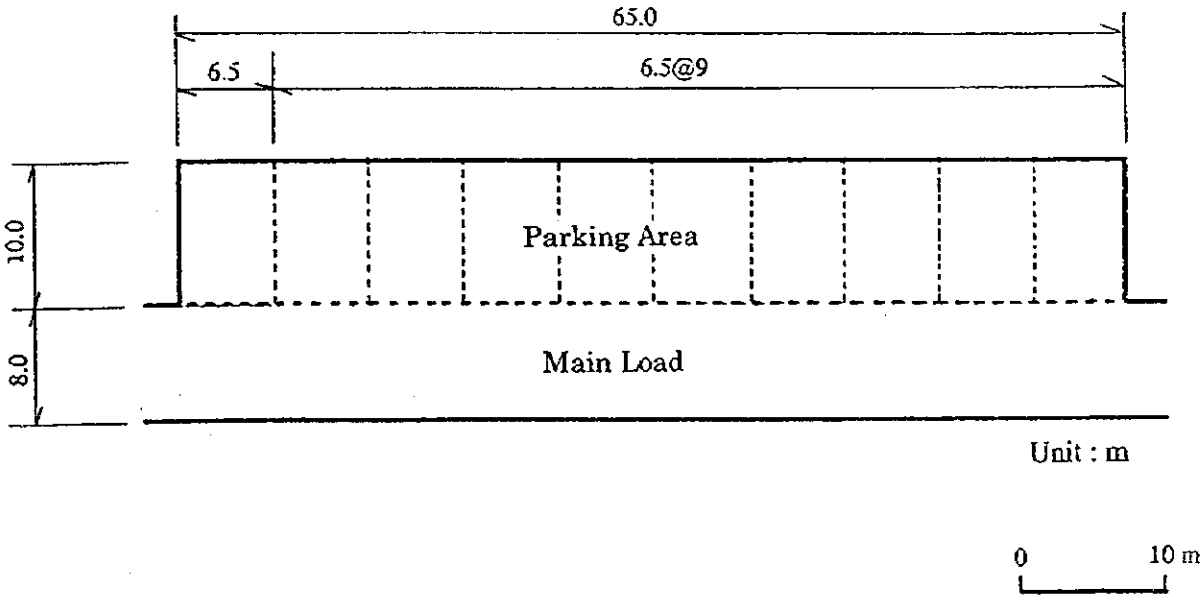


Figure 2-2-1 layout Plan for Allotment of Boat Trailers

(3) Layout Plan

Figure 2-3-1 shows the layout plan. The functional layout plan is presented in Figure 2-2-2.

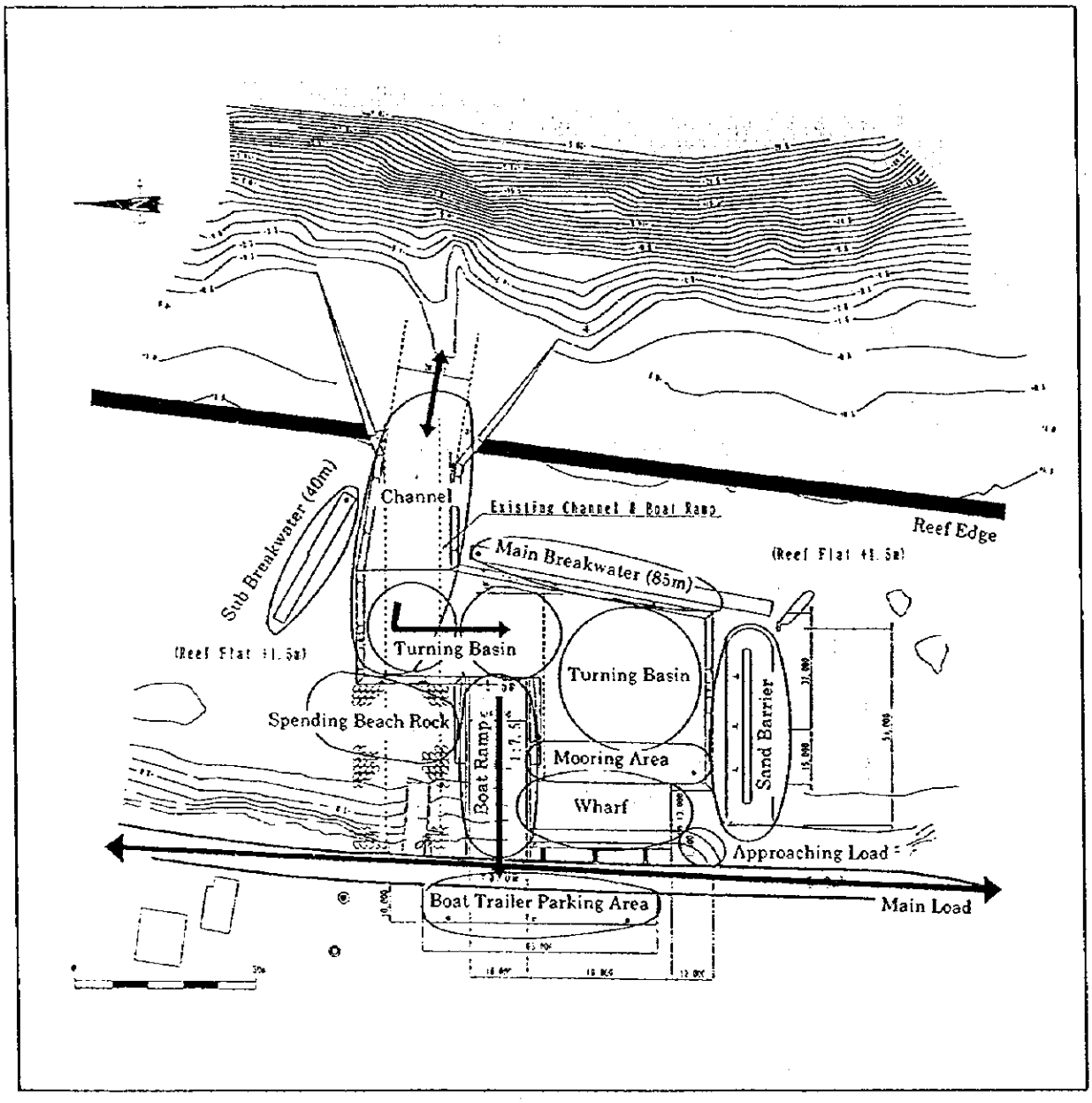


Fig. 2-2-2 Functional Layout Plan

2-3 Basic Design

2-3-1 Design Concept

(1) Design Criteria

Local Design Standards and Criteria for Fishery Port Facilities have not been established in Nauru and Japanese Design Standards and Criteria are applied to this project.

(2) Procurement of Construction Materials

The locally available materials in Nauru are sand and coral rocks only. Types of structures will be selected with due to consideration of maximum use of those local materials.

(3) Design Concept of the Facilities

1) Breakwaters

Design offshore wave for conducting the dimensions of breakwaters is estimated with the record of wind data, because there are no significant wave measurements in Nauru. Since there is no reliable wave data in Nauru, the study team obtained the wind data of Nauru Island (1989 to 1997) from Wind Model Database of National Meteorological Center (NMC) in USA and computed to hindcast offshore wave dimensions by using Global Spectral Ocean Wave Model.

For hindcasting the wave, the low pressures that are assumed to have caused impacts on Nauru from 1989 to 1997 were sampled. Table A-1-5 shows the offshore wave heights for each return period. The offshore wave for a return period of 50 years is adopted in designing community boat harbour at Anibare facilities and dimensions of the design offshore waves are shown in Table A-1-6. The eastern wave, which is considered to affect the project site most severely, is used as a design offshore wave.

Breakwaters will be set on the reef flat 1.5m above CDL. The design wave at the front of structures on the reef must be considered the wave set-up due to break of wave on the reef edge. And the wave deformation in shallow area at the front of reef edge and on the reef flat is calculated by using Takayama' s analysis method. Appendix-7 shows the design wave for structures on the reef flat based on Takayama' s analysis method.

All fishing boats will be landed through boat ramp after fishing. There are no berthing boats in the water of Community Boat Harbour at Anibare. The height of breakwaters is set to allow the over topping by the design wave. The gravity type of breakwaters is considered for the stability to be attacked the severe wave and the easy maintenance and low cost after completion.

2) Channel

The spending beach rocks will be installed at the end of channel. Armor rocks will cover up the existing boat ramp and the surrounding area. The reflecting wave force will be dissipated by the spending beach rocks for the safety and stability of fishing boats through channel. The edge of basin and steered water area should be vertical dredging work due to the safety for the fishing boats at the basin and steered water area.

3) Boat Ramp

The structure of boat ramp has adopted as the gravity type of cast-in concrete for the durability and economy. The part under the water has been poured by underwater concrete. All fishing boats will be launched and landed through the boat ramp. But, winch and cradle will not install, because the boat trailers will transport all boats.

4) Wharf

The structure of the wharf has adopted as the gravity of cast-in concrete for the durability and economy. The wharf will be installed the fenders for against the impact load by the vessel. The structure of apron will be designed to the concrete pavement for the heavy weight mobile cranes.

5) Sand Barrier

Rubble mound breakwater will be adopted due to the easy construction and economy.

6) Approaching Road to Wharf

The approaching road to the wharf will be paved with the concrete due to the heavy weight traffic, easy construction and maintenance and economy.

7) Parking Lots for Boat Trailers

The surface finishing of parking lots is compacted with coral sand, rocks of dredging materials and/or phosphate-sand. In regards the economy of the project, no pavement work will be carried out.

(4) Others

Following factors are also considered for the planning and design of the structures under this project.

1) Nauru Island formed with the volcanic activities. Therefore, horizontal seismic coefficient will be set 0.05 referred to the condition of surrounding countries.
2) Easy repairs, low maintenance costs and low impact on the environment
3) Allotment of the facilities is considered to the efficiency of customers.
4) Local life style and working pattern will be considered in designing works.

2-3-2 Layout Plan of Community Boat Harbour at Anibare

According to the aforementioned concepts of planning and design, the appropriate layout plan of Community Boat Harbour at Anibare has prepared as shown in Figure 2-3-1. The following constraints in terms of wave conditions should be considered in designing of the layout plan.

