

BASIC DESIGN STUDY REPORT
ON
ANSE LA RAYE FISH LANDING FACILITY
DEVELOPMENT PROJECT
IN
SAINT LUCIA

MARCH 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

ECOH CORPORATION

PREFACE

In response to a request from the Government of Saint Lucia, the Government of the Japan decided to conduct a basic design study on Anse La Raye Fish Landing Facility Development Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Saint Lucia a study team from October 10 to November 30, 2006.

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

October, 2006

Masafumi Kuroki
Vice-President
Japan International Cooperation Agency

March, 2007

LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on Anse La Raye Fish Landing Facility Development Project in Saint Lucia.

This study was conducted by ECOH CORPORATION, under a contract to JICA, during the period from September, 2006 to March, 2007. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Saint Lucia 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,

Eiichi Matsuura
Project manager,
Basic design study team on
Anse La Raye Fish Landing Facility
Development Project
ECOH CORPORATION

Summary

Summary

St. Lucia is a volcanic island country, the area of 616 sq. meters, 42.3km long and 22.4km wide, is located at the middle of Windward Islands in Caribbean Sea. The island is very mountainous, being comprised of lots of peaks, and is mainly of two topographical regions of the northern part with wide flat valleys and the southern and central parts with steep valleys and peaks of mountains. A tropical marine climate with an average temperature of 27 characterizes the yearly season of the rainy season during June and November, and the dry season during December and May.

The population of the country is estimated at 164,791 people in 2005, and the growth rate of population is 1.37% according to statistics of the Government of St. Lucia. In the national economy, the gross domestic product (GDP) recorded EC\$648 million in 2004 and the gross national income (GNI) per capita recorded EC\$3,989 (2004). The major industry is of tourism and agriculture that centers on the export of the banana. As for agriculture, in which 80 percent of the employees are engaged, the production of the banana gets depressed for the natural damage such as hurricanes in recent years, in addition to abolition of the preferential treatment system of UK that is the main export destination and the change of an international market. Diversification of industry centering on the promotion of the tourism industry becomes an important issue. The sector of agriculture, forestry and fisheries is important industry that accounts for about 6% of GDP (1999), and follows the tourism industry of 13% or more. The fishery plays an important role to supply the animal protein and employment opportunity (about 2000 people) etc. Moreover, the Government implements the measures for promoting development of fishery industry with collaboration with tourism industry.

The Government of Saint Lucia reiterated revision of the comprehensive National Development Plan for certain term and has been implementing the measures based on the latest plan to cover all the sectors. With the National Development Plan, the Government of Saint Lucia has prepared Medium Term Development Strategy Paper every several years as milestones toward the National Development Plan. The Government has been implementing the project for comprehensive National Development Plan with the cooperation of United Nations Department Economic and Social Affairs. For promoting the project, National Economic Council established by the Government is expected to play a key role and issued the report titled "TOWARD AN INTEGRATED ECONOMIC STRATEGY". The council proposed the Short Term Remedial Growth Strategy, which is composed of main policies of Employment Maximization, Poverty Reduction and Crime Abatement. It highlights strategic interventions in the fisheries sector as follows:

- Strategic Focus

Fisheries plays an important and sometimes underrated role in the economy of Saint Lucia, providing both full-time and seasonal employment, and contributing significantly to

domestic food security and national GDP. Employment in the fisheries sector extends to and includes persons other than those who catch fish, e.g. boat boys, vendors and truckers.

Offshore pelagics and larger pelagics have the best potential for increased exploitation and present an identifiable path for technical and economic diversification of fisheries sector in Saint Lucia. In addition, fishers are now becoming both professional and more committed. The fisheries sector is attracting younger people.

Furthermore, in recent years there has been a significant investment in fisheries infrastructure in Saint Lucia. This has, in many ways, also contributed to the transformation process within the sector.

Based on the foregoing, economic diversification in Saint Lucia must both contribute to and benefit from enhanced economic activity within the fisheries sector.

1) Priority Issues

- There is need to protect economic territorial waters from fishing activity to safeguard the depletion of fish stocks.
- Commercial operation and financial returns from the facilities extensively invested by Government are less than optimal. Government is required to put in place appropriate mechanism for efficient management & their maintenance.

2) Proposed strategic Interventions

- To encourage and facilitate more widespread use of improving fishing technology.
- To improve post harvest technology and quality assurance.
- To design strategies for improving market access locally and externally.
- To institute systems for improved fishery management.
- To re-deploy resources for improving the role and capacity of fishers organization so as to assure future benefits to fishers.
- To introduce measures for private sector involvement in improving the commercial operation of the national fisheries infrastructure.

In addition, "Plan for managing the fisheries of St. Lucia" issued by the Department of Fisheries in 2007 targets the followings:

- To develop the fishing industry in terms of modernization of fisheries infrastructure and fishing vessels and use of improved fishing gear and methods
- To promote self-sufficiency through increased production from captured fish and the aquaculture sector.
- To advance the social and economic welfare of fishermen and their families.
- To improve the nutrition of the nation through the provision of increased volumes of fish production.

Regarding the activities of fisheries sector in Saint Lucia, annual fish catch of 1,386 tons were landed in 2005 by 1,667 fishermen with 680 fishing boats registered. Insufficient supply of

local fish causes import of fish to compensate the shortage in the market. The Government established the 8-year Plan for Fisheries Development during 2000 and 2007, which stresses policies to increase the fish production by promotion of artisanal fishery and to decrease volume of fish import. The Department of Fisheries is implementing measures of:

- Improvement of fisheries facilities for fish landing, fish processing, fish distribution, etc.,
- Enhancement of fishermen's cooperatives, and
- Improvement of fishing technologies.

118 fishermen living in Anse La Raye Village, located at the west coast of the Island, conduct artisanal fishery business to catch pelagic fish and coastal bottom fish with 30 fishing boats registered. It takes about 30 minutes to drive on the road of 20 km from Castries and Anse La Raye is deemed to have high potential to supply fresh fish to the market in Castries.

In the face of given fishery merit, each function of fisheries facilities in Anse La Raye is deteriorated. The damaged jetty, constructed for ferry boats, has so high elevations of the deck that fishing boats are not accommodated. Inadequacy of the jetty suffers in-port activities of the fishing boats. As for other fisheries facilities, incompatibility of the existing facilities with fishing gear and unavailability of unification of relevant facilities have caused obstacles to fishery development, as a result of significant alternation of fish distribution system, fishing methods/ gear and approaches of hygienic control.

In order to promote fisheries activities by the fishermen in Anse La Raye and neighboring districts, the Government of Saint Lucia has requested of the Government of Japan the project under the grant aid scheme for development of facilities for securing safe and efficient activities at the landing station.

The Preliminary Study Team was dispatched during March and April in 2006 to confirm steady implementation of management of the facilities in the project. The Government of Saint Lucia committed establishment of the Management Committee for the facilities, which will take responsibility to manage them with formulating rules, guidelines and system for rental fees of the facilities.

The Government of Japan decided to conduct the basic design study for the project and dispatched the team to Saint Lucia as the following schedule.

- During October 8, 2006 and November 30, 2006 for Basic Design Study
- During February 24, 2007 and March 7, 2007 for Explanation of Draft Final Report

The following situations and constraints are confirmed through the study.

- 1) Tough loads and additional time are required for fishermen when landing fish and preparing fishing nets on the beach due to lack of berths for fishing boats.
- 2) No services of mooring fishing boats in the landing station urges fishermen to beach their boats, which results in increase of expenses for repair of boats' bottoms.

- 3) Insufficient supply of ice causes insufficient maintenance of quality of fresh fish.
- 4) Fishermen are obliged to secure time for selling fish by themselves due to no facilities for keeping quality of fresh fish and to lose their opportunities of fishing efforts.
- 5) Deterioration of the aged fisheries facilities and their management by different bodies suffer activities of the fishermen's cooperative, which targets social and economical improvement of fishers' welfare

In order to improve the above situations and constraints, the project will be implemented at Anse La Raye, a landing station among 13 stations in Saint Lucia.

The project components are comprised of a new jetty, a winch with slides, new fishing gear lockers, new Fishery Complex, and improvement of Venders' Arcade, the workshop and the toilet/shower, as tabulated in the following. The project will require 5.5 months for the detailed design work and 13 months for construction work. The project cost is estimated at 507 million Japanese Yen for the Japanese side and 155 thousand East Caribbean Dollars for the Saint Lucia side.

Contents of the Project

Scope of Assistance in Grant Aid		
Items	Specifications	Quantity
1 . Civil Works		
1)Jetty & accessories	Jetty of steel pipe piles *Length:48m, Width:5.6m *Berth length: 27m x 2 *Approach: 21m, Width:4m *Piles protected with anti-corrosion coating	1 unit
2) Boat Landing Facility	Winch and portable slides	1 unit
2 . Building Works		
1) Fishing gear lockers	R.C. Blocks construction Floorarea: 128.1sq. m &132.3 sq. m	2 buildings of 30 lockers
2) Drainage	Septic tank	1 unit
3) Fish Complex	Fishery Complex for rooms of: - Ice making & storage plants - Fishermen's Hall - Tackle shop - Office of Co-op - Office of Dept. of Fisheries * Total floor area : 341.4 sq. m	A building of 341 sq. m
Ice making machine	Capacity: 1 ton/day	1 unit
Ice storeroom	Storage capacity:2 ton	1 unit
Insulated ice box	A insulated ice box of 100 liters	2 units
Equipment of retailing fish	Tables and sinks of stainless steel	2 units
4) Workshop	Repair of roofing (area:199 sq. m) Repaint of steel frames, Electricity wiring.	1 unit
8) Venders' arcade	Reapir of floor concrete & water supply facility	1 unit

With implementing the project, the following effects are expected and the project is justified as appropriate and effective under the grant aid scheme of the Government of Japan.

【Direct Effects】

Reduction of Landing Hours (Landing efficiency)

Fish is landed from beached fishing boats. For beaching boats, a lot of labor work is required as involvement of 6 persons. The hours for landing fish will be reduced on average to 0.5 hours from 1.5 hours at present after improvement of jetty and 2 persons will be enough for landing fish at the jetty while 6 persons are involved in the said work.

Reduction of hours for the preparation of fishing (Number of fishing boats using the jetty)

Provision of the jetty reduces hours for preparation for fishing operation such as loading of fishing nets from 1.5 hours to 0.5 hours on average as well as the landing activities stated above. Reduction of labor force for the preparation is also expected from 6 persons to 2 persons. The jetty can render services of landing fish, the in-port preparation and lying by.

Reduction of number for repairing fishing boats (Number for repairing fishing boat)

The repair of the boat bottoms and the drying of boats are necessary every day for wooden boats and once every two weeks for FRP boats under the present situation of beaching boats. The repair work can be reduced to about once a few days for wooden boats and once a month for FRP boats with improving the jetty and at the same time, the damage to boat bottoms can be greatly reduced with provision of the boat landing facility. Fishing boats can be evacuated to the road located at the backside of the fisheries facilities using the boat landing facility in hurricanes and damages of boats in rough seas can be avoided.

Upgrading of freshness for caught fish (Fish purchasing ratio, Fresh fish purchasing ratio in Fish Friday)

Supply of ice to meet the demand of 1.4 tons can improve freshness of landed fish with installing ice making machine, ice storage and insulated ice box. It will be possible to supply fresh fish to the hinterland and it is also expected to increase purchase ratio of fresh fish on Fish Friday (61%).

Increase of fishing efforts (Fish landing volume)

A lot of labor for in-port operation can be reduced and fishing efforts of fishermen can be increased to enable them to control time for selling fish that is stored with ice. The alternation of fishing activities are brought about by provision of the jetty, fish processing facilities (ice making machine, ice storage, primary processing facility and etc.), a tackle shop and fish gear lockers.

Vitalization and Enhancement of Fishermen's Cooperative (Number of registered fisherman)

Anse La Raye Fishermen's Cooperative becomes the main body for the operation and management of the fisheries facilities to be improved in the project. Currently, there is no office of the cooperative and the different body has operated and managed therefore, the

activities to support the artisanal fishermen can not be attained. After the completion of the facilities, the operation and management body will be the Fishermen's Cooperative and the cooperative activities will be vitalized and enhanced.

Increase of the fisheries training, support for betterment of fishermen's welfare and education opportunity by the Department of Fisheries (Number of opportunity for education and training)

Provision of the Fishermen's Hall and the cooperative offices enables the Fishermen's Cooperative to hold regular meetings and fisheries trainings, and does the Department of Fisheries to extend fisheries technologies and training/education for advance of fishermen's welfare.

【Indirect Effects】

The project is to support fisheries' policy of the Government of Saint Lucia since the operation and management by the Fishermen's Cooperative becomes possible with the improvement of the facilities in Anse La Raye, which is the last landing station among 13 places in the west coast.

Improvement of working circumstances for fishermen and increase of opportunities of fishing operation, which results in increase of fishermen's income, are expected with implementing the project. Increase of fishing efforts and employment opportunities are expected also.

The Government of Saint Lucia has the plan of the development of Anse La Raye Village with the balanced promotion of tourism and fishery. In the aspect of tourism, the village has successfully planned and held the event of Fish Friday that reflects characteristics of the fishing village. The project will enable the fishermen to stably supply fresh fish and support the event with providing the facilities for ice supply, sanitation and convenient places for the event. It will result in enhancement of both activities of fishery and tourism and contribution to the Government policy of promoting the fishing village.

Anse La Raye Fishermen's Cooperative Society Limited is recommended to effectively operate and manage the facilities with implementing the followings after completion of the facilities. The Department of Fisheries is also recommended to conduct the relevant items listed below for assisting the cooperative.

Appropriate operation and management

With assistance of the Department of fisheries and the Department of Cooperatives, the Cooperative at Anse La Raye is expected to run the fisheries facilities on stand-alone basis and annually reserve the fund for renewal of the ice making machine and ice storeroom from the profits which will be generated with saving operation costs and efficiently managing the facilities.

For promotion of the fishery and tourism at Anse La Raye, general understanding should be required to render services of the fisheries facilities to the foreign tourists and local visitors

on Fish Friday. The cooperative should be responsible for efficient operation and management of the facilities.

Implementation of training and seminars for fishermen

The Cooperative should take responsibility to conduct training of fishing technologies and seminars for advance of their welfare, to reserve necessary funds from the profits, and to contribute to promotion of the fishing village.

Collection of more accurate fisheries statistics

The Department of Fisheries conducts sampling surveys at several landing stations and estimates the fish catch statistically. Anse La Raye, for example, was a sampling station for fish catch but no survey is conducted. It is believed that more detailed survey will bring about accurate data, which may result in easier comprehensive administration of the Department. The survey may reveal the difference between market prices of fish and fish prices directly sold by fishermen and it may produce basic data for improvement of fishermen's welfare. In addition to them, fundamental data for researching fish resources and fish catch should be collected for the fisheries administration by the Department of Fisheries. Provision of an office for a Fisheries Extension Officer will help the monitoring survey.

Management of the jetty for safe and efficient in-port operation

The jetty is deemed to be congested with fishing boats for their own purposes, since the scale of the jetty is designed for minimum services of landing, preparation and lay-by berths. For safe and efficient management of the facility, rules for using the facility should be formulated for fishermen on the basis of significant improvement of operation time.

Safe fishing operation and establishment of evacuation of fishing boats

In hurricanes, fishing boats are obliged to be evacuated ashore at Anse La Raye Village or from the Bay, in which no natural or artificial breakwater exist, to calm waters in other places. For the evacuation, meteorological information on hurricanes should be promptly transmitted to fishermen through the Cooperative and establishment of the system for transmitting such information is recommended. The Department of Fisheries is recommended to assist the Cooperative for the coordination with the Meteorological Services. The both parties require collaboration for instructing fishermen not to approach the jetty in high seas.

Establishment of fish transaction

Transactions of fish might be carried out not only in the fish processing facilities but on the jetty. The Cooperative is recommended to demonstrate its initiative for establishing the rules of fish transactions to be conducted at the sale counter in the fish processing facilities. The Cooperative is also recommended to formulate the system that the Cooperative buys all the fish from the fishermen, who are refunded by the Cooperative according to selling amount of fish catch. The formulation of the rules of transactions is expected to enhance

activities of quality control of fish to supply fresh fish to consumers.

Promotion of ice use

Fishermen supply fresh fish to not only the domestic market but foreign tourists and local visitors on Fish Friday. The situation requires the quality of fresh fish to satisfy these tourists and use of ice for fishing and fish distribution should be promoted by the Cooperative for fishermen to increase income by improvement of fish quality and to decrease volume of post-harvest loss.

