

**Republic of Palau**

**Ministry of Natural Resources, Environment and Tourism**

**PREPARATORY SURVEY REPORT**

**ON**

**THE PROJECT FOR RENOVATION OF PALAU MARICULTURE**

**DEMONSTRATION CENTER FACILITY**

**IN THE REPUBLIC OF PALAU**

*August 2016*

**Japan International Cooperation Agency**

**Fisheries Engineering Co., Ltd.**

**Fisheries and Aquaculture International Co., Ltd.**

## PREFACE

Japan International Cooperation Agency (JICA) conducted the preparatory survey and entrust the survey to Joint venture consist of Fisheries Engineering Co., Ltd. and Fisheries and Aquaculture International Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Palau, and conducted field investigations. As a result of further studies in Japan, 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.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Palau for their close cooperation extended to the survey team.

August, 2016

Hiroto MITSUGI

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## SUMMARY

### (1) Overview of country

The Republic of Palau (hereinafter referred to as “Palau”) is an island country located in the central-western part of the Pacific Ocean and composed of about 300 islands. Its land area is about 488 km<sup>2</sup> (almost the same size as Yakushima Island of Japan), while it has an exclusive economic zone of about 630,000 km<sup>2</sup>. Palau has a maritime tropical climate, composed of a dry season (from November to April) and a rainy season (from May to October), although there is not a distinguished difference between the two seasons. The annual mean temperature is 28.0°C, which, too, does not vary significantly throughout the year. The annual average rainfall is about 3,700 mm (2007 – 2013). Its four major islands such as the islands of Babeldaob and Koror have a volcanic origin and other islands are composed of raised coral reefs. This provides Palau with landscapes of scenic views including rocks of unusual shape which erosion by waves has created and a rich natural oceanic environment to attract tourists.

The population of Palau, which is 21,097 (2014; World Bank) is mainly Micronesian, of which, about 6,500 people come from overseas to work in the service industry. Palau has official languages of Palauan and English, while the State of Angaur has three official languages of Angauran, English and Japanese. The major religion in Palau is Christianity. In 2006, the country’s capital was moved from Koror City to Melekeok of the Babeldaob Island, while about two-thirds of its population still concentrate in the State of Koror which is a center of the Palau economy.

In Palau, which obtains a financial assistance from America based on the Compact of Free Association with the United States, a majority of adults are employed as public servants, while quite a large number of foreign nationals work at hotels, restaurants and retail shops in the private sector. Therefore, it can be said that major features of the Palau economy are the large-sized public sector, a large number of foreign workers, chronic trade deficits and the particularly recently booming tourist industry.

The country’s provisional GDP for 2014 was US\$184.6 million and the country has an industrial structure with primary industry accounting for 7.2% of the entire economy, secondary industry accounting for 9.7% and tertiary industry accounting for 90.9%. When looking at Palau’s industry composition, the public sector accounts for 28.5%, the wholesale/retail and car repair industries account for 25.2%, the hotel/restaurant industry accounts for 24.3% and the real estate industry accounts for 17.9% (2014; Statistical Yearbook). The fisheries industry accounts for 2.4% of GDP. Palau’s GNI is US\$230 million, which corresponds to GNI per capita of US\$11,110, while the economic growth rate is 8.0% and the inflation rate is 1.6% (2014; World Bank).

Palau is a small island country and it relies on imports for almost all of its supply of fuel, foodstuff and daily commodities. Marine products which are mainly composed of the tuna are a major export item but the country’s exports amounting to US\$19 million significantly falls short of imports amounting to US\$149 million (2014; Asian Development Bank).

On the other hand, a large number of tourists visit Palau, being attracted to a world class rich coral reefs and their marine ecosystem and in recent years, the tourist industry accounts for three-quarters of GDP growth rate, more than 80% of total exports, 15% of tax revenue and 40% of employment (2014; International Monetary Fund). Partly because the Rock Islands of Palau were designated as a UNESCO World Heritage Site in 2012, the number of tourists visiting from overseas increased to 167,000 in 2015

from 58,000 in 2002 (Palau Visitors Authority). Although traditionally, tourists who visit Palau were mainly from Japan, Taiwan, South Korea and the United States, since around 2011 tourists from China have increased to reach 87,715 in total in 2015, which accounts for a majority of tourists visiting Palau in the year.

(2) Background, circumstances, and overview of project

Traditionally fisheries are positioned as a major industry in Palau and have been contributing to the country by creating jobs and securing earnings. In addition, the tourist industry based on its rich maritime environment forms the most important industry of Palau, with the number of tourists on an increasing trend.

Palau's tourist industry significantly relies on its beautiful maritime environment, and so, the Government of Palau gives particular attention to the conservation of such environment, by working on appropriate dissemination of mariculture as well as necessary regulations and monitoring of coastal and offshore fisheries with an aim at sustainable development of marine resources well-balanced with the natural environment. As part of the government effort, the Bureau of Marine Resources (BMR) of the Ministry of Natural Resources, Environment and Tourism (MNRET) has been engaging to produce giant clam seedlings and promote giant clam culture at the Palau Mariculture Demonstration Center (PMDC) as its operation base.

Tourists demand for giant clams intensifies pressure to increase catches. Giant clams are not only used as a foodstuff by local people and tourists domestically but also exported mainly to Europe and the United States for ornament or accessory use. As the result, wild giant clams that can be caught easily are currently at risk of depletion. As demand from hotels and restaurants is increasing, theft of giant clams under farming occurs more often, too.

Considering the situation, the Government of Palau has developed a "bill concerning the establishment of a Giant Clam Seed Sustainability Project Fund" with an aim at strengthening its policies to promote giant clam culture and has worked to increase production of seedlings by inviting an expert on giant clam cultivation from the Overseas Fishery Cooperation Foundation (OFCF). Also, the government plans to develop a "bill concerning the ban on sale, purchase of giant clams (House Bill No. 9-202-12)" in order to regulate sales of wild giant clams and prevent theft of clams under cultivation.

PMDC, the only facilities enabling the production of giant clam seedlings in Palau, succeeded the former Micronesian Mariculture Demonstration Center (MMDC) founded in 1973 and changed the name to present PMDC when the country became independent in 1994. As the physical facilities of PMDC deteriorated, in 1999 and 2003, OFCF repaired water tanks and later in 2005, constructed an elevated water tank. Although ongoing maintenance services for pumps and boats have been offered, the facilities continue to deteriorate, for example, the quantity of seawater supply is decreasing, larval tanks are broken and tanks for nursery and grow-out phase culture experience water leakage. As such repair has been made to broken facilities repeatedly whenever necessity arises, the entire facilities are now in a poor condition that requires urgent improvement. There are a range of difficulties at PMDC including poor overall management, inefficient service traffic line and deteriorated giant clam seed production in terms of volume and efficiency.

Under such a circumstance, in February 2015, the Government of Palau requested Japan to provide

grant aid for a comprehensive refurbishment of PMDC, specifically, to strengthen giant clam seed production through the refurbishment so that depletion of giant clams can be prevented and hence to stimulate sustainable development of the country's marine resources as well as industries including the tourist industry.

### (3) Summary of Study Results and Details of the Project (Outline Design and Summary of Facilities/Equipment Plans)

In response to the Palau Government's request, the Government of Japan decided to implement a preparatory survey and JICA dispatched a survey team to Palau for a period from November 1 to December 3, 2015. Also from July 3 to 8, 2016, discussions were made concerning details of the outline design and the Palau side's share of responsibilities.

As the result of the field surveys, the following facts were found. Although giant clams are important in terms of both traditional food and export commodity, the number of wild giant clams has been significantly decreased due to over-exploitation, while demand is increasing as tourists increase, which generates concerns about depletion of some species. Although PMDC is the only organization to produce giant clam seedlings for mariculture, they cannot supply seedlings stably as the facilities' functions have been deteriorating. In order to reverse such a situation, it is necessary to stabilize the survival rate of juvenile clams at 80% and develop facilities that can produce giant clam seedlings stably to meet demand. It is expected that demand for giant clams will be 90,100 (target for 2021) based on a fact-finding survey on distribution and a demand forecast and, as the result, in this project, it is planned to develop facilities that have a production capacity of 112,000 with the survival rate of 80% from the time of shipment to farmers to the time they are harvested for distribution.

In this project, a 25kW solar power generation system will be installed in order to reduce the operation cost and to utilize natural lighting and LED lighting fixtures to save power consumption. In addition, the project is planned to make environmental considerations by installing and effectively using rainwater reservoir tanks as supplementary supply for water for miscellaneous use, since in Palau around 3,700 mm annual precipitation can be expected.

Furthermore, the existing PMDC facilities receive students' visits for educational purposes, while being opened also to the public such as tourists as one of tourist destinations. As giant clam broodstocks to be used for reproduction are kept in the sea area in front of PMDC and as it can be made another tourist attraction of PMDC, it is planned to create a spot for snorkeling if any tie-in with the tourist agencies becomes possible, so that an increasing number of tourists can be attracted.

Although the recipient country initially requested assistance for lodging facilities (4 rooms), it is decided not to include them in this project since nearby accommodations can be used and there is no need to plan any night-duty room as nighttime work has not been done in the past.

This project is planned to be implemented to meet an objective to contribute to the promotion and increase of giant clam culture in Palau by strengthening the functions of PMDC. Under this objective, it is planned specifically to construct a mariculture demonstration center building, sheds, an elevated water tank building, a machinery house, a pump house, etc. as well as to procure equipment for giant clam culture, for laboratories and for promotion and data processing.

Design summaries are as follows.

Item	Outline of specification	Quantity
1) Building facilities Mariculture demonstration center building	Reinforced concrete structure, two-story (1F) Exhibition hall/gift shop, workshop, diving gear store, dry laboratory / preparation room, wet laboratory / inspection room, storage, dining kitchen, public toilets, shower room, entrance (2F) Manager room, expert room, staff room, library / meeting room, toilets, utilities, corridor	536.0m <sup>2</sup>
Sheds	Base : reinforced concrete structure, roof framing : wood Larvae tanks (12 tanks, 911.68 m <sup>2</sup> )、 Juvenile clam tanks (64 tanks, 181.28m <sup>2</sup> )	1,840.8 m <sup>2</sup>
Elevated water tanks building	Reinforced concrete structure, two-story Machinery room, electric room, elevated water tank	63.75 m <sup>2</sup> , 12 m (H)
Machinery house	Reinforced concrete block structure, one-story Emergency generator	24.5 m <sup>2</sup>
Pump house	Reinforced concrete block structure, one-story Sea water intake pump	24.5 m <sup>2</sup>
Exterior facilities	Car parking, boat parking, manual jib crane, renovation of quay steps, paving	
2) Equipment For giant clam culture	Shade nets, scope nets, plastic container, plastic basket, polyethylene nettings, electric tools (high speed cutter, grinder), hand tools, etc/	1 set
Laboratory equipment	Profile projector, biological microscope, stereoscopic microscope, refrigerator, freezer, glassware, dissection apparatus, electric balance, UV water sterilizer, salinity refractometer, thermometers, etc.	1 set
Equipment for promotion and data processing	Diving gear, utilities boat, desktop computer, printer/ photocopier, multifunction copier scanner, projector, aquarium, glass display case, etc.	1 set

#### (4) Project term and approximate project cost

The required overall project term consists of 6.0 months of detailed design and tender operations and 10.0 months of facilities construction.

The cost to be borne by Palau in case the project is implemented under the grant aid is estimated to be about 99,700 US dollar (about 12.1million yen).

#### (5) Project Evaluation

By implementing this project, PMDC's capability to produce giant clam seedlings will be enhanced and hence it will be possible to ensure more stable production of seedlings that is essential for the promotion of giant clam culture and propagation. Through a stable supply of giant clam seedlings, mariculture businesses will be able to continue to operate more easily, which can contribute to an increased production

of giant clams to be used for food supply, propagation and ornament products to be exported to foreign countries. In addition, as PMDC’s awareness-raising capability will also be enhanced, the people of Palau will have a stronger awareness of conservation of marine environment. In turn, this will enable prevention of giant clam resource depletion and more sustainable use of such a resource, thereby contributing to the most important industry in Palau, the tourist industry. Through an increased production of cultured giant clams, it can be expected that this project will significantly contribute to the overall plan, the Palau 2020 National Master Development Plan. Therefore, it is judged highly relevant to implement this project with Japanese grant aid.

In this project, direct beneficiaries will be 6 staff members of PMDC and 25 existing giant clam farmers. In addition, there will be indirect beneficiaries who are hotels and restaurants using farmed giant clams and the entire people of Palau who will be supplied with giant clams as foodstuff.

Under Japan’s country assistance policy for Palau, “environmental/climate changes” and “overcoming vulnerability” have been selected as priority areas and it is set that assistance be provided to stimulate environmental conservation as well as the country’s private sector such as the tourist industry. This project is conforming to the policy.

< Effectiveness >

The effectiveness of this project is considered sufficiently high as the following effects can be expected.

1) Quantitative Indicators of the Project’s Effectiveness

Indicator	Reference value (2015)	Target value (2021) (3 years after the completion of the project)
Survival rate of giant clam at the initial juvenile phase (%)* (4 – 6 months after replaced from the larval tank to the nursery tank)	N/A	80**
Annual production quantity of juvenile giant clams (the number of clams)	32,869***	112,000

\* Owing to the juvenile clams for ornamental purpose are intentionally culled, survival rate is applied for food clam species only.

\*\* The 80% average survival rate on a continuing basis leads to stable production.

\*\*\*The population size of annually produced juvenile giant clams for 2015 is the number of clams shipped.

2) Qualitative evaluation

- ① The level of satisfaction of farmers who purchase giant clam seedlings produced by PMDC will increase.
- ② Activities for environmental awareness-raising implemented by PMDC will be further enhanced.

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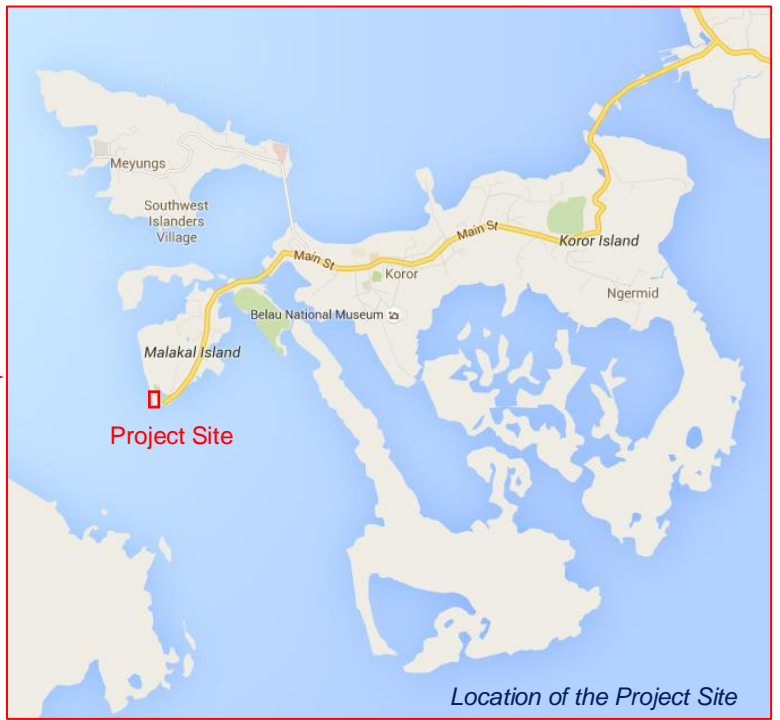
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## ABBREVIATIONS

Abbreviation	Formal Name
ADB	Asian Development Bank
BMR	Bureau of Marine Resources
CIP	Capital improvement Project
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DMLE	Division of Marine Law Enforcement
EIS	Environmental Impact Statement
EL	Elevation Level
E/N	Exchange of Notes
EQPB	Environmental Quality Protection Board
FAO	Food and Agriculture Organization
G/A	Grant Agreement
GL	Ground Level
HWL	High Water Level
IEE	Initial Environment Examination
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
JOCV	Japan Overseas Cooperation Volunteer
KSPLA	Koror State Public Lands Authority
LWL	Low Water Level
MED	Marine Export Declaration
MMDC	Micronesia Mariculture Demonstration Center
MNRET	Ministry of Natural Resources, Environment and Tourism
MPIIC	Ministry of Public Infrastructure, Industries and Commerce
NGO	Non-Government Organization
OFCF	Overseas Fishery Cooperation Foundation
PACA	Palau Aquaculture Association
PAN	Protected Area Network
PFDf	Pacific Fisheries Development Foundation
PICRC	Palau International Coral Reef Center
PMDC	Palau Mariculture Demonstration Center
SPC	Secretariat of the Pacific Community
WB	World Bank



## CHAPTER 1 BACKGROUND OF THE PROJECT

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

## **1-1 Background of the Project**

Traditionally fisheries are positioned as a major industry in the Republic of Palau (hereinafter referred to as “Palau”) and have been contributing to the country by creating jobs and securing earnings. In addition, the tourist industry based on its rich maritime environment forms the most important industry of Palau, with the number of tourists on an increasing trend.

Palau’s tourist industry significantly relies on its beautiful maritime environment, and so, the Government of Palau gives particular attention to the conservation of such environment, by working on appropriate diffusion of cultivation as well as necessary regulations and monitoring of coastal and offshore fisheries with an aim at sustainable development of marine resources well-balanced with the natural environment. As part of the government effort, the Bureau of Marine Resources (BMR) of the Ministry of Natural Resources, Environment and Tourism (MNRET) has been engaging to produce giant clam seedlings and promote giant clam culture at the Palau Mariculture Demonstration Center (PMDC) as its operation base.

Meanwhile, a number of tourists visit Palau from overseas, being attracted to the world class rich coral reefs and their marine ecosystem and in recent years, the tourist industry accounts for three-quarters of GDP growth rate, more than 80% of exports, 15% of tax revenues and 40% of employment (IMF; 2014).

Accordingly, in 2015 the number of tourists reached 167,000, having been just 58,000 in 2002. This, in turn, increases demand for giant clams and intensifies pressure to increase catches. Giant clams are not only used as a foodstuff by local people and tourists domestically but also exported mainly to Europe and the United States for ornament or accessory use. As the result, wild giant clams that can be caught easily are currently at risk of depletion. As demand from hotels and restaurants is increasing, theft of Giant clams under cultivation occurs more often, too.

Considering the situation, the Government of Palau has developed a “bill concerning the establishment of a Giant Clam Seed Sustainability Project Fund” with an aim at strengthening its policies to promote giant clam cultivation and has worked to increase production of seedlings by inviting an expert on giant clam culture from the Overseas Fishery Cooperation Foundation (OFCF). Also, the government plans to develop a “bill concerning the ban on sale, purchase of giant clams (House Bill No. 9-202-12)” in order to regulate sales of wild giant clams and prevent theft of clams under farming.

PMDC, the only facilities enabling the production of giant clam seedlings in Palau, succeeded the former Micronesian Mariculture Demonstration Center (MMDC) founded in 1973 and changed the name to present PMDC when the country became independent in 1994. As the physical facilities of PMDC deteriorated, in 1999 and 2003, OFCF repaired water tanks and later in 2005, constructed an elevated water tank. Although ongoing maintenance services for pumps and boats have been offered, the facilities continue to deteriorate, for example, the capacity of water intake and supply system are decreasing, larval tanks are broken and tanks for nursery and grow-out phase cultivation experience water leakage. As such repair has been made to broken facilities repeatedly whenever necessity arises, the entire facilities are now in a poor condition that requires urgent improvement. There are a range of difficulties at PMDC including poor overall management,

inefficient service traffic line and deteriorated seed production in terms of volume and efficiency.

Under such a circumstance, in February 2015, the Government of Palau requested Japan to provide grant aid for a comprehensive refurbishment of PMDC, specifically, to strengthen giant clam seed production through the refurbishment so that depletion of giant clams can be prevented and hence to stimulate sustainable development of the country's marine resources as well as industries including the tourist industry.

### 1-1-1 Request Components Confirmed through Preparatory Study

After making discussions concerning the request details based on the result of field survey, changes to the request components have been confirmed as listed in the table below.

Table 1-1 Content of initial request and changes made

#### 1) Building facilities

No.	Item	Requested component	Result	Priority
1	Mariculture promotion center building	Entrance hall	The gift shop should be located in a corner of the entrance and exhibition hall space and the handicraft-processing workshop should be set up separately.	A
		Exhibition hall		
		Handy-craft shop		
		Giant clams trading room	withdrawal of request	C
		Diving gear store	Diving gear store	A
		Workshop	withdrawal of request	C
		Kitchen/dining rooms	Kitchen/dining rooms	A
		Night duty room	Need examination in Japan	B
		Preparation rooms	Dry laboratory	A
		Wet laboratory/hatching room	The planned wet laboratory/hatching room should be changed to the wet laboratory/inspection room.	A
		Storages	Storages	A
		Domitories	Need examination in Japan	B
		Director's room	Director's room	A
		Scientist's room	Scientist's room	A
		Staff room	Staff room	A
Library/meeting room	Library/meeting room	A		
Toilets	With respect to toilets, public toilets/shower rooms should be set up separately from those for staff.	A		
Utilities	Utilities	A		
2	Sheds	Transparent roofing above paved rearing areas (approx. 1,200 m <sup>2</sup> )	Transparent roofing above paved rearing areas	A
3	Machinery house	Rooms for setting seawater intake pumps, air blowers, an emergency generator and elevated seawater reservoirs (40 m <sup>2</sup> )	Rooms for setting seawater intake pumps, air blowers, an emergency generator and elevated seawater reservoirs The planned elevated water tanks in the machinery house and the power generator room should be set up separately.	A

No.	Item	Requested component	Result	Priority
4	Seawater and air supply system	Seawater intakes x 2	Seawater intakes x 2	A
		Seawater intake pumps x 3	Seawater intake pumps x 3	A
		Air blowers x 4	Air blowers	A
			Submerged sand filtration tank (Seawater intake/air supply facilities)	A
		Elevated seawater reservoirs x 2	Elevated seawater reservoirs x 2	A
		Piping and electrical works x 1set	Piping and electrical works x 1set	A
		Emergency generator x 1	Emergency generator x 1	A
5	Solar power generating system	50 kW or sufficient capacity to cover daytime power consumption at PMDC	50 kW or sufficient capacity to cover daytime power consumption at PMDC	A
6	Culture tanks	FRP raceways (Equipment)	RC raceways	A

## 2) Civil engineering facilities

No.	Item	Requested component	Result	Priority
1	Slipway	Approx. 40m for small FRP boats landing	withdrawal of request	C
2	Landing quay renovation	Renovation of quay steps	Renovation of quay steps, Installation of mooring buoys, Bollards, Fenders for small boats	A
		Installation of mooring buoys		
		Bollards		
		Fenders for small boats	Manual jib crane on the quay	A
3	Exterior facilities	Car parking, boat parking gate, etc.	Car parking, boat parking gate, fence etc.	A

## 3) Equipment

No.	Item	Requested component	Result	Priority
1	Equipment for giant clam culture and trade	Assorted FRP raceways for nursery, grow-out and display, plastic tanks for spawning, egg collecting, incubating, stocking and diatom culturing, plastic containers and baskets, weighing scale, work tables, stools, etc.	Equipment for giant clam cultivation/sales is planned to be procured as equipment for seed-clam production, while the FRP water tanks for cultivation should be changed to RC tanks and be set up as part of the construction plan.	A
2	Laboratory equipment	Salinity refractometers, digital and rod thermometers, portable DO meter, biological microscope, stereoscopic microscope, glassware. Laboratory utensils, refrigerator, freezer, laboratory tables, stools, etc.	Equipment for laboratories should be procured as equipment for the dry laboratory and equipment for the wet laboratory.	A
3	Promotion and data processing equipment	Projection screens, video projector, computers, USP, network equipment, printers, flatbed scanner, etc.	Equipment for promotion, data processing and others should be procured as office OA equipment, outdoor work equipment and shell processing equipment.	A

### (1) Components cancelled (Priority C)

#### 1) Workshop

During the discussions, the Palauan side requested that the workshop for processing, making and repairing various types of pipe, water tanks and mariculture material/equipment should be

deleted from their request as the existing workshop can be used for the purpose. After confirming the existing workshop and finding no inconsistency with what the Palauan side recognized, it is decided to exclude it from the planned components under this project.

## 2) Giant clams trading room

Initially, it was planned to prevent illegal distribution such as theft by centralizing giant clam trade for domestic distribution at PMDC, but following the development of a legal system for domestic distribution of giant clams, the initial plan was shelved. Meanwhile, it was found that, of the four exporters of giant clams for the international aquarium market, two Palauan exporters were operating a packaging service for export when an inspection was made at PMDC. Based on this fact, a new request was presented to add an inspection/packaging function for export to the wet laboratory, rather than establishing a new giant clams trading function.

## 3) Slipway

The Division of Marine Law Enforcement (DMLE) of the Ministry of Justice located about 200m north of the project site has a plan to increase and improve its boats and facilities obtaining funds from the Nippon Foundation and it was found that in this plan a slipway would be constructed. The DMLE responded to our inquiry about their plan, indicating the slipway when completed could also be used by BMR. Since BMR considered it unnecessary to construct a slipway separately on their own under this project if the DMLE would construct one, and it was decided to exclude the plan for slipway from the planned components under the project.

## (2) Components that were changed

### 1) Handicraft retail space, etc. (Mariculture Demonstration Center building)

The admission fee for a general visitor to PMDC is US\$2, but owing to the current payment counter for visitors is located inside BMR building, visitors are often admitted without being charged.

When the facilities are completed under this project, it is planned to make admission tickets available at the handicraft retail space, the location of which is also planned to change and move to a corner of the entrance and exhibition hall. A request was also made to separately set up a workshop for processing clam shells (cutting, polishing, etc.).

### 2) Preparation room and wet laboratory/hatchery room (Mariculture Demonstration Center building)

Responding to our inquiry concerning the details of seed production work at PMDC, a request was made to change the initially planned preparation room to a dry laboratory to inspect maturity of clams, fertilized eggs, state of hatchling, etc. and the wet laboratory/hatchery room to a wet laboratory to keep fertilized eggs and hatchlings, respectively.

### 3) Toilets (Mariculture Demonstration Center building)

As there is no toilet at PMDC currently tourists have to use toilets located in the BMR

building. Not only tourists but also PMDC staff experience inconvenience. A request, therefore, was made to set up toilets exclusively for tourists, apart from those for staff. Another request was made to attach a shower/changing room to the toilets as works have to be conducted also in the sea.

4) Pressure sand filter (seawater intake/air supply facilities)

PMDC installs a bag filter on the inlet of larval tanks to prevent harmful living things from entering the tanks and remove small substances but the filter often comes off due to clogging. A request was made to add a pressure sand filter so that filtrated seawater will be supplied steadily.

5) Culture tanks (equipment)

Initially a request was made to procure fiber reinforced plastic (FRP) tanks to be used for giant clam rearing, while a request was newly made to provide reinforced concrete (RC) tanks that are the same as those currently used.

6) Repair of seawall

With respect to repair of the seawall, a proposal was submitted that considerations should be made to plan a seawall that can be used not only for practical work operation but also for tourists.

7) Fence (parking lots and other auxiliary facilities)

The existing facilities at PMDC are surrounded by a fence, which will need to be removed when construction is going on. A request, therefore, was made to additionally include a fence in the plan to restore the facilities to their original condition.

In conclusion, components agreed and confirmed between the survey team and the Government of Palau through reviews of the minutes produced during the preparatory survey are shown in Table 1-2. Concerning equipment, a list of equipment to complement the Minutes of Discussions was submitted and based on which, reviews will be made.

Table 1-2 Request components confirmed through Preparatory Survey

No.	Requested component	Priority		
		A	B	C
<b>1 Mriculture Promotion Center Building</b>				
1)	Entrance hall	●		
2)	Exhibition hall	●		
3)	Preparation room for handy-craft	●		
4)	Diving gear store	●		
5)	Kitchen/dining rooms	●		
6)	Night duty room		●	
7)	Dry laboratory	●		
8)	Wet laboratory	●		
9)	Storages	●		

No.	Requested component	Priority		
		A	B	C
10)	Domitories			•
11)	Manager's room	•		
12)	Scientist's room	•		
13)	Staff room	•		
14)	Library/meeting room	•		
15)	Toilets	•		
16)	Utilities	•		
17)	Shower room	•		
<b>2 Raceway tanks</b>				
1)	For nursery	•		
2)	For grow-out	•		
<b>3 Sheds</b>				
1)	Transparent roofing above paved rearing areas	•		
<b>4 Machinery house</b>				
1)	Seawater intake pumps, air blowers, emergency generator	•		
<b>5 Seawater and air supply system</b>				
1)	Seawater intake and air supply system, air blowers, elevated seawater reservoirs	•		
<b>6 Public utility</b>				
1)	Toilets	•		
2)	Shower room	•		
<b>7 Solar power generating system</b>				
1)	For daytime power consumption	•		
<b>8 landing quay renovation</b>				
1)	Renovation of quay steps	•		
2)	Installation of mooring buys	•		
3)	Manual jib crane	•		
<b>9 Exterior facilities</b>				
1)	Car parking	•		
2)	Boat parking	•		
3)	Gate	•		
4)	Fence	•		
<b>10 Equipment</b>				
1)	Equipment for giant clam culture	•		
2)	Laboratory equipment	•		
3)	Equipment for promotion and data processing	•		

A: Considered essential (First priority)

B: Considered necessary (Second priority)

C: Unjustifiable as a grant aid project component or given the lowest priority

## 1-2 Natural Conditions

Locations of the natural condition survey are shown in Figure 1-1.



Figure 1-1 Locations of the natural condition survey

### 1-2-1 Oceanography

#### (1) Tides

Tidal designation and tide amplitude in Marakal harbor are shown in the following table.

Table 1-3 Tidal designation and tide amplitude in Marakal Harbor

Tidal designation		(cm)		Tide amplitude	Angular velocity
Highest High Water Level	HHWL	197	M2	52.5 cm	303.8°
Mean Higher High Water spring	MHHWS	180	S2	20.9 cm	334.7°
Benchmark Zero	BM Zero	138	K1	19.6 cm	86.5°
Mean Sea Level	MSL	108	O	114.7 cm	72.1°
Mean Lowest Low Water spring	MLLWS	35	N2	10.2 cm	289.5°
Lowest Low Water Level	LLWL	18	P1	6.5 cm	88.5°
Chart Datum Line	Zo	0	K2	6.0 cm	327.7°

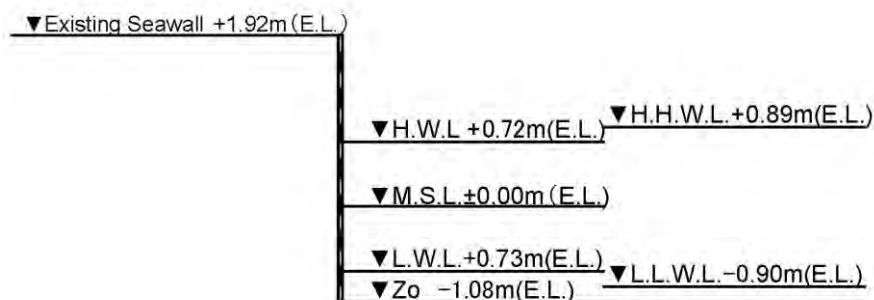


Figure 1-2 Reference level in nautical chart



(2) Seabed topography and waves

Waves at normal times are small, while it is expected the project site will be affected when a typhoon or a low-pressure system passes by. Based on previous data on wind conditions and calculations of waves hitting the site, the design waves are obtained as follows.

Wave direction : W	Wave Hight : 1.4m	Period : 4.6 sec
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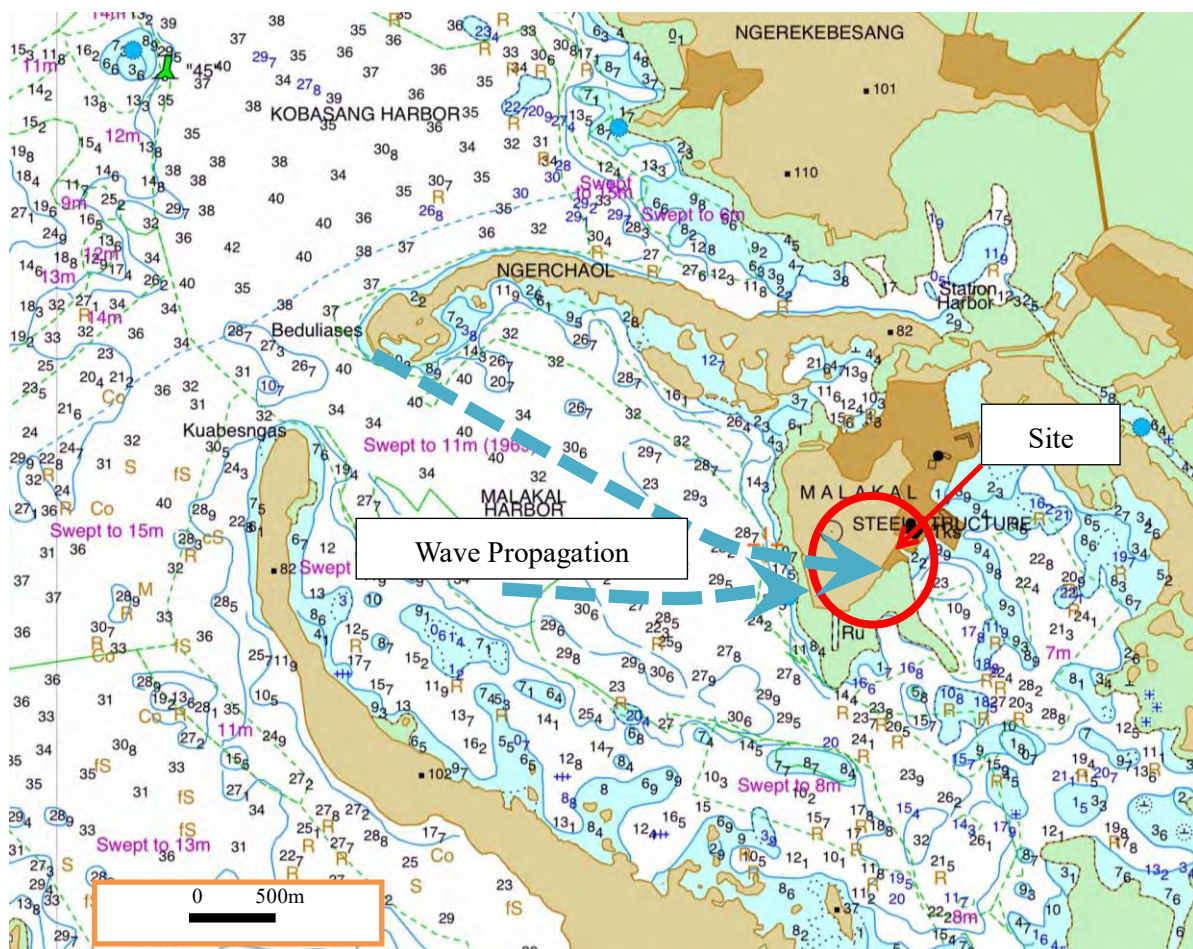


Figure 1-3 Approach routes of waves

Result of the bathymetric survey is shown in Figure 1-4.

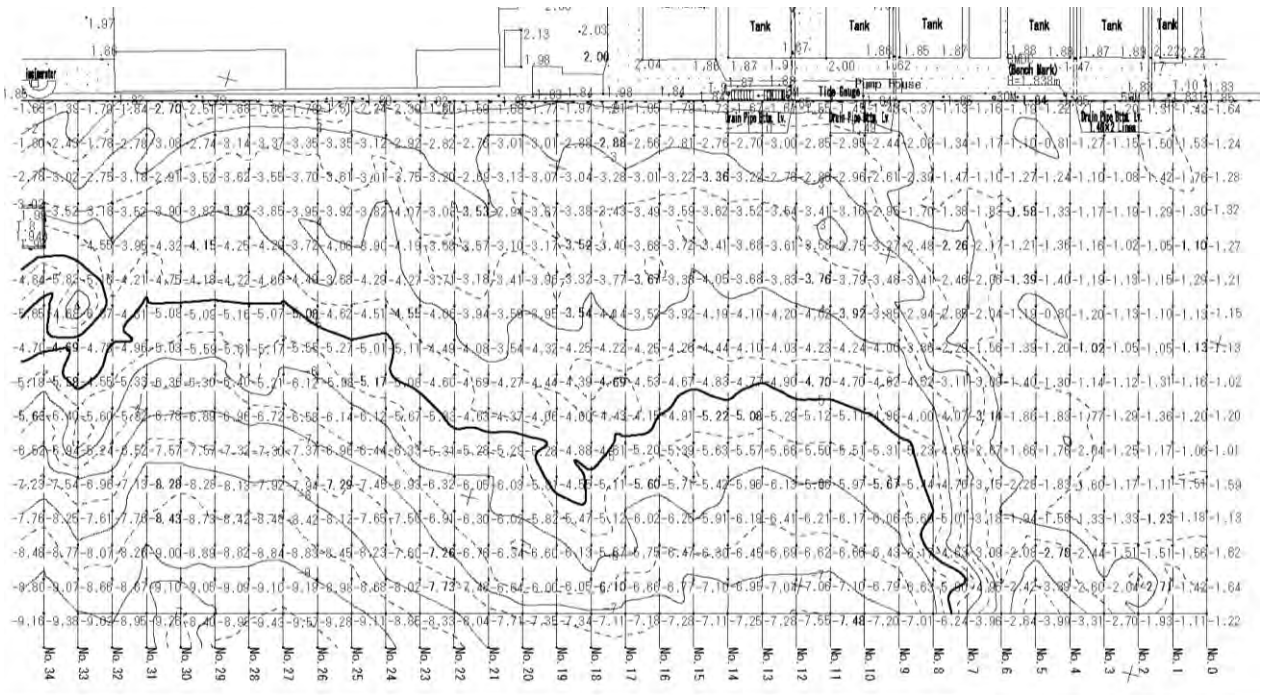


Figure 1-4 Bathymetric survey plan

### 1-2-2 Groundwater

In test pits (1.0m under the ground surface), no groundwater was observed.

### 1-2-3 Topography

Result of the topographic survey is shown in Figure 1-5.

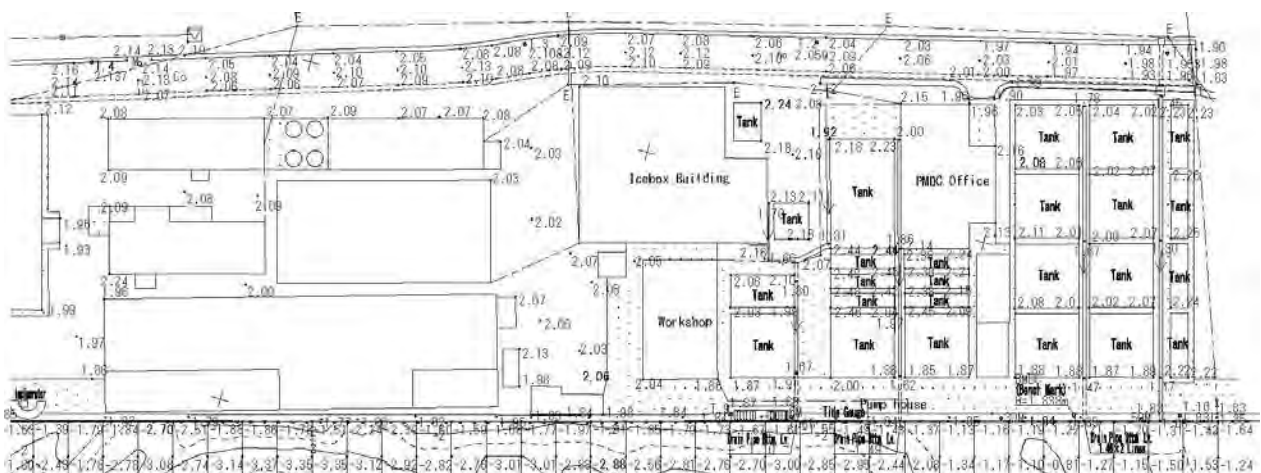


Figure 1-5 Topographic survey plan

**1-2-4 Soil condition**

The Palau Islands are surrounded with elevated coral reefs with a volcanic origin. The Malakal Island has a mountain 126 m above the sea level made of volcanic rocks at the island’s center and is surrounded by a foundation ground made of coral reef.

The area near the project site is covered with shallow water having a coral reef bed which stands on the volcanic rock foundation expanding along the mountain foothill. A land area between the existing BMR building and the PMDC facilities is considered to have been filled with soil cut from the mountain foothill.

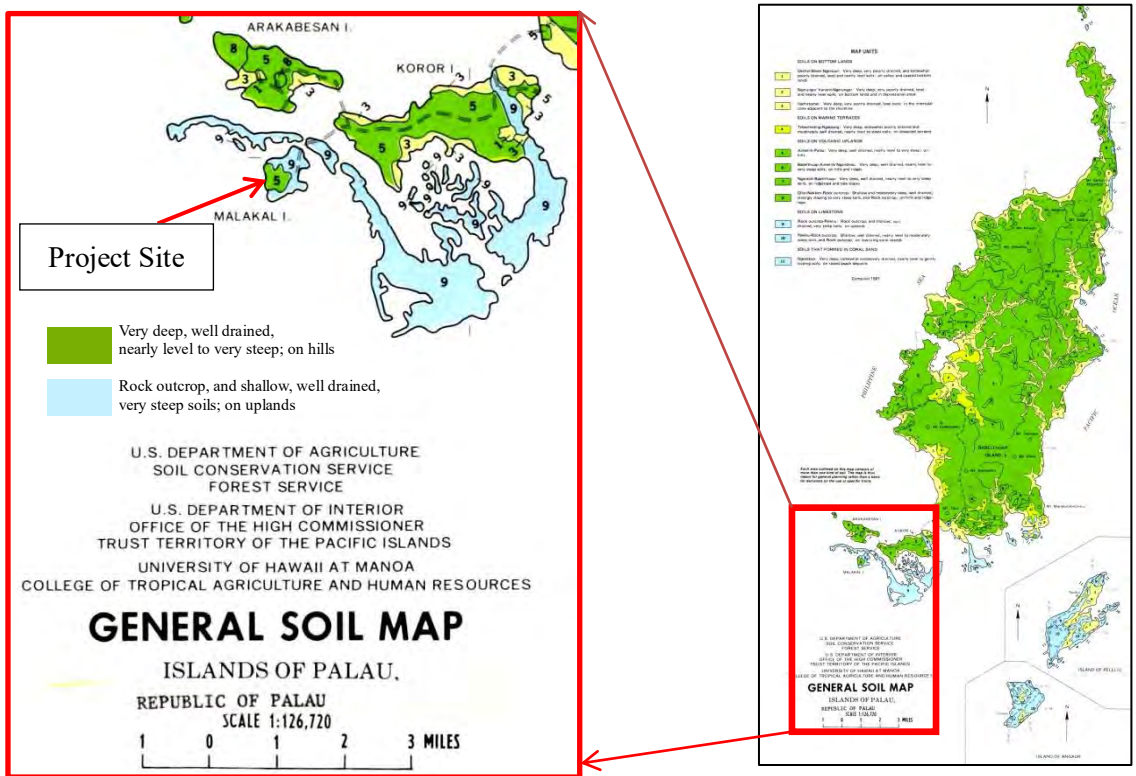


Figure 1-6 Soil condition in the project site

(Source ; [http://www.lib.utexas.edu/maps/australia/palau\\_soil\\_1983.jpg](http://www.lib.utexas.edu/maps/australia/palau_soil_1983.jpg))

**1-2-5 Geotechnical condition**

A soil exploration was implemented at three different test pits (area of 3 square feet and depth of 3 feet, each) using a portable bearing tester (CASPFOL). Based on the correlations between impact acceleration and soil parameters, the device can measure the soil parameters including the internal friction angle ( $\phi$ ) to be measured with a built-in accelerometer. The measurements obtained are shown in Table 1-4.

Table 1-4 Estimated internal friction angle and allowable bearing capacity of foundation ground

Survey ID	Impact Value	Angle of internal friction $\phi$	Shape Factor $\beta$	Unit Weight $\gamma_1$	Minimum Foundation Breadth B	Foundation Correction Factor $\mu$	Coefficient of bearing capacity Nr	Allowable bearing Capacity Qa
1-1	18.5	0.0						
1-2	19.2	33.8						
1-3	18.8	33.4						
1-4	18.7	33.3						
1-5	19.2	33.8						
Average	18.88	26.86	0.3	17.46	1.5	0.87358	28.73	65.7
2-1	18.8	33.4						
2-2	18.9	33.5						
2-3	19.4	34.0						
2-4	19	33.6						
2-5	18.7	33.3						
Average	18.96	33.56	0.3	17.46	1.5	0.87358	29.10	66.6
3-1	18.3	33.0						
3-2	19	33.6						
3-3	19.1	33.7						
3-4	20.6	35.2						
3-5	18.6	33.2						
Average	19.12	33.74	0.3	17.46	1.5	0.87358	29.92	68.4

As the result of the above survey, the foundation ground has an internal friction angle of more than 33 degrees at all points, with a mean value of 33.6 degrees. The allowable bearing capacity was determined depending on the form, size and depth of embedment of the ground foundation and in a trial calculation in which a 1.5m square form is used and no embedment is set, the capacity is determined to be around 66 kN/m<sup>2</sup>.

### 1-2-6 Meteorology

#### (1) Climate

Palau has a maritime tropical climate, composed of a dry season (from November to April) and a rainy season (from May to October). Geographically, the country is located adjacent to an area where typhoons are often created, while it is rarely hit by typhoons. In December 2012, however, Typhoon Bopha and in November 2013, Typhoon Haiyan came close to Palau and left huge damage.

Figure 1-7 shows the monthly mean temperature and rainfall in 2013. The monthly mean temperature was between 27.3°C and 28.5°C and the annual mean temperature was 28.0°C in 2013. When looking at rainfall in 2013, a number of heavy rainfalls were recorded from May to September. Although the total annual rainfall was 2,915 mm, in 2013, the annual average rainfall from 2007 to 2013 was 3,700 mm, which indicates the year 2013 saw a smaller rainfall than other years.

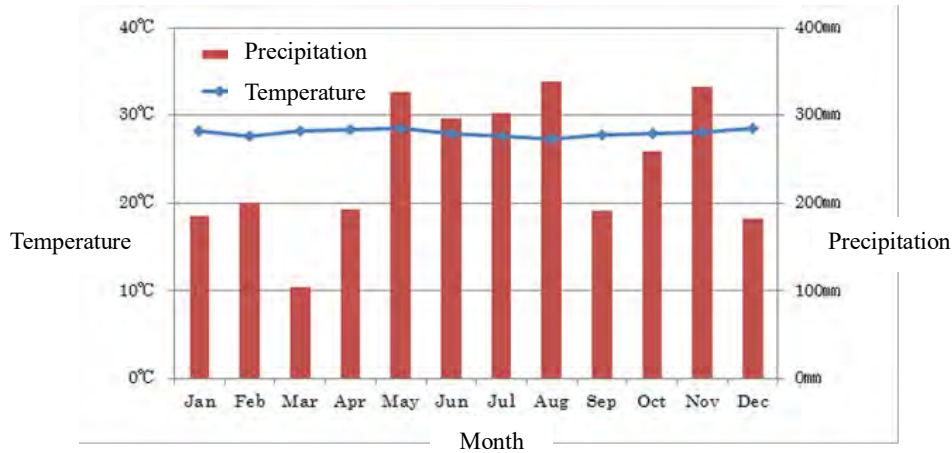


Figure 1-7 Monthly average temperature and rainfall in 2013

(Source: 2013 Statistical Yearbook)

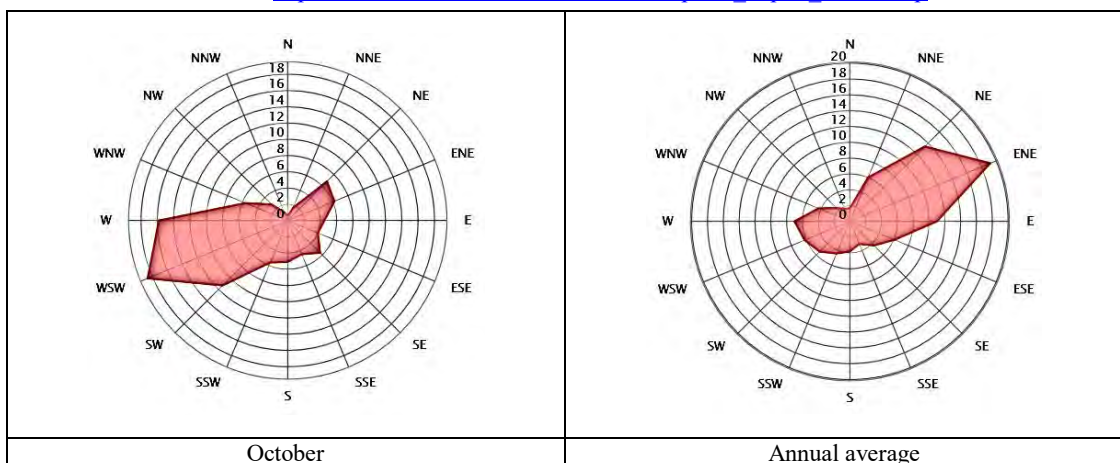
(2) Wind

In Palau, wind primarily blows from a direction between southwest and west from June to October, while, from November to May, it blows from the almost opposite direction between northeast to east-northeast. The average wind speed is 4m/s.

The project site is located in the southwestern part of the Malakal Island where a mountain with a height of 126 m above the sea level screens wind from northeast and east-northeast and the site may only be affected from June to October when typhoons pass by causing southwest and west winds.

Month of year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Month of year	01	02	03	04	05	06	07	08	09	10	11	12	1-12
Dominant Wind dir.	↖	↖	↖	↖	↖	↗	↖	↗	↗	↖	↖	↖	↖
Wind probability >= 4 Beaufort (%)	19	23	17	13	6	11	13	9	18	21	12	18	15
Average Wind speed (m/s)	4	4	4	4	4	4	4	4	4	4	4	4	4
Average air temp. (°C)	29	28	28	29	30	29	28	28	28	29	29	28	28

(Source ; [http://www.windfinder.com/windstatistics/palau\\_airport\\_babelthuap](http://www.windfinder.com/windstatistics/palau_airport_babelthuap))



(Source ; [http://www.windfinder.com/windstatistics/palau\\_airport\\_babelthuap](http://www.windfinder.com/windstatistics/palau_airport_babelthuap))

Figure 1-8 Monthly wind condition and temperature in Palau (November, 2010~May, 2014)

## 1-2-7 Water Quality

(1) Seawater quality analysis in front of the project site

In two points in the seawater area in front of PMDC, surface layer water was sampled to be sent to Japan for analysis. As the result of analysis, the water quality is considered generally good, while a sample extracted on December 2 shows a higher value of total nitrogen, which indicates a possible temporary influence of discharged water from sewage treatment plant.

Table 1-5 Result of the water quality analysis

【Sampling date and hour : 13 Nov. 2015, AM 10:35】

sampling point	Suspended solids (SS)	Total nitrogen	Total phosphorus	Total Organic Carbon
100m off-shore	Less than 1 mg/L	0.11 mg/L	0.022 mg/L	0.8 mg/L
Near seawall	Less than 1 mg/L	0.14 mg/L	0.020 mg/L	0.8 mg/L

【Sampling date and hour : 2 Dec. 2015, AM 10:20】

sampling point	Suspended solids (SS)	Total nitrogen	Total phosphorus	Total Organic Carbon
100m off-shore	Less than 1 mg/L	0.89 mg/L	Less than 0.005 mg/L	0.8 mg/L
Near seawall	Less than 1 mg/L	0.84 mg/L	Less than 0.005 mg/L	0.8 mg/L

Item	Detection limits (mg/L)	Method
Suspended solids (SS)	1	Appendix 9: Filtration gravimetric method, Notification No. 59 of the Environment Agency, 1971
Total nitrogen	0.05	JIS K0102 45.4 (Copper-cadmium column reduction method)
Total phosphorus	0.005	JIS K0102 46.3.1 and 46.1.1 (Absorption photometry)
Total Organic Carbon	0.3	JIS K0102 22.1 (Combustion oxidation-infrared radiation TOC analysis)

Table 1-6 Reference: Environmental standards concerning conservation of the living environment in Japan

Category of area	Adoptability of water use	standard		Water area
		Total nitrogen	Total phosphorus	
I	Natural environmental conservation and those listed in II and the following categories (Excluding fishery classes 2 and 3)	0.2mg/L or below	0.02mg/L or below	Water area designated for each water area category in 1.2 (2).

Category of area	Adoptability of water use	standard		Water area
		Total nitrogen	Total phosphorus	
II	Fishery class 1	0.3mg/L or below	0.03mg/L or below	
	Bathing and those listed in III and the following categories			
	(Excluding fishery classes 2 and 3)			
III	Fishery class 2 and those listed in IV	0.6mg/L or below	0.05mg/L or below	
	(Excluding fishery class 3)			
IV	Fishery class 3	1 mg/L or below	0.09mg/L or below	
	Industrial water			

Remarks:

1. The standards shall be annual average values.
2. Designation of water area categories shall be those having a risk of significant propagation of marine phytoplankton.

Note:

1. Natural environmental conservation: Conservation of the environment for nature trips, etc.
2. Fishery class 1: A variety of aquatic life including benthic fish and shellfish are caught in a well-balanced and stable manner.  
Fishery class 2: Mainly fish are caught in a large volume along with shellfish excluding some of those benthic.  
Fishery class 3: Mainly specific fish and shellfish that are resistant to pollution are caught.
3. Biological habitat conservation: Limited environment where benthic life can live through the year.

## (2) Coliform count in the seawater area in front of the project site

The coliform count in the seawater area in front of the project site was implemented in a simplified manner using 3M Petrifilm™ plates (RCC plates for quick count of coliform and EB plates for enteric bacteria count). The count result is shown in Table 1-7 and Table 1-8.

Table 1-7 Result of count of coliform (group count/1 mL)

Sampling date and hour : 18 Nov. 2015, 15:50											
A (water intake area)				B (step area)				C (discharge area)			
1	2	3	MPN	1	2	3	MPN	1	2	3	MPN
12	11	13	12	11	9	13	11	200<	200<	200<	200<
Sampling date and hour : 23 Nov. 2015, 10:45											
A (water intake area)				B (step area)				C (discharge area)			
1	2	3	MPN	1	2	3	MPN	1	2	3	MPN
16	17	16	16	11	14	12	12	0	100	200	100

Table 1-8 Result of enteric bacteria count (group count/1 mL)

Sampling date and hour : 18 Nov. 2015, 15:50											
A (water intake area)				B (step area)				C (discharge area)			
1	2	3	MPN	1	2	3	MPN	1	2	3	MPN
9	13	10	10	11	9	11	11	200<	200<	200<	200<
Sampling date and hour : 23 Nov. 2015, 10:45											
A (water intake area)				B (step area)				C (discharge area)			
1	2	3	MPN	1	2	3	MPN	1	2	3	MPN
21	16	17	18	17	20	13	17	100	0	200	100

As shown in the result of count, it is indicated that the seawater area in front has been affected by sewage discharged from the adjacent sewage treatment plant (insufficient purification). In addition,

it was indicated that the fact a large bacteria count was found in drainage area in the project site was a result of influence of sewage from the roadside ditches that are connected to the drain ditches in the PMDC site (sewage leaked from the sewage treatment plant mixes with rainwater and flows in).

