Ministry of Agriculture, Fisheries, Cooperatives, Lands and Housing
Saint Christopher and Nevis

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR CONSTRUCTION
OF
THE BASSETERRE FISHERIES COMPLEX
IN
SAINT CHRISTOPHER AND NEVIS

NOVEMBER 2000

JAPAN INTERNATIONAL COOPERATION AGENCY
PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

In response to a request from the Government of Saint Christopher and Nevis, the Government of Japan decided to conduct a basic design study on the Project for Construction of the Basseterre Fisheries Complex in Saint Christopher and Nevis and entrusted the study to the Japan International Cooperation Agency (JICA).

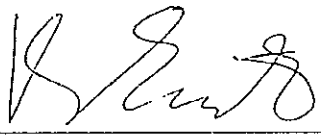
JICA sent to Saint Christopher and Nevis a study team from May 14 to June 24, 2000.

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

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

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

November, 2000



Kunihiko Saito
President
Japan International Cooperation Agency

November, 2000

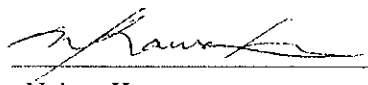
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Construction of Basseterre Fisheries Complex in Saint Christopher and Nevis.

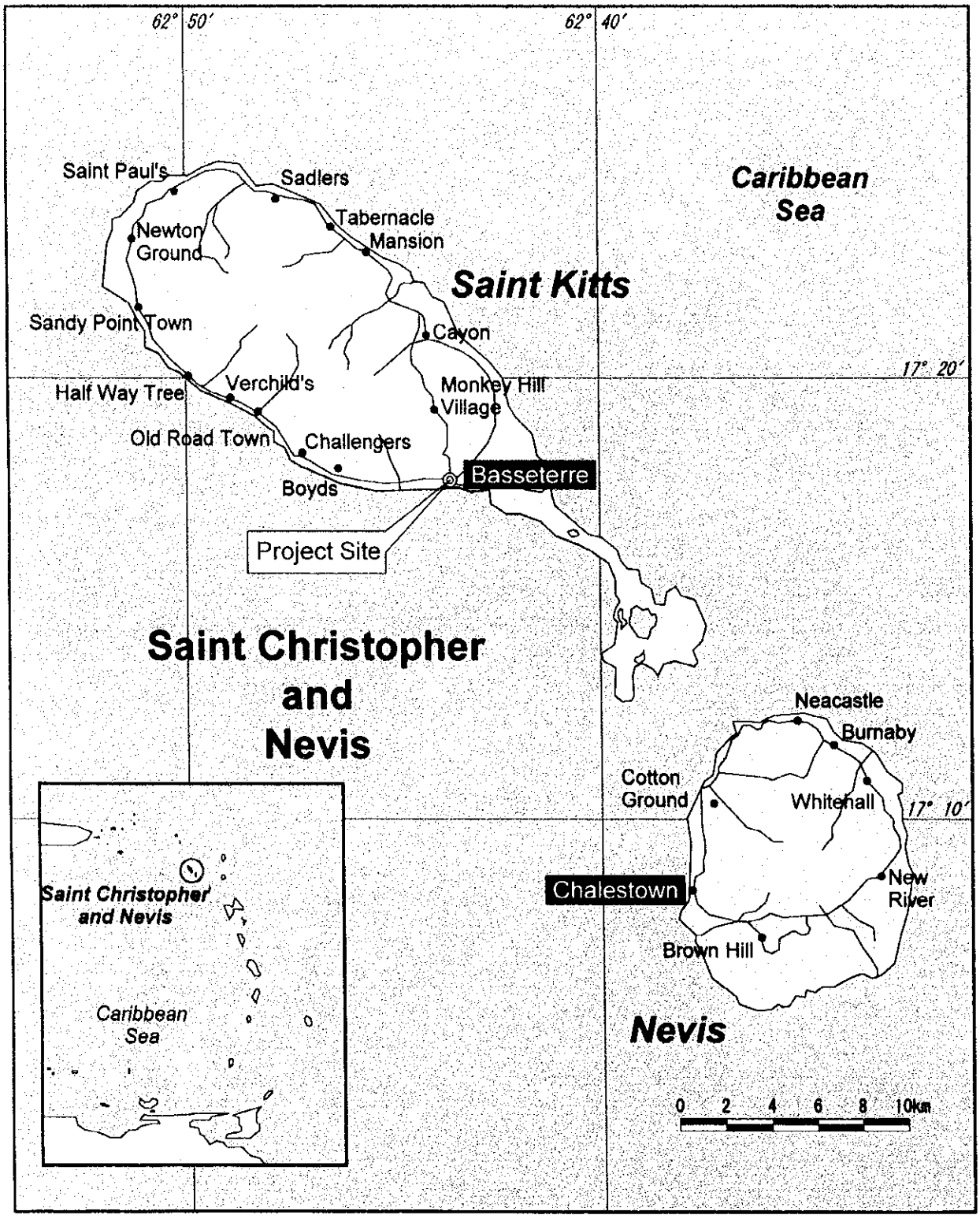
This study was conducted by Pacific Consultants International, under a contract to JICA, during the period from May 2 to November 10, 2000. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Saint Christopher and Nevis and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

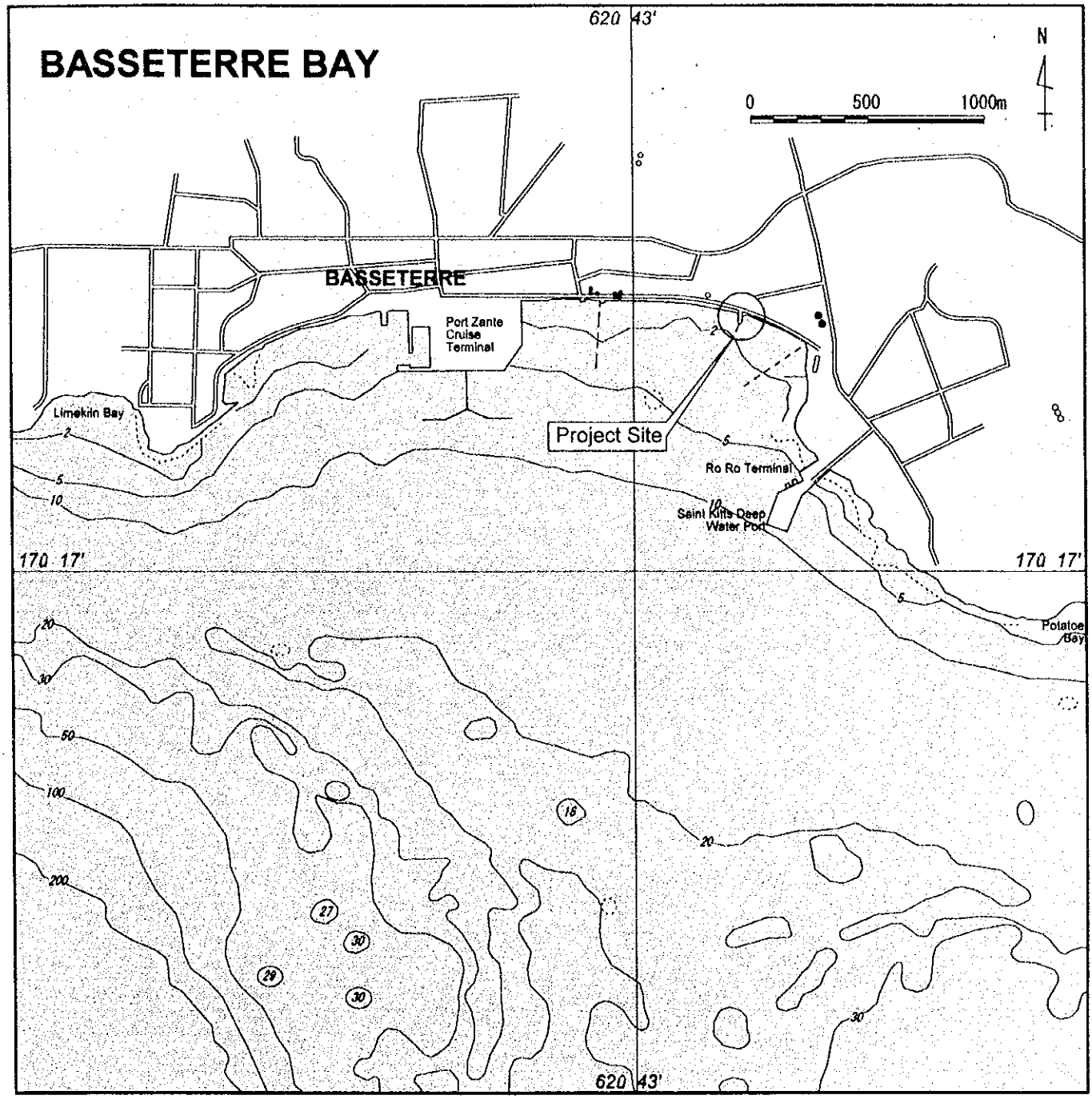
Very truly yours,



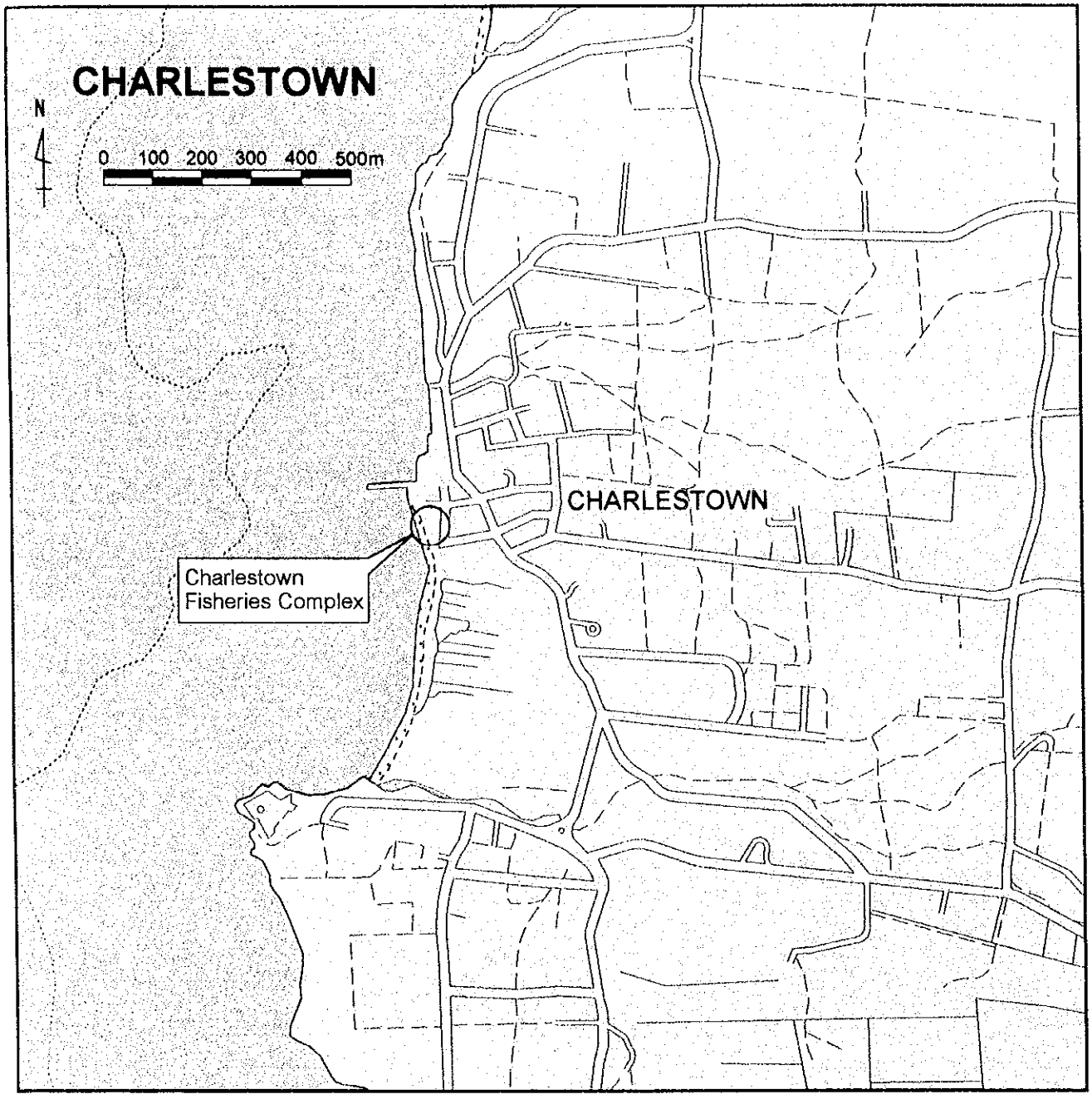
Nobuo Kawamura
Project Manager,
Basic Design Study Team on
the Project for Construction
of Basseterre Fisheries Complex
in Saint Christopher and Nevis
Pacific Consultants International