Monitoring of beach

The sand beach at Anse la Raye shows slight rate of erosion. The beach just in front of the fisheries facilities might be scoured by high waves due to short distance from the shoreline in hurricanes. For properly protecting the fisheries facilities along the shoreline, regular monitoring of the beach configuration should be conducted and some shore protection facilities should be installed, if necessary.

Maintenance of the jetty

Open mouths of the jetty, which are designed for releasing uplift pressure by waves, are usually covered with blocks of greenheart timber for traffic on the jetty. In high seas they should be removed from the positions. Even if they are flown away, however, they will be purchased from the local market.

Table of Contents

	<u>Pages</u>
Chapter 1 Background of the Project	
1-1 Background of the Request-----	1-1
1-2 Component of the Request -----	1-1
1-3 Environmental and Social Consideration-----	1-5
Chapter 2 Contents of the Project	
2-1 Basic Concept of the Project-----	2-1
2-1-1 Relation with National Development Plan-----	2-1
2-1-2 Project Outputs -----	2-4
2-2 Basic Design of the Requested Japanese Assistance -----	2-6
2-2-1 Study of requested components -----	2-6
2-2-2 design Policy-----	2-44
2-2-3 Basic Design -----	2-55
2-2-3-1 Basic Design of facilities for Fishing Boats -----	2-55
2-2-3-2 Basic Design of Buildings -----	2-66
2-2-3-3 Basic design of Ice Making Machine, Ice Storeroom and Fish Processing Equipment -----	2-75
2-2-4 Basic Design Drawings-----	2-77
2-2-5 Implementation Plan-----	2-94
2-2-5-1 Plans for implementation and Procurement-----	2-94
2-2-5-2 Consideration of Execution and Procurement-----	2-95
2-2-5-3 Scope of Work -----	2-96
2-2-5-4 Consultant Supervision-----	2-97
2-2-5-5 Quality Control Plan -----	2-100
2-2-5-6 Procurement Plan -----	2-101
2-2-5-7 Implementation Schedule -----	2-104
2-3 Obligations of Recipient Country-----	2-105
2-4 Project Operation Plan-----	2-106
2-4-1 Principal Framework of Operation-----	2-106
2-4-2 Organization -----	2-106
2-4-3 management and Operation Plan-----	2-107
2-5 Project Cost Estimation -----	2-108
2-5-1 Initial Cost Estimation-----	2-108
2-5-2 Operation and Maintenance Cost-----	2-109

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effects -----	3-1
3-2 Recommendations-----	3-6

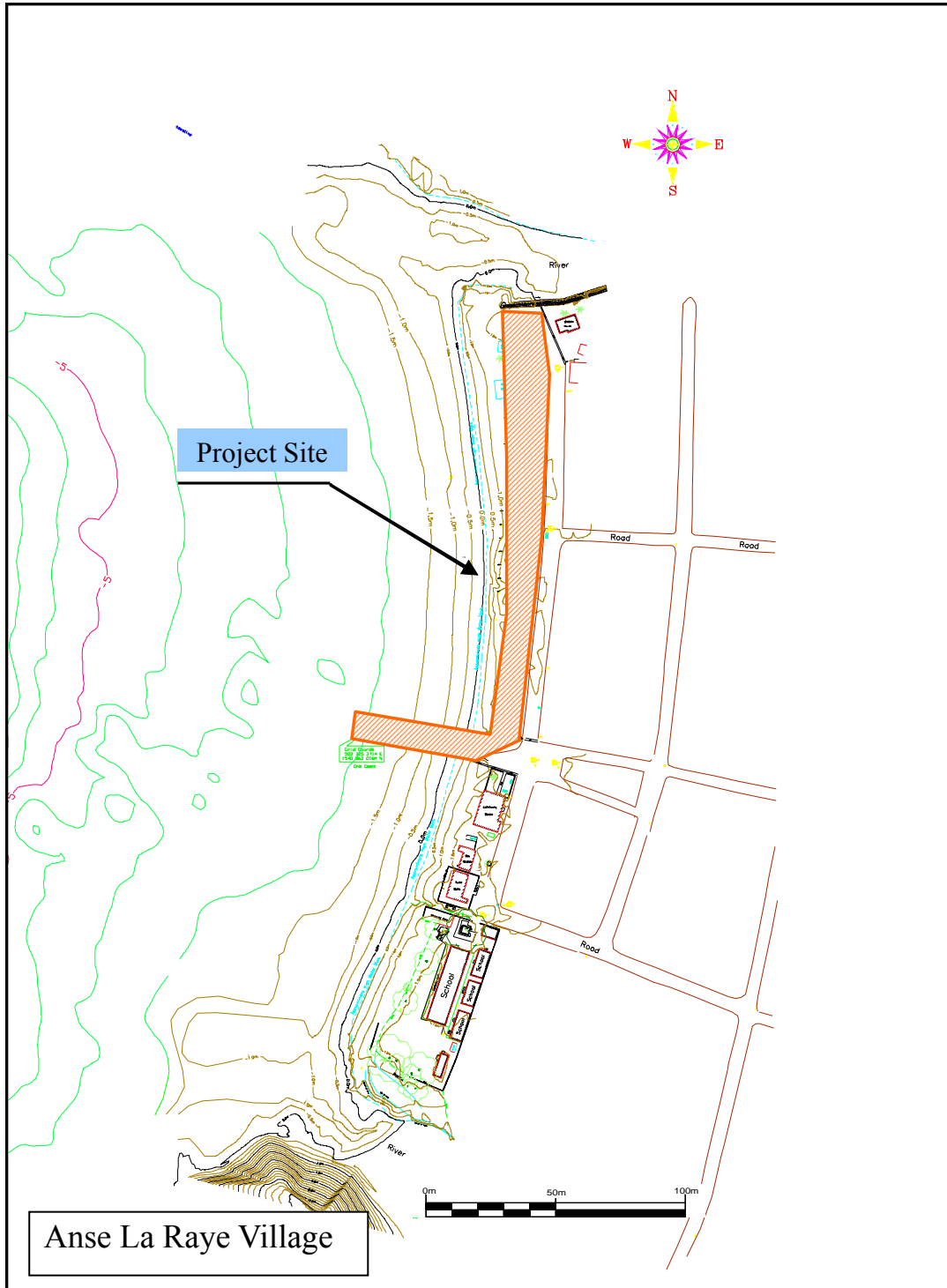
Appendices

1. Member List of the Study Team -----	A-1
2. Study Schedule-----	A-2
3. List of Parties Concerned in the Recipient Country]-----	A-5
4. Minutes of Discussions -----	A-7

Location Map



Location of Project Site



Perspective



LIST OF FIGURES

	<u>Pages</u>
Chapter 1	
Fig. 1-2(1) Layout Plan Requested by the Government of Saint Lucia -----	1-3
Chapter2	
Fig. 2-1-1 (1) Relevant with Project Goals and National Development Plan -----	2-2
Fig. 2-1-2(1) Logic Model for Relevancy between Sector Goals, Project Goals, Targets, etc.-----	2-5
Fig. 2-2-1(1) Location of major fishing grounds and landing station-----	2-7
Fig. 2-2-1(2) Shortage of fishing gear lockers due to changes of fishing net/gear and method -----	2-22
Fig. 2-2-1(3) Comparison of flow of fish and ice between the existing facilities and facilities under the project -----	2-27
Fig. 2-2-1(4) Expected effect by provision of an ice machine and an ice storage facility-----	2-28
Fig. 2-2-3(1) Permeable Types of Jetty -----	2-55
Fig. 2-2-3(2) Allocation of Berth Services -----	2-60
Fig. 2-2-3(3) Cross Section of Jetty-----	2-62
Fig. 2-2-3(4) Cross Section of Piled Slipway-----	2-63
Fig. 2-2-3(5) Concept of System for Hauling a Boat -----	2-64
Fig. 2-2-3(6) Dimensions of Slide -----	2-64
Fig. 2-2-3(7) Layout of Fishing Gear Locker-----	2-69
Fig. 2-2-4(1) Plan and Section of Jetty -----	2-78
Fig. 2-2-4(2) Cross Section of Jetty-----	2-79
Fig. 2-2-4(3) Details of Mooring Berth-----	2-80
Fig.2-2-4(4) Details of Approach-----	2-81
Fig. 2-2-4(5) Floor Plan of Fishery Complex (Ground Floor)-----	2-82
Fig. 2-2-4(6) Floor Plan of Fishery Complex (First Floor) -----	2-83
Fig. 2-2-4(7) Floor Plan of Fishery Complex (Basement Floor)-----	2-84
Fig. 2-2-4(8) Elevation of Fishery Complex-----	2-85
Fig. 2-2-4(9) Section of Fishery Complex -1 -----	2-86
Fig. 2-2-4(10) Section of Fishery Complex-2 -----	2-87

Fig. 2-2-4(11)	Plan of Gear Lockers-1-----	2-88
Fig. 2-2-4(12)	Elevation & Section of Gear Lockers-1-----	2-89
Fig. 2-2-4(13)	Plan of Gear Lockers-2 -----	2-90
Fig. 2-2-4(14)	Elevation & Section of Gear Lockers-2-----	2-91
Fig. 2-2-4(15)	Repair of Workshop -----	2-92
Fig. 2-2-4(16)	Repair of Venders' Arcade-----	2-93
Fig. 2-4-2(1)	Organization of Anse La Raye Fishermen's Cooperative -----	2-107

LIST OF TABLES

	<u>Pages</u>
Chapter 1	
Table 1-2(1) Components requested by the Government of saint Lucia-----	1-2
Table 1-2(2) Necessary Staff in the Project-----	1-4
Table 1-3(1) Procedures for EIA and Full Planning Commission -----	1-6
Chapter 2	
Table 2-1-1(1) Scope of assistance in Grant Aid-----	2-3
Table 2-1-2(1) Logic Model for Relevancy between Sector Goals, Project Goals, Targets, etc.-----	2-5
Table 2-2-1(1) Landing Volume of Fish by Species and Landing Places-----	2-9
Table 2-2-1(2) Number of registered fishermen by landing place (2009) -----	2-9
Table 2-2-1(3) Average Landing Volume of Fish by Species -----	2-12
Table 2-2-1(4) Estimation of ice production and water consumption-----	2-26
Table 2-2-1(5) Utilization Status of Community Center (2005) -----	2-32
Table 2-2-1(6) Contents of fishermen training and seminars -----	3-33
Table 2-2-1(7) Profit and Loss Statement of ALR Fishermen’s Cooperative Society Limited -----	3-36
Table 2-2-1(8) Fuel Consumption by Fishing Boat -----	3-37
Table 2-2-1(9) Situation of Project Component-----	3-38
Table 2-2-1(10) Relevancy of Project Component -----	3-39
Table 2-2-1(11) Operation and Management Bodies of Each Component -----	3-40
Table 2-2-2(1) Dimensions of Design Boat -----	2-48
Table 2-2-2(2) Surcharge -----	2-48
Table 2-2-2(3) Tide Conditions -----	2-49
Table 2-2-2(4) Design Waves -----	2-49
Table 2-2-2(5) Design Waves for Slipway-----	2-49
Table 2-2-2(6) N value for Design of Jetty -----	2-49
Table 2-2-3(1) Characteristics of Permeable Structures -----	2-56
Table 2-2-3(2) Summary of Design Berths-----	2-58
Table 2-2-3(3) Examination of Layout Options-----	2-59
Table 2-2-3(4) Additional Height from the Design Tide-----	2-61
Table 2-2-3(5) Specifications of Light Beacon -----	2-65
Table 2-2-3(6) Tractive Forces and Approach Speed of Fishing Boat -----	2-65
Table 2-2-3(7) Interval of Mooring Post-----	2-66
Table 2-2-3(8) Area of Each Facility -----	2-70

Table 2-2-3(9) Structure of Facilities-----	2-71
Table 2-2- 3(10) List of Electrical Installation -----	2-72
Table 2-2- 3(11) Required Water Quantity -----	2-73
Table 2-2-5(1) List of Equipment Requiring Installation Work-----	2-100
Table 2-2-5(2) Source of Material Procurement -----	2-102
Table 2-2-5(3) Origin of Principal Machinery -----	2-103
Table 2-2-5(4) Implementation Schedule-----	2-105
Table 2-5-1(1) Project Cost Estimation -----	2-108
Table 2-5-1(2) St. Lucia's Expenses-----	2-109
Table 2-5-2(1) Number of Fishery Cooperative Members -----	2-109
Table 2-5-2(2) Staff Salary (assumption) -----	2-111
Table 2-5-2(3) Cost of Maintenance-----	2-112
Table 2-5-2(4) Profitability of Anse La Raye Fishermen's Cooperative-----	2-113

Abbreviation

CIDA	Canadian International Development Agency
COD	Chemical Oxygen Demand
CUBiC	Caribbean Uniform Building Code
DCA	Development Control Authority
DO	Dissolved Oxygen
EEZ	Exclusive Economic Zone
EIA	Environment Impact Assessment
EIS	Environment Impact Statement
E/N	Exchange of Notes
FAO	Food and Agriculture Organization of the United Nations
FRP	Fiber Reinforced Plastic
GDI	Gross National Income
GDP	Gross National Product
LUCELEC	Saint Lucia Electricity Services Ltd.
NEC	National Economic Council
OECS	Organization of Eastern Caribbean States
SIS	Social Impact Statement
SLFMC	Saint Lucia Fish Marketing Corporation Ltd. (
UNDESA	United Nations Department of Economic and Social Affairs
V/C	Village Council
WASCO	Water & Sewerage Company Inc.

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background of the Request

The main industry of Saint Lucia is the agriculture representing Banana export, Tourism and Fishery. Especially, the agriculture which 80 % of employed population is engaged suffers its reduced production of Banana due to the international market gyration and natural calamity like recent hurricane in addition to the abrogation of preferential system by UK which has been main export market. Therefore the diversification of industry centering on promotion of tourism becomes the important issue.

In fishery industry of Saint Vincent, the number of registered fishermen is 1,667 persons and the number of registered fishing boats is 680 boats (2005). Yearly fish catch is 1,386 ton (2005) however, it is not satisfied with the domestic demand and the necessary quantity is depended on the import. For solving this the Government of Saint Lucia is trying to increase the volume of fish catch by the development of artisanal fishery and decrease the import of fishery products establishing 8 Years Plan for Fishery Development. And as the specific measure for this, the Government is putting operation of the improvement of fishery facilities concerning fish landing, processing, distribution and etc., enforcement of fishermen's organization and improving fishing technique of artisanal fishermen.

In west coast of the island where Anse La Raye is located, small scale fishery is the main target to many kinds of small pelagic fish and coastal bottom fish and the number of fisherman is 118 persons and the registered fishing boat is 25 boats.

It is located from 20km from the Capitol City, Castries and it takes about 30 minutes by car. The potentiality as a supply base of fishery products to urban area is very likely however, the functions are decreased in entire facilities due to the aging and the landing volume there was only 19 ton in 2000. Especially, the jetty which was constructed as the jetty for ferry boats therefore, it is improper for fishing boats in its height from the water what is worse, the damage by aging makes trouble for landing and mooring. And regarding the land facilities like ice making machine, refrigerator, gear rocker, sales booth are very much damaged by aging since they were installed in 20 years ago and these become the causes of after harvest losses.

For the purpose of development of fishery activities by artisanal fishermen in Anse La Raye and near by, Grant Aid Cooperation for necessary development in order to secure safe and effective fishery activities in the fish landing facilities were requested to the Government of Japan.

1-2 Component of the Request

The Government of Saint Lucia has requested for the Grant Aid for Anse La Raye Fish

Landing Facility Development Project in August 2004 to the Government of Japan. The Component of the Request is as shown in Table 1-2(1) and the floor plan of the requested plan is shown in Figure 1-2(1).

Table 1-2(1) Components Requested by the Government of Saint Lucia

Contents of Request from Governemnt of St. Lucia		
Items	Specifications	Quantity
1 . Civil Works		
1)Jetty & accessories	Trestle type jetty . Steel pipe piled structure with concrete decks for upper structure. Overall length:50m & width: :5meters This includes removal work of the existing jetty structure. The piled understructure must have anti corrosive treatment.	1lot
2) Slipway	To be structured with piles. Approx. length: 14meters with 3-meter width	1lot
3) Revetment	To be structured with reveted rubble stones for an overall length of 130 meters	1lot
4) Supply pipe for fuel, water		
2 . Building works		
1) Fishing gear lockers	R.C. Blocks construction	30units Total in 2 lots
2) Drainage	Storm drain and septic treatment work	
3) Fish Processisng Facility	Fish processing complex (new construction) for housing ice making/storage and refrigeration plant. Building with R.C. Block construction Total area:240m ²	1lot
Ice making machine	Ice making capacity: 1ton/day(flake ice)	1lot
Ice storeroom	Ice storage capacity: 2ton	1lot
Refrigerator	Refrigeration unit: ±5 Complete with electrical control device, water supply piping network	1lot
4) Fish sales counter	Construction of small building to house cooperative retail shop (on the G/floor) and fishermen training room. Area in total: 140m ² R.C. Block construction	1lot
5) Tackle shop		
6) Fishermen's training room		
7) Workshop		
8) Venders' arcade	Renewal (refurbishing) of existing venders' arcade. This includes renewal of vending booths, plumbing and so fourth.	1lot
9) Pavement	Other incidental exterior works: -Site premise pavement - Fencing/illumination -Car parking lot - Drainage/storm drain and septic treatment work -Jetty accessories such as fenders/ bollards and supply pipes and outlets for oil, fuel and water	1lot
10) Fence		
11) Lighting		
12) Parking lot		

The Government of Saint Lucia is planning the management system of the Project is as follows.