(1) Allotment of Breakwaters

The predominant wave direction in the project site is the east. The direction of the channel has been set to enable the smooth passing of fishing boats. This direction is the same of existing channel and the fishing boats could be smoothly passed through the channel for the easterly waves. The site and length of breakwaters will be allocated based on the result of calmness analysis for the effluence of wave force from Northeast to Southeast. The detailed of result of calmness analysis present in section 2-3-5. Main breakwater will be set the site that is enough dissipated of wave force. It allocates along the edge of basin. And the length of it is 85m for protecting the wave force from Southeast direction.

Sub breakwater will be set the northern part of channel for protecting the wave force from Northeast direction. The top of the breakwater is allocated to 20m from the reef edge. Its length is 40m long.

(2) Allotment of Boat Ramp

Boat ramp will be allocated at the near of backward of channel to enable to be allowed less than 40cm for the safety launching and landing. The spending beach rocks allocated along the backward of the channel will dissipate the wave through channel. The spending beach rocks will be able to dissipate the reflection of incident wave through the channel. Therefore, wave force in front of boat ramp is weak The allotment of boat ramp is examined by the calmness analysis that indicated the detailed result in section 2-3-5.

(3) Allotment of Wharf

The function of wharf is the berth alongside of the fishing boat for preparing the out-going and loading the fish catches. Wharf will be allocated at the south of boat ramp. The allotment of wharf is examined by the calmness anakysis that indicated the detailed result in section 2-3-5.

(4) Allotment of Sand Barrier

Strong current due to the ebb tide will transport the sand of coast around the planning site. The sand barrier will prevent the sand movement. The sand movement from the northern coast of the planning site will be prevented by the spending beach rock, which will be installed at the end of the channel. The sand barrier will be installed at the southern end of the planning site of the main breakwater.

(5) Allotment of Spending Beach Rock

The wave proceeding the channel will not deduce the force due to the constant water depth. This wave force will reach to the end of channel. This wave will reflect to the channel. The water in the channel will agitate by this reflected wave. Therefore, the spending beach rock will be installed at the end of the channel to the toe of the boat ramp for dissipating this reflected wave force.

2-3-3 Basic Design

(1) Design Conditions

1) Design Ship

According to the preceding section 2-1-9, the rescue boats of Fisheries and Marine Resource Authority, which have the maximum dimensions among the boats in Nauru, have been set as a design vessel. Its dimensions are as follows:

	Rescue Boat	Small Fishing Boat
·Overall Length :	8.10 m	4.55m
·Breadth :	2.72 m	1.92m
·Full Draft :	1.45 m	0.70m
·Gross Ton :	2 ton	less than 1ton

2) Sea Conditions

-H.W.L.: + 2.6 m
-L.W.L.: + 0.5 m
-C.D.L.: ± 0.0 m
-Design Wave: Dimensions of offshore design wave are as follows;

Offshore significant wave Height ($H_{01/3}$) : 5.34 m
Period ($T_{01/3}$) : 10.2 sec.
Direction : East.

Dimensions of design wave on the reef flat are as described in Appendix-5.

3) Soil Conditions

-Backfilling
Bulk density: 1.8 t/m^3 (above water)
0.8 t/m^3 (under water)
Angle of internal : of friction 30°
-Under the sea bottom: as shown in boring survey results in Figure A-1-9.

(2) Dredging work of Channel, Basin and Steered Area

The water depth of channel is 3.0m below CDL and the basin and the steered area is 2.5m below CDL. The channel, basin and steered area need to dredge the reef flat area. According to Appendix-5, the soil strata from the surface to the bottom of borehole consist of 10m deep hard rock (N value is more than 100). Only the surface is covered by several centi-meters thickness of coral sand, coral gravels and shells. Therefore, dredging works of the channel and basin will require blast excavation. Total dredging work volume is estimated to 29,579-qubic meter.

(3) Boat Ramp

According to the preceding section 2-2-2, the width of boat ramp has been set 16 m with 5 lanes for launching. The slope of boat ramp has set 1:7.5 that is one of the existing ramp, because the existing slope is suitable for the local using style.

The structure of boat ramp has adopted as the gravity type of cast-in-concrete to resist such large waves and ensure the durability and stability. The part under the water has been cast by underwater concrete. Concrete is to be cast directly on the bedrock. Fig. 2-3-2 shows the standard cross section of the boat ramp.

(4) Main Breakwater

1) Type of Structure

The structure type of breakwater is generally divided to the sloping and vertical type. The width of breakwater need to be narrow as possible due to the limitation of geomorphologic condition that is only 100m width of the reef flat at the planning site. Therefore, the vertical type of breakwater will be set for main breakwater. Table 2-3-1 presents the comparison result of various vertical types of breakwaters. Mass concrete type of breakwater will be set based on the conditions of the planning site.

Table 2-3-1 Various Vertical Type of Breakwater

	Block Type	Cellar Block Type	Mass concrete Type
Natural Condition	Not suitable for the site of attacking the sever wave	Not suitable for the site of attacking the sever wave	Suitable for the hard rock bed
Construction Condition	Large casting yard of blocks and large size of machines	Large casting yard of blocks and working Vessels for marine Works	Casting in the site and no need the heavy instruments
Construction Cost	1.2	1.3	1
Appraisal			Adopted

2) Crown Height

The head of breakwater will be installed on the site of 35m from the reef edge. The design wave height ($H_{1/3}$) is calculated to 1.53m according to the result of the deformation analysis of wave height after breaking at the reef edge (refer to Appedix-7). The crown height of breakwater has set as follows with the wave set-up due to the reef.

Crown Height =HWL + Average Wave Set-up +1.00$H_{1/3}$
= 2.6m +0.42m +1.00 X1.53m
=4.55m: 4.6m

3) Width of Breakwater

The maximum wave height at the head of breakwater is 2.75m because of the result of deformation analysis after wave braking. The width of breakwater is needed 3.70m by the stability against the maximum wave. Figure 2-3-3 shows the standard cross section of main breakwater.

(5) Sub Breakwater

1) Type of Breakwater

The vertical and mass concrete type of breakwater has set for sub breakwater same as main breakwater.

2) Crown Height

The head of sub breakwater will be installed on the site of 20m from the reef

edge. The design wave height ($H_{1/3}$) is calculated to 1.68m according to the result of the deformation analysis of wave height after breaking at the reef edge (refer to Appedix-7). The crown height of breakwater has set as follows with the wave set-up due to the reef.

Crown Height =HWL + Average Wave Set-up +1.00H1/3
= 2.6m +0.42m +1.00 x1.68m
=4.70m: 4.8m

3) Width of Breakwater

The maximum wave height at the installation point of breakwater is set 3.04m because of the result of deformation analysis of braking wave. The width of breakwater is needed 4.00m for the stability against the maximum wave. The width of it will be switched to 3.70m same as main breakwater toward the half of sub breakwater. Figure 2-3-2 shows the standard cross section of main breakwater.

(6) Spending Beach Rock for Boat Ramp

The spending beach rock will be set beside the slope of boat ramp for dissipating the wave forth through the channel. The required weight of armor stone is calculated by applying Hudson' s equation as given below. The design wave height in front of boat ramp is five-wave-height of offshore and Kd value for armor stone is set 0.28ton considering with the shape and layer thickness of armor stones.

$$W = \frac{\gamma_r H^3}{K_d (S_r - 1)^3 \cot\theta}$$

where

W: required weight of armor stone (t)

γ_r: unit weight of armor stone (t/m3)

S_r: specific gravity against sea water

θ : angle of slope

H: design wave height (1.4m)

K_d: constant, 2.8

$$W = \frac{2.50 \times 1.40^3}{2.8 \times (2.50/1.03-1)^3 \times 3} = 0.28t$$

The weight of armor stone needs to the weight of more than 300kg.

(7) Wharf

1) Structure Type

The structure types of wharf are generally divided to the block type, concrete casting type and steel pile type. The condition of soil in the planning site is the hard coral rock and the topographic condition is completely dried up at the ebb tide. The concrete form is able to pitch with dry work at the ebb tide. The concrete casting type will be adopted for the economy.

Table 2-3-2 Various Type of Wharf

	Block Type	Concrete Casting Type	Steel Pile Type
Out line	Pre-casting concrete blocks are placing and constructing the wall. This type adopts the wharf for small boat with the good soil condition.	The wall is pored the pre-packed and underwater concrete in the project site.	Retaining wall with steel and/or concrete pile is constructed at the site. Cantilever sheet pile Pile anchorage
Construction Method	1) Easy construction and simple equipment 2) Short construction period due to easy underwater works	It is not necessary to the facilities for product and transport of the pre-casting materials. Easy pitching of form due to the topographical condition of Anibare site.	Due to the hard coral rocks in Anibare site, the pitching of pile works is difficult and it is necessary to the long construction term
Maintenance Cost	No maintenance cost	No maintenance cost	In the case of steel pile, it is necessary to protect against corrosion and the maintenance cost.
Ratio of Construction Cost	1.2	1.0	1.6
Evaluation		Adopted	

2) Crown Height

The crown height of wharf is calculated using following equation based on the design standard of fishery port in Japan.

Crown Height = HWL + 0.5m to 1.0m

The blue work line of Nauruan fishing boat is 0.6m. The crown height of wharf is calculated as follow.

Crown Height = HWL + 0.6m =2.6m + 0.6m = 3.2m

(8) Parking Area for Boat Trailers

The surface finishing of parking area is compacted with coral sand, rocks of dredged materials and/or phosphate-sand. In regards the economy of the project, no pavement work will be carried out.

2-3-4 Basic Design Drawings

The outline of proposed facilities in the project is shown in Table 2-3-3. Figure 2-3-1 shows the general layout plan of Community boat harbour at Anibare. The typical cross-section of boat ramp, and main breakwater and sub breakwater are shown in Figures 2-3-2 to 2-3-4.