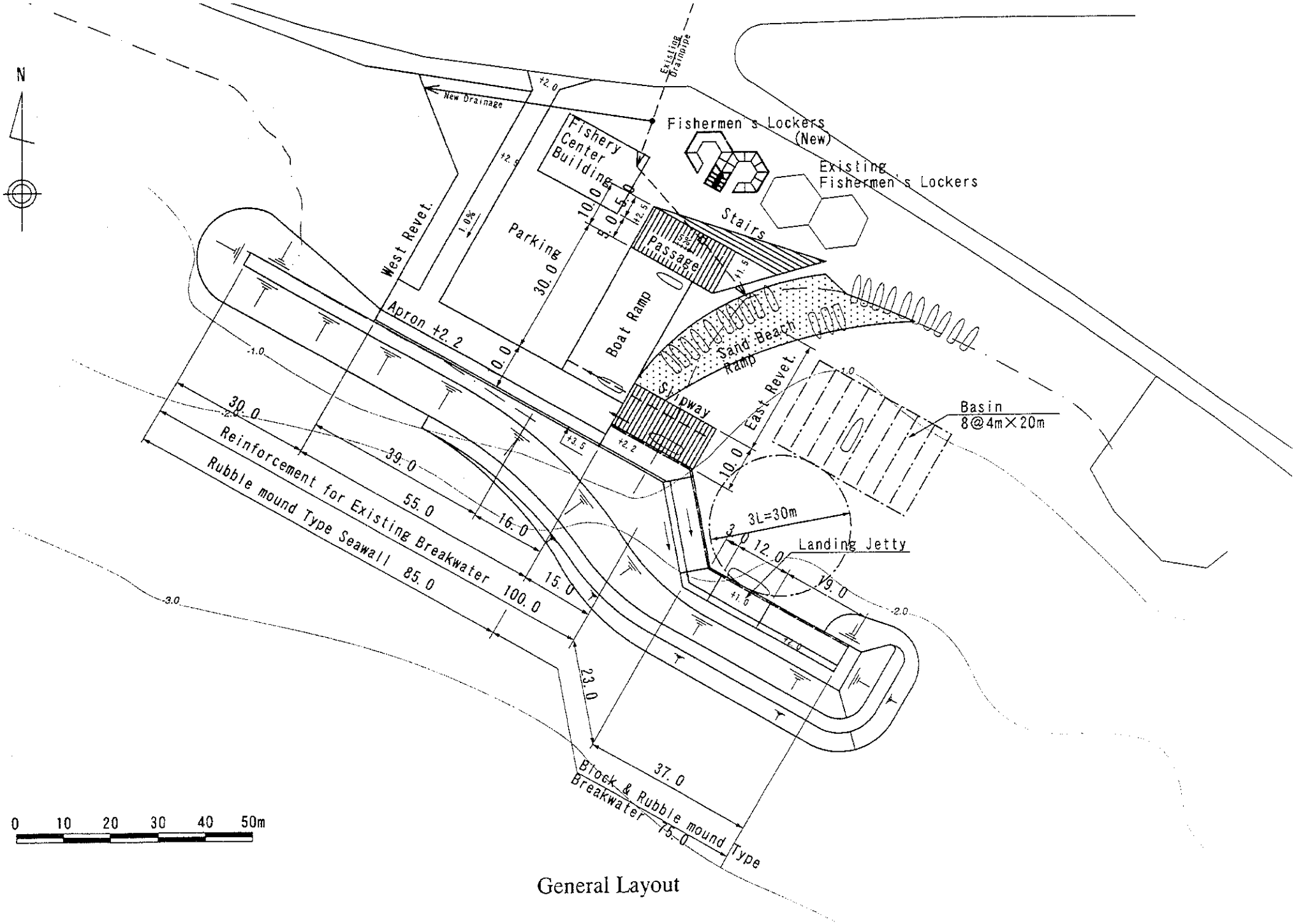
Location of Saint Christopher and Nevis



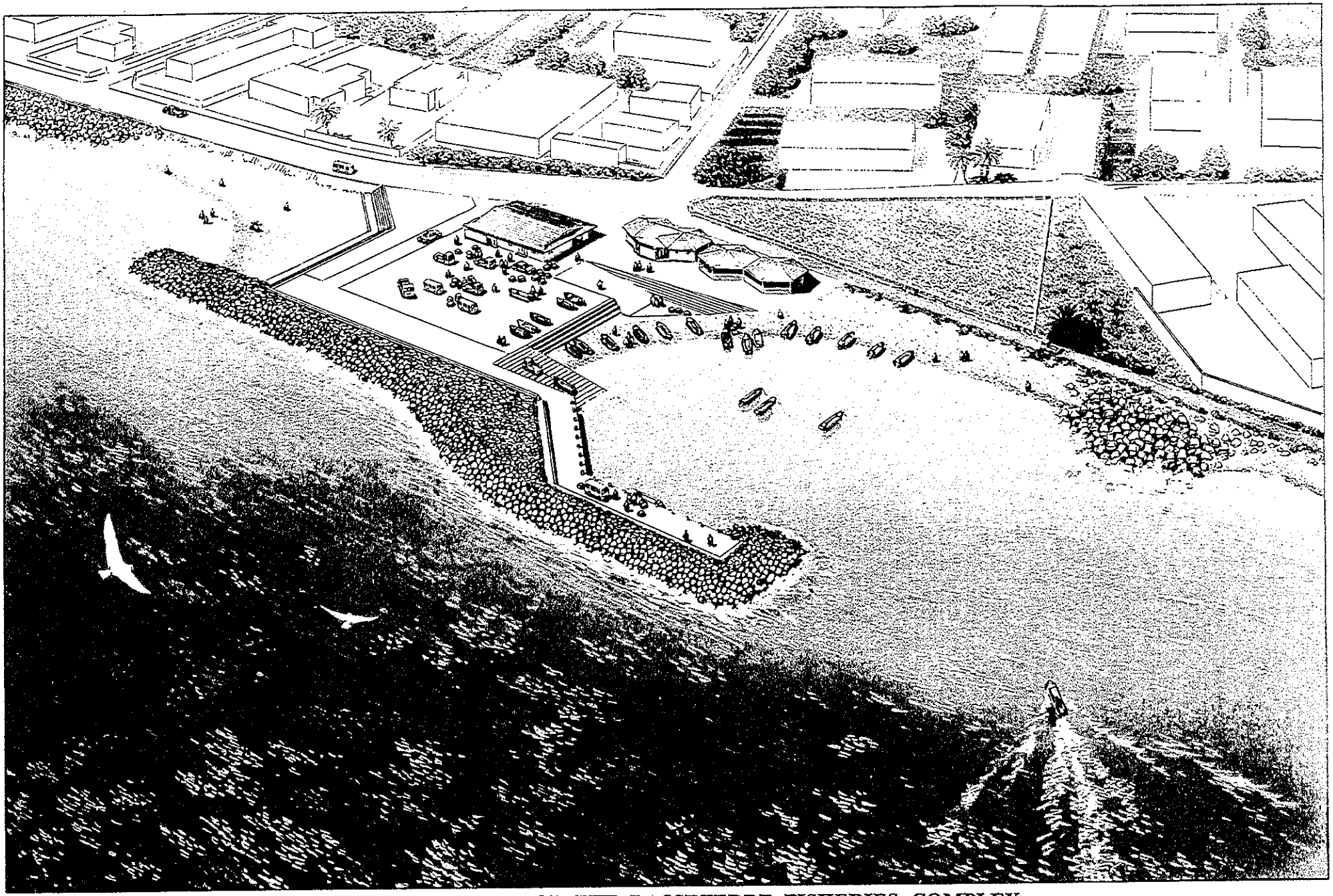
Location of Project Site (Basseterre)



Location of Charlestown Fisheries Complex



General Layout



BIRD'S EYE VIEW OF THE BASSETERRE FISHERIES COMPLEX
IN SAINT CHRISTPHER AND NAVIS

Abbreviations

B.E	:	Basseterre East
B.W	:	Basseterre West
CARICM	:	Caribbean Community
CIDA	:	Canadian International Development Agency
CFRAMP	:	Carib Fisheries Resources Management
CUC	:	Council for Canadian Unity
EIA	:	Environmental Impact Assessment
FMU	:	Fishery Management Unit
HACCP	:	Hazard Analysis Critical Control Point
H.H.W.L	:	High High Water Level
H.W.L	:	High Water Level
L.K	:	Lime Kiln
L.W.L	:	Low Water Level
M.S.L	:	Mean Water Level
NFCS	:	Newtown Fishermen's Co-operative Society
OECS	:	Organization East Caribbean Society
USAID	:	U.S Agency for International Development

TABLE OF CONTENTS

APPENDIXES

CHAPTER 1

BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

1-1 BACKGROUND OF THE PROJECT

Saint Christopher and Nevis is located in the Leeward Islands, in the northern part of the Eastern Caribbean. Comprising the two volcanic islands of Saint Kitts and Nevis, the land area of the country is 269 km^2 (Saint Kitts 176 km^2, Nevis 93 km^2). The population in 1999 was 40,130 (Saint Kitts 33,027, Nevis 7,103), with approximately half the inhabitants living in the capital city of Basseterre, located on the southeast coast of Saint Kitts.

The climate of the islands is equatorial, with constant humidity of about 75 % as a result of the year-round 6-12 knot easterly trade wind. The temperature is also relatively stable throughout the year, varying between a maximum of 32.2 °C and a minimum of 18.1 °C (average 27.3 °C). Generally the rainy season is from July to November, and the dry season is from December to June. Saint Kitts is affected by hurricanes, the period June to November being termed the hurricane season. In particular, hurricanes are most likely to occur between August and November. In the years 1900 to 1994, the number of hurricanes that passed within 75 miles of Saint Kitts was only 13 cases. However, according to recent experience, the frequency of hurricanes hitting Saint Kitts seems to have increased in the last 5 years.

The project site is located in the Newtown district of Basseterre East, facing onto Basseterre Bay. The wave conditions in the bay are a significant consideration for the small fishing boats, and as a result of the prevailing easterly trade winds, conditions are rarely calm.

Fishing in the country is traditionally carried out by artisanal fishermen. Methods used are mainly trap, hand line, net, trawling, and diving, working from wooden boats 3 to 10 m long with an outboard motors, sailing on a daily basis.

The volume of fish landed increased from 200 tons in 1995 to 470 tons in 1998 but dropped to 420 tons due to the hurricane in 1999. There are 300 fishermen and 100 fishing boats registered in Saint Kitts.

Landings in Basseterre are directly onto the beach along the coastal road, where there is no protection against waves such as would be provided by a breakwater. Consequently, it is difficult for fishermen to land their catches.

Furthermore, due to recent erosion of the beach along Basseterre Bay gently curved, it has grown difficult to find adequate sites for landing or for storing boats. This results in heavy damage to fishing boats and gear during the hurricane season. Currently fishing boats are hauled up to the side of the coastal road or to a safe place nearby fishermen's houses by trailer, but in some cases the boats are damaged due to the lack of safe places.

The present distribution system involves fishermen selling fish directly to consumers on the seawall of the coastal road. This system lacks appropriate facilities for sorting or storing fish or for ensuring that basic sanitary conditions are met. Depending on the daily catch in terms of landing time, volume and species, consumers needs are not always satisfied.

Due to the lack of proper distribution and storage systems in Saint Kitts, it is necessary to import fish products during the low season. In order to stabilize the supply of fish products throughout the year, it is therefore essential to provide appropriate storage facilities.

This situation of unstable supply and demand resulting from the lack of facilities discourages fishermen from adopting more productive fishing methods.

The findings of a consultation exercise with fishermen in Saint Kitts conducted by the Consultant are briefly described as follows:

Infrastructure:	insufficient landing facilities
Distribution system:	lack of fish marketing means
Fishing method:	insufficient fishing skills and know-how
Financial aspect:	lack of financial assistance to purchase necessary fishing gear

1-2 COMPONENTS OF THE PROJECT

The components of the Project identified by the Basic Design Study are as follows:

1) Marine Civil Work: Slipway, Boat ramp, Landing jetty (for one boat), Improvement of existing breakwater

2) Facilities: Fishery Center (Fish handling area, Fish processing area, Fish shop, Fishing gear shop, Administration office, and Meeting room) , Fishermen's lockers, Toilet & shower

3) Utilities: Water reservoir tank, Water supply and sanitary facilities and Electric supply facility.

4) Equipment: Ice making and storage plant, chiller store (Walk-in type), Freezer store (Walk-in type), Back-up generator, Fish handling & processing equipment (Small freezer, Showcase freezer, Scales, Fish containers, Insulated fish boxes, Hand cart, Processing table, Band saw, Vacuum packing machine, Knives, Gloves, Boots, Cutting board, etc), Air conditioning in the fishery center building, Two sets of computers and printers.

5) Auxiliary Work: Lighting fixtures and floodlights.

CHAPTER 2

CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 OBJECTIVES OF THE PROJECT

This project aims to provide facilities in Basseterre including: mooring facilities, breakwater improvements, and a fisheries center incorporating fresh fish processing, freezer and chiller rooms, ice making and storage equipment, a fish shop, fishing gear shop, and administration facilities. This is in accordance with the framework of the Fisheries Plan 2000 - 2002 for sustainable development and promotion of artisanal fisheries in Saint Christopher and Nevis. The objectives of the project are to ensure:

① Stable supply of fresh fish and improvement of the distribution network through the installation of processing and cold storage facilities

② Calm loading/unloading basin during normal weather conditions and a safe mooring facility in the event of hurricanes, leading to increased productivity/quality of life for the members of the fishermen's cooperative.

2-2 BASIC CONCEPT OF THE PROJECT

2-2-1 Study of Appropriateness of the Proposed Facilities

The project consists of the provision of a catch landing beach, mooring beach, slipway, boat ramp, east and west revetment, breakwater, and fisheries center. The fisheries center building comprises a fish processing room, ice making/storage facility, freezer and cold storage, and a fish shop.

By constructing a fisheries complex, fishermen can land fish at the catch landing beach, moor boats, and prepare for fishing all within the confines of a sheltered basin. Even during the hurricane season they can keep their boats safely using the boat ramp. Also, through the provision of quality storage and sales facilities, fishermen can save time and effort currently spent each day on the selling of fish, and instead concentrate on fishing activity with a resulting improvement in productivity. Fishermen can also use the time thus generated to exchange information with other fishermen for example.

It is intended that the project will lead to an improvement in productivity of the national fishery sector, the stable supply of local fish to consumers at a low cost, and reduced importation of fish. Concurrently, it is expected that these improvements

will encourage other developments already targeted in the fishery sector such as development of offshore pelagic fishing, improvement of fish handling skills, improvement and development of fishing equipment.

Following the above summary of the original Request for Grant Aid, the existing conditions, problems, planned improvements, expected benefits and a detailed breakdown of the project facilities are given in the following sub-sections. They are also illustrated in Table 2-2-1.1.

(1) Construction Works Requirements

1) Slipway, Boat Ramp

Current practice is to draw up fishing boats of less than 20 ft in length (20 boats) onto the beach for ease of landing, whilst fishing boats of over 20 ft in length (8 boats) are moored offshore. However, due to the lack of suitable landing facilities such as a slipway or boat ramp etc., normal maintenance has to be carried out under less than ideal conditions. When hurricanes strike it is difficult to find suitable shelter for boats and damage is inevitable. Hurricanes in the past two years (1998 and 1999), have destroyed close to 10 boats/year in the whole of Saint Kitts Island and 2 to 3 boats/year in Basseterre East have been wrecked.

In the light of such periodic damage, and the need for maintenance and minor repair work on a weekly basis, a boat ramp to provide refuge from storms and to carry out repairs, and a slipway for landing are necessary.

2) Landing Area

In Basseterre, fish are landed and sold directly infront of the public market (B.W.), and in "Newtown area" (B.E.), in the vicinity of the project, about 1.6 km to the east of B.W. There are 13 boats from Basseterre West (B.W.), 4 boats from Lime Kiln (L.K.) and 25 boats from Nevis island that unload fresh fish in front of the public market. Also 28 boats from Basseterre East (B.E.) unload fresh fish in the New Town area. However, as none of these landing areas has regular landing and handling facilities, fresh fish cannot be handled efficiently.

To achieve the objectives of this project, facilities for preparation for casting off (refuelling, supply of water and ice, fish container loading), for mooring of big boats coming from Nevis island, and for improving the efficiency and convenience for landing of fresh fish are required.