(3) Outbreak of plankton causing shellfish toxin and other harmful living things

Although there has been no report concerning the outbreak of shellfish toxin, juvenile giant clams rely on plankton as their nutrition source and later when they are in the cultivation phase they grow taking in nutrition from symbiotic algae and almost stop feeding on plankton. Therefore, even if harmful plankton that can cause shellfish toxin break out, there is a very little possibility that juvenile clams accumulate toxin from harmful plankton inside the body to cause shellfish toxin.

In the coral reef area which is a natural habitat of giant clams, there are harmful living things feeding on giant clams including crustaceans such as crabs and shrimps/prawns and fish having well-developed teeth such as scarid. Therefore, giant clams are grown in a nursery formed of a sandy seaweed bed where such harmful living things are not usually found. The most dangerous living things living in sandy areas are stingrays, while the risk of stingray attack can be prevented by surrounding the nursery with net.

(4) Result of water quality inspection at water intake area

Quality of culture tank water and surface layer water in front of the facilities was inspected using a portable water quality checker, WQC-24, manufactured by DKK Toa Corp. The device can measure multiple water quality items, including water temperature, dissolved oxygen (DO), pH, salt content and turbidity. In addition to water quality, as shown in Table 1-9 and Table 1-10, measurement of depth, water volume, volume of water poured and water replacement rate for each tank were also obtained. DO and turbidity were measured between 9:30 and 11:00 on November 7, as the measuring device needed an adjustment.

Table 1-9 Water quality of each tank (5, Nov. 2015 start from 2:45pm, sunny weather)

Tank No.	temperature (°C) (filling)	temperature (°C) (draining)	D.O mg/L	pH	Practical Salinity Unit	turbidity (mg/L)	water depth (m)	quantity of water (m <sup>3</sup> )	quantity of filling water (L/minute)	water-exchanging ratio (time/day)
4	30.7	30.4	5.8	8.0	34.7	3.3	0.36	6.6	14.4	3.1
6	30.9	31.8	5.8	8.1	34.7	3.3	0.32	5.8	14.4	3.6
7	30.8	31.4	5.9	8.2	34.7	3.3	0.37	6.8	14.9	3.1
8	31.0	31.4	6.0	8.2	34.8	3.3	0.35	6.4	14.5	3.3
9	31.1	31.5	5.5	8.2	34.5	3.1	0.37	6.8	13.2	2.8
10	31.3	31.5	5.9	8.2	34.7	3.2	0.36	6.6	16.4	3.6
11	31.2	31.3	5.5	8.1	34.6	3.2	0.35	6.4	5.6	1.3
12	30.4	31.6	6.0	8.2	34.8	3.2	0.36	6.6	48.4	10.6
13	31.1	31.5	6.1	8.3	34.6	3.1	0.36	6.6	15.2	3.3
14	31.3	31.8	5.9	8.2	34.6	3.2	0.36	6.6	16.6	3.6
15	30.5	31.8	6.1	8.2	34.8	3.2	0.37	6.8	31.6	6.7



Table 1-10 Water quality of each tank (5, Nov. 2015 start from 2:45pm, sunny weather)

Tank No.	temperature (°C) (filling)	temperature (°C) (draining)	D.O mg/L	pH	Practical Salinity Unit	turbidity (mg/L)	water depth (m)	quantity of water (m <sup>3</sup> )	quantity of filling water (L/minute)	water-exchanging ratio (time/day)
33	32.6	34.0	6.3	8.2	34.7	3.8	0.36	6.5	18.8	4.2
34	32.3	34.2	6.4	8.3	35.0	3.7	0.38	6.8	14.9	3.2
35	33.1	34.3	6.5	8.3	34.9	4.1	0.36	6.5	21.1	4.7
36	32.9	33.9	6.2	8.4	34.9	4.0	0.46	8.3	16.2	2.8
37	33.4	34.9	6.4	8.3	34.7	3.6	0.28	5.1	26.1	7.4
38	32.3	34.0	6.5	8.3	35.0	3.6	0.26	4.8	22.7	6.8
39	33.1	34.6	6.6	8.3	34.8	3.7	0.29	5.3	10.3	2.8
40	31.4	32.5	6.5	8.3	35.0	3.5	0.30	5.5	12.0	3.2
41	32.9	34.4	6.6	8.3	34.9	3.5	0.29	5.3	11.5	3.1
42	32.7	34.0	6.7	8.3	34.9	3.9	0.26	4.8	8.2	2.5
43	32.3	34.0	6.6	8.3	34.9	3.6	0.30	5.5	18.2	4.8
45	34.4	33.9	5.1	8.3	35.0	3.8	0.34	5.9	10.5	2.6
L-3	31.9	32.4	6.3	8.3	34.8	3.7	0.70	12.2	10.1	1.2
L-6	31.4	31.5	6.6	8.2	34.7	3.8	0.98	15.2	9.1	0.9
L-7	31.4	31.8	6.2	8.2	34.8	3.8	0.98	15.2	7.7	0.7
L-10	33.6	33.5	5.8	8.2	35.0	3.5	0.79	12.2	0.0	0.0
Surface water	29.9		5.8	8.2	34.6	3.0				

\*Some species of giant clams die when the water temperature exceeds 34 degrees continuously.

\*DO and turbidity were measured between 9:30 and 11:00 on November 7. The weather was cloudy.

The water quality was found good, while in the afternoon of sunny days, the water temperature rises and in shallow nursery tanks, the water temperature can differ over 1 degree between the inlet and the outlet of the tank, irrespective of the water replacement rate. In some tanks, the water temperature exceeds 34°C and if such a high temperature continues, symbiotic algae cannot survive, which in turn causes death of giant clams.

Meanwhile, in deeper larval tanks (L-3 to L-7), the water temperature does not rise largely even when compared with surface layer water of the sea and the difference in water temperature is smaller between the inlet and the outlet of the tank. Therefore, it is recommended to procure tanks 15 cm deeper than existing tanks while also taking into account easiness for those who work with the tanks.

### 1-3 Environmental and Social Considerations

#### 1-3-1 Environmental Impact Assessment

##### 1-3-1-1 Overview of Project Components with Environmental and Social Impacts

Components of this project can be classified into the following two: (1) Building facilities: A mariculture demonstration center building, sheds, a machinery house, a seawater and air supply system, a solar power generating system and culture tanks and; (2) Civil engineering facilities: landing quay renovation, parking lots and other auxiliary facilities.

Components of this project are shown in Table 1-11.

Table 1-11 Components of the project

	Name	Component	Consideration point
Facilities	Mariculture Demonstration Center Building	Entrance hall, exhibition hall, gift shop, Wet laboratory cum inspection room, giving gear store, dining kitchen, dry laboratory, storages, manager room, expert room, staff room, library/meeting room, toilets, utilities, etc. ( area: 521m <sup>2</sup> )	Discharged water from toilets, Solutions treatment in laboratory
	Sheds	Transparent roofing above rearing area (1,840 m <sup>2</sup> )	-
	Elevated water tanks building	Room for air blowers, elevated seawater reservoirs (63.75 m <sup>2</sup> )	Noise from air brower
	Machinery house	Room for emergency generators (24.5m <sup>2</sup> )	Noise from generators
	Pump house	Room for seawater intake pumps (24.5m <sup>2</sup> )	Noise from pumps
	Seawater and air supply system	2 x seawater intakes, 3 x seawater intake pumps, 3 x air blowers, 2 x elevated seawater reservoirs, 2 x emergency generators, piping and electrical works	-
	Solar power generating system	25kW	-
	Culture tanks	RC raceways	Water pollution around the construction site during construction period
	Landing quay renovation	Renovation of quay steps, installation of mooring buoys, bollards and fenders for small boats and a manual jib crane on the quay	Condition of ecosystem around the construction site during construction work. Negative impact for fishing activities
	Parking lots and other auxiliary facilities	Car parking, boat parking, gates, etc.	Water pollution around the construction site during construction period

### **1-3-1-2 Basic Environmental and Social Situations**

#### **(1) Target areas of the project**

The project site is located in the premises of the Palau Mariculture Demonstration Center (PMDC), which is in the southern part of Malakal Island of Koror State. PMDC was constructed in 1973 (formerly the Micronesian Mariculture Development Center (MMDC)) and later in 2001 the name of the center was changed to the current one. Facilities being in operation currently at the PMDC include ground facilities such as water intake facilities, offices and storages and existing culture facilities for giant clam seedlings including concrete tanks.

Koror State has a population of about 11,000 (2012), which corresponds to 66% of the total population of Palau. The capital of Koror State, Koror, was formerly the capital of the Republic until 2006 and it still is the country's economic center having many commercial areas. Meanwhile, Malakal Island is located to the west of Koror Island and has a commercial port and related facilities as it provides favorable conditions for ports.

The project site is shown in the Project Site Map of the beginning page of this report. Facilities of PMDC face the sea on the west side and are surrounded by a fish culture facility constructed by the assistance of Taiwan which mainly produces seeds of groupers and rabbitfish, a sedimentation basin of sewage treatment plant and government-related facilities such as the Bureau of Marine Resources (BMR). There are no residential buildings in the surrounding areas. The total land area of the project site is about 4,800m<sup>2</sup>.

#### **(2) Outline of land use, social environment and natural environment**

This project is planned to be implemented in the premises of existing facilities, PMDC. Therefore, there will be no problems such as land acquisition and resettlement of residents. It was confirmed, however, there is one commercial business owner who cultivates giant clams at existing ice making facility (ICEBOX) located on the premises of PMDC without obtaining a permit and the operation needs to be removed before demolition works for existing facilities start. As a result of interviews made individually during this survey, it was known that BMR had already given explanations on this project to the owner of the commercial business and the owner had agreed to the removal of the operation when the demolition work starts.

Rock Islands Southern Lagoon of Koror State was designated as a UNESCO World Heritage Site in 2012. The designation was awarded to the island as a "complex" having both natural and cultural heritage. The area designated is about 1,002km<sup>2</sup> in total, 60km<sup>2</sup> of which is a land area. Malakal Island on which this project site is located is outside of the World Heritage designated area. In addition, Koror State has a total of six natural conservation areas but the project site (shown within the red line) is not included in any of those six natural conservation areas. Each of the natural conservation areas (numbers in red) is shown in Figure 1-9 and details of the areas are shown in Table 1-12.



Figure 1-9 Natural Conservation Areas in Koror State

Source : Rock Islands Southern Lagoon Management Plan 2012-2016

Table 1-12 Details of the Conservation Areas in Koror State

Name	Year of establishment	Area dimension (km <sup>2</sup> )	Description of regulations
1) Ngerukewid Islands Wildlife Preserve	1956 1999	12.0	Ban on access, fisheries and harvesting of animals and plants, use of fires, etc.
2) Ngerumekaol Spawning Area	1976 1999	3.5	Ban on harvesting of fish and use of traps for an unlimited duration.
3) Ngemelis Island Complex	1995 1999	30.0	Ban on fisheries within 1 mile off the coast. Off limits to boats.
4) Ngkisaol Sardines Sanctuary	1999	0.008	Ban on harvesting of underwater animals and plants. Ban on harvesting of sardines.
5) Ngederrak Conservation Area	2001 2002	6.0	Ban on harvesting of underwater animals and plants. Off limits to and ban on use of boats.
6) Ngerkebesang Conservation Zone	2002	West of Ngerkebesang Island and adjacent to Palau Pacific Resort.	Ban on harvesting of underwater animals and plants.

Of the conservation areas, the Ngederrak Conservation Area shown as 5) is located about 2km southeast of the project site. This project has two components that are land facilities and a quay area and the construction of such will have no major direct impact on the conservation area. It is necessary, however, to take measures to minimize waste to be generated because of demolition and construction work and outflow of murky water into the sea. When the planned facilities are completed, feeding will not be necessary for giant clam cultivation and as the result, there will be

almost no risk for seawater to be contaminated by uneaten feed or excrement of clams. On the contrary, a filtering function giant clams have to take in nutrient content from seawater has an effect to purify the water. Considering the above, there does not seem to be any negative impacts on the conservation area, when the planned facilities are completed and they become in use.

The Preparatory Survey Team contacted the Palau Historic Preservation Office of the Bureau of Cultural and Historical Preservation concerning cultural heritage located in the neighborhood of PMDC. As the result, the Project Team could not confirm there were historic sites subject to protection on the premises of PMDC and in its neighborhood. The closest site subject to such protection is the site where the antiaircraft artillery was installed by the former Japan's military during WWII near the top of a mountain located east of the current PMDC facilities. This site, however, is at a far distance from the project site and no impact can be expected during construction works under this project or after the constructed facilities start being in service.

### **1-3-1-3 Policies, Legislative and Institutional Framework related Environmental and Social Considerations in Palau**

#### **(1) Environmental-related laws and regulations**

Palau's national system including that for environmental protection is said to have been significantly influenced by the era of US administration<sup>1</sup>. The section in charge of environmental conservation and protection in the government is the Environmental Quality Protection Board (EQPB), which is composed of 7 members and 15 staff. EQPB was established in accordance with the Environmental Quality Protection Act in 1981 and is responsible for enforcement of environment-related regulations in nine areas as shown in Table 1-13.

The 7 members of EQPB are appointed by the country's President and their office term is 3 years. Every three months, the board meeting is convened and their discussions are released to the public. EQPB has the responsibility to submit an environment report annually to the President and the National Congress.

#### **(2) Major laws and regulations**

Under the Environmental Protection Act, the following four areas are specified: (1) General provisions concerning the environment; (2) Establishment of the Environmental Quality Protection Board; (3) Environmental impact study and decisions made based on the study; and (4) Implementation and enforcement of environmental regulations and related legal proceedings. Palau's environment-related regulations are shown in Table 1-13.

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<sup>1</sup> Comparative Study on the Environmental Impact Assessment System in the Pacific Island Countries, Nobuyuki Hatada <http://www.apu.ac.jp/~nhatada/report/assessment/index.htm>

Table 1-13 Environment-related regulations in Palau

	Regulations	Year
1	2401-1 Earthmoving Regulations	1996
2	2401-11 Marine and Fresh Water Quality Regulations	1996
3	2401-13 Toilet Facilities and Wastewater Disposal Regulations	1996
4	2401-31 Solid Waste Management Regulations	1996
5	2401-33 Pesticide Regulations	1996
6	2401-51 Public Water Supply System Regulations	1996
7	2401-61 Environmental Impact Statement Regulations	1996
8	2401-71 Air Pollution Control Regulations	1996
9	Ozone Layer Protection Regulations 2005	2005

Source: Palau National Code Annotated (<http://palaueqpb.org/about.htm>)

(3) Environmental standards and discharge standards

In Palau, environmental standards for water quality are specified under the Chapter 2401-11: Marine and Fresh Water Quality Regulations for marine water and freshwater. In those regulations, marine water, freshwater and groundwater are classified based on their intended use. The classification is shown in Table 1-14.

Table 1-14 Classification of water uses

Type	Class	Intended purpose
Coastal water	AA	The support and propagation of shellfish and other marine life and conservation of coral reefs and wilderness areas.
	A	Recreational etc.
	B	Small boat harbors etc.
Fresh water	1	Drinking water supply, food processing and the propagation of shellfish and other marine life.
	2	Bathing, swimming, the the support and propagation of shellfish and other marine life and agricultural water supply.
Groundwater	I	Drinking water and base flow for a particularly sensitive ecological system.
	II	Drinking water and and beneficial uses.
	III	Grandwater not considered potential sources of drinking water or other beneficial use.

Source: Chapter 2401-11: Marine and Fresh Water Quality Regulations

In addition, standards are established for bacteria, pH, nutrient salts, dissolved oxygen, water temperature, turbidity, radioactive substances, oil and petroleum products and hazardous substances for each category (Table 1-15).

Table 1-15 Environmental standards for marine water, freshwater and groundwater\* (excerpts)

Item	Standard	Water class
Bacteria	The median total or fecal coliform bacteria count shall not exceed 70/100ml for any 10 consecutive samples nor shall any single sample exceed 230/100 ml.	AA, 1
	Fecal Coliform count shall not exceed a geometric mean of 200/100ml for any 10 consecutive samples nor shall any single sample exceed 400/100 ml.	A, B, 2

Item	Standard	Water class
	Enterococci count shall not exceed a geometric mean of 33/100ml for any 5 samples in a given 30 day period nor shall any single sample shall exceed 60/100ml	AA, A
	In areas where shellfish are harvested for human consumption, the micro-biological standards for Class AA and 1 Waters shall apply.	A, B, 2
pH	pH variation shall be within 7.7 and 8.5 pH units	AA, A, B
	pH variation shall not be greater than 0.2 pH units from natural conditions; but not lower than a pH of 6.5 or higher than a pH of 8.5 from other than natural causes.	1
	pH variation shall not be greater than 0.5 pH units from natural conditions; but not lower than a pH of 6.5 or higher than a pH of 8.5 from other than natural causes	2
Nutrient salts	The ratio of total nitrogen to total phosphorus concentration shall be within 11.1 - 27.1%.	AA, B
	The ratio of total nitrogen to total phosphorus concentration shall be within 6.1~18.1%.	B
	10% variation of the naturally occurring ratio.	1, 2
	The concentration of total nitrogen and total phosphorus shall not vary by more than 10% from the natural conditions.	All Waters
	Total Phosphorus : 0.025 mg/l or below	AA, A
	Total Phosphorus : 0.500 mg/l or below	B
	Total Phosphorus : 0.200 mg/l or below	1, 2
	Total Phosphorus : 0.050 mg/l or below	Fresh Waters entering lakes or reservoirs (at a point of entry) and lakes and reservoirs
	Total Phosphorus : 0.400 mg/l or below	AA, A
	Total Phosphorus : 0.800 mg/l or below	B
	Total Phosphorus : 0.750 mg/l or below	1
	Total Phosphorus : 0.500 mg/l or below	2
Dissolved oxygen	Dissolved oxygen concentrations shall not vary by more than 25% from natural conditions	All Waters
	Except for concentrations attributable to natural causes dissolved oxygen concentration shall not be less than: The greater of 6.0 mg/l, 75% or Saturation	AA, 1
	Except for concentrations attributable to natural causes dissolved oxygen concentration shall not be less than: 5.0mg/l	A, 2
	Except for concentrations attributable to natural causes dissolved oxygen concentration shall not be less than: 4.5mg/l	B
water temperature	Temperature shall not vary by more than 1.5 degree Fahrenheit (0.9 degree Celsius) from the natural conditions in marine and fresh waters	All Waters
Turbidity	Nephelometric Turbidity Units (NTU) shall not be: Greater than 1 NTU	AA, A
	Nephelometric Turbidity Units (NTU) shall not be: Greater than 2 NTU	B
	Nephelometric Turbidity Units (NTU) shall not be: Greater than 5% above natural conditions	1
	Nephelometric Turbidity Units (NTU) shall not be: Greater than 10% above natural conditions.	2

Item	Standard	Water class
Radioactive substances	The concentration of radioactive materials in water shall not exceed 1/30th of the maximum permissible limits established for continuous occupational exposure given in the latest edition of the U.S. National Bureau of Standards Handbook No. 69.	All Waters
	No radionuclides shall be present in amounts that would exceed the maximum permissible levels established in the Republic of Palau Public Water Supply Regulations.	
	The concentration of radioactive materials in water shall not result in the accumulation of radioactivity in plants or animals that would result in a hazard to humans or aquatic life.	
Oil and Petroleum products	The concentration of oil and petroleum products shall not be detectable as a visible film sheen or discoloration of the surface or cause an objectionable odor.	All Waters
	The concentration of oil and petroleum products shall not cause tainting of fish or other aquatic life, be injurious to the indigenous biota, or cause an objectionable taste in drinking water	
	The concentration of oil and petroleum products shall not form an oil deposit on beaches or shorelines or on the bottom of a body of water	

Source: Chapter 2401-11: Marine and Fresh Water Quality Regulations

Regulations on toilet facilities and wastewater disposal (2401-13 Toilet Facilities and Wastewater Disposal Regulations) specify design standards, construction works and wastewater disposal systems for installing toilet facilities. Since installation of toilets is planned in this project, it is required to comply with the above-mentioned regulations. In addition, the regulations do not provide standards on wastewater disposal, wastewater disposal standards established by Japan's Ministry of the Environment are shown in Table 1-16.

Table 1-16 National minimum effluent standards in Japan

item	Standard
Coliform bacteria	Daily average value : 3,000 / cm <sup>3</sup>
pH (Discharge to Coastal water)	5.0 and over 9.0 and fewer
Suspended solids (SS)	200 mg/L (Daily average value 150 mg/L)
Total phosphorus	16 mg/L (Daily average value 8 mg/L)
Total nitrogen	120 mg/L (Daily average value 60 mg/L)
Chemical oxygen demand (COD)	160 mg/L (Daily average value 120 mg/L)

Source: National minimum effluent standards (<http://www.env.go.jp/water/impure/haisui.html>)

Regulations on solid waste management (2401-31 Solid Waste Management Regulations) provide points of attention and procedures for solid waste management business operations aiming at preventing air, soil and water pollution, conserving the environment and protecting people's health. The regulations also provide guidelines for hazardous waste disposal. According to a report of Asian Development Bank,<sup>2</sup> hazardous effluent should be collected

<sup>2</sup> Solid Waste Management in the Pacific Palau Country Snapshot (Asian Development Bank Publication Stock No. ARM146611-2 June 2014)



and stored by the Palau Public Utilities Corporation. The storage capacity of the collection facilities is 1 million gallons (approx. 3.8 million liters). The effluent collected is transported to overseas for disposal.

Regulations on air pollution (2401-71 Air Pollution Control Regulations) provide environmental standards as follows. The standards concerning air pollution are shown in Table 1-17. For any of construction sites, a standard is provided that 0.5-gallons of water (approx. 1.8 liters) should be sprinkled for each 1 square yard of land area at least every 2 hours during the construction work is underway in order to control dust particles.

Table 1-17 Environmental standards on air quality

Item	Acceptable value	
Sulfur Oxide (SO <sub>x</sub> )	60µg/m <sup>3</sup> (0.02ppm) <sup>a</sup>	a: Annual arithmetic mean.
	365µg/m <sup>3</sup> (0.12ppm) <sup>b</sup>	b: Maximum 24-hours concentration no to be exceeded more than once a year.
	1,300µg/m <sup>3</sup> (0.50ppm) <sup>c</sup>	c: Annual geometric mean.
	650µg/m <sup>3</sup> (0.25ppm) <sup>g</sup>	d: Maximum 8-hours concentration no to be exceeded more than once a year
Particulate Matter (PM)	60µg/m <sup>3c</sup>	e: Maximum 1-hour concentration no to be exceeded more than once a year
	150µg/m <sup>3b</sup>	f: Maximum 3-hours concentration no to be exceeded more than once a year
	360µg/m <sup>3d</sup>	g: Maximum 4-hours concentration no to be exceeded more than once a year
Carbon Monoxide (CO)	10mg/m <sup>3</sup> ( 9ppm) <sup>d</sup>	
	40mg/m <sup>3</sup> (35ppm) <sup>e</sup>	
Photochemical Oxidant (Ox)	160µg/m <sup>3</sup> (0.08ppm) <sup>e</sup>	
Hydrocarbons (HC)	160µg/m <sup>3</sup> (0.24ppm) <sup>f</sup>	
Nitrogen Oxides (NO <sub>x</sub> )	160µg/m <sup>3</sup> (0.05ppm) <sup>a</sup>	

Source: 2401-71 Air Pollution Control Regulations

(4) Laws and regulations concerning environmental impact assessment

Laws and regulations concerning environmental impact assessment are described in 1-3-1-3 (2). The details are shown in the EQPB Environmental Impact Statement Regulations Chapter 2401-61. In Palau, as far as there is no established special treatment, every business operation is required to obtain an environment-related permit in accordance with the prescribed procedures. Standards on business operations required to obtain the permit are shown in Table 1-18.

Table 1-18 Business operations required to obtain environmental approval

1	Any and all actions which propose the use of national or state lands
2	Any and all actions which propose the use of national or state funds, unless the funds are to be used for: 1) Feasibility or planning studies for possible future programs 2) The acquisition of unimproved real property
3	Any use within any land which has been or may be classified as conservation district by the Republic or one of its state's land use commissions.
4	Any use directly or indirectly impacting "coastal waters" and "wetlands" as defined in the Republic of Palau Marine and Fresh Water Quality Regulations
5	Any use within any historic site as designated by the Palau Historic Preservation Office
6	Any proposed action which the Board determines may have a significant impact on the environment

Source: Chapter 2401-61: Environmental Impact Statement Regulations

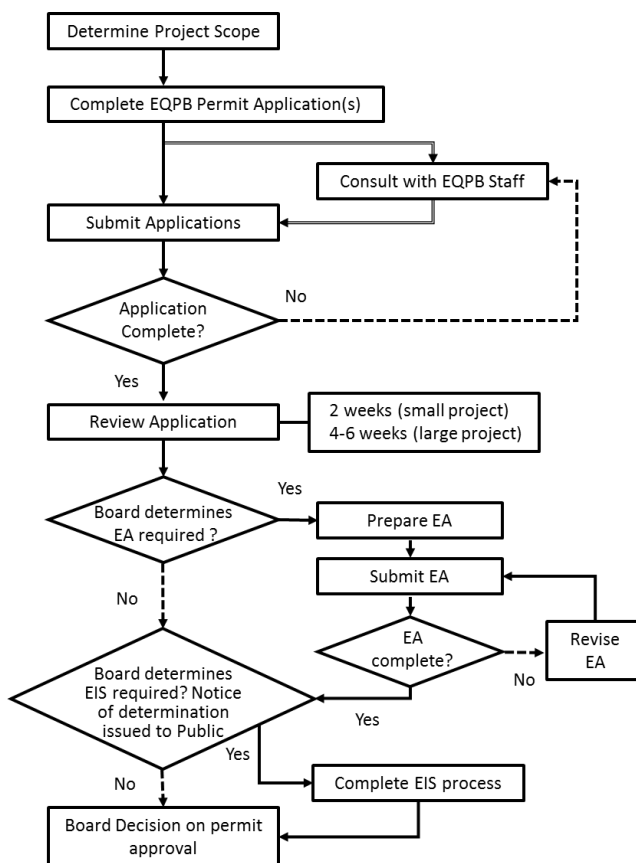
(5) Procedures for obtaining environmental approval

Procedures for obtaining environmental approval in Palau is shown in the following figure.

The procedures can be broken into three stages. At the first stage, operation owners submit to EQPB a simplified Permit Application for the relevant business operation by also attaching related documents. According to EQPB, the following documents need to be attached for this project.

- Detailed project plan including design drawings
- Application form for construction permit
- The Palau Public Utilities Corporation’s application form for sewage pipes
- The Bureau of Arts and Culture’s application form for cultural property confirmation

The application forms are also available from the EQPB website and in the application forms there is a section to describe general information in Part I of the form and earthmoving works, discharge of marine water and freshwater, toilet facilities and wastewater disposal, solid waste management, use of pesticides, a public water system, air pollution control and open burning of fields in Part II. In this project, it is necessary to describe earthmoving works, toilet facilities and wastewater disposal in the forms. A flowchart created based on the Chapter 2401-61 is shown in Figure 1-10.



Board : Palau Environmental Quality Protection Board  
 EA : Environmental Assessment  
 EIA : Environmental Impact Statement  
 EQPB : Environmental Quality Protection Board

Figure 1-10 Procedures of obtaining environmental approval  
 Source : Chapter 2401-61

For expenses for examination, a fee of \$20 should be paid for housing construction or \$100 for commercial facilities construction. Since this project is a government project, there is no need to pay such a fee.

For the examination, it takes 2 weeks in case of a small-scale project or 4 to 6 weeks in case of a large-scale project. According to EQPB, this project is categorized as a large-scale project and it will take 4 to 6 weeks to examine.

In the second stage, EQPB examines submitted application forms and, if necessary, requests the relevant business owner to submit a written Environmental Assessment (EA). In this EA, it is necessary that items shown in Table 1-19 be described. According to EQPB, it is very unlikely that this project would be required to submit an EA. Therefore, including a time period to prepare documents to be attached and time to process all procedures, it is expected that in about 2 months, an environmental clearance can be obtained if detailed project plan is ready.

Table 1-19 Items to be described in EA

<ul style="list-style-type: none"><li>• Identification of applicant;</li><li>• Identification of agencies and organizations consulted in making assessment;</li><li>• General description of the action's technical, economic, social, and environmental characteristics;</li><li>• Summary description of the affected environment, including suitable and adequate location and site maps;</li><li>• Identification and summary of major impacts and alternatives considered, if any;</li><li>• Proposed mitigation measures, if any</li></ul>
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In the third stage, EQPB examines the submitted EA and, if necessary, requests the relevant business owner to submit a written Environment Impact Statement (EIS). In this process, there is a chance that a public hearing meeting be requested to be held 3 times at the maximum and the time of examination can continue for as long as 120 days. According to EQPB, however, in this project, it will not be necessary to submit an EIS based on the scale of the project.

#### **1-3-1-4 Comparative Examination of Options (Including Zero Option)**

##### **(1) Examination of alternatives to facility improvement plan**

This project is for improving the existing PMDC facilities and it is not planned to expand the land site while the construction is underway and therefore, works will only be implemented within the current premises of PMDC. Because there are no residential areas around PMDC, this project will not generate any social impact (livelihoods, resettlement of residents and interests). Meanwhile, there is a concern that the surrounding environment will be given an impact by the demolition and construction works made within the existing PMDC facilities. As an option, therefore, reviews were made concerning “changing the

construction site” and comparative examination was made by developing Option 1 (zero option), Option 2 (the plan under this project) and Option 3 (change of construction site) as shown in Table 1-20. For the construction site in Option 3, public land that borders the Ollei Port located in Ngarchelong State on the Babeldaob Island is selected in accordance with the proposal made by the Government of Palau.



Figure 1-11 Public land proposed as an alternative site (Ollei Port)

As the result of the comparative examination, it is found that Option 1 (zero option) is unable to achieve the project purpose because no improvement in the capability to cultivate giant clam seedlings can be expected. With respect to Option 2 (the plan under this project), it is of concern that the surrounding seawater areas can be polluted by wastewater discharged during the demolition works of the existing facilities and construction works of a new center but this issue can be solved if a sedimentation tank is installed at the construction site. With respect to Option 3, it is expected that there is no major concern about wastewater but there is a risk that it is difficult to secure staff and transportation means and promote production of Giant clams, as the site is located far from Koror State. In addition, the construction cost will be more than that expected under this project when costs to procurement of equipment and materials such as concrete are taken into account.

Based on the above analysis, it is judged overall that this project is the most feasible.

Table 1-20 Comparison of this project and other options (including zero option)

Item	Option 1 (zero option)	Option 2 (this Project)	Option 3 (Ngarchelong State)
Access	Located close to the central part of Koror State where giant clams are cultivated and consumed. No inconvenience for staff to commute.	Located close to the central part of Koror State where giant clams are cultivated and consumed. No inconvenience for staff to commute.	One-hour drive access is not favorable. Difficult for staff to commute. Giant clam farming concentrate in Koror State and the inconvenient access is a hindrance, buyers of seedlings will decrease and the promotion of giant clam seedlings production will be disturbed.
Land use	N/A	N/A	Since it is public land, it is necessary to obtain agreement of the Ngarchelong State Public Lands Authority. The site area is smaller than that of this project.
Impact during the construction period	N/A	It is of concern that waste generated during the demolition of existing facilities and construction of new facilities can pollute the environment. By installing a sedimentation tank at the construction site and discharging a clear layer of water, it will be possible to control such an impact on the surrounding seawater areas.	There are only a few existing facilities and there is little concern that wastewater generated during demolition works can pollute the environment.
Environmental impact	It is close to a nature conservation area but wastewater generated by giant clam culture will not be polluted and there is no issue of water pollution when the facilities start being in service.	It is close to a nature conservation area but wastewater generated by giant clam culture will not be polluted and there is no issue of water pollution when the facilities start being in service.	It is close to a nature conservation area but wastewater generated by giant clam culture will not be polluted and there is no issue of water pollution when the facilities start being in service.
Resettlement of residents	N/A	N/A	Since there is a guard room for fishermen, an agreement should be obtained to tear it down.
Production of Giant seed-clams	As culture tanks and the water supply system age, output of clam seedlings will decrease.	By improving culture tanks and the water supply system, output of giant clam seedlings will increase.	As a new center is to be constructed, a sufficient output of giant clam seedlings is expected.
Overall evaluation	If the situation is left as it is, output of giant clam seedlings will decrease and it is not possible to meet the request from the Government of Palau. There will be no construction cost.	Although there could be some problem concerning the environmental considerations during the construction works, it is expected output of giant clam seedlings will increase and promotion of giant clam seed production will advance satisfactorily.	There should be no issue about environmental considerations during the demolition and new construction periods. The location is inconvenient, however, and there could be problems about securing of staff, transportation of clam seedlings and promotion of giant clam seed production. In addition, since it is far from Koror State, the construction costs will be larger.

### 1-3-1-5 Scoping

Since this project is a facilities construction project at an existing site, there is no need to acquire a new land site or resettle residents. This project is classified into Category B owing to the fact that the “Sensitive Sectors, Characteristics and Areas” which are stipulated in the “Japan International Cooperation Agency Guidelines for Environmental and Social Considerations” promulgated in April, 2010 are not applicable in this Project, and no significant negative impact against the environment is considerable.

Items that can give impacts on the project site and the surrounding environment due to the implementation of this project are selected based on the Environmental Checklists (for Fishery) of the JICA Guidelines for Environmental and Social Considerations (April 2014). A total of 19 items were selected including matters related to pollution control (7 items), natural environment (4 items) and social environment (7 items) and others (1 item) and the scoping process was implemented separately for before and during construction period and after the facilities commence their service. As the result, no “Evaluation A” (significant impacts) were expected from this project, while there were a total of 13 “Evaluation B” (some positive/negative impacts,) 5 items having “Evaluation C” (impact currently unknown,) and 20 items (the largest number) designated as “Evaluation D” (no impact expected). The results of scoping are shown in Table 1-21.

Table 1-21 Results of scoping

No	Environmental Item	Rating		Basis of assessment
		I / II	III	
<b>Environmental Pollution</b>				
1	Air pollution	B-	D	<Construction period> Negative impacts are expected from emissions or dust particles generated by construction machinery/equipment in operation and vehicles coming in or out. However, it is judged that such emissions or dust particles will not exceed the standards as it is not expected there will be enough vehicles to cause significant air pollution <In-service period> No construction vehicles will come in or out. Few impacts can be expected as lifting pumps generate no emissions, too.
2	Water pollution	B-	D	<Construction period> Water pollution is expected, caused by earth and sand and wastewater to be discharged during the construction period. <In-service period> Giant clams are autotrophic, living on energy from light (photosynthetic) and can be cultivated even without feed. Therefore, no pollution is expected caused by residues and excrement, which means almost no water pollution is expected from giant clam culture.
3	Waste	B-	B-	<Construction period> Construction waste is expected to be generated, such as concrete blocks from construction works. <In-service period> Wastes and liquid waste such as test reagents from offices are expected to be generated.
4	Soil pollution	B-	D	<Construction period> Soil contamination is expected to be generated by oil leaked from construction equipment. <In-service period> No impacts to cause soil contamination are expected, since the inside of the facilities will be covered with concrete and wastewater will be stored in tanks for later collection.

No	Environmental Item	Rating		Basis of assessment
		I / II	III	
5	Noise and vibrations	C	C	<Construction period> Neighboring fish culture facilities can be affected by noise and vibration caused when existing facilities are demolished and new facilities are constructed. <In-service period> Almost no noise is expected to reach outside of the facilities, since lifting pumps are installed indoors. There will be no other equipment that causes noise and vibration.
6	Ground subsidence	D	D	No subsidence is expected, since no groundwater will be used.
7	Offensive odor	D	B-	<Construction period> There will be no source of odor, since chemicals will not be used and foul water will not be generated at the facilities. <In-service period> If dead shellfish or spread seaweed are left unattended, they can be a source of odor.
<b>Natural Environment</b>				
8	Protected areas	B-	D	<Construction period> There is a protected area, Ngederrak Conservation Area, near the project site. It is expected to be impacted by earth and sand or wastewater generated during construction, depending on the tidal current. <In-service period> No impact is expected, since no air and marine pollution is projected.
9	Flora, Fauna and Biodiversity	B-	D	<Construction period> As turbid water or dust particles can obstruct sunlight in the water, growth of wild giant clams and corals in the surrounding seawater areas can be disturbed. <In-service period> No floating matters are expected to be generated during the production of clam seedlings or cultivation of giant clams.
10	Hydrometeor	D	D	A large-scale water intake that can impact on and cause changes of seawater is not expected.
11	Topography and Geology	D	D	In this project, mainly on-land facilities will be constructed in the existing site and no plans are made concerning earth cutting, drilling and banking construction. Therefore, no impact is expected on topographical and geological features on the site.
<b>Social Environment</b>				
12	Involuntary resettlement	D	D	No residents live in the project site and no resettlement will be necessary.
13	Local economy such as employment and livelihood etc.	B-	B+	<Construction period> There is one business owner who cultivates giant clams in the project site without obtaining any permit, but there has been an agreement that he will move to a substitute site before the demolition work starts for the existing facilities. <In-service period> Giant clam farmers can obtain clam seedlings more easily if output of seed-clams increases. Therefore, a positive impact can be expected.
14	Cultural property and heritage	C	C	<Construction period> There is a possibility that old Icebox originating in days before the war in the project site have been registered as a cultural heritage site. There is a possibility that stone monuments and trees for religious worship exist in the premises of PMDC.
15	Misdistribution of benefit and damage	C	C	<In-service period> There is a possibility that fishermen who capture wild giant clams will not and that the only benefit will be to businesses that cultivate giant clams.

No	Environmental Item	Rating		Basis of assessment
		I / II	III	
16	Landscape	D	D	There are no landscapes that should be given special considerations in the neighborhood. This project will give no impact on landscapes as it is a construction work project at an existing site.
17	The poor, indigenous of ethnic people	D	D	There are no residents in the surrounding area, including ethnic minorities and indigenous peoples.
18	Working condition including occupational safety	B-	B+	<Construction period> It is necessary to consider the working conditions of construction workers. <In-service period> The working conditions of PMDC staff will be improved as the environment such as facilities and equipment will be improved.
Others				
19	Accidents	B-	D	<Construction period> There can be fatal/bodily injuries due to collapse of cargo or machinery operation error during the construction period. <In-service period> There is almost no possibility of fatal/bodily injuries in association with cultivation activities.

Note 1 : I - Planning stage, II – Construction Stage, III - Operational Stage

Note 2 : Rating (Magnitude of impacts) ; both positive impact (+) and negative impact (-) are expected due to the project activities.

A (+/-) – Significant (or major impact) is expected, B (+/-) –Not significant but some impact (or moderate) is expected, C (+/-) –Extent of impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clear as study progresses) , D (+/-) –Negligible or No impact is expected.

### 1-3-1-6 TOR for Environmental and Social Considerations Study

Based on the result of the scoping process mentioned above, TOR for environmental and social considerations study is established as follows.

Table 1-22 TOR for environmental and social considerations

No	Environmental Item	Survey item	Survey method
	Stakeholder meeting	① Confirmation of the giant clam farmer's intention ② Can the giant clam farmer be removed during the demolition works of the Icebox?	① Group discussion ② Individual visits
	Examination of Alternatives	① Review of the project site ② Review of construction methods	Discussion with PMDC and BMR
1	Air pollution	① Confirmation of the environmental standards ② Confirmation of the emission standards ③ Facilities in the surrounding areas that can be impacted	① Survey of existing materials ② Hearing to EQPB ③ Field reconnaissance
2	Water pollution	① Confirmation of the environmental standards ② Confirmation of the discharge standards ③ Water quality in the surrounding	① Survey of existing materials ② Hearing to EQPB ③ Measurement survey (water temperature, total phosphorus, total nitrogen, total organic carbon, suspended



No	Environmental Item	Survey item	Survey method
		seawater areas	matters, coliform counting, pH, dissolved oxygen, electric conductivity, salt content, total dissolved solids, seawater specific gravity)
3	Waste	① Methods to dispose of construction waste	①Survey on similar cases and hearing to EQPB
4	Soil pollution	①Preventive measures for oil leaks caused during construction	① Confirmation of details, methods, duration of construction works, types and operation of construction machinery/equipment and location to store them
5	Noise and Vibration	①Confirmation of the environmental standards ②Impacts on grouper and rabbitfish seed production facilities ③Impacts during construction ④Noises from pumps when they are in use	①Survey of existing materials ②Hearing to staff working at grouper and rabbitfish seed production facilities ③Field reconnaissance ④Field reconnaissance
7	Offensive odor	①Confirmation of detailed works of PMDC	①Field reconnaissance ②Hearing to PMDC
8	Protected areas	①Current directions and speeds near PMDC ② Animals and plants in their habitats and details of impacts on them	①Measurement survey ②Survey on similar cases and hearing to concerned organizations
9	Flora, Fauna and Biodiversity	①Animals and plants in their habitats and details of impacts on them ② Estimation of the scope of impacts	①Visual survey of sediments and vegetation on the seabed ②Survey of existing materials
13	Local economy such as employment and livelihood etc.	①State of the business operation cultivating giant clams at the Icebox	①Hearing to concerned parties
14	Cultural property and heritage	①Confirmation of registration of the ice manufacturing facilities as a historical and cultural property ② Confirmation of existence of objects for religious worship within the facilities	①Hearing to the Bureau of Arts and Culture ②Hearing to PMDC staff
15	Misdistribution of benefit and damage	① Assessment of benefits and impacts of project implementation	①Group discussion and individual visits
18	Working condition including occupational safety	① Status of industrial safety measures	① Field reconnaissance and survey of similar cases
19	Accidents	①Local traffic volume ② Construction equipment to be used	①Field reconnaissance ②Survey of similar cases

No	Environmental Item	Survey item	Survey method
	Stakeholder meeting	③ Confirmation of the giant clam farmer's intention Can the giant clam farmer be removed during the demolition works of the Icebox?	① Group discussion ② Individual visits
	Examination of Alternatives	① Review of the project site ② Review of construction methods	Discussion with PMDC and BMR
1	Air pollution	① Confirmation of the environmental standards ② Confirmation of the emission standards ③ Facilities in the surrounding areas that can be impacted	① Survey of existing materials ② Hearing to EQPB ③ Field reconnaissance
2	Water pollution	① Confirmation of the environmental standards ② Confirmation of the discharge standards ③ Water quality in the surrounding seawater areas	① Survey of existing materials ② Hearing to EQPB ③ Measurement survey (water temperature, total phosphorus, total nitrogen, total organic carbon, suspended matters, coliform counting, pH, dissolved oxygen, electric conductivity, salt content, total dissolved solids, seawater specific gravity)

### 1-3-1-7 Result of the Environmental and Social Considerations Study

According to TOR developed as mentioned above, impacts of each item were identified through field surveys. The results of the surveys are shown in Table 1-23.

Table 1-23 Results of environmental and social considerations Study

No	Environmental Item	Study result
	Stakeholder meeting	On November 20, 2015, a stakeholder meeting was held. The side to implement the project offered explanations on the outline of the project. All those participating agreed that this project should be implemented. Meanwhile, there was concern that during the construction period, the production of seed-clams would decrease and the inspection room for giant clams for export would be no longer there. It was decided that some measures should be taken, for example, continuing production of clam seedlings in other seawater areas and securing a temporary inspection room while the construction is underway.
	Examination of Alternatives	MNRET of the Government of Palau proposed that Ollei Port of Ngarchelong State should be chosen as an alternative site. As the result of field reconnaissance, the alternative site is found inappropriate for this project as the land area is small, it has unfavorable location and access and the construction costs can be larger.
1	Air pollution	It is expected that dust particles will be generated while construction is underway. Residential areas, however, are far from the site and only very small impacts on residents in the neighborhood are expected. No other

No	Environmental Item	Study result
		damage is expected than that caused by vehicles using the main road near the project site to transport materials and equipment. It is unlikely, therefore, that impacts would be made on residents.
2	Water pollution	<p>Wastewater generated from the facilities to be constructed will be stored in tanks for later collection with lifting vehicles and no other wastewater than that used in cultivation will flow into the sea. Giant clams can grow without being fed as they are photosynthetic and therefore no water pollution due to residues and excrement will occur. This way, no cultivation water will be polluted or give an impact on the environment.</p> <p>As the result of water quality surveys, water quality of the surrounding seawater areas was within the environmental standard level except for coliform count. This is affected by the sewage treatment plant located adjacent to PMDC. The coliform count exceeded the environmental standard in a simplified survey, while measurement data on the count obtained by EQPB in the neighborhood are within the environmental standard. At the sewage treatment plant, it is planned to improve its wastewater treatment capability under an ADB project in 2017 and therefore, the count is expected to be improved. In addition, PMDC is an entity mainly to produce giant clam seedlings and there will be no impact on cultivated adult giant clams since purchased clam seedlings will be grown in different seawater areas for 4 years until they become good to eat.</p>
3	Waste	<p>Disposal of waste generated during construction will be contracted to specialized vendors and reclaimed in landfills.</p> <p>PMDC bleaches giant clam shells with sodium hypochlorite to sell them to be used in accessories or decoration. As it is volatile, sodium hypochlorite is disposed of after it fully naturally decomposed. When any other chemicals are used after the constructed facilities start being in service, a request should be made to Palau Public Utilities Corporation to collect liquid waste of such chemicals so that no impact will be given on the environment.</p>
4	Soil pollution	One concern is that the soil can be polluted by lubricants leaked from construction vehicles during the construction period. After the commencement of the service, the facilities are not expected to cause any problem leading to soil contamination.
5	Noise and Vibration	<p>It was thought that noise and vibration would occur during construction. As the result of field reconnaissance, the distance between the closest house and the project site is found to be 300m and a road is far from the site, too, which means no impact is actually expected.</p> <p>It is expected that there will be only small impacts as, at the fish cultivation facilities, adult fish are cultivated in indoor facilities located at a far distance from PMDC. Meanwhile, a request was made to inform clearly when the buildings would be demolished and constructed so that those fish cultivation facilities could make seed production plans for groupers and rabbitfish.</p> <p>As pumps are to be installed indoors, noise is not expected to reach outside the facilities. Houses are located at a sufficiently far distance, that no impact is expected.</p>
7	Offensive odor	The seaweed that will grow within the premises of PMDC is not large in quantity and only 1 or 2 giant clams die monthly. They will be sources of odor to the surrounding areas.
8	Protected areas	The closest protected area (Ngederrak Conservation Area) is located at a far distance of about 2km. It is expected earth and sand can flow out during construction but the impact can be limited if measures to control water turbidity are taken. No impact is expected after the facilities start being in service.

No	Environmental Item	Study result
9	Flora, Fauna and Biodiversity	As the result of visual inspections, it was found that small reef fish, corals and adult Giant clams that supply seeds for PMDC grow in their habitats in the surrounding areas. If any water pollution occurs because of construction, it will be possible for fish to escape from the polluted area and adult giant clams grown in the ocean can be removed and therefore, there will not be any impact. There is a possibility, however, that corals will be impacted by turbid water that can restrict the sunlight. The scope of such impacts is considered limited and the degree of the impacts is expected to be small as turbid water can diffuse. As no water pollution is expected after commencement of the service, no impact will be given on the ecosystems.
13	Local economy such as employment and livelihood etc.	The unauthorized business owner who grows giant clams at the Icebox has already discussed with BMR and arrived at a peaceful solution. The owner agreed to remove his business prior to the start of the demolition works of the existing facilities and plans to move his business to a substitute site to be provided by the Koror State Government. In the future, after leaving the current site, the business owner will continue to receive technical assistance from BMR.
14	Cultural property and heritage	An adjacent park, Ice Box Park, was named after the Icebox constructed before the war, which are to be demolished by the Government of Palau. The facilities have been registered as a historical site but are not subject to conservation. Therefore, when an application is submitted to the Office for Historic and Cultural Properties Protection of the Bureau of Arts and Culture, the facilities can be demolished. Pieces of blocks have already started falling at the ice manufacturing facilities and there is a risk of a collapse and, therefore, PMDC staff have agreed to the demolition. In addition, there are no trees and stone monuments for religious worship within the project site.
15	Misdistribution of benefit and damage	There are no citizens living near the project site and, therefore, it is not expected that any damages and benefits can be unevenly distributed among nearby residents during the construction. It is expected that benefits can be distributed unevenly between Giant clam cultivation farmers and other people after the facilities start being in service. This project, however, can lead to an expansion of business to release natural Giant clams or projects to promote Giant clam cultivation. Such an outcome can lead to a sharing of benefits among not only Giant clam cultivation farmers but also other fishermen and citizens who self-consume Giant clams.
18	Working condition including occupational safety	There is a concern that traffic of heavy machines and large vehicles can cause accidents but such accidents can be prevented if appropriate measures are taken such as safety education.
19	Accidents	The project site is located at the edge of Malakal Island and traffic is very light there. While the construction is underway, however, large vehicles will travel in the neighboring areas and there is a concern that accidents can occur to visitors to nearby facilities and tourists visiting the Ice Box Park. Such accidents can be prevented by appointing traffic controllers to points where particularly such vehicles travel heavily and taking measures to give important information to people being in areas where construction works are being carried out. For the construction period, it is necessary to prepare a manual on safety measures and make construction companies fully understand such measures.

**1-3-1-8 Impact Assessment**

Impact assessment made based on the study result is shown in Table 1-24.

Table 1-24 Impact assessment based on study result

No	Environmental Item	Rating				Basis of assessment
		Scoping		Survey finding		
		I/II	III	I/II	III	
Environmental Pollution						
1	Air pollution	B-	D	B-	D	Construction period: Although there will only be very small impacts on residents, emissions and dust particles will be temporarily generated during demolition of existing facilities and construction of new facilities, as well as when construction equipment is in operation and vehicles travel in the neighborhood. As the site is an open area facing the sea, however, air pollutants will immediately disseminate and not much impact can be expected. In-service period: No impact is expected as there will be no construction works nor traveling of large-size vehicles.
2	Water pollution	B-	D	B-	D	Construction period: Particularly turbid water is expected to be an impact, as during construction of quays and ground facilities, earth and sand will flow into the sea along with rainwater. In-service period: No water pollution is expected due to Giant clam culture.
3	Waste	B-	B-	B-	B-	Construction period: Construction waste like concrete blocks will be generated during demolition of the existing facilities. Waste to be generated will be disposed of by vendors appropriately according to applicable laws and regulations of Palau. In-service period: Waste generated from the office will be collected and disposed of regularly. In this project, it is not planned to purchase chemicals and no waste liquid will be generated. No problem is expected because of currently used sodium hypochlorite, as it will be fully volatilized for later disposal.
4	Soil pollution	B-	D	B-	D	Construction period: There is a possibility that soil will be polluted by oil leaked from heavy construction equipment. In-service period: No impact is expected as the inside of facilities are mostly covered with concrete and no chemicals other than sodium hypochlorite which has a natural decomposition characteristic will be used.
5	Noise and vibrations	C	C	B-	D	Construction period: The construction project does not include works that can cause problematic noise and vibration (pile

No	Environmental Item	Rating				Basis of assessment
		Scoping		Survey finding		
		I/II	III	I/II	III	
						driving) and there will be only a small impact on the neighboring fish culture facilities. In addition, the project site is located on public land at the tip of the peninsula where there is no private residence and, therefore, no issues of noise, vibration, etc. are expected to occur. In-service period: Since lifting pumps are located indoors, no noise is expected to affect outside areas. There is no other equipment that can generate noise and vibration.
6	Ground subsidence	D	D	N/A	N/A	
7	Offensive odor	D	B-	D	D	Construction period: No chemicals that can be a source of odor are used and no foul water is generated, therefore, no impact is expected. In-service period: There are no sources of odor within PMDC.
Natural Environment						
8	Protected areas	B-	D	D	D	Construction period: A protected area, Ngederrak Conservation Area, is located about 2km to the southeast of the project site but no impact during construction is expected as it is at a 2km distance. In-service period: No impact is expected as no air and water pollution is projected.
9	Flora, Fauna and Biodiversity	B-	D	B-	D	Construction period: There is concern that turbid water can inhibit photosynthesis of wild giant clams and corals and affect their growth. In-service period: No turbid water is expected to occur during the time giant clam seedlings are produced and grown.
10	Hydrometeor	D	D	N/A	N/A	
11	Topography and Geology	D	D	N/A	N/A	
Social Environment						
12	Involuntary resettlement	D	D	N/A	N/A	
13	Local economy such as employment and livelihood etc.	B-	B+	D	B+	Construction period: It is planned that the unauthorized business owner cultivating giant clams within the project site will voluntarily move to a substitute site provided by the Koror State Government and BMR promised to continue to offer technical assistance to the owner. In-service period: As more giant clam seedlings will be produced, it will be easier for cultivating farmers to obtain the clam seedlings.

No	Environmental Item	Rating				Basis of assessment
		Scoping		Survey finding		
		I/II	III	I/II	III	
14	Cultural property and heritage	C	C	D	D	No difficulty is expected to demolish the former Icebox located at the project site, as they are not subject to conservation. There are no trees and stone monuments for religious worship within the premises of PMDC, either.
15	Misdistribution of benefit and damage	C	C	D	D	Construction period: There are no neighborhood residents who will be affected by uneven delivery of damages and benefits. In-service period: It is projected that harvesting of wild giant clams will be banned except for the purpose of self-consumption. BMR's promotion of giant clam culture and an increase projected in seed production through an improvement in PMDC will lead to an enhancement of natural resources and will benefit not only giant clam farmers but also those who harvest for self-consumption, which will resolve the issue of uneven benefits.
16	Landscape	D	D	N/A	N/A	
17	The poor, indigenous of ethnic people	D	D	N/A	N/A	
18	Working condition including occupational safety	B-	B+	B-	D	Construction period: It is necessary to consider health and safety of construction workers. In-service period: PMDC's facilities and equipment will be improved leading to improved work conditions for PMDC staff.
Other						
19	Accidents	B-	D	B-	D	Construction period: There is a possibility that a collapse of materials and machinery operation error during construction can cause fatal/body injuries. In-service period: No dangerous operations are planned for cultivation activities and no accidents are expected to occur.

Note 1 : I - Planning stage, II – Construction Stage, III - Operational Stage

Note 1 : Rating (Magnitude of impacts) ; both positive impact (+) and negative impact (-) are expected due to the project activities. A (+/-) – Significant (or major impact) is expected, B (+/-) –Not significant but some impact (or moderate) is expected, C (+/-) –Extent of impact is unknown or not clear (Further examination is needed. It should be taken into consideration that impacts may become clear as study progresses) , D (+/-) –Negligible or No impact is expected.

### 1-3-1-9 Measures to Reduce Impacts and Expenses for Implementing such Measures

Measures to reduce negative impacts on the environment caused in this project and expenses necessary for implementing such measures are shown in Table 1-25.