Table 2-3-3 Contents of Proposed Facilities

Name of Facility	Dimensions	Contents
Main Breakwater	Length: 85m	Mass concrete type
Sub Breakwater	Part A: Length; 20m Part B: Length; 20m	Mass concrete type
Boat Ramp	Width: 16m Length: 39m	Pre-casting concrete plate type
Spending Beach Rocks	Length: 75m	Rubble mound type
Channel Dredging	Channel Width: 20m Steered Channel Width: 20m Total dredging volume: 19,150m^3	Blasting and Rock excavation
Wharf	Area of Apron:520m^2	40m x 13m
Dredging of Basin and Steered Area	Width: 50m, Length: 50m Area: 2,500m^2 Total Dredging Volume: 10,429m^3	Dredging of Basin, Steered area, Steered channel. Blasting and Rock excavation
Sand Barrier	Length: 54m	Rubble mound type
Navigational Apparatus	4 units	Right Beacon, Navigation Marker
Righting Apparatus	5 units	The site of wharf and parking
Unloading Road	Area:200m^2	Concrete pavement
Approaching Road	Area:56m^2	Concrete pavement
Boundary Slope	Area:80m^2	40m x 2m (3 stairs)
Parking Lot	Width: 10m Length: 65m	Compacted with coral sand and rock

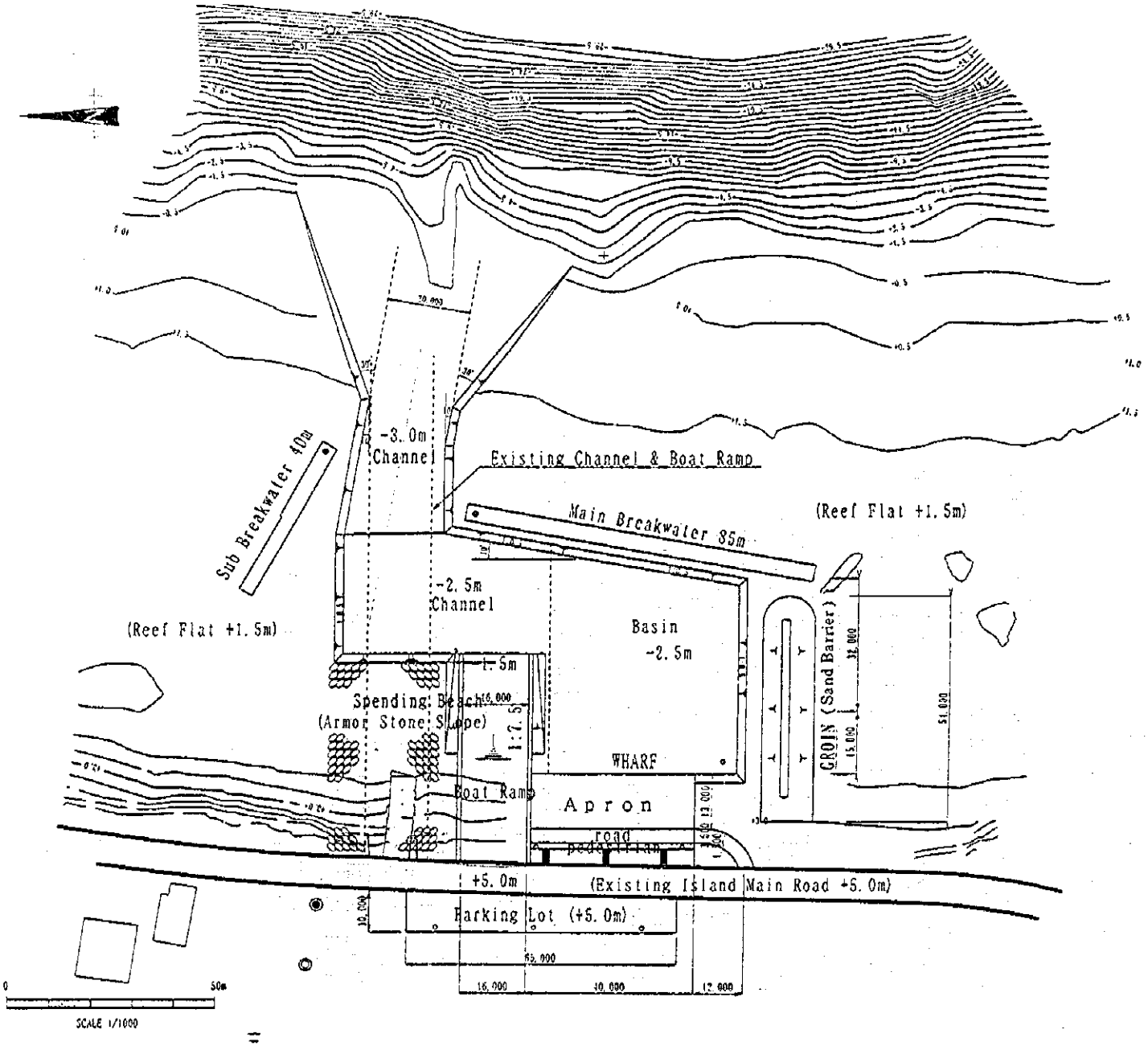


Figure 2-3-1 General Layout Plan of Community Boat Harbour at Anibare

PROJECT	
TITLE	

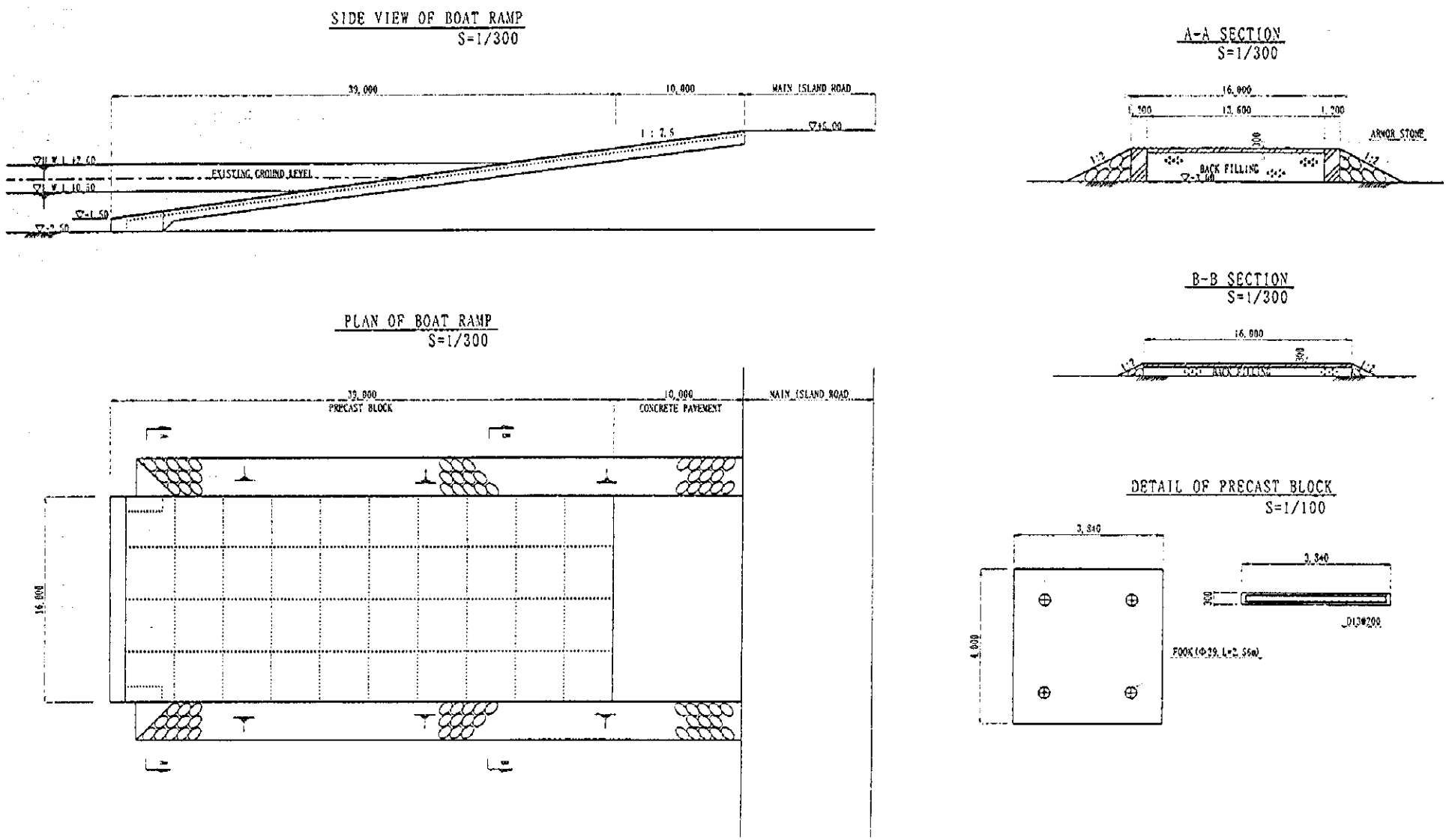
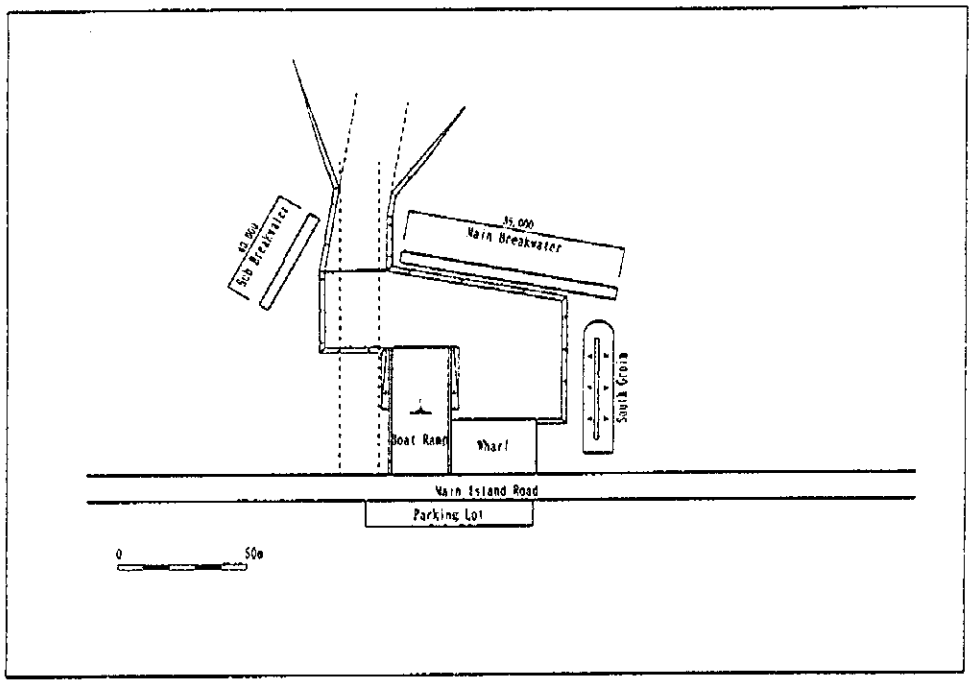
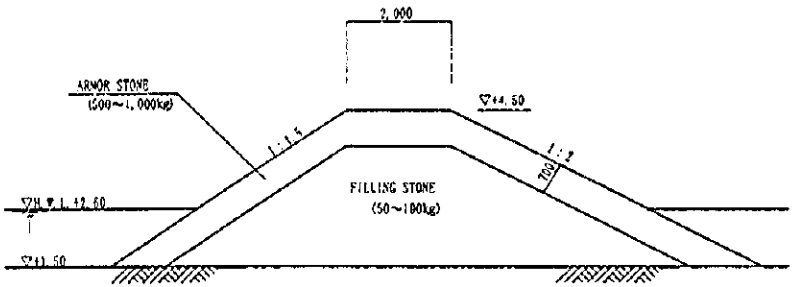