Table 2-2-1.1 Contents of the Fisheries Complex Components and their Necessity

Item	Actual situation	Problems	Improvement	Expected effects	Contents of the facility
A. Landing & mooring facilities • Slipway • Boat ramp	• Fishing boats not in use, or in case of emergency, are drawn up onto the beach. • Fishing boats are placed on the beach for repair and maintenance.	• In the event of hurricanes or storms, safe refuge can hardly be found. • As landing of boats is done manually, fishing boats cannot be efficiently landed. • Beach mooring cannot secure the boats in case of hurricanes. • Beach mooring cannot allow proper maintenance and repair of fishing boats. • Fishing boats cannot easily be landed for repair of heavy equipment such as engines.	• Secure harborage during hurricanes or storms. • Provide a facility for efficient landing. • Assure the safety of moored boats. • Assure space for effective maintenance and repair	• Mechanical assistance can allow quick landing in case of hurricanes. • Raising the ground level can afford a safe place of shelter and minimize damage. • Maintenance vehicles can easily gain access so maintenance and repair works will be easier.	• Installation of a new slipway (width 10m; 2 trailers) • Installation of a new boat ramp (for 28 boats, 8m × 2 rows × 14 boats@2m = 16m × 28m)
• Landing space for loading gear and boat preparation • Beach for landing • Beach for mooring	• Landing of fishes, supply of ice, water and fuel and loading of fishing gear are done on a steep ramp beach	• Preparation for casting off, that is: loading of large-sized fishing gears (fish containers), re-fuelling, supply of water, etc. is difficult. • Landing of fish is difficult.	• Assure a facility for easy preparation of loading of large-sized fishing gear, re-fuelling, supply of water, etc. • Assure a facility for easy landing.	• Loading of large-sized fishing gear, re-fuelling, supply of water, etc. will be easier. • Landing will be easier.	• Installation of a new landing wharf -1.5m × 1berth@12m) • Provide landing beach • Provide mooring beach
• Rehabilitation of existing breakwater	• Crest elevation of existing breakwater is low • Existing breakwater is short.	• Wave overtopping cannot be avoided because of low crest elevation. • Therefore, damage occurs due to wave overtopping. • The present layout or shape cannot allow sufficient calm sea area. • As a result, fish landing, sheltering, repair in rough weather is difficult.	• Raise the breakwater to minimize overtopping waves. • Provide the breakwater to secure a calm basin.	• Overtopping waves and the damage to land facilities can be minimized. • Calm basin can be assured so landing work can be efficiently done.	• Raising and reinforcement of existing breakwater: L = 100m • Extension of new breakwater: L = 60m
B Fisheries center (1) Building • Fish handling room • Fish processing room • Packing room • Fish shop	• Due to lack of fresh fish handling room, processing room and fish shop, fishermen of Basseterre East work in the vicinity of the existing fishermen lockers and fishermen of Basseterre West and Lime Kiln work in front of the public market	• As fishes are directly landed on the beach, they are exposed to sunlight and therefore cannot remain fresh. • As fishes are processed on the beach, many problems are caused from the sanitary and ocean-environmental viewpoints. • As the cycle of "landing → processing → sales" is implemented by each fisherman, there can be no fish distribution system. • Sale of fish by fishermen themselves is inefficient and it imposes a big burden on fishermen.	• Provide a facility to keep fish fresh. • Provide a facility for clean processing of fishes. • Provide a facility to implement functionally and efficiently the process of "landing → processing → sales"	• Fish can be kept fresh (freezer/cold storage) • Improvement from the viewpoint of hygiene • Fishermen's workload can be reduced. • Constitutes the basis of a fish distribution system. • Fishermen can be released from processing and selling fishes and concentrate on fishing only.	Construction of a fisheries center building accommodating the following : • Fish handling room Ice making & storage, fish container yard, freezer (-20°C), Cold storage(-0°C), Balance (600kg), Band saw • Fish processing room Defrosting tank, fish processing table • Packing room Vacuum packing machine
• Fishing gear shop • Cooperatives office • Meeting room • Machine room	• As these facilities do not exist for the time being, fishermen meet in the workshop adjacent to fishermen's lockers. • At present, fishermen buy, repair or fabricate individually their own fishing gear which is a burden to each of them.	• Fishermen buy, repair or fabricate by themselves their own fishing gear which lowers fishing productivity. • This room is not large enough to be used for meetings. • High-efficiency fishery techniques cannot be introduced or passed on.	• Provide a meeting facility. • Provide a facility to contribute to relieve fishermen's works of buying, repairing and fabricating fishing gear. • Provide a facility for introducing and passing on high-efficiency fishery techniques (fishermen's cooperative)	• Fishermen can be relieved from buying, repairing and fabricating fishing gear, so their fishing productivity will increase. • Fishing gear will become constantly available at low cost. • Fishermen can easily communicate each other and exchange information. • Fishermen's cooperative will be re-activated. • Propagation and passing on of fishery techniques will be accelerated. • Fishery will be developed.	Fish shop Fixed stand, Showcase freezer, Showcase cooler, chest freezer, fish container yard •Fish shop •Office: staff 6persons (including manager) •Meeting room: accommodating 25 persons •Machine room Power receiving/distribution facilities, back-up generator, compressor for ice-maker and freezer, control panel for cold storage and freezer
(2) Facilities • Cold storage • Freezer • Ice making & storage • Water reservoir tank • Back-up generator • Septic Tank • Outside Lighting	• These facilities do not exist except for the septic tank of existing toilet. • Ice is purchased at an ice shop or made at home by each fisherman.	• Sufficient ice cannot be supplied prior to fishing. • Sufficient water cannot be supplied prior to fishing. • The existing septic tank capacity will not be sufficient to treat the whole of wastewater after new toilets/showers have been installed.	• Provide an ice-making facility for fishermen. • Install a water tank to provide fishermen with enough water • Install a septic tank having enough capacity to treat the whole of waste water after repair of existing toilet/shower and installation of new toilet/shower. • Install a back-up generator for emergency power supply to ice-making facility, water reservoir, etc.	• Fishermen can conserve fishes with sufficient ice. • Sewage treatment by a septic tank having sufficient capacity will minimize the negative impact on the environment. • Emergency power supply will be available and risk can be minimized.	[Fish handling room] • Freezer (-20°C, 3100 × 2000 × 2500) • Cold storage (-0°C, 3200 × 2100 × 2600) • Ice maker (1: flake ice 750kg/day) • Ice storage box(1: 2 tons for 3.6 days) [Machine room] • Back-up generator (1 台, 30KVA) [Outdoors] • Water tank(1: 10m^3 + water feed pump) • Septic Tank (1: 5.7m^3/日, 1500GALS) • Outside Lighting (4)
(3) Equipment • Chest type freezer • Showcase freezer • Showcase cooler • Scales • Insulated fish box • Fish container • Hand cart • Processing table • Band saw • Vacuum packing machine • Knife • Glove • Cutting board	• These equipments do not exist.	• In case of good catches, there is no means of conserving of fish. • Fishes that cannot be sold may be discarded. • Freshness of fish cannot be assured because they are exposed to direct sunlight after landing. • When consumers buy fishes, their quality has already deteriorated causing health and hygiene problems.	• Provide facility to conserve fresh fish. • Provide facility and equipment to properly process fresh fish. • Provide facilities and equipment for improvement of health and hygiene. • Provide equipment to facilitate landing. • Provide facilities and equipment to implement functionally and efficiently the process of "landing → processing → sales"	• Fish can be kept fresh. • Fish can be cleanly and efficiently processed. • Landing from fishing boats will become easier. • Constitutes the basis of a fish distribution system. • Insulated cold storage of sea products accommodates variation in demand in the local market.	• Chest freezer (-20°C, 600l) • Showcase freezer (-20°C, 500l) • Showcase cooler (+2°C, 500l) • Balance(1), Automatic balance(2), suspended balance(2) • Fish box (70l × 30 sets) • Insulated fish box (150l × 10 sets) • Hand cart (4) • Band saw (1) • Vacuum packing machine (1) • Knife for freezing(4) • Gloves (wired, for band saw handling × 4) • Boots (4 sets) • Cutting board (450D × 900W × 4) • Air-conditioners(5.3Kwref, 7.6Kwref, 4.2Kwref:; 1 of each)
C. Fishermen's lockers • Fishermen's lockers	• There are 8 lockers, but their roof is broken.	• Insufficient quantity. • Broken roof prevents use. • If the roof remains unrepaired, further damage will occur with next hurricane.	• Provide new lockers to supplement existing ones. • Repair and improve broken parts of roof and damaged portions by Saint Christopher and Nevis's side as both governments agreed with Minutes of Discussions.	• Increases convenience. • Improves fishing activity.	• Supply of new lockers (20 lockers short) • Repair of existing lockers by Saint Christopher and Nevis's side.
• Toilet & Shower	• One each, but both are out of order now.	• It is not convenient and cannot be used. • One of each is not enough.	• Provide new units to supplement existing facilities. • Repair existing ones to reuse them by Saint Christopher and Nevis's side as both governments agreed with Minutes of Discussions.		• Installation of new toilet/shower (for fishermen and workers, 4 of each) • Repair of existing toilet/shower by Saint Christopher and Nevis's side.

3) Improvement of the existing breakwater

The existing breakwater on the project site was constructed as a groin type structure about 30 years ago. When the Port Zante development project was executed in 1993, its end was extended about 100m to the west to form a reverse-L shape. As a result, sand sedimentation behind the breakwater results in land formation due to the Tombolo effect. Because of its low crest elevation which is only +0.5 ~ +1.0 m, high waves overtop the crest of the breakwater in hurricanes and the road behind it is inundated together with deposition of sand.

Consequently, the breakwater must be raised and reinforced to protect the site and the facilities, and also be extended so as to provide a larger area of sheltered water.

(2) Fisheries Center Requirement

The city of Basseterre which is the capital of this country and inhabited by nearly half of the population (about 20,000 people), and visited by many foreign tourists, has no fresh fish sales facility. Fishermen sell fish directly to consumers beside their boats using a balance without facilities for cold storage. No hygiene or temperature control measures are used and fish are exposed to the hot sun and not washed. Fish viscera and heads removed are not properly treated.

Fishermen's work is physically demanding requiring preparation the night before casting off, departure at midnight or early in the morning, return in the morning or afternoon, followed by a wait for customers. This is also an inefficient use of the fishermen's time. There is no guarantee that all the day's fish can be sold immediately or even during the course of that day. Moreover, unsold fish may be sold at a discount or even discarded in the worst cases.
The fisheries center includes the following components (1 to 14).

1) Cooperative Office

This office will be the workplace of the management staff (6 personnel) of the Fisheries Complex and is indispensable for them to do their job.

2) Meeting Room

After the fishermen's cooperative is reactivated, 45 representatives from 45 target fishing boats will get together in this meeting room. Fishermen will need a meeting space to communicate with each other and exchange information, and to

introduce and pass on high-efficiency fishing techniques. Also, fishermen not only in the Basseterre area but also from all over Saint Kitts would use this room to develop and improve future fishery activities (cooperative activities).

3) Fishing Gear Shop

At present, fishermen buy, repair or fabricate by themselves their own fishing gear which lowers productivity. If fishing gear is purchased at one time by the fishermen's cooperative, it can be supplied regularly at lower prices. Moreover, if a consignment system for fabrication and repair of fishing gear is established, it will further contribute to increase productivity.

4) Fish Shop

At present, fishermen directly sell their fish catch on the seashore which imposes a big burden on fishermen's time. Moreover, the number and type of fish is limited and fish are exposed to direct sunshine. The quality of fish is degraded and consumer's willingness to buy fish falls. Once this facility is installed it will contribute to the relief of fishermen's work of selling their own fish and at the same time provide consumers with fresher fish.

5) Fish Handling Room, Fish Processing Room, Packing Room

These facilities are indispensable to process in an efficient and sanitary manner the fish that are landed. These facilities will also be the basis of a sanitary and functional fish distribution chain consisting of "landing → processing → sale", the "sale" being in the fish shop mentioned above.

6) Ice Maker

At present only a few fishermen use ice on their fishing boats. Hence fish cannot be kept fresh. In order to cool and keep fish fresh, a steady supply of ice is indispensable. Also, ice should be used in all procedures such as processing, storage, sale and transport. Ice making plant is therefore a prerequisite to fresh fish distribution.

7) Cold Storage

For this project, this facility is especially needed to keep fish catch fresh without deterioration of quality. Also, when a large amount of fish is caught, this facility will be used to temporarily keep fish fresh.

8) Freezer

The purpose of this facility is to supply fish steadily throughout the year. In particular the excess catch during the most productive January to August season will be frozen and kept for sale during the less productive season. Since in Saint Kitts, only small fishing boats are used, the catch on each trip is small, it is very important to have this facility in order to ensure a steady supply of fish to guard against variation in size of the daily catch.

9) Showcase Freezer

Since frozen fish are not favored by consumers compared to fresh fish, frozen fish will be defrosted before being sold, if necessary. The showcase freezers are needed so that the available range of frozen fish can be displayed to customers and the fish defrosted as necessary when they are sold.

10) Showcase Cooler

As the sales life of fish is limited, showcase coolers are normally required to display and preserve the fresh fish. These showcase coolers allow consumers to understand that fresh fish are clean and available at any time, in order that they can become accustomed to buying them. As a result, the demand for fresh fish will increase.

11) Chest Type Freezer

The chest type freezer is used to store weighed ice packs for sale and for storage of packed frozen fish in the fish shop.

12) Band Saw

The band saw is used to cut large sized frozen fish.

13) Vacuum Packing Machine

Small fresh fish are vacuum-packed and frozen. Frozen fish cut by the band saw will also be displayed and sold in vacuum packs.

14) Air-conditioner

The country has high humidity and high temperature typical of the Caribbean, so offices and meeting rooms need to be air-conditioned. Processing room and fish shop must also be air-conditioned to avoid degradation of fresh fish.

2-2-2 Basic Concept of the Project

In summary of the project requirements as set out above, the basic concept of the project is as follows:

① Provide protective facilities (revetment, breakwater) to protect the mooring facilities (landing space for loading gear, slipway, boat ramp, etc.), fisheries center, fishermen's lockers and on-shore ancillaries, from damage by high waves during hurricanes.

② Provide calm conditions during normal weather within the port and for landing and mooring on sandy beaches. Provide a beach for allowing easy landing of fish, loading of ice, water and fuel and loading/unloading of fishing gear. Moreover, provide a road for easy access to the landing and mooring beaches, fisheries center and fishermen's lockers.

③ Provide a landing area to accommodate larger fishing equipment (fish containers) and large sized fishing boats coming from Nevis island.

④ Provide a slipway and boat ramp for repair of boats, and as a refuge in the event of hurricanes.

⑤ Provide fresh fish handling, processing and sales facilities required for the efficient and stable supply of fresh fish to consumers. Also ensure improvement of the distribution network by provision of facilities for keeping fish fresh, ice making, insulated storage, cold processing.

2-3 BASIC DESIGN

2-3-1 Design Concept

To implement the basic design of the Project for Construction of the Basseterre Fisheries Complex, the following basic conditions have been used as design precepts when determining the scope and form of the installations.

(1) Use a Proper Project Size

1) A boat refuge ramp, landing slipway, landing beach and loading quay of scale appropriate to the needs of the current fishing fleet will be provided.

2) An alignment of the breakwater to incorporate the existing rubble-mound breakwater will be determined.

3) The contents of the facility shall be practicable within the framework of a grant assistance project and within the scope of the request made by Saint Christopher and Nevis.

4) The facility provided shall have content and size consistent with the policies aiming at increasing incentives to promotion of the fishery sector, introduction of new fishing technology and equipment, improvement of fresh fish handling, processing & distribution, and shall be easy to maintain.

(2) Consider Sufficiently the Natural Environmental Conditions of the Project Site

1) Take properly into account the topographical features of the site, tidal levels, nature of the soil and shore erosion potential in the design. Behind the existing breakwater, sedimentation of sand by the Tombolo effect has occurred. The area thus created is to be back-filled.

2) Particularly in recent years, hurricanes frequently hit the coast. Therefore the stability of structures and also their layout has to be carefully considered to minimize possible damage by inundation due to high waves overtopping the breakwater.

3) In particular, the entrance to the fisheries center shall not face the sea.

4) The design of landing areas slopes shall not impact on the form of the beach.

(3) Use Structures, Materials and Construction Processes Compatible with the Conditions of the Project Site

1) Facilities shall have simple structural form and be resistant to the effects of seawater and corrosion caused by the maritime environment.

2) Concrete aggregate and stones for the breakwater and revetment shall be procured from the government-controlled quarries at low cost. Accordingly, the design shall make use of stone where possible.

(4) Implementation of the Project without Disturbance to Fishery Activities

1) Part of the shore will be occupied during the construction works. Meanwhile, the beach on the east of the project site shall be used as a landing area.

2) Construction works shall be executed from the landward side wherever possible.

(5) Sanitary Facilities

Any development project in Saint Christopher and Nevis must be examined and approved by the EIA (Environmental Impact Assessment) Committee comprising representatives of the relevant government departments. In particular, buildings and their sanitary facilities must comply with the "Draft of Saint Kitts & Nevis Building Code" (12/07/1999)

For the present project, the code applies to the following facilities:

1) Fresh Water Supply

The city of Basseterre is totally equipped with public waterworks. To be supplied with water from the municipality, application to and approval from the municipal authority will be necessary.

2) Sewage Treatment (Septic Tanks)

As a public sewerage system is not provided in Saint Christopher and Nevis, different waste water must be treated in individual septic tanks. The "Draft of Saint Kitts & Nevis Building Code" sets out in detail the installation criteria of septic tanks.

Essentially the system of treated water disposal must be either a "gravel bed contact system" or a "ground infiltration system".

The septic tank of this facility shall treat miscellaneous wastewater and sewage by an aeration type activated sludge process. As the ground surface is near sea level, treated water disposal shall be by gravel bed filtering and not by ground

infiltration. By this method, toilet waste water (from the fisheries center and fishermen's lockers) and fish washing water are to be treated.

Septic tank maintenance/inspection once a year and cleaning every 3 years will be entrusted to a registered private company.

3) Solid Waste Treatment

Municipal waste in Basseterre are collected by the health bureau. The fisheries center will also utilize this public service after registration with the health bureau.

Municipal waste is disposed of to land-fill in the swampy ground in the Great Heeds Pond area to the east of the airport.

2-3-2 Basic Design

(1) Overall Plan

1) Location Plan Study

The current usage of the beach at the Project site (at Basseterre East) is illustrated in Figure 2-3-2.1. From the standpoint of seashore utilization, it is split into the western and eastern sections. Fishing boats are small-sized and are equipped with outboard engines. Taking advantage of a small tidal range, fishing boats moor directly on the beach to land the catch. When not working, boats are hauled onto the beach above the high-water mark. Such utilization of the beach by small-type fish boats is typical in the country (refer to Figure 2-3-2.1).

In addition, the existing locker facilities for fishermen and a working shed are located near the shoreward end of the breakwater, which faces the eastern beach. This area serves as a focal point for fishing activities by Basseterre East fishermen.

Therefore, the Project targets the improvement of the distribution system by developing the fishing infrastructure at Basseterre as a main distribution center (improvement of catch landing operations, facilities to assist fishermen, and fish distribution system).

The following three location options were examined for the Project, from the standpoint of mooring for fishing boats and also with regard to utilization of the seashore at the Project site as mentioned above:

(1) at the west side of the existing breakwater;
(2) at the east side of the existing breakwater;
(3) on both the western and eastern beaches.

The three options were examined to see how well they met the following criteria, which are essential to the Project.

a) Suitability for mooring and landing activities (catch landing; beach for hauling up boats; mooring places; pier for fishing preparation & catch landing; slipway; boat ramp), suitability for construction of breakwater, fishermen's locker facilities, parking lot; impact of topographic and oceanographic conditions (refer to Figure 2-3-2.2).

