

BASIC DESIGN STUDY REPORT  
 ON  
 THE PROJECT FOR DEVELOPMENT  
 OF FISHING COMMUNITY  
 IN PELELIU STATE  
 IN  
 THE REPUBLIC OF PALAU

OCTOBER 1998

JICA LIBRARY



31148328(6)

JAPAN INTERNATIONAL COOPERATION AGENCY

TETRA CO., LTD.

GRT
CR(2)
98-188

14 17 RT

OCTOBER 1998

14  
17  
RT  
LIBRARY







**THE REPUBLIC OF PALAU**

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT FOR DEVELOPMENT  
OF FISHING COMMUNITY  
IN PELELIU STATE  
IN  
THE REPUBLIC OF PALAU**

**OCTOBER, 1998**

**JAPAN INTERNATIONAL COOPERATION AGENCY  
TETRA CO., LTD.**



1148328(6)

## PREFACE

In response to a request from the Government of the Republic of Palau, the Government of Japan decided to conduct a basic design study on the Project for Development of Fishing Community in Peleliu State and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Palau a study team from March 21 to April 20, 1998.

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

October, 1998



---

Kimio Fujita  
President  
Japan International Cooperation Agency

October, 1998

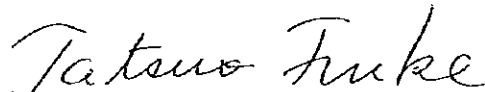
## Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Development of Fishing Community in Peleliu State in the Republic of Palau.

This study was conducted by TETRA Co., Ltd., under a contract to JICA, during the period from March 18, 1998 to October 30, 1998. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Palau 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,



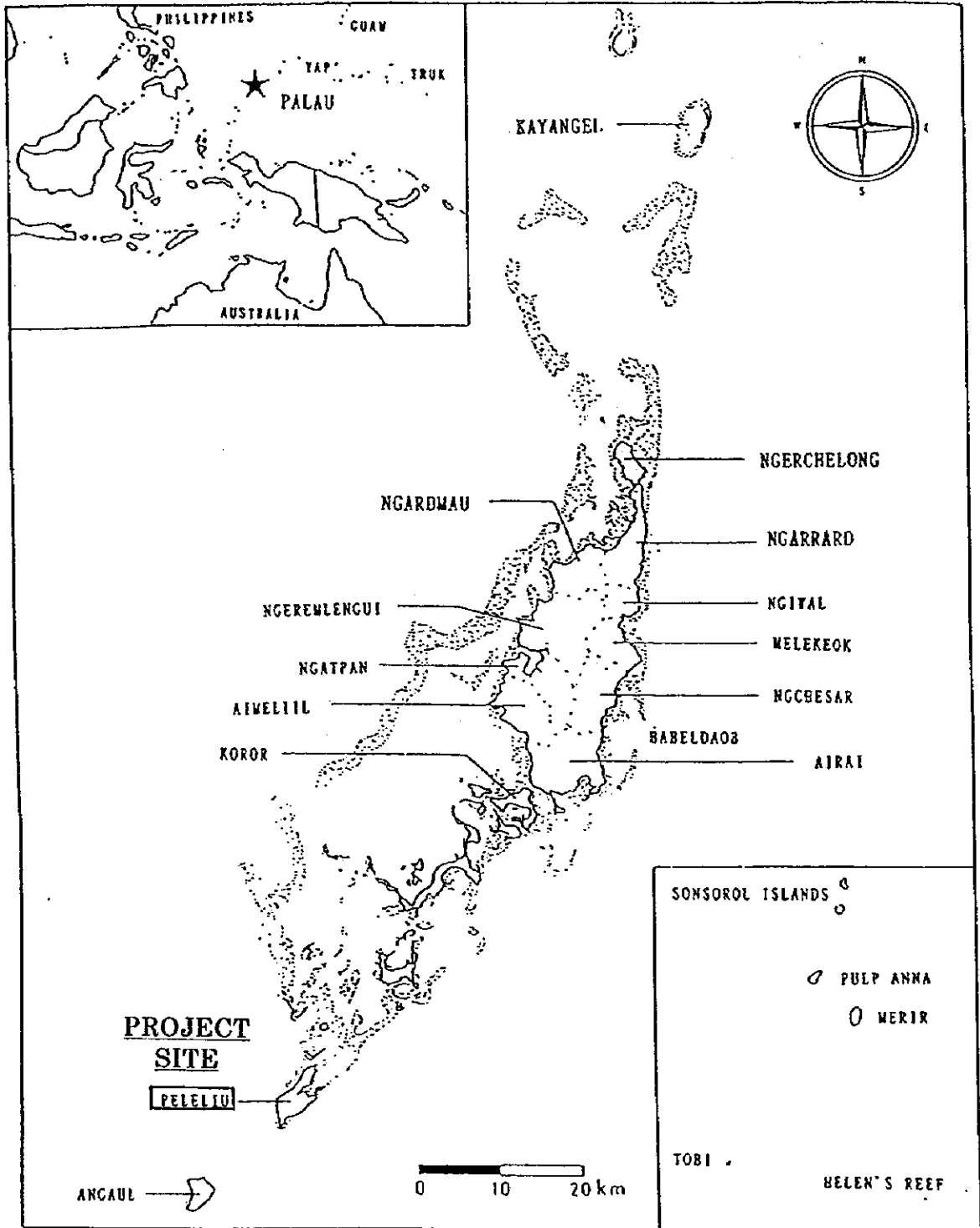
Tatsuo Fuke  
Project manager,  
Basic design study team on  
the Project for Development of  
Fishing Community in Peleliu State

TETRA Co., Ltd.





# REPUBLIC OF PALAU







## CONTENTS

### PREFACE

Letter of Transmittal

Location Map / Perspective

### CHAPTER 1 BACKGROUND OF THE PROJECT ..... 1-1

### CHAPTER 2 CONTENTS OF THE PROJECT ..... 2-1

2.1 Objectives of the Project ..... 2-1

2.2 Basic Concept of the Project ..... 2-2

2.2.1 Project items requested ..... 2-2

2.2.2 Present state of the existing facilities and problems ..... 2-2

2.2.3 Basic policy of facility design ..... 2-3

2.3 Basic Design ..... 2-7

2.3.1 Design concept ..... 2-7

2.3.2 Basic design ..... 2-7

2.3.3 Basic design drawings ..... 2-15

### CHAPTER 3 IMPLEMENTATION PLAN ..... 3-1

3.1 Implementation Plan ..... 3-1

3.1.1 Implementation concept ..... 3-1

3.1.2 Implementation conditions ..... 3-3

3.1.3 Scope of works ..... 3-4

3.1.4 Consultant supervision ..... 3-5

3.1.5 Procurement plan ..... 3-7

3.1.6 Implementation schedule ..... 3-8

3.1.7 Obligation of recipient country ..... 3-9

3.2 Project Cost Estimation ..... 3-10

3.2.1 Cost to be born by the Government of Palau ..... 3-10

3.2.2 Operation and maintenance costs ..... 3-10

### CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION .. 4-1

4.1 Verification of Project Validity and Project Effect ..... 4-1

4.1.1 Verification ..... 4-1

4.1.2 Project effect ..... 4-2

4.1.3	Method for verification of validity	4-3
4.2	Recommendation	4-4

## APPENDIX

Appendix-1	Member List of the Survey Team	A-1-1
Appendix-2	Survey Schedule	A-2-1
Appendix-3	List of Party Concerned in the Recipient Country	A-3-1
Appendix-4	Minutes of Discussion	A-4-1
Appendix-5	Soil Condition	A-5-1
Appendix-6	Environmental Assessment	A-6-1
Appendix-7	Numerical Simulation on Diffusion of Silty Material	A-7-1
Appendix-8	Wind Condition	A-8-1
Appendix-9	Result of Sea Conditions	A-9-1

## **CHAPTER 1**

### **BACKGROUND OF THE PROJECT**





## CHAPTER 1 BACKGROUND OF THE PROJECT

The republic of Palau consists of more than 200 islands and islets, and as such, has depended on sea transportation as means to transport people and goods for many years. About 70% of the total population (12,300 - 1995 census) resides in the state of Koror where the capital of the country is located. The population density of the Koror state is 668 habitants/km<sup>2</sup> which is very high as compared to the average of 12 habitants/km<sup>2</sup> of the remaining 15 states. The concentration of the population in the Koror state started in the 1970's, causing unemployment, security problem, waste disposal and environmental problems in the state where as the other states have been suffering from depopulation and declining industries.

In order to settle this problem and build an self-reliant economy without depending on the Compact Fund, it is considered necessary to further develop sea transportation system which can contribute to efficient distribution of fishery products and consumer goods and attract tourists out of Koror state to other states.

The state of Peleliu is an island state with about 600 inhabitants and can be reached from Koror within 2 hours by sea. The north port of Peleliu is the project site, which is the only port of the state with landing facilities. Therefore, this port serves as a focal point for fishing industry and as a distribution center for the state.

In 1993 JICA provided, under Fishery Grant Aid Program a medium sized multi-purpose transport vessel for shipping fish catch to Koror and constructed fishing port management office, ice-making plant, fueling and water supply facilities. As a result of the program, the number of fishermen and the sales of fish catch have significantly increased. The state was one of the major battle grounds during the last war and the number of tourists visiting war affected area have also increased so far.