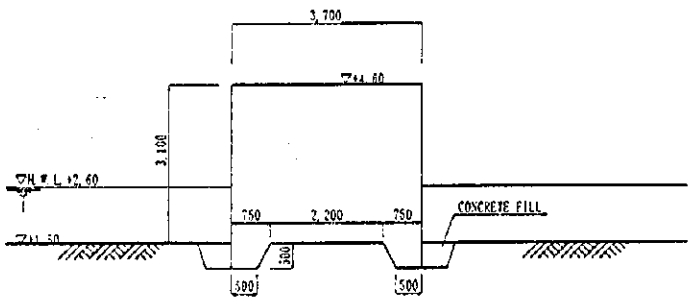
Figure 2-3-2 Typical Cross Section of Boat ramp



SECTION OF GROIN
S=1/100



SECTION OF MAIN BREAKWATER
S=1/100



SECTION OF SUB BREAKWATER
S=1/100

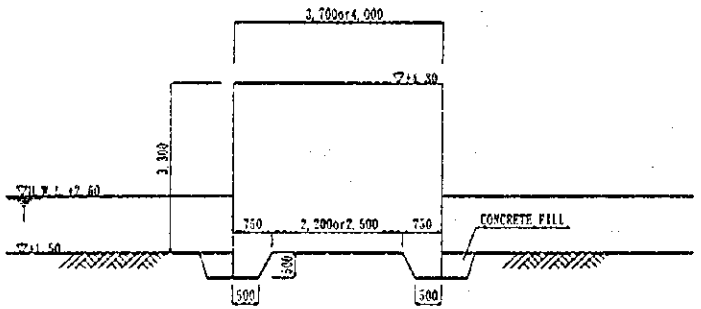


Figure 2-3-3 Typical Cross section of Main and Sub Breakwater

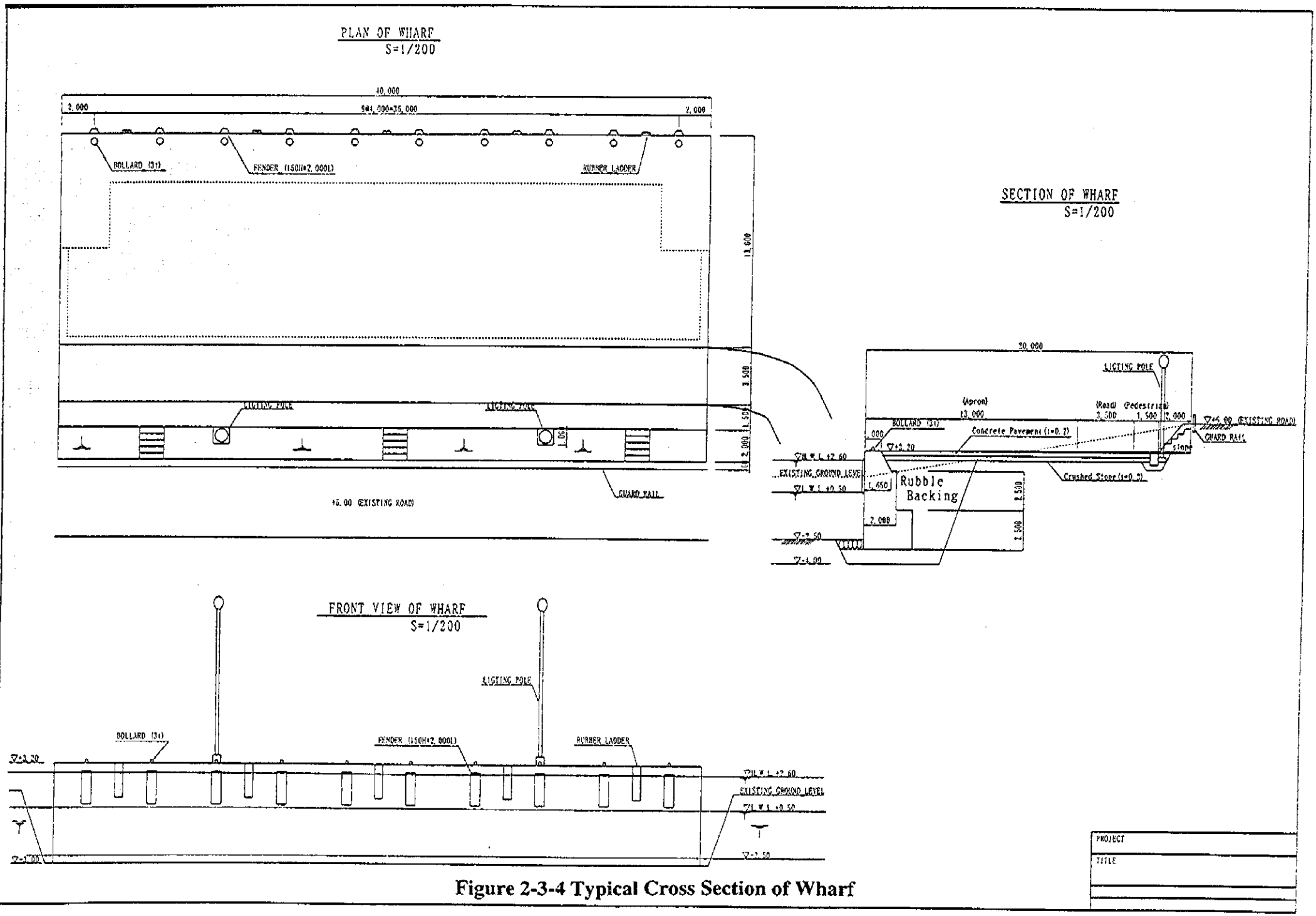


Figure 2-3-4 Typical Cross Section of Wharf

2-3-5 Calmness Analysis for Allotment of Breakwaters

The suitability of allotment of breakwaters is examined by the calmness analysis.

(1) Standard of Calmness of inner port

Table 2-3-4 shows the standard of calmness of inner harbour.

Table 2-3-4 Standard of Calmness of Inner Port

Various Type of Fishery Port Facilities	Standard Wave Height
Channel	0.90m – 1.20m
Landing and Preparation Wharf	0.30m – 0.40m
Resting Wharf	0.40m – 0.50m
By Japanese Standard of Fishery Port	

(2) Calmness analysis for 1.0m of offshore wave height

According to the existing type of fishing boat and the interview of fishermen, 1.0m of wave height in offshore is set as the limitation of wave height for out-going from the fishery port. The standard wave height is set 40cm based on Table 2-3-4. Calmness analysis of three wave directions, Northeast, East and Southeast have been carried out as the evaluation measures for the calmness to 1.0m wave height in offshore shore. Figure 2-3-6 (1) to (3) show the results of calmness analysis for three wave directions. These figures indicate the wave height distribution in the port. Table 2-3-5 shows the maximum, minimum and average wave height in front of the boat ramp.

Table 2-3-5 Wave Height in front of Boat ramp, 1.0m of Offshore Wave Height

Unit: cm

Wave Height cm	Wave Direction			Ave. Wave Height Cm
	Northeast	East	Southeast	
Max. Wave Height	62.0	44.0	39.0	48.3
Min. Wave Height	56.0	17.0	21.0	31.3
Ave. Wave Height	58.3	32.5	29.3	40.0

According to the result of calmness analysis, the wave height in front of the boat ramp is 62cm in maximum and 58.2cm in average for Northeast wave direction. These wave heights are over the limitation of wave height of out-going. However, the wave heights of East wave direction present 44cm of maximum and 32.5cm of average. And the wave heights of Southeast wave direction present 30cm of

maximum and 29.3cm of average. The breakwaters are concluded to proper allotment for usage of boat ramp under the condition of 1.0m of offshore wave height.

(3) Calmness analysis for the wave height of 50 years of return period

The wave conditions of 50 years of return period are 5.34m in wave height, East wave direction and 10.2 sec of wave period according to Appendix-5. Fig. 2-3-5 shows the wave height condition of the port for incoming the wave of 50 years of return period in East direction. Table 2-3-6 shows the maximum, minimum and average wave height in front of the boat ramp. These results indicate to appear the rough wave from 0.57m to 1.13m of wave height in front of the boat ramp.