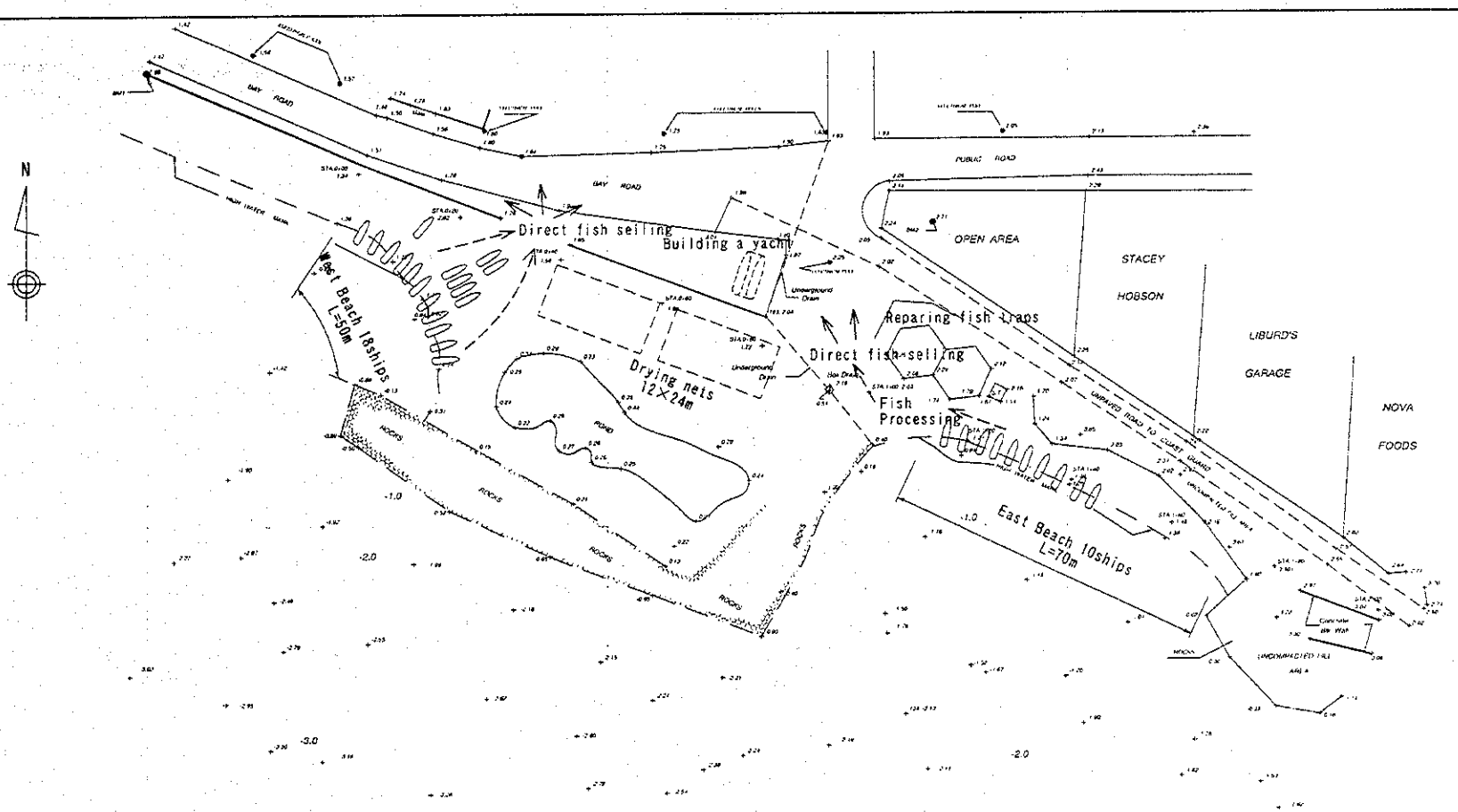
b) Material (fishing boats, fish catch, fishing gear, fuel, ice, water) and human (fishermen, consumers, staff of the Fisheries Center) flows (refer to Figure 2-3-2.3).

Following examination of these alternative options, Option 2 (east side of the existing breakwater) was adopted as the recommended plan, because it best suits the topographic and oceanographic conditions and allows efficient flow of materials and users (refer to Table 2-3-2.1).

2) Fishing Boats' Mooring Plan

Usually, the discharge of catch from fishing boats is carried out in the manner specified in Table 2-3-2.2. The comparative examination concerning discharge methods was performed with regard to the local landing conditions, particular features of the site, and required supplementary facilities.

As a result, mooring on the beach was deemed the most appropriate practice. In order to provide for the usage of a wider extent of seashore, it is proposed to form a bow-shaped sand beach in the calm waters at the rear of the breakwater, and to connect this beach to the eastern beach.



STATION	Northings	EASTINGS	Heights
BM1	1912127.81821	325400.27715	1.857 m
BM2	1912100.25004	325542.75153	2.705 m

LEGEND

Electrical Poles .....

SPOT HEIGHTS THUS .....

Scale1:1,000 Metres

0 10 20 30 40 50m

Figure 2-3-2.1 Present Land Utilization (Normal Condition)

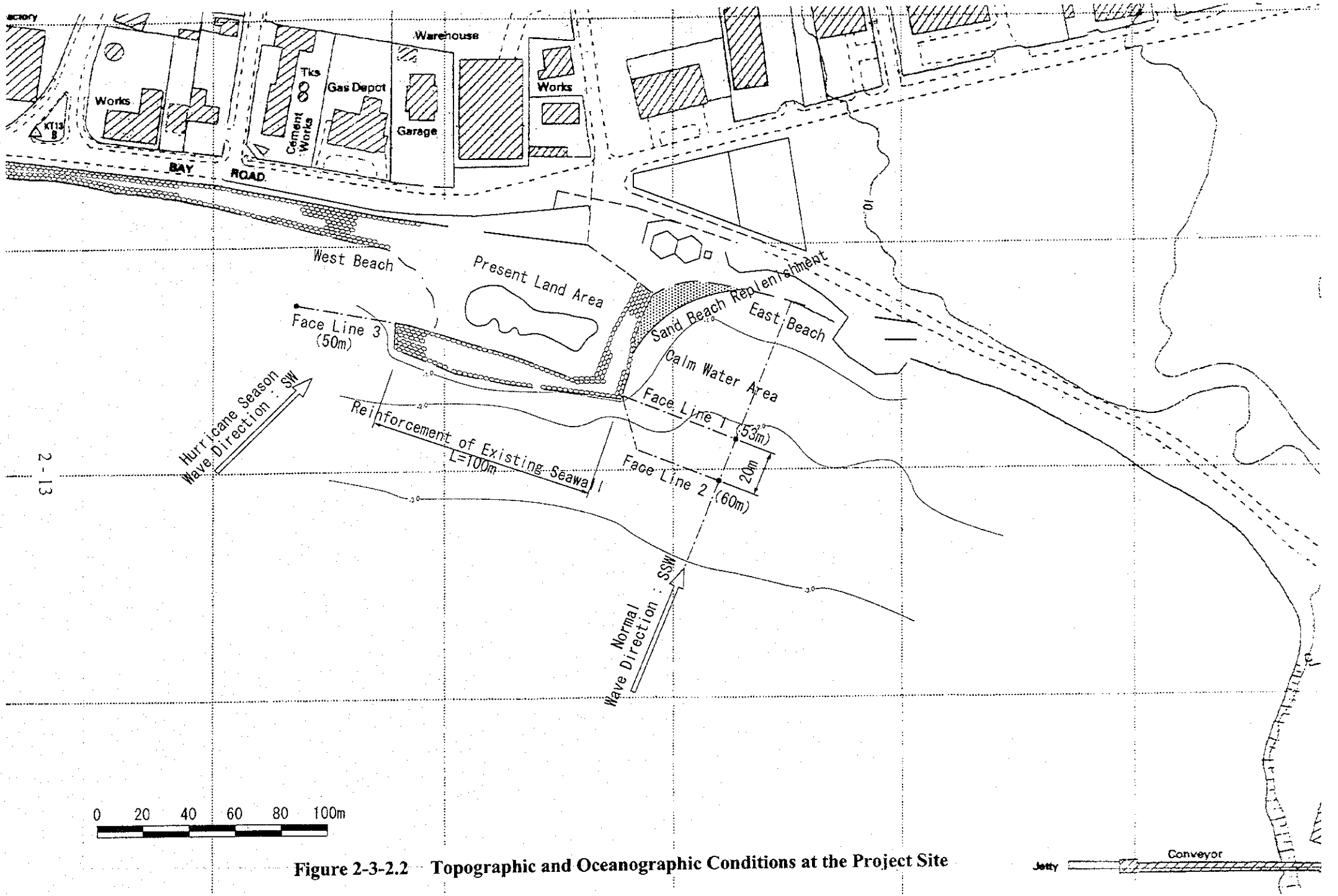


Figure 2-3-2.2 Topographic and Oceanographic Conditions at the Project Site

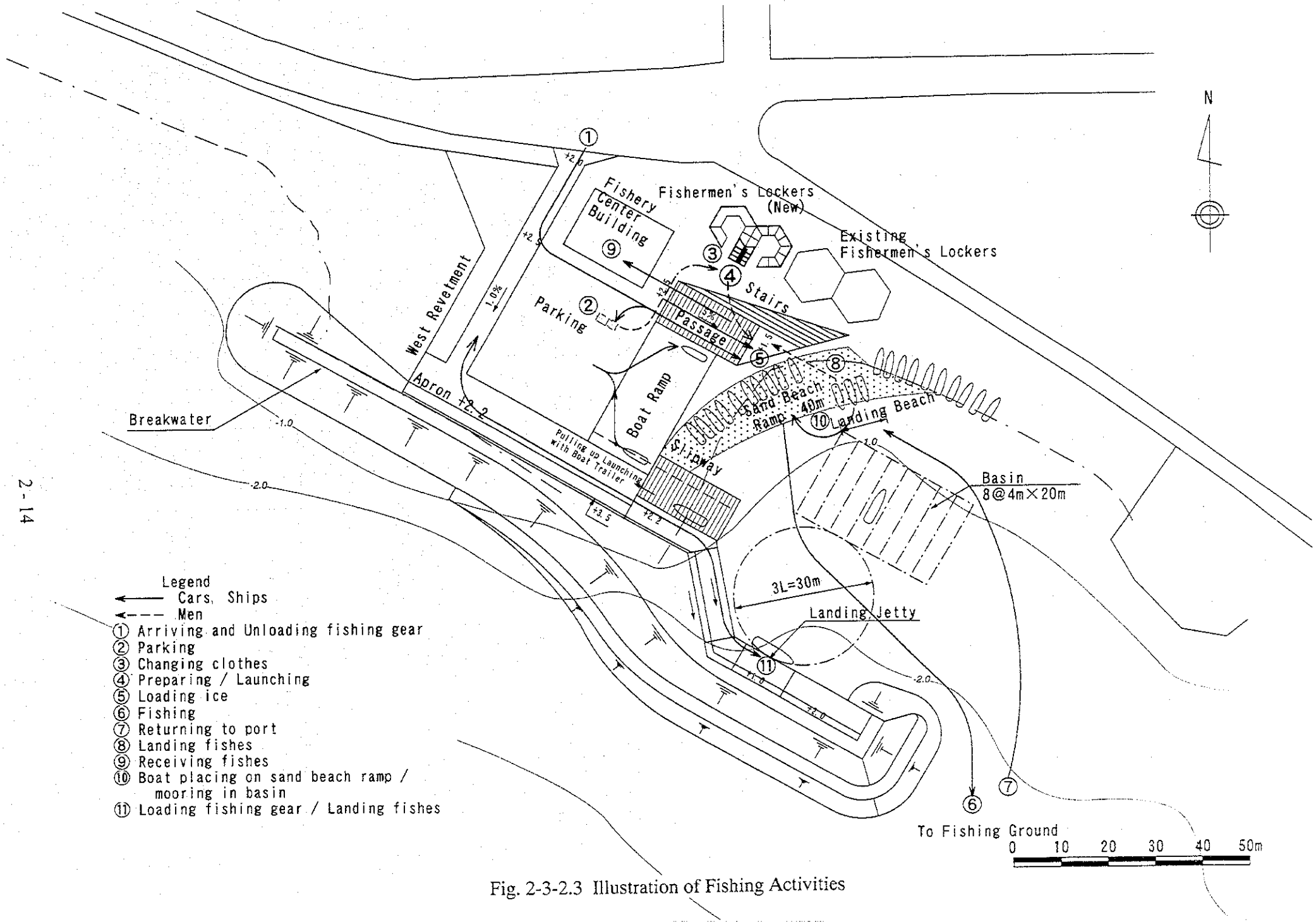


Fig. 2-3-2.3 Illustration of Fishing Activities

Table 2-3-2.1 Comparative Examination of Options for Fish Boats' Mooring Locations

Natural and utilization conditions / Options	Impact of topographic and oceanographic conditions	Compatibility with material and human flows	Overall evaluation
① At the west side of the existing breakwater (at the rear of normal line #3)	• In case of westward extension of the breakwater, the entrance to the port would face the prevailing SW direction of hurricane waves. • Water space for mooring near the coastal revetment of the stone masonry breakwater would be narrower than in east-side disposition option.	Flows in the vicinity of the fishermen locker facility and on-shore working flows in nearby area would have longer distances.	Unfavorable from the standpoint of the topographic and oceanographic conditions.
② At the east side of the existing breakwater (at the rear of normal lines #1 or #2)	• Sheltered basin can be easily provided in view of the prevailing SW waves. • Provision of the water area of 1-2 m depth would be more lucrative than in west-side disposition option.	All the flows within the facility would be neatly integrated. The area around the fishermen locker facility would become the center of the catch landing and boats' mooring area. Also, such disposition would provide for the access to the Fisheries Center building.	**The recommended option**
③ Combination of west- and east-side dispositions (line #3, and lines #1 or #2 at the rear)	• Provision of calm basin within both western and eastern sections would be ineffective.	Flows would not be effective, being separated into the western and eastern ones.	Undesirable from the standpoint of material and human flows.

Table 2-3-2.2 Comparative Examination of Catch Landing Methods

Items of comparison / Type of mooring	Catch landing method	Features	Necessary supplementary facilities	Overall evaluation
① Mooring at the seashore	The boat's bows would be directly on the beach. Immediately after the fish catch landing, the boat would be completely hauled up to the seashore.	• Easy mooring • Matches the needs of small amount catch landing from small-size fishing boats.	Sandy beach with mild slope of 1:6 or less is required. The existing beach may be used as it is.	The method matches the local conditions and will be adopted.
② Mooring at the ramp or stair landing type	Fish catch landing would be carried out from a boat moored at a ramp or at a stair landing (the boat would not be hauled out).	• Used in Asia and Pacific for fishing boats of the outrigger type. • Features the merit of matching the conditions of large tidal range.	A concrete berthing quay of ramp or stair type matching the number of serviced fishing boats would be required.	The method would be difficult in usage due to the types of serviced fishing boats, local tidal range conditions, etc.
③ Catch landing quay (gravity-type facility, piled jetty)	Fish catch landing would be carried out from a boat moored to the quay (common case).	• Appropriate for big-size vessels, big catch amounts, or for processing heavy loads (quay for fishing preparation).	Upright constructions providing for the required water depth would be necessary, as well as fendering structures and mooring rings.	The method can match the local requirements (features).
④ Floating pontoon	Fish catch landing would be on a floating pontoon.	• The method matches the conditions of substantial tidal range.	Apart from the pontoon, a connecting bridge would be necessary.	The method is inadequate due to the small tidal range and maintenance condition.

a) Catch Landing Beach/Mooring Beach

The vicinity of the existing fishermen's locker facilities, which is targeted as the Project site, features excellent natural conditions, including the existing breakwater, reclaimed land, beach, and easy access to the existing bay road. This area is the focal point of fishery activities in Basseterre East. As the planned site for the catch landing and mooring beach, it will be provided with a calm water area. The site also features convenient access to the fisheries center building.

This area is appropriate for the catch discharge and mooring beach in regard to the conditions of direct discharge of catch from boats moored on the beach, size and type of serviced boats, processed catch weights, a tidal range of less than 50 cm, amongst other factors.

A passage (ramp) accessible for trolleys will be constructed between the catch landing beach and the fish handling room, providing for easy supply of ice and fuel.