In regard to further development of the fishing industry and tourism, the existing port has the following constraints.

- 1) Because of the shallow access channel (less than 1m deep), vessel can only navigate during high tide period resulting in inefficient use of the port.
- 2) The landing quay of limited extension causes calling vessels to wait for a long time or to berth in parallel, resulting in inefficient loading and unloading operation.

This project was requested under Japanese Grant Aid Program to overcome above constraints of the port in the Peleliu.

The Government of Palau has made the requests of following project items under the grant aid to the Government of Japan in relation to the fishing village development program of the state of Peleliu.

Project items requested by the Government of Palau as follows and relevant layout maps are shown in Figure 1.1.1 and 1.1.2.

- Dredging of the access channel (25m wide, 5,400m long and 2.5m deep)
- Dredging of the berthing area (2.5m deep)
- Expansion and repair of the quay (apron, revetment and slope)
- Navigation aids (3 light beacons and 20 navigation markers)

On the basis of this request, the Government of Japan decided to carry out the Basic Design Study for the Project and subsequently the Japan International Cooperation Agency (JICA) undertook the responsibility of implementing the following activities.

- 1) The main mission was fielded during March 21 and April 20, 1998.
- 2) As follow up to the above mission, the secondary mission was fielded to report the outcome of the Basic Design Study to the government during June 1 and June 8, 1998.

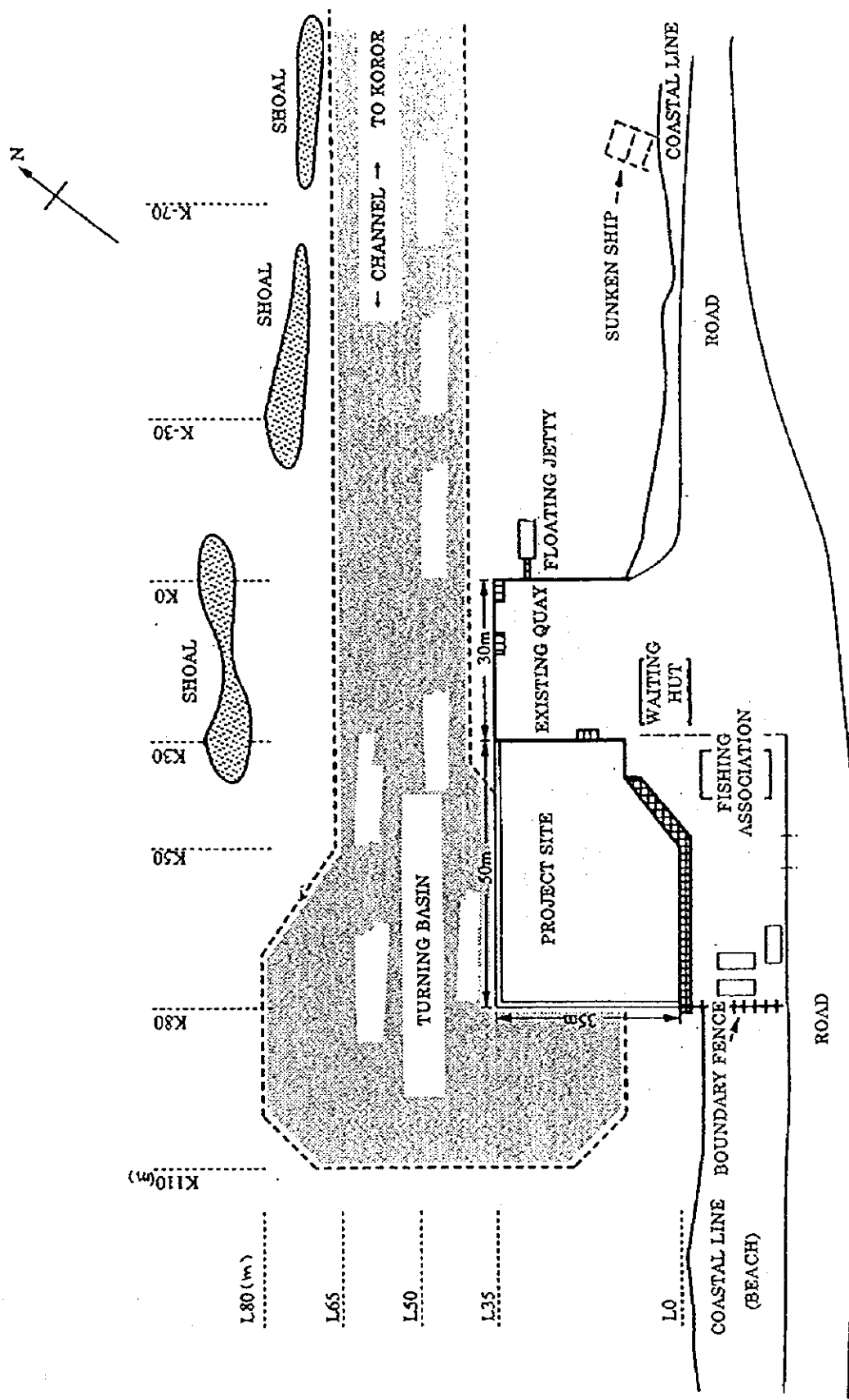


Figure 1.1.1 General Layout Plan of Requested Port Facilities

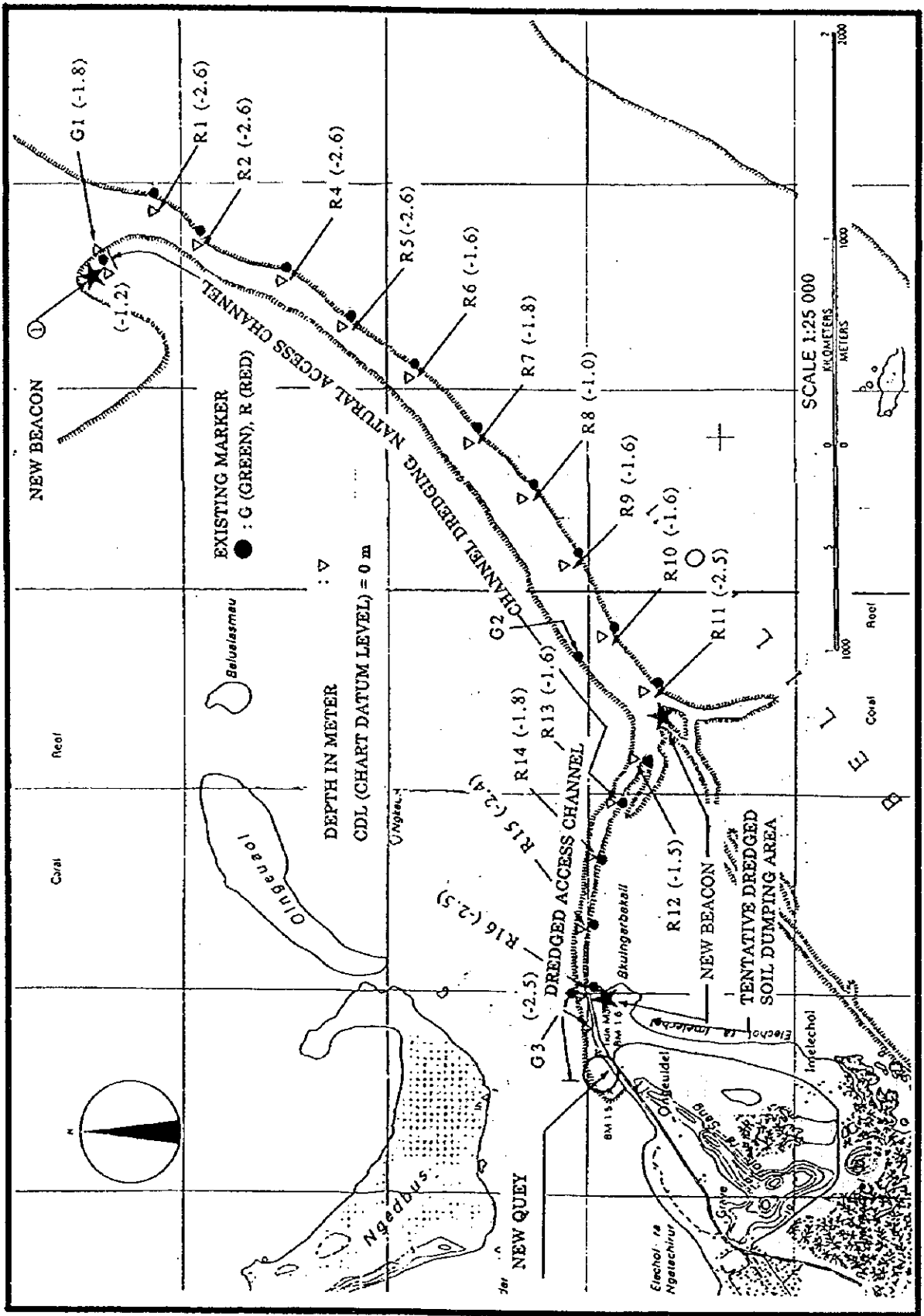


Figure 1.1.2 Alignment of Access Channel and Location of Navigation Aids

## **CHAPTER 2**

### **CONTENTS OF THE PROJECT**



## CHAPTER 2 CONTENTS OF THE PROJECT

### 2.1 Objectives of the Project

The State of Peleliu is an island state, which is about 13km from north to south and about 5km from east to west at the widest part. This state is situated in the southern part of the Republic of Palau and can be reached in about two hours by sea from Koror where the capital of the country is located. The number of inhabitants of the island is about 600 which is the third largest population in the Republic, next to Koror and Airai. Traffic between the states is dependent on sea transport. The North Port which is the Project Site is the only port in the State of Peleliu with fishing port facilities, such as a quay. Accordingly, the North Port is not only playing an important role as a distribution center but is also serving as a focal point for the fishing industry which is the main industry of the State of Peleliu. In 1993 Japan provided, under the Fishery Grant Aid Program, a medium-sized multi-purpose cargo vessel for shipping fish to Koror and constructed fishery-related facilities, such as a fishing port management office, ice-making plant, fueling and water supply facilities. As a result of the program, the number of fishermen and the sales of fish have significantly increased, contributing to the steady growth of the marine products industry of the State. Moreover, the State has excellent scuba diving spots. The number of tourists, including sports fishermen, has been increasing year after year. As the State was one of the major battle grounds during the last war, many tourists visit the war-affected area (about 3,000 visitors/year).