Table 1-25 Measures to reduce impacts and expenses for implementing such measures

Environmental item	Mitigation measure	Implementing agency	Responsible agency	Cost
Air pollution	<p>During the construction, water will be sprinkled on roads and the work site as necessary and dust-tight nets will be installed.</p> <p>According to work management plans, construction traffic will be controlled efficiently to reduce emissions.</p>	Contractor	BMR	Including construction contract
Water pollution	<p>During the construction sediment tanks to discharge water will be installed and a clear layer of rainwater and turbid water will be discharged. Sediments will be removed regularly with suction pumps.</p> <p>When constructing quays, silt fences will be installed to prevent turbid water from spreading.</p>	Contractor	BMR	Including construction contract
Soil pollution	<p>In order to prevent oil from leaking, regular maintenance will be implemented including visual inspection of hydraulic pressure hoses of heavy equipment.</p> <p>If any oil leak is found, contaminated soil will be collected for disposal and the disposal process will be contracted to specialized vendors.</p>	Contractor	BMR	Including construction contract
Noise and vibrations	<p>Explanations on construction details and period will be given to other fish culture facilities to obtain their understanding.</p> <p>Noise prevention measures (installation of soundproof cover, etc.) will be taken.</p> <p>Monitoring of noise and vibration will be made compulsory.</p> <p>When fish culture facilities submit a complaint, discussions will be made among concerned parties and measures will be taken promptly such as changes in construction hours or suspension of construction works.</p>	Contractor	BMR	no extra cost
Flora, Fauna and Biodiversity	<p>Giant clams of PMDC (adult clams) will be evacuated to other seawater areas prior to start of construction.</p> <p>When constructing quays, accumulation of sand sediments will be prevented with silt fences. The state of corals in their habitats will be monitored visually.</p>	Contractor	BMR	Including construction contract
Working condition including occupational safety	<p>Safety in work environment will be secured by encouraging helmet use, delivering dust masks, etc.</p>	Contractor	BMR	no extra cost



Environmental item	Mitigation measure	Implementing agency	Responsible agency	Cost
Accidents	<p>A safety management manual will be developed, and delivered to workers and safety education will be carried out regularly.</p> <p>Traffic controllers will be assigned to secure safety for workers within the construction site but also for users of neighboring facilities and visitors to the Ice Box Park.</p> <p>Daily near-accidents and potential accidents will be reported in a safety management logbook and such records will be shared among all workers to prevent accidents from occurring.</p>	Contractor	BMR	Including construction contract

**1-3-1-10 Environmental Monitoring Plan**

The proposed monitoring plan for this project is shown below. Monitoring will be carried out by construction companies and BMR will supervise the monitoring process. As an environmental impact fee, MNRET needs to pay an amount accounting for 0.15% of the total construction cost to EQPB.

Table 1-26 Monitoring plan

Environmental item	Survey items	Survey point	Survey frequency	Responsible agencies
Erosion and sedimentation	Erosion, overflow, blockage or damage	Silt curtains/fences, sediment traps, drainage ditches/swales, culverts/storm, drains/catch basins, roads, slopes/berms, coverings/surface, protection/vegetation, discharge points/outfalls	Once per week and after each significant storm during construction	Contractor BMR
Erosion and sedimentation	Erosion/sedimentation controls functioning	Silt curtains/fences, sediment traps, drainage ditches/swales, culverts/storm, drains/catch basins, roads, slopes/berms, coverings/surface, protection/vegetation, discharge points/outfalls	Once per week and after each significant storm during construction	Contractor BMR

**1-3-1-11 Stakeholder meeting**

On November 20, 2015, a stakeholder discussion for this project was made at a BMR meeting room. There were a total of 21 participants including giant clam farmers, representatives of the state government and PMDC staff and full support was obtained concerning the implementation of this project from them. Details of the discussion are as follows: As there are no residents living in the neighborhood, no discussion has been made with citizens in the neighborhood.

Date : 11:00~12:30, 20 November, 2015

Place : BMR office

Participants :

Giant clam farmers, Representative of State government, PMDC staff

Agenda : Renovation plan of PMDC acuaculture facilities in this project, present situation of promotion activities for giant clam and question-and-answer

The following discussion was made in a question-and-answer session.

With respect to the adequacy of existing PMDC as a site to implement this project, an agreement was reached that the current site will not cause issues in relation with nature and the environment and it is best to implement the project at the site also in terms of costs.

A concern was mentioned by participants, however, that while the project is carried out, seed production will be suspended as well as sales of seed-clams. The PMDC side explained that production and sale of giant clam seedlings would be able to continue at other seed production sites even during the construction.

A comment was also made that, after the existing facilities were demolished, there would be no place to inspect and package giant clams for export. To this comment, an explanation was made that a temporary shed would possibly be secured during the demolition of existing facilities and construction of new facilities.

Participants in the discussion expressed an agreement to the implementation of this project since demand for giant clams had been strong and it was essential to increase seed production in order to expand giant clam culture. Meanwhile, no concern was expressed concerning negative impacts on the natural and social environment that could be caused by the implementation of project.

### **1-3-2 Site acquisition and resettlement**

The planned construction site in this project is located within the premises of PDMC and, therefore, there is no need to acquire another land site or relocate residents. Confirmation was also made in writing concerning the right of use of the PMDC premises.

### **1-3-3 Grievance Mechanisms**

In the event any complaint is presented in relation with the implementation of this project, BMR will make response.

### **1-3-4 Others**

#### **1-3-4-1 Proposed Monitoring Form**

Based on the proposed plan shown in Table 1-26, a monitoring form which BMR makes records of and manages is proposed as shown in the Annex-6 of the Minutes of Discussions (Explanation of Draft Preparatory Survey Report).

1. Permits and licenses and explanations to residents

Monitoring item	Status during the reporting period
Acquisition of construction permit of Koror State	
Acquisition of the Environmental Clearance of EQPB	
Explanation meeting to neighboring residents by construction companies	

2. Pollution Control (Construction period)

- Erosion/sedimentation

Category	Measurement method	Remarks (Measurement point and frequency)
Erosion/sedimentation	The EQPB form should be used (refer to Appendices 54). EQPB will add monitoring items, as necessary.	Measurement point: Around the construction work site Frequency: Weekly and after each torrential rainfall

- Noise and vibration

Item	Measurement method	Remarks (Place and frequency of measurement)
Noise and vibration	Hearing survey to fish culture and production facilities	Place of measurement: Construction site Frequency: Weekly

3. Natural environment (during the construction period)

- Ecosystems

Item	Measurement method and status during the reporting period	Remarks (Place and frequency of measurement)
State of growth of corals	Visual confirmation of their growth and sediments Recording in the BMR's internal report	Place of measurement: Construction site Frequency: Monthly

**1-3-4-2 Environmental Checklist**

The environmental checklist to be based in this project is shown in Table 1-27. (Refer to the Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (for Fishery).

Table 1-27 Environmental checklist

Category	Environmental item	Main check item	Yes: Y No: N	Reasons
Explanation 1 Permits and	(1)EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process?	N	(a) EQPB judges whether EIS (EIA) is also required to be submitted after the application for Environmental Clearance is submitted. As soon as components of this project are finalized, the application for Environmental Clearance should be submitted to hear their judgment. A confirmation was made in advance and we were told an EIS was not necessary.

Category	Environmental item	Main check item	Yes: Y No: N	Reasons
		(b) Have EIA reports been approved by authorities of the host country's government?	N	(b) As mentioned above, since no project components are finalized yet, no judgment whether EIS is necessary has been made.
		(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?	N	(c) In case of an EIS is necessary, a public hearing is required to be held as many as three times.
		(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	N	(d) A construction permit from Koror State and the confirmation about cultural properties from the Ministry of Arts and Culture are necessary. If the construction area includes any seawater area, an approval of the Governor of Koror is necessary.
	(2)Explanation to the Local stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?	Y	(a) In order to review the content and issues of this project, on November 20, 2015, a stakeholder meeting was held at a BMR meeting room. An agreement was reached by participants concerning the implementation of this project.
		(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	Y	(b) Participants commented that an inspection room was necessary for exporting giant clams during the construction of facilities. The side to implement the project reflected the need to establish an inspection room in the project component.
		(3)Examination of Alternatives	Y	(a) As the result of reviews made on alternatives including a 'zero option,' it was confirmed that this project is the most efficient plan to achieve the objectives.
2 Pollution Control	(1)Water Quality	(a) Are considerations given to water pollution of the surrounding water areas by effluents, such as fish pond effluents? Are adequate standards for the use of feeds and agents/antibiotics established? Is a framework established to increase awareness of these standards?	Y	(a) Giant clams do not need to be fed to grow. Water to culture giant clams is purified by their filtering function. In this project, no chemicals that can pollute the environment will be used. Wastewater such as that from toilets, etc. will be stored in a tank and collected regularly by collection vehicles. Therefore, wastewater from PMDC will not pollute the environment.
		(b) Do effluents from various sources, such as fish ponds, processing facilities, and fishing boats, and water quality of the surrounding water bodies comply with the country's effluent standards and the country's ambient water quality standards?	Y	(b) Water quality in seawater areas neighboring PMDC is all within the environmental standard. The only exception, coliform bacteria count, is the result of wastewater from the adjacent sewage treatment facilities. No impact will be made to the production and sale of Giant clams as PMDC is involved only in Giant seed-clam culture. The treatment capacity of the sewage treatment facilities will be improved in an ADB project in

Category	Environmental item	Main check item	Yes: Y No: N	Reasons
				2017 and the issue of coliform bacteria will also be solved.
	(2)Waste	(a) Are wastes generated from the ships and other project facilities properly treated and disposed of in accordance with the country's regulations (especially fish processing facilities)?	Y	(a) Waste generated during construction will be disposed of in landfills by specialized vendors. After the commencement of service, the facilities will use sodium hypochlorite to bleach giant clam shells but no problem is expected as the chemical will be disposed of after it is fully volatilized.
	(3)Noise and Vibration	(a) Do noise and vibrations comply with the country's standards (especially fish processing facilities)?	Y	(a) There are no standards in place for noise and vibration. No noise and vibration problem is expected since no residents are in the neighborhood. As there is a concern about the fish culture facilities located adjacent to the project site, it is necessary to conduct hearing surveys regularly to share information on construction plans.
	(4)Odor	(a) Are there any odor sources? Are adequate odor control measures taken (especially fish processing facilities)?	N	(a) There are no sources of odor within the project site and the small number of dead Giant clams will not cause odor.
	(5)Sediment	(a) Are adequate measures taken to prevent contamination of sediments by discharges or dumping of hazardous materials from the ships and related facilities?	Y	(a) There should be facilities where survey ships of BMR will temporarily lay aside and no commercial ships will anchor. No discharge and dumping of hazardous substances are expected and no adverse impacts will be made to bottom sediments.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	N	(a) The project site is not located in a conservation area. The nearest natural conservation area is 2km away from it and no adverse impact is expected.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	N	(a) The project site has no ecologically valuable habitat. Corals grow in a neighboring seawater area.
		(b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions?	N	(b) The project site does not encompass habitats of endangered species. Habitats of protected fish (groupers, sea turtles and rabbitfish) are in the neighboring seawater areas.
		(c) Is there a possibility that changes in localized micro-meteorological conditions, such as solar radiation, temperature, and humidity due to a large-scale timber harvesting will affect the surrounding vegetation?	N	(c) No significant impacts on ecosystems are expected to occur from this project.
		(d) Is there a possibility that the project will adversely affect aquatic organisms? If significant impacts are anticipated, are adequate protection measures taken to reduce the impacts	Y	(d) Turbid water generated during construction can give adverse impacts on the growth of corals. Measures will be taken during the construction period, such as installation of silt fences and discharge

Category	Environmental item	Main check item	Yes: Y No: N	Reasons
		on aquatic organisms?		of a clear layer of rainwater stored in a sediment tank on ground.
		(e) Is there a possibility that the project will adversely affect vegetation and wildlife? If significant impacts are anticipated, are adequate measures taken to reduce the impacts on vegetation and wildlife?	N	(e) As this project is an improvement project of facilities, acquisition of a new land is unnecessary. No adverse impacts on vegetation and wild animals on the ground are expected.
		(f) Is there a possibility that aquatic organisms and fish will be overexploited? Are fishery practices that reduce impacts on ecosystems employed? Is there a possibility that lost or discarded fishing nets, traps and other fishing gear will adversely affect ecosystems?	N	(f) This project does not include fishing activities.
		(g) Is there a possibility that the feeding associated with aquaculture activities will cause eutrophication of water bodies and result in red tide blooms? Are adequate measures for eutrophication considered?	N	(g) For giant clam seed production, no feeds will be used and no red tide is expected to occur.
		(h) Is there a possibility that introduction of exotic species (non-native invasive species) and migration of disease-carrying pests will disturb ecosystems? Are adequate pest control measures considered?	N	(h) Giant clams targeted in this project are a local species and introduction of alien species is not planned.
	(3) Hydrology	(a) Is there a possibility that hydrologic changes due to installation of facilities, such as fish ponds in inland and coastal areas will adversely affect surface water and groundwater flows?	N	(a) In this project, only seawater will be used by pumping from coastal areas. River water or groundwater will not be used and there will be no impact on water systems.
	(4) Topography and Geology	(a) Is there a possibility that development in coastal zones will cause a large-scale of alteration of topographic features and geologic structures, subsidence and elimination of natural beaches?	N	(a) This project is a project to improve existing facilities. New land development or geological alterations are not planned.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	N	In this project, no resettlement is planned.
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?	N	In this project, no resettlement is planned.
		(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?	N	In this project, no resettlement is planned.

Category	Environmental item	Main check item	Yes: Y No: N	Reasons
		(d) Are the compensations going to be paid prior to the resettlement?	N	In this project, no resettlement is planned.
		(e) Are the compensation policies prepared in document?	N	In this project, no resettlement is planned.
		(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly people below the poverty line, ethnic minorities, and indigenous peoples?	N	In this project, no resettlement is planned.
		(g) Are agreements with the affected people obtained prior to resettlement?	N	In this project, no resettlement is planned.
		(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?	N	In this project, no resettlement is planned.
		(i) Are any plans developed to monitor the impacts of resettlement?	N	In this project, no resettlement is planned.
		(j) Is the grievance redress mechanism established?	N	In this project, no resettlement is planned.
		(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	Y
	(b) Are proper allotments for rights to water area use (e.g. fishing rights) made?		N	(b) There are no fishermen operating in the seawater areas near the project site.
	(c) Is there a possibility that water-borne or water-related diseases (e.g., schistosomiasis, malaria, filariasis) will be introduced? Is adequate consideration given to public health education, if necessary?		N	(c) No diseases are expected to occur due to wastewater discharged from the project site.
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	N	(a) There are no architectural structures registered as cultural heritage sites at the existing facilities and in the neighborhood. In the project site, there are no trees or stone monuments for religious worship, either. The existing facilities will be demolished after obtaining an approval of the Ministry of Arts and Culture, which is a standard procedure.
		(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	N

Category	Environmental item	Main check item	Yes: Y No: N	Reasons
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?	N	There are no ethnic minorities or indigenous peoples in the neighborhood that can be affected by the project implementation
		(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	N	
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?	Y	(a) Education will be provided to concerned parties of this project so that they can conform to the labor law and industrial safety law.
		(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?	Y	(b) Safety measures will be taken, for example, requiring the use of safety shoes, construction helmet and dust mask.
		(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?	Y	(c) Make concerned parties in this project hold safety workshops regularly.
		(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	Y	(d) By not only clearly describing workers activities during and after work hours in the employment contract but also by promoting close communication with concerned parties in this project, a monitoring framework should be established so that workers will not enter neighboring facilities and threaten residents safety.
	5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	Y
(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?			Y	(b) Silt fences and sediment tanks will be installed as there is a concern that turbid water can affect corals adversely.
(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?			N	(c) No impact is expected on the social environment.
(2) Monitoring		(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?	Y	(a) The monitoring plan is described in Table 1-26 of this report. Construction companies will be the implementing organizations and BMR will act as the



Category	Environmental item	Main check item	Yes: Y No: N	Reasons
				supervising organization.
		(b) What are the items, methods and frequencies of the monitoring program?	Y	(b) Considering impacts on coral reef and fish culture facilities in the sea near the project site, particularly a focus is placed on the monitoring of water quality. Water quality will be monitored weekly and when it is raining and monitoring of other items will be made monthly.
		(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?	Y	(c) A monitoring team will be organized within BMR and the implementation of monitoring will be provided in the construction contract as one item
		(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	Y	(d) It is necessary to report the result of monitoring in accordance with the rule of EQPB. The method and frequency of reporting has not been established.
6 Note	Reference to Checklist of Other Sectors	(a) For processing and storage facilities, where necessary, pertinent items described in the Mining and Industry checklist should also be checked.	N	(a) The facilities in this project do not correspond to processing and storage facilities.
		(b) Where necessary, pertinent items described in the Ports and Harbors checklist should also be checked (e.g., projects including construction of ports and harbor facilities).	Y	(b) In this project, "improvement of quays" is included in the plan and therefore, reviews were made by adding a section for "(5) Bottom sediments" in 2. Pollution control.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed, (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	N	(a) This project does not correspond to a cross-border project or a project with a global-scale environmental issue.

## CHAPTER 2 CONTENTS OF THE PROJECT

## **CHAPTER 2. CONTENTS OF THE PROJECT**

### **2-1 Basic Concept of the Project**

#### **2-1-1 Overall Goals and Project Goals**

Fisheries in Palau have been traditionally positioned as a leading industry, which has contributed to Palau's job creation and securing of cash income. Tourism based on the country's rich marine environment is also positioned as one of the most important industries in Palau and the number of tourists visiting has been on the rise.

Tourism in Palau heavily relies on its beautiful marine environment and therefore, the Government of Palau pays close attention to the conservation of the marine environment and works on the promotion of fish culture, development of regulations and monitoring of coastal and offshore fisheries, aiming at developing sustainable marine resources that are well-balanced with the natural environment. As part of those efforts, the Ministry of Natural Resources, Environment and Tourism (MNRET) and the Bureau of Marine Resources (BMR) have carried out the production of giant clam seedlings at the Palau Mariculture Demonstration Center (PMDC).

Meanwhile, a large number of tourists are visiting Palau as they are attracted to the world-class coral reef and its ecosystem and as the result, in recent years, tourism in Palau has been contributing to three quarters of the country's GDP growth rate, more than 80% of exports, 15% of tax revenues and 40% of employment (IMF, 2014).

The number of tourists visiting Palau reached 167,000 in 2015 compared to 58,000 in 2002, accordingly, demand for giant clams also increased with the growth in the number of tourists, leading to a stronger pressure on giant clam catches. The clams are not only used domestically as food for local citizens and tourists but also exported to many countries, particularly to Europe and the United States where shells are used as materials for ornaments and accessories and now wild giant clams that can easily be harvested are facing the threat of extinction. In addition, as demand at hotels and restaurants increases, incidents in which cultured giant clams are stolen have recently occurred.

Considering these situations, the Government of Palau developed a bill concerning the Giant Clam Seed Sustainability Project Fund aiming at strengthening policies to increase the output of cultivated giant clams as well as it has worked to increase the production of giant clam seedlings by inviting specialists from the Overseas Fishery Cooperation Foundation (OFCF). In addition, the Government plans to introduce a bill concerning ban on sale, purchase of giant clams (House Bill No. 9-202-12), aiming at regulating trade of wild giant clams and preventing theft of cultivated giant clams.

PMDC which is the only organization producing giant clam seedlings in Palau is the successor of the Micronesian Mariculture Demonstration Center (MMDC) established in 1973 and was renamed in 1994, taking the favorable opportunity when the country became independent. As the facilities of PMDC became obsolete, in 1999 and 2003, OFCF repaired tanks and in 2005 OFCF installed elevated water tanks. The maintenance service for pumps and boats has been provided continuously basis at the facilities. But, in addition to the fact that the quantity of seawater supply declines, larval tanks break and facilities in generally aged, repair works have been made randomly and repeatedly when necessity occurred, while the facilities lack a comprehensive management policy, physical work flows are inappropriate and problems

occur such as a decrease in production amount and a lower work efficiency. Now the facilities need an urgent improvement.

This project, by renovating facilities of PMDC, providing equipment and promoting production of giant clam seedlings, plans to contribute to the country, for example, in decreasing pressure on wild giant clam catches, improving local residents' livelihood based on giant clam culture, increasing income of concerned business owners including giant clam farmers and recovering resources through release of seed clams. Promoting giant clam culture can comply with the country's economic development plan that places an emphasis on economic development utilizing marine resources and environmental protection and also can contribute to its sustainable economic growth.

[Overall goal]

This Project aims at further promotion of giant clam culture.

[Project purpose]

The functions of the PMDC are strengthened through renovation of the facilities and equipment.

## 2-1-2 Outputs of the Project

In this project, assistance will be provided to improve facilities at PMDC in order to achieve the above-mentioned overall goal and purpose. Through the above, this project is expected to generate such detailed outputs as follows.

### (1) Quantitative effects

Indicators	Base (2015)	Target (2021) (3 years after the completion of the Project)
Survival rate of giant clam at the initial juvenile phase (%)* (4 – 6 months after replaced from the larval tank to the nursery tank)	N/A	80%**
Annual production quantity of juvenile giant clams (the number of clams)	32,869***	112,000

\* Owing to the juvenile clams for ornamental purpose are intentionally culled, survival rate is applied for food clam species only.

\*\* The 80% average survival rate on a continuing basis leads to stable production.

\*\*\* The population size of annually produced juvenile giant clams for 2015 is the number of clams shipped.

### (2) Qualitative effects

- 1) The giant clam farmers are more satisfied with the seeds produced in PMDC.
- 2) PMDC contributes to awareness raising for marine resources conservation.

Among others, components that are targets of this cooperation project include construction of a mariculture demonstration center building, sheds, an elevated water tanks building, a pump house and a machinery house and development of machinery and equipment.

### 2-1-3 Examination of the Request

The adequacy and necessity of each of the requested item are evaluated as shown in Table 2-1.

Table 2-1 Result of evaluation of requested items

#### a. Building Facilities

Requested Component		Priority	Result of the examination		
1	Mariculture Promotion Center Building	Entrance hall	A	○	Necessary to function as a threshold to the facilities and should be included in the project.
		Exhibition hall / Shop	A	○	Necessary for promotion and promotion/publicity activities and should be included in the project.
		Preparation room for handy-craft	A	○	Necessary to produce handicrafts and should be included in the project.
		Diving gear store	A	○	Necessary to store diving gear and should be included in the project.
		Kitchen / dining rooms	A	○	Necessary for employees to prepare meals and take breaks and should be included in the project.
		Night duty room	B	×	Overnight works are not carried out and should not be included in the project.
		Preparation rooms	A	○	Necessary as an examination room when producing seed-clams and should be developed as a dry laboratory.
		Wet and dry laboratories	A	○	Necessary for seed-clam production and inspection and packaging for export and should be developed as a room used both as wet laboratory and inspection and packaging room for exporters.
		Exporter's room	A	○	Necessary for seed-clam production and inspection and packaging for export and should be developed as a room used both as wet laboratory and inspection and packaging room for exporters.
		Storages	A	○	Necessary for storing equipment required for seed production and should be included in the project.
		Dormitories	C	×	Accommodations in downtown are available and should not be included in the project.
		Manager's room	A	○	Necessary as the office for persons responsible for facilities management and should be included in the project.
		Scientist's room	A	○	Necessary as the office for experts and should be included in the project.
		Staff room	A	○	Necessary as the office for staff and should be included in the project.
		Library / conference room	A	○	Necessary as a room for both storage and reading of materials as well as small-scale meetings and should be included in the project.
		Toilets	A	○	Toilets for staff to be included in the project.
Utilities	A	○	Necessary as the small kitchen for staff and should be included in the project.		
Shower room	A	○	To be used by staff after works such as diving, maritime operation, selection, etc. and should be included in the project.		
2	Raceway tanks	Raceways for nursery and grow-out	A	○	Indispensable for seed production and should be included in the project.

Requested Component			Priority	Result of the examination	
3	Sheds	Transparent roofing above paved rearing areas (1,200 m <sup>2</sup> in total)	A	○	Necessary for water quality management and should be included in the project.
4	Machinery house	Rooms for setting seawater intake pumps, air blowers, an emergency generator and elevated seawater reservoirs	A	○	Necessary facilities for setting up major seed production facilities and should be included in the project.
5	Seawater and air supply system	Seawater intake x 2	A	○	Necessary facilities for seed production and should be included in the project.
		Seawater intake pumps x 3	A	○	Necessary facilities for seed production and should be included in the project.
		Air blowers x 4	A	○	Necessary facilities for seed production and should be included in the project.
		Rapid sand filters x 2	A	○	Necessary facilities for seed production and should be included in the project.
		Elevated seawater reservoirs x 2	A	○	Necessary facilities for seed production and should be included in the project.
		Piping and electrical works x 1 set	A	○	Necessary facilities for seed production and should be included in the project.
		Emergency generator x 1	A	○	Necessary facilities for seed production and should be included in the project.
6	Public utility	Toilets and changing / shower rooms for visitors	A	○	Necessary as a room that encompasses toilets and for changing/shower for visitors and should be included in the project.
7	Solar power generating system	50 kW or sufficient capacity to cover daytime power consumption at PMDC	A	○	Necessary facilities contributing to reduction of operational costs and should be included in the project.

#### b. Civil engineering facilities

Requested Component			Priority	Result of the examination	
1	Landing quay renovation	Renovation of quay steps	A	○	Necessary facilities for promotion of Giant clam culture and should be included in the project.
		Mooring buoys, bollards and fenders for small boats			
		A manual jib crane			
2	Parking lots and other auxiliary facilities	Car parking, Boat parking, Gate, Fence	A	○	Necessary facilities for facilities operation and should be included in the project. For removing existing fences for implementing construction, fences should also be included.

#### c. Equipment and materials

Requested Component			Priority	Result of the examination	
1	Equipment for Giant	Screen nets	B	○	Necessary at the outlets of culture tanks to prevent seed-clams being washed away and should be included in the project.
	Clam Culture	Shade nets	A	○	Necessary for light control when producing seed-clams and should be included in the project.

Requested Component		Priority	Result of the examination		
		Plankton nettings	A	○	Necessary for collecting fertilized eggs and hatchlings and should be included in the project.
		Scoop nets	B	○	Necessary for selection of juvenile clams and harvesting and should be included in the project.
		Plastic container	A	○	Necessary for collection of juvenile and adult clams and should be included in the project.
		Plastic basket	A	○	Necessary for selection of juvenile and adult clams, cleaning, etc. and should be included in the project.
		Polyethylene nettings	B	○	Necessary for multiple purposes such as screens for outlets and for collection of juvenile clams and should be included in the project.
		Oxygen regulator	B	○	Necessary when shipping and packing Giant clams and should be included in the project.
		Spray gun, horse	B	○	Necessary when shipping and packing Giant clams and should be included in the project.
		Friction sawing machine	A	○	Necessary for cutting pipes, reinforcing steel, etc. and should be included in the project.
		Bench grinder	A	○	Necessary for drilling holes in PVC pipes for aeration and should be included in the project.
		Disk grinder	A	○	Necessary for processing shells (cutting and polishing) and should be included in the project.
		Hand grinder	A	○	Necessary for processing shells (for craftworks and ornaments) and should be included in the project.
		Hand tools	A	○	Necessary for maintaining facilities/equipment such as pumps and blowers and should be included in the project.
		Electric screwdriver	A	○	Necessary for drilling holes and processing of culture equipment and materials and should be included in the project.
2	Laboratory Equipment	Profile projector	A	○	Necessary for measuring and observing eggs, hatchlings, etc. and should be included in the project.
		Biological microscope	A	○	Necessary for measuring and photographing symbiotic algae, eggs and hatchlings and should be included in the project.
		Stereoscopic microscope	A	○	Necessary for measuring and photographing hatchlings, juvenile clams, parasitic shellfish, etc. and should be included in the project.
		Refrigerator	A	○	Necessary for storing samples and reagents and should be included in the project.
		Deep freezer	A	○	Necessary for long-term storage of samples and should be included in the project.
		Cabinet for glassware	A	○	Necessary for storing glass tools, etc. and should be included in the project.
		Glassware	B	○	Necessary for microscopic observation and should be included in the project.
		Forceps	B	○	Necessary for stimulating spawning and should be included in the project.
		Dissecting Scissors	B	○	Necessary for stimulating spawning and should be included in the project.
		Scalpel and blades	B	○	Necessary for stimulating spawning and should be included in the project.
		Scoopula	B	○	Necessary for measuring reagents and should be included in the project.
		Analytical balance (Electric)	A	○	Necessary for measuring reagents and should be included in the project.

Requested Component		Priority	Result of the examination	
	Pipet	B	○	Necessary for stimulating spawning and should be included in the project.
	Micropipet, chip set	A	○	Necessary for counting the number of eggs and should be included in the project.
	Beaker 1	B	○	Necessary for stimulating spawning and should be included in the project.
	Beaker 2	B	○	Necessary for observation, etc. of eggs and hatchlings and should be included in the project.
	Erlenmeyer flask 1	B	○	Necessary for stimulating spawning and should be included in the project.
	Erlenmeyer flask 2	B	○	Necessary for transplanting symbiotic algae and should be included in the project.
	Graduated cylinder	B	○	Necessary for blending of reagents, etc. and should be included in the project.
	Counting Chamber	B	○	Necessary for counting the number of eggs and hatchlings and should be included in the project.
	Petri dish	B	○	Necessary for observation of hatchlings, symbiotic algae, etc. and should be included in the project.
	Digital vernier calipers	A	○	Necessary for accurate measurement of shell length and should be included in the project.
	Stainless vernier calipers	A	○	Necessary for measuring juvenile shell length and should be included in the project.
	Calipers (large)	A	○	Necessary for measuring adult clam length and should be included in the project.
	Calipers (middle)	A	○	Necessary for measuring adult clam length and should be included in the project.
	Injection syringe	B	○	Necessary for stimulating spawning and should be included in the project.
	Polyethylene container	A	○	Necessary for stimulating spawning and should be included in the project.
	Culture tank (FRP)	A	○	Necessary for egg collection and hatchling cultivation and should be included in the project.
	Panlite tank 1	A	○	Necessary for egg collection and hatchling cultivation and should be included in the project.
	Panlite tank 2	A	○	Necessary for egg collection and hatchling cultivation and should be included in the project.
	Panlite tank 3	A	○	Necessary for egg collection and hatchling cultivation and should be included in the project.
	Panlite tank 4	A	○	Necessary for egg collection and hatchling cultivation and should be included in the project.
	Styrol tank	A	○	Necessary for egg collection and hatchling cultivation and should be included in the project.
	Double bottom plate	A	○	Necessary for egg collection and hatchling cultivation and should be included in the project.
	Plastic vats	A	○	Necessary for observation, anatomy and transportation of juvenile clams and should be included in the project.
	Air stone (round)	B	○	Necessary for supplying air into indoor tanks and should be included in the project.
	Air stone (square)	B	○	Necessary for supplying air into indoor tanks and should be included in the project.
	polyvinyl chloride tube 1	B	○	Necessary for supplying air into indoor tanks and should be included in the project.
	polyvinyl chloride tube 2	B	○	Necessary for supplying air into indoor tanks and should be included in the project.
	Three-way stopcock	B	○	Necessary for supplying air into indoor tanks and should be included in the project.



Requested Component		Priority	Result of the examination		
	Braided hose	A	○	Necessary for transferring water for cultivation and should be included in the project.	
	Titanium heater	B	○	Necessary for stimulating spawning and should be included in the project.	
	Air pump	B	○	Necessary for supplying air into indoor tanks and should be included in the project.	
	Submersible pump	B	○	Necessary for transferring water for cultivation and should be included in the project.	
	UV water strilizer	B	○	Necessary for stimulating spawning and should be included in the project.	
	Salinity refractometer	A	○	Necessary for measuring seawater salinity and should be included in the project.	
	Thermometer	A	○	Necessary for measuring water temperature and should be included in the project.	
	Thermometer	A	○	Necessary for correcting stick thermometers and should be included in the project.	
	Cartridge filter accessories	B	○	Necessary in a combination with the UV water sterilizer when stimulating spawning and should be included in the project.	
	Cartridge filter	B	○	Necessary in a combination with the UV water sterilizer when stimulating spawning and should be included in the project.	
	Stell shelves	A	○	Necessary for drying and tidying up equipment, tools, etc. and should be included in the project.	
3	Equipment for Promotion, Data processing and others	Buoyancy Control Jacket	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Diving cylinder	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Regulator	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Mask	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Snorkel	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Fin boots	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Diving boots	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Diving suit	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Weight belt	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Waterproof camera	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Accessories for waterproof camera	A	○	Necessary for promoting and monitoring Giant clam culture and should be included in the project.
		Aqua scope	Ex	○	Necessary for servicing visitors and should be included in the project.
		Utility boat	Ex	○	Necessary for rescue of visitors and light-duty works in the sea in front and should be included in the project.
		Outboard engine	Ex	○	Necessary for rescue of visitors and light-duty works in the sea in front and should be included in the project.
		Desktop computer	A	○	Necessary for data processing, material preparation, etc. and should be included in the project.

Requested Component		Priority	Result of the examination	
	Laptop computer	A	○	Necessary for recording in account-book, etc. and should be included in the project.
	Hard disk	A	○	Necessary for data storage and back-up and should be included in the project.
	Uninterruptible Power Supply	A	○	Necessary for supplying power in case of black-out and should be included in the project.
	Printer	A	○	Necessary for printing data, materials, etc. and should be included in the project.
	Multifunction copier scanner	A	○	Necessary for printing data, materials, etc. and should be included in the project.
	Wireless network router	B	○	Necessary for sharing printers, etc. and should be included in the project.
	Projector	A	○	Necessary for projecting visual materials, etc. and should be included in the project.
	Screen	A	○	Necessary for projecting visual materials, etc. and should be included in the project.
	Video recorder	Ex	○	Necessary for projecting visual materials, etc. and should be included in the project.
	Monitor	Ex	○	Necessary for projecting visual materials, etc. and should be included in the project.
	Aquarium	A	○	Necessary for displaying living Giant clams and should be included in the project.
	Pin board	A	○	Necessary for publicity activities and should be included in the project.
	Glass display case	A	○	Necessary for exhibiting handicrafts and should be included in the project.
	Glass display refrigerator	A	○	Necessary for sale of drinks to visitors and should be included in the project.
	Security cameras	C	×	Priority of security camera system is relatively low and should not be included in the project.

\*Priority level A: Indispensable and top priority component.

\*Priority level B: The second top priority and highly necessary component.

\*Priority level C: Low priority component under this project and reviews should be made in the future also about the exclusion from this project.

\*Priority level Ex: No description is made in the M/M but will be necessary for supporting the project.

## 2-2 Outline Design of the Requested Japanese Assistance

### 2-2-1 Design Policy

#### 2-2-1-1 Facilities Design

- ① Based on the demand forecast to be reviewed in 2-1-1-3, facilities for production of giant clam seedlings should be planned to produce 120,000.
- ② At the existing facilities, not only giant clam seedlings are produced but also, as a site for promotion and publicity activities, the PMDC is visited by citizens of Palau, students and tourists. At the facilities planned in this project, rooms will also be developed for promotion and publicity activities in addition to those for production of seedlings and therefore, by paying sufficient attention and allocating rooms of different characteristics appropriately depending on their functions, flows of staff working on seed production and those of visitors to the facilities will be clearly separated.

- ③ The existing concrete water tanks have been located all around the premises of the facilities and have been in service for a long time being repaired repeatedly. The tanks have been located to secure a necessary area to achieve the targeted production volume of seedlings within the undersized premises and as the result, convenience was hampered. Although the tanks have been repaired as necessary, there still are problems such as cracks caused by, for example, aged deterioration. In addition, on the edges of some tanks, steel columns have been installed for hanging up shade nets, which can cause cracks in the tanks as seawater may leak in through gaps between the steel columns and concrete. At the premises as they are now, in order to allocate concrete tanks of the same scale as the existing tanks in the future while securing convenience, there is concern that the current land area is not large enough. In this project, however, plans will be developed by improving cultivation conditions and giving enough considerations to convenience, so that the required number of seedlings will be produced even in the limited space.
- ④ The implementation plan shall take into consideration the climate of Palau and the environmental conditions in the area.
- ⑤ Economical structure and construction methods shall be taken to this plan, as the site is in an island nation, to adopt shortening the construction period and limiting expenses for materials, equipment and personnel which will constitute major part of the construction cost.
- ⑥ In this project, construction works will be implemented even while the existing neighboring seed production facilities (production of grouper seeds) continues to be in operation and therefore, when implementing the construction works under this project, it will be planned that safety of workers at the neighboring seed production facilities be secured and utmost considerations be made not to interrupt the seed-grouper production activities.
- ⑦ For demolition and removal of existing seawalls in the quay area or existing structures at the planned construction site, the works should be implemented after identifying sites, beforehand, to which waste materials can be disposed of and an appropriate construction period should be projected while making efforts to reduce environmental load (some people have expressed they want to collect concrete remnants to use them for private landfills).

#### **2-2-1-2 Implementation Conditions**

- ① Major construction materials and equipment are procured and imported from Japan or third countries such as Republic of the Philippines, United States of America (USA) and Taiwan therefore, due attention shall be paid to domestic stocks and the period required for procurement of individual materials in the implementation system.
- ② Temporary works should be planned with due consideration for the high-temperature, high-precipitation climate and safety measures should be taken. Also, adequate care should be taken in the curing of concrete and plaster to avoid cracks and exfoliation.
- ③ In the sea area in front of the project site, broodstock giant clams are stocked and the area will continue to be in use after the completion of the new facilities. It is planned that sufficient exchange of opinions be made and communication be fostered among BMR, PMDC, consultants and construction

companies and the construction works be implemented without any disturbance so that the seawater area will not be polluted by oil leak from heavy construction equipment, fresh mixed concrete or water used for construction works during the construction period.

- ④ In order that construction companies in Palau can appropriately meet construction requirements of this project, as general and common as possible specifications in Palau should be employed and construction plans using general methods should be developed.

### 2-2-1-3 Establishment of the Scale of Water Tanks to be used for Seed-clam Production

#### (1) Projection of demand for giant clam seedlings

In Palau both cultivated giant clams and wild ones that are harvested in coastal zones are traded.<sup>3</sup> Although wild giant clams are harvested mainly for self-consumption, some of the harvested wild clams are also sold to hotels, restaurants and retailers. Meanwhile, cultivation of giant clams is carried out to accommodate domestic demand from hotels and restaurants, while there is strong demand for clam shells in overseas markets where shells are used for the purpose of ornament. In Palau, there are a number of incidents of theft of giant clams while they are being cultivated and significant quantities of stolen clams are considered to be sold to hotels and restaurants. As the result of questionnaire surveys and records of BMR concerning the trade of giant clams in Palau, the distribution flow of clams is projected as follows.

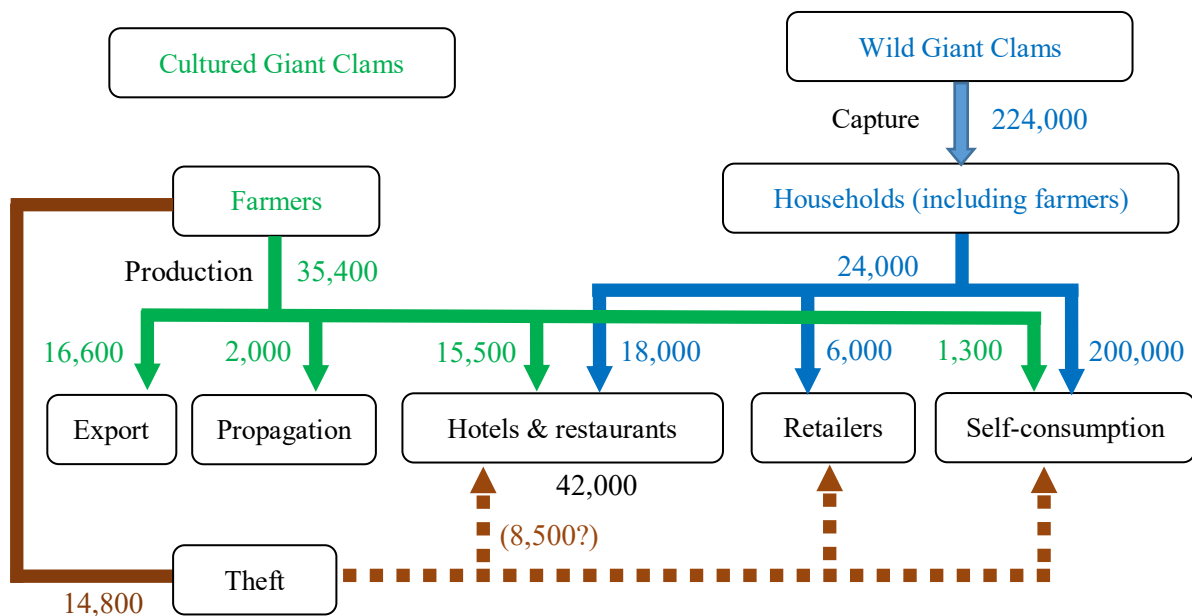


Figure 2-1 Distribution flow of giant clams in Palau

<sup>3</sup> Although harvesting in conservation areas is banned, wild giant clams can be harvested in other seawater areas and as of December 2015, those clams harvested legally can be traded. It is banned to take seeds out of wild giant clams.

Table 2-2 Estimation for the number of distributed giant clam in Palau

	Farmed	Wild	Total	Remarks
Export	16,600		16,600	Actual number exported in 2014
Propagation	2,000		2,000	Performed annual number (2014 – 2015)
Hotels & restaurants	15,500	18,000	42,000*	Estimated number including stolen clams of 8,500
Retailers		6,000	6,000	Estimated number
Self-consumption	1,300	200,000	201,300	Estimated number
Sub-total	35,400	224,000	259,400	
Theft	14,800			Estimated number (Destinations unidentified)
Ground total	50,200	224,000	274,200	

If a bill concerning the ban on sale, purchase of giant clams (House Bill No. 9-202-12) submitted to the Congress as of January 2016 is approved, it is expected that a total of about 24,000 wild giant clams currently traded for hotels, restaurants and retailers will be substituted with cultivated ones. At the same time, under the bill, it is planned to introduce a framework for traders to get licenses and require them to keep trade records. Through these measures, it is expected, theft of wild giant clams will be significantly reduced and hence giant clam culture farmers' willingness to produce the clams will increase.

Demand for giant clams in a target year of 2021 (3 years after the completion of the facilities) is expected to be around 90,100 clams annually and 112,000 juvenile clams will be needed to produce the projected number of clams.

Table 2-3 Demand forecasting for the number of giant clam in Palau (target year 2021)

Target Demand	Assumption/Prerequisites	Necessary Actions to be Taken by the Palauan Side
① Hotels and Restaurants Current: 42,000 In 2021: 50,100 (+8,100)	a. The number of Chinese tourists keeps increasing <sup>4</sup> b. The consumption of giant clams per person does not decrease.	a. Tourism promotion b. Promotion of consumption of giant clams
② Sales at Retail Shops Current: 6,000 In 2021: 6,000 (+-0)	a. Wild giant clams sold at shops are replaced with cultured ones	a. The ban of giant clam trade is well respected. b. Awareness raising for resource conservation.
③ Ornament Clams for Export Current: 16,600 In 2021: 32,000 <sup>5</sup> (+16,000)	a. The farmers continue export of ornamental giant clams. b. Private production capacity of ornamental giant clam seed is still limited.	c. Effective prevention of theft from the farms.
④ Seed Clams for Propagation Current: 2,000 In 2021: 2,000 (+-0)	a. The giant clam restocking activities continue.	a. National/State governments secure necessary budgets to purchase giant clams for release. b. Awareness raising.
Total consumption demand: ① 50,100 demands + ② 6,000 demands + ③ 32,000 demands + ④ 2,000 demands = Total 90,100/year Total demand for seed giant clams (survival rate during the grow out=80%) 90,100 consumption demands / 80% = <u>112,000 Seed Production required</u>		

<sup>4</sup> The majority of the foreign tourists are from China. This projection assumes that the Chinese tourists increase in proportion to the moderately estimated Chinese GDP growth of 5%.

<sup>5</sup> It seems the demand is already exceeding 32,000 at present.

(2) Current status of seed production at PMDC

PMDC does not cultivate broodstocks onshore. Broodstock clams are collected from the shore area in front of PMDC or private farmers or harvested from natural waters when it is time to collect eggs. To stimulate spawning of larger species of clams, nursery tanks are used. Adult clams for which spawning is stimulated will be moved to egg collection containers so that they can spawn. In the containers, insemination is carried out to get fertilized eggs. Fertilized eggs are kept in larval tanks for 4 to 6 months until they grow to become juvenile clams of a shell length of 4 to 10mm. Later, they are grown in nursery tanks for 8 to 12 months and when they are large enough to have a shell length of 2 to 5cm, they are shipped as seedlings. Depending on the kind of clams, the growth rate varies and there are differences in their cultivation periods and sizes at the time they are shipped. The time period to be spent in nursery tanks are separated in two, the first half and the second half. When 4 to 6 months have passed after being moved to the tanks, juvenile clams are again moved to separate tanks depending on how far they have grown.

There are already a total of 10 larval tanks at the facilities, including 4 tanks with 8.7m in length, 2.0m in width and 0.9m in depth and 6 tanks with 8.85m in length, 1.8m in width and 1.3m in depth and the area of base totals 162.5m<sup>2</sup>. The sizes of nursery tanks are different from tank to tank in terms of width and depth and there are a total of 53 tanks with 8.7m in length, 2.0-2.1m in width and 0.32-0.5m in depth. The total area of the 53 tanks accounts for 962m<sup>2</sup>.

When the survey was conducted on November 5, hatchlings were being grown in 4 larval tanks and juvenile clams were being grown in 42 nursery tanks. The operating rate of larval tanks was as low as 40% (4 out of 10 tanks) partly because of a shortage of water supply. Nursery tanks were being operated at a high rate of about 80% (42 out of 53 tanks). One of reasons why 11 nursery tanks were not in use at that time is they were being given regular maintenance. Tanks are sun dried for 3 to 7 days when juvenile clams are separated and moved into other tanks, so that algae grown in the tanks can be killed. Other reasons for tanks not being in service include leaks or because seawater has not been supplied sufficiently because of power loss in the pump.

Records of juvenile clam production (those 4 to 6 months after hatchling) are shown in Table 2-4. The data shown here are the number of juvenile clams that have grown in larval tanks for 4 to 6 months after hatchling and have a shell length of 4 to 10mm. In 2012 to 2014, the number of juvenile clams produced had fallen but in 2014 when specialists of OFCF were dispatched, the operating rate of the facilities improved and in 2015 the yield increased.

Table 2-4 Production records of juvenile clams grown 4 to 6 months after hatchling

Species	2010	2011	2012	2013	2014	2015
Smooth giant clam	233,389	548,723	28,510	174,659	2,908	28,792
Horse's hoof clam	6,420	20,332	0	4,356	0	213,645
Fluted giant clam	376,230	5,467	44,634	187,529	8,701	23,236
Elongate giant clam	27,744	23,843	17,626	0	37,053	258,092
Boring clam	0	0	0	1,451	149,632	28,565
Elongate giant clam/ Boring clam	18,630	0	1,293	0	0	0
Total	662,413	598,365	92,063	367,995	198,294	552,330

Records of juvenile clams delivered or sold to cultivation farmers as seed-clams after having grown for 8 to 12 months after collection are shown in Table 2-5. The number of juvenile clams produced is recorded in the year eggs are collected and the number of seed-clams delivered or sold is recorded in the year they are delivered. As the result, there is a time lag of 1 or 2 years between the year for the number of juvenile clams produced and the year for the number of juvenile clams delivered or sold.

Table 2-5 Records of seed clams distributed or sold to the farmers

Species	2010	2011	2012	2013	2014		2015	
Smooth giant clam	67,750	90,975	36,452	31,979	27,125	1,550	1,500	6,275
Horse's hoof clam	42,257	12,300	4,200	8,303	3,600	854	8,500	9,000
Fluted giant clam	540	44,653	2,427	7,382	6,175	722	0	973
Elongate giant clam	900	2,000	6,263	9,060	500	0	0	0
Boring clam	2,000	1,600	111	1,500	750	0	0	6,621
Elongate giant clam/ Boring clam		3,500						
Free of charge	113,447	155,028	49,453	58,224	38,150		10,000	
Charged	0	0	0	0		3,126		22,869
Total	113,447	155,028	49,453	58,224	41,276		32,869	

### (3) Scale of the planned facilities

As mentioned in 2-1-1-3 (1), there is expected to be demand for 90,100 giant clams. It takes 3 to 4 years from the collection to shipping of seed-clams and their survival rate for the years is around 80%, based on which, it is calculated about 112,000 seed-clams are needed to meet the demand.

In addition to the above, it is necessary to work on artificial breeding of giant clams (*T. gigas*) and China clams (*H. porcellanus*) that are endangered species and in this project, it is planned that the facilities should have a capacity to produce around 120,000 seedlings, a little more than the quantity actually needed.

### (4) Approach to determining water tank size

In this section, how seedlings are being produced will be explained. Growth of seed clams is different depending on the kind of clams but a cycle of seedlings production is composed of 3 stages and takes 1 year and a half in total. In the first stage of the cycle, fertilized eggs are kept in larval tanks until they grow from hatchlings to initial juvenile clams with a shell length of about 10mm. In the second stage, those initial juvenile clams are moved to nursery tanks to keep them until they grow to juvenile clams with a shell length of about 2.5cm (nursery phase). In the third stage, the juvenile clams are moved again to other nursery tanks and when they have grown to seed-clams with a shell length of about 5cm, they will be shipped (grow-out phase).

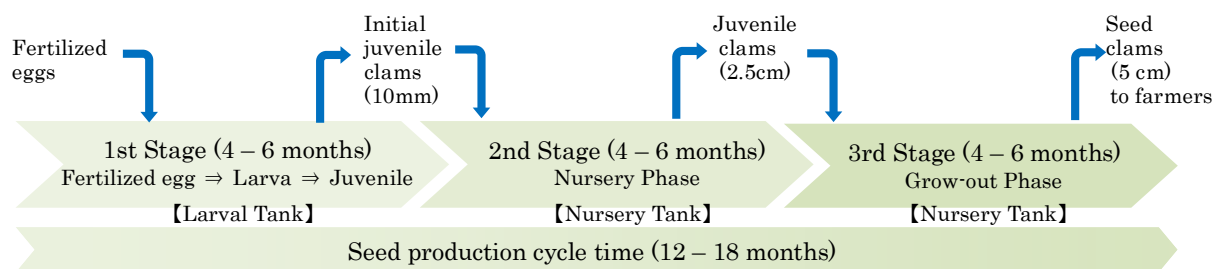


Figure 2-2 Conceptual diagram for giant clams seed production

The total base area of nursery tanks necessary for producing 120,000 seedlings is calculated as follows.

In order to obtain 120,000 seedlings in the third stage, it is necessary to have 141,000 (120,000 divided by 0.85) and hence, the required total base area of tanks is 705m<sup>2</sup> (141,000 divided by 200). In addition, in order to obtain 141,000 juvenile clams in the second stage, it is necessary to have 176,000 initial juvenile clams and the total base area necessary is 220m<sup>2</sup> (176,000 divided by 800). Based on these, the total base area required is 925m<sup>2</sup>.

Table 2-6 the required total bottom area of nursery tanks

Stage	Stocking density (Number/m <sup>2</sup> )	Survival rate	Required number of clam at stocking	Required area (m <sup>2</sup> )
2nd Stage (Nursery phase)	800	80%	176,000	220
3rd Stage (Grow-out phase)	200	85%	141,000	705
Total				925

Meanwhile, the productivity of initial juvenile clams heavily depends on the quality of fertilized eggs. If extremely high-quality fertilized eggs are obtained, all the required number of seed-clams for nursery and grow-out phases can be obtained in only one-time spawning, while if high-quality fertilized eggs are not obtained, the whole juvenile clams are often thrown away 1 to 3 months later and the spawning process needs to be conducted again. Therefore, PMDC tries to obtain necessary juvenile clams by using 10 larval tanks with a total base area of 162.5m<sup>2</sup>. In this project, too, it is planned that a similar level of tank base area should be secured.

## 2-2-2 Basic Plan (Construction Plan / Equipment Plan)

### 2-2-2-1 Policy for Planning

#### (1) Basic policy

In designing the outline of this assistance project, the following shall be the basic policy.

1. Facilities and equipment shall have components that enable: (1) Production and promotion of culture of giant clam seedlings; and (2) Publicity activities concerning the protection and sustainable utilization of the giant clam resource.



2. In order to reduce the future financial burden of the implementing organization in the recipient country, designs shall be developed taking feasible maintenance works and reduction of maintenance costs into account.
3. The scale and functions of facilities and equipment shall be appropriate to the scale of giant clam seedlings production determined based on demand forecast and to the content of related publicity activities.
4. As this project will be implemented with Japan's grant aid, efforts shall be made to complete construction strictly up to the deadline and to save costs by employing structures, equipment/materials and construction methods that are appropriate to construction situations in Palau and natural conditions at the construction site. In implementing this project, considerations shall be made also to utilize local equipment/materials and human resources as much as possible and to contribute to the revitalization of local economy.
5. In selecting grades of equipment/materials, conditions such as cost effectiveness, robustness, endurance and ease of maintenance (maintenance can be implemented locally, etc.) shall be reflected appropriately in the selection.
6. Considerations shall be made to reduce negative impacts on the land and ocean environment.

#### (2) Policy concerning natural and environmental conditions

Based on the result of surveys on natural conditions, the following shall be the design policy for this project.

1. Palau has an oceanic tropical climate and has two seasons, the dry season (November to April) and the rainy season (May to October). Yearly average temperature is stable at around 28°C and the weather is hot and humid. When designing the facilities, plans shall be developed giving considerations to energy-saving by, for example, introducing ventilation using natural draft and shielding of sunlight.
2. In addition to the fact the weather is hot and humid, the project site is expected to be damaged by seawater, as it is located in a coastal area and, therefore, it is planned that damp and rust-proof materials should be employed not only for major construction materials such as exterior walls and steel framing but also secondary materials such as foundation layers for walls and ceilings and metals exposed to external air.
3. It is planned that seawater used for growing giant clams should be taken in directly from the area in front of the project site using intake pipes as it has been taken in that manner in the past. In the seawater area in front of the facilities, the waves and tides are quiet all year round and only small impacts are expected on undersea structures. Although the site is located in an area where water intake pipes can have limited impact to the underwater natural environment, designs should be developed by giving sufficient considerations to the preservation of the natural environment.

#### (3) Policy concerning socioeconomic conditions

For social considerations to be made in Palau, the following shall be the design policy for this project.

1. As the number of tourists has been increasing, so has the number of workers flowing in to Palau from foreign countries with different religions and culture also been increasing, particularly those foreigners who work in the service and the construction industries. It is expected, however, workers involved in this project will be mainly Palauan people and it is planned for now that no special considerations in terms of religion will be made.
2. In Palau, people generally commute by car and PMDC staffs are not an exception. In this project, it is planned that parking lots should be developed not only for visitors but also for staff of the facilities.

(4) Policy concerning construction and procurement conditions

In Palau, no design and structure standards of their own are established and designs are developed in general in accordance with the standards of the United States or donor countries. Being Japan's grant aid project, this project shall comply with Japan's building standards.