However, for servicing big-size boats from Nevis, the facility mentioned below for loading gear and preparation of boats is required.

b) Mooring Facility

Among 28 fishing boats in operation at Basseterre East, approximately 20 vessels use the existing fishermen's locker facilities as the base for their operations. When not working these boats would be hauled out onto the western beach at the rear of the existing breakwater (reclaimed land), and on the eastern beach. The approximately 8 fishing vessels that are over 20 ft length will use for mooring berths, in water of -1.0 ~ -2.0 m deep.

- Mooring Beach (Artificial Beach Replenishment)

  Under the Project, a bow-shaped sand beach will be formed for mooring needs at the jetty section of the existent breakwater, adjacent to the eastern beach (artificial beach replenishment area). Thereby, the 28 vessels working out of Basseterre East, which have previously been dispersed over the eastern and western beaches, will be brought together on the eastern beach.

- Boat Ramp and Slipway

As a hurricane shelter, the 28 vessels of Basseterre East use relatively higher land (about +1.5 m) at the rear of the existent breakwater. However, landing facilities are unavailable here and landing operations are difficult. Besides, this area is not high enough above sea level, and occasionally high waves sweep boats away. Meanwhile, in the neighboring Basseterre West vessels are hauled out directly onto the road and then to shelter. In Lime Kiln, the highest part of the shore is used as a shelter.

Therefore a boat ramp at adequate elevation above sea level will be provided (as a ship shelter facility) for the 28 vessels of Basseterre East (HHWL = +1.5 m, GL = 1.5 m + 1.0 m = 2.5 m). In addition a slipway will also be incorporated in order to haul out boats (width 5 m x 2 vessels = width 10 m, front water depth –1.0 m, slope 1:6).

The boat ramp will also be used on a daily basis as a fishing boat maintenance yard (at a typical frequency of once per week per boat vessels from Basseterre West and Lime Kiln may also be serviced). Taking account of the fishing boats' access requirements, the boat ramp and the slipway will be sited adjacent to the eastern beach.

c) Gear Loading & Preparation Quay

The quay for loading of equipment and preparation of boats will be provided at the rear of the breakwater extension, making it possible to load larger sized fishing equipment (fish-traps etc.) and to provide mooring for large vessels from Nevis.

3) Breakwater

a) Reinforcement of Existing Breakwater by Raising the Crest Height

In order to protect the rear area from wave overtopping, the crest height of the existing breakwater will be raised and reinforced.

The permissible wave-overtopping amount is determined as qa = 0.06 $m^3/s/m$ on the basis of the susceptibility to damage and importance of the structures in the rear area, in compliance with "The Technical Standards for Port and

Harbor Facilities and their Explanation" (published in 1999 by the Japan Port and Harbor Association).

Table 2-3-2.3 Permissible Wave-Overtopping Amount, in Regard to the Importance of Rear Area ($m^3/s/m$)

Rear area with concentration of dwelling houses, public facilities etc., where particularly heavy damage can be anticipated in case of wave overtopping, penetration of wave splashes etc.	About 0.01
Other important land uses	About 0.02
Other land	0.02 ~ 0.06

Source: "The Technical Standards for Port and Harbor Facilities and their Explanation" (published in 1999) (in Japanese).

b) Extension

In order to assure calm water in the eastern basin where fishing boats will be concentrated, and also in order to protect the Fisheries Complex, the breakwater will be extended eastwards. Two extension options have been examined, namely (1) eastward extension of the existing breakwater in a straight line (normal line #1: L = 53 m), and (2) a broadening of the protected area by 20 m (normal line #2: L = 60 m).

Following examination of these options with regard to construction cost, calm water provision and sedimentation impact, Option #2 of broadening the protected area by 20 meters was adopted.

Table 2-3-2.4 Comparative Examination of Breakwater Extension Options

Items of comparison / Options	Construction cost	Calm water area	Sedimentation impact (amount received, at -1.0 m)	Overall evaluation
(1) Option #1 (normal line #1, L = 53 m)	Taken as 100	50 m x 50 m A = 2,500 m^2	50 m x 30 m x 0.5 m = 750 m^2	Investment effect B/C* is taken as 1
(2) Option #2 (normal line #2, L = 60 m)	113 (13 % increase against Option #1)	50 m x 70 m A = 3,500 m^2 (1.4 times more than in Option #1)	50 m x 50 m x 0.5 m = 1,250 m^2 (1.67 times more than in Option #1)	Calm basin effect: B/C = 1.24 Sedimentation effect: B/C = 1.48 • B/C effect is sufficient. • Maintenance of water depth in the gear loading and preparation area (-1.5 m) and slipway area (-1.0 m) is easy.

* B/C: benefit cost ratio

3) Fishery Center Building Project

A facility for efficient handling, processing and sale of fresh fish is planned in proximity to the catch-landing beach. The facility (Fisheries Center) will incorporate cooperative office premises, a meeting room, and a fish shop that can be used by the cooperative association of fishermen. Further, new lockers will be provided for the convenience of fishermen, adjacent to the existent lockers, in order to remedy a present lack of facilities.

The outline of the fishery products' flow is shown in Figure 2-3-2.4

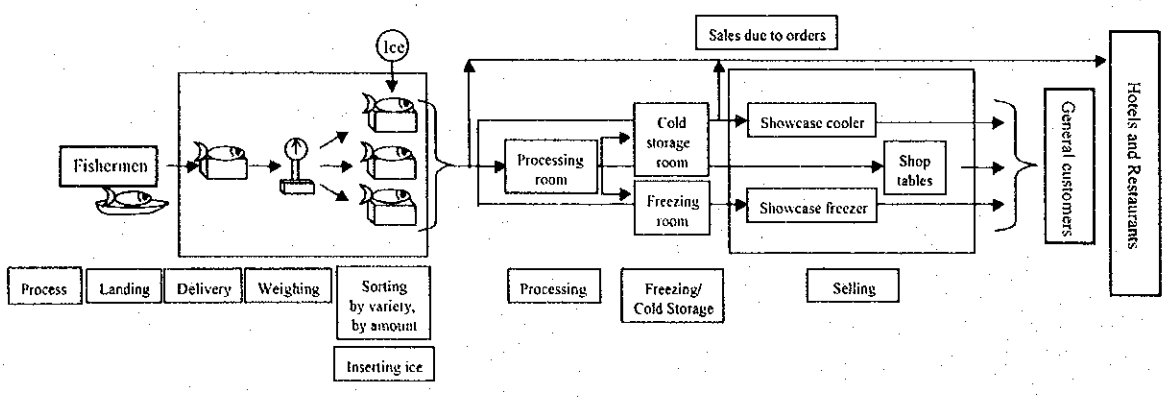


Figure 2-3-2.4 Fishery Products' Flow in the Fishery Center

(2) Civil Engineering Facilities Plan

1) Fish Catch Landing Beach

a) Fishing Boats Targeted as Catch-Landing Beach Users

The practice of direct mooring of fishing boats on the beach for catch landing used at present, is the method that suits local small-size fishing boats. Therefore, the catch landing beach is planned to serve 45 small-size fishing boats, including 28 Basseterre East boats, 13 Basseterre West boats, and 4 boats from Lime Kiln.

- Daily number of landing boats: at the assumption of operating ratio = 30 %, 45 boats x 30 % = 13.5 boats/day ≈ 14 boats/day
- Average numbers of loading boats per hour: 14 boats ÷ 2 hours = 7 boats/hour
- Beach turnover ratio per hour: 1 hour ÷ 20 min./boat = 3 rounds
- Required number of berths: 7 boats/hour ÷ 3 rounds = 2.3 berths ≈ 3 berths

Therefore, 3 berths are planned as the landing beach. Total length of berth is 9 m (3 berths @3 m = 9 m).

2) Slipway

Hauling up to the boat ramp will be carried out mainly for daily routine maintenance works and sheltering in case of hurricane.

- Number of boats targeted for daily routine maintenance: BE 28 + BW13 + LK4 = 45 boats
- Boats targeted for sheltering in case of hurricane: BE 28 vessels

A comparison was made between the following alternative methods for hauling boats up the slipway. As a result, use of trailers was adopted as a realistic solution, a method providing flexible usage appropriate to local conditions.

Table 2-3-2.5 Comparative Examination of Boat Hauling-Out Methods

Boats' hauling-out method	Supplemented facilities	Evaluation
Winch method	After lifting a boat ashore by winch, a transporting device is required (trolley, forklift, transtainer, etc.)	Land usage at the boat ramp is limited. The method requires a lot of mechanical devices and is undesirable from the viewpoint of maintenance.
Trailer method	Trailer can both lift a boat ashore and transport it. However, a towing vehicle and space for turning are required.	The parking lot can be used as a turning area. The method features high flexibility of land usage and easy maintenance. → The method is adopted.

Therefore, the following dimensions are provided for the slipway: 5 m width x 2 boats = 10 m width, slope 1:6, concrete paving.

3) Boat Ramp

- Boats targeted for daily routine maintenance:
  BE 28 boats + BW 13 boats + LK 4 boats = 45 boats
  Space required for 1 round per week maintenance:
  45 boats x 1/7 = space corresponding to 7 boats
- Boats targeted for the shelter during hurricane: BE 28 vessel

Therefore, the boat ramp for 28 BE boats is projected.

- Type of targeted boats: 25 ft class (L = 7.5 m, B = 1.6 m), per boat space = 8 m x 2 m.
- 2 rows x 14 boats space: width 16 m (= 2 x 8 m), length 28 m (= 14 x 2 m) space is planned.

4) Existing Breakwater Improvement & Reinforcement

The existing breakwater has crest elevation of approximately +0.5 m to +1.2 m, and has sand sedimentation to its rear. The breakwater has been virtually transformed into a shore. Land reclamation is planned at the rear, basically without modifying the topography. Therefore, in order to minimize the amount of wave overtopping to the terminal yard, it is planned to raise the crest elevation to +3.5 m. Also the structure will be strengthened.

Approximately 60 m eastward expansion of the breakwater will provide the calm basin required for the gear loading & preparation quay and the slipway.

Refer to Attachment-2 concerning the estimation of degree of wave overtopping, crest elevation and calmness of the basin,

5) -1.5 m Gear Loading & Preparation Quay

This quay will serve for occasional mooring of the 25 boats based in Nevis (overall length 10 m, draft 1.0 m).

- Berth length (mooring alongside: overall length 12 m): 1.2 m x 10 m = 12 m/berth
- At the assumption of 30 % operating ratio: 25 boats x 30 % = 7.5 boats/day
- Number of moored boats per hour: 7.5 boats ÷ 2 hours = 3.75 boats/hour
- Quay turnover ratio per hour: 1 hour ÷ 15 min./boat = 4 rounds/hour
- Number of required berths: 3.75 boats/hour ÷ 4 rounds = 1 berth

Therefore, 1 berth is projected for the -1.5 m, L = 12 m gear loading & preparation quay. In front of this quay, a turning basin with diameter of 3L = 30 m is provided.

6) Parking Lot

The following is the basis for the estimation of parking lot.

• Fisheries center staff 6 persons x 1/3	= 2 vehicles
• Fishermen (BE) 28 boats x operating rate 30 % (Note 1) x allocation rate 70 % (Note 2)	= 6 vehicles
• Maintenance (lifting boat ashore 1 round/week + launching boat 1 round/week = 2 rounds/week)	
BW: 13 boats x 2/7	= 4 vehicles
LK: 4 boats x 2/7	= 2 vehicles
• Fish buyers	
Peak time number of visitors: 20 persons	
Fellow passengers: 1.5 persons/vehicle	
Projected parking for vehicles: 20 persons ÷1.5 persons/vehicle	= 14 vehicles
Total	28 vehicles

Note 1: *operating ratio*: during the study period, daily operating volume was approximately 8 to 9 boats, meaning (8~9) boats / 28 boats = 30 %.

Note 2: *allocation ratio*: during the study period, 6 vehicles were parked daily (2 vehicles of the west beach + 4 vehicles of the east beach), meaning 6 vehicles ÷ (8~9) boats ≈ 70 %.

Required parking space according to "The Manual of Road Construction" per vehicle is 25m^2. Therefore, necessary area A = 28 vehicles x 25 m^2/vehicle = 700 m^2.

The parking lot will be outfitted along with the boat ramp, so that the parking lot space could also be used for turning of a tow car and a trailer when towing or launching a boat.

(3) Fisheries Center Plan

1) Basic Information on Planned Fisheries Center

a) Daily Amount of Fish Handled/Processed at Fisheries Center

Table 2-3-2.6 presents statistics on the amounts of fish catch on Saint Kitts by method and variety (species) for the 5-year period from 1995 to 1999. Table 2-3-2.7 shows the composition of different fishing methods at each fishermen settlem--ent on Saint Kitts. Being developed on the basis of the two above-mentioned tables, Table 2-3-2.8 characterizes the amount of catch by fishing method at Newtown (the planned catch landing site, Basseterre East) and in front of the Public Market (Basseterre West), through the 5-year period.

Table 2-3-2.6 Estimated Landings at Saint Kitts by Method and Species (1995-1999)

(Unit: ton)

Fishing Method	Major Sp.	1995	1996	1997	1998	1999	Total
Trap, Hand Line	Doctor fish (*Acanthuridae*)	4.79	11.21	4.19	8.74	6.24	35.17
	Trigger fish (*Balistidae*)	2.93	6.83	2.25	5.15	6.32	23.49
	Grunts (*Pomadasyida*)	1.08	10.11	1.42	3.36	2.74	18.72
	Squirrel fish (*Holocentridae*)	2.89	8.61	5.14	7.84	8.79	33.28
	Snappers (*Lutjanidae*)	4.06	9.25	4.70	8.07	15.10	41.19
	Goat fish (*Mullidae*)	2.76	9.66	1.17	2.49	1.46	17.54
	Parrot fish (*Scaridae*)	7.23	19.20	5.26	8.26	7.50	47.44
	Groupers (*Serranidae*)	7.67	17.75	9.90	11.24	11.46	58.02
	Lobsters (*Panularius argus*)	5.23	11.90	4.03	20.60	14.78	56.55
Sub total		38.63	104.54	38.06	75.76	74.39	331.39
Net	Gars (*Belonidae*)	12.42	26.68	25.96	60.18	58.12	183.37
	Bollyhoo (*Exocoetidae*)	21.45	53.98	22.53	37.76	22.14	157.86
	Jacks (*Selar crumenophthalmus*)	0.00	0.00	16.35	20.32	35.83	72.51
Sub total		33.87	80.66	64.85	118.26	116.10	413.74
Trolling	Dolphin (*Coryphaena hippurus*)	2.67	13.27	19.53	34.01	12.98	82.46
	Tuna/Mackerel (*Thunnus/Scombridae*)	0.92	3.48	2.62	9.99	9.37	26.38
Sub total		3.59	16.75	22.15	43.99	22.35	108.84
Dive	Conch (*Strombus gigas*)	13.20	28.81	20.20	21.94	20.86	105.00
Others	Mixed	12.83	34.00	14.60	21.35	30.77	113.55
Total		102.11	264.76	159.86	281.31	264.47	1,072.52

Source: Fisheries Management Unit

Table 2-3-2.7 Percentage of Landings by each fishing method and landing site in Saint Kitts (1999)

(Unit: %)

Landing site \ Fishing Method	Trap	H. Line	Net	Diver	Trolling	Average
New Town (B.E.)	15	2	20	90	2	25.8
Public Market (B.W.)	35	50	5	10	10	22.0
Old Road (O.R.)	10	20	30	0	30	18.0
Sandy Point (S.P.)	20	7	25	0	20	14.4
Dieppe Bay (D.B.)	15	15	20	0	35	17.0
Others	5	6	0	0	3	2.8
Total	100	100	100	100	100	100.0

Source: Fisheries Management Unit

Table 2-3-2.8 Landings by each fishing method and landing site of the project (1995 - 1999)

(Unit: ton)

Landing Site	Fishing method	1995	1996	1997	1998	1999
Newtown	Trap	2.9	7.8	2.9	5.7	5.6
	Hand Line	0.4	1.0	0.4	0.8	0.7
	Net	6.8	16.1	13.0	23.7	23.2
	Trawling	0.1	0.3	0.4	0.9	0.4
	Diver	11.9	25.9	18.2	19.7	18.8
	Others	5.8	15.3	6.6	9.6	13.8
	Sub total	27.9	66.4	41.5	60.4	62.5
Public Market (incl. Landings at Lime Kiln and Nevis)	Trap	6.8	18.3	6.7	13.3	13.0
	Hand Line	9.7	26.1	9.5	18.9	18.6
	Net	1.7	4.0	3.2	5.9	5.8
	Trawling	0.4	1.7	2.2	4.4	2.2
	Diver	1.3	2.9	2.0	2.2	2.1
	Others	4.9	12.9	5.5	8.1	11.7
	Sub total	24.8	65.9	29.1	52.8	53.4
Total		52.7	132.3	70.6	113.2	115.9

Note: Estimated by the Consultant

b) Average Yearly Catch Landing Amount

Year 1995 was the first year of data collection, and data collection error etc. is possible for this period. Therefore, the data portion for 1995 was excluded from further examination. Accordingly, the annual average volume of total fish landing at the planned site from 1996 to 1999 is estimated at 108 t.

c) Daily Average Fish Handling Amount and Catch Amount Variation

In a month, the Fisheries Center has 25 working days in average, and daily average fish handling amount is estimated as:

108 t /year ÷ 12 months = 9 t/month → 9 t/month ÷ 25 days = 360 kg

Generally, in a month there would be 5 to 6 times difference between the catch amounts between days of bumper and poor catches. On Saint Kitts and Nevis, however, such spread is lower and is estimated as 3 ~ 4 times.