(1) Management System

1) Operation and Management Organization for Fish Landing Facilities

It is to consign to existing Fishery Cooperative (Anse La Raye Fishery Cooperative) under the supervision and support by Department of Fisheries, although it will be owned by Department of Fisheries, Ministry of Agriculture Forestry and Fisheries after the completion of this project. Department of Fisheries deems that Anse La Raye Fisheries Cooperative is also possible to be self sustainable since the Department of Fisheries has experienced the same in Choiseul and Soufriere Fishing Ports and found that they were both profitable. The Department of Fisheries believed that the maintenance and management is possible by the hand of educated persons of Fisheries Cooperative in the Ministry of Labor Cooperative Union which is the governmental organization in addition to their confidence in their past experiences.

2) Maintenance and Management System by Fisheries Cooperative

The maintenance and management in Anse La Raye Fisheries Cooperative is executed under the supervision, support and instruction by Department of Fisheries and the Ministry of Labor Cooperative Union. The cooperative membership is now 81 however, in the future registered fishermen 118 in Anse La Raye district, 91 in Canaries district, 1 in Roseau district and 2 in Cal De Sac district totaling 212 fishermen will be intended to be the members. The management will be executed by 5 commissioners including cooperative president. In this project the fisheries cooperative is going to employ a managers, technical assistances for ice making machine and so forth. However, a chief engineer of ice making machine is done by an engineer of ice making machine and refrigerator in SLFMC (St. Lucia Fish Marketing Corporation) under the training of Department of Fisheries and train and bring up assistant engineer employed by the cooperative.

The necessary number of staff and the name of department for maintenance and management in this project are shown below.

Table 1-2(2) Necessary Staff in the Project

Duty	Number
Management representative and accounting	1
Ice manufacture sale chief person	1

Clerk	1
Security guard	1
Cleaning ladies: 2 persons x 0.5 days.	2

1-3 Environmental and Social Consideration

(1) The necessity of environmental procedure

All that performs the act of development in Saint Lucia has been obliged to submit the report executing EIA (Environmental Impact Assessment) by law (Physical Planning and Development Act, 2001). In this project also, the person who acts the development i.e. Department of Fisheries of Saint Lucia shall execute EIA. As shown in Table 1-3(1), the Department of Fisheries shall submit necessary documents to Development Control Authority (DCA) after the submission of the full set of the documents for the detailed design by the Japanese Consultant to the Department of Fisheries. This procedure is called Preliminary Planning Approval. DCA will show TOR of EIS/SIS to Department of Fisheries and the Department of Fisheries shall submit the report after execution of the assessment. DCA will show additional TOR if necessary, and the Department of Fisheries will revise the report. The development permit is usually issued with collateral conditions within about 4 weeks after its application.

The procedures for “Full Planning Commission” shall be conducted in parallel with the procedures for “Preliminary Planning Approval” As shown in Table 1-3(1), the Department of Fisheries submits detailed design drawings to DCA, which the Consultant submits to the department of Fisheries. DCA will issue the permit for construction through the screenings of experts in the related government organizations. It usually takes about 4 weeks for the final permit.

The procedures for the above formality will be made within one month since the both procedures will be carried out in parallel

Table 1-3(1) Procedures for EIA and Full Planning Commission

Preliminary Planning Approval	1st week	2nd week	3rd week	4th week	Application documents, etc.
1. Submission of Detailed Design Drawings to DOF 2. Submission of Application to DCA by DOF 3. Referral Agency make TOR of EIA to Applicant. 4. Delivery of TOR to Applicant 5. Enforcement of EIA by Applicant 6. Referral Agencies feedback additional TOR to Applicant. 7. Issue of Permission for construction works with comments					*Detailed design drawings *3 copies of Project Proposal 1 copy of Facility Location Plan 10 copies of Conceptual Plan 1 copy of Survey Plan 1 copy of certificate of Land Ownership *TOR of EIS/SIS *TOR of EIS/SIS *Report of EIA *Additional TOR of EIA *Permission with comments
Full Planning Commission	1st week	2nd week	3rd week	4th week	Application documents, etc.
1. Submission of Detailed Design Drawings 2. Submission of D/D drawings to DCA 3. Screening of D/D drawings by Technical Committee of DCA 4. Issue of Approval of Construction Works by DCA	▽				*3 copies of Project Proposal 3 copies of Facility Location Plan 3 copies of Site Plan 3 copies of Building Drawings including Architectural, Structural, Electrical, Plumbing with septic tank & sewerage and Fire System *10 copies of Report of EIA ▽ *Approval of construction works

(2) Monitoring at Planning Stage

1) Eminent Domain and Resident Relocation

The land for existing fisheries facilities and the sand beach to sea are confirmed to be under the jurisdiction of CROWN i.e. the Government. Therefore, it is understood that there will be no Eminent Domain and Resident Relocation nor any social and environmental impacts in this Project.

2) Change of Fishing Ground and Land Use

This project is basically considered to improve merely existing fishery related facilities and present environment is to be kept as they are. New jetty will be installed at the location where existing one will be removed and Fishery Complex and all other facilities will be planned within the area where existing facilities are constructed. Beach seine net fishery is done in front of Anse La Raye beach however, the jetty which is protruding one to sea side will be the same or smaller scale with the existing jetty and therefore, the impact to the fishing will be very small. In the Stake Holders Meeting held on April 7, 2006 at the Preliminary Study the participants have strongly supported this project.

The impact influenced to the change of fishing ground and land use is likely to be small.

3) Coastal Erosion

As described in previous chapter, Anse La Raye coast and beach trends to be eroded and according to an inspection by aerial photo the shoreline is retreated with a ratio of 0.5m/year. At the same time, although it is not strong trend but the fact is confirmed that sand is moving along with coast. This situation is likely to be occurred on an ongoing basis regardless implementation of this project. This project has to form a plan subject to that fact. Therefore, the selection of jetty which will be constructed in coast line shall be the pile type one to cut out littoral drift and decide the position to be able to correspond for shoreline retreat. It is possible to minimize the influence of coast line change. However, as there is no room in hinterland where narrow strip of land is sweep away north to south, it is concerned that wave runs up to buildings in existing fishery related facilities at the time of stormy weather and beach in front of the foundation is scoured. The countermeasure for the purpose of the protection shall be considered when new buildings will be constructed.

With the above method, it is considered to be possible that the facilities constructed in this project will be strong enough against natural external force and minimize influence to beach deformation.

(3) Environmental Impact during Construction

1) Land change by construction works

There are two methods to construct pile type jetty in shallow water area like this project, one is to use marine construction barge, the other one is piling by land crane from temporary road to be constructed. In comparison of the construction cost for both methods, the latter one is relatively cheaper therefore, this method will be selected. In this case, the temporary road will be constructed almost parallel to existing jetty therefore, this temporary road may be the obstacle to littoral drift however, the magnitude of littoral drift is small as understood from the site condition. The temporary road will be installed for the period of about 7 months which is short therefore, the shoreline will be considered to be smooth after removal of the temporary road. With the reason, special countermeasure will not be necessary although monitoring of shoreline will be executed during construction period.

2) Construction of Coastal Facilities

SS of water area was measured in this site survey and found relatively high value. It is assumed the influence of discharged sand from small river located north to south.

As further water turbidity in this water area is concerned when the construction of temporary road and piling work will be conducted, the silt protection will be installed as the mitigation measure. With this method, it will be possible to prevent diffusion of SS as minimum. During construction period,

SS shall be continuously monitoring as index of water turbidity.

3) In and Out of Vehicles for Construction Material and Equipments

Judging from the road condition in Anse La Raye, ample road width is not kept. People are gathering around jetty and the backside road of fishery related facilities. Therefore, special consideration to resident is necessary since the material and equipments is very often carried in from stock yards near by and the counter measures are as follows.

Keeping speed limit in village roads

Arrangement of vehicle securities

Publicity to resident for working hours

As piling works are conducted on temporary road the arrangement of pilot boat to prevent encounter by fishing boats to the construction site.

4) Construction works in the Fish Friday

Considering that the Fish Friday is important tour event for Anse La Raye Village, the construction works have no other choice but are discontinued during preparation period and cleanup hours. Therefore, the construction work should be conducted in the morning time on Friday and completely stop from noon time.

(5) Environmental Impact during Operation

1) Drainage

There are 3 of drainage channels at shoreline and 1 river mouth of Petite Riviere in Anse La Raye Village and sewage from village is discharged from these and guts from landed fish and etc. are thrown into sea and or river as they were. The penetration type septic tank which was donated by Japan's Grant Aid Cooperation has been lost its functions by past disaster and the water from toilet and fishery related facilities are discharged untreated . As penetration type of septic tank can not be installed due to the limitation of little space, the aerating septic tank will be selected. In this case, it is necessary to dilute chloride concentration added at the end of septic tank before discharging into rivers. Like this, as discharging water from the facilities to be constructed at least in this project will be discharged to water area after purified, the influence to water environment will be small.

2) Traffic of fishing boats

After completion of the facilities to accommodate the current number of fishing boats, it is not expected to invite further number of fishing boats even if the number increases. In starting the sale of fuel and ice under the operation of the Fishermen's Cooperative, some fishing boats from other communities will call at Anse La Raye. The impact of the traffic of fishing boats will be very slight, considering the pattern of fishing operation,

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Relation with National Development Plan

(1) Sector Goals

The project contributes to the development of fishing industry in Anse La Raye and the neighborhood area.

(2) Project Goals

- The efficiency of in-port operation and fishing operation is promoted and fishing efforts and fish catch volume are increased.
- This project contributes to local economy with combination of fishing industry and tourism through Fish Friday .

(3) Outline of Project

This project is to construct fish landing facilities in Anse La Raye which is one of 13 fish landing bases of Saint Lucia, in order to attain above goals. The project components are composed of 1) Jetty, 2) Slipway, 3) Gear Locker, 4) Fishery Complex, 5) Vendor's Arcade, 6) Toilet/Shower. Figure 2-1-1(1) shows the relevancy of important issues and fishery development plan in National Development Plan with this project. And Table 2-1-1(1) shows the outline of project component.

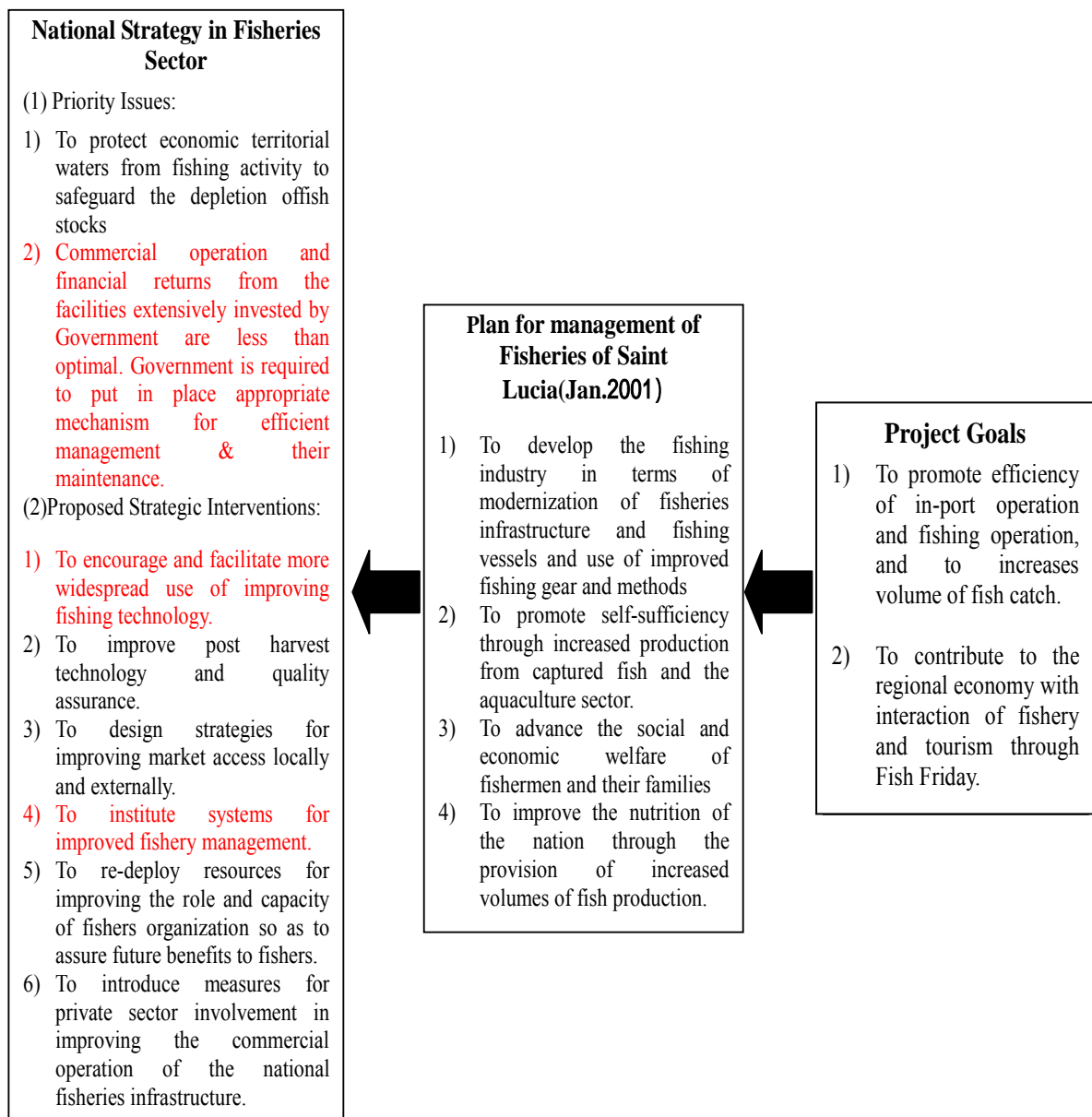


Fig. 2-1-1 (1) Relevant with Project Goals and National Development Plan

Table 2-1-1(1) Scope of assistance in Grant Aid

Contents of Request from Governemnt of St. Lucia			Scope of Assistance in Grant Aid	
Items	Specifications	Quantity	Specifications	Quantity
1 . Civil Works				
1)Jetty & accessories	Trestle type jetty . Steel pipe piled structure with concrete decks for upper structure. Overall length:50m & width: :5meters This includes removal work of the existing jetty structure. The piled understructure must have anti corrosive treatment.	1lot	Jetty of steel pipe piles Total length:: 48m, *Berth: 27m long x 5.6m wide *Approach: 21m long x 4m wide *Piles with anti-corrosion treatment	1 unit
2) Slipway	To be structured with piles. Approx. length: 14meters with 3-meter width	1lot	Winch and portable slides	1 unit
3) Revetment	To be structured with reveted rubble stones for an overall length of 130 meters	1lot	Not supported	
4) Supply pipe for fuel, water			Not supported	
2 . Building works				
1) Fishing gear lockers	R.C. Blocks construction	30units Total in 2 lots	R.C. Blocks construction Floorarea: 128.1sq. m &132.3 sq. m	2 buildings of 30 lockers
2) Drainage	Storm drain and septic treatment work		Septic tank	1 unit
3) Fish Processising Facility	Fish processing complex (new construction) for housing ice making/storage and refrigeration plant. Building with R.C. Block construction Total area:240m2	1lot	Fishery ccomplex for housing ice making & storage plants with offices & fishermen's training hall. Building with R.C. Block construction Total area :341.4sq. M	A building of 341.3 sq. m
Ice making machine	Ice making capacity: 1ton/day(flake ice)	1lot	Capacity: 1 ton/day	1 unit
Ice storeroom	Ice storage capacity: 2ton	1lot	Storage capacity:2 ton	1 unit
Refrigerator	Refrigeration unit: ± 5 Complete with electrical control device, water supply piping network	1lot	A insulated ice box of 100litters	1 unit
4) Fish sales counter	Construction of small building to house cooperative retail shop (on the G/floor) and fishermen training room. Area in total: 140m2 R.C. Block construction	1lot	The facilities are included in the Fishery Complex	An area of Fishery Complex is inclusive of the facilities.
5) Tackle shop				
6) Fishermen's training room				
7) Workshop			Repair of roofing, columns	1 unit
8) Venders' arcade	Renewal (refurbishing) of existing venders' arcade. This includes renewal of vending booths, plumbing and so fourth.	1lot	Reapir of floor concrete & water supply facility	1 unit
9) Pavement	Other incidental exterior works: -Site premise pavement - Fencing/illumination -Car parking lot - Drainage/storm drain and septic treatment work -Jetty accessories such as fenders/ bollards and supply pipes and outlets for oil, fuel and water	1lot	Not supported	
10) Fence				
11) Lighting				
12) Parking lot				

2-1-2 Project Outputs

The expected outputs are as follows:

- Reduction of fish landing hours (Landing Efficiency)
- Reduction of fishing preparation hours (Number of fishing boats to utilize jetty)
- Decrease of opportunities of repairing fishing boats (Number of fishing boats to repair)
- Improvement of freshness of landed catch (Fish purchasing ratio, Fresh fish purchasing ratio in Fish Friday)
- Improvement of fishing efforts (Fish catch volume)
- Vitalization and Enhancement of Fishermen's Cooperative Activities (Number of Fishermen's participation)
- Fishery training, support for life improvement and increase of education opportunity by Department of Fisheries and others (Number of education and training)

Fig.2-1-2(1) shows a logic model showing the relation of project, outputs, project goals and National Development Plan.