In this project, the project owner needs to submit a construction application along with drawings to the Capital Improvement Program (CIP) of the Ministry of Public Infrastructure, Industries and Commerce (MPIIC) for examination. Next, detailed drawings need to be submitted to the Environmental Quality Protection Board (EQPB) and after receiving examination and permit, a set of drawings for designs, structures and facilities (electricity and water supply and sewage) and bills of estimated costs need to be submitted to the Koror State Government Building and Zoning Office to receive a construction authorization.

(5) Policy concerning suppliers of construction materials

Excluding aggregates and some kinds of materials, for construction materials, Palau relies mostly on imports from the Philippines, Japan, Taiwan and the United States. Equipment and materials to be used in this project should be procured by selecting suppliers giving considerations to the cost and quality as well as the ease of future maintenance and procurement. In principle, materials that are available locally should be procured locally, while when local procurement is found difficult based on standards, specifications and price, procurement from Japan or third countries should be considered.

(6) Policy concerning procurement of equipment

Most of the equipment planned to be used in this project is difficult to obtain in Palau and therefore, it is planned to procure such equipment from Japan. Copy machines for which maintenance and procurement of supplies are required regularly should be procured locally.

(7) Policy concerning construction methods

In order that construction companies in Palau can appropriately meet construction requirements of this project, as general and common as possible specifications in Palau should be employed and construction plans using general methods should be developed. Details of the policy for construction methods are as follows:

- Plans that require special materials and technologies should not be developed.
- Plans should be developed so that construction works can be implemented with machinery available in Palau.
- Plans should be developed to have plenty of room for margin considering Palauan construction companies' technological level.

### **2-2-2-2 Plans for Zoning and Layout**

#### (1) Points to note in zoning and layout planning

The project site is a flat land of 4,500m<sup>2</sup> extending about 100m from north to south and 45m from east to west. Activities for which PMDC is responsible include the production of giant clam seedlings and promotion and publicity to deepen people's understanding of giant clam breeding and cultivation as well as administration works to support the above-mentioned activities. PMDC's activities can be separated into four areas according to the characteristics of each activity: Seed-clam production area; Production management area; Administration area and; Promotion and publicity area. In addition, a large number of adult clams to be used in seed production are also kept in the shore area in front of PMDC and the area will be used as an area for visiting tourists to snorkel.

#### 1) Seedling production area

For the seedling production area, it is planned to install culture tanks (larval tanks and nursery tanks) and an elevated water tanks building. Culture tanks should be covered with roofing, part of which will be made with transparent material. Layout of each facility should be determined giving considerations to the actual works of giant clam seedlings production at PMDC, piping and drainage channels for supplying required amount of water and air, which will be obtained based on the cycle and demand forecast, and a space for workers to perform their duties.

#### 2) Culture support area

This area is to support culture of giant clams that includes seed-clam production and it is composed of various rooms such as a diving gear store, a dry laboratory, a wet laboratory/inspection room, storage, toilets and a dining kitchen. These rooms are closely connected to activities of the seed-clam production area and therefore, the layout should be planned by giving considerations to flows of "people" and "things" while prioritizing simple access lines.

#### 3) Administration area

The administration area is composed of rooms such as a manager's room, an expert's room, a staff room and a library and meeting room to support the related activities, toilets and small kitchens. These rooms should be allocated as adjacent as possible so that communication and information exchange among staff can be easily made.

#### 4) Promotion and publicity area

The facilities developed in this project are open to both domestic cultivation farmers and the general

public to visit there (citizens, students and tourists) and therefore, composed of various rooms including an entrance, an exhibition hall and gift shop, a workshop and toilets. The promotion and publicity area should be located near the entrance for not only domestic cultivation farmers but also general visitors and at the same time, traffic lines of the two should be separated so that seed-clam production will not be hindered thanks to a neutral zone for avoiding confusion and interference where these two cross each other.

Zoning of facilities and traffic lines reflecting the above basic policies are shown below.

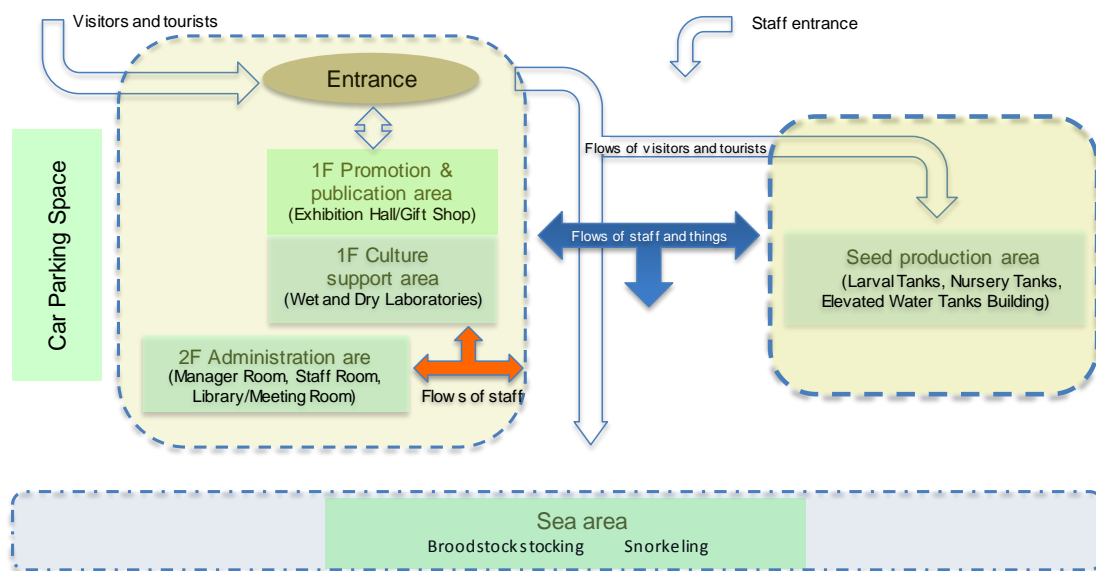


Figure 2-3 Plan for zoning and layout

### 2-2-2-3 Layout Plans

#### (1) Points to note in layout plans

The planned facilities are composed of a mariculture demonstration center building, sheds to cover seedlings production tanks, a pump house, a machinery house to accommodate an emergency power generator, filtering tanks, air blowers, an elevated water tanks building to accommodate elevated water tanks and parking lots and the total floor area should be 2,489.55m<sup>2</sup> as shown in Table 2-12.

When considering it is necessary to secure parking lots and a neutral space to avoid congestion and interference within the premises, the existing land area is undersized. Points to note in layout plans are as follows.

- 1) Plans should be developed so that the seedlings production tanks be allocated in a concentrated area as compactly as possible to ensure that seed-clams will be moved easily and works will be conducted efficiently as well as that pipes and drainage channels to supply seawater and air for cultivation and discharge of wastewater be laid out in an effective manner.

- 2) Plans should be developed so that the mariculture demonstration center building be designed by taking into account the flow between the seed-clam production area and easy access for visitors as well as location of existing workshops.
- 3) As there is an interference to the access line of fish seed production facilities on the north side of the premises, plans should be developed taking such a limitation in installation of buildings and facilities into account.
- 4) Plans should be developed so that the intake pump room be laid out at a place where as much efficient pumping as possible can be achieved.
- 5) Plans should be developed so that the elevated water tanks building be positioned where efficient supply of seawater and air to the culture tank cluster can be achieved.
- 6) As a power generator is to be installed in the machinery house, plans should be developed so that the machinery house be located in an area as distant as possible from traffic lines of visitors and other people than staff.

## (2) Policy concerning layout plan

Based upon above-mentioned points to note, a major policy for implementing the planned layout is shown below.

- 1) Plans should be developed so that the culture support area and the seedlings production area be clearly separated from the promotion and publicity area as they have different functions and that seedlings production regardless of time and existence of visitors be enabled.
- 2) Plans should be developed so that the culture tank cluster including the mariculture demonstration center building and sheds be laid out to use the undersized premises to achieve utmost efficiency and effectiveness.
- 3) Plans should be developed so that, in order to secure sunlight and natural air ventilation, a sufficient distance to the next building be secured taking the orientation and wind direction into account.
- 4) Plans should be developed so that the pump house be laid out away from other facilities and close to the coastal seawall taking into account the pumping efficiency and the possibility that it will be a source of noise and vibration.

As the result of reviews made as above, plans should be developed so that sheds to accommodate the culture tank cluster be laid out on the south side of the premises where a large space can be secured, that the mariculture demonstration center building be positioned at the facilities' center and next to existing workshop and that the entrance and parking lots be allocated on the south side.

### **2-2-2-4 Construction Plans**

When determining the size of various offices, reference should be made to how ordinary offices are developed in the country and to various rooms of neighboring BMR and the Division of Marine Law Enforcement (DMLE). In addition, since there are no established standards to comply with in Palau, reference should be made also to the "Handbook of Environmental Design" of the Architectural Institute

of Japan and the “Area Criterion” for the government buildings by the Ministry of Land, Infrastructure, Transport and Tourism of Japan.

The size of rooms should be determined according to the following procedures.

1. Determine the function and capacity of the room.
2. Determine the necessary equipment and fixtures and calculate the floor area necessary to install the equipment and fixtures and lay out a working space.
3. Verify the properness of the calculated floor area by making comparison with related laws and regulations, standards and similar facilities.
4. Calculate the floor area by taking the structural limitations of the building (span arrangements) into account.
5. Determine the size of the entire facilities by adding a common space such as corridors and the entrance to the total floor area of various rooms obtained through above calculation.

(1) Mariculture demonstration center facilities

The functions and capacity of various rooms to be determined in addition to fixtures to be placed in those rooms are shown in Table 2-7.

Table 2-7 Calculation base for the size of Mariculture Demonstration Center Building

Mariculture demonstration center building				
Planned rooms		Function	Staff	Equipment/furnishings
1st floor	Exhibition hall / Gift shop	Posters / aquarium exhibition relation to the marine conservation and sales handicrafts, shells, etc.,	—	Aquarium, display cases
	Workshop	Manufacturing handicrafts and shell processing	1	Processing table, hand grinder
	Diving gear store	Storing diving gear	—	Shelves
	Dry laboratory · Preparation room	Counting./observing of fertilized eggs, hatchlings, larvae, examination, sampling, sample preservation, reagent preparation, etc.	—	Table, profile projector, biological microscope, stereoscopic microscope, refrigerator, freezer, glassware display case
	Wet laboratory / Inspection room	Works for maturation, egg collection, packing, inspection of export commodities, etc.	—	Water tanks, baskets, oxygen bottle, working table, selves, cabinet
	Dining kitchen	Food preparation, dining, and rest for staffs	6	Table, chairs (6), sink, refrigerator, sofa
	Public toilets	Toilets for visitors	—	Male (1), Female (1)
	Shower room	Shower for snorkeling visitors	—	Male (1), Female (1), shelves
2nd floor	Manager room	Office for manager	1	Work table and chair (4), visitor set, cabinet (provision of Palauan side)
	Expert room	Office for expert of seed production	1	Work table and chair (4), visitor set, cabinet (provision of Palauan side)

Mariculture demonstration center building			
Planned rooms	Function	Staff	Equipment/furnishings
Staff room	Office for field staffs	6	Work table and chair (6), cabinet (provision of Palauan side)
Library / Meeting room	Meeting space cum library	20	Meeting tables and chairs (20) (provision of Palauan side)
Other common spaces			
Toilets	Toilet for staffs	—	Male (1), Female (1)
Shower room	Shower for staffs	—	Shower head, shelves
Utilities	Room for servicing		Water supply, water heater, sink
Entrance	Doorway for visitors and staffs	—	
Corridor	Passageway for visitors and staffs	—	

### 1) Exhibition hall/gift shop (39.0 m<sup>2</sup>)

For the exhibition hall/gift shop, plans should be developed so that promotion and publicity activities be conducted by displaying posters (life and cultivation method of giant clams, natural resource conservation, etc.) and showing giant clams in tanks and that a space be secured to sell handicrafts such as shellworks. By reference to standards specified by the “Handbook of Environmental Design” and to the size of a gift shop in the Palau International Coral Reef Center (PICRC) (48.0m<sup>2</sup>), plans should be developed to ensure a space for visitors to study and shop.

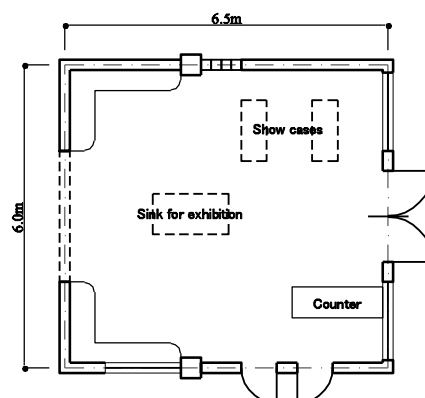


Figure 2-4 Exhibition hall/gift shop

The largest number of visitors acceptable at one time is 10 to 15 if such tourists visit the facilities by small bus or 20 to 30 individuals if they are local elementary school children. It is expected that most of those who visit the gift shop will be tourists and therefore, the size of the shop is determined based on the above expectation.

In the “Handbook of Environmental Design”, the required floor area for a shop is specified as 2.0-3.0m<sup>2</sup>/person. If visitors are expected to be tourists, the required floor area for the gift shop will be between 20m<sup>2</sup> (2.0m<sup>2</sup>/person × 10) and 45m<sup>2</sup> (3.0m<sup>2</sup>/person × 15).

Including a shopping space, the total area required should be 39.0m<sup>2</sup> which also includes a space for fixtures (9.15m<sup>2</sup>) such as a display showcase (6.0m<sup>2</sup>), a reception counter (1.8m<sup>2</sup>) and a display water tank (1.35m<sup>2</sup>).

### 2) Workshop (shell processing room) and store (9.9 m<sup>2</sup> · 6.6 m<sup>2</sup>)

The work room is a room where shellworks are processed and stored for sale at the gift shop and one worker will work inside the workshop. As it is expected that dust and noise will be generated when shells are cut and ground, plans

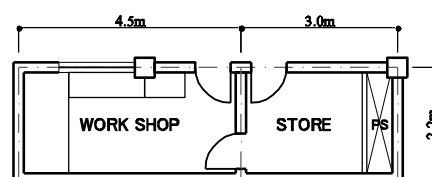


Figure 2-5 Workshop (shell processing room) and store

should be developed so that a partition be installed to separate those two spaces.

Fixtures needed for the processing room include a processing table and a chair and equipment such as bench grinder and disc grinder will be laid out. In the store room, storage shelves should be installed to store materials to be processed in addition to finished products.

Considering how these necessary fixtures should be laid out and what the workers' traffic line should be, a necessary floor area of  $9.90\text{m}^2$  ( $4.5\text{m} \times 2.2\text{m}$ ) and  $6.60\text{m}^2$  ( $3.0\text{m} \times 2.2\text{m}$ ) is obtained.

### 3) Wet laboratory/inspection room and storage ( $94.5\text{m}^2 \cdot 12.25\text{m}^2$ )

It is planned that the wet laboratory should be a room where works related to stimulation of spawning and egg collection are conducted as well as where cultivation farmers bring products for export, receive inspections, obtain export permits and conduct packing for export. Storage should also be planned to store fixtures necessary for these works and materials related to seed-clam production.

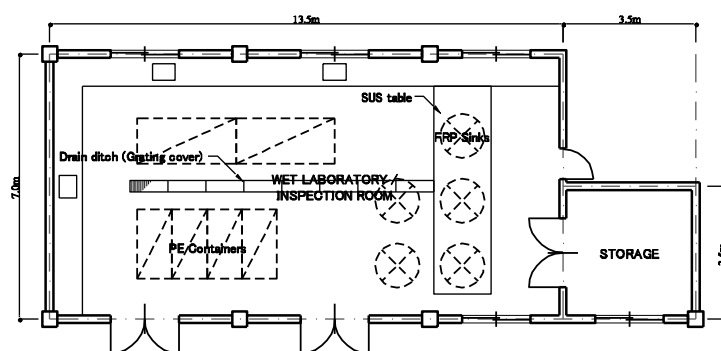


Figure 2-6 Wet laboratory/inspection room and storage

Major fixtures here include polycarbonate water tanks for egg collection ( $\phi 1.16\text{m} \times \text{H } 0.76\text{m} \times 5$  and  $\phi 0.85\text{m} \times \text{H } 0.575\text{m} \times 5$ ), small-size water tanks (10 to 100 liter  $\times 40$ ), polyethylene corner water tanks (L  $1.84\text{m} \times \text{W } 0.92\text{m} \times \text{H } 0.41\text{m} \times 4$  and L  $2.56\text{m} \times \text{W } 1.16\text{m} \times \text{H } 0.77\text{m} \times 2$ ), equipment such as ultraviolet sterilizers, work tables and inspection and packaging counters. The total area necessary for laying out these fixtures and for workers' traffic line should be  $94.5\text{m}^2$  ( $13.5\text{m} \times 7.0\text{m}$ ).

The affiliated storage is planned to be a space to place small-size water tanks, polyethylene corner tanks, shade nets, plankton netting, polyethylene nets, etc. in storage shelves. When taking into account how these fixtures should be laid out and what the workers' traffic line should be, the total necessary area should be  $12.25\text{m}^2$  ( $3.5\text{m} \times 3.5\text{m}$ ).

### 4) Dry laboratory and preparation room ( $24.50\text{m}^2 \cdot 12.25\text{m}^2$ )

The dry laboratory should be planned to be a room where fertilized eggs and hatchlings are measured and observed, samples are prepared and stored, pathological examinations are conducted and chemicals are prepared. Plans should be developed so that works can be conducted in cooperation with the wet laboratory as well as a preparation room should be planned to store equipment commonly used with the wet laboratory and hence to shorten workers' traffic line and reduce humidity coming from the wet



laboratory.

In the dry laboratory, equipment and fixtures to be installed include a counter table and a profile projector, a biological microscope, a stereoscopic microscope, a refrigerator, a deep freezer and a storage cabinet for glassware. The total necessary area should be  $24.50\text{m}^2$  ( $3.5\text{m} \times 7.0\text{m}$ ) which is determined by taking into account how these fixtures should be laid out and what the workers' traffic line should be. As it will be a space where optical instruments are placed, an air conditioning system should be installed, too.

In the preparation room, shelves to store chemicals and fixtures and a working table should be installed. The total necessary area should be  $12.25\text{m}^2$  ( $3.5\text{m} \times 3.5\text{m}$ ), which is determined by taking into account how these fixtures should be laid out and what the workers' traffic line should be.

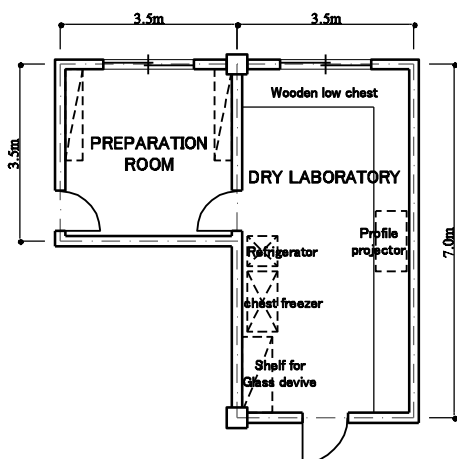


Figure 2-7 Dry laboratory and preparation room

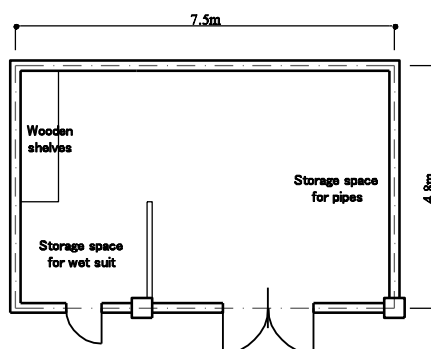


Figure 2-8 Diving gear store

5) Diving gear store ( $36.0\text{m}^2$ )

The diving gear store should be planned as a room to store and manage diving gear and spare pipes.

In the diving gear store, fixtures should be placed side by side, which include diving gear storage shelves, clothing lockers for clothes and an equipment inspection table. The total area obtained by considering how these fixtures should be laid out and what the workers' traffic line should be is  $36.0\text{m}^2$  ( $7.5\text{m} \times 4.8\text{m}$ ).

6) Dining kitchen/toilet and shower room ( $33.86\text{m}^2$ )

In Palau, it has been a habit that workers bring cooking ingredients to jointly cook food and therefore, plans should be developed to have a room with a cooking space that can be used as a dining room and staff room, too. As the staff members are not many, in the plan, it should be a room not separating spaces for cooking and standing-by.

The number of workers to be accommodated in this room shall be 6 in total and the total floor area obtained by considering how fixtures including a table and chairs in the

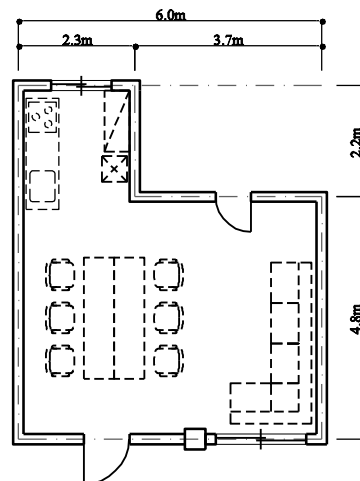


Figure 2-9 Dining kitchen

dining space, a cooking table, a sink and a refrigerator in the kitchen space and sofa, etc. in the stand-by space should be laid out is 33.86m<sup>2</sup>.

7) Manager’s room (19.25m<sup>2</sup>)

The manager’s room is planned to be a room for the manager responsible for the management of the facilities and it has an office workspace and another area for 2 or 3 visitors. By reference to the size of ordinary manager’s rooms at local government organizations, the “Compilation of Architectural Design Materials” and the “Standards for Estimating Total Area for General Government Buildings to be newly Constructed”, it is planned to secure a space enabling the manager to perform his or her duties effectively.

The total necessary area obtained by considering how necessary fixtures such as a desk, a chair, bookshelves and a table and chairs for visitors should be laid out and what the traffic line should be is 19.25m<sup>2</sup> (3.5m × 5.5m).

In the “Compilation of Architectural Design Materials,” it is specified that the area requirement of an office of a director-level person should total between 18.0-25.0m<sup>2</sup>/person + an aisle space + an affiliated space for a storage cabinet for materials, bookshelves, etc., while the “Standards for Estimating Total Area for General Government Buildings to be newly Constructed” specify the same area as 3.3m<sup>2</sup>/person x 6-10 (multiplying rate for a general director-level person) = 19.8-33.0m<sup>2</sup>. With regard to the manager’s room of neighboring government organizations, that of BMR and DMLE have an area of 30.8m<sup>2</sup> (4.0m × 7.7m) and 23.18m<sup>2</sup> (6.1m × 3.8m), respectively.

The total necessary area of 19.25m<sup>2</sup> obtained for the manager’s room in this project is considered as appropriate when compared with a similar space at related facilities in the neighborhood and other standards as above.

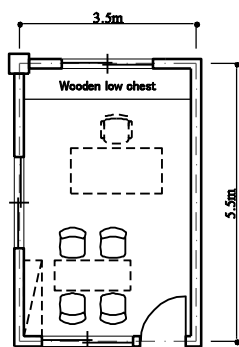


Figure 2-10 Manager’s room

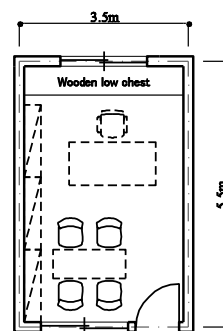


Figure 2-11 Experts’ room

8) Experts’ room (19.25m<sup>2</sup>)

The experts’ room is a room for experts who offer technical instructions and it is planned that a floor area similar to that of the manager’s room should be secured.

9) Staff room (19.25m<sup>2</sup>)

The staff room is a room for staff and it should be planned to accommodate 6 staff members. The total necessary area of the staff room is 6.4m<sup>2</sup>/person at BMR, 5.4m<sup>2</sup>/person at DMLE and by reference to the size of staff rooms in general like the above, the standards of the “Compilation of Architectural Design Materials” and the “Standards for Estimating Total Area for General Government Buildings to be newly Constructed”, it should be planned so that the staff room will have a space that enables staff to perform their duties effectively.

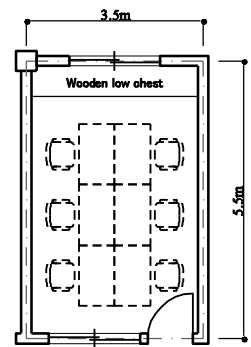


Figure 2-12 Staff room

The total necessary area of the staff room obtained by considering necessary fixtures such as work desks, chairs and bookshelves and what the workers’ traffic line should be is 19.25m<sup>2</sup>. In the standards of the “Compilation of Architectural Design Materials,” the floor area for an office of general staff-level workers is specified as 4.5-7.0m<sup>2</sup>/person + an aisle space + an affiliated space for a storage cabinet for materials, bookshelves, etc., while in the “Standards for Estimating Total Area for General Government Buildings to be newly Constructed”, it is specified to be 3.3m<sup>2</sup>/person x 6 persons x 1 (multiplying rate: general staff-level worker) = 19.8m<sup>2</sup>. In this project, the total necessary area of 19.25m<sup>2</sup> should be selected for the staff room based on considerations on the layout of fixtures and the workers’ traffic line.

10) Library/meeting room (46.75m<sup>2</sup>)

For a meeting room, spaces for meetings and for storage shelves for related materials should be secured. It should be planned that the largest number of people to use the room will be 20, by considering that there will be meetings and seminars participated in also by cultivation farmers and the meeting tables for 3 persons to sit will be positioned in the form of a square. The library should employ the open-shelf system and it is planned that users should use the meeting table for reading. By reference to the size of a general meeting room in Palau including the size of a meeting room at the neighboring DMLE (2.25m<sup>2</sup>/person) and the standards of the “Handbook of Environmental Design”, it is planned that the meeting room should have a space that enables users to work effectively.

The total necessary area of the library/meeting room is 46.75m<sup>2</sup>, which is obtained by considering how the necessary fixtures such as meeting tables and chairs and a space for bookshelves should be laid out and what the workers’ traffic line should be. Meanwhile, the standards of the “Handbook of Environmental Design” employ the total area of about 50m<sup>2</sup> when the room accommodates 20 people (2.5m<sup>2</sup>/person) and meeting tables for 3 persons are laid out in the form of a square. In this project, it is

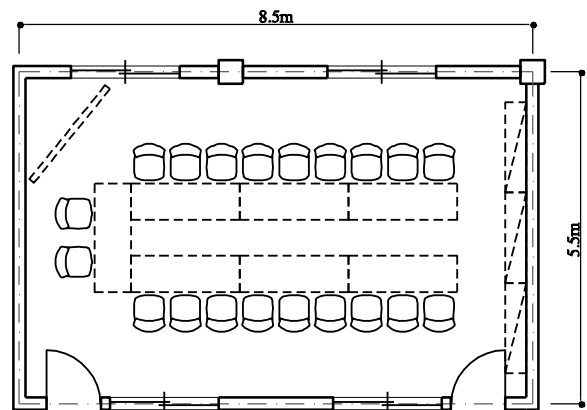


Figure 2-13 Library/meeting room

planned that the total area of the meeting room should be  $46.75\text{m}^2$  ( $2.3\text{m}^2/\text{person}$ ) based on considerations for the layout of bookshelves, workers' traffic line and span arrangements.

11) Public toilets/shower rooms ( $3.75\text{m}^2/4.0\text{m}^2$ )

Toilets for visitors should be laid out adjacent to the exhibition hall/gift shop. A shower room for visitors should be allocated for men and women, respectively, and each should be used also by snorkeling visitors for changing.

As minimum-size facilities, a toilet should have one closet bowl and one wash bowl for both men and women and the total necessary area obtained by taking the traffic line into account is  $3.75\text{m}^2$ , respectively.

As minimum-size facilities, a shower room has one showerhead and one shelf for clothes and the total necessary area obtained taking the traffic line into account is  $4.0\text{m}^2$  for both men and women.

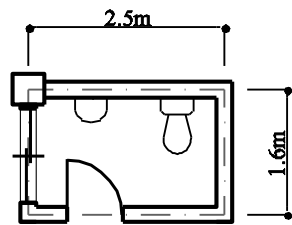


Figure 2-14 Public toilets

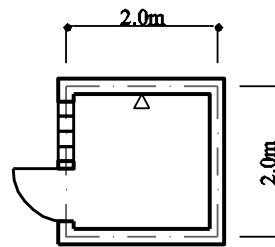


Figure 2-15 Shower rooms

12) Toilets and shower rooms for staff

Toilets for staff should be installed on each floor. Currently staff members at the facilities are all men and therefore, plans should be developed to have one toilet for men on the first floor and two toilets, one for men and one for women on the second floor to also accommodate women who visit the facilities for meetings. The shower room should be planned to be attached to the toilet on the first floor as it will be used after working outdoors or working on the beach in front of PMDC.

- Toilet/shower room on the first floor (attached to the dining kitchen)  
As a minimum-size toilet/shower room, it should have one closet bowl, a showerhead and a shelf for clothes and the total necessary area obtained taking the traffic line into account is  $8.14\text{m}^2$  ( $3.7\text{m} \times 2.2\text{m}$ ).
- Toilet on the second floor  
As a minimum-size toilet for both men and women, respectively, each should have one closet bowl and one wash bowl and the total necessary area obtained taking the traffic line into account is  $6.0\text{m}^2$ , respectively.

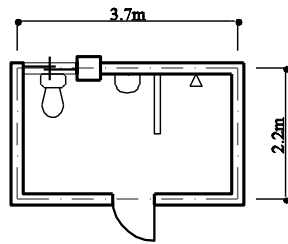


Figure 2-16 1F Toilets and shower rooms for staff

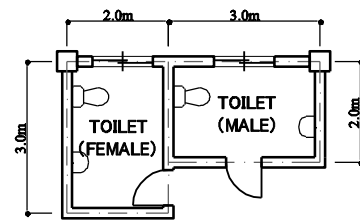


Figure 2-17 2F Toilet

13) Utilities room (7.5m<sup>2</sup>)

As a utilities room for staff, it should be laid out on the second floor. Fixtures necessary for the room include a sink, a refrigerator and a cupboard and the total necessary area obtained taking the layout of these fixtures and the traffic line into consideration is 7.5m<sup>2</sup>.

Meanwhile, the “Area Criterion” specify the total necessary area for a utilities room as 6.5 to 13.0m<sup>2</sup>. In this project, the total necessary area obtained by taking the layout of the fixtures and the traffic line into account is 7.5m<sup>2</sup>.

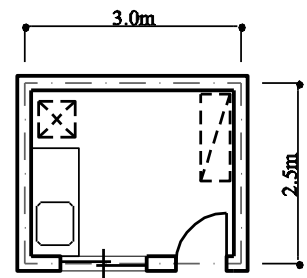


Figure 2-18 Utilities room

14) Entrance/corridor/staircase

The entrance space is a space to introduce people to PMDC and it should be planned to have an open outdoor space with a roof above to avoid strong sunlight and rainwater and to respond flexibly when visitors arrive in a large number at one time.

The size of entrance, corridor and staircase areas should be determined appropriately using a floor plan and by reference to related facilities in the neighborhood and the “Area Criterion (35% of the total area of these spaces)”.

(2) Seed-clam production area

Facilities for which the size should be determined and major equipment and fixtures to be installed are shown in Table 2-8.

Table 2-8 Facilities planned for the seed production area

Planned facilities	Content / specification	amount	Function of the facilities
Culture tank	Reinforced concrete structure		
• Larval tank	Type C1 and C2	12	Larvae rearing
• Nursery tank	Type A and B	64	Juvenile clams rearing
Sheds			Providing an appropriate rearing condition
Elevated water tanks building	Reinforced Concrete structure Height = 10.0m FRP tank Pressure type sand filter Air blower 1.5kW	4 1 3	Seawater reserve, filtrate and supply Air supply

Planned facilities	Content / specification	amount	Function of the facilities
Machinery house	Reinforced Concrete block structure Existing emergency generator 40kVA	1	Emergency power supply
	Planned emergency generator 45kVA	1	
Pump house	Reinforced Concrete block structure Sea water intake pump 7.5kW	3	Seawater intake

### 1) Culture tank



For cultivating seed-clams, two kinds of tanks, larval tanks and nursery tanks, are necessary. In larval tanks, giant clams are grown from the state of hatchlings to the state of initial juvenile clams and in nursery tanks, they grow from initial juvenile clams to seed-clams of a size appropriate for shipment. The policy for designing culture tanks is as follows.

- To secure working efficiency  
In order to collect juvenile clams and conduct daily maintenance such as tank cleaning efficiently, designs should be developed so that tanks have a size that enables workers to easily reach inside of tanks from the outside.
- To reduce influence of weather (measures against rainwater and a rise in culture water temperature)  
Plans should be developed to reduce influences such as a drop in salinity of culture water and a rise in water temperature caused by strong sunlight.
- To secure durability (measures against cracks in concrete structures)  
In order to prevent aged deterioration, plans should be developed particularly paying attention to the durability of culture tanks.

As mentioned in 3-2-1-3 (4) above, the total necessary area of nursery tanks is 925m<sup>2</sup>. Meanwhile, the productivity of initial juvenile clams depends heavily on the quality of fertilized eggs. If extremely high-quality fertilized eggs are obtained, all the required number of seed-clams for nursery and grow-out phases can be obtained in only one-time spawning, while if high-quality fertilized eggs are not obtained, all of the juvenile clams are often thrown away 1 to 3 months later and the spawning process needs to be conducted again. PMDC, therefore, secures the necessary number of juvenile clams for nursery and grow-out phases using a total of 10 tanks having a total base area of 165m<sup>2</sup> and in this project, plans should be developed to secure a similar total base area.

An ideal shape of a tank is that of an independent tank to which workers can reach from all the four directions but if it is planned to make all tanks independent from each other, it will be difficult to secure the necessary tank area because of undersized project site. To solve this issue, plans should be developed to secure a necessary tank installation space by employing a two-connecting tank style in principle. As it is expected, however, to maintain tanks frequently when juvenile clams are being grown, plans should be developed that some of nursery tanks be installed independently.

Table 2-9 Shape and features of tanks

Independent type		As the tank can be reached from all the four directions, it is suitable when frequent maintenance is required but a space surrounding the tank needs to be secured for workers.
Twin type		As a space for an aisle can be saved it results in a larger tank area but workability should be relatively small as the tank can be reached from only three directions.

The result of reviews made on the site conditions, workers' traffic line and aisles in relation with the obtained total necessary area of tanks is shown in Figure 2-19.

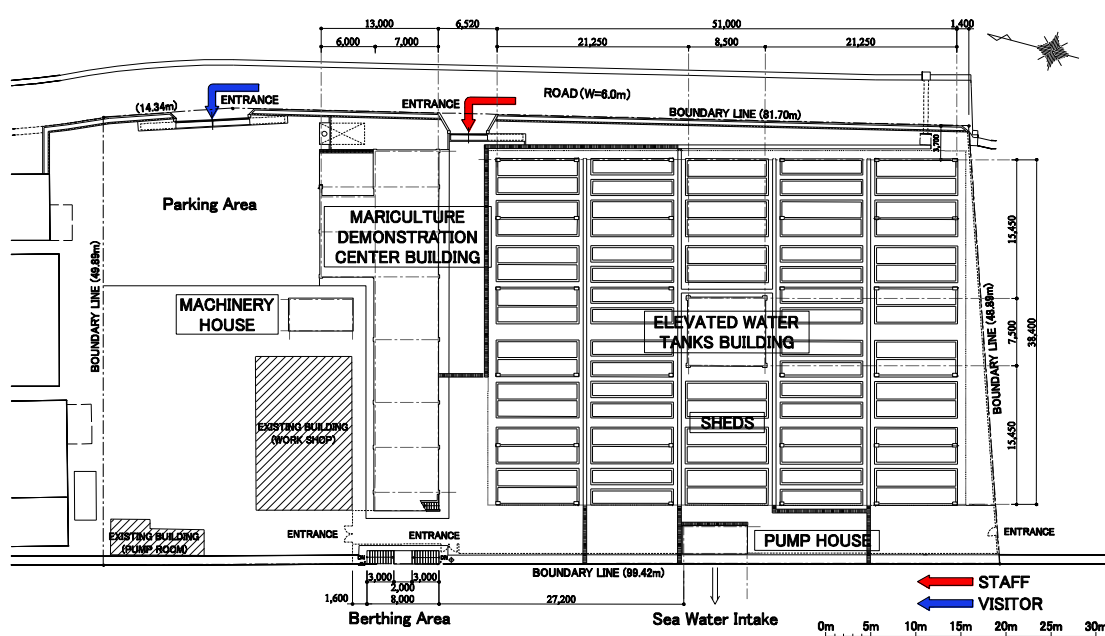


Figure 2-19 Layout plan of raceway tanks

Larval tanks are planned to be Type C1 (1.7m wide) and Type C2 (1.75m wide) to make them appropriately aligned while securing a proper aisle width around them. Nursery tanks are planned to be Type A (independent tank: 1.4m wide) and Type B (connected tank: 1.75m wide) to secure the total necessary base area while taking workability into account. The length should be 8.8m commonly for all tanks.

As the result of layout planning, it is planned to have flexibility in tanks depending on clams' growth, as larval tanks can be converted to nursery tanks by reducing the water depth. The total tank area is reduced to 1,092.96m<sup>2</sup> from the previous 1,127m<sup>2</sup>, a difference which should not cause much problem, and as the total necessary base area (925m<sup>2</sup>) is also secured for nursery tanks, it is judged that an appropriate size and layout plans are secured.

Table 2-10 Comparison of existing tanks and planned tanks

Tank	Existing tank		Planned tank			difference	
	Amount	area	Tank type	Amount	area	Amount	area
Larval tanks	10	165m <sup>2</sup>	Type C1 (Two-connecting)	8	181.28m <sup>2</sup>	+2	+16.28m <sup>2</sup>
			Type C2 (Two-connecting)	4			
Nursery tanks	56	962m <sup>2</sup>	Type A (Independent)	24	911.68m <sup>2</sup>	+8	-50.32m <sup>2</sup>
			Type B (Two-connecting)	40			
Total	66	1,127m <sup>2</sup>		76	1,092.96m <sup>2</sup>	+10	-34.04m <sup>2</sup>

As a measure to prevent deterioration of concrete induced by corrosion of reinforcing steel, plans should be developed to secure a sufficient coating of concrete for nursery tanks which have a lower wall and to paint the interior wall of larval tanks, which has a 1.2m wall height, after coating the wall interior with FRP.

The surface of tank should be finished smoothly so that cleaning can be easily performed.

### 2) Culture tank shed building

As measures against a drop in salinity caused by rainfall and a rise in culture seawater temperature caused by sunlight, sheds should be installed to cover the culture tank area. In order to secure light necessary for giant clams to grow, however, a part of the shed should be made with transparent material (polycarbonate). The total area of the culture tank area obtained by taking the aisles between tanks into account is 1,840m<sup>2</sup>.

### 3) Elevated water tanks building

Filtrated seawater will be necessary for cultivating hatchlings in addition to raw seawater. It should be planned to supply pumped up culture water from the elevated water tanks using gravity flow. For raw seawater to be used in a larger quantity, loop piping should be employed to reduce a drop in water pressure in the pipe at the end of nursery tanks.

It is planned that water to be supplied should be 2,350m<sup>3</sup>/day in total as shown in Table 2-11.

Table 2-11 Review of required quantity of water

Tank	Average volume (m <sup>3</sup> )	Amount	Required capacity	Required water volume (m <sup>3</sup> /day)
Filtrated seawater (Larval tank)	18.75	12	200%/day	450
Raw seawater (Nursery tank)	7.25	64	400%/day	1,856
For backup				44
Total				2,350

The height of the elevated water tanks should be 10m taking into account the loss of water head caused



by the submerged sand filtration tank. The elevated tanks should be made of FRP which is excellent in terms of ease for construction and durability and in order to supply culture water even when cleaning and maintenance is underway, two systems for each tank should be planned.

The first floor of the elevated water tanks building should have a machinery room to install submerged sand filtration equipment and air blowers and an electric room to install a solar power generation system and plans should be developed to make the building a closed space so that noise will not leak.

Machinery to be installed includes submerged sand filtration equipment, a backwash pump, 3 floor pumps (including one for backup) and control panels for those machines and the total necessary area obtained taking the workers' traffic line into account is 34.00m<sup>2</sup>.

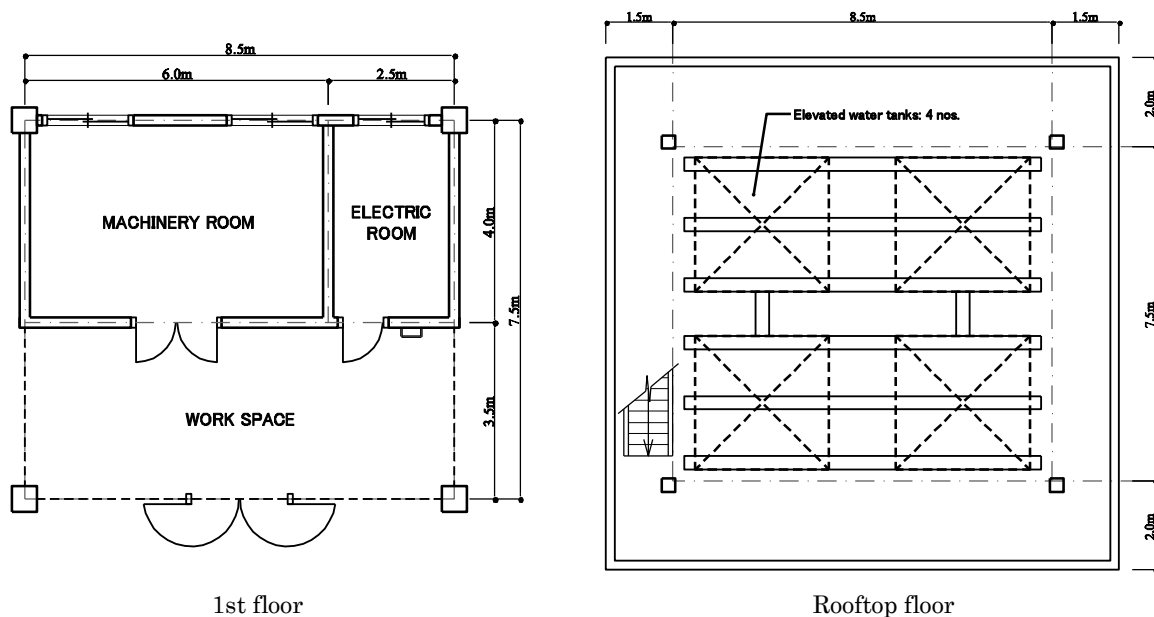


Figure 2-20 Elevated water tanks building

4) Machinery house

The machinery house is a room to supply electricity in case of power outage and plans should be developed so that the machinery house will have an existing and 2 new emergency power generators.

The total necessary area obtained taking into account the installation of 2 new emergency power generators, service tanks and control panels and the workers' traffic line is 24.5m<sup>2</sup> (7.0m × 3.5m).

5) Pump house

The pump house is a room to supply seawater and it is planned that 3 seawater intake pumps should be installed (including one for backup).

The total necessary area obtained taking into account the installation of 3 seawater intake pumps, piping space and control panels and the workers' traffic line is 24.5 m<sup>2</sup> (7.0m × 3.5m).

**2-2-2-5 Floor Planning**

(1) Mariculture demonstration center building

The facilities planned under this project are composed of three areas, areas for production management,

administration, and promotion and publicity. The policy for floor planning is as follows.

- 1) As the premises are undersized, the mariculture demonstration center building should be planned to have a layered structure and functions and traffic lines should be separated from layer to layer.
- 2) The central function of the planned facilities is to provide rooms for production management and therefore, plans should be developed to lay out those rooms on above-ground floors to secure workers' convenience, simplified traffic lines of "people" and "goods" and ease of access to seedling production tanks, while installing administration offices which mostly involve traffic lines of "people" on the second floor. It should also be planned to install an extra staircase on the west side, taking into account the workers' convenience for accessing the seed-clam production area and preventing traffic lines of workers and tourists from crossing each other.
- 3) It should be planned to make considerations on congestion and interference, by laying out rooms for promotion and publicity near the parking lot on the ground level to prioritize visitors' accessibility, by clearly separating traffic lines of workers and visitors not to cause interference to seed-clam production and by establishing a neutral area where crossing of traffic lines can occur.

A floor plan of the mariculture demonstration center building developed based on the above-mentioned considerations is shown below.

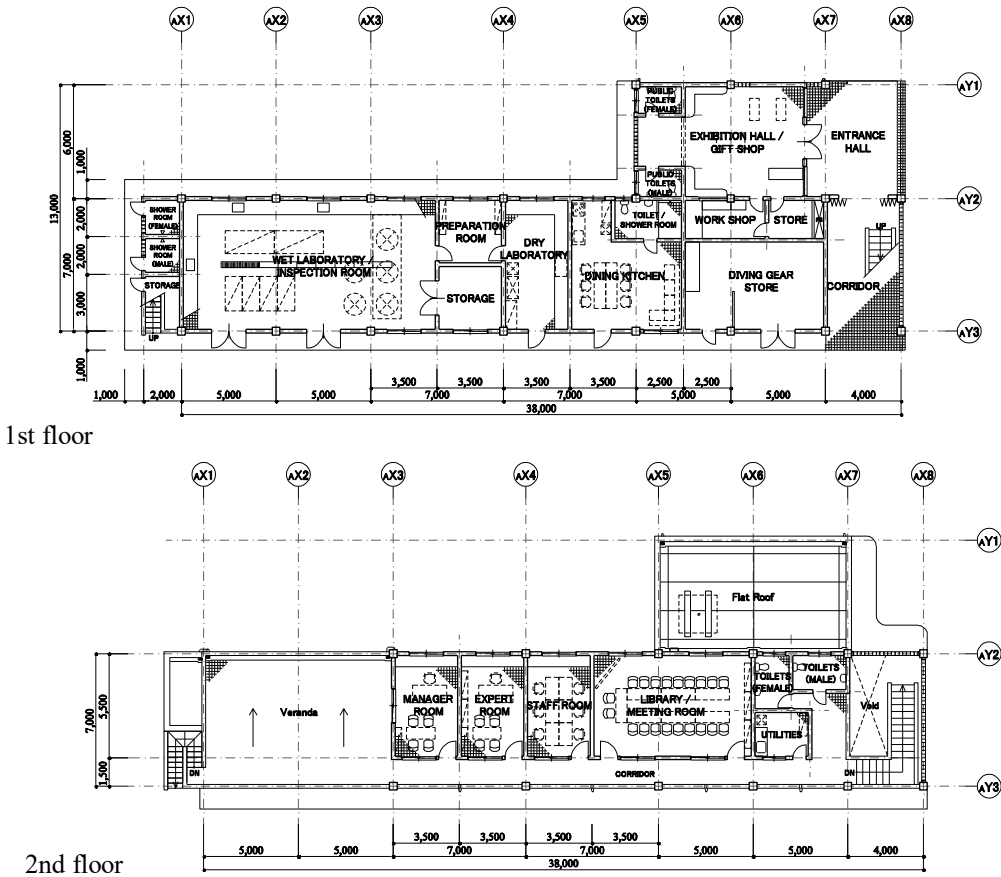


Figure 2-21 Mariculture Demonstration Center Building Plan

(2) Culture tank shed building and elevated water tanks building

The culture tank shed building should be developed to cover the entire culture tank cluster shown in Figure 2-19 and columns of the building should be placed to secure an aesthetic design while not interfering with works at culture tanks. Meanwhile, by being laid out at the center of the culture tank cluster, the elevated water tanks building should reduce the length of piping and efficient supply of water and air should be secured.

(3) Pump house and machinery house

It should be planned to place the pump house near the seawall so that seawater intake will be easy and to place the machinery house between the fish culture facilities and the giant clam culture facilities taking into account convenience for the service of public power lines and supply of emergency power.

A layout plan for the facilities based on the above-mentioned layout and floor plans is shown below.

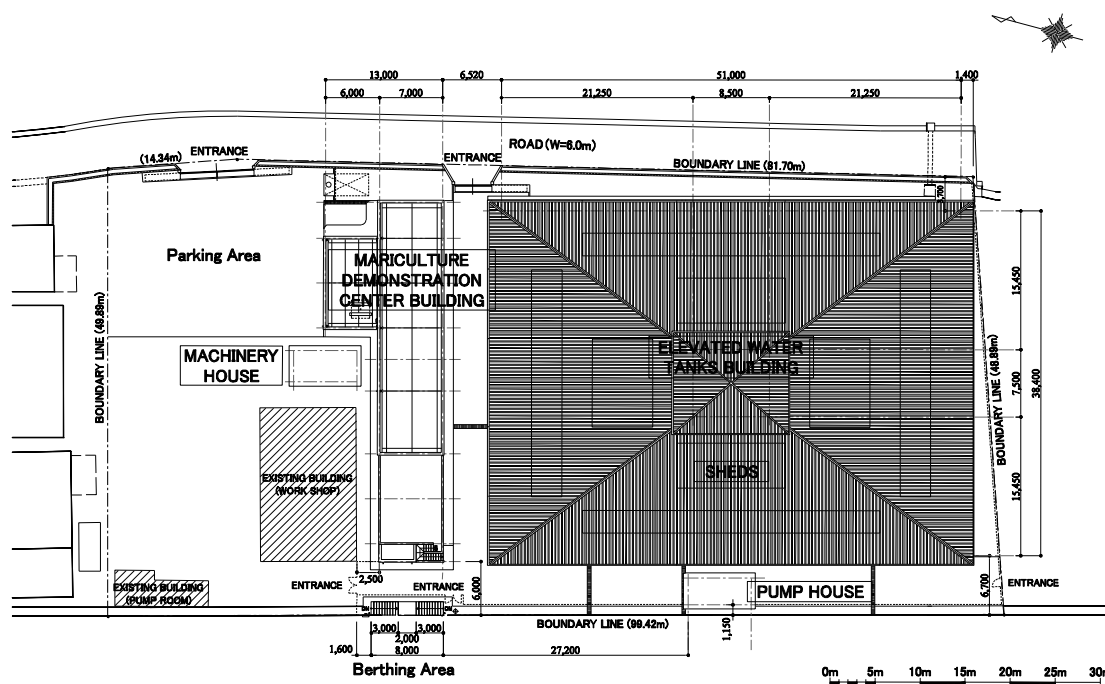


Figure 2-22 Lalyout Plan

Table 2-12 Planned facilities and dimensions

Name of the planned facilities	Dimensions (m <sup>2</sup> )
1. Mariculture demonstration center building	536.00
【First floor】	340.00
Exhibition hall / Gift shop	39.00
Workshop	9.90
Store	6.60
Diving gear store	36.00
Dry laboratory	24.50
Preparation room	12.25
Wet laboratory / Inspection room	94.50
Storage	12.25

Name of the planned facilities	Dimensions (m <sup>2</sup> )
Dining kitchen (including Toilets and shower room for staff)	42.00
Public toilets	15.00
Shower room	8.00
Entrance hall	40.00
<b>【Second floor】</b>	196.00
Manager room	19.25
Expert room	19.25
Staff room	19.25
Library / Meeting room	46.75
Toilets	12.00
Utilities	7.50
Stairs	28.00
Corridor	44.00
2. Sheds	1,840.80
3. Elevated water tanks building	63.75
Machinery room	24.00
Electric room	10.00
Work space	29.75
4. Machinery house	24.50
5. Pump house	24.50
Total	2,489.55

### 2-2-2-6 Cross-section Plans

#### (1) Floor height

The height of existing seawalls is E.L. +1.84m at the end of apron. Rainwater is drained to the seawater area in front of the facilities and it is planned that the standard height of the land should be E.L. +2.0m to secure a drainage slope for rainwater. This height is almost the same as that of the current project site (E.L. +1.98m to 2.24m) and there should be no problem to connect to the existing road (E.L. +1.97m to 2.16m).

It is planned to have a sufficient drainage slope toward drains and catch basins in the floors of buildings and culture tanks and toward peripheral areas under the eaves and exterior areas. The floor height of each facility should be as follows.

Table 2-13 Planned floor level

Name of the facilities	Floor level
1. Mariculture demonstration center building	EL +2.35m
2. Sheds	EL +2.30m
3. Elevated water tanks building	EL +2.30m
4. Machinery house	EL +2.35m
5. Pump house	EL +2.35m
Existing road height	EL +1.96~2.24m
Existing sea wall crown height	EL +1.84m

#### (2) Building height and roof shape

##### 1) Mariculture demonstration center building

It is planned that an atrium be laid out at the entrance on the east of the mariculture demonstration center building. All of the rooms in daily usage have an opening on the both south and north sides for

prevailing wind to secure sufficient ventilation and natural light. In order to reduce a rise in the room temperature, it is planned to have a floor height of over 3.50m by reference to that of related facilities in the neighborhood to secure enough air space.

Roof materials should be concrete that is highly durable and easy to maintain and a flat roof shape should be employed considering possible installation of rainwater tanks on top of it.

## 2) Culture tank shed building

The culture tank shed building is a structure mainly composed of columns placed in a relatively large span to cover the culture tank space (38.40m × 51.00m). The roof is planned to have a shape with the same eaves height in four directions, which is a pyramid shape with four corner ridges that get together at the top. With this shape, it is planned that the roof of the shed has a sufficient height to secure enough air space to control a rise in the temperature underneath. In order to gain more efficient ventilation, it is planned to have an opening in the center of the roof, too. As the result of balancing ventilation, workability and structure, it is planned that the roof should have inclination at 2.4/10 in the north and south direction and 1.8/10 on the east and west direction, an eaves height of 4.10m and a ridge height of 7.60m.

The roof material is planned to be Galvalume folded plate that is excellent in durability and easy to maintain. In order to secure light necessary for the growth of giant clams, it is planned to use transparent material in a part of the roof. A sectional view of the planned structure is shown below.

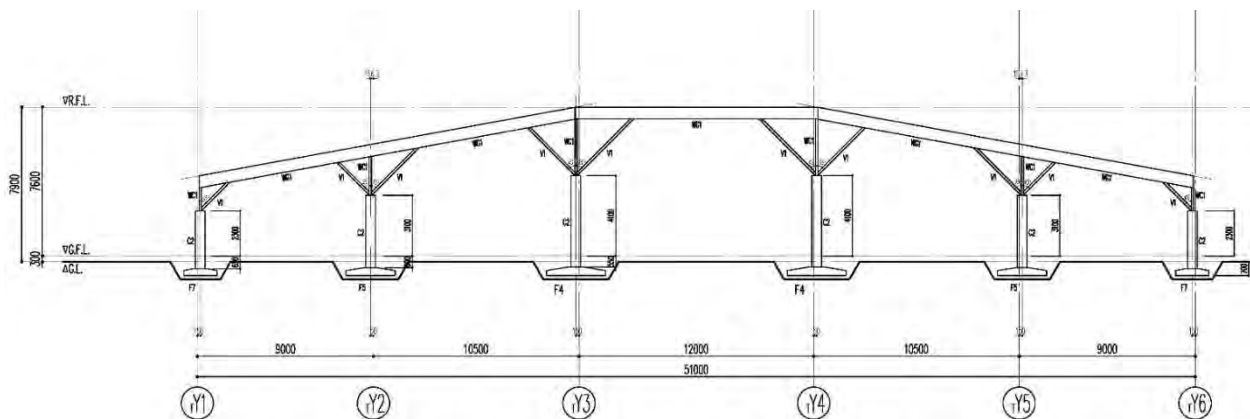


Figure 2-23 Planed section of the culture tank shed building

Table 2-14 Floor level of planned facilities

Name of the facilities	Floor level
1. Mariculture demonstration center building	1FL +3.60m 2FL +3.55m
2. Sheds	1LF +4.10~7.60m
3. Elevated water tanks building	1FL +10.00m
4. Machinery house	1FL +2.80~3.10m
5. Pump house	1FL =2.80~3.10m

## 2-2-2-7 Structural Planning

### (1) Design conditions

To structural designing, Japan's standards should apply. Meanwhile, to external force, the following should apply.