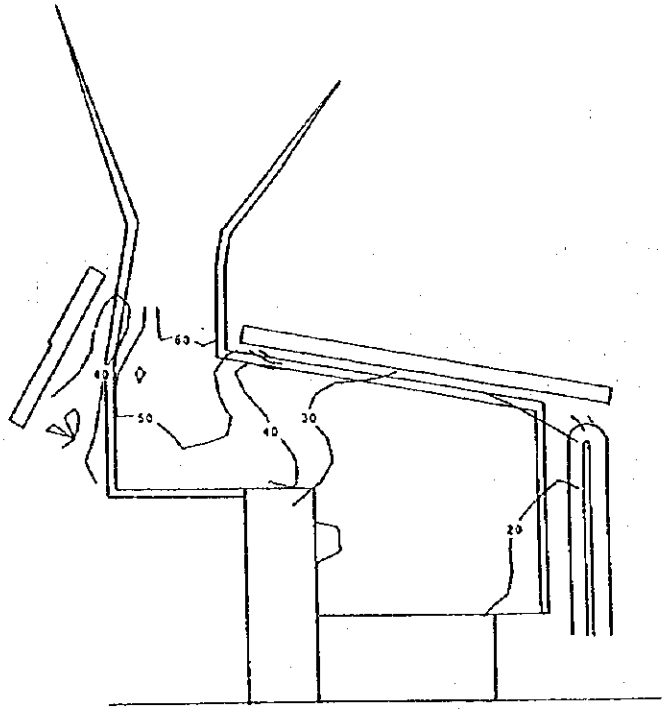
Table 2-3-6 Wave Height in front of Boat Ramp, 5.34m of 50 years of Return Period

Unit: cm

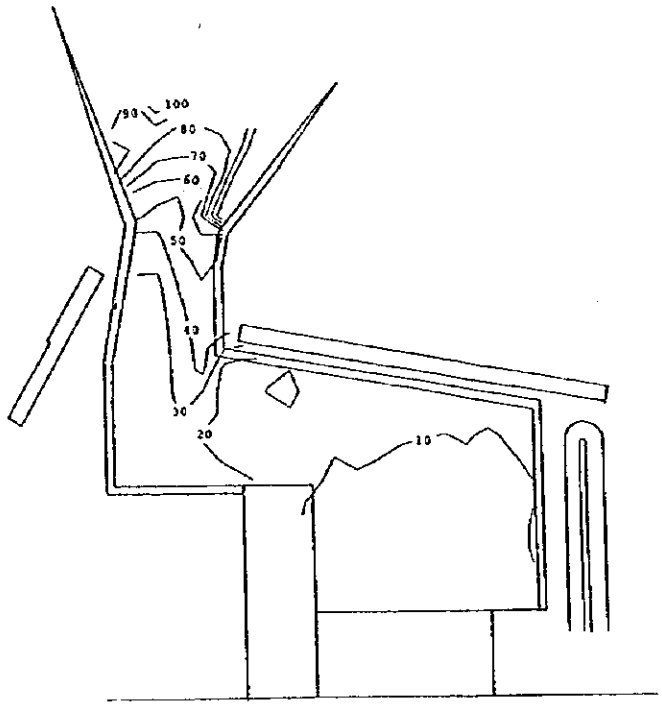
Wave Height cm	Wave Direction East
Max. Wave Height	113.0
Min. Wave Height	57.0
Ave. Wave Height	88.2

(4) Conclusion

The boat ramp is able to use under the condition of limitation of wave height of out-going according above discussions. However, 1.13m of wave height in front of the boat ramp is generated by 50 years of return period. The design wave height for the stability analysis of the structures is set 1.13m of wave height.

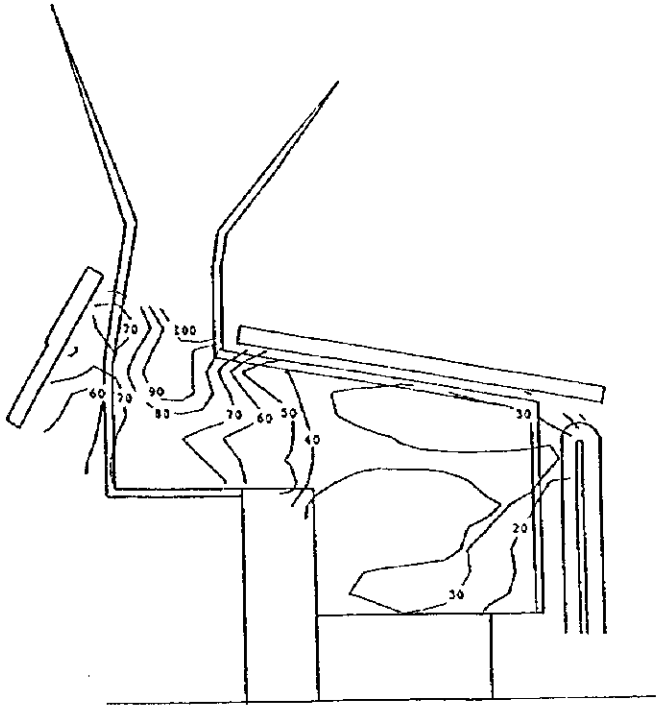


H.W.L, Wave Direction : NE

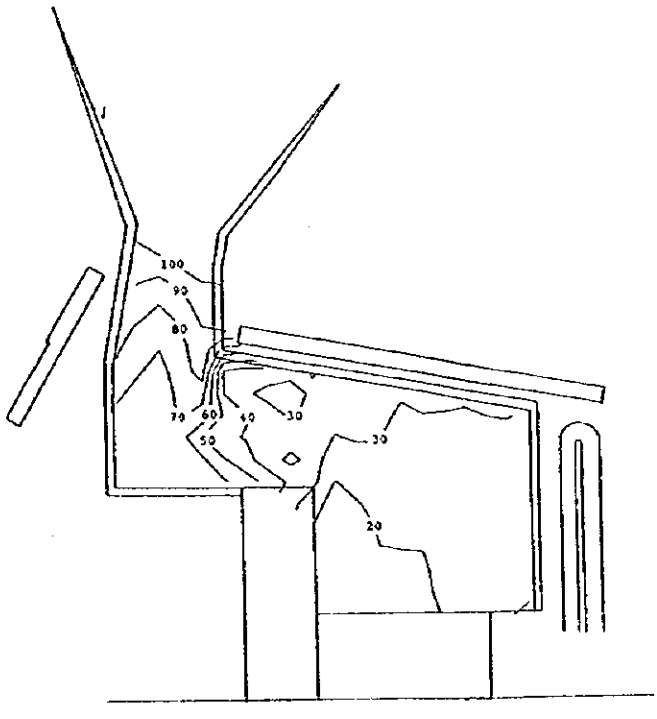


L.W.L, Wave Direction : NE

Figure 2-3-6 (1) Wave Height Distribution (Wave direction: Northeast, Wave height: 1.0m, Wave period: 10.2sec)

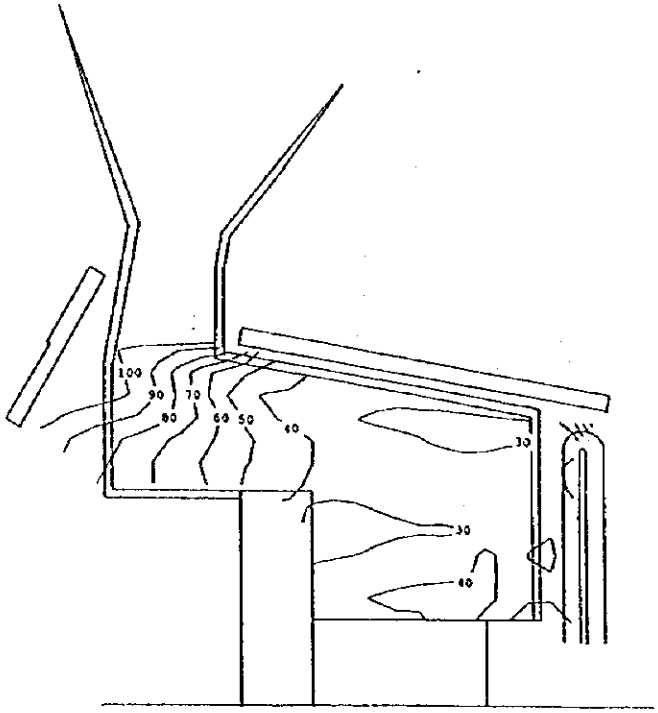


H.W.L, Wave Direction : E

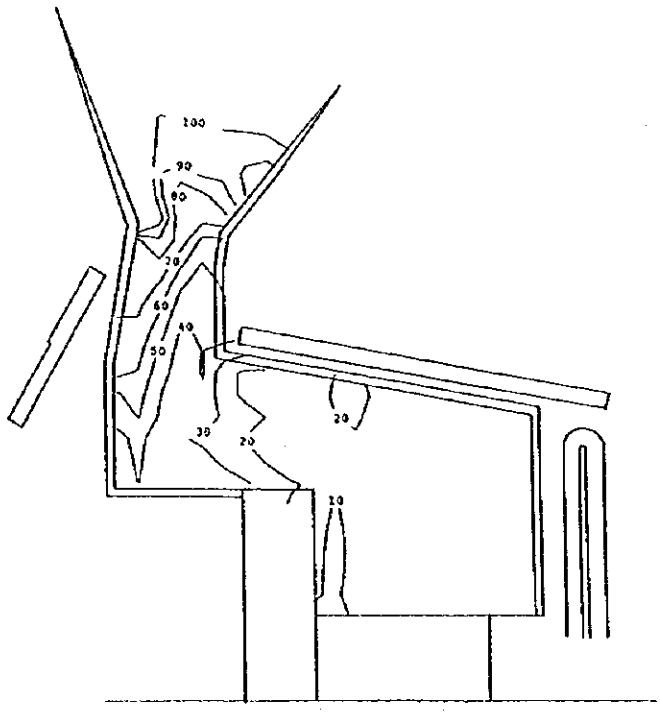


L.W.L, Wave Direction : E

Figure 2-3-6 (2) Wave Height Distribution (Wave direction: East, Wave height: 1.0m, Wave period: 10.2sec)