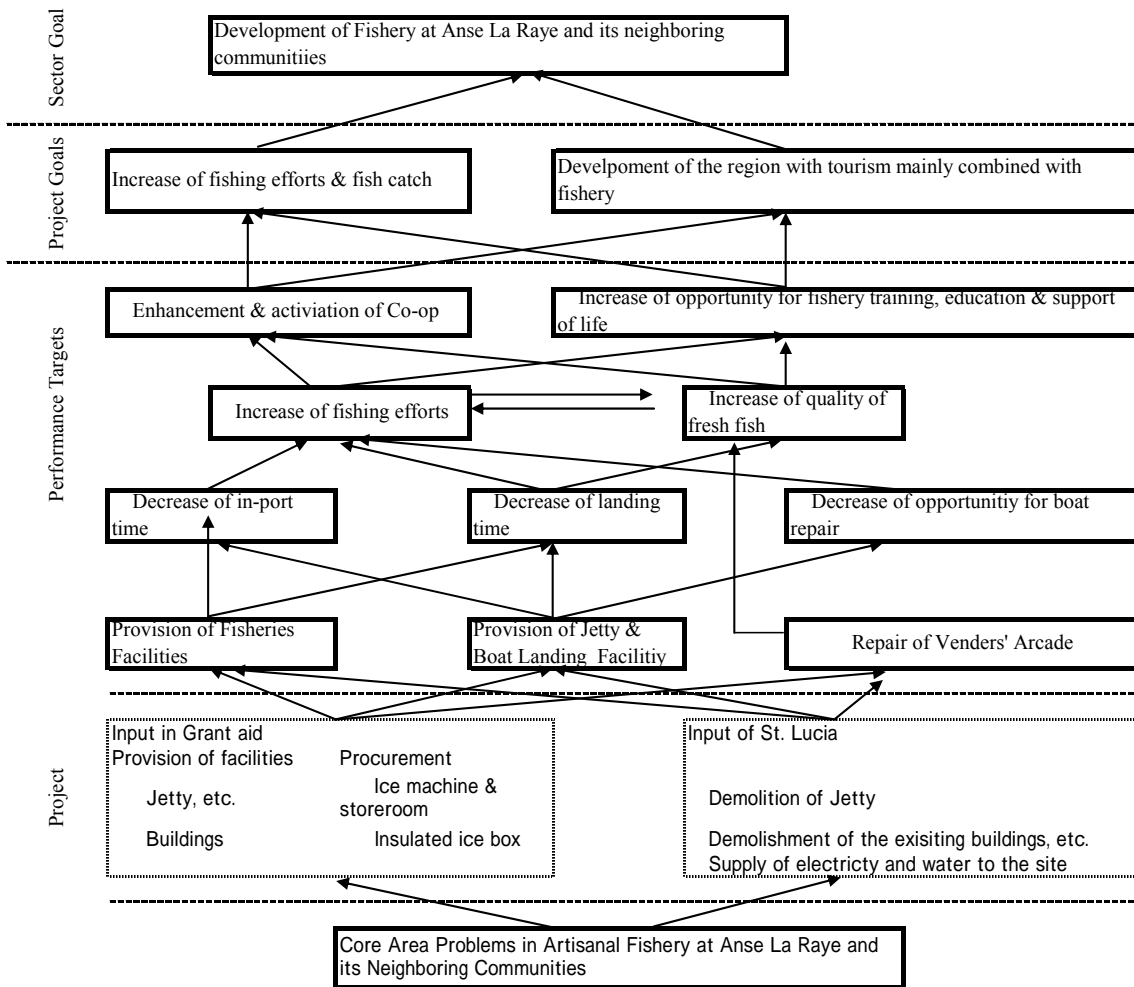


Fig.2-1-2(1) Logic Model for Relevancy between Sector Goals, Project Goals, Targets, etc.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Study of requested components

(1) Roles and Situations of Fishery at Anse La Raye in Saint Lucia

The roles and situations of fishery at Anse La Raye are summed up as follows:

- 1) Deterioration of functions of the fisheries facilities and no comprehensive management and operation of the facilities despite recognition of an important place among 13 landing stations.
- 2) Supply base of cheap fish (half beak etc.) in Saint Lucian
- 3) Activity base for Anse La Raye Fishermen's Cooperative (Jurisdiction over Cul De Sac, Roseau, Anse La Raye and Canaries)
- 4) Fresh fish supply base to Anse La Raye district (Anse La Raye Village and the neighborhood)
- 5) Promotion of fishing village with close interdependence between fishing industry and tourism in the event of Fish Friday

Whereabouts in Fishery Industry of Saint Lucia as listed above are explained below respectively.

1) Deterioration of functions of the fisheries facilities and no comprehensive management and operation of the facilities despite recognition of an important place among 13 landing stations.

Fig. 2-2-1(1) shows location of main fish landing places and banks of fishing ground of pelagic fish. Anse La Raye is one of 13 main landing places. St. Lucia Channel is very important fishing ground for large size pelagic fish (Bonito, Tuna, Dolphin fish, Spanish mackerel and etc.) Main species in the northern sea and west coast area where Anse La Raye is located are of coastal pelagic fish like horse mackerel, sardine, flying fish, half beak and etc. so called cheap fish or popular fish. And, north, west and south coasts are all rocky area and is fishing ground for bottom fish like snapper, lobster, octopus and etc.

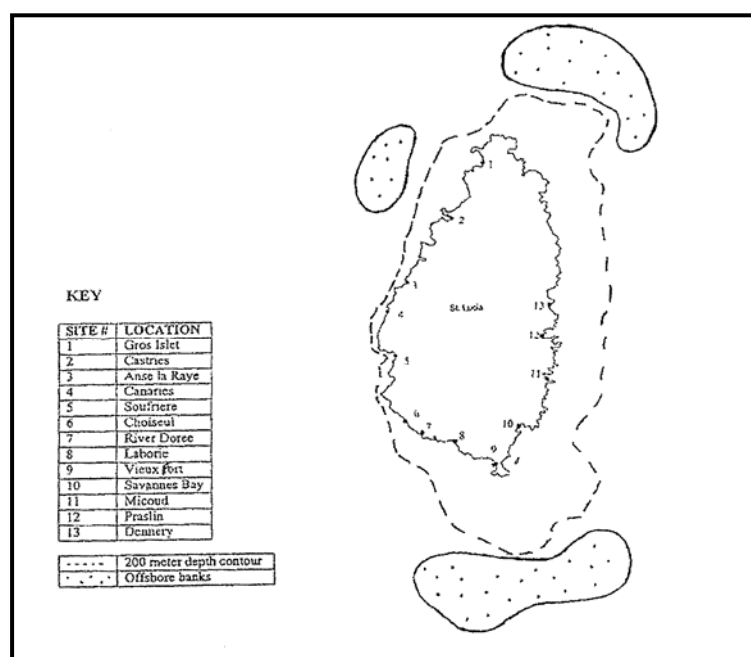


Fig. 2-2-1(1) Location of major fishing grounds and landing stations

The feature of distribution pattern and system of fishery products in Saint Lucia is found on seasonal big variation of fish catch, excessive supply in high fishing season and short supply in low season. 3 patterns stated below are common distribution pattern. The negotiation transaction is popular and no auction system is done here.

- Direct sale to consumers by fishermen, fish dealer and retailer (approx.50%)
- Purchasing by wholesalers and brokers and sell to consumers, hotels, restaurants and super markets (approx. 20%)
- Purchasing and sales by SLFMC (approx. 30%)

The followings are the roles of SLFMC (Saint Lucia Fish Marketing Corporation) founded in 1984 as public enterprise under the National Development Corporation.

- Purchasing of fish catch with proper price and promotion of motivation to increase of fish catch by fishermen
- Processing after purchase, sales, quality control, stable supply of fish and maintaining price stability
- Proper import and export of fishery products
- Development, operation and management of Fishery Complex

SLFMC plays a important role of controlling the stable fish supply, fish price stability and proper import and export with equipping refrigerators of the capacity of 100tons in1994 and 250tons in 2000 at Castries and Vieux Fort respectively under the Japanese

Grant Aid scheme. Castries, Vieux Fort and Dennery are now the key bases of SLFMC as national distribution centers and fisheries facilities at other landing places are operated and managed by Fishermen's Cooperatives respectively. Each Fishermen's Cooperative is taking another role as the base of development of fishing village in addition to the above. Department of Fisheries, Department of Cooperative and Department of Regional Office and Centres have supported strengthening of fishermen's cooperatives and the development of fishing villages.

Therefore, the policies of improvement of fish landing places in Saint Lucia are planned by Department of Fisheries and the Department has improved each landing place. SLFMC is in charge of the improvement, operation and management of Fishery Complex at the 3 locations in Castries, Vieux Fort and Dennery where SLFMC directly purchases fish from fishermen based on their fish purchasing list. In case of Anse La Raye, Department of Fisheries is the main body to improve the facilities and Anse La Raye Fishermen's Cooperative has had to operate, maintain and manage the facilities under the governmental control. However, the facilities provided in 1987 have been operated, maintained and managed based on the functions of SLFMC before the large scale refrigerator being installed in 2000 at the above 3 locations. Actually, SLFMC is responsible for operation of ice making and refrigerated facilities (Distribution Center), V/C is for fresh fish sales stand and only gear locker and work shop are managed by Anse La Raye Fishermen's Cooperative. As described as above, SLFMC fixes the stations for purchasing fish at Castries, Vieux Fort and Dennery as main sources and SLFMC is to withdraw its management one by one from the facilities with ice making and refrigerated facilities or the facilities that the expected lifetime is over. Incidentally, as ice making and refrigerated facilities in Anse La Raye have passed 18 years and the expected lifetime (13 years) is already passed, SLFMC has an intention to withdraw from the distribution center on the occasion of the implementation of this project.

2) Supply base of cheap fish (half beak etc.) in Saint Lucia

There are 13 main fish landing places in Saint Lucia. Department of Fisheries of Saint Lucia has executed the estimation of landing volume by sampling method of FAO system. Table 2-2-1(1) shows fish type and landing place wise landing volume in 2005. As Anse La Raye was not included in monitoring places by Department of Fisheries therefore, based on the estimation of landing volume in Anse La Raye describing later stage, the ratio of landed volume is occupied by 4 % ($47.84 \div 1386.4 = 0.035$) of total landed volume of Saint Lucia. Production at Anse La Raye is about 10% of the total

volume of fish catch except Bonito, Tuna, Dolphin fish, Wahoo, etc. as calculating $47.84 \div (1386.4 - 465.6 - 198.4 - 168.8) = 0.086$. And, coastal pelagic fish (others) has 13% share ($57.89 \div 380.0 = 0.126$) and it is understood that Anse La Raye is in the important position as supply base of coastal pelagic fish (cheap fish).

Table2-2-1(1) Landing Volume of Fish by Species and Landing Places

	Tunas	Dolphin	Wahoo	Flighing Fish	Snapper	Shark	Conch	Lobster	Other	Total
Gros Islet	8.2	4.0	0.6	20.8	5.4	3.8	40.9	6.5	51.3	141.5
Castries	23.8	1.5	0.0	2.4	6.3	2.0	0.0	0.4	48.2	84.6
Bannanes	2.0	0.1	0.0	0.0	2.0	0.3	0.0	1.2	18.3	23.9
Souriere	16.2	1.4	0.3	0.5	0.3	0.0	0.0	0.0	84.3	103.0
Choiseul	40.1	4.4	2.7	13.5	1.8	0.6	0.0	0.1	11.5	74.7
Laborie	23.5	2.0	1.6	2.0	3.6	0.0	0.7	0.8	12.4	46.6
Dennary	99.5	67.8	95.3	2.3	4.7	0.7	0.1	0.7	11.7	282.8
Micoud	26.0	14.1	9.7	4.7	1.2	0.2	0.0	0.0	8.9	64.8
Vieux Fort	166.1	77.2	43.0	0.6	1.2	0.6	0.3	0.5	21.1	310.6
Other	60.2	25.9	15.6	24.7	6.5	3.4	0.0	5.3	112.3	253.9
Total	465.6	198.4	168.8	71.5	33.0	11.6	42.0	15.5	380.0	1,386.4

3) Activity base for Anse La Raye Fishermen's Cooperative (Jurisdiction over Cul De Sac, Roseau, Anse La Raye and Canaries)

There exists Anse La Raye Fishermen's Cooperative comprised of fishers and non fishers of 4 villages as Cul De Sac, Roseau, Anse La Raye and Canaries. Table2-2-1(2) shows number of registered fishermen by landing place. The number of registered fishermen in Anse La Raye is 118 and the share is 5.2% in total St. Lucia. The registered number of fishermen in 4 villages controlled by Anse La Raye Fishermen's Cooperative is 212 and the share is 9.4%. The registered fishermen in west coast between Castries to Soufriere are 737 that is 16.1% as Anse La Raye and 28.9% as Anse La Raye Fishermen's Cooperative. Thus, the influence area of Anse La Raye is 9.4% in total Saint Lucia and 28.9% in west coast where main fish is coastal pelagic fish.

Table 2-2-1(2) Number of registered fishermen by landing place (2005)

	Full-time	Part time	Non fisher	Total
Gros Islet	125	78	3	206
Marisule	7	12	1	20
Monchy	6	8	0	14
Castries	145	110	10	265
Banannse	42	44	6	92
Cul De Sac	0	1	0	1
Roseau	1	1	0	2
Anse La Raye	66	46	6	118
Canaries	52	36	3	91
Sofriere	95	62	7	164
Choiseul	102	38	8	148
River Doree	16	10	0	26
Laborie	82	44	8	134
Dennery	156	92	29	277
Praslin	33	19	1	53
Micoud	102	104	0	206
Anse Ger	2	0	0	2
Savannes	33	7	4	44
Vieux Fort	245	132	27	404
Total	1,310	844	113	2,267

The facilities that the Fishermen's Cooperative operates and manages, however, are only fishing gear lockers, a workshop and fuel station. The gear lockers are badly aged that the repair or new installation is definitely necessary. As the fuel station which is one of profitable facility of Fishermen's Cooperative is not functioned due to the broken foundation, the income of the Fishermen's Cooperative is short and the vitalization of Fishermen's Cooperative has not been attained. The other fisheries facilities are operated by other organs as mentioned below:

- Distribution Centre: SLFMC
- Septic tank, Jetty, Toilet/shower and Fish retail shop: V/C

As these facilities have been installed as independent buildings, the improvement of fishery facilities is required from the aspect of the quality management focused on the use of ice and hygienic control of fresh fish.

At Choiseul and Soufriere which are located at same west coast of Saint Lucia, each cooperative operates and manages the own fishery facilities such as a cooperative office (including gear sales stand and assembly hall), a workshop, a slipway, a jetty (or wharves), a fish sale counter, an ice making machine and ice storage facilities, gear lockers, toilets and showers, and a fuel station. Each fishermen's cooperative is vitalized and they devoted to the better life of artisanal fishermen.

The operation and management by Fishermen's Cooperative with improvement of the facilities in the said 2 fish landing places has been appreciated as the excellent examples for identification of roles for fish distribution at such landing places without operation of SLFMC. Anse La Raye is the only one landing place left undeveloped in the west coast, and it is needed to correspond to the change of fishing activities, fishing boats, the policies of Department of Fisheries. With improvement of the facilities, Department of Fisheries attempts to make the activation of the Fishermen's Cooperative and the improvement of fishermen's life.