Seismic force: International Building Code, Seismic Zone 2A

Wind load: 160 mph

Soil bearing capacity: 50kN/m<sup>2</sup> (based on the result of soil survey)

### (2) Structure style

The foundation should have a spread structure, taking into account the geographical conditions of the project site, which is relatively small in size. The foundation configuration should be: Footing foundation for the mariculture demonstration center building, the culture tank shed building and the elevated water tanks building; Long-strip footing foundation for the machinery house and the pump house and; Mat foundation for areas where water tanks are to be installed.

For the project site, possible upper structures include wooden structure (laminated wood), steel structure, reinforced concrete blocks and reinforced concrete structure (RC).

The mariculture demonstration center building and the elevated water tanks building should employ the reinforced concrete structure which is common in Palau, based on the results of the review shown in Table 2-15. The machinery house and the pump house should employ the reinforced concrete block wall structure which is economical and easy to procure, as the facilities have a large area of wall and are small in size.

For the structure of the culture tank shed building, possible structures include wood structure (laminated wood), steel structure and RC. For the lower part of the building, the RC structure should be employed, which has several advantages such as, resistant to salt erosion, flexible for designs and easy to cast to suit the layout of tanks and for the framework for the upper hipped roof, wood (laminated wood) material should be selected, which is lighter to suit a larger span structure, can be constructed in a short period, durable against salt corrosion and easy to be maintained.

Table 2-15 Review of structure style

Structure style	Durability and maintenance	Rust-proofing	Suitability to large spanning	Cost	Construction period	Procurement	Review result
Reinforced concrete	○	◎	○	△	△	◎	To be employed for lower part of the mariculture demonstration center building, the elevated water tanks building and the culture tank shed building
Reinforced concrete block wall	○	◎	×	○	△	◎	To be employed for small-size buildings having a large area of wall (the machinery house and the pump house)

Structure style	Durability and maintenance	Rust-proofing	Suitability to large spanning	Cost	Construction period	Procurement	Review result
Wood (laminated wood)	◎	◎	◎	△	○	△	To be employed for upper part of the culture tank shed building
Steel	△	△	◎	△	○	△	Not to be employed as salt corrosion is a concern

**2-2-2-8 Utilities Planning**

(1) Electricity

In this project, electricity generated using solar power and emergency generators should be used in addition to commercial power. The concept for electricity supply through these three systems is shown below.

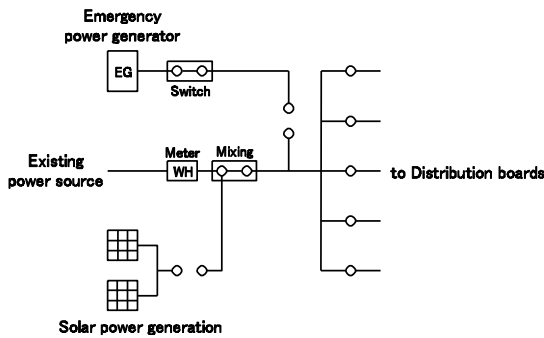


Figure 2-24 Power supply system diagram

1) Commercial electricity

Electricity used in PMDC is public electricity supplied by PPUC (three-phase 208V, single-phase 110V, 60Hz), which is serviced from the transformer installed on the utility poles along the road in front of the project site. In this project, the public power should be used.

2) Solar power generated electricity

A solar power generation system can cost a large amount of money when renewing batteries and therefore, it is planned that no batteries should be installed and it should be used as daytime auxiliary power supplied only whilst sunlight is available.

<Outline of the system>

Electricity generated using solar panels will be sent to the facilities’ switchboard through PV inverter and transformer and will be supplied to all relevant equipment installed at the facilities such as lighting fixtures, outlets, air-conditioners, pumps, air blowers, etc. after being mixed with commercial electricity. The main feature of this system is that it does not supply power to specific load apparatus but supplements the entire power consumption around the facilities.

<Determination of the scale of power generation>

Daytime power consumption at the facilities should be around 60kWh (during normal time excluding peak

time). In Palau, there is no system for selling power to utilities and therefore, over generated electricity will be wasted. If a design to control the waste as low as possible is to be developed, it is recommended by manufacturers of the system that the scale of power generation should be around 40% of the power consumption based on the data owned by the manufacturers. In this project, the scale of power generation will be set as 25kWh, which is 40% of the daytime power consumption (around 60kWh). Solar panels are planned to be installed on structures such as the roof of the culture tank shed building that have a large area to receive direct sunshine.

### 3) Emergency power generation

In Palau, power blackouts occur frequently and therefore, emergency power generators should be installed to supply power to seawater intake pumps and blowers in case of nighttime blackout. Necessary output calculated based on starting current for pumps and blowers should be 45kVA. Specifications of the emergency power generators are planned as follows.

Table 2-16 Specification of emergency generator

Engine	Diesel engine
Service voltage	Three-phase 4 line 208V / single phase 2 line 110V, 60Hz
Generation capacity	45 kVA

### 4) General electric equipment

General electric equipment should be planned including lighting fixtures and outlets. Lighting should be natural illumination in principle and only the minimum lighting fixtures be installed as possible. Lighting fixtures and piping materials should have specifications with salt-corrosion proofing. In order to reduce maintenance works and save costs, it is planned to employ mainly LED fixtures. In order to prevent crimes in early morning or after dark, streetlights should be installed along the existing roads. Luminous intensity for indoor lighting fixtures is planned to be established shown in Table 2-17.

Table 2-17 Designed Indoor Illuminance

Office and general areas	Approx. 300Lux
Toilets, storages	Approx. 150Lux
Culture tank	Approx. 50Lux

Table 2-18 Planned power consumption of various installations/equipment

Type of installation/equipment	Power consumption (kW)
Lighting	5.0
Power outlets	3.0
Seawater intake / Airlation	20.0
Ventilation	1.5
Air conditioning	30.0
Others	0.5
Total	45.0



For telephone and Internet connection, it is planned that only service wiring be used and servicing construction works should be the responsibility of the recipient country.

(2) Water supply and sewage

Water supply in this project is planned to include supply of seawater, service water (tap water) and rainwater and sewage is planned for three kinds of wastewater including culture seawater, rainwater and domestic wastewater.

1) Seawater supply system

For over 40 years since its establishment, PMDC has been taking in seawater from an area 25.00m away from the shore and 2.50m in depth. In water quality inspection conducted during the field survey, no data were obtained to suggest the seawater in front was inappropriate for culture. In addition, there is no development plan that can cause significant change in the surrounding seawater environment in the future and it is possible to use the area as a source of water in the future. As the seawater temperature can exceed 28°C at low tide, however, it should be planned that the seawater intake point be changed to 40.00m away from the shore and 4.50m in depth.

It is planned that two seawater intake pipe systems should be used to prepare for maintenance and a breakdown and 3 pumps including 2 intake pumps and 1 back pump should be operated alternately.

In order to stabilize seed-clam production, filtered seawater should be supplied to larval tanks and the wet laboratory. For filtration, it is planned to provide a submerged filter which is easy to handle and seawater should be filtered as it flows by gravity from elevated tanks.

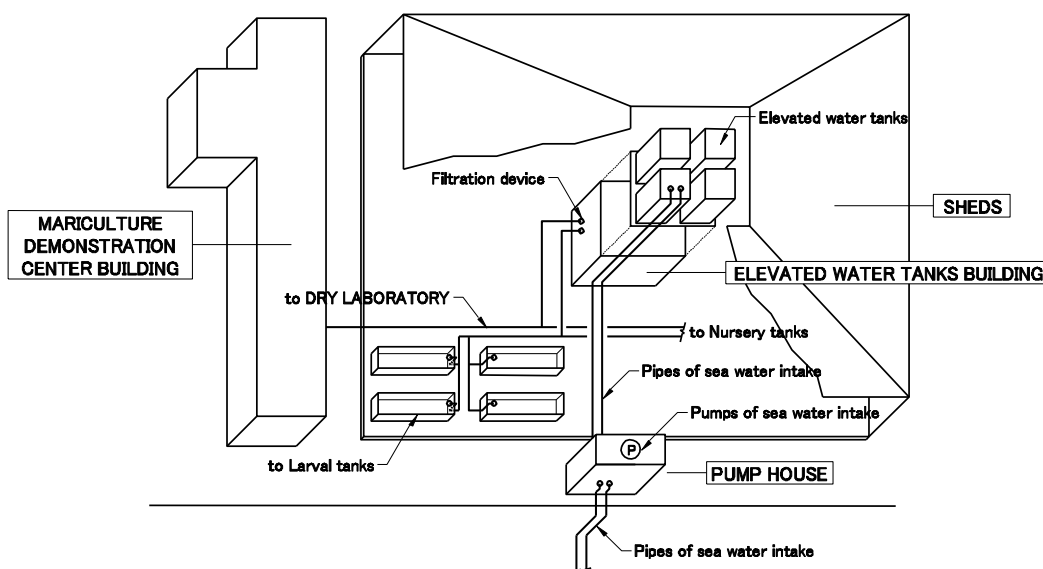


Figure 2-25 Seawater supply system

2) Public water supply system

Public water has been supplied by PPUC to the existing facilities. The supply pressure of tap water is

high enough and public water should be used by directly connecting to the main.

### 3) Rainwater supply system

In Palau, a stable amount of rainfall can be expected all year round not only in the rainy season and therefore, it should be planned to collect rainwater from the roof of the mariculture demonstration center building into tanks and use it as general service water at various facilities by allowing it to flow from the tanks by gravity.

### 4) Culture seawater drainage

Giant clams are grown without being fed and no wastewater treatment is particularly necessary. It is planned to follow the current method to directly discharge used culture water in tanks into the seawater in front of the facilities through drainage ditch.

### 5) Rainwater drainage

In the surrounding area of the project site, rainwater penetrates naturally or is discharged to the seawater through ditches. In this project, it should be planned to discharge into the seawater in front of the facilities through ditches.

### 6) Drainage of domestic wastewater

Although sewage systems have been developed generally well in Koror State, no sewage system has been in place in the project site. Therefore, it is planned that filthy water and wastewater should be collected in storage tanks in the same way as in neighboring BMR and DMLE.

### (3) Ventilation system

In Palau's hot and humid weather, air-conditioning is commonly used in both public and private buildings and it is planned in this project, too, that major rooms in daily usage have an air-conditioning system. The air-conditioners should be those of a separate type and an automatic voltage stabilizer (AVS) should be installed to protect electric equipment from voltage fluctuation. It is also planned that a ventilation fan be installed at toilets, the dining kitchen and shower rooms.

## **2-2-2-9 Finish Planning**

### (1) Opening and ventilation screens

In Koror City, it is common that buildings have aluminum sash windows and wooden or aluminum hinged doors. In this project, it is planned in principle to employ aluminum sash windows and aluminum sash or wooden doors by considering the facilities' location in a coastal area prone to salt damage and necessity to secure airtightness for air-conditioning.

For ventilation screens in an open space like the entrance and the base of handrails for corridors, it is planned to employ concrete screen blocks which are commonly used. For part of openings in staircases and the exhibition hall/gift shop, it is planned to employ glass blocks that are excellent in taking in homogenous sunlight and provide thermal and sound insulation.

(2) Exterior finishing

Plans for exterior finishing are as shown in Table 2-19.

Table 2-19 Exterior finishing plan

Name of the facilities	Roof	External wall	Remark
1) Mariculture demonstration center building	Waterproof cement mortar S.T. 3 plies of asphalt membrane waterproofing	Waterproof cement mortar , MCD	
2) Sheds	Folded-plate (H=150) , a skylight on the ceiling : polycarbonate	Column : Waterproof cement mortar , MCD Roof framing: Wood OP	Culture tank ① Larval tank : mortar S.T., EP ② Nursery tank : mortar S.T., EP
3) Elevated water tanks building	Folded-plate (H=85)	Waterproof cement mortar , MCD	
4) Pump house	Waterproof cement mortar S.T.	Waterproof cement mortar , MCD	
5) Machinery house	Waterproof cement mortar S.T.	Waterproof cement mortar , MCD	

MCD : Multi-layer coating, EP : Synthetic resin emulsion paint

(3) Interior finishing

Plans for interior finishing are as shown in Table 2-20.

Table 2-20 Interior finishing plan

Name of the facilities	Floor	Skirting	Wall / column	Ceiling
1) Mariculture demonstration center building (First floor)				
Entrance hall	Tile (15cm x 15cm)	Mortar, EP	Mortar, MCD	Cement board, EP
Exhibition hall	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Insulation board, EP
Gift shop	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Insulation board, EP
Workshop	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Cement board, EP
Store	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Cement board, EP
Wet laboratory/Inspection room	Mortar S.T.	Tile (15cm x 15cm)	Mortar S.T. EP	Mortar S.T. EP
Storage	Mortar S.T.	Mortar S.T. EP	Mortar S.T. EP	Cement board, EP
Dry laboratory / preparation room	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Cement board, EP
Diving gear store	Mortar S.T.	Mortar S.T. EP	Mortar S.T. EP	Cement board, EP
Dining kitchen	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Insulation board, EP
Toilet / Shower room	Tile (15cm x 15cm)	—	Tile (5cm x 5cm)	Cement board, EP
Public toilets	Tile (15cm x 15cm)	—	Tile (15cm x 15cm)	Cement board, EP
Shower room	Tile (15cm x 15cm)	—	Tile (15cm x 15cm)	Cement board, EP
(Second floor)				
Manager room	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Insulation board, EP

Name of the facilities	Floor	Skirting	Wall / column	Ceiling
Expert room	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Insulation board, EP
Staff room	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Insulation board, EP
Library / Meeting room	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Insulation board, EP
Toilets	Tile (15cm x 15cm)	—	Tile (15cm x 15cm)	Cement board, EP
Utilities	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar S.T. EP	Cement board, EP
Corridor	Tile (15cm x 15cm)	Tile (15cm x 15cm)	Mortar, MCD	Cement board, EP
2) Sheds	Mortar S.T.	Mortar S.T. EP	Mortar S.T., EP / Mortar, MCD	Wood OP.
3) Elevated water tanks building				
Electric room	Mortar S.T.	Mortar S.T. EP	Mortar S.T. EP	Mortar S.T. EP
Machinery room	Mortar S.T.	Mortar S.T. EP	Mortar S.T. EP	Mortar S.T. EP
4) Pump house	Mortar S.T.	Mortar S.T. EP	Mortar S.T. EP	Mortar S.T. EP
5) Machinery house	Mortar S.T.	Mortar S.T. EP	Mortar S.T. EP	Mortar S.T. EP

EP : Synthetic resin emulsion paint    MCD : Multi-layer coating,

## 2-2-2-10 Equipment Plan

### (1) Equipment for giant clam cultivation and sale

In culture tanks, it is necessary to install screens to prevent clams from escaping, pipes with holes and shade nets to adjust sunlight prior to the start of seed-clam production. These fixtures should be prepared and installed by the Palauan side after the delivery of the facilities. For works such as collection of hatchlings and juvenile clams, cleaning and changing of tanks, various kinds of nets should be processed and used. Also in cultivation activities, fixtures have to be processed and operated by the users themselves and in this project it is planned to provide materials and tools for the processing works. In addition, containers and baskets to store adult and juvenile clams, oxygen regulators to be used during packing for shipment and spray guns and air hose should be provided.

### (2) Experiment equipment and tools

During the process of seed-clam production, it is essential to use physical and chemical appliances for preparation of chemicals, anatomy, injection and microscopic observation of fertilized eggs and hatchlings. As PMDC does not conduct research activities, no high precision tools are necessary but tools with high utility and durability should be selected by paying attention to the fact that such tools are exposed to high temperature and humidity as well as seawater.

Plans should be made on spare parts for profile projectors and ultraviolet sterilizers. Supplies for the profile projector include halogen lamps (rating of 300 hours) and it is planned to procure 3 lamps as it is expected to consume one lamp annually. Supplies for the ultraviolet sterilizer include ultraviolet lamps and it is planned to procure lamps for one cycle as it takes time from order to procurement.

### (3) Promotion and office administration equipment and tools

Promotion activities are composed of support to culture farms through revolving funds, attraction of visitors to PMDC and education on giant clam resource protection for visitors.

As works to support cultivation farms include diving for construction of farms, delivery of clam seedlings and regular monitoring, it is planned to provide equipment and tools necessary for diving works, while it should be planned that a number of diving shops existing in Koror City be used as maintenance of compressors necessary to fill up pressured air can cost a large amount of money.

It is necessary to have a computer, peripheral devices, photocopiers, etc. for activities for attracting visitors to PMDC, preparation of pamphlets and posters for educational activities, accounting and data processing. Some of these devices require regular maintenance and procurement of supplies and therefore, it is planned that in principle they should be procured locally.

Table 2-21 Planned equipment

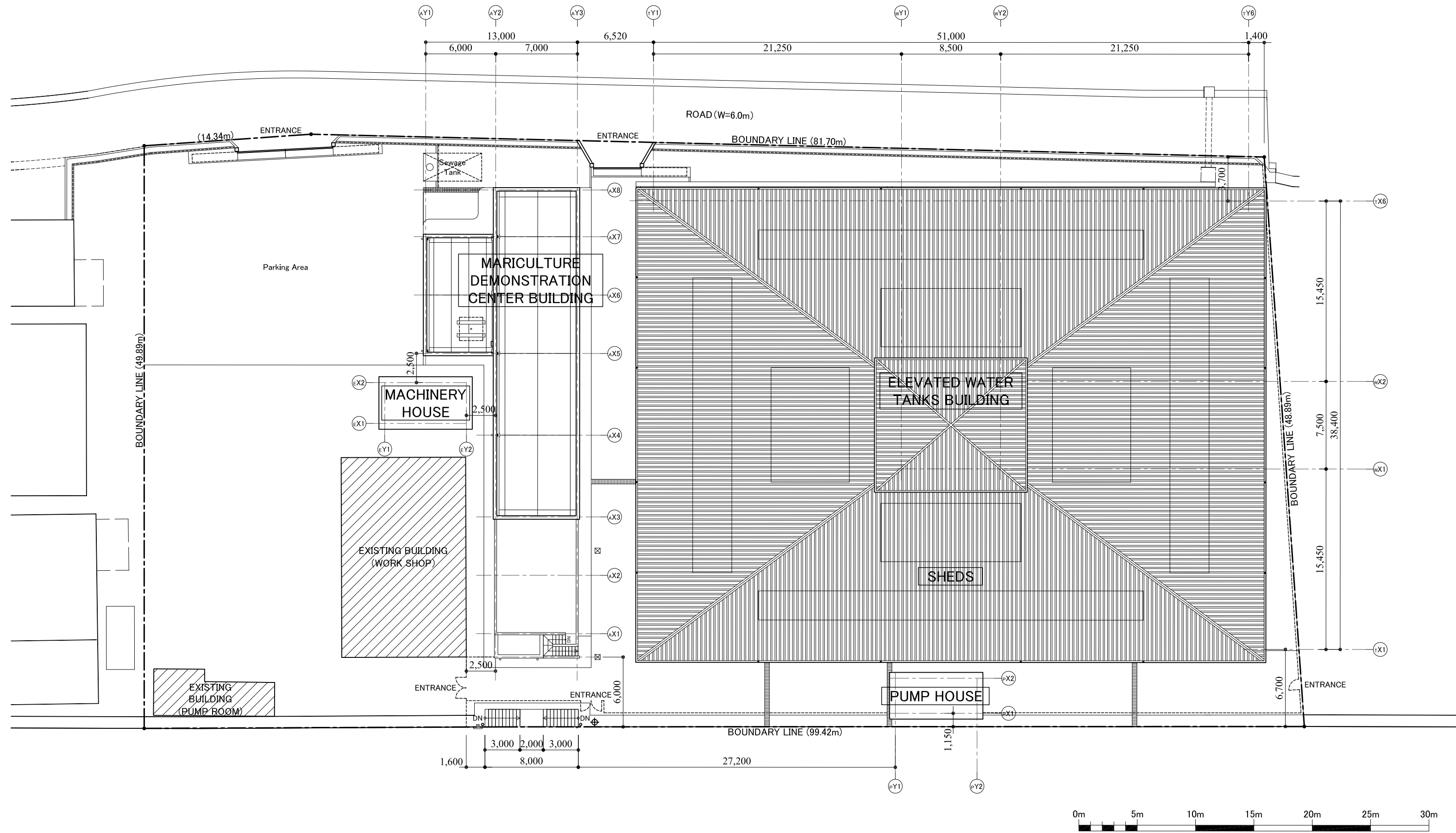
Equipment	Outline of specification	Quantity
(1) Equipment for giant clam culture		
Screen nets	polyvinylidene chlorid, Mesh size : 60 fibers/inch、 50m/reel	1 roll
Shade nets	Extinction efficiency : 90% and 97%	1 set
Plankton nettings	Mesh size : 60 $\mu$ and 150 $\mu$	1 set
Scoop nets	Small size : 100x80mm、 Middle size : 125 x 105mm、 Large size : 150 x 130mm	1 set
Plastic container	Polyethylene, Approx. 75 liters, with cap	10 nos.
Plastic basket	Polyethylene, Approx. 45 liters, with cap	30 nos.
Polyethylene nettings	Mesh size : Approx. 2.1, 3.0, 7.5, 21mm, W 100cm x 50m/reel	1 set
Plain weave netting	Polyethylene, Mesh size : 526 $\mu$ , 122cm x 50m/reel	2 rolls
Oxygen regulator	Oxygen regulator , Spray gun, Air horse 5 m	1 no.
Spray gun	Aluminum die casting	1 set
Electric tools	High speed cutter, bench grinder, disk grinder, hand grinder, vibration drill driver	1 set
Hand tools	Screwdriver, wrench, socket wrench, pliers, hammer etc.	1 set
(2) Laboratory equipment		
Profile projector	Desktop type, Screen effective diameter : 30cm or more, power : x10 ~x100	1 no.
Biological microscope	power : x40~x400, Image photographing device for microscope (photo and moving image)	1 no.
Stereoscopic microscope	Binocular type with zoom function、 power : x7~x45	1 no.
Refrigerator	Capacity : Approx. 250 litres	1 no.
Freezer	Capacity : Approx. 300 litres	1 no.
Glassware display cabinet	Approx. W 1,500mm x D 600mm	1 no.
Glassware	Glassware, pipet, beaker, flask, graduated cylinder, Petri dish etc.	1 set
Dissection apparatus	Forceps, Dissecting Scissors, Scalpel and blades	1 set
Electric balance	Measurement range : 0~1000g, Minimum scale : 0.1g	1 set
Micropipette	Capacity : 1ml, Variable capacity type	2 nos.
Vernier calipers	Measurement range : 0~150mm、 0~300mm	1 set
Calipers	Measurement range : 0~50cm、 0~100cm	1 set
Injection syringe	Syringe : 5ml, Needle length : 2cm	5 nos.
Polyethylene container	Capacity : 500 litres, outer length : Approx. 920mm x 1840mm x 410mm	4 nos.
Culture tanks	FRP tank, polycarbonate tank, styrene tank, double bottom plate	1 set
Plastic vat	Polypropylene, Capacity : Approx. 7.3 liters	50 nos.
Instruments for aeration	Air stone, polyvinyl chloride tube, Three-way stopcock, Air pump	1 set
Bladed hose	Inside diameter 25mm、 Length 50m/reel	1 roll
Titanium heater	Capacity : 1kW	1 no.

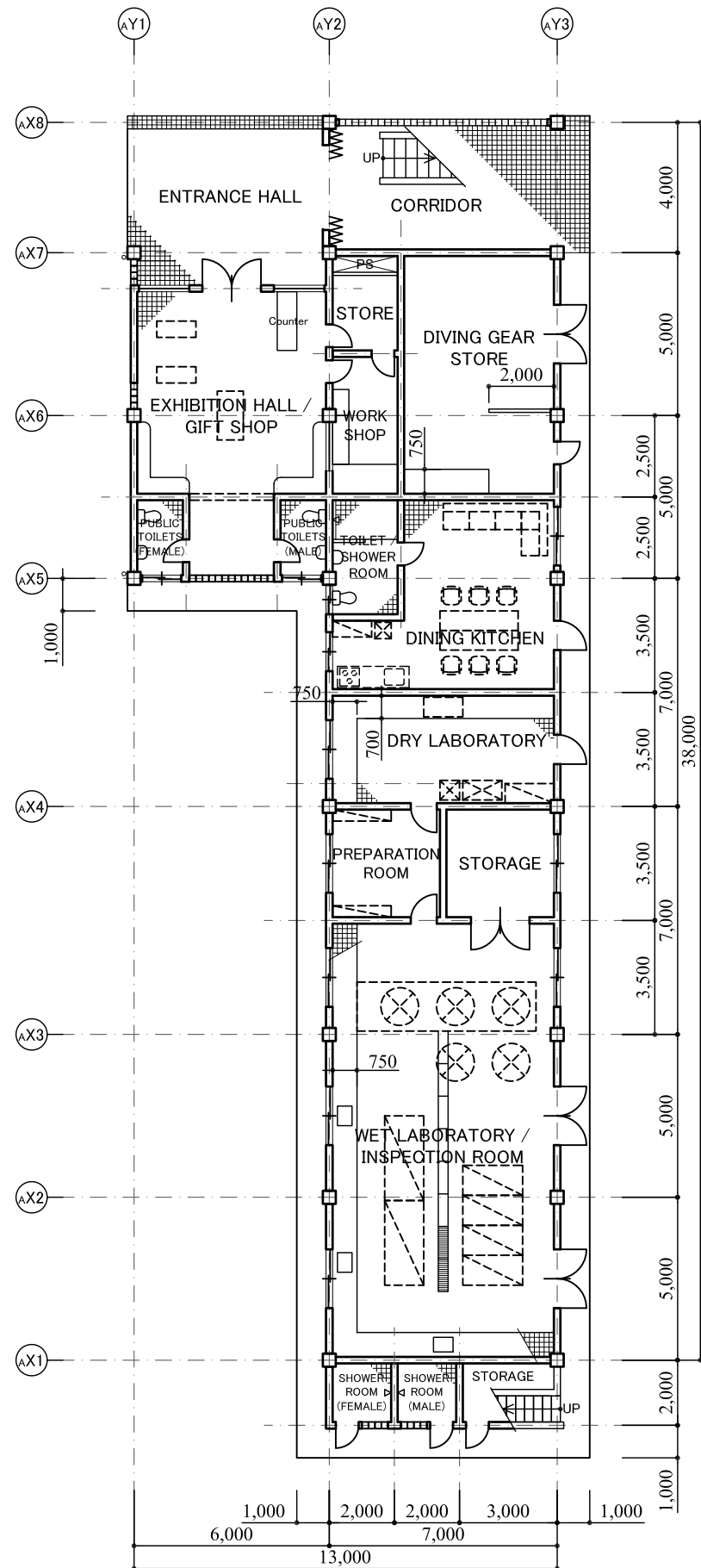
Equipment	Outline of specification	Quantity
Submersible pump	Diameter (Connecting) : 25mm、 Maximum flow : 65 liters/minute	1 no.
UV water sterilizer	Capacity : 0.24m <sup>3</sup> /hour	1 no.
Salinity refractometer	Measurement range : 0~100‰, Minimum scale : 1‰	3 nos.
Thermometers	Measurement range : 0~50°C, alcohol thermometer, standard thermometer	1 set
Cartridge filter	Length 250mm, Mesh size : 5μ	1 set
Steel shelves	W 1,800mm × D 600mm × H 1,800mm	1 no.
(3) Equipment for promotion, data processing and others		
Diving gear	Buoyancy Control Jackets, Tanks, regulators, Masks, Fins, Wetsuits etc.	1 set
Waterproof camera	Water resistant : 10m or more, number of pixels : ten million pixel or more, with waterproof case	1 no.
Aqua scope	Polypropylene, Length of a Lens : Approx. 20cm、 Hight : Approx. 20cm	6 nos.
Utilities boat	Length : Approx. 3.3m, breadth : Approx. 1.6m, Capacity : 4 persons, Outboard engine : Approx. 2 PS	1 no.
Desktop computer	quad-core processor, operation clock : 3GHz or more, Memory : 8GB or more, Monitor : 20" or more, Uninterruptible Power Supply (UPS)	1 no.
Laptop computer	quad-core processor, operation clock : 3GHz or more, Memory : 8GB or more, Monitor : Approx. 15"	1 no.
Printer/photocopier	Maximum print size : A3, Continuous printing number (A4) : 20 pages/minute, both side printing	1 no.
Multifunction copier scanner	Maximum scan size : A3、 reading resolution : 200~4800dpi	1 no.
Wireless network router	IEEE802.11a/b/g/n/ac、 power consumption : Approx. 8W	2 nos.
Projector	Maximum resolution : WUXGA (1920 ×1200), Output (speaker) : Approx. 16W (Maximum) , Screen	1 set
Video monitor	liquid crystal display Approx. 55 inches (for hanging on walls) , Blu-ray Disc, CD-R, CDR-W, USB memory	1 set
Aquarium	W600 ×L1,500 ×H600mm	1 set
Pin board	Size : Approx. W900 × L1,800mm	2 nos.
Glass display case	Size : Approx. W600 × L1,200 × H1,200mm	2 nos.
Glass display refrigerator	Size : Approx. W600 × D450 × H1,100mm、 adjustment range : 3 ~10°C	1 no.

### 2-2-3 Outline Design Drawing

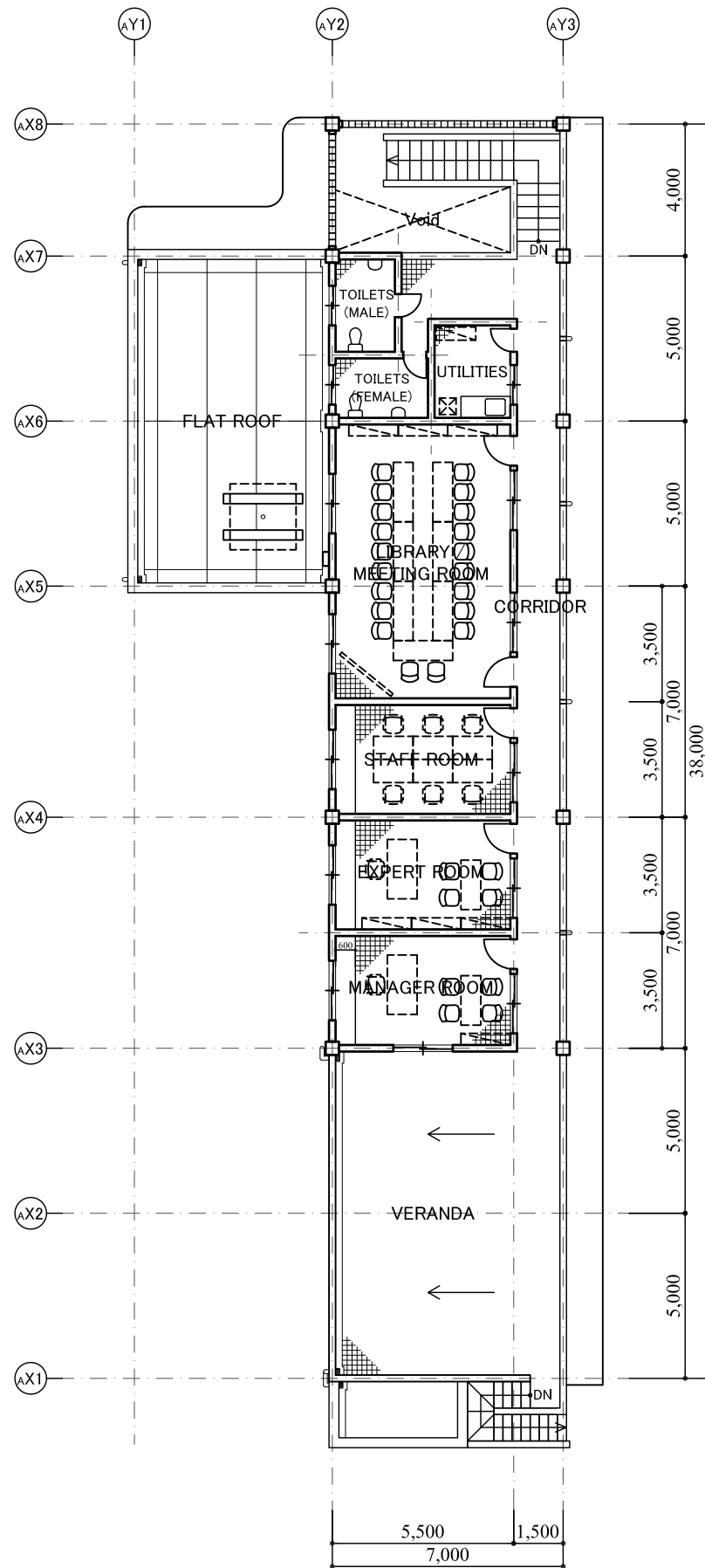
Table 2-22 List of drawings

Drawing No.	Title of Drawing
01	Site Plan
02	Mariculture Demonstration Center Building Plan/Roof Plan
03	Mariculture Demonstration Center Building Elevation
04	Sheds Plan/Roof Plan
05	Sheds Elevation/Section
06	Sheds Nursery Tank (TYPE A) / Larval Tank (TYPE C1)
07	Elevated Water Tanks Building Plan/Roof Plan/Elevation
08	Michinery House / Pump House Plan/Roof Plan/Elevation

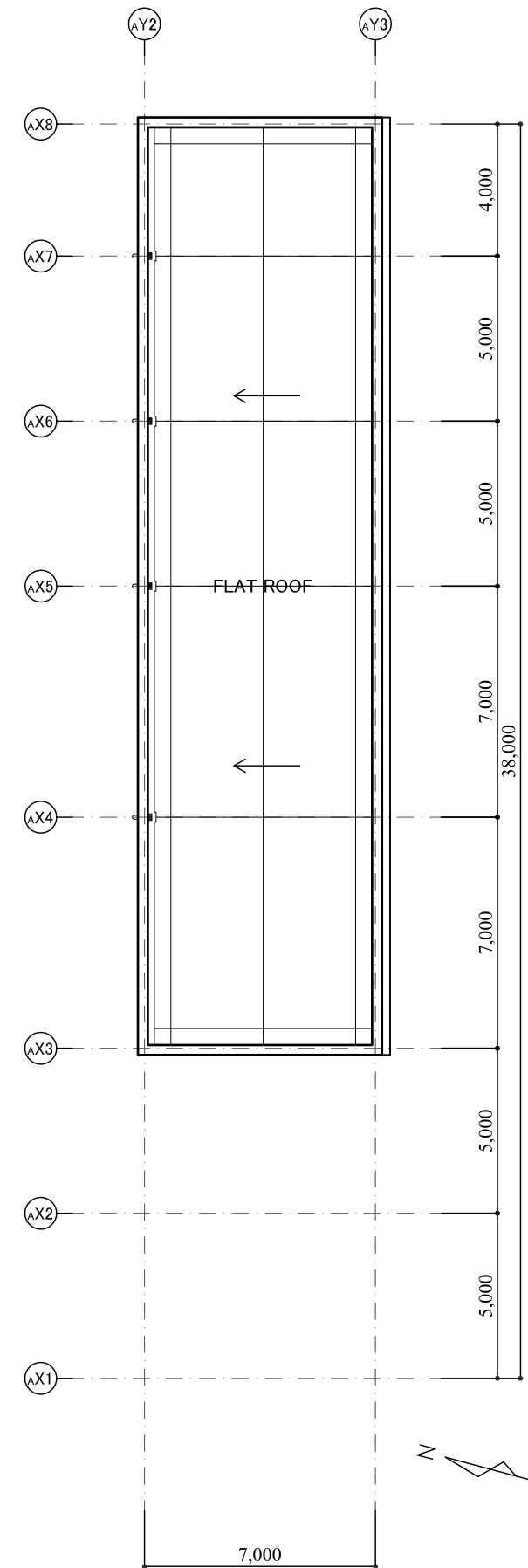




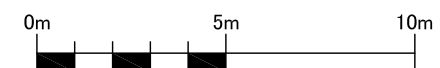
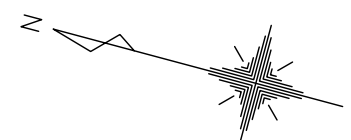
GROUND FLOOR PLAN



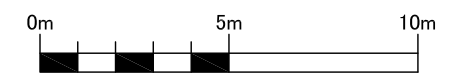
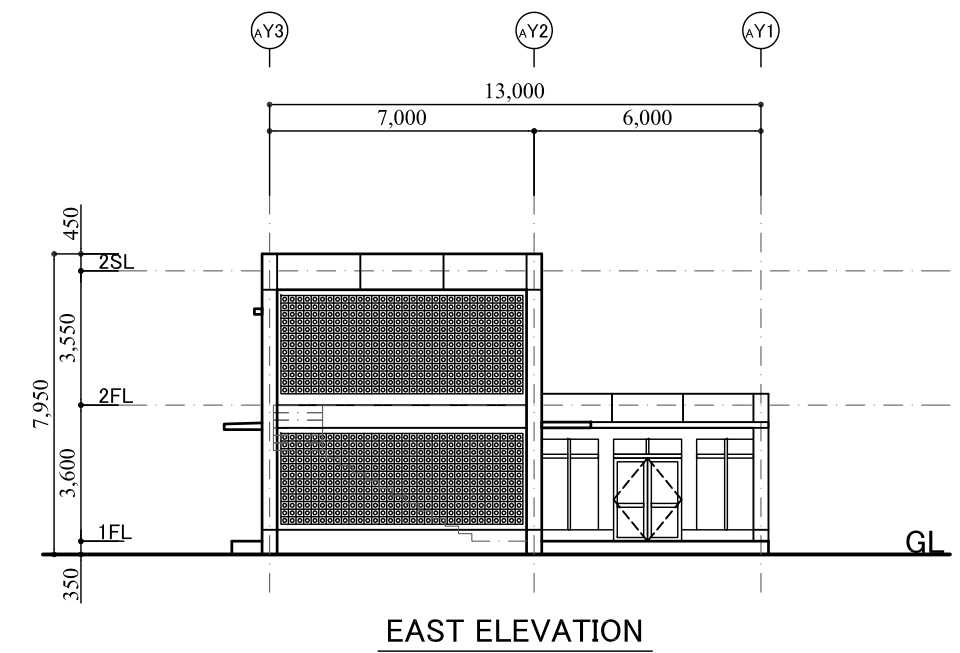
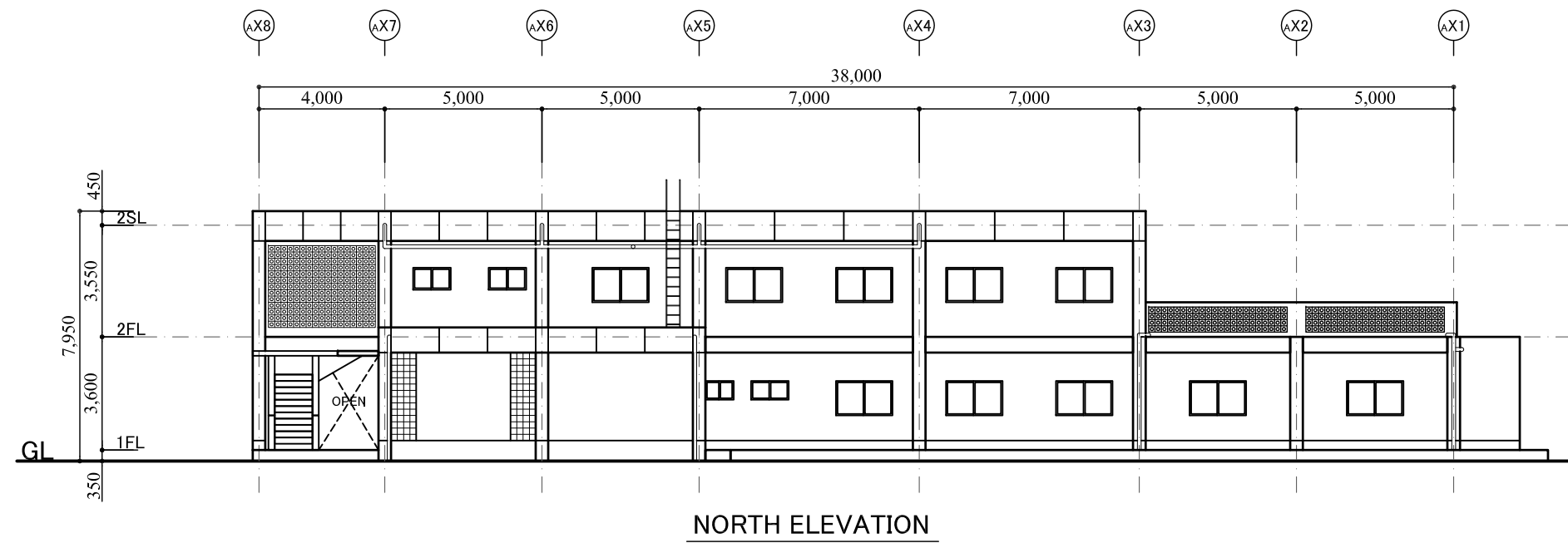
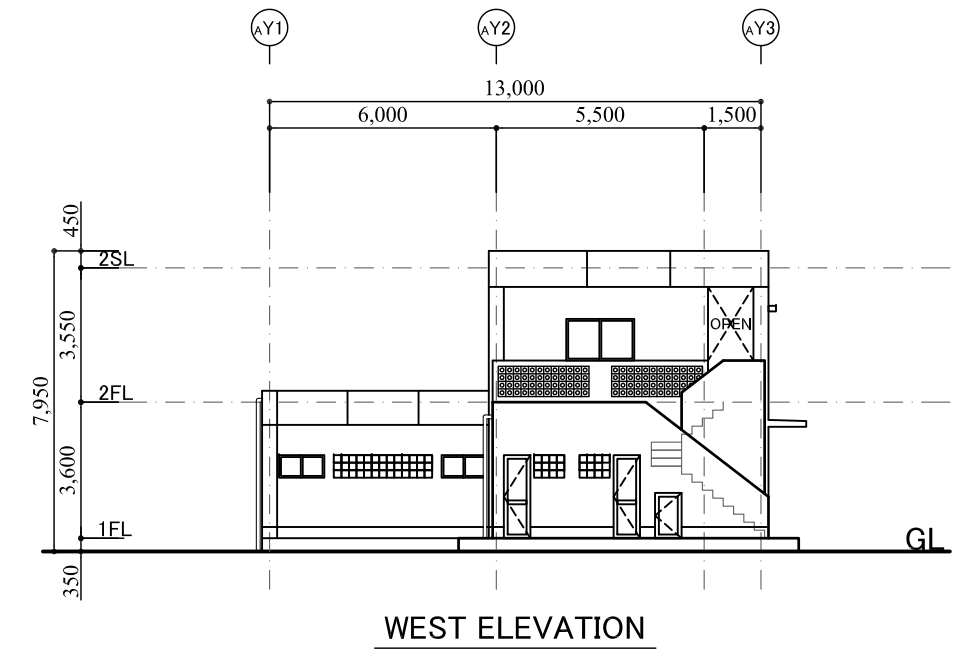
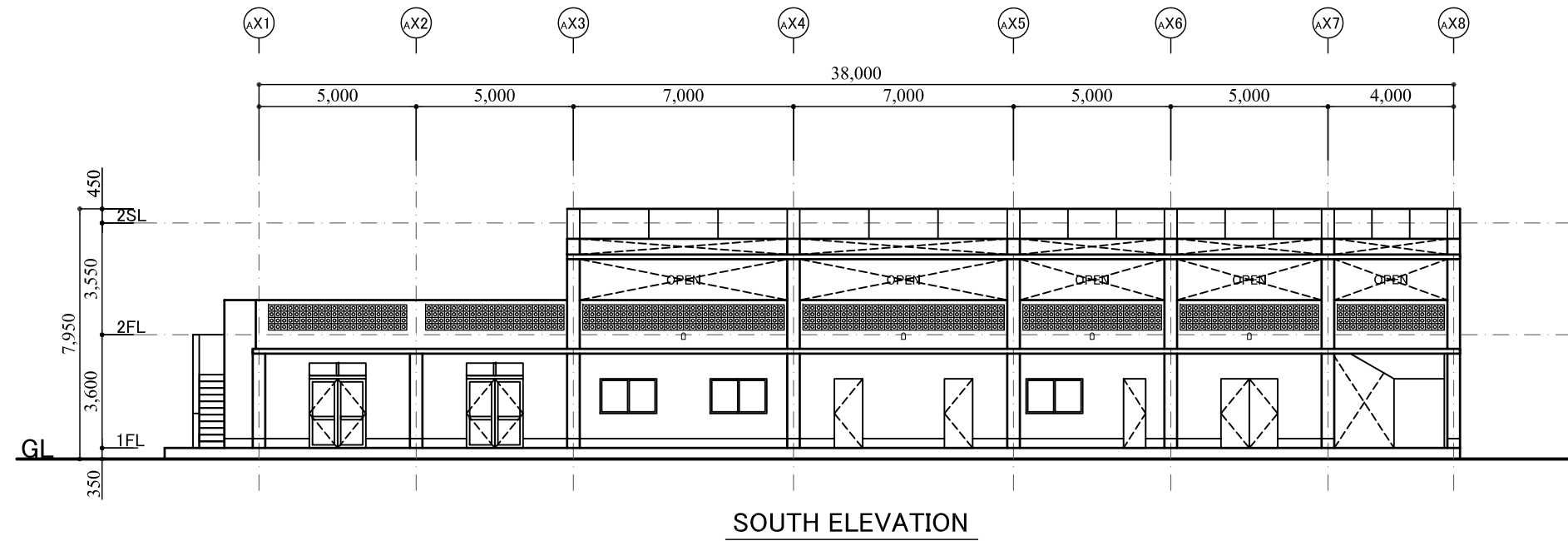
1st FLOOR PLAN

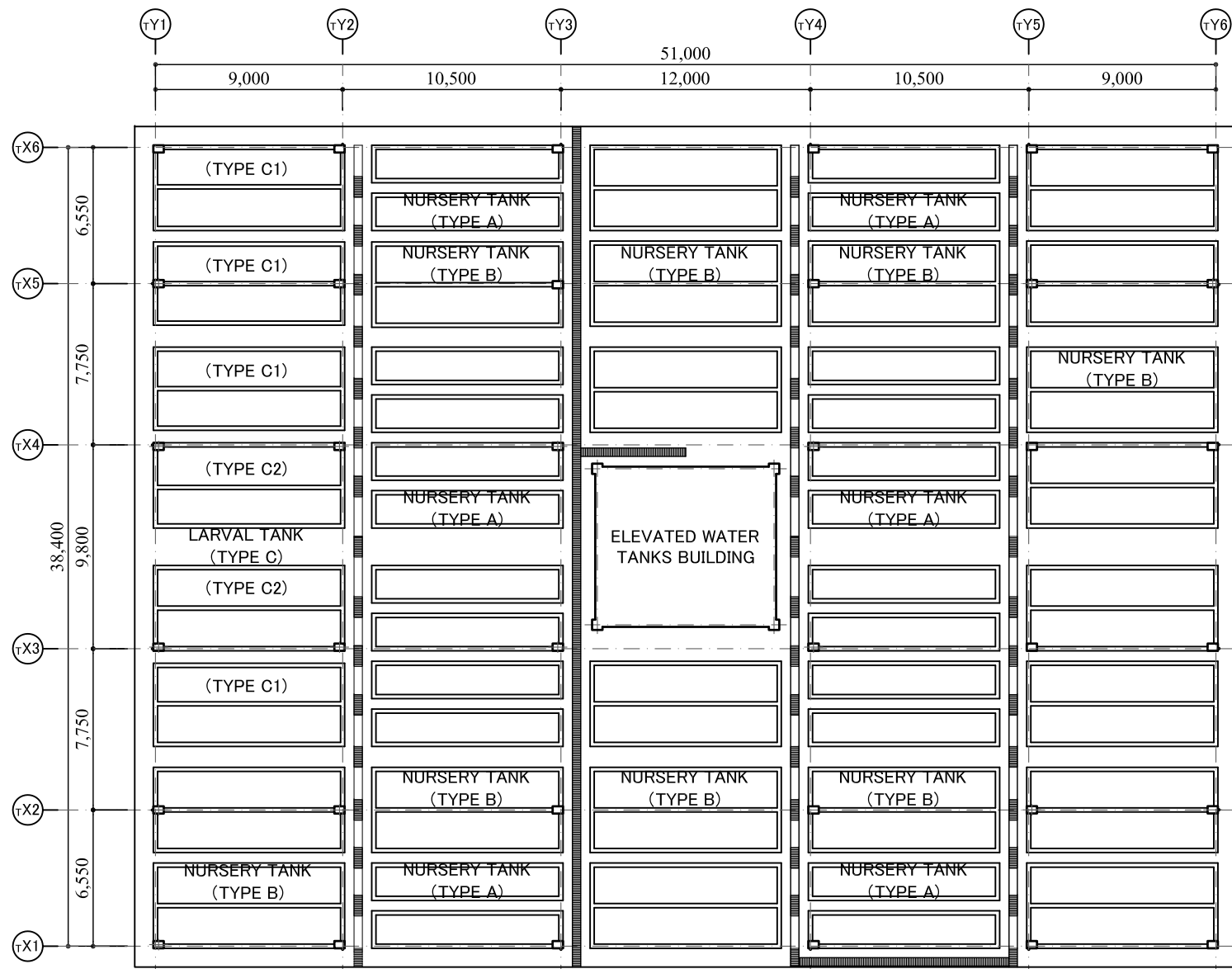


ROOF PLAN

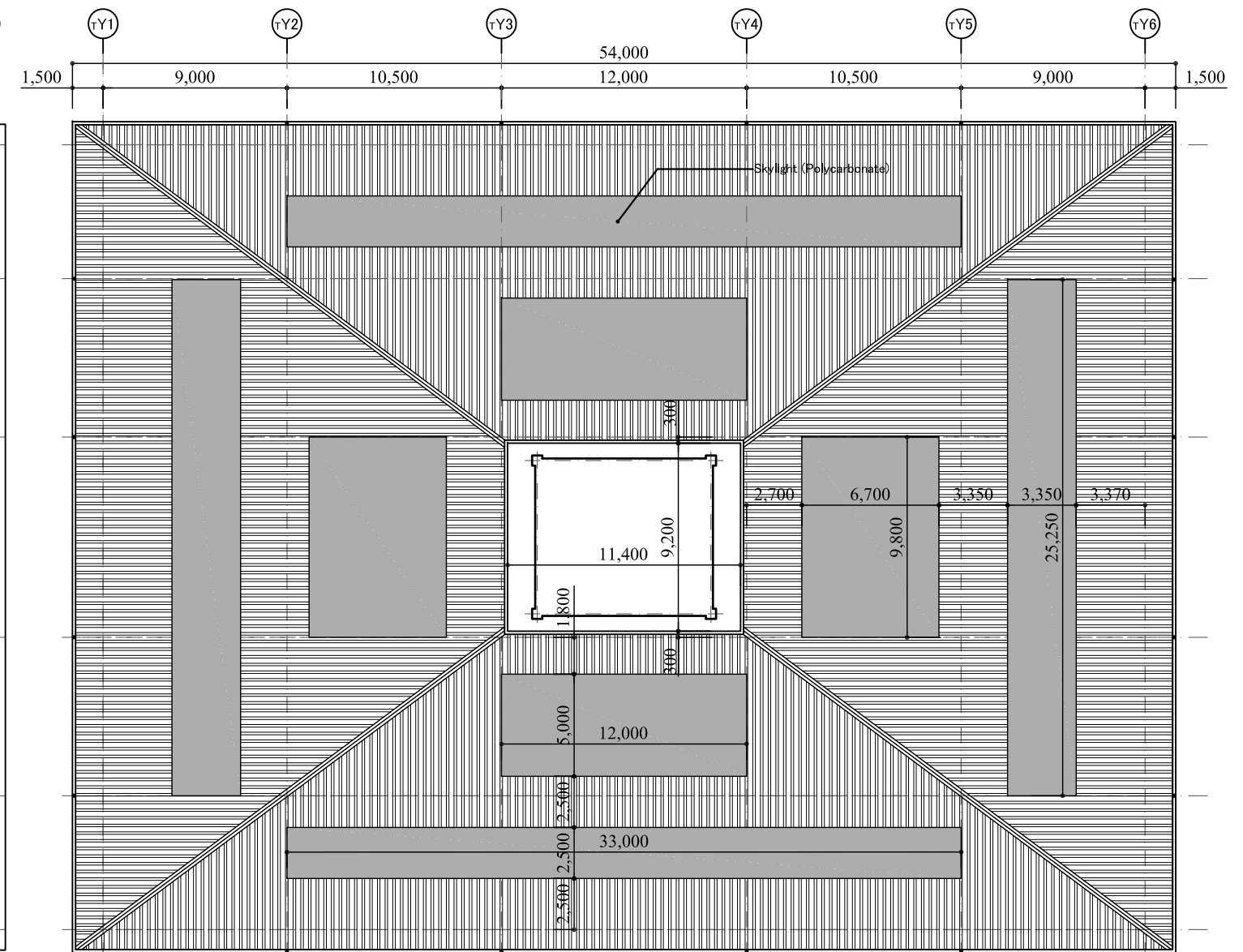






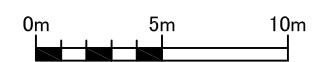
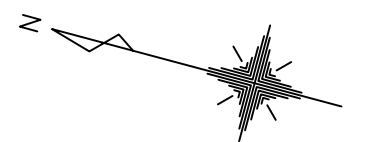