Accordingly, the fishery-related facilities of the North Port, including the quay, constitute the State's lifeline.

The North Port was built before the last war (about 1930) to transport phosphate from Peleliu Island to Japan. As the Port has undergone little maintenance and repairs during the 60 years since then, the depth of water in the access channel has decreased to about 1.0m, insufficient for the vessels transporting fresh fish to Koror. Furthermore, the quay facilities are in great disrepair and require repairs. As described above, the North Port is not fully functioning as the distribution center for the State, giving adverse effect on materials flow and further development of the fishing industry of the State.

The purpose of this Project is solved the aforementioned problems through dredging of the access channel and repairing the landing quay.

## 2.2 Basic Concept of the Project

### 2.2.1 Project items requested

The Project items requested are as follows. The planned layout of the facilities requested is shown in Figure 1.1.1, while the positions of the access channel and navigation aids are shown in Figure 1.1.2.

Dredging of the access channel (25m wide, 5,400m long, and 2.5m deep)

Dredging of the berthing area (2.5m deep)

Expansion and repair of the quay (apron, revetment and slope)

Navigation aids (3 light beacons and 20 navigation markers)

### 2.2.2 Present state of the existing facilities and problems

The land facilities (management office, refrigerators, fueling facilities, etc.) provided by Japan under the Fishery Grant Aid Program in 1993 are functioning smoothly under the management of the Fishery Cooperative of the State of Peleliu. However, some problems have occurred in the basic facilities of the fishing port, particularly in the landing quay and access channel. Namely, the quay facilities are in disrepair and the access channel has become shallow as described below, resulting in inefficient use of the port by vessels.

#### 1) Quay

As the quay of the North Port have been in use for many years, and is in disrepair. This quay is of concrete block structure. Some concrete blocks on the seaward side have collapsed, creating an unstable condition. The depth of water at the quay is as shallow as 1.0m in places, the average being about 1.5m. (See Figure 2.2.1)

#### 2) Access channel

As shown in Figure 1.1.2 the access channel consists of a natural channel 3.6km long on the north side and a 1.8km long manmade channel constructed during the Japanese administration of Palau.



In dredging the manmade channel, the dredged earth (coral sand with gravel mixed, coral lumps of 50cm in diameter) was piled up on the north side of the access channel to form a breakwater. Under the influences of waves, currents, etc., over a long time, however, the sand of the breakwater has gradually silted the deeper part of the channel. Accordingly, the depth of water in the channel has decreased to 1.0m in places, obstructing the smooth navigation of vessels.

The natural channel is in a similar state. Namely, the coral sand has gradually flowed into the deeper part of the channel, under the influence of waves, currents, etc. over many years, decreasing the depth of water to about 1.0m (0.7m in places).

### 3) Berthing area

The berthing area is also silted though not so severely as the access channel. The depth of water in the berthing area is about 1.2m in places.

### 4) Navigation markers

16 red markers and 3 green markers are installed along the access channel, as shown in Figure 1.1.2.

These aids were installed in December, 1996 by the Government of Palau. These aids are fully fulfilling their functions for vessels navigating in daytime.

## 2.2.3 Basic policy of facility design

### 1) Basic concept

The basic policy of the present Project is to solve the following problems that the sole marine transport line between the State of Peleliu and Koror is now confronted with.

(1) As the access channel and berthing area of the North Port has become shallow due to silting over a long time, the free navigation of vessels is greatly hampered.

(2) The quay of the North Port is losing its function due to deterioration.

Accordingly, the facilities are planned and designed under the basic concept described below.

- (1) The depth of water in the access channel and berthing area and the width of the access channel to be dredged are determined based on the size of multi-purpose transport vessel now in operation.
  - (2) The depth of water and the top height of the quay after repair are determined based on the size of the multi-purpose transport vessel. However, facilities, such as stairs, are provided for small-sized vessels, such as fishing and sightseeing boats. The overall length of the quay is not extended from the current length.
  - (3) It is expected that vessels larger than those now in operation will be put into service with future development of tourism in the State of Peleliu. As nothing definite has been decided on, however, the operation of such vessels is excluded from the scope of the present project.
- 2) Facilities requested by the Government of Palau but not included in the Project.

The facilities requested by the Government of Palau but not included in the present Project are shown in Table 2.2.1 with the reasons stated.

Table 2.2.1 Facilities requested but not included in the Project

Facility	Reason
Navigation marker	<p>1. The navigation markers have been installed only recently by the Government of Palau and are fully fulfilling their functions. As the markers have such problems as low height and large spacing, however, improvement is required. This improvement work can be carried out by the Government of Palau.</p> <p>For this reason, the improvement work of the aids is excluded from the scope of the study.</p>
Light beacon	<p>1. At present, no light beacons are installed.</p> <p>2. The multi-purpose transport vessels, such as the Nippon Maru, are not navigating in the night. There is no plan of operating such vessels in the night.</p> <p>3. The Government of Palau is requesting the light beacon in anticipation of night navigation of such vessels in emergency.</p> <p>4. Fishing boats navigate, heading for the light reflected from the tape attached to the navigation aids.</p> <p>For the reasons described above, the installation of light beacons is given a low priority.</p>
Expansion of quay	<p>1. It would not be necessary to expand the existing landing quay since fishing vessels and sightseeing boats could be effectively use the existing landing quay as well as the adjacent pontoon. This is because the rate of occupancy by multi-purpose vessels at the landing quay is only 60% and therefore the remaining portion (40%) can be utilized by fishing vessels and sightseeing boats.</p> <p>2. Whilst the Government of Palau accords high priority on tourism development and Peleliu island is considered as one of the tourism island in the long run, it is unrealistic, at this stage, to consider the introduction of a large scale multi-purpose vessels which would require the need for expanding the landing quay.</p> <p>Because of the above reasons, it cannot be considered appropriate to expand the size of the landing quay was.</p>
Slope	<p>1. At present, the Peleliu Island does not have a slope.</p> <p>2. Originally, the slope is provided for pulling up the fishing boats, etc. on land to clean their bottom or apply paint thereto. For multi-purpose transport vessels which are comparatively large in size among the vessels using the North Port, it is technically and economically advantageous to repair them on the slope in Koror which is a port of call.</p> <p>3. As the fishing and sightseeing boats are light in weight (less than 1t), they can be easily pulled up on land by manpower. Accordingly, the slope is not necessary.</p>