Under such hypothesis, the average daily handling amount is 360 kg, however the figure would increase to 600~700 kg in bumper catch days and decrease to 150~200 kg in poor days.

d) Monthly Fluctuation of Fish Catch

- Fish Catch in Saint Kitts

Table 2-3-2.9 presents actual fish quantity by month on Saint Kitts in 1999. It can be seen that there are two seasons, the bumper period which is from January to August and poor period which is from September to December. The "Bumper period" partially coincides with the hurricane season, and this can lead to a decrease in fish catch as fisherman do not leave port.

Table 2-3-2.9 Fish Catch in Saint Kitts in 1999

(Unit: ton)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total
Fish catch	24.1	24.1	30.2	22.3	26.6	19.8	31.1	22.9	10.7	18.3	19.7	14.6	264.5

Source: Fisheries Management Unit (FMU)

- Fish Catch Amount in Basseterre

Table 2-3-2.10 presents actual fish catch amount by month on Basseterre in 1999.

The peak catch amount was registered in July and the poorest catch was in September.

Table 2-3-2.10 Fish Catch by Month at Project Site

(Units: ton)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year total	Monthly average
Fish catch amount, by month	9.8	9.8	12.3	9.1	10.9	8.1	12.7	9.4	4.4	7.5	8.0	6.0	108.0	9.0
Fish catch amount, in bumper months	9.8	9.8	12.3	9.1	10.9	-	12.7	9.4	-	-	-	-	74.0	10.6
Possible amount for storage *	0.0	0.0	1.7	0.0	0.3	0.0	2.1	0.0	0.0	0.0	0.0	0.0	4.1	-

* Note: Possible amount for storage = (bumper month catch amount) - (bumper month average catch amount) (10.6 t)

e) Present Fish Catch and Capacity of Stock

From the fish catch data in Basseterre, daily fish catch for the month of peak catch as July and month of poorest catch as September are calculated as follows.

Daily fish handling amount in July: 12.7 ton ÷ 25 days = 508 kg/day

At most 800 ~ 900 kg and at least 250 ~ 300 kg
Estimated by Consultant

Daily fish handling amount in September: 4.4 ton ÷ 25 days = 176 kg/day

At most 300 ~ 400 kg and at least 100 ~ 150 kg
Estimated by Consultant

Since there is no cold storage facility at present, required capacity is estimated taking into account requirements for both keeping fish fresh and long-term store for poor period.

f) Cold Storage Capacity

FMU estimated the lost catch due to freshness deterioration is 15 % of total amount. Cold storage capacity is calculated taking into account fish catch during the bumper month of July.

Estimates of selling amount during bumper period per day: S = average selling amount per day

Note: Selling amount is equivalent to average fish catch per day, i.e. average fish catch per month ÷ 25 days.

Requirement of the amount of fish which should be kept fresh per day : X = C - S + N

Maximum fish catch : C; 900 kg/day

Estimated loss of fish catch because of deterioration of quality : N; 900 kg x 0.15 = 135 kg/day

Selling amount : S; 10.6 ton ÷ 25 days = 424 kg/day

Therefore, X = 900 - 424 + 135
= 611 kg

g) Freezer Capacity

Since there is no freezer facility at present, the requirement and capacity of freezer is estimated taking account of the differences between the fish catch amount during bumper period and poor period.

Freezer capacity is calculated to sum up the excess of average fish catch during bumper period.

Freezer Capacity: $Y = A_1 + A_2 + A_3$
A_1: Excess in March; 1.7 ton (See Table 2-3-2.10)
A_2: Excess in May; 0.3 ton (See Table 2-3-2.10)
A_3: Excess in July; 2.1 ton (See Table 2-3-2.10)
Therefore, $Y = 1.7 + 0.3 + 2.1$
$= 4.1$ ton

h) Water Supply

In Saint Kitts, water is supplied from two sources: the valley located about 4 km to the north-west of the Basseterre site, and the valley located about 1.5 km to the east of the site. The latter is used for water supply to Basseterre East. (3 water reservoir tanks are used for this purpose, being installed at elevation +130m and each having dimensions B20 m x L25 m x H5 m). As a 4-inch water pipe (capacity: 228 l/min) is laid along the bay road near the site, no water-related problems are anticipated. The water is natural, it is supplied from the mountains and is good quality.

Loss of water supply occurs mainly after storms, and at times may last a week to ten days. Apart from this, interruptions to supply occur about once every few months, and last from several hours to several days. Under normal circumstances, failure of old equipment is the main cause.

i) Power Supply

On Saint Kitts, electric power is generated by the thermal power plant (36 MW) located at about 1.5 km to the north of the Basseterre site. The electricity is supplied through the trunk line (440 V, three-phase, 4-wire) and through the spur line (230 V, single-phase, 2-wire). Power supply cable is laid underground along the bay road near the Project site. Sufficient power could be supplied to the project under normal circumstances.

Failures of power supply occur mainly after the passage of storms, and at times may last for about a week. Apart from this, power supply failures occur about once every few months and last from several minutes to several hours.

2) Determination of Facilities Requirements

a) Fish Handling Room

The following floor area is required for the fish handling room (39.4 m^2):

Ice making machine / ice storage plant	3.2 m^2
Platform scale	0.5 m^2
Bandsaw	1.4 m^2
Fish containers	5.4 m^2
Passages	14.0 m^2
Space for the ice storage plant's door	1.2 m^2
Working space for 5 operators	13.7 m^2
(Total)	39.4 m^2

b) Fish Processing Room

The following floor area is required for the fish processing room (28.3 m^2):

Sink to defrost fish/Fish washing sink	3.2 m^2
Working table	1.1 m^2
Passages	10.2 m^2
Space for the refrigerator's door	3.0 m^2
Working space	10.8 m^2
(Total)	28.3 m^2

c) Packing Room

The following floor area is required for the fish processing room (4.3 m^2):

Vacuum packing machine	0.8 m^2
Working table	1.1 m^2
Working space and passages	2.4 m^2
(Total)	4.3 m^2

d) Fish Shop

The following floor area is required for the fish shop (36.9 m^2):

Shop tables	3.2 m^2
Show-case type freezer	1.3 m^2
Chest-type freezer	1.3 m^2
Space for customers	31.1 m^2
(Total)	36.9 m^2

e) Fishing Gear Shop

Extra 14.8 m^2 is planned as the floor area at the fishing gear shop, in addition to the fishing gear storage space (5.2 m^2), passages and fetch-out space (9.6 m^2).

f) Cooperatives' Office

An office for the staff of 6 persons will require the floor area of 4.425 m^2/person x 6 persons = 26.6 m^2.

g) Meeting Room

The floor area for 45 fishermen targeted by the Project (representatives of 45 vessels, 25 boats from Nevis are excluded) will require 0.6477 m^2/person x 45 persons = 29.2 m^2.

h) Machine Room

The following floor area is required for the machine room (26.5 m^2):

Freezers (2 units)	1.7 m^2
Generator	1.7 m^2
Automatic voltage regulators	1.0 m^2
Distribution power board	0.5 m^2
Parts storage shelves	0.9 m^2
Passages for carrying machinery	4.5 m^2
Space for disassembly and repair works	16.2 m^2
(Total)	26.5 m^2

i) Cold Storage Facility (Room Temperature 0°C)

Cold storage facility is determined as follows.

No. of fish containers to be kept	:	611 kg ÷ 25 kg/container ≈ 25 containers
Method of store	:	4 layers
Space for loads (fish containers)	:	0.7 m (depth) x 3.0 m (length) = 2.1 m^2
Space for passage	:	1.0 m (width) x 3.0 m (length) = 3.0 m^2
Inside dimension	:	1.7 m (width) x 3.0 m (length) x 2.4 m (height)

j) Freezer Facility (Room Temperature -20°C)

Walk-in type freezer (capacity 4.1 t) is planned in order to supply fresh fish throughout the year as follows.

Storage method	: shelf at both sides of passage, 3 layers on 1 row	
Require volume	: 4.1 ton x 2.5 m^3 (Note) = 10.3 m^3	
Space for loads	: 1.65 m (height) x 1.1 m (deep) x 3.2 m (length) =	5.8 m^3
	1.65 m (height) x 1.1 m (deep) x 2.5 m (length) =	4.5 m^3
	Total	10.3 m^3

Space for freezing	: 1.1 m (deep) x 0.7 m (length)
Space for passage	: 0.8 m (width) x 3.2 m (length)
Inside dimension	: 3.0 m (width) x 3.2 m (length) x 2.5 m (height)

k) Ice Making Plant & Ice Storage

The following amount of ice is estimated for the corresponding amount of fresh fish:

Ice consumption when loading into fishing boats	(fish amount : ice) 1 : 0.8
Ice consumption during processing, storage and sales in the Fisheries Center	(fish amount : ice) 1 : 0.4
Ice consumption during sales	(amount of sales : ice) 1 : 0.2
(Total)	1.4

Therefore, the proportion of 1:1.4 is determined as the correlation between the weight of fish and the total amount of ice consumption.

The following ice production capacity is estimated on the assumption of 508 kg/day catch in bumper season in July and ice consumption coefficient of 1.4:

508 kg/day x 1.4 = 711 kg/day

Ice making and storage plant are inseparably related to each other. Ice, which is made by ice making plant, is kept in the ice storage and will be taken away as the need arises. Since ice-making capacity represents the amount that can be made in 24 hours, no ice can be utilized during working time if there is not enough ice. Therefore, at least ice for 1 day should be kept. Therefore, the capacity of ice storage plant, which will use an automatic ice-making device, is determined as 1,260 kg/day (= 900 kg x 1.4), by considering 900 kg as the maximum amount during bumper days.

l) Toilets

One toilet for men and one toilet for women will be provided for the office rooms, meeting room, and shop.

m) Toilets, Shower Rooms and Lockers for Fishermen

The Project targets 28 fishing boats in Newtown. On a basis of 1 locker per boat, construction of 20 new lockers together with the 8 existing lockers gives a total of 28 lockers. Regarding toilet requirements, 56 fishermen are targeted, on the assumption of crew of 2 persons per boat. According to the "Handbook of Construction Equipment and Administration", Ministry of Labor regulations state that 4 toilets are required. The same number of showers is also planned. The toilets, showers and lockers will be provided in a separate building.

n) Water Reservoir Tank

The amount of water used daily at the Fisheries Center will be as follows:

Ice making plant, 711 kg/day	=	711 *l*/day
Fish washing, 800 kg/day (max.) x 5 *l*/kg	=	4,000 *l*/day
Water for offices, 6 persons x 50 *l*	=	300 *l*/day
Floor washing, 143 m^2 x 5 *l*/day	=	720 *l*/day
Utensils and equipment washing, 50 units x 20 *l*/day	=	1,000 *l*/day
Other water taps, 4 units x 10 times x 20 *l*	=	800 *l*/day
(Total)		7,531 *l*/day

Taking into consideration a 20 % safety margin for the estimate, the following water amount is estimated:

7,513 *l*/day x 1.2 = 9,037 *l* ≈ 9 m^3

The water reservoir tank capacity is also determined as 9 m^3, in the view of the above-mentioned water supply conditions and reliability.

o) Power Generator

The following power generator capacity is determined:

1.	Freezing device for refrigerating	7.5 kW
2.	Condenser fan for air conditioning	1.1 kW
3.	Unit cooler fan	0.6 kW
4.	Show-case-type freezer	1.1 kW
5.	Chest-type freezer	0.2 kW
6.	Show-case-type cooler	0.75 kW
7.	Lighting	2.73 kW
8.	Pump	2.2 kW
	(Total)	16.18 kW

(4) Layout Plan

The layout plan was developed according to the design policy specified above, and also in consideration of the following issues.

1) Land Reclamation Plan

The rear of the existing breakwater has undergone sedimentation of sand by the tombolo effect and has practically transformed into a shore, with ground elevation of +0.2m ~ +1.5m. It is proposed to reclaim this rear area to a ground elevation of +2.2m ~ +2.5m, basically without modifying the shore topography. The

ground elevation of the reclaimed area was determined in consideration of +2.0 m elevation of the existing road at the rear, and of high tide overtopping waves.

2) Alignment of Breakwater and Extension

The existing 100m long breakwater is planned to be reinforced and the existing alignment will be retained. This portion of the breakwater will function as a seawall protecting the landward areas, and construction of a 10m-wide apron is planned here.

Furthermore, in order to secure the required water depth at the slipway and in front of the gear loading & preparation area, as well as to provide a calm area under normal conditions, the breakwater will be extended eastwards by 60 m.

3) Slipway and Gear Loading & Preparation Area

A slipway and gear loading & preparation area will be constructed along the rear side of the eastward breakwater extension.

4) Buildings

A Fisheries Center and fishermen's locker facility will be constructed on the shore, approximately 45m from the seawall, as a precaution against damage by overtopping waves during hurricanes. These facilities will be located close to the existing lockers. The entrance to the fish shop at the Fisheries Center will face the existing road.

(5) Machinery, Equipment and Materials Plan

The specifications for equipment, machinery and materials are planned as follows.