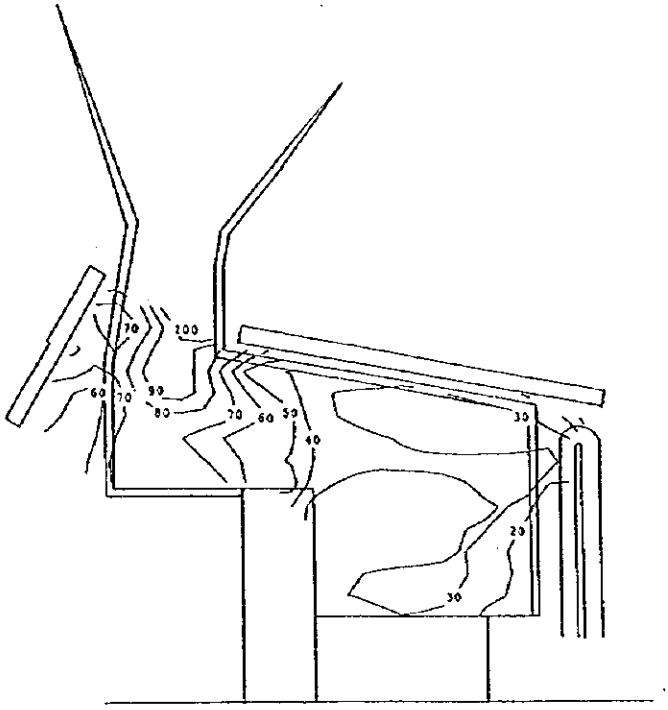


H.W.L, Wave Direction : SE

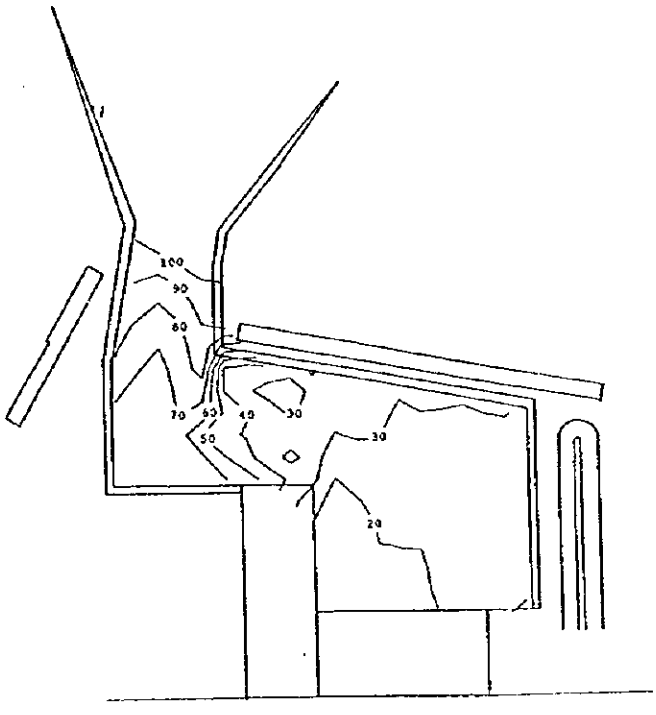


L.W.L, Wave Direction : SE

Figure 2-3-6 (3) Wave Height Distribution (Wave direction: Southeast, Wave height: 1.0m, Wave period: 10.2sec)



H.W.L, Wave Direction : E



L.W.L, Wave Direction : E

Figure 2-3-7 Wave Distribution, 50 years of Return Period
(Wave direction: East, Wave height: 5.34m, Wave period: 10.2sec)

Chapter 3 Implementation Plan

3-1 Implementation Plan

3-1-1 Implementation Concept

(1) Basic Concept

1) Upon implementation of this project, after the Exchange of Notes (E/N) between the Government of Japan and the Government of the Republic of Nauru, a contract on consulting services will be concluded between the Government of the Republic of Nauru and a Japanese consultant.

2) The consultant will prepare all the tender documents such as drawings, technical specifications, bill of quantities, conditions of contact and so on necessary for the tender and the construction contract. After the approval of those documents by the Government of the Republic of Nauru, the contractor for this project will be selected among Japanese construction companies through the procedure of the pre-qualification and the tender.

3) The construction works will be performed by the selected contractor in accordance with the construction contract concluded between the Government of the Republic of Nauru and the contractor.

4) The construction period is expected to be 9 months in the first stage and 7 months in the second stage taking into consideration the scale of the project and the site conditions.

(2) Implementation Concept

1) Community Boat Harbour at Anibare is to be constructed by excavating the reef flats. The reef flats in the project site, which have the ground height of 1.5m above C.D.L., dry up at the low tide. Therefore, land construction, which will contribute to reduction of the construction cost and the shortening of construction period can execute most of the constructions such as breakwaters, boat ramp, wharf and

basin.

2) There are only small construction companies that have insufficient experiences in the field of such marine construction works as this project in Nauru. Nauru Phosphate Corporation, which manages the construction industry, has large sized construction equipment such as cranes, excavators, dump tracks and so on. But those equipment are usually used for phosphate mining and can not be leased to any other project. Only unskilled labors are available by managing from the local construction companies. Therefore, most of the construction works have to be executed by the contractor itself by using the imported construction equipment and skilled labors from Japan or the third countries.

(3) Executing Organizations of the Project

Executing Organizations of the project are as follows:

1) Organization responsible for the tender
Ministry of Island Development & Industry

2) Organization to coordinate the project
Nauru Fisheries and Marine Resources Authority

3) Organization to supervise the Construction
Nauru Fisheries and Marine Resources Authority

4) Organization to maintain the facilities after the completion
Nauru Fisheries and Marine Resources Authority

3-1-2 Implementation Conditions

(1) Construction Conditions

1) Construction Company

There are only small construction companies servicing for house building construction works that have no experiences of such marine construction works as this project. These companies are not suitable for a subcontractor to execute this project.

2) Construction Equipment

Nauru Phosphate Corporation owns most of the construction equipment in Nauru. Cranes, excavators, dump tracks and so on are usually used for phosphate mining. All construction equipment available for this project are grader and tire-roller for road construction and most of the construction equipment have to be procured from foreign countries.

3) Labors

Skilled labors have to be managed from foreign countries, but unskilled labors such as common labor or stone worker can be managed from local construction companies.

4) Construction Materials

Construction materials procurable in Nauru are aggregates for concrete such as sand, crushed and rubble stones. There is no problem of quality and supply capacity of those materials. The other materials such as cement and timber for concrete form-works and others imported from Australia are available in Nauru. For those imported materials, the contractor shall examine the quality, the supply capacity and the duration required for procurement and shall establish the procurement plan to manage the material supply to the site with a close discussion with the concerned agencies.

(2) Importance Notices for Construction

1) As the project site is located on the reef flats facing to the ocean, an appropriate construction plan should be prepared considering the natural conditions at site, especially the marine conditions.

2) Dispatch of the Japanese staffs and technical experts should be planned carefully considering the appropriate number of persons, timing and duration in accordance with the progress of works.

3) Local equipment and materials should be used as much as possible, minimizing the procurement from foreign countries.

4) As there will be involved the long term rock excavation work, special attention should be paid to the blasting and noise.

5) As the project site is located next to the existing island road, utmost care should be taken for the safety of people inhabitants in the nearby area by installing safety signs and making a detour during construction.

3-1-3 Scope of Works

The scope of works of the project to be undertaken by the Government of Japan and the Government of the Republic of Nauru are divided as follows;

(1) Scope of Works to be undertaken by the Government of Japan

- Construction of channel,
- Construction of boat ramp
- Construction of breakwaters
- Construction of wharf and apron
- Construction of approaching road
- Construction of basin and steered area
- Construction of navigation aids
- Construction of righting apparatus and
- Construction of parking area for boat trailers.

(2) Scope of Works to be undertaken by the Government of the Republic of Nauru

- To provide the field of construction works for the project,
- To provide the distribution works for electricity, water supply and telephone,
- To exempt the contractor from customs duties with respect to the supply of products and equipment necessary as a part of the project,
- To acquire permits and approvals required for implementation of the project,
- To bear the commission on banking arrangement and authorization to pay,
- To secure, with respect to the supply of the products and services under the verified contracts, that Japanese nationals shall not be subject to any customs duties, internal taxes and other fiscal levies which may be imposed in Nauru,

- To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into Nauru. And Japanese nationals stay there in for the performance of their work in accordance with the relevant laws and regulations of Nauru, and
- To bear all the expenses other than those covered by the Grant, necessary for the execution of the project.

3-1-4 Consultant Supervision

The policy of the Government of Japan for Grant Aid Projects requires that the project proceed consistently throughout the period from the detailed design stage to the construction stage with assistance of the consultant who fully understands the objectives of the basic design. The consultant is required to supervise the construction work by stationing capable resident engineers at the site for management and communication as well as by dispatching special engineer for a short term for inspections and instructions in accordance with the progress of works.

(1) Supervisory Policies

1) Control of the work progress in accordance with the construction schedule, with maintaining close contact and communication between the responsible organizations in both countries,

2) Provision of prompt and adequate instructions and advice to the contractor so that they can complete the construction of the facilities in conformity with the design plans,

3) Provision of instructions for maximum adoption of local materials and local construction methods,

4) Promotion of technology transfer in construction and engineering to make the most of grant aid project and

5) Provision of adequate instructions and advice on maintenance of the delivered facilities to help smooth operations thereof.

(2) Supervisory Works

1) Assistance on Contracting

Providing assistance on selection of contractor, determining the type of contract, drafting contract documents, evaluating the bill of quantities and witnessing contract awarding.

2) Evaluation and Approval of Shop Drawings

Evaluating and approving shop drawings as well as materials and equipment proposed and submitted by the contractor.

3) Instruction to Construction Works

Reviewing construction plans, schedule, etc., providing instructions to contractor and reporting the progress of works to the client.

4) Assistance in Procedure of Payment

Evaluating and approving the bills of payment to the contractor for the work in progress and upon the completion of the project.

5) Inspection and Witness

The consultant inspects where necessary the work in progress and gives instructions to the contractor. The consultant, upon the confirmation of completion of the works and fulfillment of requirements of the contract, witnesses the delivery of the objects of the contract and confirms the Client's acceptance thereof to complete his obligations.

The consultant also provides reports to the Government of Japan in relation to the progress of works, payment procedures and delivery of completed facilities.