Manmade Channel

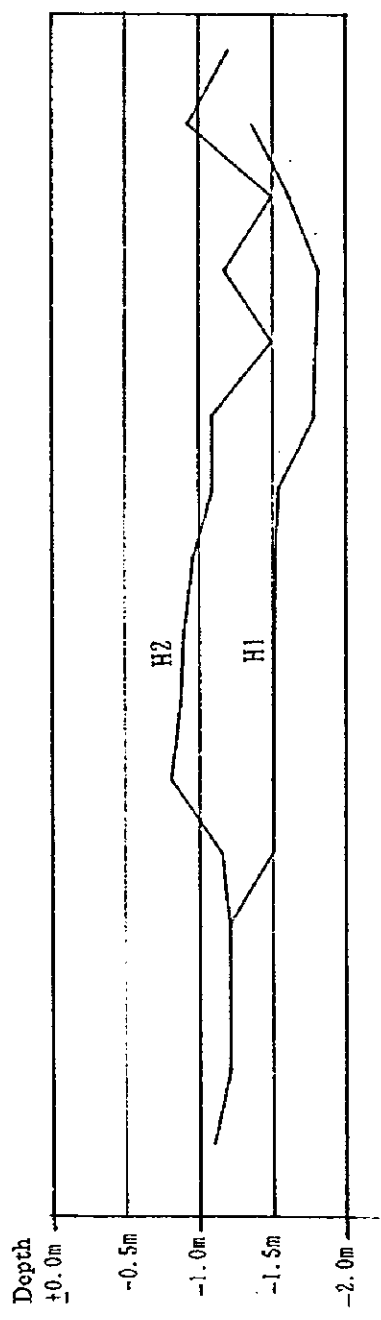
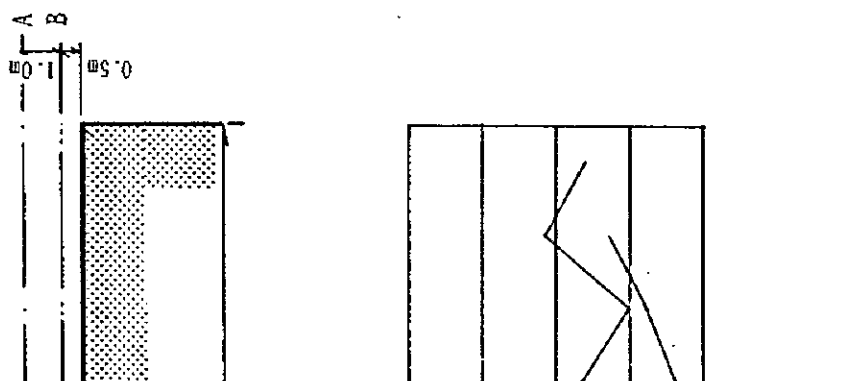
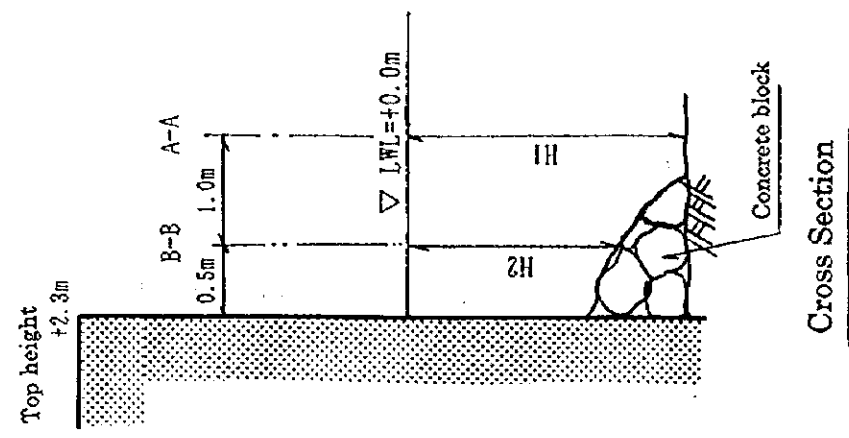


Figure 2.2.1 Depth of the Water at the Quay

## 2.3 Basic Design

### 2.3.1 Design concept

- 1) As the design standards concerning the fishing port structures have not been established in the Republic of Palau, the Japanese design standards for fishing port structures apply.
- 2) In the Peleliu Island which is the Project Site, coral rocks are available as a back-filling material for construction. In the Koror Area, concrete aggregates and cement are easily available. As several full-scale concrete plants are in operation, the supply of freshly mixed concrete is also easy.
- 3) Earthquakes occur in the Peleliu Area. Accordingly, seismic design is required.
- 4) The facilities shall be designed so as to ensure the ease of maintenance and to minimize their effects on adjacent environment.
- 5) The facilities shall be used safely and in a convenient manner by the inhabitants of the island and fishermen who utilize them.

### 2.3.2 Basic design

#### 1) Design condition

##### (1) Design ship

The sizes of the largest calling ship, Nippon Maru, will be used in designing the access channel, berthing area and the landing quay.

The dimensions of the design ship are presented below.

Overall length	:	15.0m
Breadth	:	3.40m
Full load draft	:	1.50m
Gross tonnage	:	6 tons

##### (2) Tide condition (See Figure 2.3.1)

H.W.L. (High Water Level)	:	1.47m
---------------------------	---	-------

L.W.L. (Low Water Level) : 0.33m  
 R. W. L. (Residual Water Level) : 0.90m

(3) Soil condition and surcharge

Access channel and berthing area : Silty sand

Landing quay

Surcharge : ordinary case 1.0t/m<sup>2</sup>  
 : earthquake case 0.5t/m<sup>2</sup>

Filling material

Unit weight : 1.8t/m<sup>3</sup> (in air)  
 : 1.0t/m<sup>3</sup> (in water)

Internal friction angle : 35°

(4) Earthquake condition

Horizontal seismic coefficient : 0.1

2) Access channel and berthing area

(1) The alignment line of the access channel will be the same as that of the existing channel.

(2) Width and depth of access channel (See Table 2.3.1)

Design width : Basic 15.0m, Wider portion 20.0m

Design depth : 1.5m

A typical cross section of the access channel is shown in Figure 2.3.2.

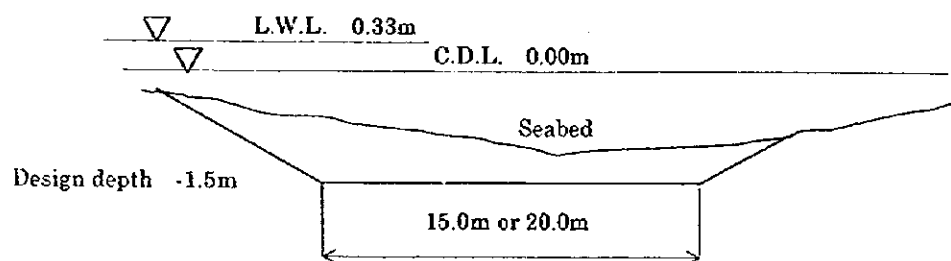


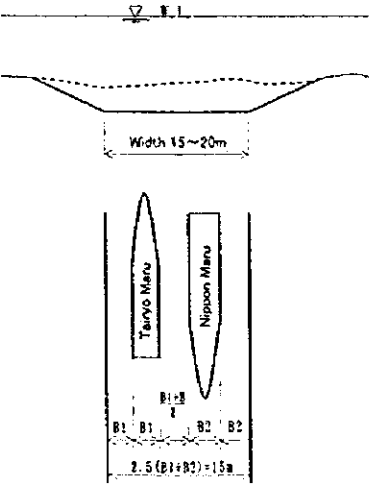
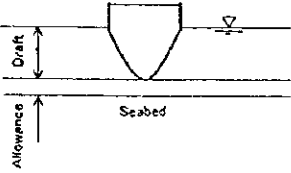
Figure 2.3.2 Cross section of access channel

(3) Berthing area (Turning basin)

The depth of water shall be the same as that in the access channel, i.e., 1.5m. The berthing area shall be a circular area with a radius of 1.5L which is necessary for turning the Nippon Maru. (See Figure 2.3.3)

$$1.5L = 1.5 \times 15.0 = 22.5\text{m (L: Vessel length)}$$

Table 2.3.1 Basis for setting the width and depth of access channel

Reference drawing	Basis for design
<p data-bbox="263 398 359 432">Width</p> 	<p data-bbox="662 405 1449 584">1. Though there were no cases where the Nippon Maru (breadth <math>B_1 = 3.4\text{m}</math>) and the Tairyo Maru (breadth <math>B_2 = 2.6\text{m}</math>) passed each other within the access channel, the width is determined in consideration of the worst case.</p> <p data-bbox="689 636 1249 674">Required width <math>B = 2.5 (B_1 + B_2) = 15.0\text{m}</math></p> <p data-bbox="662 779 1449 857">2. For the areas where sand is excessively accumulated, the width shall be <math>20.0\text{m}</math>.</p>
<p data-bbox="263 1104 480 1137">Depth of water</p> 	<p data-bbox="662 1104 1449 1227">The operating time ratio of the Nippon Maru water in the case where the access channel is dredged to <math>1.5\text{m}</math> is studied.</p> <p data-bbox="662 1245 1449 1413">1. As the max. draft of the Nippon Maru is <math>1.5\text{m}</math>, it is assumed that this vessel can run when the depth of water is more than <math>2.0\text{m}</math> (max. draft of <math>1.5\text{m}</math> + an allowance of <math>0.5\text{m}</math>).</p> <p data-bbox="662 1431 1433 1469">2. At present, the Nippon Maru navigates 2 times/7 days.</p> <p data-bbox="662 1487 1449 1700">3. The navigation of the Nippon Maru is restricted at spring tide (about 5 days at a time). As the spring tide occurs twice a month, the duration of this tide is 10 days per month. Accordingly, the navigation of the Nippon Maru is restricted as shown below:</p> <p data-bbox="689 1718 1361 1756">10 days/month x 2 times/7 days = 2.8 times/month</p> <p data-bbox="689 1765 1449 1843">In other words, the Nippon Maru must wait for the tide 2.8 times a month. The average waiting time is 1 hour.</p> <p data-bbox="689 1852 954 1890">No serious problem</p> <p data-bbox="689 1899 1313 1937">Accordingly, the dredging depth shall be <math>1.5\text{m}</math>.</p>