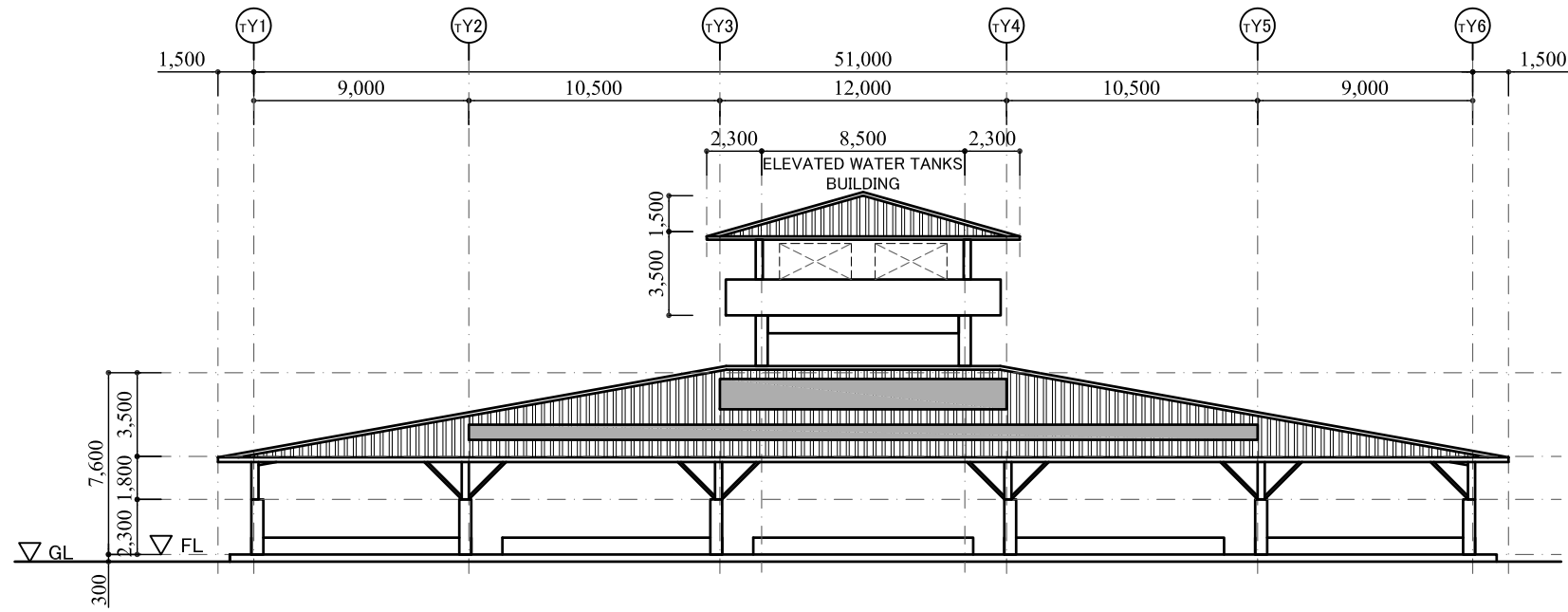
PLAN



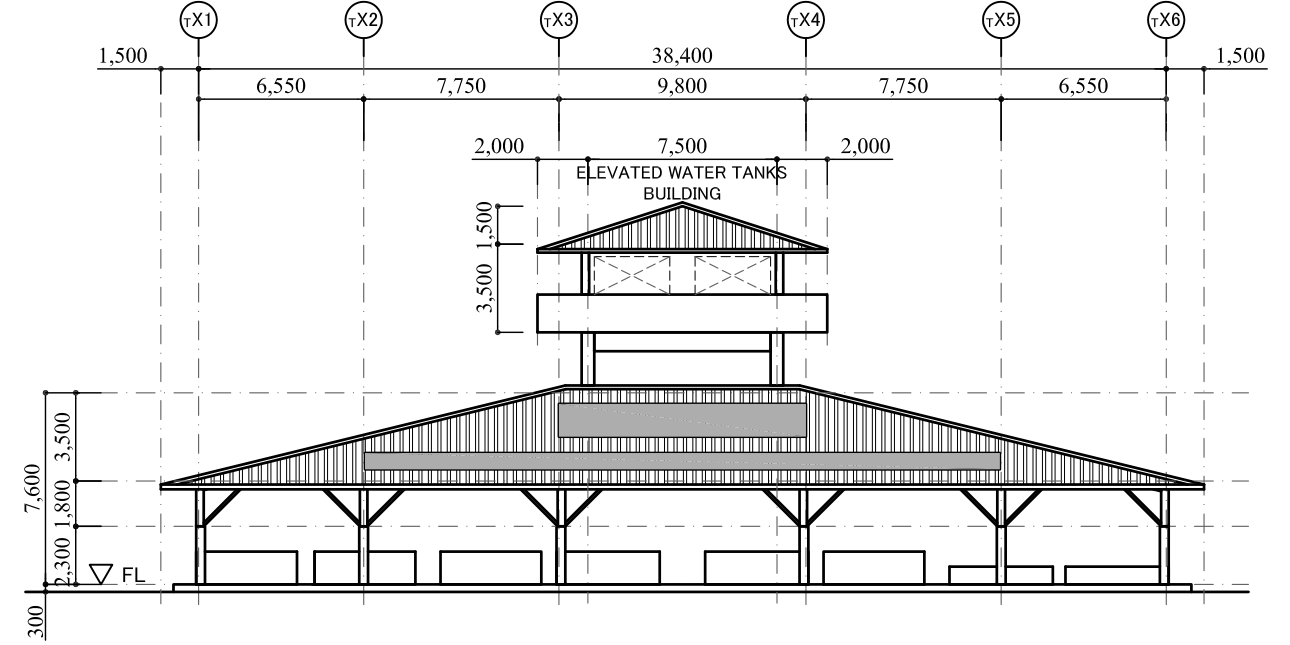
ROOF PLAN

TYPE	SHAPE	NUMBERS	AREA
LARVAL TANK	Type C1 (DOUBLE)	8	181.28m <sup>2</sup>
	Type C2 (DOUBLE)	4	
NURSERY TANK	Type A (SINGLE)	24	911.68m <sup>2</sup>
	Type B (DOUBLE)	40	
TOTAL		76	1,092.96m <sup>2</sup>

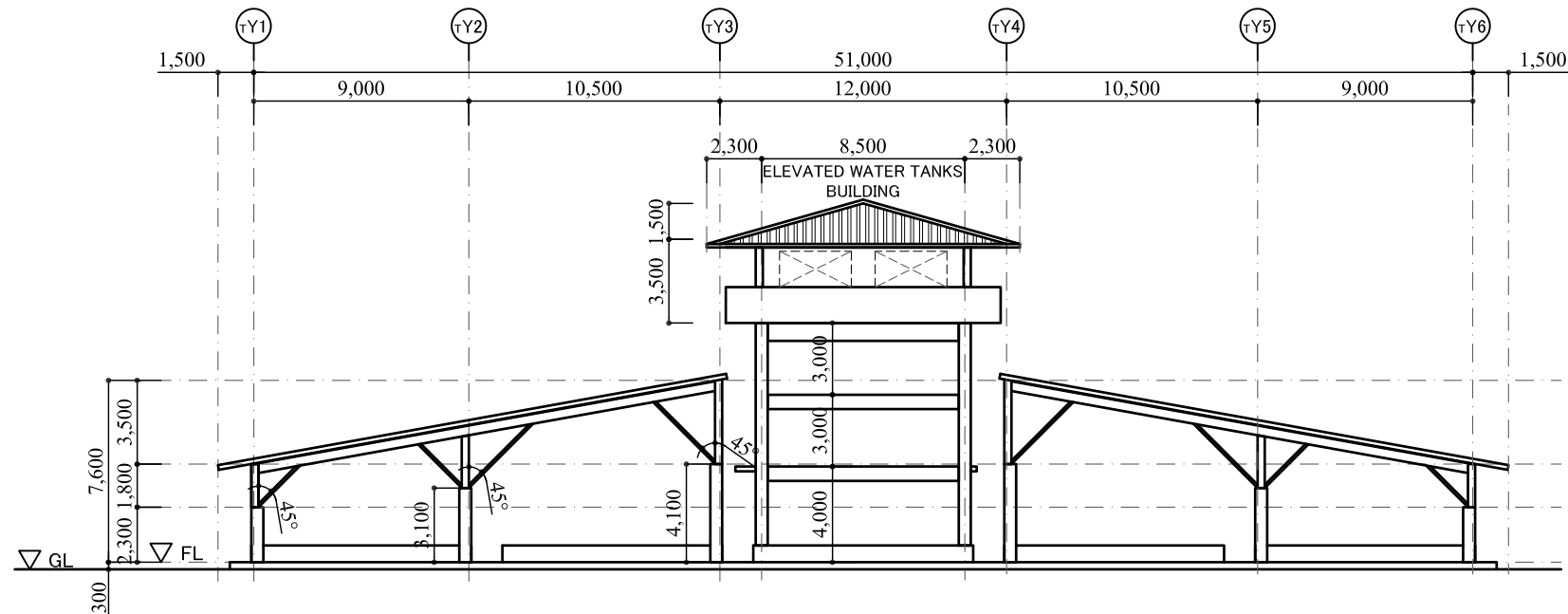




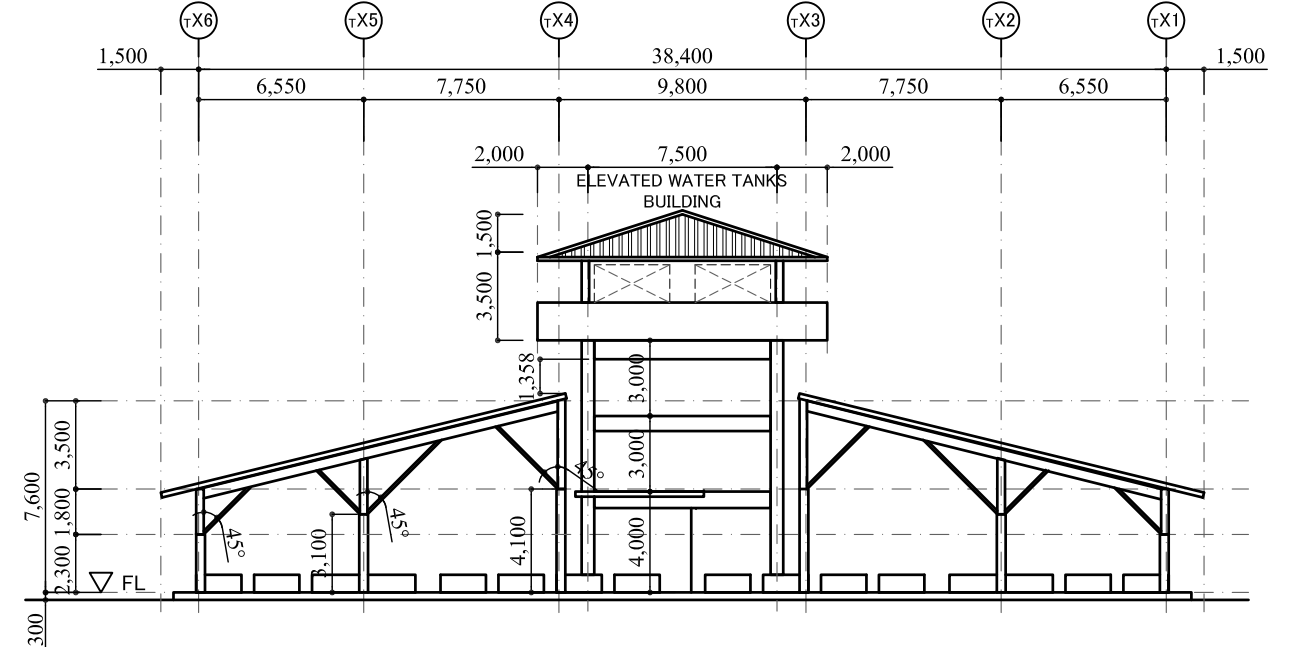
WEST/EAST ELEVATION



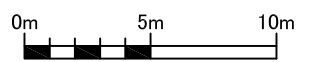
SOUTH/NORTH ELEVATION

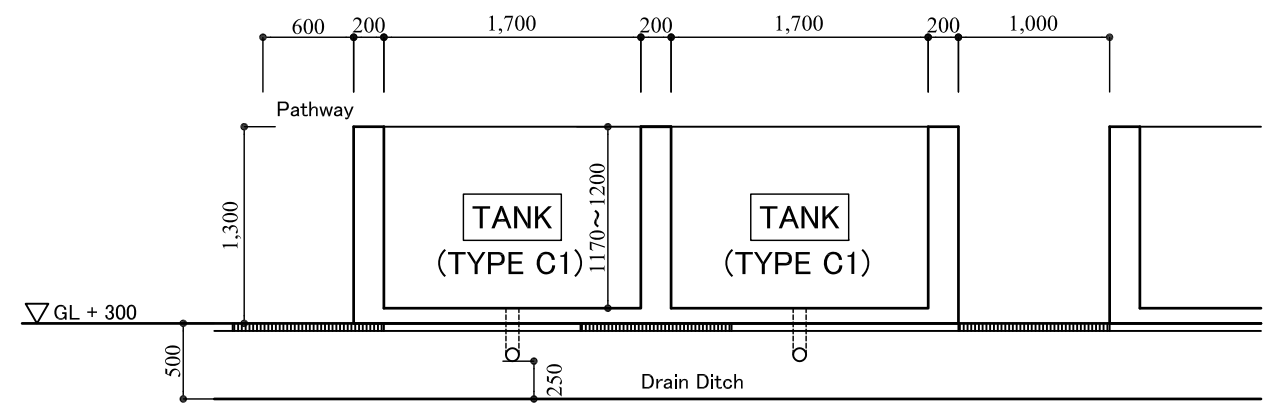
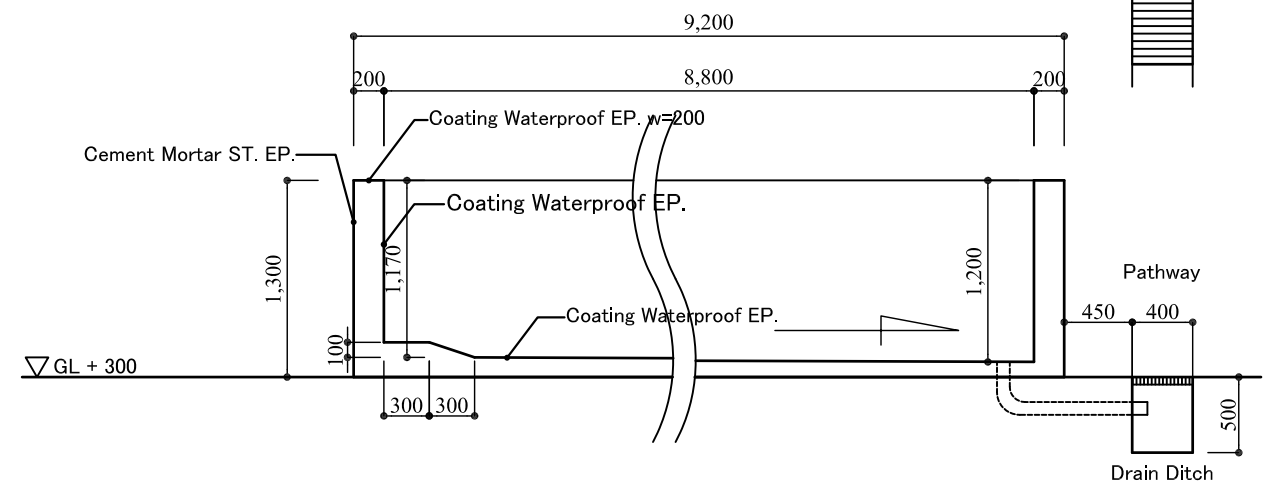
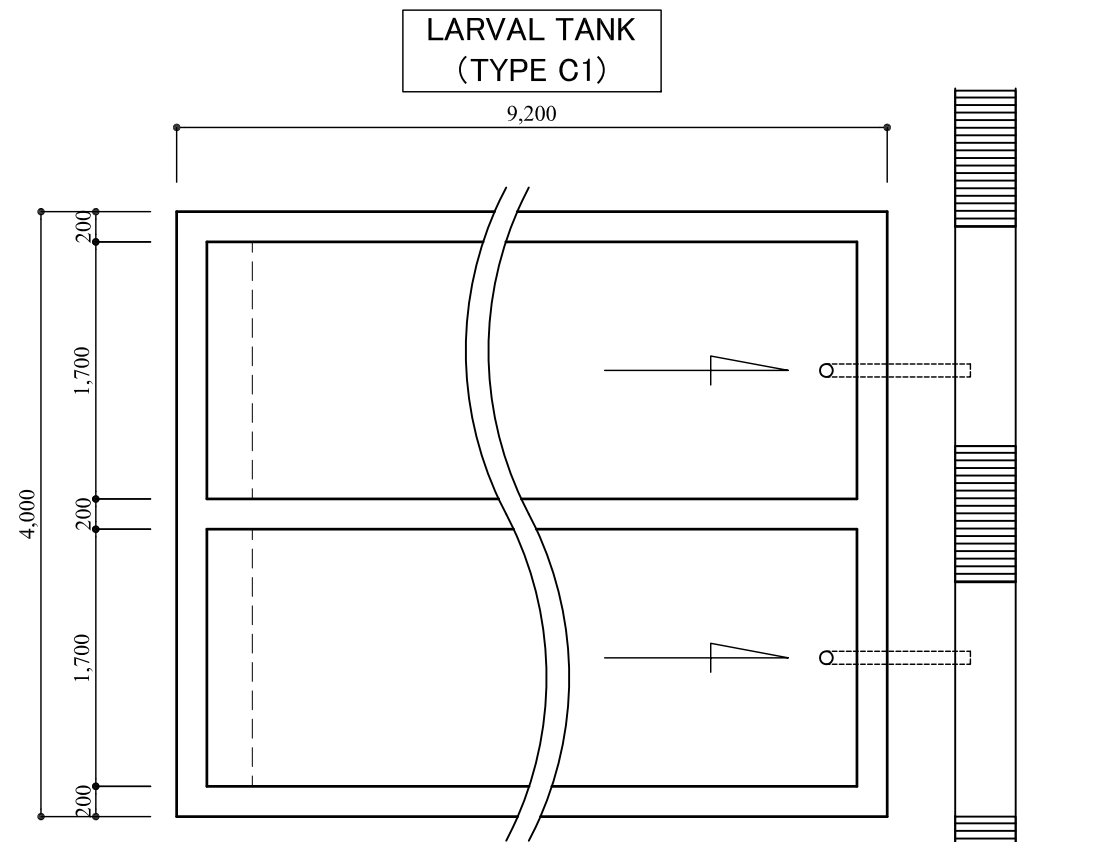
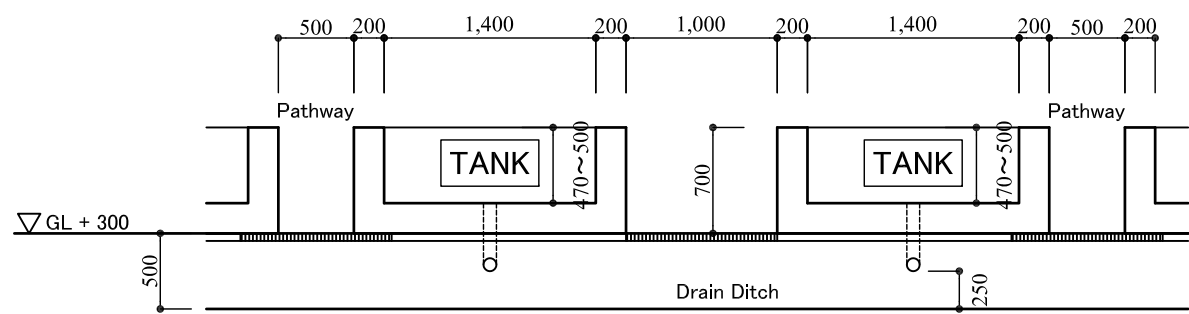
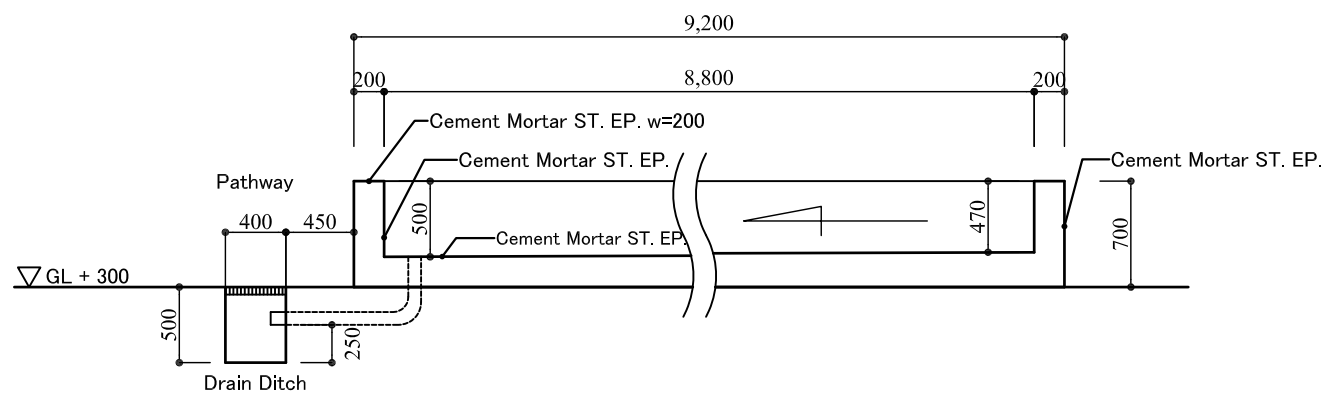
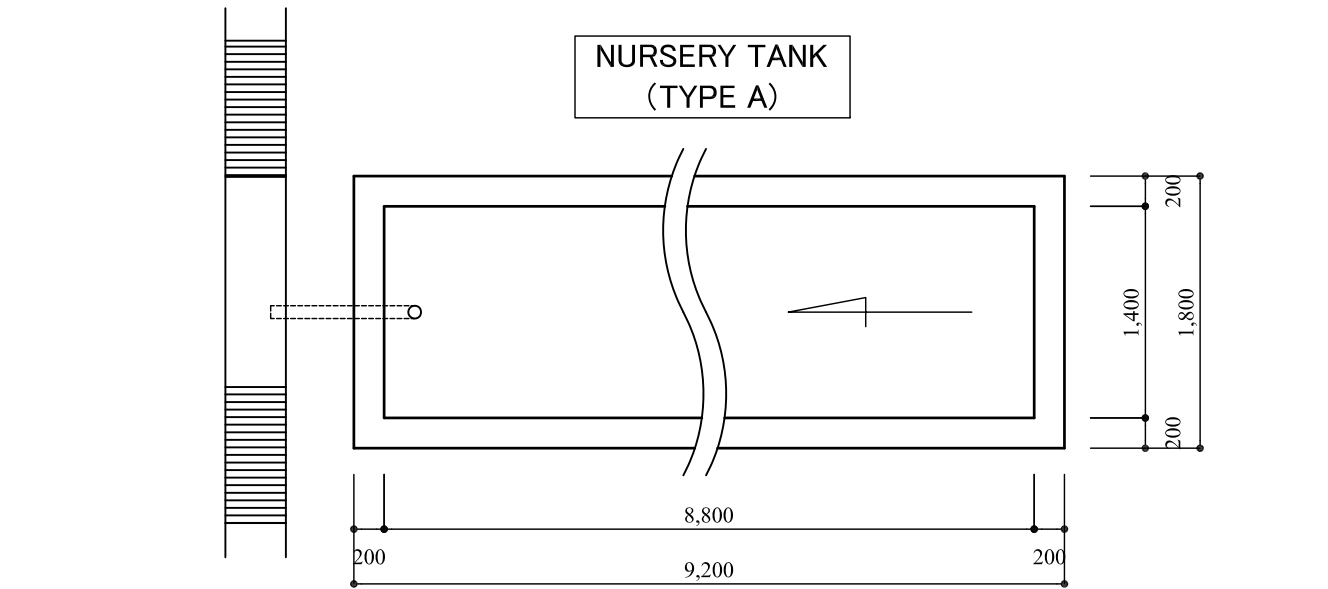


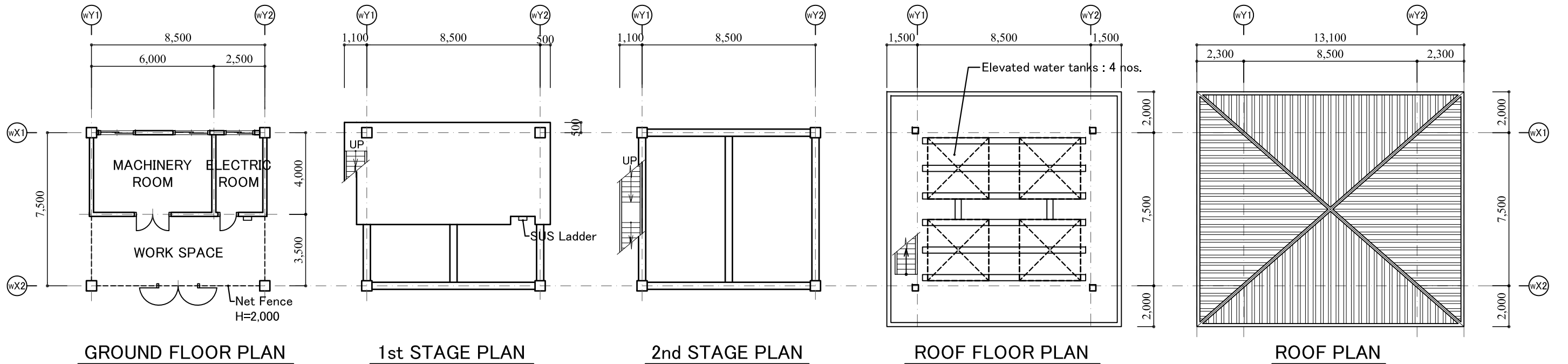
SECTION-1



SECTION-2







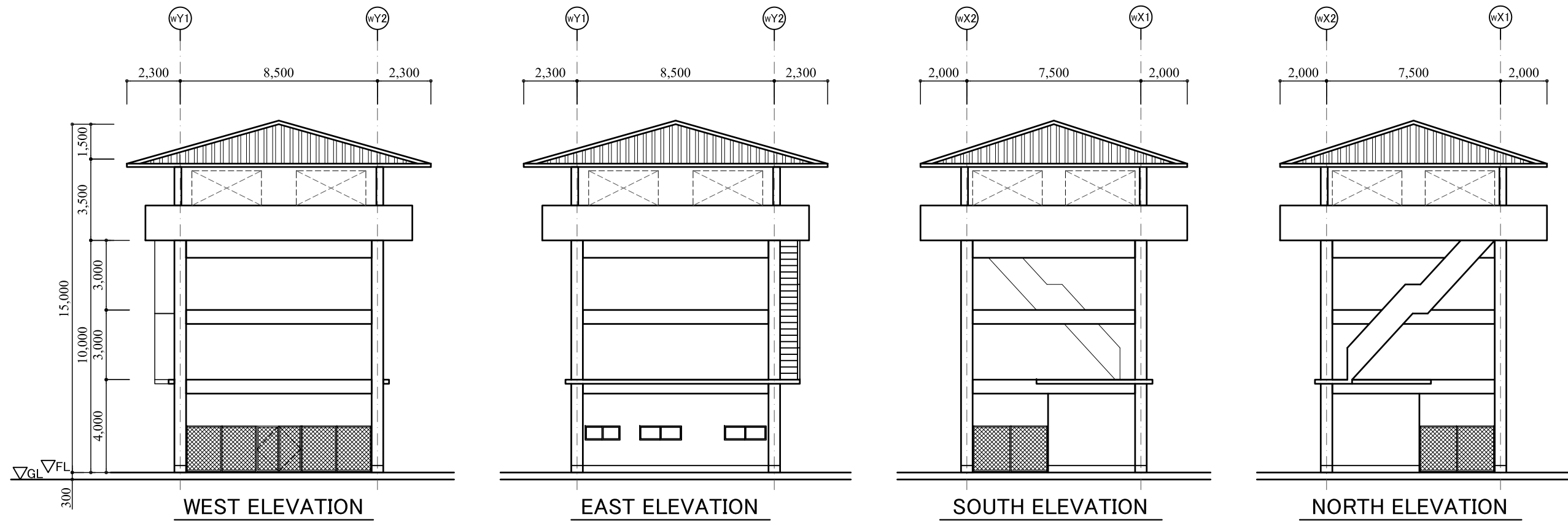
GROUND FLOOR PLAN

1st STAGE PLAN

2nd STAGE PLAN

ROOF FLOOR PLAN

ROOF PLAN

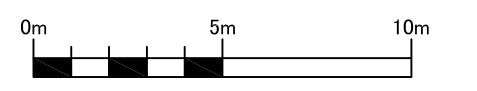
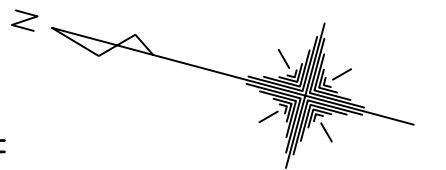


WEST ELEVATION

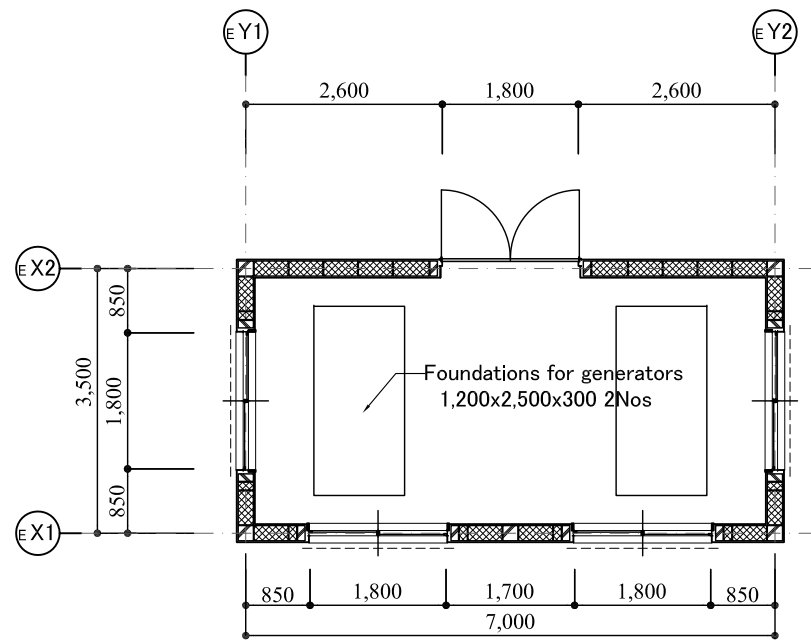
EAST ELEVATION

SOUTH ELEVATION

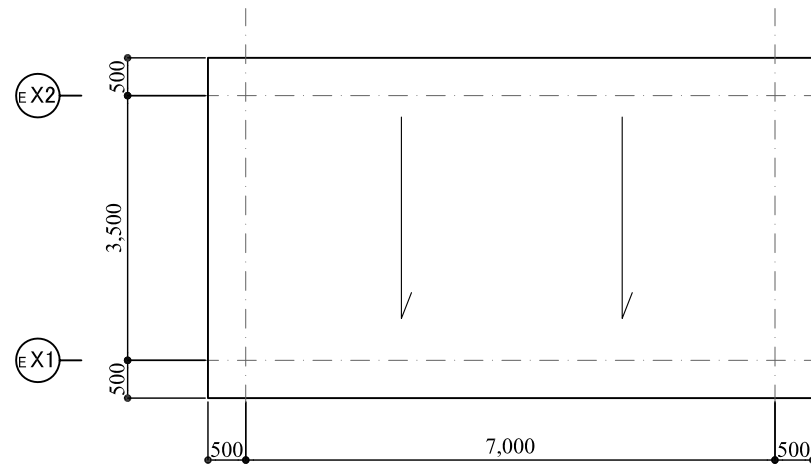
NORTH ELEVATION



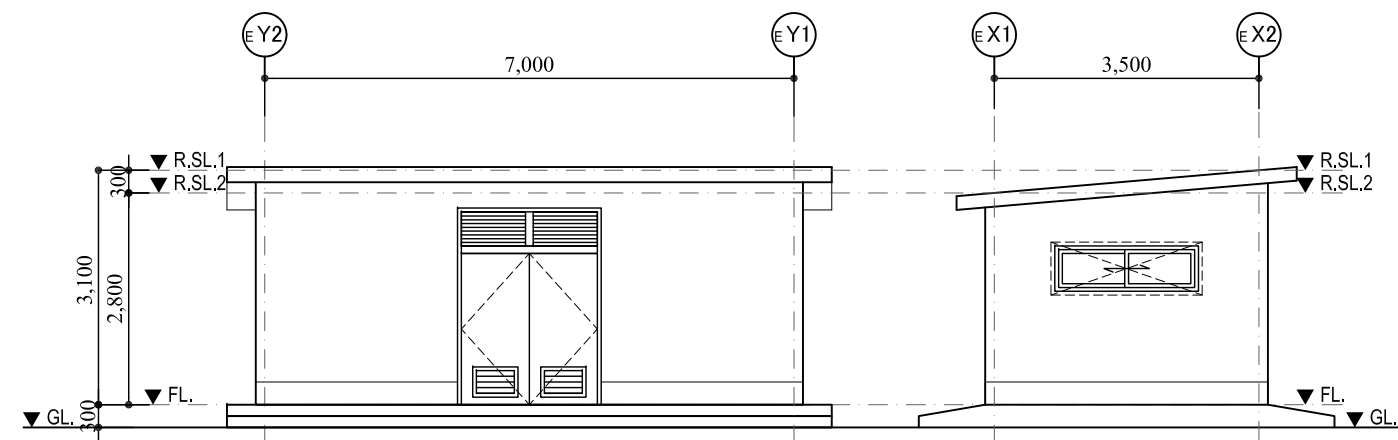
# MACHINERY HOUSE



PLAN



ROOF PLAN

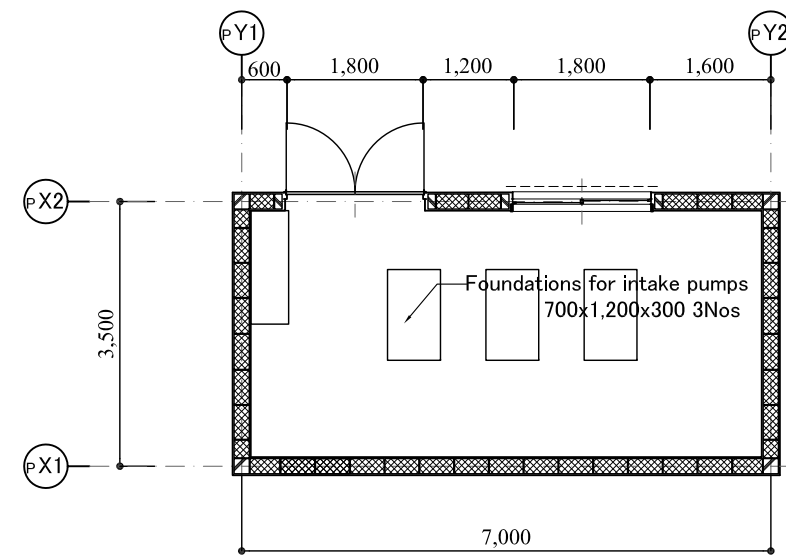


EAST ELEVATION

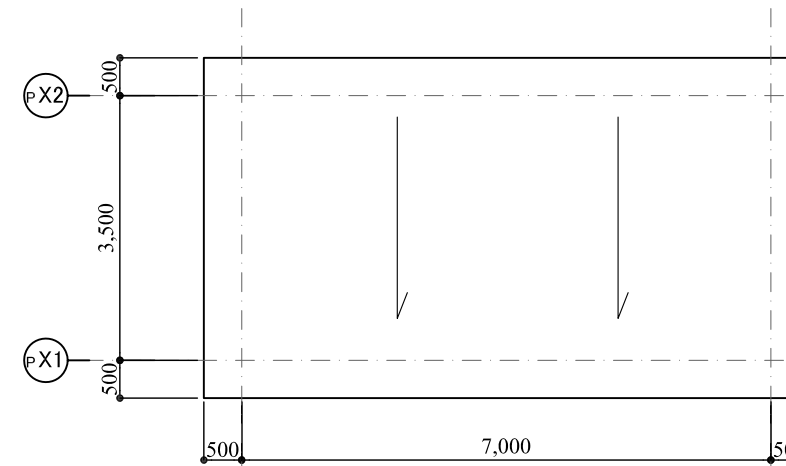
SOUTH/NORTH ELEVATION



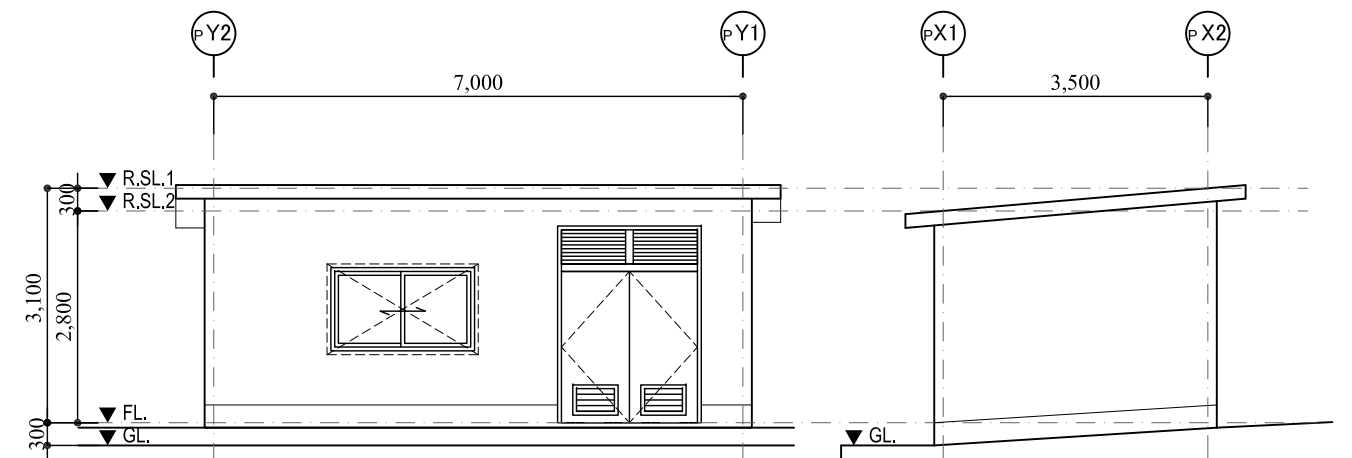
# PUMP HOUSE



PLAN

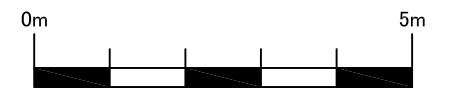


ROOF PLAN



EAST ELEVATION

SOUTH/NORTH ELEVATION



## **2-2-4 Implementation Plan**

### **2-2-4-1 Implementation Policy**

- ① When this plan is to be implemented under the grant aid program of Japan, strict control of a construction period shall be a precondition. Therefore, an appropriate construction period plan shall be prepared so that contractual conditions shall be met within the term of the Exchange of Notes.
- ② The implementation plan shall take into consideration the climate of Palau and the environmental conditions in the area.
- ③ Economically appropriate structure and construction methods shall be taken to this plan, as the site is in an island nation, to adopt shortening the construction period and limiting expenses for materials, equipment and personnel which will constitute major part of the construction cost.
- ④ In this project, construction works will be implemented even while the existing neighboring seed production facilities (production of seed-groupers) continues to be in operation and therefore, when implementing the construction works under this project, it will be planned that safety of workers at the neighboring seed production facilities be secured and utmost considerations be made not to interrupt the seed-grouper production activities.
- ⑤ In the seawater area in front of the site, broodstock and seed-clams that were sent to offshore facilities are grown and therefore, construction plans should be established so that earth and sand pollution in seawater can be held down as much as possible.
- ⑥ For demolition and removal of existing seawalls in the quay area or existing structures at the planned construction site, the works should be implemented after identifying sites, beforehand, to which waste materials can be disposed of and an appropriate construction period should be projected while making efforts to reduce environmental load (some people have expressed they want to collect concrete remnants to use them for private landfills)

### **2-2-4-2 Implementation Conditions**

- ① Major construction materials and equipment are procured and imported from Japan or third countries such as Republic of the Philippines, United States of America and Taiwan therefore, due attention shall be paid to domestic stocks and the period required for procurement of individual materials in the implementation system.
- ② Temporary works should be planned with due consideration for the high-temperature, high-precipitation climate and safety measures should be taken. Also, adequate care should be taken in the curing of concrete and plaster to avoid cracks and exfoliation.
- ③ In the sea area in front of the project site, giant clam broodstocks for reproduction are stocked and the area will continue to be in use after the completion of the new facilities. It is planned that sufficient exchange of opinions be made and communication be fostered among BMR, PMDC, consultants and construction companies and the construction works be implemented without any

disturbance so that the seawater area will not be polluted by oil leak from heavy construction equipment, fresh mixed concrete or water used for construction works during the construction period.

④ In order that construction companies in Palau can appropriately meet construction requirements of this project, as general and common as possible specifications in Palau should be employed and construction plans using general methods should be developed. Details of the policy for construction methods are as follows:

- Plans that require special materials and technologies should not be developed.
- Plans should be developed so that construction works can be implemented with machinery available in Palau.
- Plans should be developed to have plenty of room for margin considering Palauan construction companies' technological level.

### 2-2-4-3 Scope of Works

The table below shows the scopes of work in the project by Japanese side and by Palau side.

Table 2-23 Scope of works of Japanese side and Palau side

	Undertakings in construction, procedures and expenses	Japan	Palau
1.	Securing of construction sites (including securing of site for a construction materials depot and an on-site office)		○
2.	Landscaping, planting and provision of furniture and general goods in the facilities after completion of the work.		○
3.	Introduction of electricity and water supplies to the project site.		○
4.	Application for and acquisition of all the approvals and permits in Palau related to the Project (including building permit, use of power and water supply infrastructure, construction permit, etc.)		○
5.	Maintaining close communication and sufficient discussion with related officials, PMDC staffs and visitors to PMDC during construction work.		○
6.	Consulting services including detailed design, assistance in the tender process and supervision	○	
7.	Construction of the Mariculture demonstration center building and related facilities	○	
8.	Procurement of the Equipment for promotion	○	
9.	Import and customs-clearance for the materials, machinery and equipment required for implementation of the Project		○
10.	Banking Arrangement (B/A) and bank commissions for the Japanese bank		○
11.	Provision of convenience for the Japanese personnel to enter and stay in Palau in conjunction with the implementation of the project.		○
12.	Proper and efficient operation of the facilities and equipment to be provided under the project.		○
13.	Payment or exemption of any kind of taxes, customs duties or domestic levies imposed upon the equipment and materials and also the services to be procured by the contractor (s) of the project in Palau		○



#### **2-2-4-4 Consultant Supervision**

##### (1) Policy on consultant supervision

- ① In order to conduct the construction without hitch, the consultant shall maintain close communication and sufficient discussion with the counterparts on the Palau side, throughout the detailed design and procurement/construction phases to achieve completion of construction of the facilities without delay in line with the implementation schedule.
- ② In order to carry out smooth construction, the consultant shall maintain close communication and sufficient discussion with the contractor (s) , and provide adequate advice and instructions as necessary.
- ③ In the consultant supervision, a supervisor specializing in civil engineering and in building work will be resident locally at the site and Japanese engineers specializing in various works will be dispatched in a timely fashion.

##### (2) Detailed design/Selection of contractors

In implementing the project, following the Exchange of Notes between the Governments of Japan and the Government of Palau, a Consultant Agreement will be concluded between MNRET and a consultant of Japanese nationals with regard to detailed design and construction supervision.

##### ① Detailed design

On the basis of the results of the outline design survey, the consultant will conduct a detailed survey and detailed design of civil engineering and building facilities to be constructed. The detailed design work shall cover the following items.

- Design conditions and standards
- Design report
- Drawings
- Bill of quantities and estimation
- Implementation Plan
- Tender documents

##### ② Selection of contractors

After completion of the detailed design for the construction work, MNRET will select a Japanese contractor who will undertake the works through tender with the assistance of the Consultant. The consultant shall assist MNRET in the following procedures.

- Pre-Qualification notice
- Pre-qualification
- Explanation of tender documents
- Opening of bids
- Tender evaluation

- Contract negotiations

### (3) Consultant Supervision

The consultant's responsibilities in implementation supervision are as follows.

#### ① Assistance in concluding construction contract

The consultant will prepare a draft of the evaluation method of pre-qualification, a draft of tender documents consists of a construction contract, technical specifications and drawings and a bill of quantities for the project costs. The consultant will assist tendering and contract procedures and provide an evaluation of and advice on selection of the contractor and contract conditions.

#### ② Instructions to contractor

The consultant will examine the implementation plan of the contractor and provide the necessary instructions on the construction methods and work schedule in a timely fashion.

The consultant will examine and approve working drawings, shop drawings of the contractor, samples of materials and finishing.

#### ③ Supervision of construction works

Through supervision made by a resident supervisor and spot supervisors, construction methods should be confirmed and their quality be controlled. Over the entire construction period on site, supervision should be made by full-time construction technology experts as well as architect or facility engineers should be dispatched as spot supervisors for a relevant short term to be present on site when the construction starts, the upper skeleton is installed or the finish work is implemented.

#### ④ Witness to inspections

The consultant shall perform on-site inspections at interim stage of the construction as necessary, and a final inspection upon completion of the construction.

#### ⑤ Report on the progress of the work

The consultant will prepare reports on the progress of construction of the facilities, problems encountered, measures taken against the problems and the outcome of the measures taken, and submit the reports to MNRET and the relevant government organizations of Palau, the Embassy of Japan in Palau and JICA.

#### ⑥ Witness of handover

The consultant shall verify the handover documents at the time of handing over the constructed facilities upon completion of the construction.

⑦ Confirmation for payment approval

The consultant will assist in confirmation and approval of the amount of work done corresponding to the construction costs payable to the contractor in accordance with the contract, or completion of the work, and examination of the payment documents.

**2-2-4-5 Quality Control Plan**

The consultant's construction supervisor should verify whether or not the quality of the equipment and materials to be procured in this project and the completed work comply with the specifications in the contract literature and the quality and accuracy requirements shown in the design drawings, etc.

(1) Major points in quality control relating to natural conditions

The site is located on the seaside which can be affected regularly by sea breeze and sea spray and therefore, sufficient attentions should be paid to measures to prevent salt damage and rust for the planned structure. Particularly with respect to concrete for the structural skeleton, a system should be established to make on-site inspection without fail on aggregates to be used, salinity of mixing water, etc., types of cement, concrete quality and concrete thickness covering reinforced steel.

(2) Concrete work

The quality of the concrete will be maintained and controlled by conducting the following verification and tests and by preparing concrete strength control tables (including X-R control charts) for the respective mix proportions.

Table 2-24 List of concrete quality controls

Cement	Verification of type, standard and performance
Admixture	Verification of test results
Mixing water	Content of detrimental materials
Aggregate	Verification of grading, specific gravity and water absorption
Trial mixing	Verification of slump, strength, mix proportion and quality

**2-2-4-6 Procurement Plan**

(1) Policy on procurement

When procuring materials and equipment, their costs and quality will be thoroughly investigated and the costs of local procurement, procurement from Japan and procurement from third countries of materials and equipment of equivalent quality and availability will be compared. Those with the lowest costs will then be procured. Particularly for the materials and equipment locally available, their quality and availability will be thoroughly investigated.

(2) Procurement of major construction materials and equipment

Domestically produced and imported construction materials available in Palau or Palau will be

procured locally for this plan so long as they satisfy the qualitative and quantitative requirements and are inexpensive. Although domestic products in Palau are limited to sand, concrete blocks and wood, their quality and availability will meet the demands of this plan.

Some of materials for mechanical and electrical work are available in local stocks of imported goods. However, in order to construct a reliable system, some of the materials and equipment such as switchboards, distribution boards and pumps, will be procured from Japan, in consideration of both quality and costs.

### (3) Procurement of major construction machinery

The construction machinery required for the planned work includes excavators for the foundation work, cranes for the reinforced concrete work and dump trucks for the transport of materials. As major construction companies located in Palau own and maintain such kinds of machinery, they will be able to be used in the plan.

The table below shows the procurement sources of major construction materials and machinery to be used in this project.

Table 2-25 Procurement sources of major construction equipment and materials

Major construction materials	Japan	Palau	Third country	Remarks
< Building work >				
Cement		○		(Products from Philippines are distributed)
Sand		○		(Products made in Palau are widely distributed)
Gravel/stone materials		○		"
Reinforcing steels	○			Economic efficiency
Forms		○		Economic efficiency (Products from Philippines are distributed)
Scaffolding members		○		Economic efficiency
Tiles		○		Economic efficiency (Products from Japan and China are distributed)
Woods		○		Economic efficiency (Products from United States are distributed)
Metalic roof materials	○			Quality, maintenance and marketability
Laminated wood	○			Quality, economic efficiency
< Electrical and plumbing work >				
Pumbling and piping materials	○			Quality, economic efficiency
Light fixtures	○			Quality, maintenance and marketability
Distribution boards/Pumps	○			Quality, economic efficiency
Sanitary fixtures	○			Quality, economic efficiency

Name of heavy machinery	Japan	Palau	Third country	Remarks
Backhoe		○		Economic efficiency
Tamping machine (60~80kg)		○		Economic efficiency
Vibrating roller 0.8~1.1t		○		Economic efficiency
Bull dozer (3t)		○		Economic efficiency
Truck crane 20t		○		Economic efficiency
Electric welding machine (300A)		○		Economic efficiency
Air compressor (portable)		○		Economic efficiency
Concrete breaker		○		Economic efficiency
Dump truck 4t		○		Economic efficiency
Trailer 30t		○		Economic efficiency
Bucket 0.5 m <sup>3</sup>		○		Economic efficiency
Salvage barge 200t		○		Economic efficiency
Utility boat		○		Economic efficiency

#### (4) Transportation plan

For transport by sea, a regular freight vessel service traveling between Japan and Palau (Koror, 3 operations/month) will be used. It takes about 1.0 month for shipping equipment and materials, including processes for packing, loading, sea transport, unloading and customs clearance (0.7 months for sea transport and 0.3 months for customs clearance). The distance from the Port of Palau to the project site is 1km along a paved road and there will be no problem to transport equipment and materials.

#### 2-2-4-7 Implementation Schedule

When the project is implemented under the grant aid scheme of Japan, an Exchange of Notes (E/N) between the two countries and a Grant Agreement (G/A) between JICA and the Government of Palau will be concluded, followed by a design and supervision contract to be signed between the Government of Palau and the Japanese consulting firm. Detailed design, preparation of tender documents, tendering, conclusion of the contract (s) with the awarded contractor (s), and construction, procurement and the soft component by the Consultant shall subsequently be carried out.

The project under the grant-aid program in Japan shall be strictly adhered to the construction period in compliance with the system of national budget in Japan, and the implementation schedules as well as a detailed progress plan shall be conceived based on the requirements of natural conditions, procurement conditions for materials, equipment and manpower.

##### (1) Detailed design

In the detailed design phase, the consultant shall draw up the detailed design of each facility and equipment based on the preparatory survey report and shall prepare a set of tender documents including detailed design drawings, specifications, and tender requirements. The total period of time required is expected as 3.5 months.

##### (2) Tendering phase

The contractor(s) (Japanese company) of the project shall be selected by the means of

competitive tender. The tendering procedure shall be carried out in the order of notice for prequalification of the tender, reception of expression of interests, pre-qualifications, distribution of tender documents, tender opening, tender evaluation and contracting with the successful tenderer(s). It will require approximately 2.5 months.

(3) Construction works

After the construction contract is signed by concerned parties, the contractor should implement the work promptly but since laminated materials to be used in culture tanks will be produced to order, it will take 3.0 months for production and 1.0 month for marine transport and customs clearance. The total construction period is expected to be 10.0 months for construction and procurement.

(4) Equipment Procurement

Equipment procurement will require a total of 4.0 months between the order to the arrival in Palau, including 1.0 month for ocean shipping and customs clearance. The timing of shipping shall be adjusted with the progress of the construction work.

The figure below shows the implementation schedule.

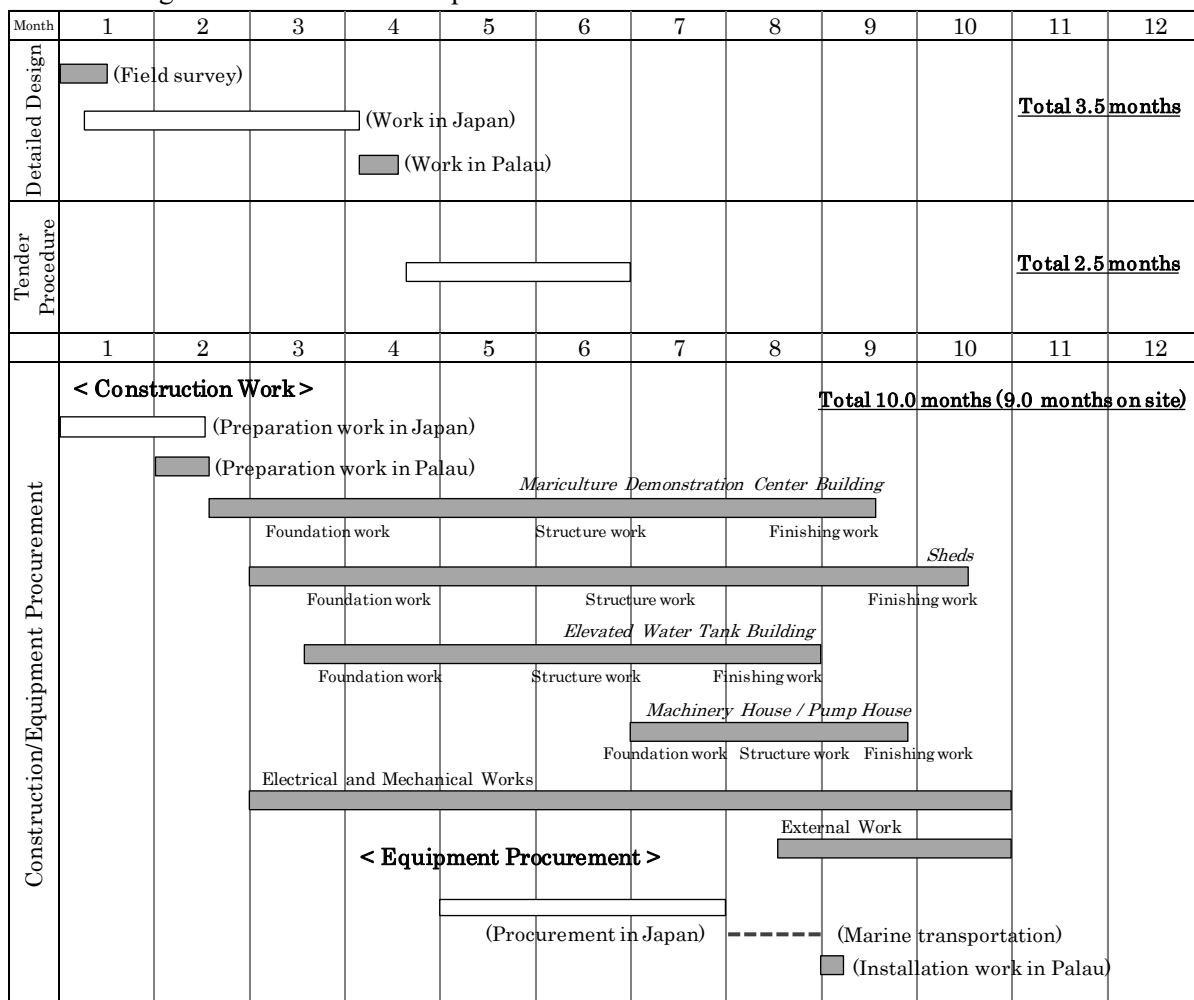


Figure 2-26 Implementation schedule

## **2-3 Obligations of Recipient Country**

- (1) Securing the planned construction site  
The planned facility construction site should be secured by the government of Palau.
- (2) Ground leveling of the project site  
Before the start of construction works under this project, the Palauan side is required to demolish and remove existing structures located on the project site (Icebox--former ice-making facilities, PMDC office building, elevated water tanks, pump room, culture tanks, etc.) and level the ground. In disposing of and reusing concrete debris, preparation works should be made by paying attention to the fact that an approval of EQPB is required to secure a place to dump.
- (3) Securing the temporary work site  
The Palau side must secure a temporary work site for the construction work as necessary.
- (4) Providing power cables, telephone lines and water service pipes to the site  
The Palau side must provide power cables, telephone lines and water service pipes to the project site at their own cost. The work to lay power cables and water service pipes must be completed by the start of the construction work in this project at the latest.
- (5) Applications for all permits and licenses for the construction work (building certifications, use of electricity and water and work permits, etc.) and Environmental Assessment by the Government of Palau  
Applications for approvals pertaining to the construction work, including the work permit from the Government of Palau, as well as permits for use of electricity and water, and Environmental Assessment need to be processed by the Palau side in order to obtain the necessary permits before the start of the construction work.
- (6) Environmental check lists/ monitoring sheets should be prepared by the Government of Palau and implemented in accordance with the environmental impact statement and JICA Environmental Guidelines.
- (7) Securing of safety for users of the adjacent fish culture facilities and diffusion of information  
Even during the construction works under this project, seed production will continue at the fish culture facilities. In order to secure safety of users of the facilities, the Palauan side needs to ensure safety by constructing a substitute parking lot and banning access to the construction areas as well as to keep such users informed of construction works.
- (8) Exemption from customs duties, internal taxes and other fiscal levies and prompt customs clearance for all the equipment and materials to be imported to Palau in relation to this project
- (9) Exemption from value added tax and other taxes  
The Palau side should bear or exempt from value added tax and other domestic taxes with

respect to payments for the equipment and services to be procured by the construction contractor(s) for the project.