1) Cooling Equipment

a) Equipment for the ice making plant

i)	Flake ice making device ice production capacity: 750 kg/day	1 unit
ii)	Condensing unit (type R-22), for the above-mentioned ice making device	1 unit
iii)	Cooling condenser	1 unit
iv)	Prefabricated ice storage plant	1 unit

v) Stand, ladder 1 set
vi) Valves 1 set
vii) Piping materials 1 set
viii) Thermal insulation materials for piping 1 set
ix) Power distribution board, electric wiring, thermal insulation materials 1 set

b) Equipment for freezer facility (room temperature –20°C)

i) Condensing unit (type R-22) 1 unit
ii) Cooling condenser 1 unit
iii) Unit cooler 1 unit
iv) Prefabricated ice storage plant 1 unit
v) Valves 1 set
vi) Piping materials 1 set
vii) Thermal insulation materials for piping 1 set
viii) Power distribution board, electric wiring, thermal insulation materials 1 set

c) Equipment for cold storage (refrigerating) facility (room temperature 0°C)

i) Prefabricated ice storage plant 1 unit
ii) Power distribution board, electric wiring, thermal insulation materials 1 set
iii) Unit cooler 1 unit

d) Industrial chemicals (cleaning/air conditioner maintenance)

i) Industrial chemicals 1 set
ii) Reserve articles 1 set

e) Air conditioning equipment

Separate-type equipment is planned. Installation is planned in the following premises.

i) Office rooms
ii) Meeting room
iii) Fish processing room
iv) Fish shop

2) Electrical Equipment

a) Terminal box and equipment, electric wiring
b) Lighting equipment

3) Processing Equipment and Materials

i)	Show-case freezer (with front glass) capacity: 500 l (-20°C)	1 unit
ii)	Show-case cooler (with front glass) capacity: 500 l (for chilled products)	1 unit
iii)	Chest-case freezer (top-door type) capacity: 600 l (-20°C)	1 unit
iv)	Platform scale	1 unit
v)	Suspended scale (with trays)	2 units
vi)	Automatic pan scales	2 units
vii)	Fish containers (plastic, ~70 l)	30 pieces
viii)	Insulated fish boxes (~150 l)	10 pieces
ix)	Hand cart	4 pieces
x)	Bandsaw	1 unit
xi)	Vacuum packing machine	1 unit
xii)	Knives (for frozen products)	4 pieces
xiii)	Gloves (for operating wire bandsaw)	4 pairs
xiv)	High boots	4 pairs
xv)	Cutting board	4 pieces
xvi)	Stainless steel sink	1 set
xvii)	Stainless steel shop table	1 set
xviii)	Stainless steel working table	1 set
xix)	Stainless steel waste disposal box	1 set

4) Backup Generator

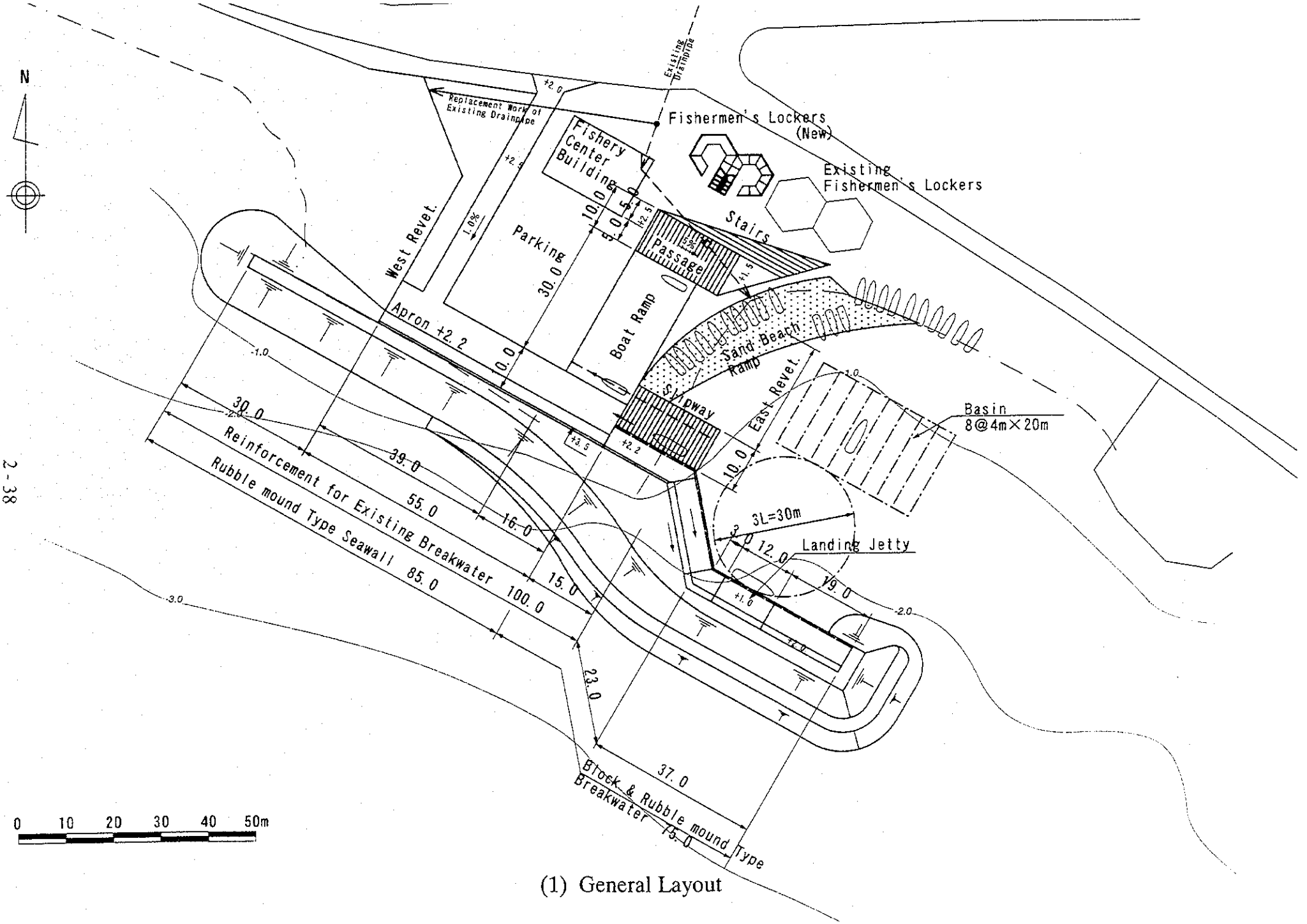
a)	Diesel generator (low-noise type) Output 40 kVA, fuel tank: 300 l	1 unit

5) Water Supply and Sanitary Equipment

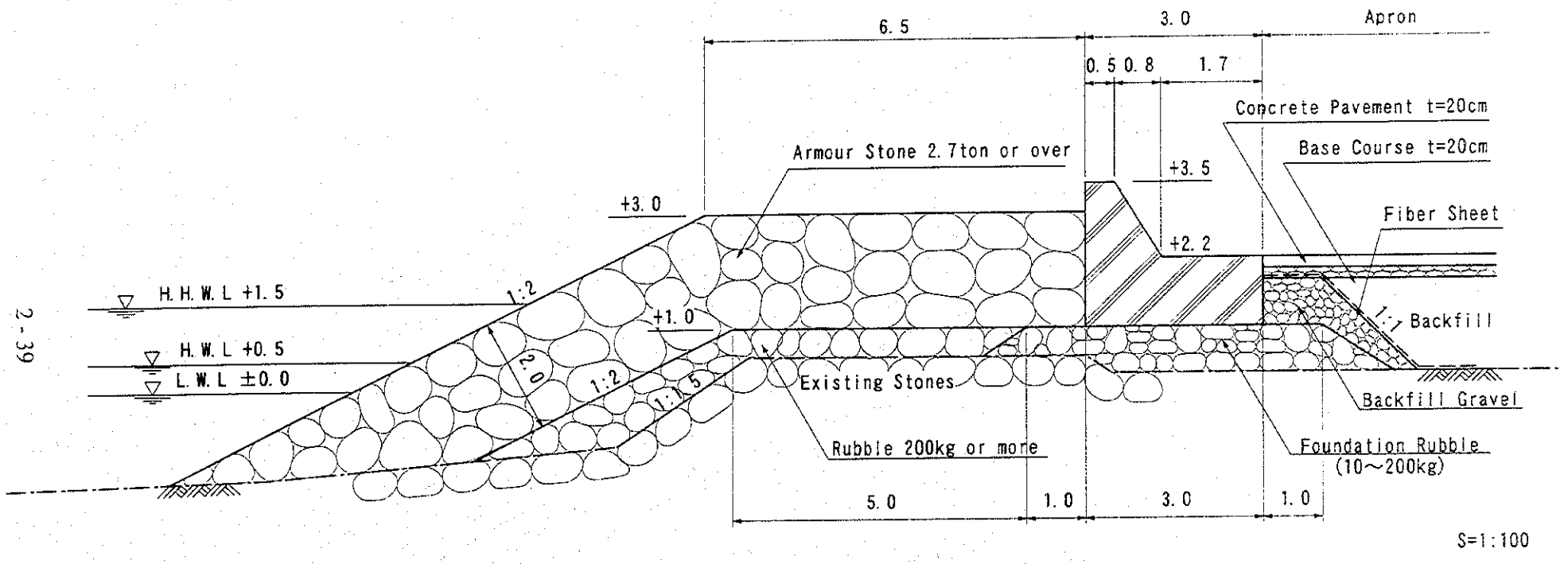
a)	Water supply equipment	1 set
b)	Waste water equipment	1 set

2-3-3 Drawings of Basic Design

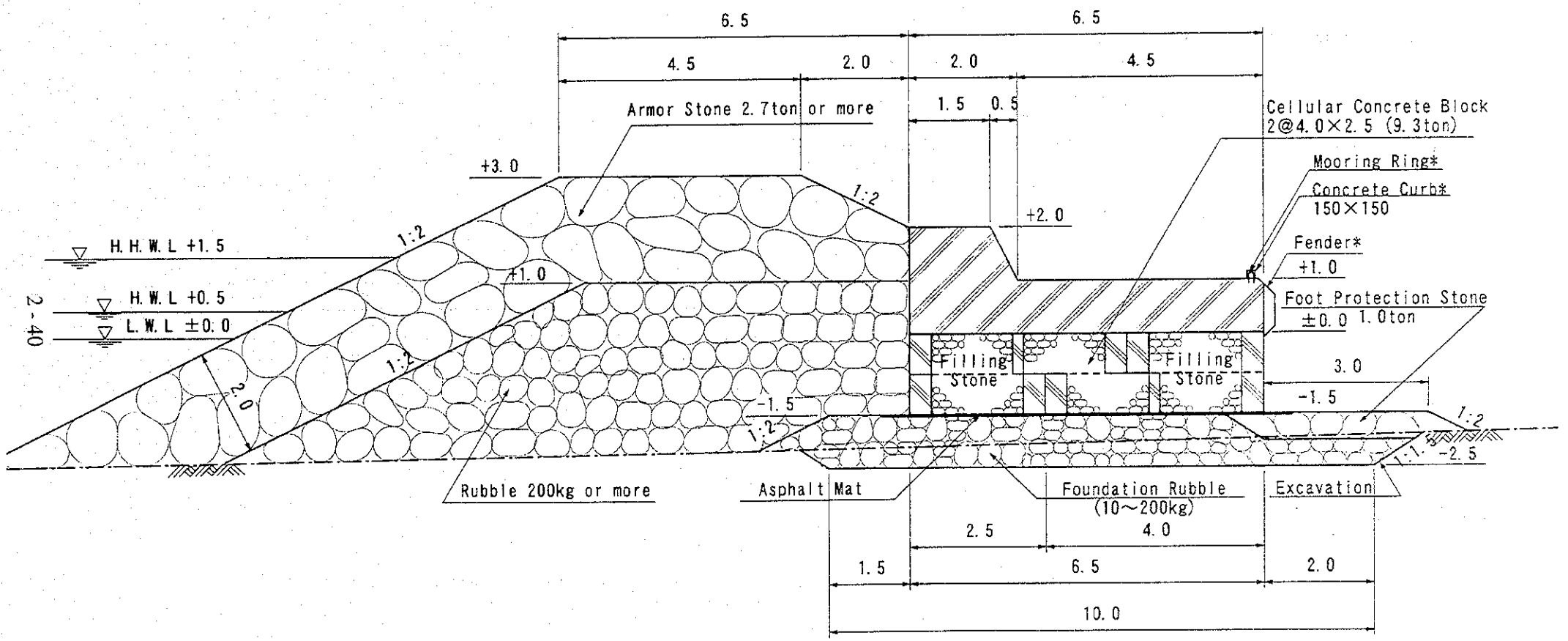
(1) General Layout
(2) Breakwater Section A-A
(3) Breakwater with Landing Space
(4) Slipway
(5) East Revetment
(6) West Revetment
(7) Fisheries Center Building (Plan)
(8) Fisheries Center Building (Section)
(9) Fishermen's Locker (Plan and Section)



(1) General Layout



(2) Breakwater Section A - A



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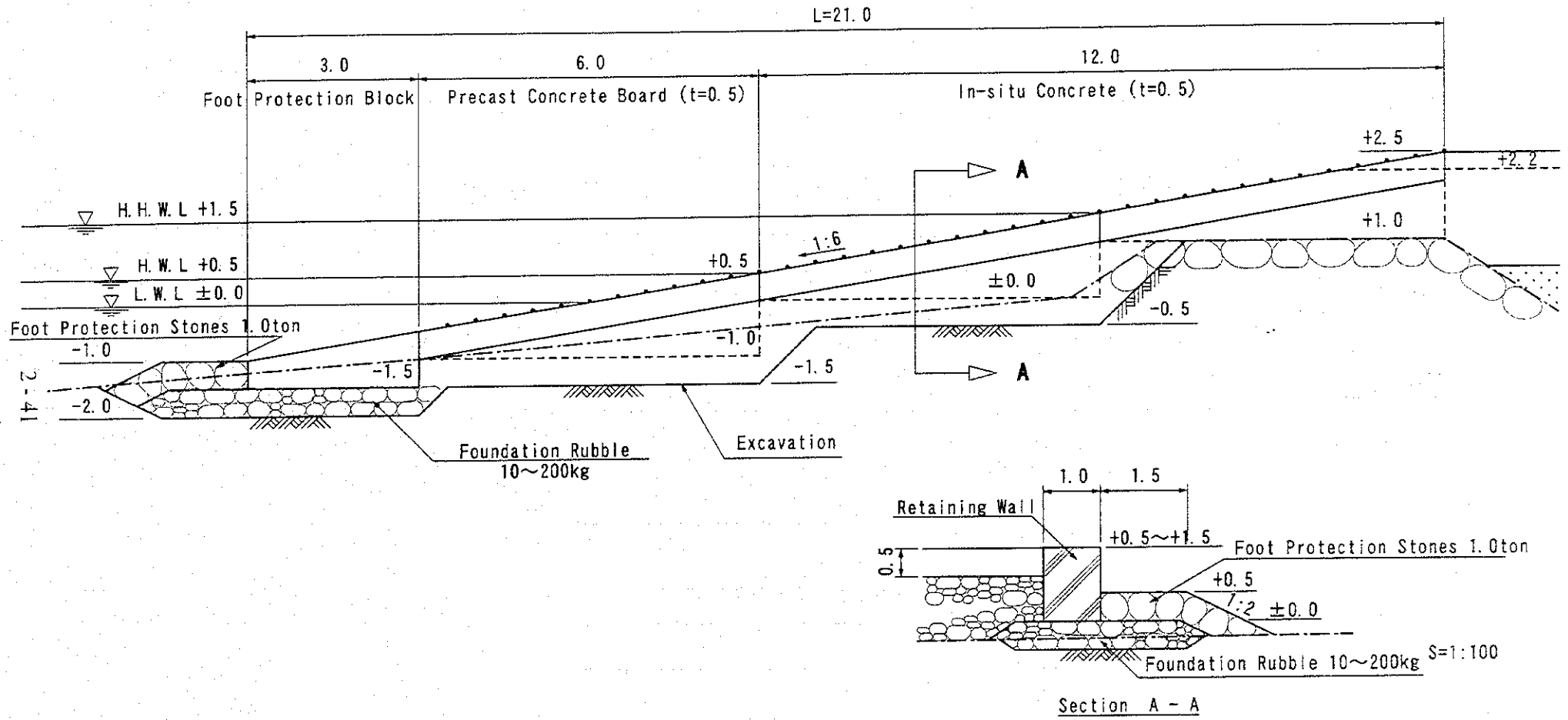
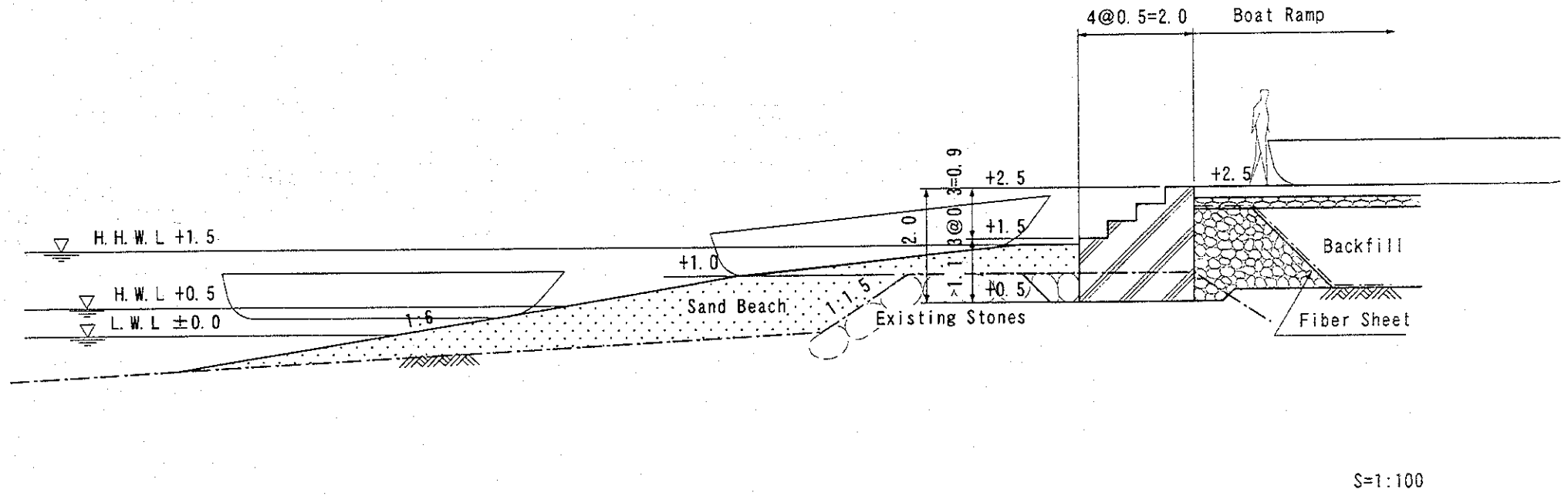
Note
*: Placed at Landing Space Only