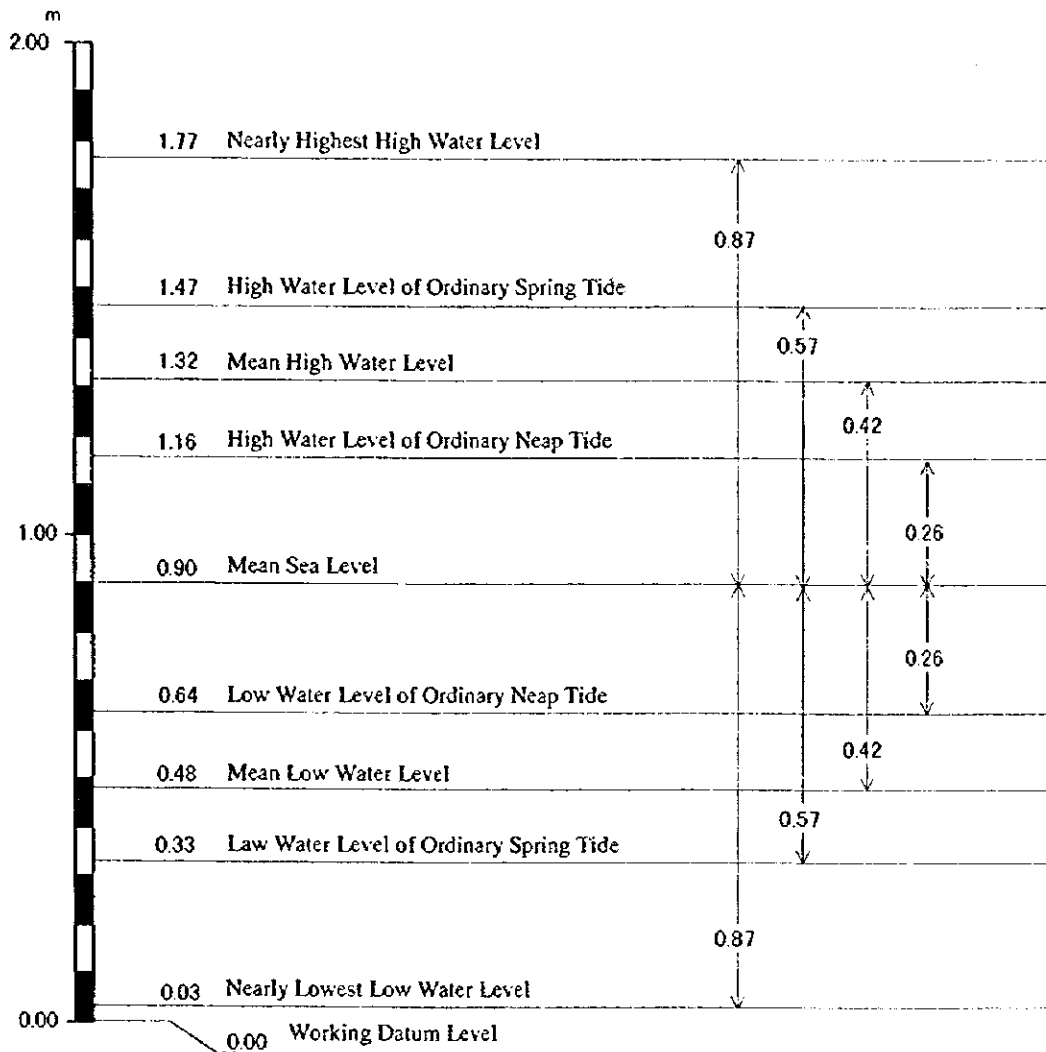


Figure 2.3.1 Tide Level Chart

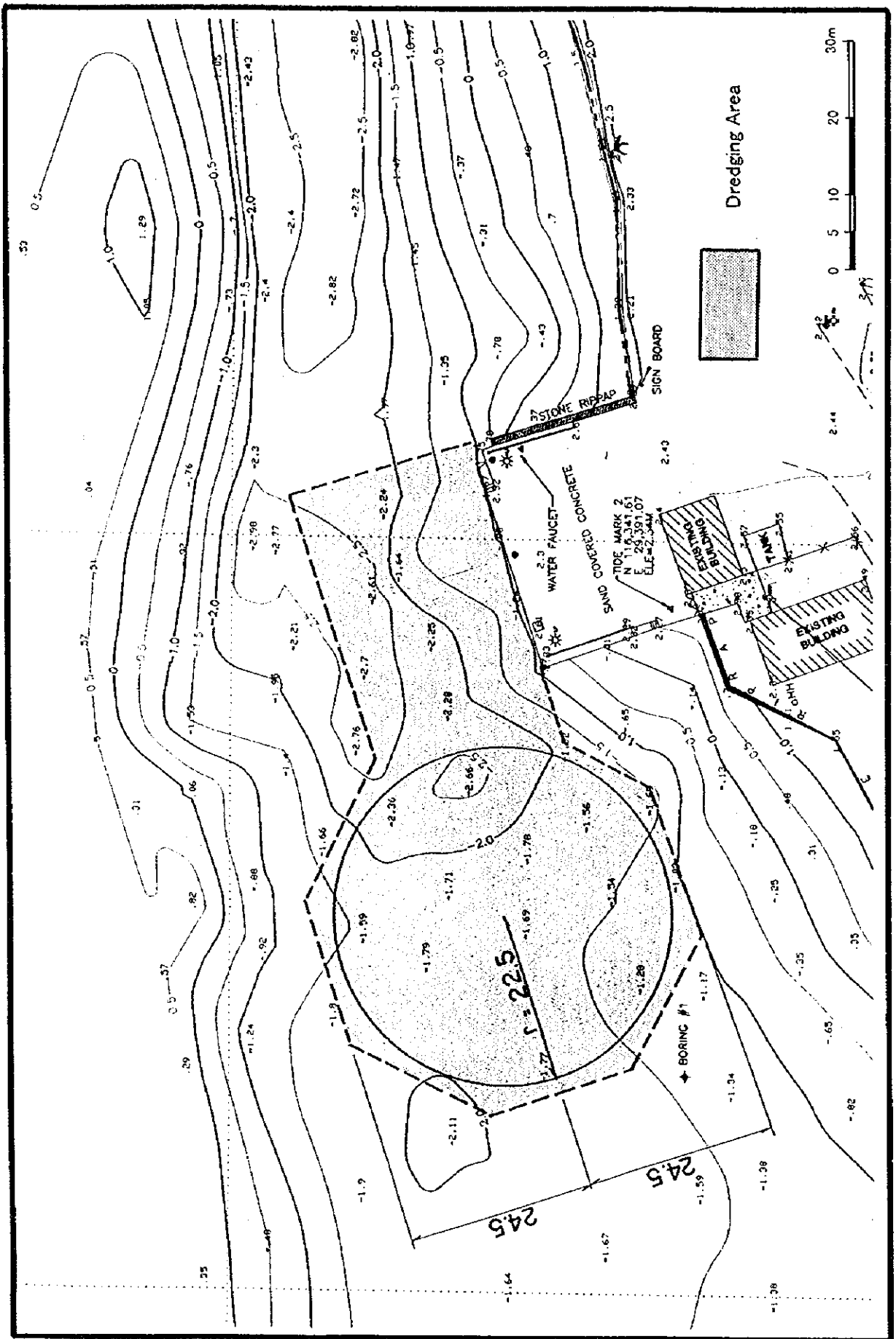


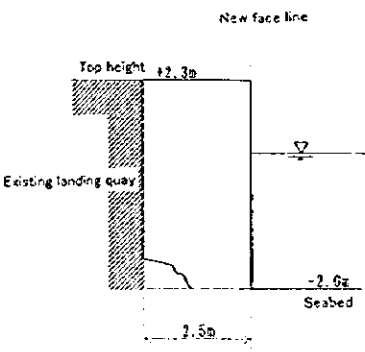
Figure 2.3.3 Location Map of Berthing Area

3) Landing quay

- Depth of water : 2.0m
- Top height : 2.3m
- Planned face line : 2.5m forward from the existing quay line

The design bases for the respective items are summarized in Table 2.3.2.

Table 2.3.2 Design bases for depth of water, top height and face line of quay

	Design basis
<p>Repair of quay</p>	<p>1. The depth of water shall be 2.0m.                  2. The planned depth of water for the access channel and berthing area is 1.5m.                  3. As the multi-purpose transport vessels are moored at the quay for 24 hours, a sufficient depth of water is required to provide for abnormal decrease in the tide level due to bad weather.                  Accordingly, an allowance of 0.5m is added to the depth of 1.5m required for the access channel and berthing area.</p>
<p>Top height</p> 	<p>The top height of the existing quay is 2.3m. This height is appropriate for the multi-purpose transport vessels but too high for small-sized fishing boats, sight-seeing boats, etc., giving rise to practical difficulties in mooring, cargo handling and getting on and off of passengers. If the top height is changed, however, a big difference in level is caused, posing problems in moving automobiles, personnel, cargoes, etc. To solve this problem, stairs are effectively provided without changing the top height.</p>
<p>Planned face line</p>	<p>Even during the repair work, the existing quay must permit mooring, cargo handling, etc. To build a new quay, while utilizing the existing quay effectively, a new face line is provided 2.5m forward from the front side of the existing quay.</p>

Landing quay repair plans are summarized in Table 2.3.3.

For this repair, the construction methods shown below can be applied.

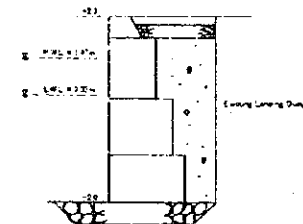
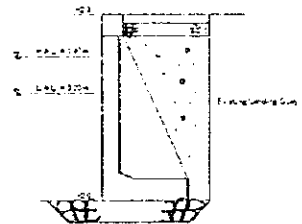
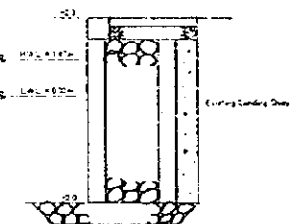
Concrete block construction

L-type concrete construction

Cellular block construction

In consideration of the local conditions, the concrete block construction is considered to be the best from the standpoints of workability and economy. The design of quay using sheet piles, steel pipe piles, etc. is taken out of the scope of study as the layer of limestone exists at a very small depth of the foundation soil.