- (10) Banking Arrangement with a Japanese bank and issuance of Authorization to Pay for the Consultant and the Contractor(s) to the Bank for the Project.
- (11) Exemption from taxes and surcharges imposed in Palau on Japanese people who provide services in relation to this project
- (12) Other matters that are necessary for the implementation of this project and not included in the matters under the responsibility of the Japanese government

## 2-4 Project Operation Plan

### 2-4-1 Organizations Responsible for Maintenance and Operation

The responsible organization for this project on the Palauan side is MNRET. Meanwhile, actual works for maintaining facilities of PMDC and activities related to giant clam culture and promotion should be the responsibility of the implementing organization of this project, BMR.

### 2-4-2 Operation Plan

#### (1) Operation framework

PMDC is the name of the facilities and operational responsibility is with BMR, which has been led by its acting director. It is planned that PMDC will be operated based on the current operation framework of BMR even after the PMDC facilities have been improved under this project. In order to strengthen response to and publicity for visitors including tourists, however, it is planned that the facilities be operated in collaboration between personnel in charge at the Administration, Human Resources and Finance and the Division of Information and Data Management of BMR.

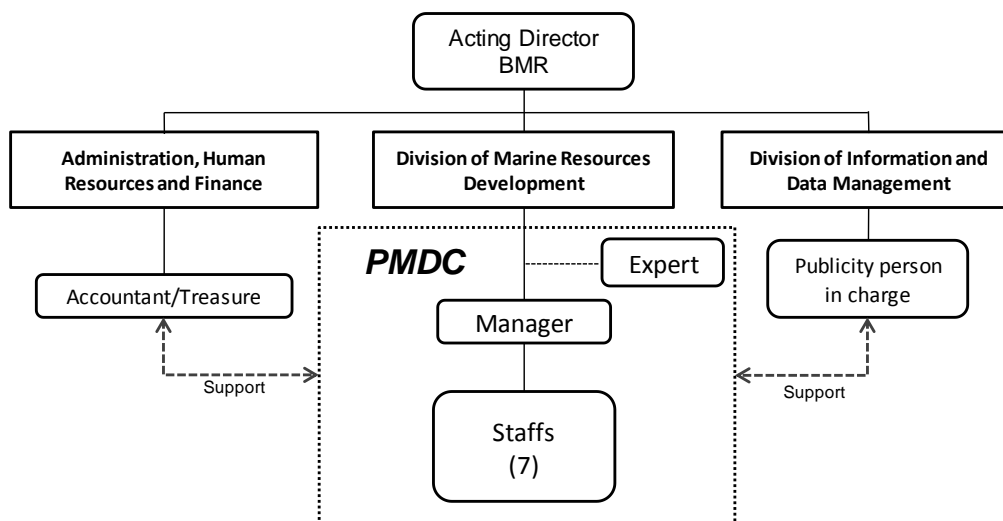


Figure 2-27 Organization plan of operation and management



## (2) Role sharing

Each division's roles are shown in Table 2-26. Processes of budgeting and accounting including accounting for revolving funds, all related to the operation of PMDC, should be the responsibility of the Administration, Human Resources & Finance under the leadership of the acting director of BMR, while actual works such as giant clam seedlings production should be the responsibility of personnel of the Division of Marine Resources Development. The Administration, Human Resources and Finance should be responsible for the allocation of staff to and accounting and inventory management for the gift shop and the Division of Information and Data Management be responsible for education on giant clam resource conservation as well as production of posters and pamphlets necessary for publicity of PMDC.

Table 2-26 Sharing of roles concerning operation of PMDC among concerned divisions

Division	Description of responsibility
Marine Resources Development	Production of giant clam seedlings, promotion of giant clam culture, maintenance of PMDC facilities and offering of explanations to visitors
Administration, Human Resources & Finance	Budget management, accounting, inventory management, cooperation with travel agents and sale of handicrafts, etc.
Information & Data Management	Preparation of educational and publicity materials, posters, pamphlets, etc.

## 2-5 Project Cost Estimation

### 2-5-1 Initial Cost Estimation

#### (1) Costs to be borne by Palau

The cost to be borne by Palau in case the project is implemented under the grant aid is estimated to be about 99,700 US dollar (about 12.1 million yen), broken down as follows.

1) demolish and removal work for structures existing in the construction site	US\$ 70,000	(8.5 million yen)
2) Acquisition of furniture and office supplies	US\$ 16,700	(2.0 million yen)
3) Bank transfer and handling fees	US\$ 5,600	(0.7 million yen)
4) Environmental impact fee (0.15% of the total construction costs)	US\$ 7,400	(0.9 million yen)
Total	US\$ 99,700	(12.1 million yen)

#### (2) Conditions of Estimation

- 1) Time of estimate      December, 2015
- 2) Exchange rate      US\$1.00 = 121.93 Japanese yen
- 3) Construction period      The time schedule for carrying out the detailed design and construction is shown on the Project Implementation Schedule.
- 4) Others      The project will be implemented in accordance with the grant aid scheme of the Japanese Government.

## 2-5-2 Operation and Maintenance Cost

The operation of PMDC should continue to be the responsibility of BMR. Major expenses such as labor costs and utilities costs are expected to be paid out from the BMR's own budget and income from revolving funds is planned to be aggregated and appropriated to operational expenses of PMDC. Earnings and expense plans based on the operation plan are as follows.

### (1) Projection of income from revolving funds

Income from revolving funds is projected as follows.

Table 2-27 Projection of income from Revolving Funds

<<Income>>		
Projection	Assumption/ Prerequisites	Necessary Actions to be Taken by the Palauan Side
①MED & CITES→36,000 USD /year	(Not a significant change)	
②Sales of the Seeds @0.4USD × 72,000 (for consumption and release) +@0.5USD × 40,000 (ornamental) =48,800 USD (80 farmers x 2,100 clams x 2/3*) *assumption: 2/3 new farmers continue farming clams	a. 10 new farmers per year start clam culture per year. b. at least 2/3 continue farming.	Support to Clam Farming
③Visitors to PMDC: 2 USD × 50 persons / month × 12months =1,200 USD Snorkeling: 10 USD × 50 persons / month ×12months =6,000 USD Sales of souvenirs: 1,000 USD/year	a. Double the number of visitors	a. Public relations, Effective exhibition and Tourism promotion
Total Income: 93,000 USD / year		
<<Expenditure>>		
Support to new farmers 2,000 USD × 10 new farmers/year =20,000 USD	a. 10 new farmers each year	a. Promotion of clam culture
Total Expenditure: 20,000 USD / year		

\* In 72,000 clams, juvenile clams for release are included in addition to those for consumption as food.

### (2) Expenditure

A trial calculation of operational costs accrued at the new facilities is shown in Table 2-28. Personnel expenses accrued from activities at PMDC are excluded from this calculation as such costs continue to be paid out by BMR.

Table 2-28 Annual expenditure (excluding personnel expenses)

Item		Summary	Expenditure (USD/year)
Utilities	Electricity	106,195kW/year × USD 0.286/kW	30,371.77
	Water	470 gallons/day × 255 days × USD 0.00495/gallon	593.26
	Collection of wastewater	172 collections/year × USD 30.00/collection	5,160.00
Support to newly joining farmers		USD 2,000.00/farmer × 10 farmers/year	20,000.00
Activity cost		USD 3,000.00/month × 12 months	36,000.00
Depreciation		For renewal of major equipment	42,000.00
Total			134,125.03

① Electricity consumption

For a trial calculation of electricity charges, the following conditions are established.

Business days: Monday to Friday, 8:00 to 17:00: 255 days/year  
 Holidays: Saturdays, Sundays and holidays: 110 days/year (no business in principle)  
 Effective sunlight-illuminating hours: 12 hours/day × 80% = 9.6 hours/day

Table 2-29 Estimation of daily electricity consumption

[Business days]

Equipment	Quantity	Capacity (kW)	Demand factor	Hours	Electricity consumption (kW)
Seawater intake pump	2	7.5	67%	24	241
Blower	2	1.5	100%	24	72
Air-conditioner	9	6	40%	9	194
Ventilation fan	1	1.5	100%	24	36
Lighting (business hours)	1	6	80%	9	43
Lighting (nighttime)	4	0.25	100%	10	10
Outlet	1	5	20%	9	9
Others	1	1	10%	24	2
Solar power generation	90	0.275		9.6	-238
Total					369

[Holidays]

Equipment	Quantity	Capacity (kW)	Demand factor	Hours	Electricity consumption (kW)
Seawater intake pump	2	7.5	67%	24	241
Blower	2	1.5	100%	24	72
Ventilation fan	1	1.5	100%	24	36
Others	1	1	10%	24	2
Solar power generation	90	0.275		9.6	-238
Total					113

Annual electricity consumption is projected to be around 106,195kW when deducting power obtained through solar power generation. Fuel costs accrued from operation of emergency power generators during blackouts are not allocated as they are to be offset with costs to buy electricity.

Business days	369kW/day × 255 days =	94,095kW/year
Holidays	113kW/day × 110 days =	12,100kW/year
Projected annual electricity consumption		106,195kW/year

② Public water consumption

Daily public water consumption is projected as shown in Table 2-30. As rainwater can be used as fresh water to clean water tanks, water for tank cleaning is not included in this calculation. As public water is not used in principle on holidays, public water consumption is projected to be around 1.78m<sup>3</sup> (470 gallons)/day × 255 days = 453.9m<sup>3</sup> (119,850 gallons).

Table 2-30 Estimation of daily public water consumption

	Quantity (liter)	Number of users	Total (liter)	Total (Gallon)
Office	120	9	1,080	285
Shower	50	10	500	132
Toilet	20	10	200	53
Total			1,780	470

③ The number of collections of wastewater

When accounting the quantity of domestic wastewater to be collected as same as the above public water consumption, wastewater to be collected should be 470 gallons × 225 days = 119,850 gallons. The capacity of a collection vehicle is 700 gallons/collection and thus 172 collections per year (119,850 gallons divided by 700 gallons) should be necessary.

④ Support to provide equipment/materials to newly joining farmers

Based on past records, it is projected that equipment/materials of USD 2,000.00 should be provided to each newly joining farmer and it is planned to support a total of 10 farmers per year through activity to encourage farmers to start giant clam culture.

⑤ Activity cost

Based on past records, USD 3,000.00/month should be allocated as expenses for purchase of goods necessary for activities of PMDC and maintenance of facilities and equipment.

⑥ Depreciation

Annual depreciation expense should be allocated for major equipment, tools and supplies to be procured for the planned facilities. Depreciation is allocated using the straight-line method.

Table 2-31 Depreciation rate for machinery and equipment

Machinery and equipment	Durable life	Depreciation rate (straight-line method)
Water intake pump, blower	7 years	0.143
Air-conditioner	13 years	0.077
Solar power generator	17 years	0.059
Other equipment	10 years	0.1
Profile projector, microscope, refrigerator, etc.	10 years	0.1
Other general-purpose equipment	5 years	0.2

Based on the above depreciation rates, depreciation expenses allocated should be about USD 42,000/year.

### (3) Balance of payment

Based on the above, it is projected that annual balance of payment should be a deficit of USD 41,000 (income of USD 93,000: Table 2-27 and expenses of about USD 134,000: Table 2-28). BMR needs to continue to budget an amount of about USD 41,000 annually as an expense for operation and maintenance. The amount corresponds to 7.5% of BMR's total budget for 2015 of USD 550,000 and it is judged as possible for BMR to allocate. In order to stabilize income from revolving funds, however, it is desirable that the sale of seedlings at a fair price be promoted as well as income sources be diversified and income be increased through activities such as attraction of tourists.

## CHAPTER 3 PROJECT EVALUATION

## **CHAPTER 3. PROJECT EVALUATION**

### **3-1 Preconditions**

Preconditions for implementing this project are as follows:

- The existing structures located in the project site have been demolished and removed and the site ground has been leveled by the Government of Palau, so that it can be used as a construction site.
- Shared responsibilities indicated in the “3-3 Obligations of Recipient Country” and M/M, including procedures related to construction authorization, customs clearance and tax exemption, have been completed without fail up to a relevant date, respectively.
- Application for environmental approval and accompanying documents have been submitted to EQPB and the approval has been obtained.
- Public order and safety is secured at the planned site.

### **3-2 Necessary Input by Recipient Country**

The Palau Government’s input to be made to realize and sustain the effect of the project is as follows:

- BMR shall assign necessary staff and allocate financial resources for effective awareness raising for marine resources conservation, and shall strengthen its awareness raising activities for marine resources conservation in collaboration with other governmental bodies if applicable.
- Implement budgetary measures appropriately related to expenses for maintenance and renewal of equipment and facilities. Particularly for intake pumps, air blowers and emergency power generators, failure of which can cause massive deaths of giant clams, secure budgets according to plans for reserving spare parts on a regular basis and for mid- and long-term renewal.
- Manage revolving funds appropriately and establish a system to deliver giant clam seedlings to clam cultivation farmers on a charged basis in order to ensure a self-reliant expansion of the facilities. In addition, make efforts to increase revenues through actively attracting tourists and hence obtaining sales from admission fees and sale of handicrafts.
- At BMR, promote enhancement of giant clam seed production not only for food supply but also for ornamental use targeting at overseas markets. In addition, target at business continuation of two-thirds of newly participated farmers, by enhancing support for such businesses.
- Take effective measures against theft of giant clams under farming as well as enforce a bill concerning the ban on sale, purchase of giant clams (House Bill No. 9-202-12).
- Implement evaluation of effectiveness of this project and environmental monitoring on a regular basis, in order to properly understand the effect of the project implementation.

### **3-3 Important Assumptions**

Important assumptions to realize and sustain the outcome of this project are as follows:

- Policies concerning the promotion of giant clam culture, including production of clam seedlings and the conservation of wild giant clams, do not regress significantly.
- The number of tourists who visit Palau does not decrease significantly. Demand for cultured giant clams at restaurants, etc. does not decrease.
- The market of giant clams for ornamental use does not shrink due to a worldwide economic downturn and for other reasons.
- Spawning of mother clams does not deteriorate for the reasons of high water temperature, bleaching effect, outbreak of diseases, occurrence of food-related damage, etc. In addition, there is no obstacle to the growth of both wild and cultured giant clams.
- No serious damage occurs to farmers due to climate change, environmental change, natural disasters such as typhoons, etc.

### **3-4 Project Evaluation**

#### **3-4-1 Relevance**

By implementing this project, PMDC's capability to produce clam seedlings will be enhanced and hence it will be possible to ensure more stable production of seedlings that is essential for the promotion of giant clam culture and propagation. Through a stable supply of giant clam seedlings, mariculture will be able to continue to operate more easily, which can contribute to an increased production of giant clams to be used for food supply, propagation and ornament products to be exported to foreign countries. In addition, as PMDC's awareness-raising capability will also be enhanced, the people of Palau will have a stronger awareness of conservation of marine environment. In turn, this will enable prevention of giant clam resource depletion and more sustainable use of such a resource, thereby contributing to the most important industry in Palau, the tourist industry. Through an increased production of cultured giant clams, it can be expected that this project will significantly contribute to the overall plan, the Palau 2020 National Master Development Plan. Therefore, it is judged highly relevant to implement this project with Japanese grant aid.

In this project, direct beneficiaries will be 6 staff members of PMDC and 25 existing giant clam farmers. In addition, there will be indirect beneficiaries who are hotels and restaurants using cultured giant clams and the entire people of Palau who will be supplied with giant clams as foodstuff.

Under Japan's country assistance policy for Palau, "environmental/climate changes" and "overcoming vulnerability" have been selected as priority areas and it is set that assistance be provided to stimulate environmental conservation as well as the country's private sector such as the tourist industry. This project is conforming to the policy.



### 3-4-2 Effectiveness

The effectiveness of this project is considered sufficiently high as the following effects can be expected.

#### 1) Quantitative evaluation

Table 3-1 Quantitative indicators of the Project’s effectiveness

Indicator	Reference value (2015)	Target value (2021) (3 years after the completion of the project)
Survival rate of giant clam at the initial juvenile phase (%)* (4 – 6 months after replaced from the larval tank to the nursery tank)	N/A	80**
Annual production quantity of juvenile giant clams (the number of clams)	32,869***	112,000

\* Owing to the juvenile clams for ornamental purpose are intentionally culled, survival rate is applied for food clam species only.

\*\* The 80% average survival rate on a continuing basis leads to stable production.

\*\*\*The population size of annually produced juvenile giant clams for 2015 is the number of clams shipped.

#### 2) Qualitative evaluation

- ① The level of satisfaction of farmers who purchase giant clam seedlings produced by PMDC will increase.
- ② Activities for environmental awareness-raising implemented by PMDC will be further enhanced.

### 3-4-3 Other Relevant Issues

- ① The Palauan side shall enforce compliance with laws and regulations effective in Palau regarding safety management upon its personnel.
- ② BMR shall keep records of production of the seeds of giant clams (particularly the survival rates and the number of produced seeds) in order to monitor the achievement of the Project.

## **[Appendices]**

- (1) Member List of the Study Team
- (2) Study Schedule
- (3) List of Parties Concerned in the Recipient Country
- (4) Minutes of Discussions

(1) Member List of the Study Team

1) Field Survey

Name	Title	Organization
Mr. Satoshi CHIKAMI	Leader	Senior advisor, Japan International Cooperation Agency (JICA)
Mr. Kenji Kaneko	Project Coordinator	Senior Assistant Director, Team 1, Agriculture and Rural Development Group 1, Rural Development Department, JICA
Mr. Michio TORII	Project manager /Aquaculture facilities planning /Management and maintenance planning	Fisheries Engineering Co., Ltd.
Mr. Atsumu TERAJ	Mariculture research and training planning	Fisheries & Acuaculture International Co., Ltd.
Mr. Kunihiro WATANABE	Architecture and facility designing	Fisheries Engineering Co., Ltd.
Mr. Fumiaki SHIOMI	Civil engineering /Survey on natural conditions	Fisheries Engineering Co., Ltd.
Mr. Toshiya TOGASAWARA	Construction and procurement planning /Cost estimation	Fisheries Engineering Co., Ltd.
Dr. Kosuke SANO	Environmental and social considerations	Fisheries & Acuaculture International Co., Ltd.

2) Draft Outline Design Survey

Name	Title	Organization
Mr. Osamu TANAKA	Project Coordinator	Advisor, Team 2, Agriculture and Rural Development Group 1, Rural Development Department, JICA
Mr. Michio TORII	Project manager /Aquaculture facilities planning /Management and maintenance planning	Fisheries Engineering Co., Ltd.
Mr. Kunihiro WATANABE	Architecture and facility designing	Fisheries Engineering Co., Ltd.

## (2) Study Schedule

### 1) Field Survey

			JICA	Chief consultant/Aqua-culture facilities planning/Operation, maintenance and management planner Michio Torii	Mariculture research and training planner Atsumu Terai	Architectural planner Kunihiko Watanabe	Civil engineer and surveyor Fumiaki Shiomi	Engineering work planner and cost surveyor Toshiya Ogasawara	Environment and socio-economic researcher/ Evaluation planner Kosuke Sano	
1	1 Nov.	Sun		NRT→KOROR	NRT→KOROR			NRT→KOROR		
2	2 Nov.	Mon		Courtesy call to JICA office Courtesy call to BMR Explanation of Inception report and Questionnaire				Courtesy call to JICA office Courtesy call to BMR Explanation of Inception		
3	3 Nov.	Tue		Site survey				Site survey		
4	4 Nov.	Wed		Survey / Existing facilities for mariculture	Survey for present condition of mariculture research			Data collection (Cost estimation)	NRT→KOROR	
5	5 Nov.	Thu		Survey / Existing facilities for mariculture	Survey for present condition of mariculture research			Site survey		
6	6 Nov.	Fri		Survey / Existing facilities for mariculture	Supervise / Distribution survey			Investigation on general conditions of construction		
7	7 Nov.	Sat		Supervise / Distribution survey		NRT→KOROR		Data Check		
8	8 Nov.	Sun		Internal Meeting						
9	9 Nov.	Mon		Survey / Operation and Management	Survey for present condition of mariculture research	Site Survey (Existing facilities)	Site Survey Data Collection (Natural conditions)	Data Collection (Cost estimation)	Social and Environmental survey	
10	10 Nov.	Tue		Survey / Operation and Management	Survey for present condition of mariculture research	Site Survey (Existing facilities)	Data Collection (Natural conditions)	Data Collection (Cost estimation)	Social and Environmental survey	
11	11 Nov.	Wed	NRT→KOROR	Survey / Operation and Management	Survey for present condition of mariculture training	Planning of Architectural facilities	Natural conditions survey	Data Collection (Cost estimation)	Data Collection (Environmental assessment procedure & schedule)	
12	12 Nov.	Thu		Courtesy call to Japanese Embassy and JICA office Site Survey			Natural conditions survey	Data Collection (Cost estimation)	Data Collection (Environmental laws and regulation)	
13	13 Nov.	Fri		Discussion with BMR and PMDC			Planning of Civil facilities	Data Collection (Cost estimation)	Data Collection (Environmental laws and regulation)	
14	14 Nov.	Sat	Internal Meeting	<del>KOR→</del>	Internal Meeting					
15	15 Nov.	Sun	Internal Meeting	<del>KOR→</del>	Internal Meeting					
16	16 Nov.	Mon	Discussion with BMR and PMDC	<del>→KOR</del>	Discussion with BMR and PMDC					
17	17 Nov.	Tue		Discussion with BMR and PMDC			Natural conditions survey	Procurement condition survey	Data Collection (Environmental laws and regulation)	
18	18 Nov.	Wed		Final Discussion with BMR and PMDC Signing of the Minutes of Discussions			Natural conditions survey	Procurement condition survey	Data Collection (Environmental laws and regulation)	
19	19 Nov.	Thu		Report to Japanese Embassy and JICA office	Survey for present condition of mariculture research	Construction condition survey	Natural conditions survey	Procurement condition survey	Data Collection (Budget and implementing agency of Environmental assessment)	
20	20 Nov.	Fri	KOROR→NRT	Survey / Existing facilities for mariculture	Survey for present condition of mariculture research	Construction condition survey	Natural conditions survey	Procurement condition survey	Data Collection (Budget and implementing agency of Environmental assessment)	
21	21 Nov.	Sat		Internal Meeting						
22	22 Nov.	Sun		Internal Meeting						
23	23 Nov.	Mon		Survey / Existing facilities for mariculture	Survey for present condition of mariculture research	Construction condition survey	Natural conditions survey	Data Collection (Cost estimation)	Survey for operation evaluation	
24	24 Nov.	Tue		Survey / Existing facilities for mariculture	Survey for present condition of mariculture research	Construction condition survey	Natural conditions survey	Data Collection (Cost estimation)	Survey for operation evaluation	
25	25 Nov.	Wed		Survey / Operation and Management	Survey for present condition of mariculture training	Construction condition survey	Natural conditions survey	Data Collection (Cost estimation)	Data collection (Monitoring plan)	
26	26 Nov.	Thu		Survey / Operation and Management	Survey for present condition of mariculture training	Construction condition survey	Natural conditions survey	Data Collection (Cost estimation)	Data collection (Monitoring plan)	
27	27 Nov.	Fri		Supervise / Distribution survey		Construction condition survey	Natural conditions survey	KOROR→NRT	Data collection (Monitoring plan)	
28	28 Nov.	Sat		Internal Meeting						
29	29 Nov.	Sun		Internal Meeting						
30	30 Nov.	Mon		Data Collection	Data Collection	Data Collection	Data Collection			
31	1 Dec.	Tue		Data Collection	KOROR→NRT	Data Collection	Data Collection			
32	2 Dec.	Wed		Report to BMR and PMDC		Report to BMR and PMDC				
33	3 Dec.	Thu		KOROR→NRT		KOROR→NRT				

BMR : Bureau of Marine Resources

PMDC : Palau Mariculture Demonstration Center

2) Explanation on Draft preparatory survey report

			JICA	Chief consultant/Aquaculture facilities planning/Operation, maintenance and management planner Michio Torii	Architectural planner Kunihiro Watanabe
1	3 July	Sun	Narita → Koror		
2	4 July	Mon	Courtesy call to JICA office JICA, site survey		Narita → Koror
3	5 July	Tue	Explanation of the draft Outline Design Report, discussion with EQPB		
4	6 July	Wed	Discussion with BMR, Discussion with CIP (on Draft Outline Design)		
5	7 July	Thu	Signing of the Minutes of Discussions, Report to Japanese Embassy and JICA office		
6	8 July	Fri	Koror → Narita		

(3) List of Parties Concerned in the Recipient Country

(3) -1: Field survey

Name	Title and organization
Hon. Mr. F. Umiichi SENGEBAU	Minister, Ministry of Natural Resources, Environment and Tourism (MNRET)
Mr. Casmir REMENGESAU	Director, Bureau of Budget and Planning, Ministry of Finance
Mr. King M. SAM	Special Assistant to Minister / Program Manager, MNRET
Mr. Leon E. REMENGESAU	Acting Director, Bureau of Marine Resources (BMR)
Mr. Asterio TAKASHI	Tuna Project Manager, MNRET
Mr. Charley I. MATSUTARO	Coastal Fisheries Officer, BMR
Mr. Percy 'bito' RECHELLUUL	Fisheries Technician, BMR
Mr. Harvey RENGUUL	Fisheries Specialist, BMR
Mr. Cartor WASISANG	Compliance Officer II, Environmental Quality Protection Board (EQPB)
Ms. Metiek Kimie NGIRCHECHOL	Laboratory Supervisor, EQPB
Mr. Michael BLESAM	Compliance Supervisor, EQPB
Mr. Alexandlo McQILLAN	Engineer, EQPB
Mr. Calvin Taurengel EMESIOCHEL	Deputy Historic Preservation Officer, Bureau of Cultural and Historical Preservation
Mr. Burton WONG	Cartographer Supervisor, Bureau of Lands and Survey
Mr. Mario ROTAMAL	National Surveyor, Bureau of Lands and Survey
Ms. Pasquana BLESAM	Koror State Public Lands Authority (KSPLA) Realty Manager, Koror State Government
Ms. Sherma NAGATA	KSPLA Realty Aide, Koror State Government
Mr. Kaleb MELTEL	GIS Technician, Building and Zoning, Koror State Government
Ms. Bernice NGIRKELAU	President, Palau Aquaculture Association (PACA)
Mr. McVey KAZUYUKI	Board Manager, PACA
Mr. Dion C. T. HSIEH	Aquaculture Specialist, Palau National Aquaculture Center (Aquaculture Project)
Mr. Shigeaki SONE	Giant Clam Culture Expert, Overseas Fishery Cooperation Foundation (OFCF)
Mr. Minoru HATANO	Fisheries Expert, OFCF
Mr. Kazuhiro TAJIRI	Ambassador Extraordinary and Plenipotentiary, Embassy of Japan
Mr. Koji TOMITA	Counsellor, Embassy of Japan
Mr. Takao MOCHIDA	Economic Researcher, Embassy of Japan
Dr. Seiji NAKAYA	Project Coordinator, Japan International Cooperation Agency (Palau International Coral Reef Center)
Mr. Nobuaki MATSUI	Resident Representative, JICA Palau Office

(3) -2: Explanation of Draft preparatory survey report

Name	Title and organization
Hon. Mr. F. Umiichi SENGEBAU	Minister, Ministry of Natural Resources, Environment and Tourism (MNRET)
Mr. Casmir REMENGESAU	Director, Bureau of Budget and Planning, Ministry of Finance
Mr. Leon E. REMENGESAU	Acting Director, Bureau of Marine Resources (BMR)
Ms. Roxanne Y. BLESAM	Executive Officer II, Environmental Quality Protection Board (EQPB)
Ms. Lynna E. THOMAS	Compliance Specialist, EQPB
Mr. Benjamin R. ASUNCION	Senior Project Manager, Capital Unprovement Program (CIP)
Mr. Mays SKEBANG	Head Construction Inspection, CIP
Mr. Shigeaki SONE	Giant Clam Culture Expert, OFCF
Mr. Kazuhiro TAJIRI	Ambassador Extraordinary and Plenipotentiary, Embassy of Japan
Mr. Takao MOCHIDA	Economic Researcher, Embassy of Japan
Mr. Nobuaki MIYATA	Resident Representative, JICA Palau Office
Mr. Shigehiro MIZUNO	Volunteer Coordinator, JICA Palau Office

(4) Minute of Discussion

(4) -1 : Field Survey

MINUTES OF DISCUSSIONS  
ON  
THE PREPARATORY SURVEY  
FOR THE PROJECT FOR RENOVATION  
OF PALAU MARICULTURE DEMONSTRATION CENTER FACILITY  
IN THE REPUBLIC OF PALAU

In response to the request from the Government of the Republic of Palau (hereinafter referred to as "Palau"), the Government of Japan decided to conduct a Preparatory Survey for the Project for Renovation of Palau Mariculture Demonstration Center Facility (hereinafter referred to as "the Project"), and entrusted the Preparatory Survey to Japan International Cooperation Agency (hereinafter referred to as "JICA").

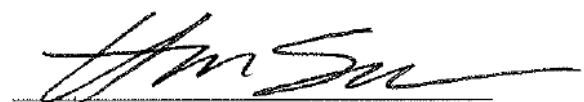
JICA sent the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") to Palau, headed by Mr. Satoshi Chikami, Senior Advisor, JICA, and is scheduled to stay in the country from November 1 to December 3, 2015.

The Team held a series of discussions with the officials concerned of the Government of Palau and conducted a field survey in the Project area. In the course of the discussions, both sides have confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

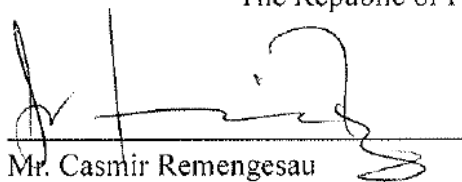
Koror, November 18, 2015



Mr. Satoshi Chikami  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency  
Japan



Mr. F. Umiich Sengebau  
Minister  
Ministry of Natural Resources,  
Environment and Tourism  
The Republic of Palau



Mr. Casmir Remengesau  
Director  
Bureau of Budget and Planning  
Ministry of Finance  
The Republic of Palau



**ATTACHEMENT**

1. Objective of the Project

The objective of the Project is to prevent the exhaustion of giant clam resources in Palau through the improvement of production of giant clam seeds in the Palau Mariculture Demonstration Center (PMDC), thereby contributing to the achievement of sustainable economic growth in consideration of the environment and to the improvement of the standard of living of the Palauan nation.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for Renovation of Palau Mariculture Demonstration Center Facility”.

3. Project Site

Both sides confirmed that the site of the Project is in Malakal Island, which is shown in Annex-1.

4. Line Agency and Executing Agency

Both sides confirmed the line agency and executing agency as follows:

- 4-1. The line agency is Ministry of Natural Resources, Environment and Tourism (MNRET), which would be the agency to supervise the executing agency.
- 4-2. The executing agency is Bureau of Marine Resources (BMR). The executing agency shall coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the Undertakings are taken by relevant agencies properly and on time. Their organization charts are shown in Annex-2.

5. Items requested by the Government of Palau

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Palau are as follows:

a. Building facilities

No.	Requested Component	Remarks
1	Mariculture Promotion Center Building	Entrance hall, exhibition hall, handy-craft shop, giant clams trading room, diving gear store, workshop, kitchen/dining rooms, night duty room, preparation rooms, wet

		laboratory/hatching room, storages, dormitories, director's room, scientist's room, staff room, library/meeting room, toilets, utilities, etc.
2	Sheds (1,200 m <sup>2</sup> in total)	Transparent roofing above paved rearing areas
3	Machinery house (40 m <sup>2</sup> )	Rooms for setting seawater intake pumps, air blowers, an emergency generator and elevated seawater reservoirs
4	Seawater and air supply system	2 x seawater intakes, 3 x seawater intake pumps, 4 x air blowers, 2 x elevated seawater reservoirs, 1 x emergency generator, piping and electrical works
5	Solar power generating system	50 kW or sufficient capacity to cover daytime power consumption at PMDC

#### b. Civil engineering facilities

No.	Requested Component	Remarks
1	Slipway	Approx. 40m for small FRP boats landing
2	Landing quay renovation	Renovation of quay steps and installation of mooring buoys, bollards and fenders for small boats and a manual jib crane on the quay
3	Parking lots and other auxiliary facilities	Car parking, boat parking, gate, etc.

#### c. Equipment and materials

No.	Item	Specification
1	Equipment for Giant Clam Culture and Trade	Assorted FRP raceways for nursery, grow-out and display, plastic tanks for spawning, egg collecting, incubating, stocking and diatom culturing, plastic containers and baskets, weighing scales, work tables, stools, etc.
2	Laboratory Equipment	Salinity refractometers, digital and rod thermometers, portable DO meter, biological microscope, stereoscopic microscope, glassware, laboratory utensils, refrigerator, freezer, laboratory tables, stools, etc.

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3	Promotion and Data Processing Equipment	Projection screens, video projector, computers, UPS, network equipment, printers, flatbed scanner, etc.
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- 5-2. Based on the results of the survey and discussions, the components of the Project such as the construction of building facilities and civil engineering facilities, and the procurement of the equipment and materials under consideration for the Project are shown in Annex-3.
- 5-3. JICA will assess the appropriateness of the above revised requested items through the survey and will report findings to the Government of Japan. The final components of the Project would be decided by the Government of Japan.

#### 6. Japan's Grant Scheme

- 6-1. The Palauan side understands the Japan's Grant Scheme and its procedures as described in Annex-4, Annex-5 and Annex-6, and necessary measures to be taken by the Government of Palau.
- 6-2. The Palauan side understands to take the necessary measures, as described in Annex-7, for smooth implementation of the Project, as a condition for the Japanese Grant to be implemented. The detailed contents of the Annex-7 will be worked out during the survey and shall be agreed no later than by the Explanation of the Draft Preparatory Survey Report.

The contents of Annex-7 will be used to determine the following:

- (1) The scope of the Project.
- (2) The timing of the Project implementation.
- (3) Timing and possibility of budget allocation.

Contents of Annex-7 will be updated as the Preparatory Survey progresses, and will finally be the Attachment to the Grant Agreement.

#### 7. Schedule of the Survey

- 7-1. The Team will proceed with further survey in Palau until 3<sup>rd</sup> December, 2015.
- 7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Palau in order to explain its contents around May 2016.
- 7-3. If the contents of the draft Preparatory Survey Report is accepted in principle and the undertakings are fully agreed by the Palauan side, JICA will complete the final report in English and send it to Palau around July, 2016.
- 7-4. The above schedule is tentative and subject to change.




8. Environmental and Social Considerations

- 8-1. The Team explained that the environmental and social considerations studies would be conducted according to JICA Guidelines for Environmental and Social Considerations (April, 2010) in order to examine the mitigation measures of impacts and monitoring plan during/after the project implementation.
- 8-2. The Palauan side confirmed to give due environmental and social considerations during implementation of the Project, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations.
- 8-3. The Palauan side confirmed to conduct the necessary procedures concerning the environmental assessment (including Initial Environmental Examination (IEE) etc.) and make IEE report of the Project. The IEE approval shall be received from the responsible authorities and submitted to JICA by October 2016.
- 8-4. Both sides confirmed that the Team would assist the Palauan side to conduct the Initial Environmental Examination (IEE) for the Project under the laws and regulations of Palau.
- 8-5. BMR as responsible agency for conducting the Environmental Impact Assessment (EIA) for the Project shall promptly initiate the EIA process and obtain an environmental permission from the Palauan authorities concerned by one month before the tender for contractor of the Project. This environmental permission is a condition for obtaining a construction permit from the local authority.
- 8-6. The Palauan side explained about the process and progress of EIA approval procedure as follows:
- (1) Submission of permit application to Environmental Quality Protection Board (EQPB)
  - (2) Depending on the requirement, submission of EIA to EQPB
  - (3) Depending on the requirement, submission of the Environmental Impact Statement to EQPB
- 8-7. Both sides confirmed that there is no PAP (Project Affected People) residing in the Project site.
- (1) The Palauan side explained the demolition of the icebox building to a giant clam farmer who is conducting culture activities inside the icebox building. The farmer agreed to move out from the icebox building.
  - (2) Both sides confirmed the land settlement agreement of PMDC contracted in 1997 between the Republic of Palau and Koror State by the document. The



Vicinity Map and Cadastral Maps are shown in Annex-8.

## 9. Other Relevant Issues

### 9-1. Site Clearance

The Team emphasized that the Palauan side shall demolish and remove any remains including the existing buildings, facilities, foundations, icebox building and other obstacles such as elevated tank, trees, etc. The removal shall be completed before the end of December, 2016.

### 9-2. Necessary Approval of Construction of the Facilities

The Palauan side described necessary procedures for obtaining approval for the construction of facilities in the Project as follows;

- (1) MNRET submits draft outline design to Capital Improvement Project (CIP), Ministry of Public Infrastructure, Industries and Commerce (MPIIC) for their review and recommendations (expected in May, 2016).
- (2) MNRET submits detailed design (detailed drawings of architecture and engineering) to EQPB for their review (expected in December, 2016).
- (3) MNRET submits the building permit application to Koror State for final approval (expected in February, 2017).
- (4) Issuance of KSG building permit is expected in March, 2017.

The Palauan side agreed to obtain all the necessary approval required under the laws and regulations of Palau from relevant authorities prior to the signing of the contract agreement for construction of the Project facilities.

### 9-3. Urgent necessity to establish legal framework on the distribution management of giant clams

The Palauan side expressed the urgent necessity to establish the regulations concerning distribution of giant clams. After establishing the above regulations, the restaurants must procure only cultured giant clams through licensed farmers. Both sides recognized that the regulations to be established will contribute to the protection from theft of the cultured giant clams, as well as prevent the overfishing of the giant clams from the wild.



#### 9-4. Stakeholder consultation

A stakeholder consultation meeting will be held during the survey period. In this meeting, participants are expected to deepen their understanding on the Project which will enhance the capacity of the seed production of giant clams and promote the extension of the giant clam culture throughout Palau.

#### 9-5. Operation and Maintenance of Facilities and Equipment

The allocation of necessary human resources such as engineers and technicians is indispensable to implement giant clam seed production successfully and to accomplish the aims of the Project. The Team suggested BMR should appoint a sufficient number of qualified and enthusiastic human resources at earlier stage for ensuring technical sustainability.

On the other hand, the Palauan side requested the Team to include technical assistance for operation and maintenance of facilities and equipment as a "Soft-Component" of the Project for the effective use of the facilities and equipment. The Team took note of the request made by the Palauan side.

#### 9-6. Securing Budget by the Government of Palau for the Project

The Palauan side shall secure necessary budget to cover the cost for taking necessary major undertakings to be covered by Palauan side for the Project as per Annex-7.

#### 9-7. Customs Duties and Tax exemption

The taxes including customs duty, and any other taxes and levies in Palau which are to arise from the Project activities will be exempted by the Palauan side. MNRET will take any procedures necessary for the tax exemption with the Ministry of Finance on its responsibility.

#### 9-8. Submission of Project Monitoring Report

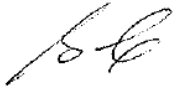
Project Monitoring Report (PMR) will be prepared by the Palauan side for confirming the outline and progress of the Project. The Team described the purpose of the preparation of PMR, BMR agreed to submit PMR to JICA monthly during the Project implementation. The format of Project Monitoring Report is attached as Annex-9.



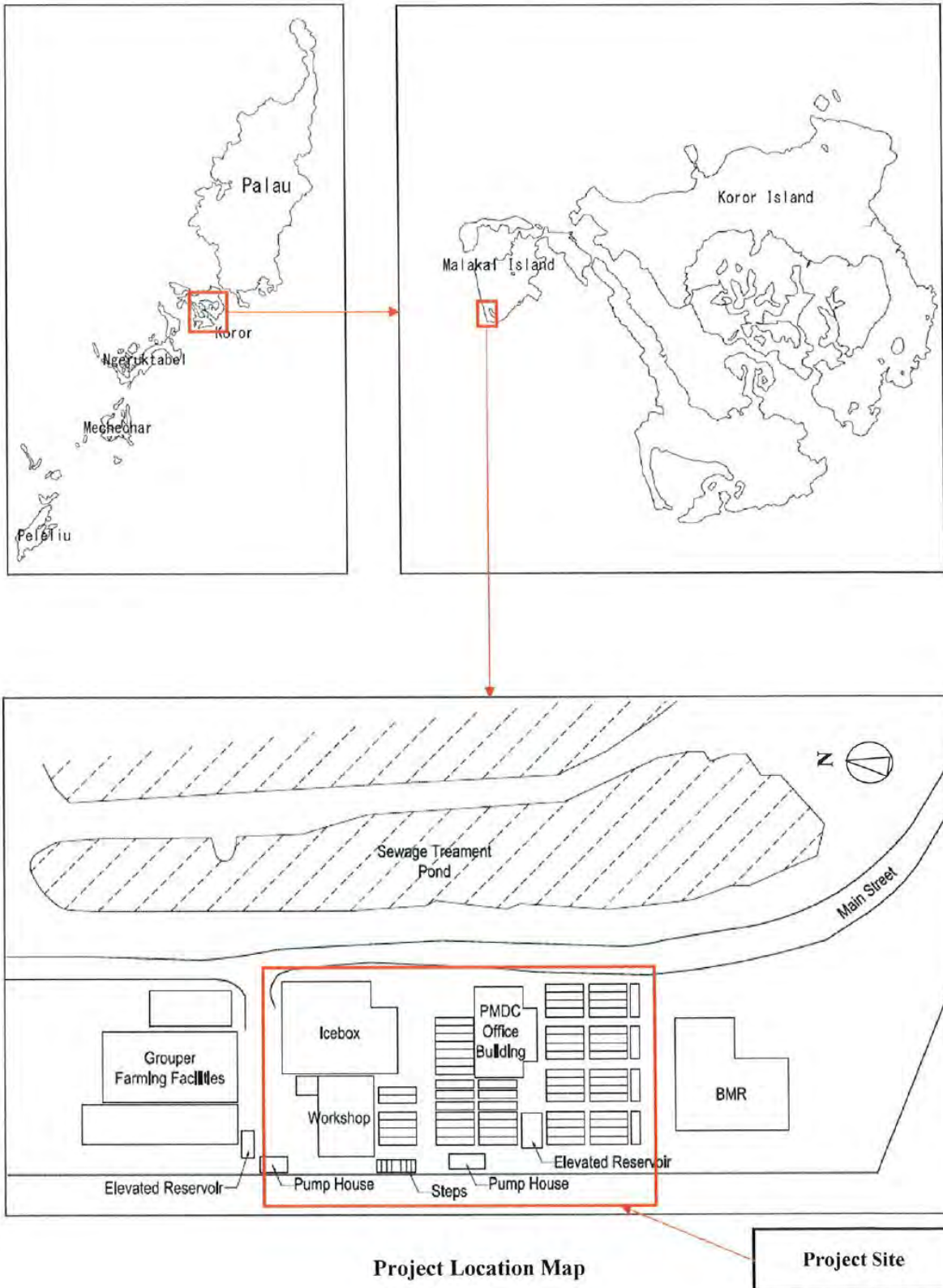
#### 9-9. Questionnaire

BMR shall answer to the Questionnaire submitted by the Team in English with relevant documents by the end of November, 2015.

- Annex-1 Project Site
- Annex-2 Organization Charts of Line and Executing Agencies
- Annex-3 Revised List of Requested Items
- Annex-4 Japanese Grant
- Annex-5 Flow Chart of Japanese Grant Procedures
- Annex-6 Financial Flow of Japanese Grant
- Annex-7 Major Undertakings to be taken by Each Government
- Annex-8 Vicinity Map and Cadastral Maps
- Annex-9 Format of Project Monitoring Report



Project Site

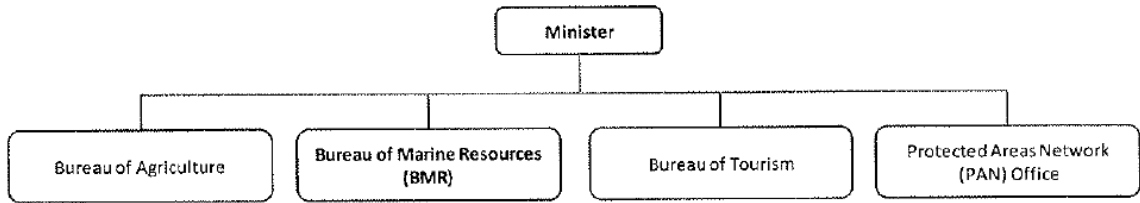


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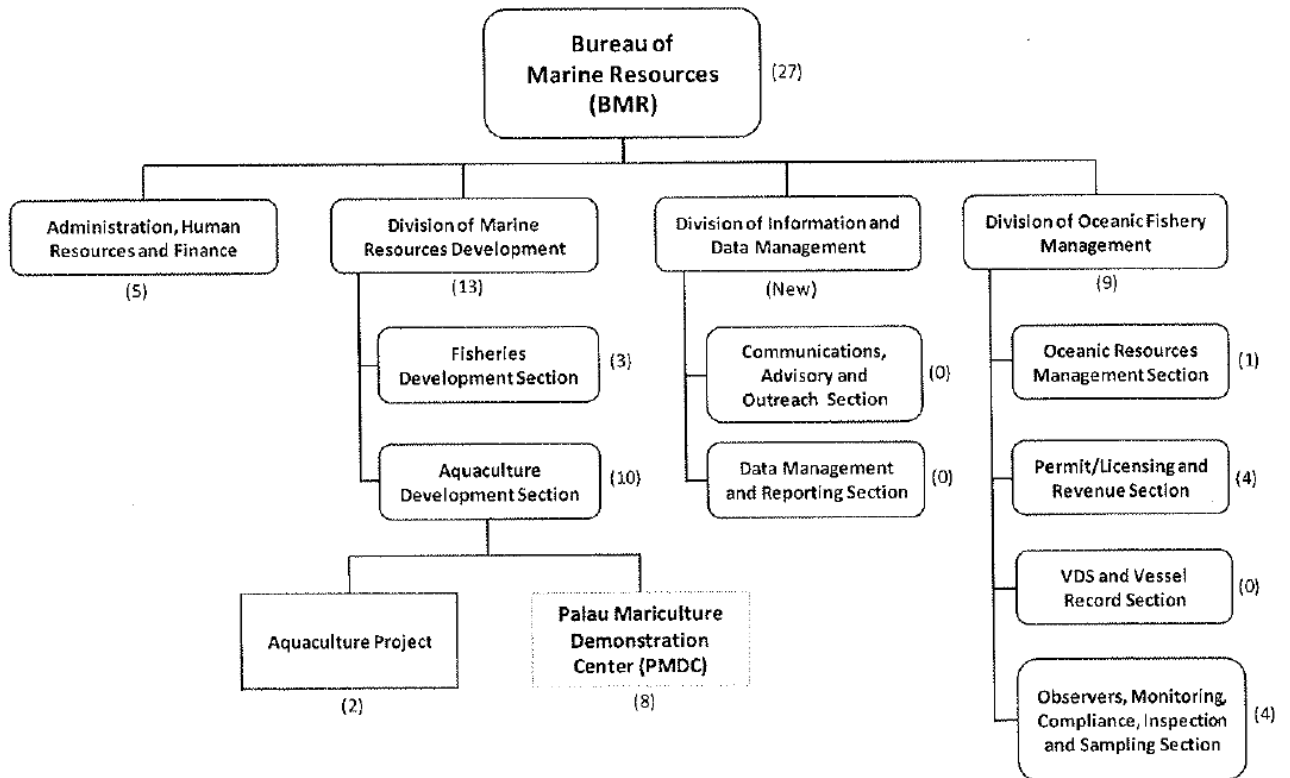
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Organization Charts of Line and Executing Agencies



Organization Chart of the Ministry of Natural Resources, Environment and Tourism



Organization Chart of the Bureau of Marine Resources (BMR)

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## Revised List of Requested Items

## a. Building facilities

No.	Requested Component	Description	Priority
1	Mariculture Promotion Center Building	Entrance hall	A
		Exhibition hall / shop	A
		Preparation room (for handy-craft)	A
		Diving gear store	A
		Kitchen/dining rooms	A
		Night duty room	B
		Preparation rooms	A
		Wet and dry laboratories	A
		Exporter's room	A
		Storages	A
		Dormitories	C
		Manager's room	A
		Scientist's room	A
		Staff room	A
Library/conference room	A		
Toilets	A		
Utilities	A		
Shower room	A		
2	Raceway tanks	Raceways for nursery and grow-out	A
3	Sheds (1,200 m <sup>2</sup> in total)	Transparent roofing above paved rearing areas	A
4	Machinery house (40 m <sup>2</sup> )	Rooms for setting seawater intake pumps, air blowers, an emergency generator and elevated seawater reservoirs	A
5	Seawater and air supply system	2 x seawater intakes, 2 x rapid sand filters, 3 x seawater intake pumps, 4 x air blowers, 2 x elevated seawater reservoirs, 1 x emergency generator, piping and electrical works	A
6	Public utility	Toilets and changing/shower rooms for visitors	A
7	Solar power generating system	50 kW or sufficient capacity to cover daytime power consumption at PMDC (for daytime only)	A

## b. Civil engineering facilities

No.	Requested Component	Description	Priority
1	Landing quay renovation	Renovation of quay steps	A
		Installation of mooring buoys, bollards and fenders for small boats	A
		A manual jib crane	A
2	Parking lots and other auxiliary facilities	Car parking	A
		Boat parking	A
		Gate	A
		Fence	A

**c. Equipment and materials**

No.	Requested Component	Description	Priority
1	Equipment for Giant Clam Culture	Assorted FRP tanks	A
		Plastic tanks for spawning, egg collecting, incubating, stocking, etc.	A
		Weighing scales & balance (pound scale)	A
		Plastic containers and baskets	A
		Bottom plates for tanks	A
		Aeration tools (air stones, three-way cock, vinyl tubes, air pumps)	A
		UV sterilizer	A
		Packing tools (Oxygen regulator, spray gun, rubber hose etc.)	A
		Cartridge filter and housing; 5 micron	A
		Filter bags 5 micron, 10 micron	A
		Sunshade nets	A
		Plankton nets	A
		Polyethylene nets	A
		Scoop nets	A
		Work tables	A
Stools	B		
2	Laboratory Equipment	Salinity refractometers (salinometer)	A
		Thermometers (digital, rod type, certificated)	A
		Portable DO meter	A
		Biological microscope	A
		Stereoscopic microscope with digital camera system	A
		Profile projector	A
		Aluminum caliper 50cm, 100cm	A
		Digital vernier calipers	A
		Stainless calipers	A
		Streptomycin	B
		Serotonin	B
		Laboratory utensils (glassware, pipette, dissection tools, balance etc.)	A
		Refrigerator	A
		Freezer	A
		Laboratory tables	A
Stools	B		
3	Equipment for Promotion, Data Processing and Others	Aquarium with recirculation system	A
		Diving equipment (BC jacket, air tank, regulator, mask, fin, snorkel, boots, wetsuit, weight, compressor etc.)	A
		Digital camera with housing	A
		Projection screens	A
		Video projector	A
		Computers (desk top, laptop)	B
		External HDD	B
		UPS	B
Network equipment	B		

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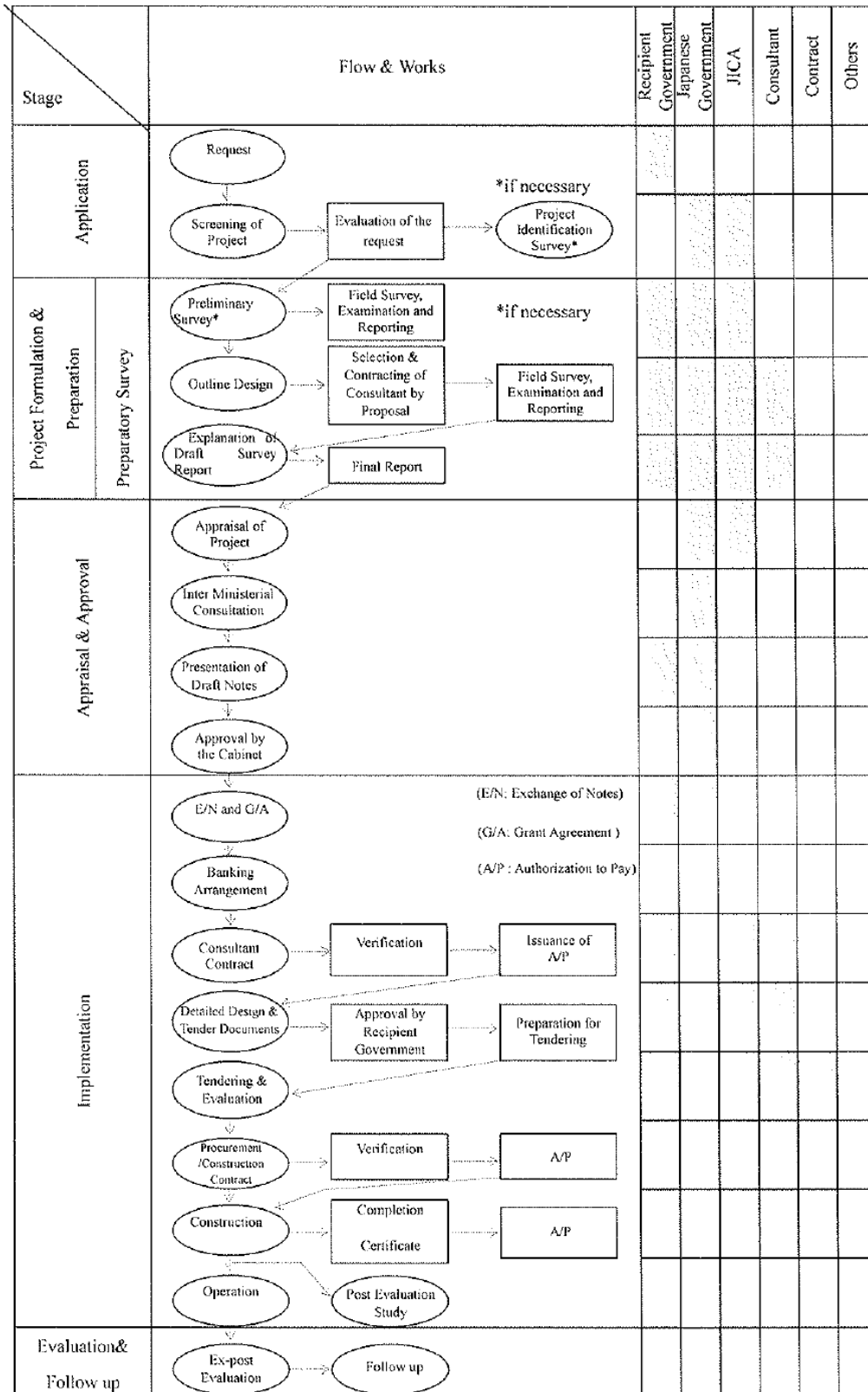
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	Printer & scanner	B
	Tools for shell work (hand grinder set, drill set, high speed cutter etc.)	A
	Tools for maintenance	A
	Flatbed scanner	B
	Photo copier	A
	Security cameras with recorder	A

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FLOW CHART OF JAPANESE GRANT PROCEDURES



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## JAPANESE GRANT

Based on a JICA law which was entered into effect on October 1, 2008 and the decision of the GOJ, JICA has become the executing agency of the Japanese Grant for Projects for construction of facilities, purchase of equipment, etc.