4) Fresh fish supply base to Anse La Raye district (Anse La Raye Village and the neighborhood)

Artisanal fishermen in Anse La Raye has annually caught about 100tons of mainly cheaper pelagic fish and has annually landed about 48 tons, which is equivalent to the volume of fresh fish demand in Anse La Raye (including Fish Friday). 100% of the villagers at Anse La Raye and 43% of the villagers in the district except Anse La Raye Village depend on the supply of fresh fish landed at Anse La Raye and the landing station is performing a role as fresh fish supply base in the Anse La Ray district (Anse

La Raye Village and the neighborhood communities)

5) Promotion of fishing village with close interdependence between fishing industry and tourism in the event of Fish Friday.

Saint Lucia is the country that makes tourism as the main industry. Anse La Raye where many buildings have the history more than 100 years. It is one of main sightseeing spots in the west coast as the bay is configured with an beach arch and the historical heritage. The church in Anse La Raye of all others was constructed in 1762. Anse La Raye used to be the place for producing sugar and molasses at the time when the production of sugar cane was active in Cul De Sac and Roseau districts. The empty lot of sugar cane refinery at the time now becomes one of tourism resources and the existing jetty which has been functioned as the jetty for collecting and shipping cargos is also the one of tourism resources to explain the history. Anse La Raye having such back ground as a sightseeing spot holds the Fish Friday which fish dishes are served for 600 visitors on every Friday. The event brings villagers in valuable cash income. 61.5% of fresh fish handled by venders in Fish Friday is bought from artisanal fishermen in Anse La Raye thus it is clear that there exists a close dependency between Fish Friday and artisanal fishermen each other. In another word, the more visitors or fresh fish consumption increase, the more fish catch and income increase and it conduces to welfare of artisanal fishermen.

(2) Scale of Fishery Activity in Anse La Raye

1) Fish catch in Anse La Raye

Anse La Raye is not specified as the point for monitoring fish catch though Anse La Raye is identified as one of the 13 places for lading fish in Saint Lucia. No statistical data on the landed fish catch at Anse La Raye and the fish catch by the fishermen are available. It is understood that all the fish landed at Anse La Raye is consumed in the district since the landed fish is sold to villagers in Anse La Raye and other communities, in addition to venders for Fish Friday. From estimation of the consumption of the fresh fish in the Anse La Raye district, the landing volume and the fish catch are estimated on the basis of the questionnaire survey and the interview survey to the fishermen in Anse La Raye, which were conducted by the study team.

In estimating the fish demands, basic landing volume will be determined on the basis of the statistics on landing volume of fish catch during 1993 and 2005. The data, however, include some problems of a short statistical term for 13 years and an unfixed period for monthly monitoring landing volume. They result in the difficulty to estimate the standard volume of fish catch for planning through statistically processing the data.

In consideration of the restriction of the data analysis, annual landing volume of fish catch is obtained with summing up the average landing volume of each fish species. The following table shows 1586 tons of the annual volume, and shows maximum and minimum volume respectively. 1,586 tons, average volume stated below, is applied to estimation of the fish demand at Anse La Raye.

Table 2-2-1(3) Average Landing Volume of Fish by Species (Unit: ton)

	Average	Max.	Min.
Tune	376	473	247
Dolphin	391	588	198
Wahoo	232	310	169
Flying Fish	115	323	11
Snapper	51	82	31
Shark	9	20	5
Conch	46	60	40
Lobster	20	36	10
Others	347	345	267
Total	1,586	2,327	978

It is supposed that 9.62kg/capita obtained with dividing the landed catches (1,586 tons) except the import marine product by overall population of 164,791 in 2005 is consumption of the fresh fish in Saint Lucia.

In the estimation, Anse La Raye village is regarded as primary consuming region and Anse La Raye district excluding Anse La Raye village is regarded as second consuming region. Other market is for the Fish Friday too. The fish landed at Anse La Raye is supplied to the above three fish markets. The dependency is assumed to be 0.43, because 43% of the residents in the communities except Anse La Raye Village is deemed to buy fresh fish landed at Anse La Raye from the interviewing survey result.

- Fresh fish demand in the primary consuming region (Anse La Raye Village)

Because the consumption of the fresh fish per person in Saint Lucia is 9.62kg/capita as above-mentioned and is applied to the population 1,400 people of Anse La Raye Village in 2005, the amount of the fresh fish demand in the first consuming region can be estimated as follows.

Fresh fish demand of the primary consuming region $Q_1 = \text{population (1,400 people)} \times \text{consumption of fresh fish (9.62kg/person)} = 13,468\text{kg/year} = 13.47 \text{ tons/year}$

- Fresh fish demand in the second consumption region (Communities in Anse La Raye District except Anse La Raye Village)

The population of the Anse La Raye district is 6,382 people (2005), and 6,382 - 1,400 = 4,982 excluding the population of the Anse La Raye village are regarded as population of the object of the second consumption region.

The fresh fish purchase rate (dependency) in Anse La Raye district is 43%. A fresh fish demand on the second consumption region can be estimated as follows.

Fresh fish demand of the second consuming region $Q_2 = \text{population (4,982)} \times \text{consumption of fresh fish per person (9.67kg/person)} \times \text{fresh fish purchase rate in Anse La Raye (0.43)} = 20,609\text{kg/year} = 20.61 \text{ tons/year}$

- Fresh fish demand in Fish Friday

61.5% of venders purchases fresh fish from fishermen at Anse La Raye in Fish Friday. Overall costs for food and drink in the event is EC\$12,733, 40% of which is spent for buying fresh fish. A rate of fresh fish is EC\$5. On the basis of the conditions, the volume of the fresh fish purchase by the venders in Fish Friday can be estimated as follows.

Fresh fish purchasing volume in one Fish Friday $Q_3 = \text{purchasing price (EC\$12,733)} \times \text{fresh fish purchasing rate (0.4)} \div \text{unit price (EC\$5/lb)} = 1,018.64\text{lbs}$

Fresh fish purchasing volume per month $Q_4 = 1,018.64\text{lbs} \times 4 \text{ times/month} = 4,074.56\text{lbs/month}$

Fresh fish purchasing volume per year $Q_5 = 4,074.56 \times 12 = 48,894.72\text{lbs/year}$

Fresh fish purchasing volume from artisanal fishermen in Anse La Raye $Q_F = 48,894.72 \times \text{purchasing rate from fishermen in Anse La Raye (0.615)} = 30,070.25\text{lbs/year} = 30,070.25 \times 0.4575 = 13.76 \text{ tons/year}$

- Volume of fresh fish demand in Anse La Raye

Therefore, the volume of the fresh fish demand in Anse La Raye is as follows.

- Volume of fresh fish demand in the primary consuming region: 13.47 tons/year
- Volume of fresh fish demand in second consumption region: 20.61 tons/year
- Volume of fresh fish demand in Fish Friday: 13.76 tons/year
- Volume of Fresh fish demand in Anse La Raye: 47.84 tons/year

- Fish catch by artisanal fishermen in Anse La Raye

It is surmised that artisanal fishermen of Anse La Raye is at least catching the fish more than the volume of the fresh fish demand, since the volume of the fresh fish

demand in Anse La Raye is 47.84 tons a year from the above estimation. The ratio of fish landing at Anse La Raye is 57.3% according to the questionnaire survey, and 43.9 % at Castries and 2.4% in other districts. Therefore, the fish catch by artisanal fishermen using 27 fishing boats in Anse La Raye can be estimated as follows.

Fish catch volume by artisanal fishermen in Anse La Raye = fresh fish demand in Anse La Raye (47.84) ÷ fish landing volume to Anse La Raye (0.573) = 83.49 tons/year.

This fish catch volume becomes 3.09 tons/boat for 27 artisanal fishing boats in Anse La Raye, equal to the fish catch volume of artisanal fishing boat in Saint Lucia therefore it is considered as appropriate.

Therefore, the design fish landing volume in Anse La Raye is regarded as 47.84tons/year and daily average fish landing volume is about 1.5% of yearly landing volume so it becomes 47.84tons/year x 0.015=0. 72tons/day.

2) Estimation of Ice demand in Anse La Raye

Fishermen in Anse La Raye target so called cheap fish such as coastal pelagic fish and coastal bottom fish according to the questionnaire survey and the interviewing survey. The difference in catch volume on and off season in fishing operation is few and has the feature of a-day-trip fishing due to targeting a cheap fish. Ice is used by 66.7% of fishing boats and 40% of fishing boats use the ice carrying fish boxes according to the questionnaire survey. This means that landed fresh fish is sold soon and proves no storage function (refrigeration demand) in Anse La Raye. As the volume of the ice demand is the index to show the situation of fishery activities in Anse La Raye., the volume of ice demand for fishing boat loading, the fresh fish sales, and Fish Friday are estimated.

- Volume of ice demand for fishing boat loading

According to the questionnaire survey, 40% of fishing boats use ice carrying fish boxes. The ice user is loading 2.3 buckets (2.5 gallon =11.365kg/bucket, 26.14kg) on the average. The ice demand by 27 fishing boats in operation can be estimated as follows.

Ice demand for fishing boat loading = the number of fishing boat (27) x ice loading rate (0.40) x load volume/boat (26.14kg) x rate for fishing boat in operation (0.72) =203.26kg=0.20 ton

- Volume of ice demand for fresh fish sale

The direct sale of the fresh fish rate by the fishermen is 45%. It is assumed that 60% of the fishermen who do not carry a fish box on board do not use ice. The rate of selling fish to retailers is 52.5%, and the rate of storing fish a night due to their landed time is 2.5%. The ice necessary for selling fish is estimated as follows:

- Volume of ice demand for fresh fish sales by fishermen

Volume of yearly ice demand = fish landing volume (47.84 tons/year) x fresh fish sales rate (0.45) x use-ice rate (0.4) = 8.61 tons/year

It is adequate to set 200 days as the yearly operation days according to questionnaire survey. Therefore, demand for the fresh fish sales by the fishermen are as follows.

Daily ice demand volume= 8.61 tons/year ÷ yearly operation days (200 days) =0.04 tons/day

- Volume of ice demand by selling over to retailer

Daily ice demand volume = landed volume (47.84 tons/year) x selling over rate to retailer (0.525) ÷yearly operation days (200) =0.13 tons/day

- Volume of ice demand by fresh fish stock

Daily demand volume= landed volume (47.84 tons/year) x stock ratio(0.025) ÷yearly operation days (200 days)=0.006 tons/day, or 0.01 tons/day

Therefore, the volume of the ice demand for the fresh fish sales is 0.04+0.13+0.01=0.18 tons/day, or 0.2 tons/day.

- Volume of ice demand for Fish Friday

All the vendors of Fish Friday (16 persons) use ice, and the amount of purchase of ice is EC\$17.9 per day from a questionnaire survey on the average. The purchase price of ice is 6EC\$/bucket and one bucket is 2.5 gallon =11.365kg. Vendors buys three bucket in one holding day. However, as the first two buckets are free of charge and so they are using the ice with 5 buckets in one holding day. By the above, the volume of the ice demand in Fish Friday can be estimated as follows.

Daily ice demand volume = the number of retailers (16) x average purchase buckets (5) x ice volume per bucket (11.365kg)=909.2kg/day=0.91 tons/day

- Maximum volume of the daily ice demand in Anse La Raye

As mentioned in the above, the maximum volume of the ice demand in Anse La Raye is estimated as follows.

<input type="checkbox"/> Volume of ice demand for fishing boat loading	0.2 tons/day
<input type="checkbox"/> Volume of ice demand for fresh fish sales and stock	0.2 tons/day
<input type="checkbox"/> Volume of ice demand for Fish Friday	0.9 tons/day
<input type="checkbox"/> Others (demand such as village ceremonial occasions)	0.1 tons/day.
Total	1.4 tons/day

The ice production capacity of the ice machine should be designed so as to meet the above demand and minimize the operation cost of the machine with effectively utilizing an ice storeroom for adjustment of its production. Hence, the capacity of the machine and storeroom are as follows:

1.0 tons/day (ice making capacity)

2.0tons/day (ice storage capacity)

(3) Appropriateness of Assistance for the Project under Grant Aid Scheme

The Government of Saint Lucia has changed the distribution system of fresh fish with effectively utilizing the fishery complex facilities in Castries, Vieux Fort, and Dennery constructed under the Grant Aid scheme of Japan (It is abbreviated in this section, "Fishery Complex"). The Government has been fostering the policy of stable supply of fresh fish and development of fishing villages through enhancement of cooperatives with transferring management and operation of the fish landing stations to each Fishermen's Cooperative.

At Anse La Raye together with other 5 fish landing places, fundamental facilities were provided during 1987 and 1988 under the Japan's Grant Aid scheme, however, since then, Anse La Raye has become the last landing station to be improved along the west coast of Saint Lucia for with the change of fishing method, inducement of FRP fishing boats, change of the government recognition for hygienic management, etc. Under the situation, the Government of Saint Lucia has the intention to rehabilitate and improve the fishery related facilities in Anse La Raye urgently.

The facilities of "Fishery Complex" were not completed at the time of the construction 18 years ago, and each facility was operated by different organization, and the balance of demand and supply of fresh fish in Saint Lucia was controlled by SLFMC. After completion of Fishery Complex facilities, however, SLFMC has been changing its stances only to manage and operate the Fishery Complex facilities, to purchase fish at the 3 major Fishery Complex facilities, and to import and export fresh fish. In addition to this, the Government is promoting regional development policy by means of establishment of fishermen's cooperatives under control of the Government of Saint

Lucia. And therefore, the Government is executing the policy to promote fishing villages through the funds prepared by fishermen's cooperatives gradually established under the Cooperative Act after completion of fishery complex facilities at each fish landing place.

The Government of Saint Lucia is planning to develop Anse La Raye Village with good balance of tourism and fishery. In the aspect of tourism of the fishing village, Fish Friday featuring the fishing village and fish in addition to traditional historical resources is planned and held with success. The fishing industry is also increasing the fresh fish demand by this event and the interdependent relationship becomes strong.

In the situation, the existing fishery facilities in Anse La Raye do not effectively function. The processing and selling facilities at the village are in the halt condition and the fishermen are obliged to sell fish by themselves, losing their fishing efforts. The situation causes that the consumers miss opportunities to buy fresh fish. Therefore, the installation of the primary processing and selling facilities indoors is indispensable to convert the system "from the outdoor sale of the fresh fish in the sweltering heat to the indoor sale in the shop" for the purpose of reducing the serious selling efforts of fishermen and promoting an increase in the fishing efforts. It is also understood that the facilities improvement brings about increase of opportunities for consumers to buy fresh fish.

Steady and smooth supply of ice to fishing activities is indispensable for maintaining freshness of landed fish in the facilities. For the purpose, it is necessary to maintain an ice machine, an ice storage room, primary processing facilities, a selling counter, etc. at the same space as unified facilities from the viewpoint of the traffic line and the hygienic control of the fish and ice. As the concept for freshness and hygienic generally recognized now were not general at the time of provision of the existing facilities, however, they have remained their conditions since they were constructed separately without effective function. The present situation maintains the difficulty to supply fresh fish to the consumers. Therefore, for keeping freshness with ice being effectively demonstrated, it is indispensable to consolidate ice making machine and ice storage, primary process and selling counter in the same space.

Moreover, there remain a lot of fishery facilities that cannot meet the diversification and enlargement of the fishing boat, fishing gear, and the fishing method etc., compared with them at the time of construction.

Department of Fisheries is planning to unify the operation and management to the Anse La Raye Fishermen Cooperative by attempting the improvement of such existing facilities. The Department aims at synchronizing its policies with the policies of the

Department of Cooperatives of Ministry of Labor and the Ministry of Social Transformation, Culture & Local Government, and at leading to the improvement of artisanal fishermen's welfare.

From the point of view, improvement of main fish landing places is executed according to fishery administration policy of the Government of Saint Lucia. Fish landing places except three major Fishery Complex facilities are being improved under the governmental policies to improve artisanal fishermen's life with promoting fishing villages. The promotion is made through activation of fishing industry and Fishermen's Cooperative which will be made to manage and operate the fisheries facilities. The successful experiences are found in Choiseul and Soufriere neighboring to Anse La Raye and they suggest possibility to apply it to Anse La Raye as well.

Moreover, the so-called cheap fish that the nationals usually eat in daily life is landed there as observed in Anse La Raye Village. These are sold in inland district of Anse La Raye and Castries. As for the execution of the project, the consumers not only in the district but also the metropolitan area will enjoy the benefits of stable purchase, because it is expected that the project will support fishing activities of fishermen at Anse La Raye and promote stable supply of cheap fish.