Table 2.3.3 Alternate Plan Comparison of Landing Quay Structure

Natural Condition	1. Good foundation with large bearing capacity 2. Rock stratum at -1.7m depth, some lock dredging required 3. Calm wave and wind condition		
Structure Type	Concrete Bloke Wall Type	L-shaped Concrete Block Wall Type	Cellular Concrete Block Wall Type
Casting of Block	Simple Casting of Plain Concrete	Complicated Casting of Re-Concrete	Complicated Casting of Re-Concrete
Installation of Block	Small Crane	Relatively Large Crane	Relatively Large Crane
Construction Material	Cement	Cement and Re-bar	Cement and Re-bar
Durability	Semi-permanent	Semi-permanent	Semi-permanent
Ratio of Construction Cost	100	110	110
Evaluation	Best	Good	Good
Standard Cross Section			

2.3.3 Basic design drawings

The basic design drawings for the main facilities are shown in Figure 2.3.4 ~ 2.3.6.

Figure 2.3.4 Plan view of landing quay repair

Figure 2.3.5 Standard cross section of landing quay

Figure 2.3.6 Standard cross section of access channel

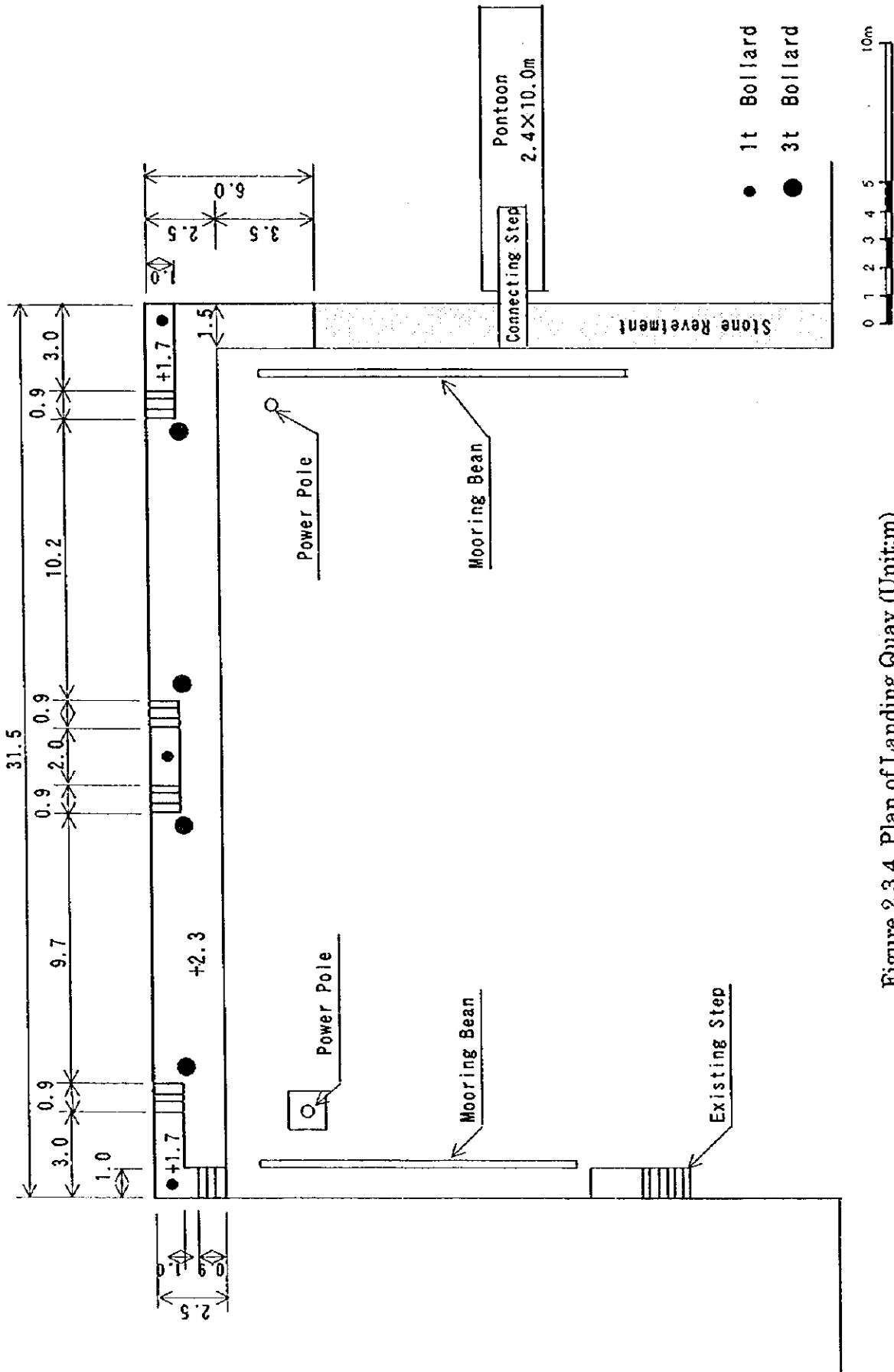


Figure.2.3.4 Plan of Landing Quay (Unit:m)

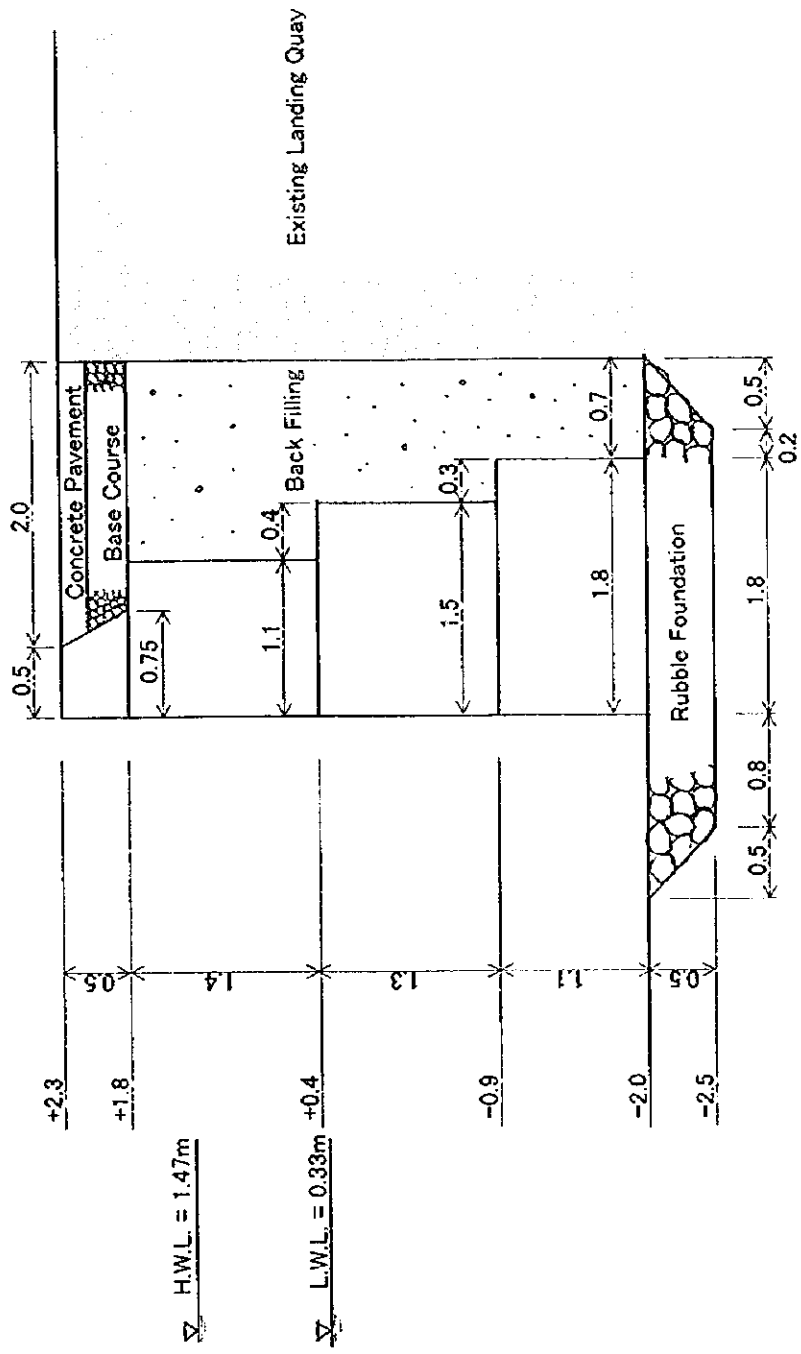
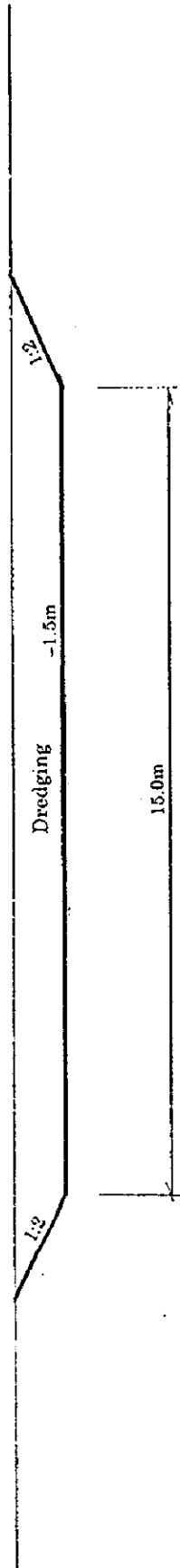