3-1-5 Procurement Plan

In procuring necessary materials and equipment for the project, special attentions are required as follows:

(1) Procurement Policy

1) Procurement from Japan

For certain construction materials to be procured from Japan, a procurement schedule must be studied carefully since such materials require an extended period from production to packing and shipping. All construction equipment including some special small equipment such as testing instrument, etc. will be procured from Japan.

2) Local Procurement

Only materials such as sand and aggregates will be procured from local market.

3) Cost

The lowest price has priority in selecting procurement either from local market, Japan or third countries. It should be noted that the price of procurement from Japan includes the charges for packing, transport and insurance but is exempted from taxes.

(2) Procurement of Materials and Equipment

From the above consideration, procurement of construction materials and third countries equipment required for the project are planned as follows:

1) Materials

- Local: rubble stones, aggregates, sands and cement
- Japan: concrete admixture, reinforcement steel bars and dynamite
- Third Country: non

2) Equipment

- Local: non

-Japan: Diving-boats, Track-mixers, Concrete-pomp truck, Backhoes, Compressors, Generator, Damp-trucks, Tire-shovel, Bulldozers, Tire-roller, Motor grader, Truck-crane and Concrete-plant
(Plate bearing testing instrument, Concrete compression testing machinery)

3-1-6 Implementation Schedule

Implementation of the project under the Japan's Grant Aid Program will be proceeded in the following manners;

After the Exchange of Notes regarding preparation of detailed design documents concluded between two countries, the Japanese consulting firm will be appointed by the Government of the Republic of Nauru and the consulting contract will be concluded between the said Government and consulting firm. The project will be completed in three stages; i.e. the execution of tender and construction contract and the execution of construction works.

(1) Preparation of Detailed Design Documents

After the consulting contract concluded between the executing organization of the project in Nauru and the Japanese consulting firm, the contract will be verified by the Government of Japan and the consultant will prepare the detailed design. In the detailed design stage, the tender documents consisting of detailed design drawings, technical specifications, instructions to tenders, etc. will be prepared based on this basic design report. Meantime, the consultation with the Government of Nauru regarding the details of the facilities will be held and the approval of all the tender documents will be obtained from the Government of Nauru. The detailed design requires 2.5 months in the first and second stage of implementation.

(2) Execution of Tender and Construction Contract

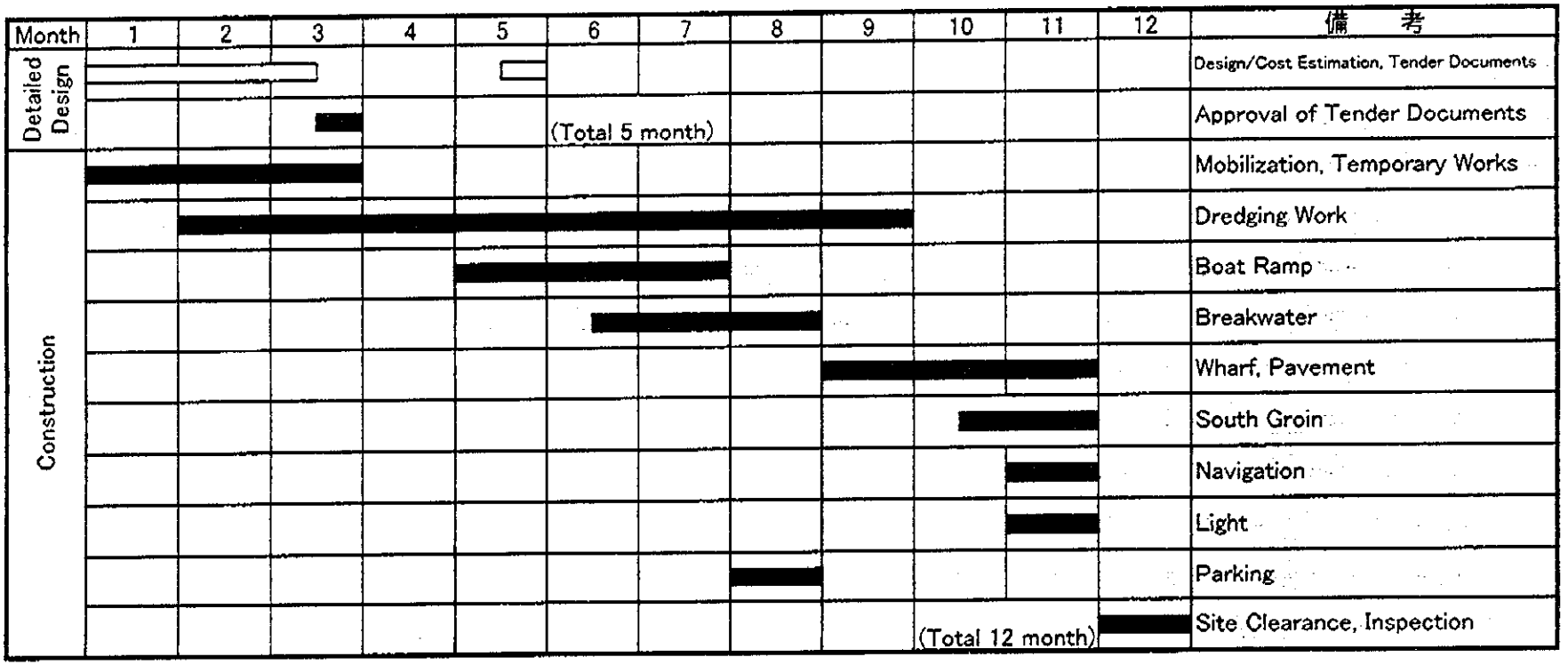
The tender will decide the contractor (Japanese Construction Company) for construction of project facilities. All procedures regarding the tender will be performed in such order as the notification, the acceptance of the offer for the tender, the pre-qualification, the distribution of the tender documents, the evaluation of the tender results, the designation of the contractor, and the construction contract. The whole procedure will take 2.0 months in the stage of implementation.

(3) Execution of Construction Works

After the conclusion of the construction contract and the verification by the Govemment of Japan, construction will be started. The construction period is expected to be 12 months in the stage of implementation considering the scale and contents of facilities, the local construction conditions and the lower marine work efficiency.

Figure 3-1-1 shows the implementation schedule covering from the Exchange of Notes to completion of the project.

Figure 3-1-1 Implementation Schedule



3-2 Project Cost Estimation

3-2-1 Cost Borne by the Government of the Republic of Nauru

Estimated cost borne by the government of the Republic of Nauru is as follows:

A$ 40,000 is required for the distribution of city power (415/240 volt) to the site with power meter and switchboard and a rent of land for parking area.

3-2-2 Operation and Maintenance Costs

Community Boat Harbour at Anibare will implement the fundamental facilities of fishery port such as breakwaters, boat ramp, channel, wharf, sand barrier, navigational aids, righting apparatus and parking lot for boat trailers. Annual maintenance cost is the consumption articles for the navigational aids and righting apparatus. It is supposed to be required small amount of repair cost in the case of the collapse of the surface of concrete facilities. The Republic of Nauru will be manage this require cost.

(1) Annual Expenditure

After the completion of Community Boat Harbour at Anibare, there will be required the costs of security for rescue and maintenance. Nauru Fisheries and Marine Resources Authority will have to manage the additional cost for security activities in the budget of Anibare channel. This additional amount will be equivalent to 25 percent of staff salaries of Anibare channel as calculated below.

Security Activities

- Chief 1staff/year = Aus$14,293/year

-StaffsSalary:2staffs/yearxAus$1,150/month/staffx25%x12months

=Aus$ 6,900/year

- Miscellaneous Expenditure : Aus$6,900/year×10% =Aus$ 690/year

(10% of staff salaries)

Maintenance

- Rental Fee of Land for Parking 0.065hectar×Aus$1,250/hectar/year

=Aus$ 81.25/year

- Consumption Article of Navigational Aids

Aus$65,178.46 x 5% = Aus$3,258.92/year

- Consumption Article of Righting Apparatus

Aus$14,563.62 x 5% =Aus$ 728.18 /year

Total Expenditure **Aus$25,261.35 /year**

(2) Balance of Revenue and Expenditure

The annual expenditure of Community Boat Harbour at Anibare is estimated to Aus$25,261.35 respectively. Expenditure is 3.8 per cent of total budget of NFMRA. NFMRA is able to manage Community Boat Harbour at Anibare.

Chapter 4 Project Evaluation and Recommendations

4-1 Project Effects

Annual catch volume was reported in 374 ton per year by presently 170 fishing boats in Nauru. The Government of Nauru, since gaining independence in 1968, has utilized and invested much of the money earned from the phosphate industry to secure long term funding for the people and the Government of Nauru once the phosphate deposits in Nauru are exhausted. It is estimated that the phosphate deposits in Nauru will be exhausted in very near future at the current method and rate of mining. The Government of Nauru is compelled to undergo a major structural reform and to determine and secure alternative sources, such as the industry of fishery and tourism, of income for the post-phosphate economy era.

Government and the people of Nauru have to fully utilize the fisheries and a marine resource of Nauru is a natural resource, to gain maximum economical and social benefit. It is against this background that the Government of Nauru has compiled the Long-term National Fisheries and Marine Resources Development Strategy. The Government of Nauru regards improvement project of the first fishery port in Nauru as a top priority project of basic infrastructure construction, which will provide the basis for improvement of the proposed community boat harbour at Anibare. It has a great significance to establish Community boat harbour at Anibare to promote the fishery industry in Nauru. The project will provide the following benefits.

(1) Construction of breakwaters, channel and boat ramp will provide a year round operating base for fishing boats. It is expected that the rate of out-going fishing boats number per day and fish landing volume will increase. The source of promoting the fishery industries will be secured by this project.

(2) Construction of the wharf, apron, basin, navigational aids and lighting apparatus will provide the significant benefits, such as the shortened the time for launching and landing at the slip-way, easy handling for landing of the catches and night operating at the community boat harbour at Anibare. Rescue boats will be set in the community boat harbour at Anibare. And the safety system for fishing will be provided by this project.