It is understood that the project will appropriately be executed under the Japan's Grant Aid scheme, since the project is expected to contribute to the promotion of the governmental policies that effectively develop the fishing village with a core of the fishermen's cooperative, and the extension of the benefits produced by the project into not only the region but also the metropolitan area too.

(4) Necessity and emergency of requested component

The necessity and the emergency of the requested component of the Government of Saint Lucia can be judged as follows.

1) Jetty

【Present bottlenecks】

The existing jetty is used for storing fishing nets but it is not used for fish landing, preparation and so forth. Present bottlenecks concerning the in-port activities as landing fish, preparing operation and mooring without using the jetty are as follows.

- Heavy labor is necessitated for launching fishing boats from beach with fishing net, fish box, ice, water, fuel and etc. on board, which have to be loaded on the beach.
- About 6 persons are needed at each time of fish landing, beaching and launching due to landing fish, and loading and unloading of fishing gears.
- The berthing place is few when necessary.
- Some boats have to be anchored offshore so the time and fishermen have to spend

time to bring the fishing boat to the beach side when going out for fishing.

- Frequency of damages and the repair of the bottom of their boats gives the increase of the repair expense as increasing the beaching.



【Location of Jetty Installation 】

Concerning the location of a new jetty, two options were proposed for discussing. The first option is to install the jetty at around the center of a group of facilities, considering overall traffic lines of fishermen with fishing boats and the function of the fishery facilities. The other option is to lay a new jetty at the same location of the existing one. As a result of the discussions with Saint Lucian side, the location of the existing jetty is recommended for a new jetty due to the strong request from Saint Lucian side, explaining that the location of the jetty owns the role to tell the history of sugar industry for Anse La Raye to load sugar as a center of sugar cane business extended to Cul De Sac, Roseau, and Canaries. The related historic places in Anse La Raye are resources of tourism.

【Necessity of Jetty 】

The necessity of installation of the new jetty can be described as follows.

- Excessive labor is forced at the time of preparation for fishing and fish landing due to unavailable jetty for fishing boats. A new jetty having the functions for the preparation for fishing and fish landing in order to attain efficient fishing activity.
- The berthing Jetty is necessary to attempt the reduction in the expense of the fishermen by reducing beaching frequency of the fishing boat and reducing damage of the bottom of fishing boat.
- It is also necessary to maintain lay-by berths to avoid offshore anchoring.

2) Boat Landing Facility

【Present Bottleneck】

It is assumed that the slipway requested as a project component will be used in hoisting fishing boats for repair of fishing boats and drying boats. As for the reality, drying boats about once every several days is done though it is preferable to dry a wooden boat every day. The frequency is different each other between FRP and wooden boats as a result of the interview investigation. An FRP boat requires inspection and repair of its bottom once every two weeks on the beach. About 5 days landing period is necessary for the inspection and the repair of boat bottom. At present, the demand of a slipway is assumed as follows.

- Estimated number of boat beaching at present:

- ❑ CANOE; 17 boats x 200 day/year =3400 times/year (Only in Anse La Raye).
- ❑ PIROGUE; (8+14+1+2=25 boats) x200/14=357times/year (For registered boats under Anse La Raye Fishermen's Cooperative).
- ❑ TRANSOM, SHALOO, OTHERS; 3 boats x200 day/year =600 times/year (Only in Anse La Raye).
- ❑ The total: 4,357 times (4,357times x2=8,714 times/year) that is possible use demand of slipway.

- Number of beaching when jetty is installed:

It is assumed that the number of beaching of FRP boat is reduced around one time in one month but the wooden boat is thought to be beached around one time in several days for drying when jetty is installed.

- ❑ CANOE; 17 boats x (200 days/6days)=566.7 times/year (Only in Anse La Raye)
- ❑ PIROGUE; (8+14+1+2=25 boats) x200/30=166.7/year (For registered boats under Anse La Raye Fishermen's Cooperative)
- ❑ TRANSOM, SHALOO, OTHERS; 3boats x (200 days/6 days)=100 times/year (Only in Anse La Raye).
- ❑ The total: 832times (832 times x2=1,664/year) This is the demand for slipway.

【Necessity of Boat Landing Facility】

Therefore, the estimation of frequency shows reduction to 1,664 times/year from the present number of estimation 8,714 times/year but it becomes 4.6 times/day= 1,664 times/year ÷ 365days, and the necessity to have the facility to support beaching is high. Moreover, the hoisting of fishing boats is necessary in the site with no service of

emergency evacuation of boats in hurricanes. Slipway (or equivalent facilities with its function) is expected to haul fishing boats to make them evacuate to roads etc. located at backside of beach.

3) Workshop

The daily check of engines is now executed by fishermen but the repair is conducted by technicians from manufacturers' agents. A boat builder resides in the Anse La Raye village, and the builder executes repair of the boat bottom, etc. now. The present workshop should be repaired because the roof and structural pillars were rusted; however, it keeps its function.

On the other hand, although the existing workshop has been designed to use both as workshop and place for drying fishing net, the both functions are not served at same time. Boat repair flutters powder dust of FRP at the workshop, while the space cannot be sufficient for larger sizes and numbers of fishing nets and fish pots. The place for repairing fishing net and producing/repairing for fish pot should be separated from workshop since the powder dust of FRP influences on the health aspect.

4) Fishing Gear Lockers

【Present Bottleneck】

There exist fishing gear lockers granted under the Japan's Grant Aid scheme at Anse La Raye in 1988, and repaired in 1999 after the hurricane hit. The gear lockers were installed adjacent to the coastline and the structural frame work is composed of light steel and wall of canvas cloth over the steel mesh frames that are easy to receive the salt damage. The strength of the structure is not enough due to weakness of the structural design itself. The repair of structure is difficult, because some welded parts should be cut and re-welded for improvement.

The operation of a-day-trip fishing at Anse La Raye has not been unchanged since 1988, however, major fishing methods using beach seine net, round haul net, trawl, fish pot etc. have been very much changed since then. For 5 years in installation of FADs, a type of fishing boats has gradually changed to Pirogue (FRP) with using bigger engines from wooden Canoe boats. At the time of 1988 beach seine net, hand lines, small-scale fish pots, etc. were used with wooden Canoe boats. However, several fishing methods have been applied such as beach seine net (3 nets/boat and 400m in length), gill net (3 nets/boat and 102m in length), round haul net (4 nets/boat, 270m in length), fish pot (10 baskets/boat and total 6 boats), fishing hand line (total 5 boats) spearing (total 2 boats), net for flying fish (total 5 boats), bottom trawling (2 boats and 100m in length). Since 1988, fishing methods have been diversified and enlarged

in size, and fishing boats with engines for the operation have been enlarged in size with introduction of FRP fishing boats. Incidentally, fishermen load on board beacon pole, floating ball, fixed anchor, light buoy, floating rope, anchor rope and etc. as accessory fishing gear. Especially, because the demand of high-valued fish (bottom fish etc.) is increased in the event of Fish Friday, the fish pots and baskets have become bigger in size remarkably. Under the situation of alternation of fishing gear that cannot be stored in the lockers, fishermen leave them around the gear lockers, on their roofs, etc.

At the same time, the outboard engines of 75 HP for FRP boats have been introduced for 20HP engines, and the bigger outboard engines are left on the fishing boats because the existing gear lockers without engine holders cannot accommodate them. Therefore, these outboard engines have been left in their fishing boats. There remains a big problem in the aspects of safety for personal property. The situation suggests that the area of an individual locker is obviously insufficient as shown in Figure 2-2-1(2).

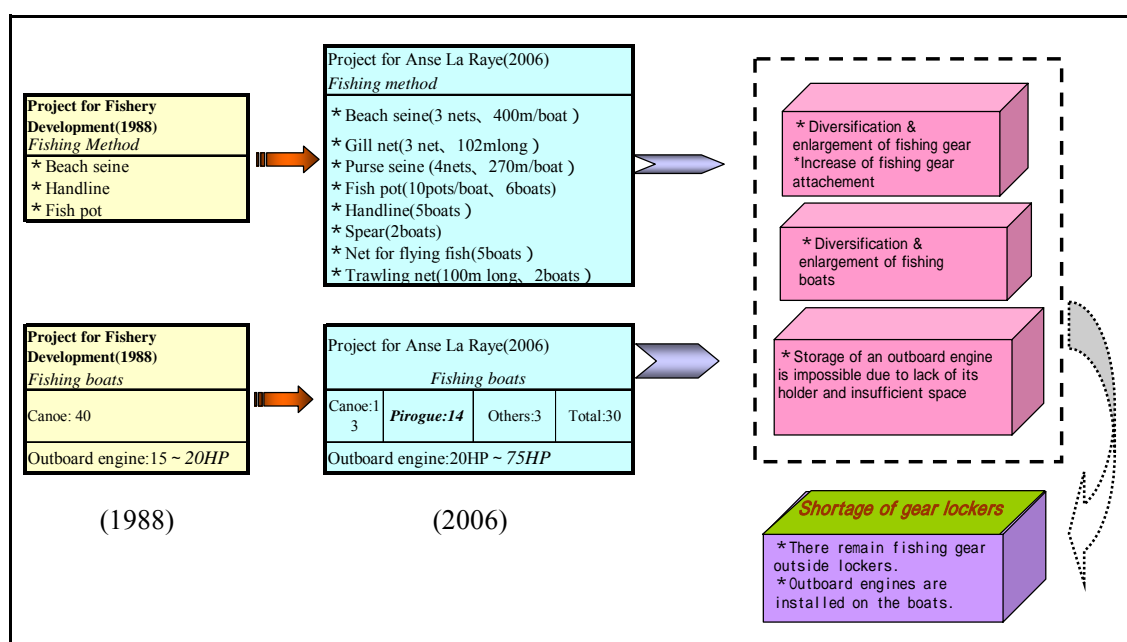


Fig. 2-2-1(2) Shortage of fishing gear lockers due to changes of fishing net/gear and method

【Necessity of Fishing Gear Lockers】

As mentioned above, it is necessary to improve or newly install the fishing gear lockers with the reasons below.

- The fishing method has changed greatly in Anse La Raye with introduction of FADs (Fish Aggregating Devices) that Department of Fisheries of Saint Lucia set up offshore five years ago. Introduction of FADs has changed fishing methods and sizes

of fishing boats to Pirogue(FRP) to Canoe. Therefore, as the fishing net, the fishing gear and the outboard engine, etc. cannot be stored in the existing fishing gear lockers, the valuables are kept at home and other stuff cannot help being left outside the lockers. The outboard engine, fishing net, fishing gear and the accessories cannot be stored in existing lockers (outer size 2.0m x 2.0m). The analysis result of the field investigation results in requirements of the inside dimensions of about 2.5m x 2.5m x 2.5m (about 50% increase more). Actually, the number of fishing boats in present Anse La Raye is 30, and 30 lockers will be needed though the number of existing locker were allotted 40 as number of canoe at that time in 1988.

- When the scale of one existing fishing gear locker is enlarged, it is necessary to dismantle steel structural pillars in present lockers. It is necessary to cut the welded parts in structural pillars when dismantling them, and recycling structural pillars will be difficult. Observing steel structure of pillars of this building, a part of steel structures is exposed between the floor slab and the canvas cloth. This parts rust and the section modulus at the time of construction has decreased greatly, which means that the function as the structure has been lost. Moreover, the wire net and the canvas cloth composing the walls in an existing building located at the coast are the materials that have the difficulty for salt atmosphere and weather resistance. The rust of the metal can be seen as for the former, and the latter perceive deterioration by rain and ultraviolet rays obviously. The materials for the wall should be decided considering the salt atmosphere and weather resistance from this fact in this project. Thus, if the improvement of an existing fishing gear locker is attempted, both structural building frames of the base, the pillars, and the beams and the wall are necessary to improve all most in full scale and it almost equal to the volumes of new construction.
- In present fishing gear lockers, the attic is open, not an individual locker. The damages are heavy in the lockers along with road and the doors are broken partly, and an early repair is necessary from the viewpoint on security.

5) Toilet/shower

【Present Bottleneck】

Toilet/shower is located adjacent to the workshop. The toilet/shower facilities (one each for man/woman) are managed by Village Council (V/C) and always are locked so usually these cannot be used by fishermen. V/C prepares this toilet/shower to the tourist in Fish Friday.

Because the existing septic tank is broken, drain is thrown without being processed in

seawater though the existing toilet/shower functions. Present bottlenecks in the situations are explained as follows:

- Fishermen cannot use the existing toilet/shower adjacent to the workshop, which is only for the tourists now.
- The fishermen who need the toilet/shower must go home or go to the beach for the purpose. Absence of the facilities for fishermen causes worse situations for the hygiene and health.
- The existing toilet/shower is under the situation to discharge untreated effluent, which results in the contamination of sea water.

【Necessity of Toilet/Shower】

The necessity of the Toilet/shower can be brought together as follows.

- As no Toilet /shower for fishermen is available, there remain problems on fishermen's health and hygiene at the periphery and toilet/shower for the fishermen is necessary at an appropriate location. The existing toilet/shower is limited to use only for international tourists; however, it is possible for both fishermen and tourists to use the facilities, keeping good sanitary condition with proper management of Fishermen's Cooperative. Repair of the drain system should be made for the purpose.
- Because of collapse of the septic tank, a new system of the tank is necessary. Moreover, the Government's regulations for installation of a septic tank in St. Lucia require the specified distance between water fronts and seepage pipes; however, the distance cannot be secured due to the narrow area of the project site. For the local system of a septic tank, the system used in Japan will be applied to the facility.

6) Fishery processing facilities (Ice making machine, Refrigeration facilities, and Processing and Retail facilities)

【Present Bottleneck】

The Distribution Center at Anse La Raye is operated by SLFMC as the supply base of fresh fish through out Saint Lucia with equipping an ice machine and a refrigerator, while Fish Market is operated by V/C as the supply place of fresh fish to Anse La Raye village and the neighborhood communities.

Afterwards, large-scale refrigeration facilities were installed at Dennery, Castries, and Vieux Fort in 1998 and these Fishery Complex facilities in the three places started operations as distribution bases of the fresh fish in the whole country. A role of stable supply of fresh fish and the price control is performed to be covered enough with these refrigerators in the three places. The management of facilities at other landing places except the three locations has been shifted to each Fishermen's Cooperative. Anse La

Raye Fishermen's Cooperative is left under the situation that the above policies are not applied as stated above.

The fishermen and the brokers use ice for keeping the fresh fish. SLFMC is eager to centralize the function of purchasing fresh fish from fishermen at the Fishery Complex facilities in Castries, Dennery, and Vieux Fort. The organization has the intention to transfer the management of the ice making machine, the ice storeroom and refrigerator at Anse La Raye to Fishermen's Cooperative. According the above intension of SLFMC, the refrigerator at Anse La Raye has been going into decline of its role for control of distribution volume of fish. It was confirmed to exclude the refrigerator from the project components requested by the Government of Saint Lucia after the discussion with the study team. The Government of Saint Lucia requests supply of the insulated ice box for storing fresh fish over night.

At present, hygienic control of fresh fish is required, while it was not so seriously considered in starting the operation of the facilities in 1988. Such control is not secured for primary fish processing at the existing Fish Market without walling. Unhygienic processing of fish at the open Fish Market has been gradually avoided when foreign tourists have visited the village. In the situation the Fish Market has been obliged to terminate its operation.

The Fish Market does not function due to scarcity of water supply and breakdown of the septic tank, which results in no treatment of waste water. The fishermen in the village are obliged to sell fish in the village and go out the village to the inland villages to sell fresh fish. That is, the "system for fishermen to wait consumers at store" is obliged to change to the "system for fishermen to go and sell by themselves". As a result, sale of the fresh fish under hot weather are done through necessity in the village, and the situation is produced that the fishermen sell or peddle fish according to the time for consumers to purchase fresh fish. It is noted that such a situation limits the supply chance of the fresh fish to the consumers, and it decreases the fishing efforts fishermen, that is, it narrows the way of the stable income for fishermen. To improve such situations, the facilities should be provided for converting the current system to the distribution system that fresh fish buyers visit the fishery facilities.

The investigation was made for clarifying the current conditions of the ice making machine, ice storage house and the refrigerator at the distribution center that SLFMC managed. As a result, it is believed that there are fatal damages in the cooling devices, and a complete shutdown of the machine will be forced soon or later. It is difficult to recover the specified capacity. A large volume of water more than the volume of water necessary for ice making is consumed due to the trouble of the machine now, and

moreover, a large sum of water service fees and power consumption being 1.4 times in the normal operation are excessively paid against production volume. Ice making capacity and the consumed quantity of water and electricity are estimated at Table 2-2-1(4). The table shows that the ice production capacity is about 0.8-1.0 tons/day, and three tons of water is consumed against production of a ton of ice. The electrical system is out of order in the refrigerator, and it is not driven due to the fatal damage in the cooling devices.