The Japanese Grant (hereinafter referred to as the "Grant") is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant is not supplied through the donation of materials as such.

### 1. Grant Procedures

The Grant is supplied through following procedures :

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal & Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - Agreement concluded between JICA and a recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

### 2. Preparatory Survey

#### (1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Scheme



from a technical, financial, social and economic point of view.

- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of a outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant project. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

## (2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

## (3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

## 3. Japanese Grant Scheme

### (1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles, in accordance with the E/N, to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.



(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. The Grant may be used for the purchase of the products or services of a third country, if necessary, taking into account the quality, competitiveness and economic rationality of products and services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals", in principle.

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals, in principle. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

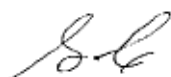
In the implementation of the Grant Project, the recipient country is required to undertake such necessary measures as Annex. The Japanese Government requests the Government of the recipient country to exempt all customs duties, internal taxes and other fiscal levies such as VAT, commercial tax, income tax, corporate tax, resident tax, fuel tax which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract, since the Grant fund comes from the Japanese taxpayers.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant.

(7) "Export and Re-export"

The products purchased under the Grant should not be exported or re-exported from the recipient





country.

(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"), in principle. JICA will execute the Grant by making payments in Japanese yen, in principle, to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

The Government of the recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

(11) Monitoring

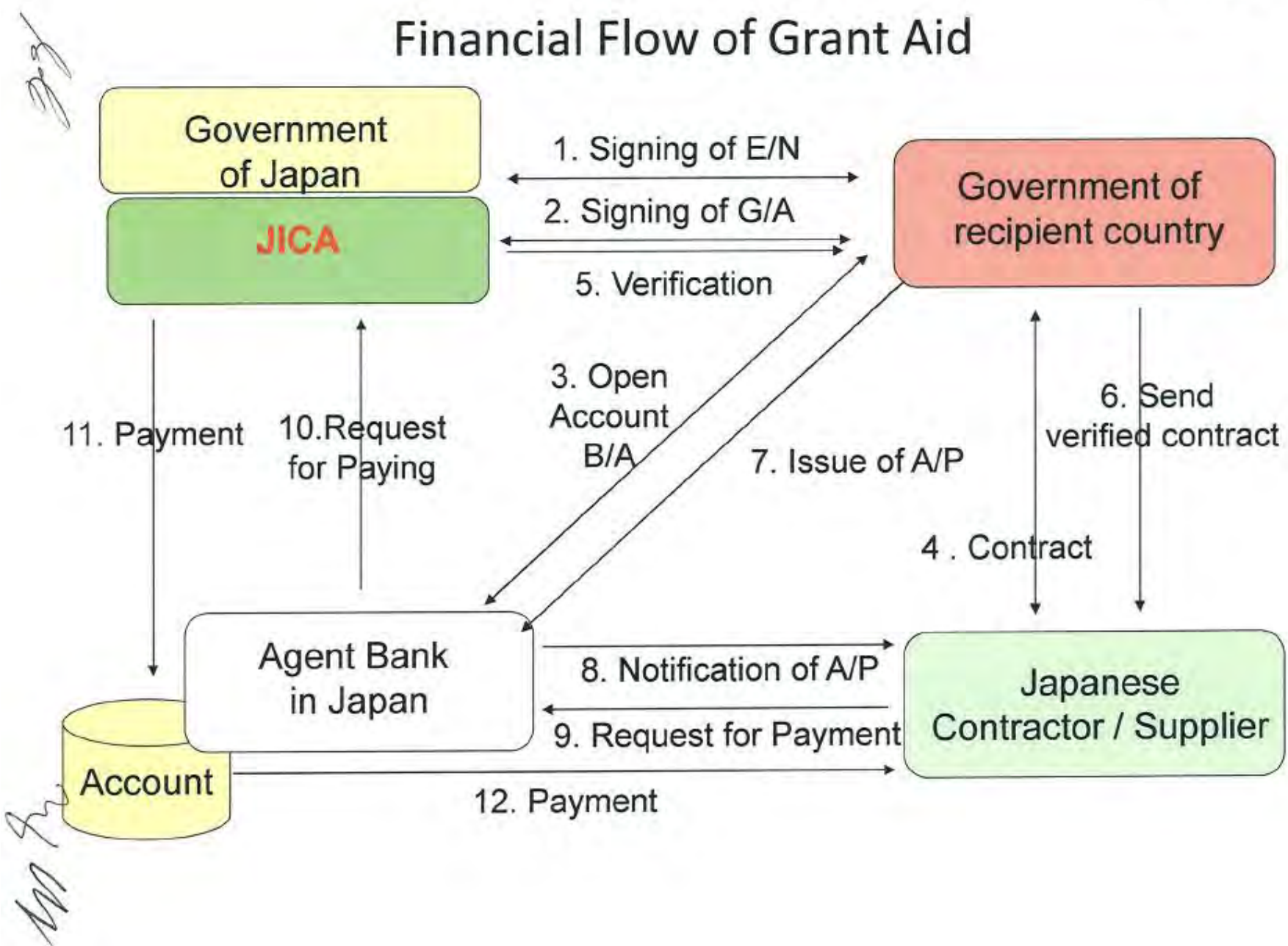
The Government of the recipient country must take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and must regularly report to JICA about its status by using the Project Monitoring Report (PMR).

(12) Safety Measures

The Government of the recipient country must ensure that the safety is highly observed during the implementation of the Project.



# Financial Flow of Grant Aid



## Major Undertakings to be taken by Each Government

No.	Items	Responsibility		Major Undertaking to be taken by Recipient side			
		To be covered by Grant Aid	To be covered by Recipient Side	Deadline	in charge	Cost	Remarks
	Before the Tender						
1	To approve IEE/EIA		●	within 1 month after G/A	MNRET		
2	To implement EIA		●	before start of the construction	MNRET		
3	To open Bank Account (Banking Arrangement (B/A))		●	within 1 month after G/A	MOF		
4	To secure the following lands;						
	1) Project site		●	before notice of the tender document	MNRET		
	2) Temporary construction yard and stock yard near the Project area		●	before notice of the tender document	MNRET		
	3) Borrow pit and disposal site near the Project area		●	before notice of the tender document	MNRET		
5	To obtain the planning, zoning, building permit		●	before notice of the tender document	MNRET		
6	To clear, level and reclaim the following sites;						
	1) remove utilities		●	before notice of the tender document	MNRET		
	2) Demolition of unnecessary existing facilities including the icebox building, office, clam hatchery, culture tanks and other structures		●	before notice of the tender document	MNRET		
	3) Removal of unnecessary existing trees		●	before notice of the tender document	MNRET		
	4) Leveling and reclaiming the sites for the building		●	before notice of the tender document	MNRET		
	During the Project implementation						
7	To bear the following commissions to a bank of Japan for the banking services based upon the B/A						
	1) Advising commission of A/P		●	within 1 month after the signing of the contract	MOF		
	2) Payment commission for A/P		●	every payment	MOF		

8	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products					
	1) Marine (Air) transportation of the Products from Japan to the recipient country	•		during the Project	Contractor, Supplier(s)	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		•	during the Project	MNRET	
	3) Internal transportation from the port of disembarkation to the project site	•		during the Project	Contractor, Supplier(s)	
9	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•		MNRET	
10	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted. Such customs duties, internal taxes and other fiscal levies mentioned above include commercial tax, income tax and corporate tax of Japanese nationals, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•	during the Project	MOF MNRET	
11	To bear all the expenses, other than those to be borne by the Grant Aid		•		MNRET	
12	To construct the following facilities					
	1) The buildings (Mariculture Promotion Center Building, Sheds, Machinery house)	•			Contractor	
	2) Renovation of Quay Steps	•			Contractor	
	3) The gates and fences in and around the site	•			Contractor	
	4) The parking lot and other auxiliary facilities	•			Contractor	
	5) The road within the site	•			Contractor	
13	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites.					
	1) Electricity					
	a. The distributing power line to the site		•	before start of the construction	MNRET	
	b. The drop wiring and internal wiring within the site	•			Contractor	
	c. The main circuit breaker and transformer	•			Contractor	
	2) Water Supply					
	a. The city water distribution main to the site		•	6 months before completion of the construction	MNRET	
	b. The water supply system within the site (receiving and elevated tanks)	•			Contractor	
	3) Drainage					
	a. The drainage system (for common waste, storm drainage and others) within the site	•			Contractor	
	4) Telephone System					

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*By LW*

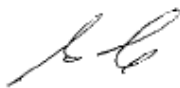
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		•		MNRET		
	b. The MDF and the extension after the frame/panel	•			Contractor		
	5) Furniture and Equipment						
	a. General furniture		•	1 month before completion of the construction	MNRET		
	b. Project equipment	•			Contractor		
14	To submit environmental monitoring report to JICA Palau Office	•	•	during the Project	MNRET Contractor		
	After the Project						
15	To ensure that the Facilities and the products be maintained and used properly and effectively		•		MNRET		
16	To bear all the expenses, other than those covered by the Grant Aid, necessary for the operation of the completed facilities		•		MNRET		
17	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid						
	1) Allocation of maintenance cost		•	After completion of the construction	MNRET		
	2) Operation and maintenance structure and staff		•	After completion of the construction	MNRET		
	3) Routine check/periodical maintenance		•	After completion of the construction	MNRET		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

\*; The cost estimates are provisional. This is subject to the approval of the Government of Japan.

MOF: Ministry of Finance

MNRET: Ministry of Natural Resources, Environment and Tourism




Annex - 8 Cadastral Map

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- Appendices 28 -

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Annex - 2 Coastal Map

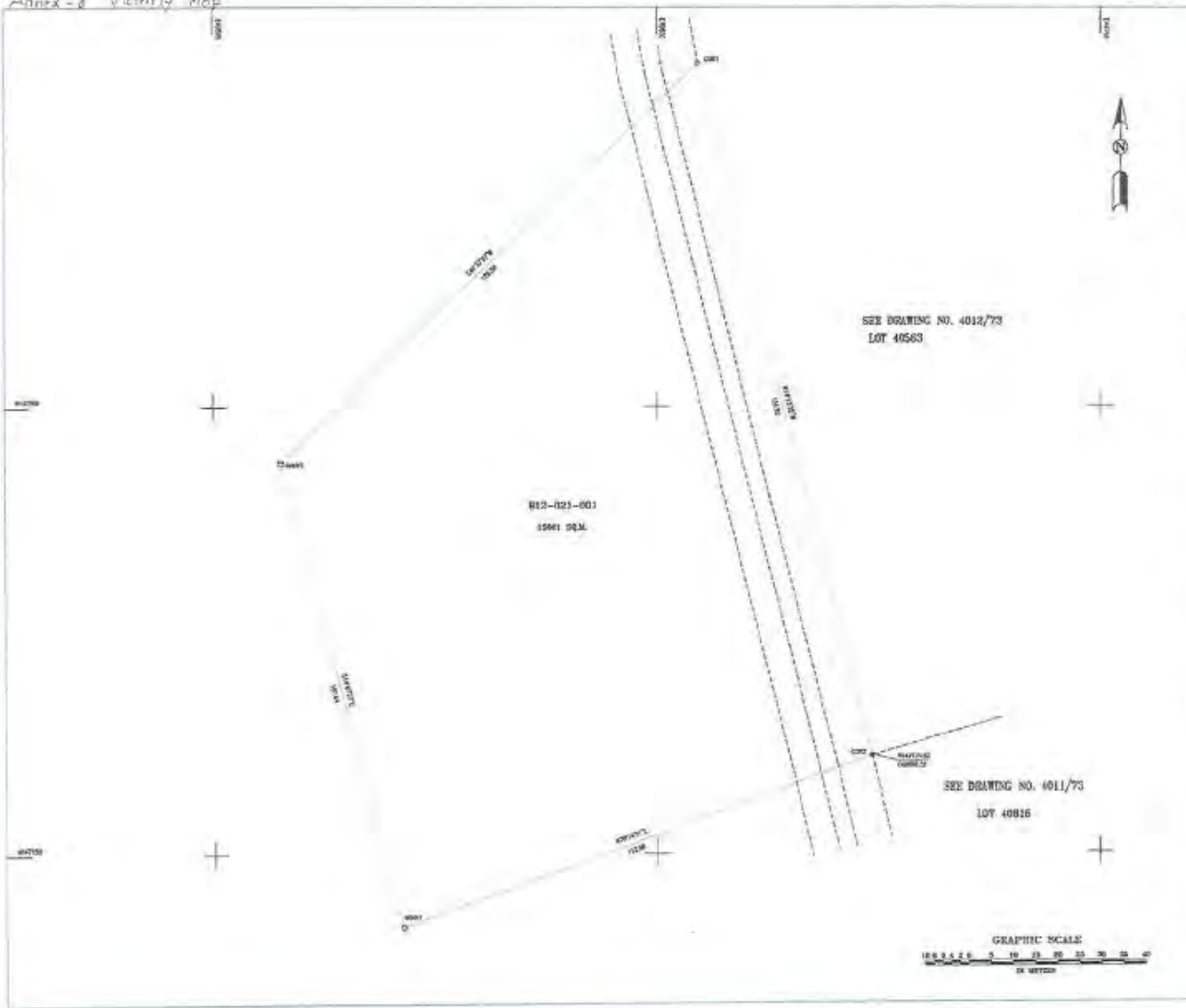
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Annex-F Vicinity Map

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- NOTES**
1. DIMENSIONS ARE REFERRED TO U.S.G.S. (1982) CORNELL POINT OF ORIGIN "MAGNETIC" BY "N 120°00' 00" E 20.000 M.
  2. ALL DIMENSIONS ARE BASED ON GRID NORTH.
  3. ...
  4. ...
  5. Corner height = 2.5 mm, distance between line = 5 mm, height of "LEGS" & "LEGEND" = 5 mm, distance between line to "LEGEND" = 10 mm.
- LEGEND**
- CONCRETE MONUMENT POINT
  - SUR SET
  - ROAD PAVEMENT
  - ROAD SET
  - COMPUTED CORNER
  - SHORELINE

REPUBLIC OF MALAYSIA  
KEDAH STATE GOVERNMENT  
KEDAH STATE PUBLIC LAND AUTHORITY

KEDAH STATE MALAKAL ISLAND  
MALAKAL MARKET LAND REGISTRATION AREA NO. IV

BMIC  
**SUBMERGE**

APPROVED BY:  DEPUTY LAND OFFICER  SAC

APPROVED BY:  CHIEF PLANNING ENGINEER  SAC

DATE OF ISSUE	20/1/14
DATE OF REVIEW	20/1/14
DATE OF ISSUE	20/1/14
DATE OF REVIEW	20/1/14

**B12-021**

*SL*



**Project Monitoring Report**  
 on  
**Project Name**  
**Grant Agreement No. XXXXXXXX**  
 20XX, Month

**Organization Information**

<b>Authority (Signer of the G/A)</b>	Person in Charge _____ _____ (Division) _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____
<b>Executing Agency</b>	Person in Charge _____ _____ (Division) _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____

**Outline of Grant Agreement:**

<b>Source of Finance</b>	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____
<b>Project Title</b>	
<b>E/N</b>	Signed date: Duration:
<b>G/A</b>	Signed date: Duration:




**1: Project Description**

**1-1 Project Objective**

**1-2 Necessity and Priority of the Project**

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

**1-3 Effectiveness and the indicators**

- Effectiveness by the Project

**2: Project Implementation**

**2-1 Project Scope**

Table 2-1-1a: Comparison of Original and Actual Location

<b>Location</b>	Original: (M/D) Attachment(s):Map	Actual: (PMR and PCR) Attachment(s):Map
-----------------	--------------------------------------	--

Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
(M/D)  'Soft component' shall be included in 'Items'.	(M/D)	(PMR and PCR)  Please state not only the most updated schedule but also other past revisions chronologically. All change of design shall be recorded regardless of its degree.




2-1-2 Reason(s) for the modification if there have been any.

(PMR and PCR)

2-2 Implementation Schedule

2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
[M/D]	(M/D)		(PMR,PCR) As of (Date of Revision)
'Soft component' shall be stated in the column of 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Project Completion Date*			

\*Project Completion was defined as \_\_\_\_\_ at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

(PMR and PCR)

2-3 Undertakings by each Government

2-3-1 Major Undertakings

See Attachment 2.

2-3-2 Activities

See Attachment 3.

2-3-3 Report on RD

See Attachment 4.

2-4 Project Cost

2-4-1 Project Cost

Table 2-3-1 Comparison of Original and Actual Cost by the Government of Japan  
 (Confidential until the Tender)

Items	Original		Actual	Cost (Million Yen)	
	Original	Actual		Original	Actual
Construction Facilities	'Soft component' shall be included in 'Items'.				Please state not only the most

(or Equipment)				updated schedule but also other past revisions chronologically.
Consulting Services	- Detailed design -Procurement Management -Construction Supervision			
Total				

Note: 1) Date of estimation:  
 2) Exchange rate: 1 US Dollar = Yen

Table 2-3-2 Comparison of Original and Actual Cost by the Government of XX

Items			Cost (Million USD)	
	Original	Actual	Original	Actual
	'Soft component' shall be included in 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Total				

Note: 1) Date of estimation:  
 2) Exchange rate: 1 US Dollar = (local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR, PCR)

2-5 Organizations for Implementation

2-5-1 Executing Agency:

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: (M/D)




Actual, if changed: (PMR and PCR)

**2-6 Environmental and Social Impacts**  
 Report based on the agreed environmental checklist and monitoring form (See Attachment 4)

**3: Operation and Maintenance (O&M)**

**3-1 O&M and Management**  
 - Organization chart of O&M  
 - Operational and maintenance system (structure and the number ,qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

Original: (M/D)
Actual: (PCR)

**3-2 O&M Cost and Budget**  
 - The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

Original: (M/D)

**4: Precautions (Risk Management)**

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): (M/D)	
Potential Project Risks	Assessment
1.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:

	Action during the Implementation:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: H/M/L Impact: H/M/L Analysis of Probability and Impact: Mitigation Measures: Action during the Implementation: Contingency Plan (if applicable):
3. (Description of Risk)	Probability: H/M/L Impact: H/M/L Analysis of Probability and Impact: Mitigation Measures: Action during the Implementation: Contingency Plan (if applicable):
<b>Actual issues and Countermeasure(s)</b> (PMR and PCR)	

**5: Evaluation at Project Completion**

**5-1 Overall evaluation**

Please describe your evaluation on the overall outcome of the Project.

(PCR)

**5-2 Lessons Learnt and Recommendations**

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and

assurance of sustainability.

(PCR)



Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Monitoring report on environmental and social considerations
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)  
(Completion Report Only)





(4) -2 : Explanation of Draft preparatory survey report

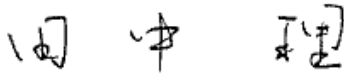
**Minutes of Discussions  
on the Preparatory Survey for  
the Project for Renovation of Palau Mariculture Demonstration Center Facility  
(Explanation on Draft Preparatory Survey Report)**

On the basis of the discussions and field survey in the Republic of Palau (hereinafter referred to as "Palau") in November and December, 2015, and the subsequent technical examination of the results in Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a draft Preparatory Survey Report on the Project for Renovation of Palau Mariculture Demonstration Center Facility (hereinafter referred to as "the Draft Report").

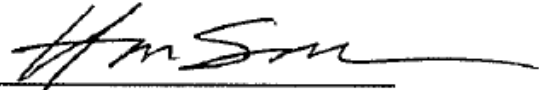
In order to explain the Draft Report and to consult with the concerned officials of the Government of Palau on the Outline Design and other contents, JICA sent the Preparatory Survey Team to Palau for the explanation of the Draft Report (hereinafter referred to as "the Team"), headed by Mr. Osamu Tanaka, Advisor to Director for Team 2 of Rural Development Department, and is scheduled to stay in the country from 3rd to 7th July, 2016.

As a result of the discussions, both sides confirmed the main items described in the attached sheets.

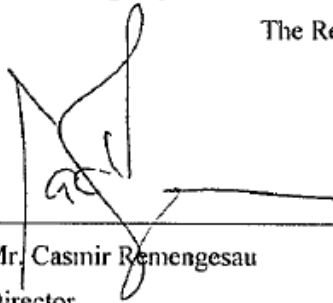
Koror, 7th July, 2016



Mr. Osamu Tanaka  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency  
Japan



Mr. F. Umiich Sengebau  
Minister  
Ministry of Natural Resources,  
Environment and Tourism  
The Republic of Palau



Mr. Casmir Remengesau  
Director  
Bureau of Budget and Planning  
Ministry of Finance  
The Republic of Palau

## ATTACHEMENT

### 1. Objective of the Project

The both sides confirmed that the objective of the Project is to strengthen the functions of the Palau Mariculture Demonstration Center (PMDC) through renovation of the facilities and equipment, thereby contributing to promotion of giant clam culture.

### 2. Contents of the Draft Report

After the explanation of the contents of the Draft Report by the Team, the Palauan side agreed in principle to the Outline Design and other contents.

### 3. Cost Estimation

Both sides confirmed that the Project cost estimation described in the Draft Report was provisional and would be examined further by the Government of Japan for its final approval.

### 4. Confidentiality of the Cost Estimation and Specifications

Both sides confirmed that the Project cost estimation and technical specifications in the Draft Report should never be duplicated or disclosed to any third parties until all the contracts of the Project are concluded.

### 5. Japan's Grant Aid Scheme

The Palauan side understands the Japan's Grant Scheme and its procedures as described in Annex 2, Annex 3 and Annex 4, and necessary measures to be taken by the Government of Palau as described in Annex 7.

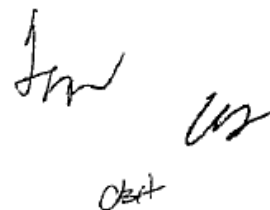
### 6. Project Implementation Schedule

The Team explained to the Palauan side that the expected implementation schedule is as attached in Annex 5.

### 7. Expected Outcomes and Indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Palauan side has responsibility to monitor the progress of the indicators and achieve the target in year 2021.

#### 7-1. Quantitative Effects

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Indicators	Base (2015)	Target (2021) (3 years after the completion of the Project)
Survival rate during the second stage*	—	80%**
Number of seeds of giant clams produced annually	32,869***	112,000

\*Primal rearing period after being transferred from the larval tank.

\*\*This indicator is applied only to the species for food.

\*\*\*The number of giant clams distributed in 2015.

#### 7-2. Qualitative Effects

- The giant clam farmers are more satisfied with the seeds produced in PMDC.
- PMDC contributes to awareness raising for marine resource conservation.

#### 8. Environmental and Social Considerations

- 8-1. The Palauan side confirmed to give due environmental and social considerations during implementation of and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).
- 8-2. The Palauan side confirmed to conduct the necessary procedures to obtain construction permit for the Project. The permit application shall be submitted to the Environmental Quality Protect Board (EQPB) by the beginning of December, 2016.
- 8-3. Bureau of Marine Resources (BMR) as responsible agency for conducting the Environmental Assessment (EA) for the Project, if it is required, shall promptly initiate the EA process and obtain an environmental permission from the Palauan authorities concerned by one (1) month before the tender for contractor of the Project. This environmental permission is a condition for obtaining a construction permit from the local authority.
- 8-4. Both sides confirmed environmental monitoring will be conducted by BMR in accordance with the Environmental Monitoring Plan and by using the proposed Monitoring Form as described in the Draft Report.
- 8-5. Both sides confirmed information on environmental and social considerations including major impacts and relevant mitigation measures are summarized in the Inspection and Monitoring Form obtained from EQPB (attached as Annex 6). There will possibly be other monitoring indicators to be added upon receiving the environmental permission if EQPB finds other additional environmental concerns for the construction. The Palauan side confirmed that they will inform JICA of any major changes which may affect environmental and social considerations made for the Project by revising the Inspection and Monitoring Form in a timely manner.

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- 8-6. The Palauan side confirmed that the results of environmental monitoring will be provided to JICA as a part of Project Monitoring Report (PMR) by attaching the Inspection and Monitoring Form as per Annex 6 on a quarterly basis until the completion of the Project, provided that there is no outstanding issue regarding the environmental and social considerations during operation of the Project.
- 8-7. In case JICA finds that there is a need for improvement in a situation with respect to environmental considerations after the agreed monitoring period, JICA may request to extend the period of monitoring and reporting until JICA confirms the issues have been properly solved in accordance with the agreement between the Palauan side and JICA.
- 8-8. The Palauan side confirmed it will take stipulated procedures for information disclosure in accordance with the relevant laws and regulations. In addition, the Team requested the Palauan side to disclose the monitoring results to local stakeholders, and the Palauan side agreed to disclose monitoring results in their field offices.
- 8-9. The Palauan side agreed JICA's disclosure of provided monitoring results in the proposed Monitoring Form as described in the Draft Report on their website.
- 8-10. Both sides confirmed the land settlement agreement of PMDC concluded in 1997 between the National Government of Palau and the Koror State Government (hereinafter referred to as "KSG").

#### 9. Undertakings Taken by the Both Sides

Both sides confirmed undertakings described in Annex 7. The Palauan side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at the Outline Design level. Contents of Annex 7 will be updated and will finally be the Attachment to the Grant Agreement.

#### 10. Monitoring during the Implementation

PMR will be prepared by the Palauan side for confirming the outline and progress of the Project. BMR agreed to submit PMR to JICA every three (3) months during the Project implementation. The proposed format of PMR is attached as Annex 8.

#### 11. Ex-Post Evaluation

JICA will conduct ex-post evaluation three (3) years after the Project completion with respect to five evaluation criteria (Appropriateness, Impact, Effectiveness, Efficiency, Sustainability) of the Project. Result of the evaluation will be publicized. The Palauan side shall provide necessary support for the ex-post evaluation.

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## 12. Schedule of the Preparatory Survey

JICA will complete the final report in accordance with the confirmed items and send it to the Palauan side by the end of September, 2016.

## 13. Other Relevant Issues

### 13-1. Site Clearance

(1) The Palauan side shall demolish and remove any remains including the existing buildings, facilities, foundations, cultivating tanks, icebox building and other obstacles such as elevated tank, trees, etc at its own expense. The completion of the removal is a prerequisite for the tendering procedure and shall be done by the end of December, 2016.

(2) In case any structures are found to be remaining during the construction, the Palauan side shall take prompt actions in accordance with the relevant laws and regulations in order for smooth implementation of the Project.

### 13-2. Necessary Approval of Construction of the Facilities

The Palauan side shall follow necessary procedures for obtaining approval for the construction of the facilities in the Project as follows;

(1) Ministry of Natural Resources, Environment and Tourism (hereinafter referred to as "MNRET") submits the draft Outline Design to Capital Improvement Project (CIP), Ministry of Public Infrastructure, Industries and Commerce (MPIIC) for their review and recommendations (expected in July, 2016).

(2) MNRET submits the detailed drawings of architecture and the cost estimate to the KSG to start the building permit application process (expected in December, 2016).

(3) MNRET shall prepare an EA for the Project if EQPB deems it is necessary by February, 2017.

(4) Issuance of building permit by the KSG is expected in March, 2017.

The Palauan side agreed to obtain all the necessary approval required under the laws and regulations of Palau from relevant authorities prior to the signing of the contract agreement for construction of the Project facilities.

### 13-3. Securing Budget by the Government of Palau for the Project

The Palauan side shall secure necessary budget to cover the cost for taking necessary major undertakings to be covered by the Palauan side for the Project as per Annex 7.

### 13-4. Customs Duties and Tax Exemption

The taxes including customs duties, and any other taxes and levies in Palau which are to arise from the Project activities will be exempted by the Palauan side. MNRET will take procedures necessary for the tax exemption with the Ministry of Finance on its

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responsibility.

13-5. Efficient Project Management

The Palauan side shall take a coordination role for the Project implementation particularly in relation to other projects as the site area and the access routes to the site are narrow.

13-6. Operation and Maintenance of Facilities and Equipment

The allocation of necessary human resources such as engineers and technicians is indispensable for effective operation and maintenance of the facilities and equipment. BMR shall appoint the sufficient number of qualified and enthusiastic human resources at an earlier stage for ensuring technical sustainability.

13-7. Actions to be Taken for Achieving the Objective of the Project

MNRET shall take necessary actions;

- (1) to promote the giant clam production for the aquarium markets; and
- (2) to support new farmers of giant clams so that more than two thirds of them can sustain the grow-out production.

13-8. Conservation of Wild Giant Clams and Protection of the Farms

The Palauan side shall urge itself to implement effective measures for banning trade of wild giant clams and for prevention of cultured giant clams from theft including imposing obligation of recording purchase of giant clams and prohibition of purchasing giant clams from non-registered farmers.

13-9. Awareness Raising

- (1) BMR shall assign necessary staff and allocate financial resources for effective awareness raising for marine resource conservation.
- (2) BMR shall strengthen its awareness raising activities for marine resource conservation, in collaboration with other governmental bodies if applicable.

13-10. Recording

BMR shall keep records of production of the seeds of giant clams (particularly the survival rates and the number of produced seeds) in order to monitor the achievement of the Project.

13-11. Safety Management

The Palauan side shall enforce compliance with laws and regulations effective in Palau regarding safety management upon its personnel.

13-12. Disclosure of Information

Both sides confirmed that the results of the Preparatory Survey except the Project costs will be disclosed to the public after completion of the Preparatory Survey.

Annex 1 Project Cost Estimation

Annex 2 Japan's Grant Aid

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- Annex 3 Flow Chart of Japan's Grant Aid Procedures
- Annex 4 Financial Flow of Japan's Grant Aid
- Annex 5 Implementation Schedule
- Annex 6 Inspection and Monitoring Form
- Annex 7 Major Undertakings to be Taken by Each Government
- Annex 8 Project Monitoring Report (template)

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Annex 1 : Project cost estimation

(1) Project cost to be borne by Japan's grant aid

This part is closed due to the confidentiality.

(2) Project cost to be borne by the Palauan side

**(2) Project Cost to be Borne by the Palauan side**

Category	Cost (US\$)	(Million JPY)
1) Demolish and removal work for structures existing in the construction site	70,000	(8.5)
2) Acquisition of furniture and office supplies	16,700	(2.0)
3) Bank transfer and handling fees	5,600	(0.7)
4) Environmental impact fee (0.15% of the total construction costs)	7,400	(0.9)
Total	99,700	(12.1)

※Conditions of Estimate

- 1) Time of estimate December, 2015
- 2) Exchange rate US\$1.00 = 121.93 JPY
- 3) Construction period The time schedule for carrying out the detailed design and construction is shown on the Project Implementation Schedule.

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## JAPANESE GRANT

Based on the Act of the Incorporated Administrative Agency - Japan International Cooperation Agency—which came into effect on October 1, 2008, JICA became the executing agency of the Japanese Grant for Projects for construction of facilities, purchase of equipment, etc.

The Japanese Grant (hereinafter referred to as the “Grant”) is non-reimbursable fund provided to a recipient country to procure facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant is not supplied through the donation of materials as such.

### 1. Grant Procedures

The Grant is supplied through following procedures :

- Preparatory Survey
  - The Survey conducted by JICA
- Appraisal & Approval
  - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
  - The Notes exchanged between the GOJ and the recipient country
- Grant Agreement (hereinafter referred to as “the G/A”)
  - Agreement concluded between JICA and the recipient country
- Implementation
  - Implementation of the Project on the basis of the G/A

### 2. Preparatory Survey

#### (1) Contents of the Preparatory Survey

The aim of the Preparatory Survey (hereinafter referred to as “Survey”) is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA.

The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of the relevant agencies of the recipient country necessary for the implementation of the Project.

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JICA  
US  
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- Evaluation of the appropriateness of the Project to be implemented under the Grant scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both JICA and the recipient country concerning the basic concept of the Project.
- Preparation of an Outline Design of the Project.
- Estimation of costs of the Project.

The contents of the original request made by the recipient country are not necessarily approved in their initial form as the contents of the Grant Project. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

#### (2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

#### (3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

### 3. Japanese Grant Scheme

#### (1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles, in accordance with the E/N, to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country and procurement conditions.

*JICA*  
*USA*  
*CHA*

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project implementation after the E/N and G/A.

(3) Eligible Source Country

Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. The Grant may be used for the purchase of the products or services of a third country, if necessary, taking into account the quality, competitiveness and economic rationality of products and services necessary for achieving the objective of the Project. However, the prime contractors, namely constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals" in principle.

(4) Necessity of Verification

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals in principle. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major Undertakings to be Taken by the Government of the Recipient Country

In the implementation of the Grant Project, the recipient country is required to undertake such necessary measures as Annex 8. The Japanese Government requests the Government of the recipient country to exempt all customs duties, internal taxes and other fiscal levies such as value added tax, commercial tax, income tax, corporate tax, resident tax, fuel tax which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract, since the Grant comes from the Japanese taxpayers.

(6) Proper Use

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant.

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(7) Export and Re-export

The products purchased under the Grant should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank") in principle. JICA will execute the Grant by making payments in Japanese yen in principle, to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.
- b) The payment will be made when a payment request is presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

The Government of the recipient country must carefully consider social and environmental impacts created by the Project and must comply with the environmental regulations of the recipient country and JICA's guidelines for environmental and social considerations.

(11) Monitoring

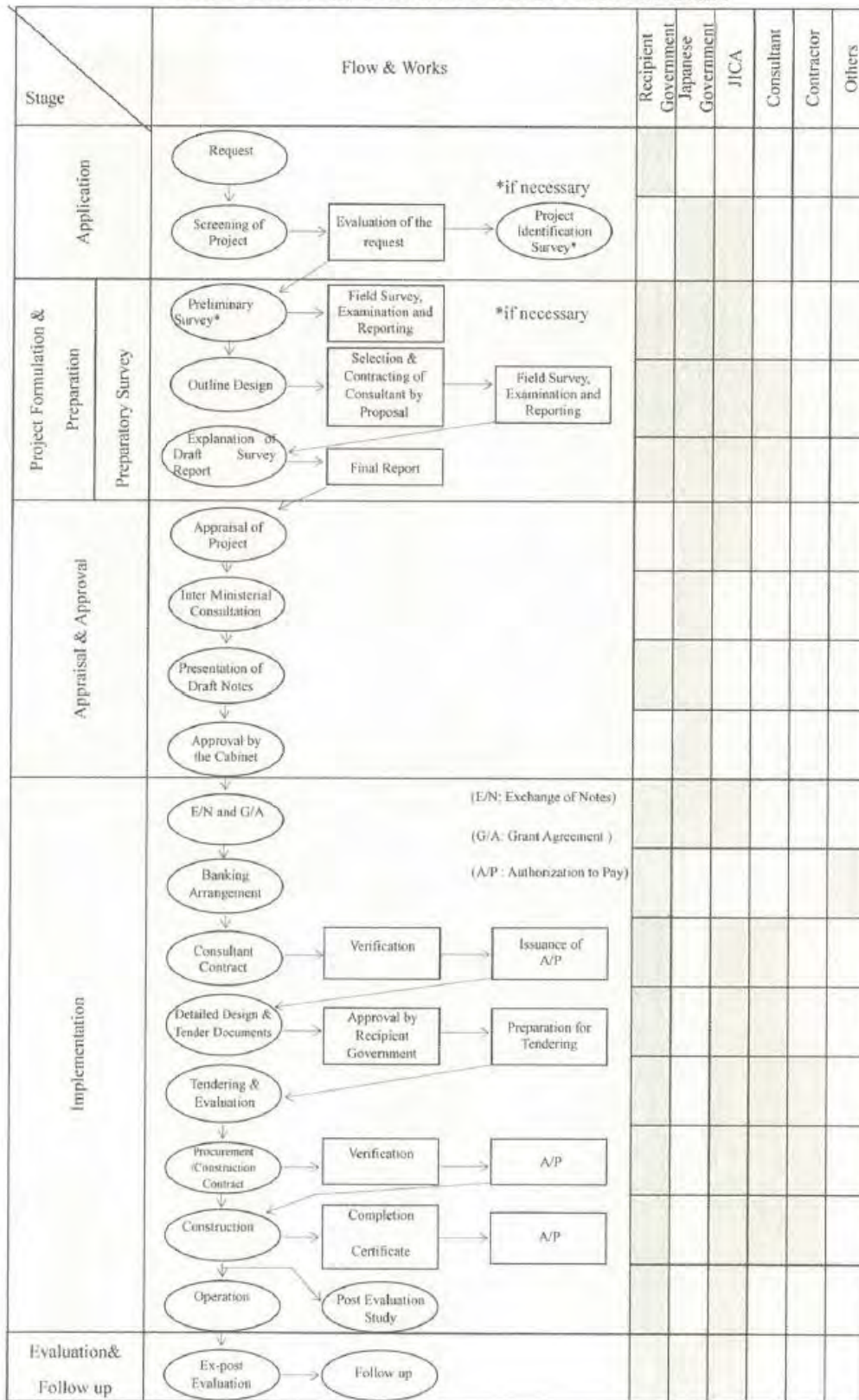
The Government of the recipient country must take their initiative to carefully monitor the progress of the Project in order to ensure smooth implementation as part of their responsibility defined in the G/A, and must regularly share the progress status with JICA by Project Monitoring Report (PMR).

(12) Safety Measures

The Government of the recipient country must ensure that the safety is strictly observed during the implementation of the Project.

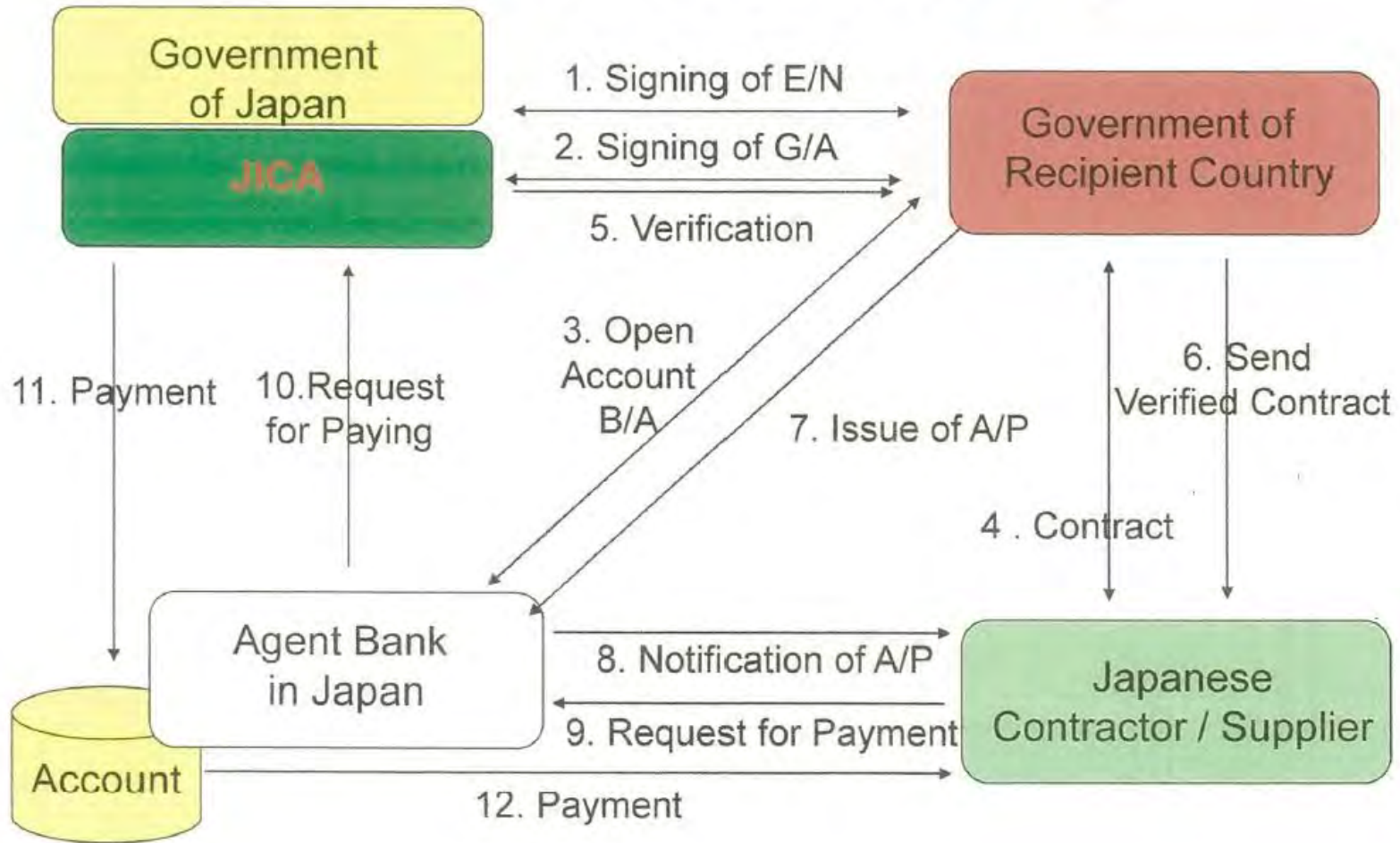
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FLOW CHART OF JAPANESE GRANT PROCEDURES



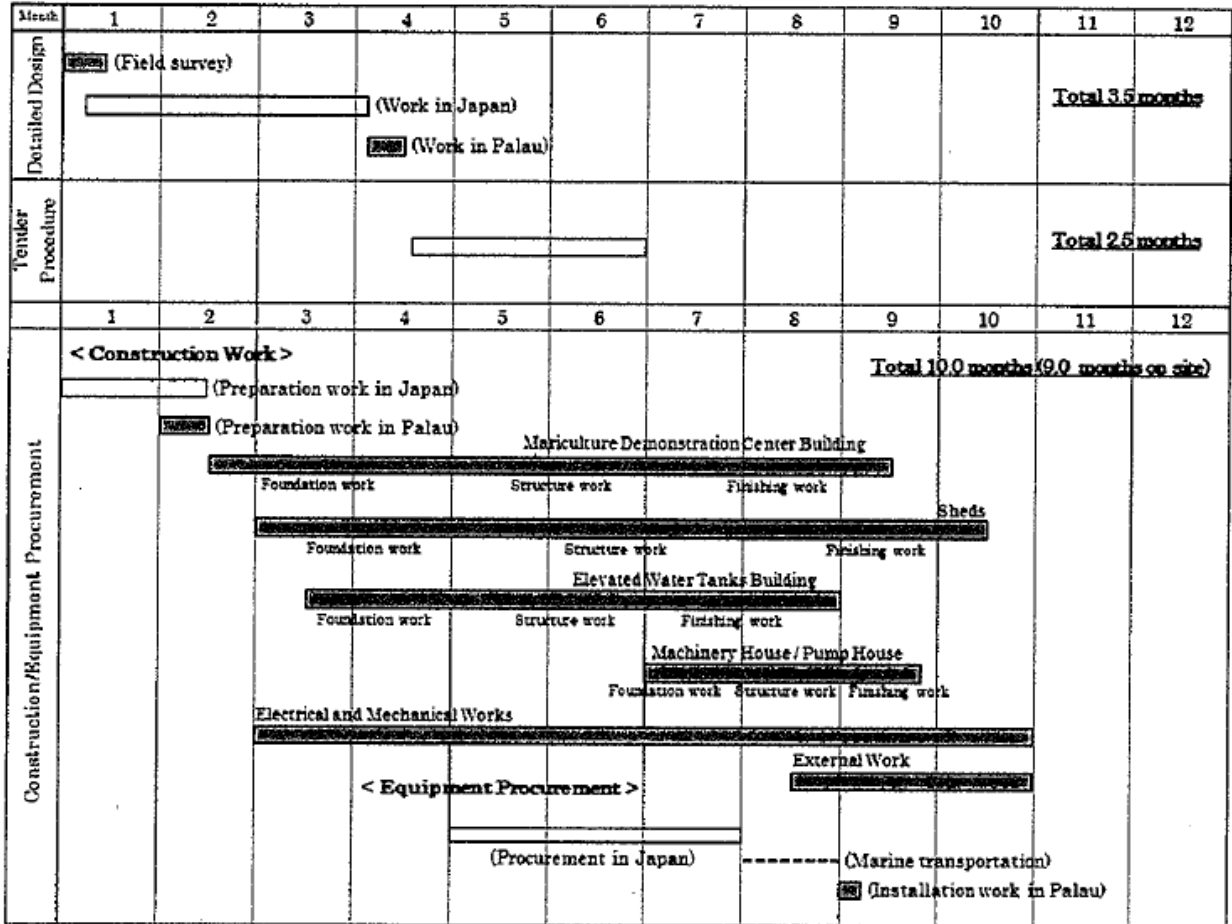
*For Us*  
*OSI*

# Financial Flow of Japan's Grant Aid



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Implementation Schedule



*From US*  
*AKH*

**EXHIBIT 4**  
**EROSION & SEDIMENTATION CONTROL – INSPECTION AND MONITORING FORM**

*To be filled out by inspector weekly and after each significant storm for the appropriate project controls.*

Date: \_\_\_\_\_

Inspector: \_\_\_\_\_

Location of Potential Erosion, Sedimentation, Blockage or Damage	Evidence of Erosion, Overflow, Blockage or Damage?		Erosion/Sedimentation Controls Functioning Properly?		Describe Condition and Recommend Corrective Action
	Yes	No	Yes	No	
Silt Curtains/Fences					
Sediment Traps					
Drainage Ditches/Swales					
Culverts/Storm Drains/Catch Basins					
Roads					
Slope/Berms					
Coverings/Surface Protection/Vegetation					
Discharge Points/Outfalls					

- Appendices 54 -

Annex 6

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*To be filled out by person responsible for erosion control plan:*

Have corrective action(s) been implemented to correct deficiencies noted during inspection? Yes ( ) No ( )

Date(s) corrective action(s) completed: \_\_\_\_\_



## Major Undertakings to be Taken by Each Government

No	Items	Responsibility		Major Undertaking to be taken by Recipient side			
		To be covered by Grant Aid	To be covered by Recipient Side	Deadline	in charge	Cost	Remarks
<b>Before the Tender</b>							
1	To approve IEE/EIA		•	Within 1 month after G/A	MNRET		
2	To implement EIA		•	Before start of the construction	MNRET		
3	To open Bank Account (Banking Arrangement (B/A))		•	Within 1 month after G/A	MOF		
4	To secure the following lands;						
	1) Project site		•	Before notice of the tender document	MNRET		
	2) Temporary construction yard and stock yard near the Project area		•	Before notice of the tender document	MNRET		
	3) Borrow pit and disposal site near the Project area		•	Before notice of the tender document	MNRET		
5	To obtain the planning, zoning, building permit		•	Before notice of the tender document	MNRET		
6	To clear, level and reclaim the following sites;						
	1) Remove utilities		•	Before notice of the tender document	MNRET		
	2) Demolition of unnecessary existing facilities including the icebox building, office, clam hatchery, culture tanks and other structures		•	Before notice of the tender document	MNRET		
	3) Removal of unnecessary existing trees		•	Before notice of the tender document	MNRET		
	4) Leveling and reclaiming the sites for the building		•	Before notice of the tender document	MNRET		
<b>During the Project Implementation</b>							
7	To bear the following commissions to a bank of Japan for the banking services based upon the B/A						
	1) Advising commission of A/P		•	Within 1 month after the signing	MOF		

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				of the contract every payment	MOF		
	2) Payment commission for A/P		•				
8	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products						
	1) Marine (Air) transportation of the Products from Japan to the recipient country	•		During the Project	Contractor, Supplier(s)		
	2) Tax exemption and customs clearance of the products at the port of disembarkation		•	During the Project	MNRET		
	3) Internal transportation from the port of disembarkation to the project site	•		During the Project	Contractor, Supplier(s)		
9	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•		MNRET		
10	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted. Such customs duties, internal taxes and other fiscal levies mentioned above include commercial tax, income tax and corporate tax of Japanese nationals, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•	During the Project	MOF MNRET		
11	To bear all the expenses, other than those to be borne by the Grant Aid		•		MNRET		
12	To construct the following facilities						
	1) The buildings (Mariculture Promotion Center Building, Sheds, Machinery house)	•			Contractor		
	2) Renovation of Quay Steps	•			Contractor		
	3) The gates and fences in and around the site	•			Contractor		
	4) The parking lot and other auxiliary facilities	•			Contractor		
	5) The road within the site	•			Contractor		
13	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites.						
	1) Electricity						
	a. The distributing power line to the site		•	Before start of the construction	MNRET		
	b. The drop wiring and internal wiring within the site	•			Contractor		
	c. The main circuit breaker and transformer	•			Contractor		
	2) Water Supply						

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	a. The city water distribution main to the site		•	6 months Before completion of the construction	MNRET		
	b. The water supply system within the site (receiving and elevated tanks)	•			Contractor		
	3) Drainage						
	a. The drainage system (for common waste, storm drainage and others) within the site	•			Contractor		
	4) Telephone System						
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		•		MNRET		
	b. The MDF and the extension after the frame/panel	•			Contractor		
	5) Furniture and Equipment						
	a. General furniture		•	1 month Before completion of the construction	MNRET		
	b. Project equipment	•			Contractor		
14	To submit environmental monitoring report to JICA Palau Office	•	•	During the Project	MNRET Contractor		
<b>After the Project</b>							
15	To ensure that the Facilities and the products be maintained and used properly and effectively		•		MNRET		
16	To bear all the expenses, other than those covered by the Grant Aid, necessary for the operation of the completed facilities		•		MNRET		
17	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid						
	1) Allocation of maintenance cost		•	After completion of the construction	MNRET		
	2) Operation and maintenance structure and staff		•	After completion of the construction	MNRET		
	3) Routine check/periodical maintenance		•	After completion of the construction	MNRET		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

\*; The cost estimates are provisional. This is subject to the approval of the Government of Japan.

MOF: Ministry of Finance

MNRET: Ministry of Natural Resources, Environment and Tourism

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 MKT

**Project Monitoring Report**  
 on  
**Project Name**  
**Grant Agreement No. XXXXXXXX**  
 20XX, Month

**Organization Information**

<b>Authority (Signer of the G/A)</b>	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
<b>Executing Agency</b>	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

**Outline of Grant Agreement:**

<b>Source of Finance</b>	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____
<b>Project Title</b>	
<b>E/N</b>	Signed date: Duration:
<b>G/A</b>	Signed date: Duration:

*For UJ*  
*at*

**1: Project Description**

**1-1 Project Objective**

[Empty box for Project Objective]

**1-2 Necessity and Priority of the Project**

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

[Empty box for Necessity and Priority of the Project]

**1-3 Effectiveness and the indicators**

- Effectiveness by the Project

[Empty box for Effectiveness and the indicators]

**2: Project Implementation**

**2-1 Project Scope**

Table 2-1-1a: Comparison of Original and Actual Location

<b>Location</b>	<b>Original: (M/D)</b> Attachment(s):Map	<b>Actual: (PMR and PCR)</b> Attachment(s):Map
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Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
(M/D)  'Soft component' shall be included in 'Items'.	(M/D)	(PMR and PCR)  Please state not only the most updated schedule but also other past revisions chronologically. All change of design shall be recorded regardless of its degree.

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2-1-2 Reason(s) for the modification if there have been any.

(PMR and PCR)

2-2 Implementation Schedule

2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
[M/D]  'Soft component' shall be stated in the column of 'Items'.  Project Completion Date*	(M/D)		(PMR,PCR) As of (Date of Revision)  Please state not only the most updated schedule but also other past revisions chronologically.

\*Project Completion was defined as \_\_\_\_\_ at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

(PMR and PCR)

2-3 Undertakings by each Government

2-3-1 Major Undertakings  
 See Attachment 2.

2-3-2 Activities  
 See Attachment 3.

2-3-3 Report on RD  
 See Attachment 4.

2-4 Project Cost

2-4-1 Project Cost

Table 2-3-1 Comparison of Original and Actual Cost by the Government of Japan  
 (Confidential until the Tender)

Items	Cost (Million Yen)			
	Original	Actual	Original	Actual
Construction Facilities	'Soft component' shall be included in 'Items'.			Please state not only the most

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(or Equipment)				updated schedule but also other past revisions chronologically.
Consulting Services	- Detailed design - Procurement Management - Construction Supervision			
Total				

Note: 1) Date of estimation:  
 2) Exchange rate: 1 US Dollar = Yen

Table 2-3-2 Comparison of Original and Actual Cost by the Government of XX

Items			Cost (Million USD)	
	Original	Actual	Original	Actual
	'Soft component' shall be included in 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Total				

Note: 1) Date of estimation:  
 2) Exchange rate: 1 US Dollar = (local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR, PCR)

2-5 Organizations for Implementation

2-5-1 Executing Agency:

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: (M/D)

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Actual, if changed: (PMR and PCR)

- 2-6 **Environmental and Social Impacts**  
 Report based on the agreed the monitoring form (See Attachment 5)

**3: Operation and Maintenance (O&M)**

- 3-1 **O&M and Management**  
 - Organization chart of O&M  
 - Operational and maintenance system (structure and the number ,qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

Original: (M/D)

Actual: (PCR)

- 3-2 **O&M Cost and Budget**  
 - The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

Original: (M/D)

**4: Precautions (Risk Management)**

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): (M/D)	
Potential Project Risks	Assessment
1.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:

*Jan. 1997*  
*CBH*



	Action during the Implementation:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: H/M/L
	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: H/M/L
	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
<b>Actual issues and Countermeasure(s)</b>	
(PMR and PCR)	

**5: Evaluation at Project Completion**

5-1 Overall evaluation  
 Please describe your evaluation on the overall outcome of the Project.

(PCR)

5-2 Lessons Learnt and Recommendations  
 Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and

*For UG*  
*MA*

assurance of sustainability.

(PCR)

*John W*  
*(12)*

Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Monitoring report on environmental and social considerations
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)  
(Completion Report Only)

*Am. UY*  
*1/2/21*