(3) The improving the community boat harbour at Anibare will accelerate the effects of promoting the fishery industries in Nauru, such as the establishment of Nauru Fishery Cooperation, purchasing the middle size fishing boats, settlement of the floating devices and the construction of fishery market.

(4) And also, the container cargo will be able to handle at this community boat harbour at Anibare during the south-west monsoon season instead of the boat harbour of west- side of the island.

4-2 Recommendations

It is recommended that the following actions shall be taken once the community boat harbour at Anibare is completed in order to make effective use of fishery port and the implementation of fishery industry based on the National Fisheries and Marine resources Development Strategy.

(1) Community Boat Harbour at Anibare will be managed and controlled by Nauru Fisheries and Marine Resources Authority. It is necessary to prepare regulations and guidelines for smooth management and supervision of Community Boat Harbour at Anibare and to improve the management structure with Nauru Fishermen' s Association.

(2) Second step construction works will start to after examination of the events of promotion for fishery industries such as increment of number of out-going fishing boats and fish catch volume, implementation of fish market, purchase and operation of the middle size fishing boats and establishment of Nauru fisheries cooperation. Therefore, it is necessary to promote the fishery industries and implementation plan.

(3) Fishermen shall be strictly instructed to moor the boat at the landing wharf in a single row for the efficient use of landing wharf: boats without fish shall not moor at the landing wharf.

(4) The maintenance cost will increase after completion of second step construction works because of increment of fishing boats and activity of

middle size fishing boats and fish landing. It may be necessary to collect the resister fee of fishing boats and fishermen.

(5) Infrastructures of Community Boat Harbour at Anibare such as breakwater, wharf and boat ramp will be implemented in the project. It will be necessary to implement the functional facilities of Community Boat Harbour at Anibare such as a use of refrigerator and ice making machine in the event of the change of number of fishing boat, fish catch volume and fishing methods.

Appendix-1 Member List of the Survey Team

(1) Basic design Study

Name	Assignment	Organization
Official Member		
Tsutomu MATSUNAGA	Leader	Deputy Director, Disaster Prevention and Coastal Protection Div., Fishing Port Dept., Fisheries Agency
Akihide NOGAWA	Technical Advisor	Fisheries Development Div., Fisheries Agency
Toru SHIMODA	Coordinator	Second Project Study Div., Grand Aid Project Study Dept., JICA
Consultant Member		
Iwao MIZUISHI	Chief Engineer/ Fisheries Development	TETRA Co., Ltd.
Eiichi MATSUURA	Fishing Port Planning	TETRA Co., Ltd.
Kiyotaka SASAO	Construction Planning/ Cost Estimation	TETRA Co., Ltd.
Gen-ichiro SHIMOJI	Natural Condition and Environmental Studies	TETRA Co., Ltd.

(2) Consultation on the Draft Basic Design

Name	Assignment	Organization
Tsutomu MATSUNAGA	Leader	Deputy Director, Disaster Prevention and Coastal Protection Div., Fishing Port Dept., Fisheries Agency
Hidetoshi ISHIOKA	Staff	First Project Management Div., Grant Aid Project Management Dept.,JICA
Iwao MIZUISHI	Chief Engineer/ Fisheries Development	TETRA Co., Ltd.
Eiichi MATSUURA	Fishing Port Planning	TETRA Co., Ltd.

Appendix-2 Survey Schedule

1 Field Survey

No.	DATE		DAY	Official Members		Consultant Members			
				Leader/Technical Advisor	Coordinator	Chief Engineer	Fishing Port Planning	Construction / Cost Estimation	Natural Condition and Environmental Studies
				MATSUNAGA/ NOGAWA	SHIMODA	MIZUSHI	MATSUURA	SASAO	SHIMOJI
1	10	27	Mon		Leave Tokyo/Arrive at & Leave Guam				
2		28	Tue		Arrive at Nauru				
3		29	Wed		Courtesy Call to the Government of Nauru				
4		30	Thu		Field Study				
5		31	Fri		Field Study				
6	11	1	Sat	Leave Tokyo	Field Study				
7		2	Sun	Sydney/Fiji	Team Meeting				
8		3	Mon	Courtesy Call on Embassy/JICA	Confirmation of Present Conditions of Project Site (Land, Environment)			Tokyo/Guam	
9		4	Tue	Fiji/Nauru	Re-confirmation of Site Conditions, Discussion on Selection of Site			Arrive at Nauru	
10		5	Wed	Re-confirmation of Site Conditions and Discussion on Selection of Site with officials concerned					
11		6	Thu	Discussion on Selection of Site and Decision of Appropriate Site				Field Study	Agreement of Sub-letting Survey
12		7	Fri	Discussion on Draft Minutes of Discussions with officials concerned					
13		8	Sat	Field Study				Price of Materials of Construction	Preparation of Survey for Natural Conditions
14		9	Sun	Team Meeting					
15		10	Mon	Discussion on/Signing of Minutes of Discussions with officials concerned					
16		11	Tue	Nauru/Fiji		Survey on Fishing Boats Incoming/Outgoing		Price of Materials of Construction	Commencement of Tide Survey
17		12	Wed	Report to Embassy/JICA		Survey on Floating Barge to convey Import Cargo		Price of Materials of Construction	Commencement of Topo/Sounding Survey
18		13	Thu	Fiji/Tokyo		Data Collection/Interview of Fish Catch/Cargo Vol.		Survey on Site Infrastructure	Water Quality/Seabed Materials Survey
19		14	Fri			Survey on Distribution of Landed Fish		Survey on Site Infrastructure	Survey related to Littoral Sand
20		15	Sat			Survey on Distribution of Landed Cargoes		Procurement of Equipment	Survey on Construction Materials
21		16	Sun			Team Meeting			
22		17	Mon			Organization/Management of Department of Fishery		Procurement of Equipment	Tidal Current Survey
23		18	Tue			Organization/Management of Department of Fishery		Procurement of Materials	Collection of Data for Climate/Sea Condition
24		19	Wed			Examination of Justification of Project		Procurement of Materials	Collection of Data for Climate/Sea Condition
25		20	Thu			Examination of Neccesity of Project Components		Procurement of Labors	Collection of Data for Climate/Sea Condition
26		21	Fri			Formulation of Draft Scope of Project		Cost Borne by Govt. of Nauru	Collection of Data for Climate/Sea Condition
27		22	Sat			Analysis of Collected Data		Analysis of Collected Data	Analysis of Collected Data
28		23	Sun			Team Meeting			
29		24	Mon			Discussion with Officials Concerned		Nauru/Guam/Tokyo	Supervising Subletted Survey
30		25	Tue			Nauru/Fiji			Ditto
31		26	Wed			Report to Embassy/JICA			Ditto
32	11	27	Thu			Fiji/Tokyo			Supervising Subletted Survey
33		28	Fri						Ditto
34		29	Sat						Analysis of Collected Data
35		30	Sun						Recovery of Tide Gauge
36	12	1	Mon						Nauru/Guam/Tokyo

2 Presentation of Draft Final Report

No.of Dates	Date (DD/MM/YY) (月日)		Activities (活動) Mr. MATSUNAGA (松永) Mr. ISHIOKA (石岡) Mr. MIZUISHI (水石) Mr.MATSUURA (松浦)	Stay (宿泊)	Remarks (備考)
1	20/04/98	Mon	Tokyo / Guam(JL941 9:40-14:05) Departure from Guam (ON412 18:40-)	in airplain 機中泊	
2	21/04/98	Tue	Arrival in Nauru (-1:50) Courtesy Call to MIDI and NFMRA (先方政府表敬)	Nauru	
3	22/04/98	Wed	Meeting with NFMRA (水産公社協議)	Nauru	
4	23/04/98	Thu	Meeting with NFMRA (水産公社協議)	Nauru	
5	24/04/98	Fri	Meeting with NFMRA (水産公社協議)	Nauru	
6	25/04/98	Sat	Site Survey (サイト現況確認)	Nauru	
7	26/04/98	Sun	Internal Meeting (団内打合せ)	Nauru	
8	27/04/98	Mon	Meeting with NFMRA (水産公社協議) (Signature on the Minutes of Disscussions) (ミニッツ署名)	Nauru	
9	28/04/98	Tue	Nauru / Nadi / Suva / Nadi (ON221 3:10-6:15) (PC136 9:00-9:25) (PC288 18:15-18:40) Report to the Embassy of Japan and JICA Office	Nadi	
10	29/04/98	Wed	Internal Meeting (資料整理)	Nadi	
11	30/04/98	Thu	Nadi / Tokyo (FJ302 7:45-13:55)		

MIDI: Ministry of Island Development and Industry
NFMRA: Nauru Fisheries and Marine Resources Authority

Appendix-3 List of Party Concerned in the Recipient Country

1 Field Survey

- Department of Island Development and Industry

Mr. Vassal Gadoengin	Acting Minister
Mr. Joseph Cain	Senior Project Officer
Mr. Andrew Pitcher	Special Projects Officer(Environment)

- Nauru Fisheries and Marine Resources Authority

Mr. Felix Kun	Chairman
Mr. Cyril Buramen	Director
Mr. Johnny Taumea	Director
Mr. Anthony Garabwan	Director
Mr. Anton Jimwereiy	Chief Executive Officer
Mr. Ramos Agege	Senior Fisheries Officer

- Department of Land and Survey

Mr. Wess Tsitsi	Deputy Director

- Department of Public Works

Mr. Barry Grundler	Director of Works

- Nauru Fishermen Association

Mr. Nelson Tamakin	President

2 Presentation of Draft Final Report

- Department of Island Development and Industry

Mr. Bernard Dowiyogo	Minister
Mr. David Agir	Acting Secretary
Mr. Andrew Pitcher	Special Projects Officer(Environment)

- Nauru Fisheries and Marine Resources Authority

Mr. Felix Kun	Chairman
Mr. Cyril Buramen	Director
Mr. Johnny Taumea	Director
Mr. Anthony Garabwan	Director
Mr. Anton Jimwereiy	Chief Executive Officer
Mr. Ramos Agege	Senior Fisheries Officer

- Department of Land and Survey

Mr. Porthos Bop	Director

- Department of External Affairs

Mr. Jarden Kephas	Administrative Officer