Table 2-2-1(4) Estimation of ice production and water consumption

	Revenue from sales of ice (ECS)		Expenditure of water (ECS)		Expenditure of Electricity (ECS)		Estimation of quantity of water consumption & ice production					
	2004	2005	2004	2005	2004	2005	2004(ton)			2005(ton)		
							Monthly water consumption	Monthly ice production	Daily Ice Production	Monthly water consumption	Monthly ice production	Daily Ice Production
1月	900.00	730.00	312.00	300.00	2,049.00	1,671.00	70.92	23.64	0.79	68.19	22.73	0.76
2月	500.00	0.00	512.00	299.00	2,390.00	2,066.00	116.38	38.79	1.29	67.96	22.65	0.76
3月	350.00	500.00	549.00	479.00	2,236.00	4,267.00	124.79	41.60	1.39	108.88	36.29	1.21
4月	500.00	700.00	610.00	759.00	2,835.00	3,519.00	138.65	46.22	1.54	172.52	57.51	1.92
5月	400.00	500.00	541.00	392.00	1,957.00	2,149.00	122.97	40.99	1.37	89.10	29.70	0.99
6月	0.00	500.00	347.00	186.00	1,723.00	1,807.00	78.87	26.29	0.88	42.28	14.09	0.47
7月	328.00	0.00	419.00	212.00	1,942.00	2,046.00	95.24	31.75	1.06	48.19	16.06	0.54
8月	300.00	590.00	457.00	228.00	2,486.00	2,541.00	103.88	34.63	1.15	51.82	17.27	0.58
9月	360.00	0.00	485.00	321.00	2,126.00	2,727.00	110.24	36.75	1.22	72.96	24.32	0.81
10月	400.00	670.00	316.00	229.00	2,607.00	1,087.00	71.83	23.94	0.80	52.05	17.35	0.58
11月	1,300.00	0.00	461.00	179.00	1,976.00	1,868.00	104.79	34.93	1.16	40.69	13.56	0.45
12月	400.00	0.00	431.00	217.00	1,668.00	1,057.00	97.97	32.66	1.09	49.32	16.44	0.55
Total	5,738.00	4,190.00	5,440.00	3,801.00	25,995.00	26,805.00	1,236.51	412.17	13.74	863.97	287.99	9.60
Average	478.17	349.17	453.33	316.75	2,166.25	2,233.75	103.04	34.35	1.14	72.00	24.00	0.80

【Necessity of integral development with integrated combination of ice making machine, ice storage facilities, and processing and sales facilities】

As mentioned above, a system for a primary distribution of fresh fish at Anse La Raye has changed due to lack of a selling-fish function at Fish Market and the situation has worsened the fishers' activities and the consumers' convenience of purchasing fresh fish. For overcoming these difficulties, a fish processing facilities with functions of primary processing and sale of fresh fish should be provided indoors. The provision will improve fishing efforts of fishermen and increase opportunities for consumers to buy fresh fish.

For maintaining freshness of fish, smooth and steady supply of ice is indispensable in the facilities. In examining the interactive functions between the facilities as mentioned above, the facilities for an ice machine, an ice storeroom, primary processing facility, a retail counter, etc. should be installed in the same space as the unified facilities from the viewpoint of the flow lines and the hygienic program of the fish and ice. Especially, the recognition of food hygiene greatly differs from the concept in 1988 when existing facilities were provided, and the Department of Fisheries has a consciousness of applying the concept of HACCP to the new facilities and the project in Anse La Raye.

On the other hand, the existing ice making machine, ice storage house, processing and retail facilities are installed separately each other and operated by the different organizations. Fig. 2-2-1(3) shows the flow lines of fish and ice in the existing facilities and the new facilities in the project.

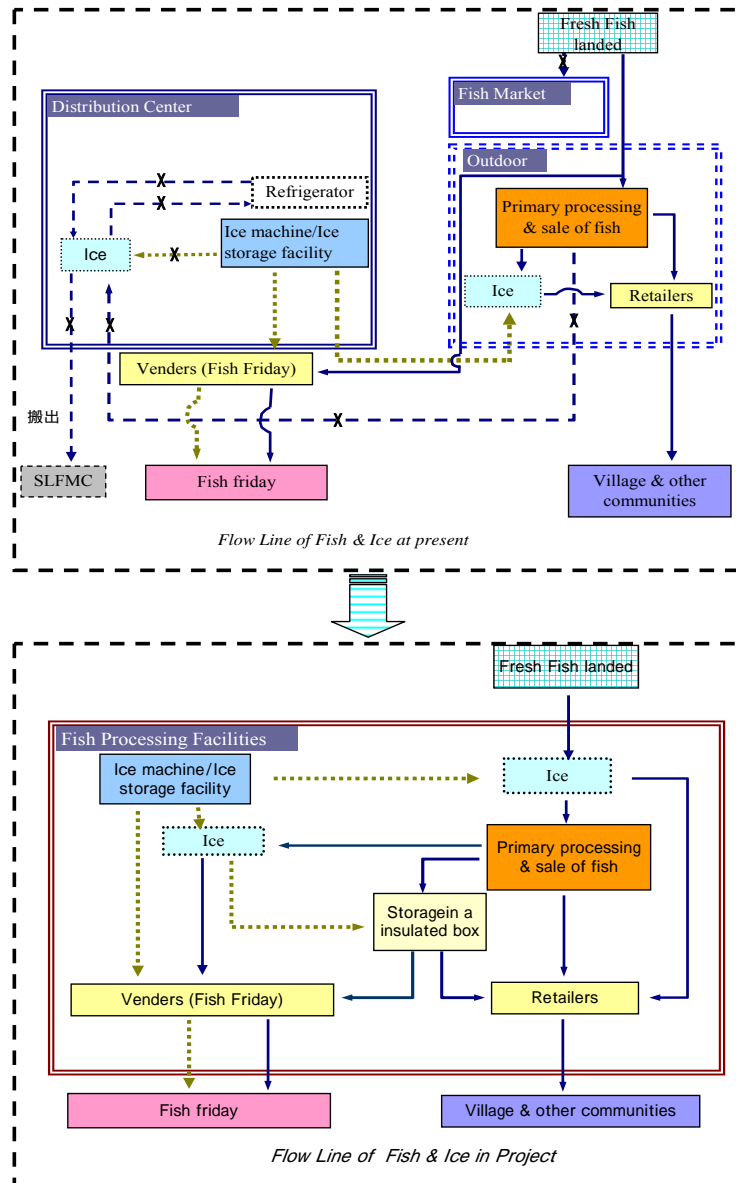


Fig. 2-2-1(3) Comparison of flow of fish and ice between the existing facilities and facilities under the project

In comparing the flow lines between two situations, it is obvious that the lines in the in the existing facilities are far from the smooth traffic lines. Furthermore, the existing facilities are open types without a hygienic function. It is difficult for the existing facilities to render the services for supplying fresh fish to consumers with good

hygienic conditions.

Therefore, in order to properly satisfy the conditions required in the keeping freshness and the hygienic control, it is necessary that the installation of an ice making machine, an ice storeroom, primary processing tables and sale counters are indispensable to be consolidated in the same space. Moreover, the same organization, that is, the Fishermen's Cooperative should operate and manage all the facilities.

The project targets unification of the facilities and the supply of necessary volume of ice to the fishing activities, distribution processes of landed fish, Fish Friday and the village demand. It is expected to contribute greatly to promotion of fishing industry and development of Anse La Raye, because the constraints in above destination of supplying ice will be dissolved as shown in Fig. 2-2-1(4)

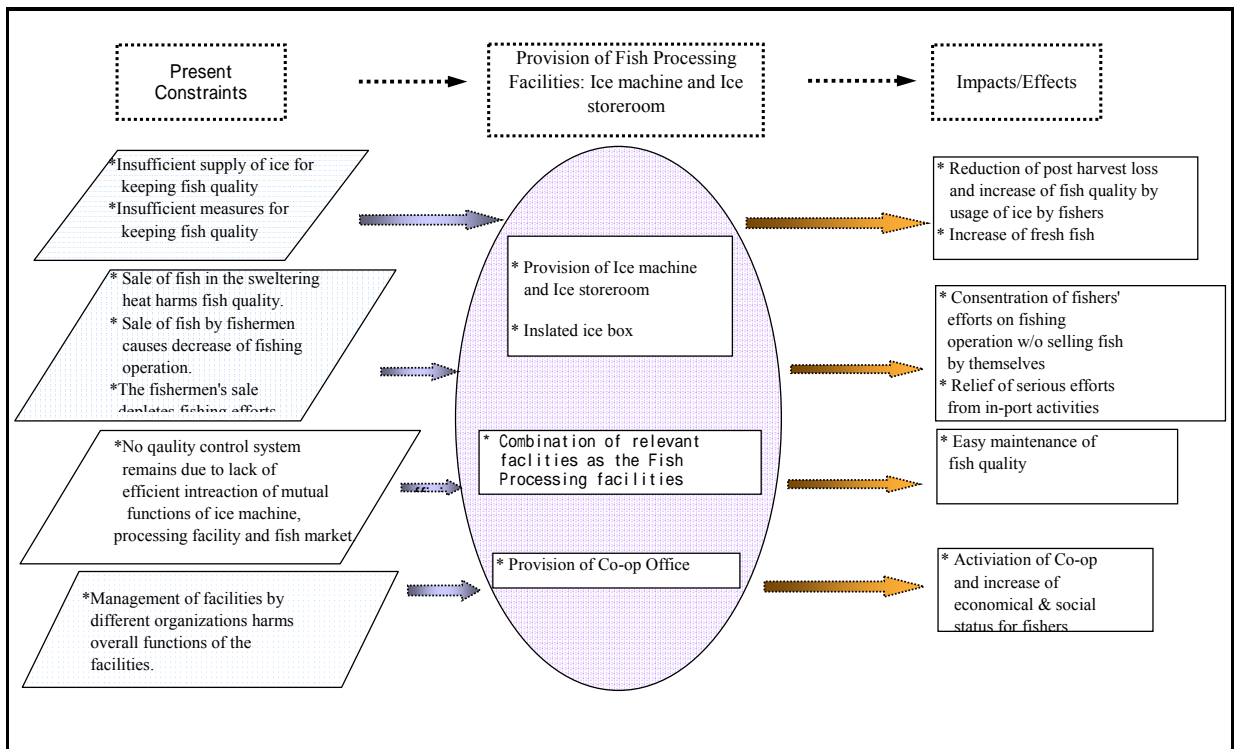


Fig. 2-2-1(4) Expected effect by provision of an ice machine and an ice storage facility

【Necessity of ice making facilities】

The existing ice making machine is estimated to have a production capacity of about 0.8-1.0 tons/day. The production satisfies the ice demand of 0.5 tons/day, which is composed of 0.2 tons/day for fishing boats, 0.2 tons/day for distribution of fresh fish, 0.1 tons/day for demand in V/C. The production capacity remains the difficulty to

meet the total volume plus 0.9 tons/day for Fish Friday or 1.4tons/day. Operation of the aged ice-making machine for meeting the demand has increased excessive loads to the machine. As a result, it causes frequent suspension of machine operation and consumption of excessive water and electricity.

Therefore, when the function of the ice making machine and ice storage is suspended completely, the modern fishing industry would be converted to fishery without ice because no supplier is available in Anse La Raye and its outskirts. The breakdown of the machine would cause reduction of freshness of fish catch, increase of post-harvest losses, decrease of purchase of fish in Fish Friday and decrease of fishing efforts. In addition, another concern is that the restriction of the time for selling fresh fish might exert the influence to decrease of the quantity supplied to the inland of Anse La Raye district.

- An Ice making machine with production capacity of 1.4 tons/a day should be provided to satisfy increase of the demand from the modern fishing activities and the activity of Fish Friday, and the demand of V/C, etc.
- A new machine will be required to secure high productivity, considering that the repair of the existing with using parts purchased in the market will cost same as provision of the new machine.
- The Fishermen's Cooperative is recommended to activate itself with introduction of an ice machine with storage for a source of revenue, following the intension of SLFMC which wishes to withdraw its management and to transfer it to Fishermen's Cooperative.

【Necessity of fish processing facilities】

The direct sale by the fishermen is 45%, the sale to retailer is 52.5% and the one night stock with ice and others is 2.5% for the fish landed in Anse La Raye. Although the some fish is sold in next day, almost all fish is sold on the day. Therefore, it was judged that the refrigeration facilities are unnecessary as the Government of Saint Lucia has agreed to delete the refrigerator from requested components through discussions with the study team. A box for keeping fish of 0.01tons/day with ice for a night is needed and an insulated fish box of 0.1 m³ will be provided, considering a size of Wahoo of about 50cm long.

As for the processing of the fresh fish, primary processing (such as fins and fresh fish's round slices levels) level for the fresh fish sales by the fishermen is executed as mentioned above. The retail counters are available in the existing fishery facilities, and it is defined as fresh fish market which is managed by V/C. V/C has removed the water taps for the theft prevention of water and doesn't execute the joint management

of the fresh fish dealings. Moreover, because wastewater disposal from the retail counters cannot be processed as the septic tank is not in operation, the retail counters are not used. The fishermen are obliged to sell fresh fish under hot weather along the roads now. Therefore, it is necessary to provide the fishery processing facilities where the functions of primary processing of fresh fish and a retail shop are provided. The unified facilities, which will provide a base for selling fresh fish, will help to relieve fishermen's efforts for selling fresh fish by themselves and increase the fishing efforts as a result. With the assumption that the volume of handling of the fresh fish in the fishery processing facilities is 200 days a year, the volume of landed fish a day is around 280kg and it will be around 560kg as maximum even if the tolerance of landing volume is considered. The facilities of tables and sinks for the services of primary processing and sale will be sufficient enough and are arranged indoors for meeting the concept of HACCP (the measure to be able to wash the spandrel wall and easy to keep clean condition) because of invitation of international tourists in Anse La Raye.

7) Venders' Arcade

【Present Bottleneck】

Fish Friday has established itself at Anse La Raye to invite 28 thousands tourists who spend EC\$1,206,384 there. The study estimates the scale of fishing industry as annual fish catch of 101.03 tons, 47.84 ton of which is landed at Anse La Raye. The amount of landed fish on the basis of buying rate of EC\$5.00 is estimated as follows:

- Total amount of catch

$$83.49 \text{ tons/yr} \div 0.4575 \times 1000 \times 5 = \text{EC\$}912,459/\text{yr}$$

- Amount of landed fish

$$47.84 \text{ tons/yr} \div 0.4575 \times 1000 \times 5 = \text{EC\$}522,842/\text{yr}$$

The revenue from Fish Friday is almost equivalent to the revenue of total fish catch by fishermen in Anse La Raye. 13.76 ton /yr of volume of fish purchased by venders for Fish Friday is equal to a fourth of 47.84 tons/yr of landing volume at Anse La Raye. Fish Friday, which attracts tourists to scenery of the fishing village, are mutually interdependent with the fishing industry from a view point of the economic scale.

Venders' Arcade has been built as a shed of roofing with columns with coarse material. No service of water supply in the arcade is available for cleaning the concrete floor and there exists no hygienic control in the arcade.

【Necessity of improved Venders' Arcade】

- There is the interdependent relationship between Fish Friday and the fishermen in

Anse La Raye, and it is necessary to execute the improvement of the fishery facilities and the dissolution of bottleneck of Venders Arcade as one body from the viewpoint of the hygienic program.

- As the location of the jetty and the fishery complex building is closely related, it is reasonable to locate the fishery complex building at the place of Venders Arcade. The Venders' Arcade and the jetty function effectively as tourism resource. The appeal point of Venders Arcade in Fish Friday would be possibly disturbed if the Fishery Complex be constructed. The present bottlenecks of the Venders Arcade should be dissolved at present location.
- The Government of Saint Lucia has expressed the recognition that the improvement of Venders Arcade is one of the important components, with sending a letter to request consideration of the component in the project.

8) Fishermen's Cooperative Facilities

【Present Bottleneck】

Anse La Raye Fishermen's Cooperative manages a fuel supply station, fishing gear lockers, a workshop with fishing net, and has no office building of Fishermen's Cooperative. Neither various meetings by the Fishermen's Cooperative, the fishery training by the Department of Fisheries nor the personnel training by the Department of Cooperative, etc. are enforceable due to lack of an appropriate conference room. The meetings of Fishermen's Cooperative were held 6 times in 2005 using the room of Community Center operated by V/C as shown in Table 2-2-1(5), however, Fishermen's Cooperative is not in apposition to have easy access to the room.