Fig. 2.3.5 Standard cross section of landing quay

Standard cross section (W = 15.0m)



Standard cross section (W = 20.0m)

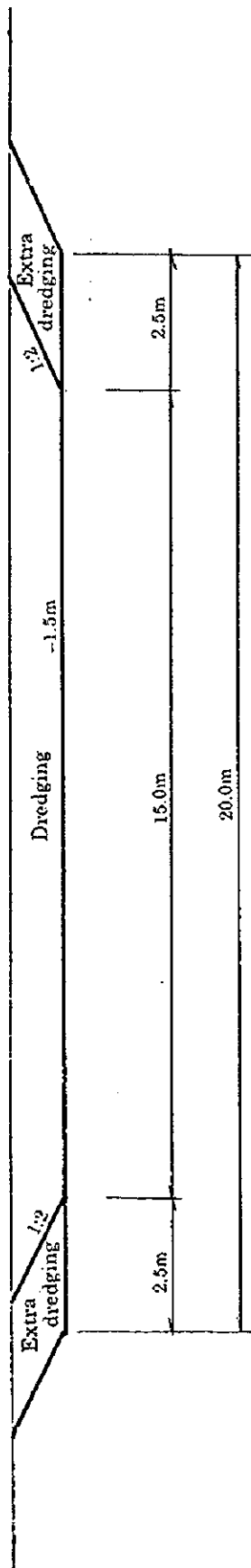


Fig. 2.3.6 Standard cross section of access channel



**CHAPTER 3**  
**IMPLEMENTATION PLAN**



## CHAPTER 3 IMPLEMENTATION PLAN

### 3.1 Implementation Plan

#### 3.1.1 Implementation concept

##### 1) Basic concept

- (1) After the Exchange of Notes (E/N) for the implementation of the Project is concluded between the Government of Japan and the Government of Palau, a contract on consulting services will be concluded between the Government of Palau and a Japanese consultant.
- (2) The consultant will prepare all the tender documents such as drawings, technical specifications, the bill of quantities and the terms of contract required for the tender and the contract for construction. After the approval of those documents by the Government of Palau, the contractor for this project will be selected from among Japanese construction companies according to the procedure established for the examination of pre-qualifications and the tender.
- (3) The construction work will be undertaken by the selected contractor in accordance with the contract of construction concluded between the Government of Palau and the contractor.
- (4) The construction period is expected to be about 8 months taking into consideration the scale of the project and the site conditions.

##### 2) Implementation concept

- (1) Construction to be carried out under the Project includes the dredging of the existing channel and berthing area and the repair of the existing landing quay. Since the existing channel and landing quay are the only facilities supporting marine transport between the project port and Koror, dredging work will be carried out by using the method which will minimize the disturbance to vessel navigation and by selecting a dredger suitable for such method. Consideration will be given to the same aspects when

dredging is carried out for the berthing area. Care will be taken for the security of passengers and loading/unloading of cargo during the repair work of the landing quay and the dredging work.

- (2) Measures will be taken to prevent water pollution during construction in order to preserve the marine environment. A special measure will be taken to protect the coral reefs from contamination.
- (3) In the Republic of Palau, there are several construction companies that own marine construction vessels and construction machinery, but none of them has a special dredger which is suitable for carrying out work in such a narrow area as is the case of this Project. There are not many construction vessels for general use as well as machinery, and when available, the rental is high. Therefore, only when there are a sufficient number of vessels and machinery and/or the rental is lower as compared with that in Japan, the procurement will be made locally. It is possible to procure labour from local construction companies.

### 3) Executing organizations of the project

Executing organizations of the project are as follows:

- (1) Organization responsible for the tender  
Ministry of Resources and Development
- (2) Organization to coordinate the project  
Ministry of Resources and Development
- (3) Organization to supervise the Construction  
Ministry of Resources and Development
- (4) Organization to maintain the facilities after the completion  
Government of Peleliu State

### 3.1.2 Implementation conditions

#### 1) Background

##### (1) Construction companies

In Palau, there are several construction companies including those owned by foreign capitals undertaking small scale reclamation works, engineering and building work. Although local construction companies do not have experiences in carrying out a full scale port construction work like the Project by themselves, it appears that they have the capability of undertaking work under a sub-contract terms.

##### (2) Construction machinery

Several companies own construction machinery for general purpose such as cranes, backhoes and dump trucks, and some own pontoons and tug boats, but the number of such machinery locally available are limited and the rental is expensive. It is therefore necessary to procure marine construction vessels except a pontoon with crane in Japan or in a third country. Most of general engineering machinery can be procured locally except for some of them. However, when the rental is high, they must be procured from Japan or from a third country.

##### (3) Labor

While skilled workers or expertise for port construction need to be procured from abroad, unskilled workers such as general engineering workers and masons may be hired from local construction companies.

##### (4) Construction materials

Major construction materials include concrete blocks and aggregates, cement, water, rubble stone, backfilling and a small quantity of steel bars for concrete structure. Good quality stones for concrete and rubble base are available in Koror, but not in Peleliu Island.

As for water required for construction, groundwater of about 0.1% salt concentration is supplied through the city water system in Peleliu Island for three hours in the early morning and evening. However, it is difficult to secure a sufficient quantity of water needed. Therefore, concrete blocks which require a greater amount of water will be cast in Koror and

transported by sea. Sands for in-situ concrete will be procured in Peleliu Island obtaining high quality sand from the seashore or from the dredged sand.

Cement and steel bars are available in Koror.

## 2) Construction work

- (1) Special care will be taken to protect marine environment at the Project site. A number of counter measures (e.g. set of a silt-protecting curtain) will be established to prevent the turbidity of water which may be caused by dredging work.
- (2) An adequate number of staff and experts will be sent from Japan taking into account the time frame of the project (e.g. timing and period) in accordance with the progress of work.
- (3) Local materials will be used as much as possible and the procurement of foreign materials will be minimized.
- (4) Special care will be taken for the noise and safety when explosives are used for rock drilling.
- (5) As the Project site is situated in the only access channel and berthing facility for the sea transport between Peleliu island and Koror, adequate measures will be taken during work implementation to minimize disturbances to passengers and cargo loading/unloading. An adequate safety management method will be adopted.

### 3.1.3 Scope of works

The scope of work to be undertaken by the Government of Japan and the Government of Palau is as follows;

#### 1) Scope of work to be undertaken by the Government of Japan

Dredging of the access channel and the berthing area  
Repair of the existing landing quay

## 2) Scope of work to be undertaken by the Government of Palau

To provide and improve an area at the site required for the project.

### 3.1.4 Consultant supervision

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

#### 1) Supervisory policies

- (1) Control of the work progress in accordance with the construction schedule by maintaining close contact and communication with the responsible organizations in two countries,
- (2) Provide prompt and adequate instructions and advice to the contractor so that they can complete the construction of the facilities in conformity with the design plan,
- (3) Provide instructions to use local materials and local construction methods as much as possible,
- (4) Promotion of technology transfer in construction and engineering which is one of the principles of the Grant Aid Project and
- (5) Provide adequate instructions and advice on the maintenance of the facilities provided to the country in order to accelerate the smooth operation of such facilities.

## 2) Supervisory works

### (1) Assistance on contracting

Providing assistance on the selection of contractors, determining the types of contracts, drafting contract documents, evaluating the bill of quantities and witnessing contract awarding.

### (2) Evaluation and approval of shop drawings

Evaluation and approval of shop drawings, materials and equipment submitted by contractors.

### (3) Instructions on construction work

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

### (4) Assist in expediting payment procedures

Evaluate and approve the bills of payment to the contractor during the implementation stage or upon completion of work.

### (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 work and fulfillment 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 materials and equipment necessary for the project, special attention needs to be paid to the following matters:

### 1) Procurement policy

The quality and availability of the materials and machinery that are locally available will be fully examined, and priority will be accorded on the



procurement of local materials, minimizing the procurement from Japan.

(1) Procurement from Japan

A detailed plan for procurement and transport needs to be carefully designed for materials which will be procured and processed in Japan as it requires a considerable period of time for order, manufacturing, packaging and shipment. As regards construction machinery, when it is available locally, it is necessary to examine the cost for acquisition of such machinery in each country. If the cost for procurement from Japan is cheaper, it will be shipped from Japan.

(2) Local procurement

As to the major materials such as rubble stones, aggregates and cement which will be locally procured, decision will be made by taking into full account on the producing area, quality, transport capability, etc.

(3) Cost

Comparison will be made as regards the cost for procurement from Japan, the third country and the local market. The lowest price will be taken. 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

Bearing in mind the preceding conditions, the procurement of materials to be used by the Project will be planned as mentioned below.

(1) Materials

Local : Rubble stones, Aggregates, Sands, Cement and Reinforcing bar, etc.  
Japan: Concrete admixture, Joint filler, etc.