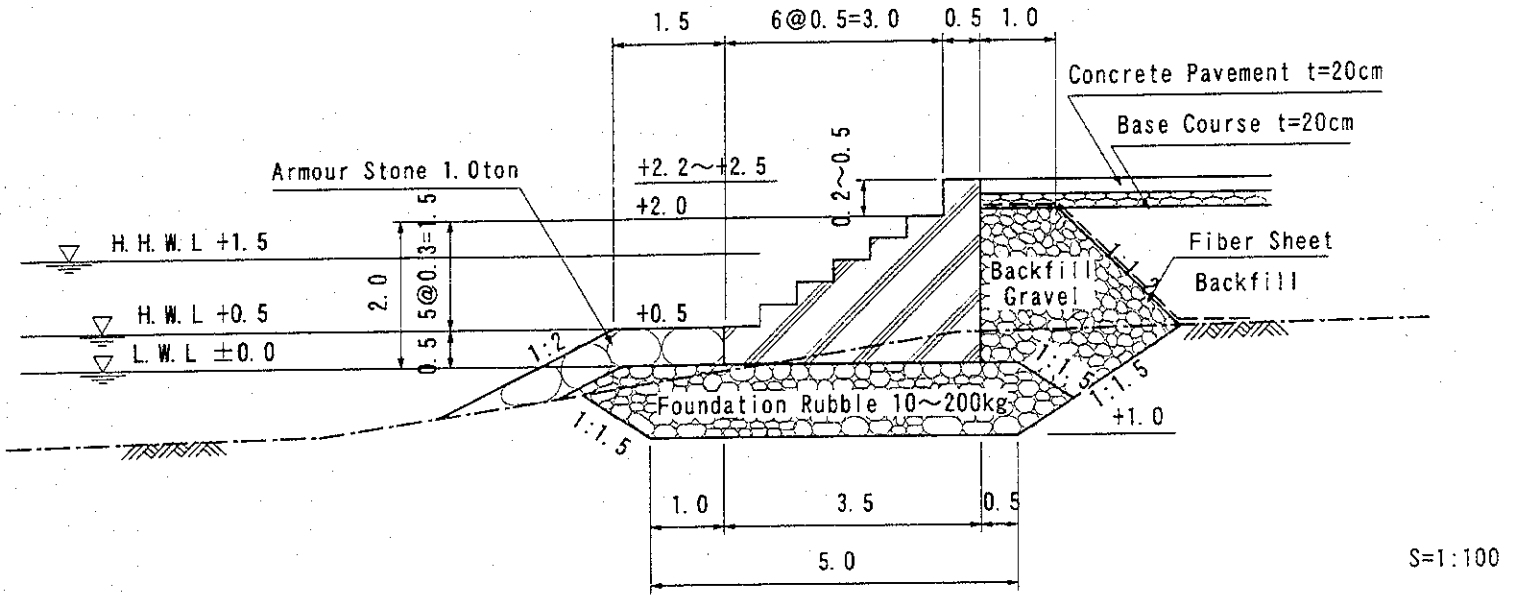
(3) Breakwater with Landing Space


L=21.0
3.0
6.0
12.0
Foot Protection Block
Precast Concrete Board (t=0.5)
In-situ Concrete (t=0.5)
+2.5
+2.2
+1.0
H.H.W.L +1.5
H.W.L +0.5
L.W.L ±0.0
+0.5
1:6
±0.0
-0.5
Foot Protection Stones 1.0ton
-1.0
-1.0
-1.5
-1.5
-2.0
2.41
Foundation Rubble
10～200kg
Excavation
A
A
1.0
1.5
Retaining Wall
+0.5～+1.5
0.5
Foot Protection Stones 1.0ton
+0.5
1:2
±0.0
Foundation Rubble 10～200kg
S=1:100
Section A - A

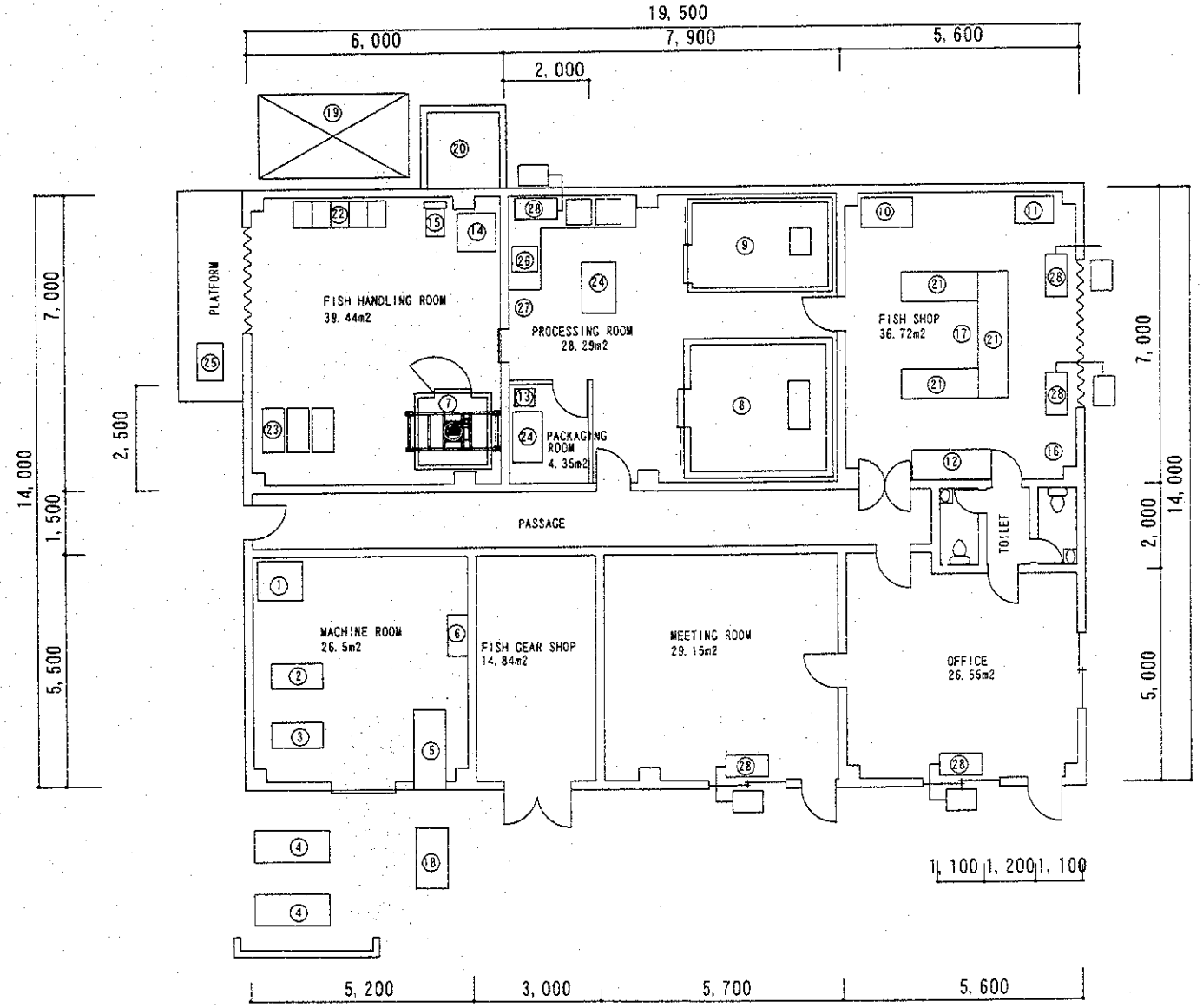
(4) Slipway



(5) East Revetment

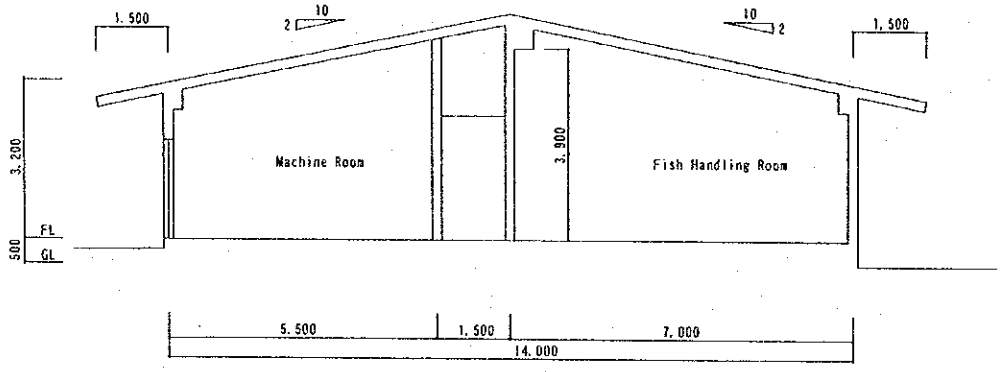


(6) West Revetment



1	AUTOMATIC VOLTAGE REGULATOR 30KVA
2	COMPRESSOR FOR ICE MAKING MACHINE 5.5KW
3	COMPRESSOR FOR COLD-STORAGE 7.5KW
4	AIR-COOLED CONDENSER
5	DIESEL ENGINE GENERATOR 40KVA
6	CONTROL PANEL
7	FLAKE-ICE MAKING MACHINE 750kg/Day
8	FREEZER ROOM-20℃ 3.0mWx3.2mLx2.5mH(IN CLEAR)
9	COOLER ROOM 0℃ 1.7mWx3.0mLx2.4mH(IN CLEAR)
10	SHOWCASE FREEZER 500L -20℃ 1 unit
11	SHOWCASE COOLER 500L +3℃ 1 unit
12	CHEST TYPE FREEZER 600L -20℃ 1 unit
13	VACUUM PACKAGEING MACHINE 0.5KW 1 unit
14	BAND SAW 1.5KW 1 unit
15	STAND SCALE 1 unit
16	UPPER PLATE SCALE 2 units
17	SUSPENSION SCALE 2 units
18	FUEL TANK 300lit.
19	WATER STORAGE TANK 10m3
20	WATER PRESSURE TANK
21	STAINLESS SALES STAND
22	FISH CONTAINER 70lit. 30pcs.
23	INSULATED FISH-BOX 150lit. 10pcs.
24	STAINLESS WORKING TABLE
25	MANUAL CART 2 units
26	STAINLESS SINK
27	GARBAGE CAN 2 units
28	AIR CONDITIONER

(7) Fisheries Center Building (Plan)



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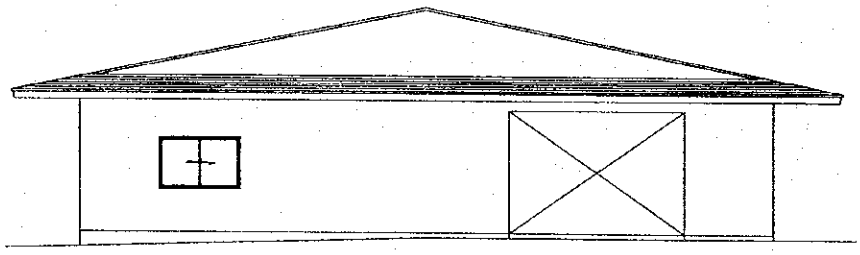
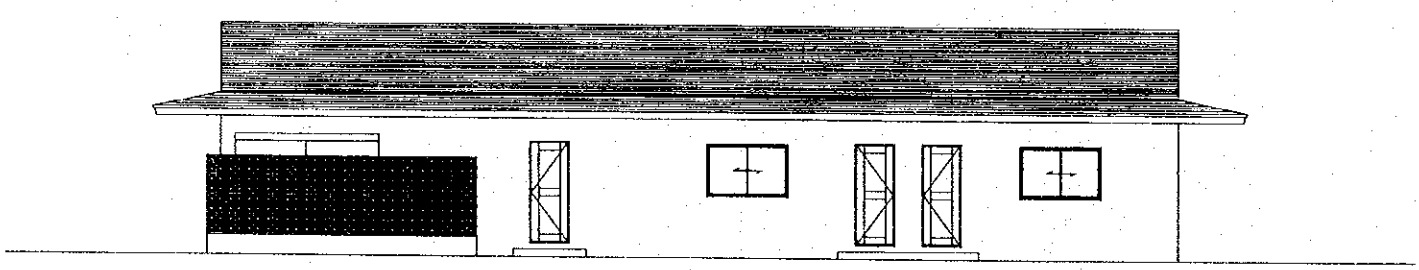
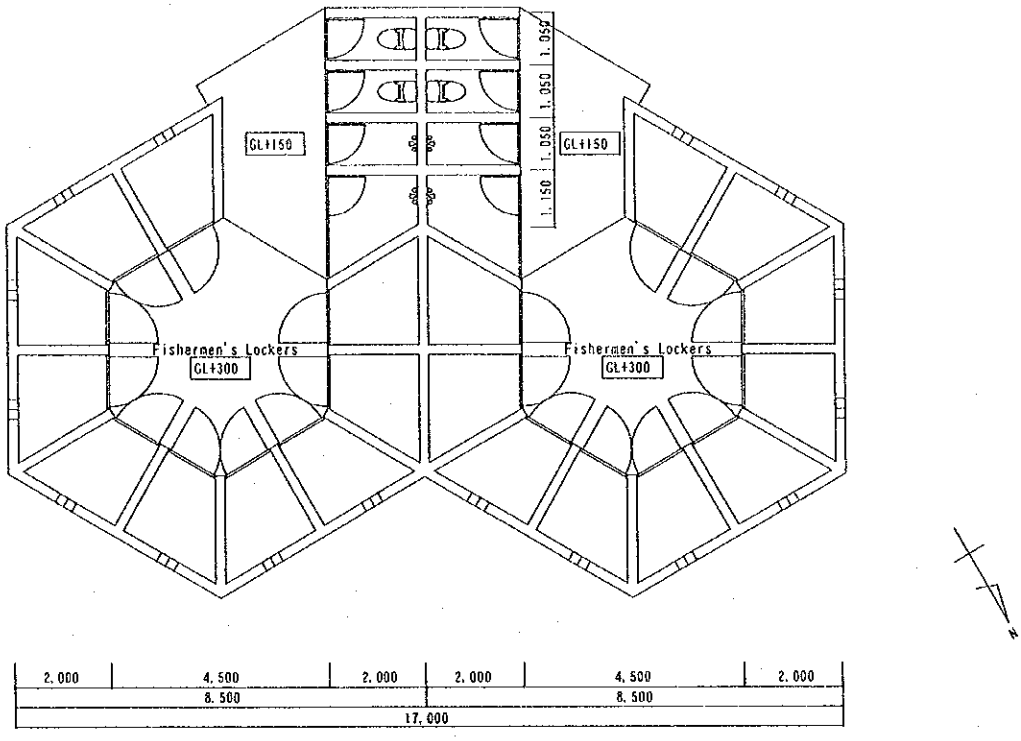


West Elevation S=1:150

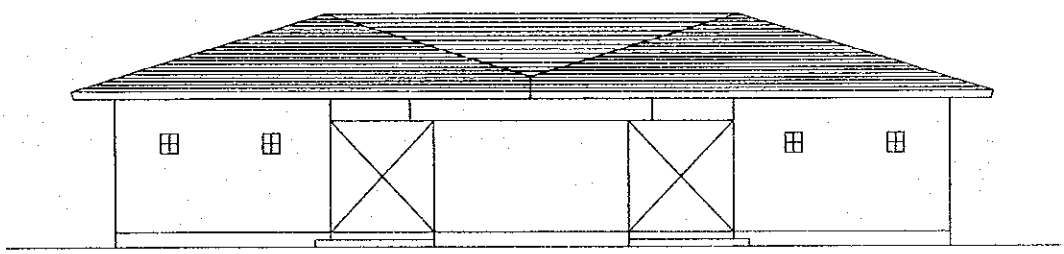


North Elevation S=1:150

(8) Fisheries Center Building (Section)



Plan S=1:150



Section S=1:150

(9) Fishermen's Lockers (Plan and Section)