(2) Construction machinery

Local : Pontoon with crane, Truck crane, Crawler crane, Bulldozers, Damp-trucks, etc.  
Japan: Backhoe dredger with spuds, Pontoon, Tug boats, Diving-boats, Backhoes, Compressors, Generator, Water sprinkler truck, etc.

### 3.1.6 Implementation schedule

The project under the Japan's Grant Aid Program will be implemented in the following manners.

After the Exchange of Notes is concluded for the preparation of detailed design documents between the two countries, the Japanese consulting firm will be selected by the Government of Palau. Then, a consultant contract will be concluded between the Government of Palau and the consulting firm. The project will be implemented in three stages; i.e. detailed design, tender and construction work.

#### 1) Preparation of detailed design documents

After a consulting contract is concluded between the executing organization of the project in Palau 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 bidders, etc. will be prepared on the basis of this basic design report.

Meantime, the consultation will be held with the Government of Palau regarding the details of the facilities and the approval for a set of tender documents will be obtained from the Government of Palau. Detailed design work would require about 3 months.

#### 2) Execution of tender

The contractor (Japanese Construction Company) who will undertake construction of the project facilities will be selected through tender. The tender will be carried out following the procedures such as the notification, the acceptance of offer, the examination of qualifications, the distribution of tender documents, the execution of tender, the assessment of applications, the selection of the contractor, and the contract of construction. The entire procedure will take approximately 2 months.

#### 3) Execution of construction work

After the construction contract is concluded and is verified by the Government of Japan, construction will be started. Taking into account the scale, type of work, and local conditions, the construction period will be about 8 months assuming that no incidents beyond control will take place.

Figure 3.1.1 shows the implementation schedule covering the period from the conclusion of the Exchange of Notes to the completion of construction work.

MONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Detailed Design	[Bar]					Design/ Cost Estimation, Tender Document								
	[Bar]				Approval of Tender Document							[Bar]		
	[Bar]					Tender and Contract				[Bar]				
Construction	[Bar]					Mobilization, Preparation Work								
	Dredging Work					[Bar]								
	Repair of Landing Quay					[Bar]								
	[Bar]					Demobilization								
	[Bar]					Hand Over								

Figure 3.1.1 Implementation schedule

### 3.1.7 Obligation of recipient country

The obligation of the Government of Palau were confirmed by the Minutes of Discussions during the Basic Design Study implemented in March/June 1998.

To provide an area at the site required for the project,

To provide facilities for the distribution of electricity, water supply and telephone,

To exempt the contractor from customs duties with respect to the supply of products and equipment required for 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 Palau,

To provide conveniences to 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 Palau. And Japanese nationals stay there in for the performance of their work in accordance with the relevant laws and regulations of Palau and

To bear all the expenses other than those covered by the Grant, necessary for the execution of the project.

## **3.2 Project Cost Estimation**

### **3.2.1 Cost to be born by the Government of Palau**

About \$12,600 will be required for the preparation of temporary construction yard with the extent of about 20,000 square meters. Land area for this construction yard shall be prepared by cutting trees, removing obstacles and providing fences.

### **3.2.3 Operation and maintenance costs**

Since sedimentation takes place gradually in the access channel and berthing area, there is a need to carefully observe such phenomenon to establish countermeasures for the future. This means that it is necessary to conduct sounding in the channel on a regular basis in order to examine the state of sedimentation. In this way the state of sedimentation as well as the speed of sedimentation can be known. Such information would be valuable for establishing countermeasures to prevent sedimentation. Hydrographic survey should be carried out once a year.

Rehabilitation of the landing quay will not incur any expenses for the maintenance.

#### **1) Annual expenditure**

Hydrographic survey expense: about 10,000 US\$/year (one survey only)

#### **2) Maintenance and control system**

The Government of Peleliu State consists of 40 staff members. Landing quay and access channel are presently managed by the Public Works Department, which will continue to assume the same responsibility.

## **CHAPTER 4**

### **PROJECT EVALUATION AND RECOMMENDATION**



## CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

### 4.1 Verification of Project Validity and Project Effect

The Republic of Palau consists of many islands and islets, and as such, has depended on sea transportation as means to transport people and goods for many years. The landing quay with small-scale fishing port functions, access channel and adjacent facilities of the North Port are playing an important role as the base for transportation of goods, exchange of information and interchange of people between the land and the sea. As these facilities have deteriorated as many years have elapsed since their construction, the present project is requested for their maintenance.

#### 4.1.1 Verification

The North Port of the State of Peleliu was opened before the last war (about 1930) to transport phosphate rocks produced in the Peleliu Island to Japan. Over 60 years since then, the Port has undergone little maintenance. As a result, the depth of water in the access channel has decreased to about 1.0m, obstructing the navigation of vessels carrying fresh fish to Koror. The landing quay facilities have been greatly damaged, necessitating repairs. Accordingly, the North Port cannot fully fulfill its function as the distribution center for the State of Peleliu, having an adverse effect on the material flow and the promotion of fishery in the State.

The following effects are expected when the present Project has been implemented.

#### 1) Improvement of operation ratio of multi-purpose transport vessels and others.

The multi-purpose transport vessel "Nippon Maru" is the largest among the vessels utilizing the North Port of Peleliu. This vessel is engaged in the transportation of fresh fish catch, machinery and materials for construction, the necessities of life, fuels, and personnel, including sightseers, in the similar manner as other vessels are doing, thus forming the main artery between Peleliu and Koror.

The existing access channel and berthing area were dredged (to about 2.5 ~ 3.0m) during the period of Japanese administration of Palau. As they have not been dredged since then, the depth of water in the access channel and

berthing area has been decreased to less than 1.0m in the shallowest part, due to the sedimentation of sand. Under the present project, therefore, they will be dredged to a depth of 1.5m.

At present, the multi-purpose transport vessels, such as the Nippon Maru, have to wait for the tide because of insufficient depth of water. The Nippon Maru cannot be operated with a probability of about 50%. After dredging to 1.5m, however, this vessel will be operated with a probability of about 90%, nearly eliminating the necessity of waiting for the tide. Accordingly, the operation ratio will be remarkably improved.

#### 2) Revitalization due to repairs of the existing landing quay

The existing landing quay lacks safety because of deterioration resulting from many years of use and requires full-scale repairs as soon as possible. The top height of the quay is 2.3m. This height is suitable for the multi-purpose transport vessels but too high for smaller fishing boats, sightseeing boats, etc., giving rise to practical difficulties in mooring, cargo-handling and getting on and off of passengers. Under the present project, this problem is solved and safety is greatly improved by providing stairs effectively.

As described above, the dredging of the access channel and berthing area and the repairs of the landing quay will enable almost all of vessels to navigate and moor freely and safely. This will make a great contribution to the transportation of fresh fish, the necessities of life, machinery and materials for construction, and sightseers and island inhabitants between Peleliu and Koror. The functions as the base of transportation will be fully recovered and the original functions as the fishing base will also be greatly improved.

#### 4.1.2 Project effect

As this Project aims at improving the living environment of the inhabitants of the State of Peleliu and the basis of production by repairing or restoring the badly deteriorating facilities, the following effects can be derived.

- 1) As it becomes possible to draw up an operation schedule in which multi-purpose transport vessels and other large vessels can navigate more freely and safely without waiting for the tide, services to users is improved and the necessities of life, such as fresh fish and agricultural products, can be supplied on a stable basis.



- 2) It will become possible for large vessels, including multi-purpose transport vessels, to have an easier access, mooring and departure from the landing quay.
- 3) As a result of full-scale repairs of the existing landing quay, the usability of the landing quay by fishing boats is promoted, with a result that the fish catch will be increased.
- 4) The facilities under this Project can serve also as the infrastructure necessary for the development of tourism which is a promising industry along with the fishing industry for the State of Peleliu.

#### **4.1.3 Method for verification of validity**

Of the items requested, dredging of the access channel and berthing area and repairs of the landing quay have a higher priority. These items not only make a great contribution to the convenience of local inhabitants and users of the facilities but also provide a useful and effective basis for future development on a national level.

Based on the results of the verification of the following items, the objectives, contents and course of the Project are judged to be reasonable as an object of the Grant Aid Program.

- 1) The facilities provide not only the fishing port functions to support the fishing industry but also the functions as the basic infrastructure to support the production and living activities of the inhabitants of the Peleliu Island. They hold an important role and position in the project planned by the Government of Palau to support the local industries and improve the living environment.
- 2) The facilities are in line with the intentions of the Government of Palau and the general inhabitants and fishermen of the State of Peleliu. The earliest possible implementation of the Project is desired.
- 3) The maintenance of the facilities is undertaken by the Government of Peleliu State. The budget and personnel required for the maintenance will not be a

burden to the Government of Peleliu State.

- 4) In the present Project, the facility design and work plan are studied in due consideration of environment. In the Environmental Assessment Report prepared by the Ministry of Resources and Development of this country (not completed yet), it is stated that this Project has no adverse effect on the natural environment around the Project Site.

#### 4.2 Recommendation

It is planned that the facilities under this Project will be maintained as the public facilities under the control of the Government of Peleliu State.

Of the facilities, the repaired landing quay requires little labor and little cost for maintenance. However, the access channel and berthing area are always subject to burying with sand. Accordingly, the Government Peleliu State has an obligation and responsibility to investigate the burying state of the access channel and berthing area under the initiation of the Bureau of Public Works, Ministry of Resources and Development, to obtain important data for access channel dredging in the future.