Table 2-2-1(5) Utilization Status of Community Center (2005)

(1) Organization	Frequency
1. Anse La raye Vendors Association	20
2. Anse La Raye Youth and Sports Council	10
3. MAC Police	2
4. Mothers and Fathers Group	30
5. Anse La Raye Council of the Disabled	20
6. Anse La Raye UK Committee	2
7. Anse La Raye Club 60	20
8. Foundation Sports and Cultural Club	30
9. All Stars Sports Club	10
10. Young Stars Sports Club	10
11. Lion Hearts Sports & Cultural Club	20
12. Fishermen's Cooperative	6
Sub-total	180
(2) Wedding, funeral, etc.	10
(3) Village Council	
1. Village Council	12
2. Other governmental organs	24
Sub-total	36
(4) Fish Friday	
1. Dance hall	52
<hr/>	
Total	278
Remarks: Official request is needed in writing to V/C before 2 weeks and the date is appointed by the Clerk.	

On the other hand, the new government that was born in December, 2006 is appealing the policy of tying to "Restoration of public order" by the economic stabilization through expansion of employment. To promote the new entry from the unemployed nationals to fishing industry according to the policy, the Department of Fisheries has commenced the operations to hold the fishery training courses and seminars for the younger generation, since scarcity of new entries from the younger generation is a serious concern of the Government in spite of a high unemployment rate of young people. There are such training courses and seminars that are held for several days and

or two weeks.

Anse La Raye is a typical region in the social and the economic ambience such as unemployment and poverty in Saint Lucia, and the Department of Fisheries recognizes that the promotion of new entries to fishing industry from the younger generation is a serious issue in the region where the fishery is assumed to be main industry. The training courses and the seminars are planned as measures for the purpose. A seminar for a long term was and will be held about once a year and training with an individual theme are planned a few times in a year. Table 2-2-1(5) shows the content and the holding frequency of the training course and seminars. The seminars for the new comers are intensively held covering the contents shown in the table in two weeks. The training for full time fishermen is held one time in two months with the content shown in the table. Therefore, the lectures for the fields in Table 2-2-1(6) are to be annually held one time for a long term and 6 times for a short term, totaling 7 times are planned in a year.

The lectures and seminars will possibly oppress opportunities of other groups or individual in the village (especially, ceremonial occasions) and cause decrease of the services to the local residence, if the use of the community center is attempted for this training course and seminars.

Table 2-2-1(6) Contents of fishermen training and seminars

	Contents of Training and Seminars	Trainees
1 .	Fishing gear, fishing method & fish resources * FAD * Current fishing methods * Fishing grounds, methods & landing * Species, resources, Closed seasons of some Species	Fishers, newcomers New comers Fishers, newcomers Fishers, newcomers
2 .	Engine and repair of fishing gear * Repair of outboard engine * Repair of fishing gear	Fishers Fishers
3 .	Quality control of fish(HACCP) * Ice storage of fish * HACCP and governmental policy * Hygiene control of fish processing facilities	Fishers, newcomers Fishers, newcomers Fishers, newcomers

4 .	Support of increase of life quality * Management of fishing (Pension, subsidy, etc.) * Fishermen's Cooperative	Fishers, newcomers Fishers, newcomers
5 .	Safe Operation * Techniques of boat operation * Climate information * Sea rescue	Fishers Fishers Fishers
6 .	Operation of facilities * Operation of Jetty * Operation of workshop	Fishers Fishers
7 .	Operation of fishery complex Sale of Ice, fuel, fishing gears and usage of gear lockers	Fishers

Moreover, the lectures and the hearing of fishers' opinions are individually conducted twice a week by Fisheries Extension Officer as a usual activity of the Department of Fisheries on the beach now, because there is no training room.

Under such present situation, the circumstance obliges the Extension Officer to seriously work so hard for extending fishery technology to fishermen.

【Necessity of Fishermen's Cooperative Facilities】

- Fishery training courses and seminars by the Department of Fisheries and the personnel training by the Department of Cooperatives, etc. are indispensable and the facilities for serving the training are required.
- Appropriate management of the fishery facilities requires offices for management of fishery and related facilities.
- There is a conference room in community center, and it is possible for the cooperative to annually use the room around 6 times. The room is used for meetings of various groups, Fish Friday and ceremonial occasions of the villagers etc. and it is not in the situation that the Fishermen's Cooperative can use at any time.
- It is presumed that a business scale of the Fishermen's Cooperative will exceed the twice of the present and the report of monthly inventory to the board members will be required. The change of the situation will need a monthly meeting of the board members as same as the other cooperatives. Moreover, a general meeting of the Fishermen's Cooperative members is held once a year.
- If the Fishermen's Cooperative manages the facilities by themselves, the Department of Cooperatives demonstrates the intention to hold a monthly regular meeting between the regional official and Fishermen's Cooperative. The meeting is usually done in the

locally for other Fishermen's Cooperatives, and it is thought for the meeting to be held once a month in Anse La Raye.

- The facilities are necessary in order to support the effective activities of Fisheries Extension Officer at two times a week.
- It is necessary to provide the facilities specially for Fishermen's Cooperative since the number of meetings, trainings, seminars and etc. is assumed about 170 days a year.

9) Others

a) Operation and Management Structure

The Anse La Raye Fishermen's Cooperative, which has already been established, will execute the operation and management of the facilities when the project is implemented. The cooperative holds the jurisdiction over the four fishing villages in Cul De Sac, Anse La Raye, Canneries, and Roseau, and the project site will perform a key role among them. The main income source of the Anse La Raye Fishermen's Cooperative is now only from the sale of fishing gear and cooking gas. In the situation the income source such as fishing gear lockers, ice sales, toilet/shower, events sponsoring by fishermen's cooperatives, etc. cannot be added as other fishermen's cooperatives. The Cooperative is a duty-free juristic body which sets aside the legal statutory reserves of 20% and the education fund of 10% and the death fund of 10% from the annual profits under the Cooperative Act of Saint Lucia. Table 2-2-1(7) shows the statement of the profit/ loss for the Cooperative and it shows a loss in the fiscal year 2004, while turned profit side in 2005 by reducing the salary payment greatly. It made a profit in 2006 by taking down the reserved fund to cope with the broken fuel tank which was the main income source.

Table 2-2-1(7) Profit and Loss Statement of Anse La Raye Fishermen's Cooperative Society Limited

	2002	2003	2004	2005
REVENUE:				
Sales income	589,952	599,169	695,814	611,614
Other income	1,175	3,898	3,523	1,613
Total income	591,127	603,067	699,337	613,227
COST OF SALES:				
Opening Inventory	21,281	17,033	19,481	30,058
Purchases	545,922	548,301	653,992	550,738
Closing Inventory	17,033	19,481	30,058	16,331
	550,170	545,853	643,415	564,465
GROSS PROFIT	40,957	57,214	55,922	48,762
LESS: OPERATING EXPENSES				
Accounting and Audit	4,300	4,300	4,300	4,300
Bank Charges	796	562	517	730
Insurance	1,583	1,688	1,697	1,736
Depreciation	318	723	897	837
Stationary and Printing	2,255	2,123	865	4,562
Miscellaneous Expenses	1,658			
Repairs and Maintenance	737	327	122	909
Salaries and Wages	16,800	15,477	22,828	8,155
Traveling and Entertainment	1,022	1,362	1,624	286
Utilities	1,510	3,544	3,393	4,198
Advertising			25	330
Staff Expenses		165		
Dues and Subscriptions			200	1,196
Honorarium and Bonus	6,400			
Security			500	550
Donation				758
Cash Shortage	294	1,568	26,716	15,039
Bad Debt Expense		1,720		
	37,673	33,559	63,684	43,586
Net Income	3,284	23,655	-7,762	5,176

To attempt rebuilding, the election of the board members was conducted in the general meeting on Sunday, November 5, 2006. When the jurisdiction of fishery facilities are shifted to Fishermen's Cooperative in the occasion of the project, revenue and expenditure will be improved, and education and training, etc. to artisanal fishermen will be efficiently executed, and it will contribute to improvement of the artisanal fishermen's life. The Government of Saint Lucia is going to establish the management committee related with this project for smooth management and operation of the facilities in the project. The members of this committee will be composed of two from Anse La Raye Fishermen's Cooperative, one each from Anse La Raye Village Council,

Fisheries Department, Department of Cooperatives and Village of Anse La Raye.

b) Fuel Supply Facility

An existing fuel supply station is not functioning now. Most of all the fishermen procure supplies of fuel from Marigot (yacht harbor) in the vicinity through necessity. The fishermen cannot obtain subsidies for fuel consumption to be refunded by the Government, because the privilege is given only for refueling at facilities operated by fishermen's cooperatives. The Fishermen's Cooperative at Anse La Raye is planning repair of the existing refueling facility. The fishing boats registered at the villages in the jurisdiction of Anse La Raye Fishermen's Cooperative will be refueled. The volume of necessary gasoline is calculated from the consumption of the gasoline of 23 gallons per navigation as follows.

Table 2-2-1(8) Fuel Consumption by Fishing Boat

	CANOE	PIROGUE	OTHERS
CANARIES	17	8	5
ANSE LA RAYE	13	14	3
TOTAL	$(17+13) \times 23 \times 0.72 = 496.8 \text{ gal/day}$ $496.8 \times 200 = 99360 \text{ gal/day}$	$(8+14) \times 23 \times 0.72 = 364.3 \text{ gal/day}$ $364.3 \times 200 = 72860 \text{ gal/day}$	$(5+3) \times 23 \times 0.72 = 16.78 \text{ gal/day}$ $16.78 \times 200 = 3356 \text{ gal/day}$

Therefore, the consumption of fuel by the fishing boats in Anse La Raye Cooperative becomes 877.88 gallon/day and 175,576 gallons/year. Because minimum tanks of the oil trader who supplies the fuel are 5,000 gallons, the demand for five days can be covered by setting up one tank.

(5) Location Plan of whole requested components

1) Basic policy of layout plan

a) Arrangement of project components

The situation of the project components is explained and tabulated in the following table as discussed in the previous section. The components to utilize the existing facilities with repair are the workshop and toilets/shower as shown in the table below. Therefore, an overall layout of the components is examined with fixing the two components at the existing location.

Table 2-2-1(9) Situation of Project Component

Components	Present Constraints	Necessity of facilities	Proposed Location of Facilities
1 . Jetty	<p>More than 6 fishers are required for hauling boats.</p> <p>Serious efforts are needed for preparation with landed boats.</p> <p>The same efforts are needed for landing fish from boats on the beach.</p> <p>A few places for boats to lay by.</p> <p>In- port preparation for fishing operation needs time and efforts due to offshore anchorage of boats.</p> <p>Frequent landing boats on the beach increase of repair.</p>	<p>Relief of efforts for in-port activities are necessary.</p> <p>Reduction of fishers' expenditure should be made with decreasing landing boats on the beach</p> <p>Services for lay by berths are needed.</p>	<p>The existing jetty</p> <p>Near the Fishery Complex</p>
2 . Boat Hauling Facilities	<p>No slipway urges fishers to park boats.</p> <p>Many efforts required for landing boats on the beach</p> <p>Many efforts to haul boats on the beach for repair.</p> <p>Evacuation from the site to calm places in hurricanes.</p>	<p>Services for hauling boats are highly required as 4.6 time a month.</p> <p>Efforts in hauling boats should be relieved in hurricanes.</p> <p>Damages to boats should be reduced.</p>	<p>In front of Workshop</p>
3 . Workshop	<p>Damages of roofing and columns</p> <p>Maintenance of the function</p> <p>Repair of FRP causes harmful effects on fishers mending nets at the workshop.</p>	<p>Indispensable for regular maintenance of boats</p> <p>Repair of roofing and columns are required.</p> <p>Separation of workshop function and net mending function is necessary for fishers' health.</p>	<p>Repair of the existing</p>
4 . Fishing Gear Lockes	<p>Saline damages to wire meshes for walls.</p> <p>Insufficient strength</p> <p>Repair of rusted steel is difficult.</p> <p>Insufficient space to accommodate gears and engines to be currently enlarged.</p> <p>Insufficient security due to damages of lockers.</p>	<p>Enlargement is needed for accommodating fishin gear, etc.</p> <p>Repair is impossible.</p> <p>The lockers are needed for eliminating security issues.</p>	<p>New buildings around the existing.</p>
5 . Toilets/shower	<p>No toilets for fishers</p> <p>Toilets only for tourists are available.</p> <p>Poor hygiene due to lack of toilets for fishers.</p> <p>No fuction of a septic tank is available with free flow of waste water.</p> <p>Improvement of hygiene is required to accommodate tourists.</p>	<p>Toilets for fishers are needed in terms of fishers' health and hygiene around the fishing facilities.</p> <p>A septic tank is required due to collapse of the existing.</p>	<p>Repair of the existing</p> <p>A new septic tank at the north end of the site</p>
6 . Fishery Copmlex 1) Ice Making Machine	<p>Termination of operation is coming very soon due to serious damages of Evapolation condenser.</p> <p>SLFMC is eager to transfer management due to high operation cost.</p> <p>No revenue of the Co-op from sale of ice</p> <p>Insufficient production of 1.0t/day against the demand of 1 .6t/day</p>	<p>Production of 1.0 t/day does not satisfy the demand of 1.4t/day.</p> <p>Serious deterioration of the machine will cause a termination of the facilities very soon.</p> <p>SLFMC intends to transfer magement to another and Co-op may obtain a revenue source.</p>	<p>A new machine installed in a new building of Fishery Complex</p>
2) Fish Processing Facilities	<p>Low necessity of refrigerator</p> <p>Refrigerator is mechanically deteriorated not to be repaied.</p> <p>Primary processing is done by fishers.</p> <p>Further processing is not made.</p> <p>No service at Fish Market is available.</p> <p>Fishers are obliged to sell fish along the road in the sweltering heat.</p>	<p>A demand for storing fish a night remains with using an insulated box.</p> <p>Relief from selling fish in a swletering heat for fishers.</p> <p>Relief from efforts to selling fish byfishers.</p> <p>Incease of fishing efforts is needed forincreasing their quality of life.</p> <p>Introduction of concept of H A C C P is required.</p>	
7 . Facilities for Co-op	<p>No office and Taining Hall are available.</p> <p>No opportunity of training and seminars for fishers are provided.</p> <p>Difficulty to secure room for conference of Co-op</p> <p>Co-op is not vivacious.</p>	<p>With provision of conference space, training and seminars are required for fishers for support their life quality.</p> <p>Convenience of fishing activities for fishers should be improved with proper operation of the facilities.</p>	<p>In a new building of Fishery Complex located around the</p>
8 . Venders' Arcade	<p>It is built as a temporary shelter, very fragile.</p> <p>Low hygiene due to no facilities of water supply and drainage system.</p> <p>Shelters from sudden rain are not enough for the guests.</p>	<p>Fish Friday using Venders' Arcade causes promotion of fish sale due to mutual reliance of fishing industry and the</p> <p>The fishing facilities and Venders' Arcade are inseparable.</p>	<p>Repair of the existing</p>

b) Relevancy of Project Component

As shown in Table 2-2-1(10), the project components have relevancy each other. The components with high relevancy each other are the fishery complex facility and the jetty, work shop and slipway, fishing gear locker and Toilet/shower. and venders arcade and Toilet in the project according to this table.

Table 2-2-1(10) Relevancy of Project Component

	Jetty	Boat Landing Facility	Workshop	Gear Lockers	Toilets w/ septic tank	Fish Processing Facilities	Venders' Arcade
Jetty		B	B	A	B	AA	A
Boat Landing Facility	B		AA	A	B	B	B
Workshop	B	AA		A	B	B	B
Gear Lockers	A	A	A		AA	B	B
Toilets w/ septic tank	B	B	B	AA		B	AA
Fish Processing Facilities	AA	B	B	B	B		A
Venders' Arcade	A	B	B	B	AA	A	

AA: Strong
A: Medium
B: Weak

2) Options for layout

The location of jetty, workshop, and Toilet/shower is fixed as a precondition of the layout planning. The relevancy of the facilities should be considered also as discussed above. An option of the layout is proposed so as to minimize the removal and relocation of the existing facilities. The alternative plan is to locate the facilities for fishery complex at the place of Venders' Arcade, considering the function of fishery complex and the strong relevancy of fishery complex facilities and the jetty.

Therefore, two options are examined.

* Plan-A: Present location option

The plan is to arrange the Fishery Complex building with necessary functions at

the location of the existing Distribution Center and Fish Market.

* Plan-B: Fishery Complex located at Venders Arcade

The plan is to arrange the Fishery Complex building at the location of the existing Venders Arcade, which will be relocated at the center of the Distribution Center. It is the precondition that the operation and management of Venders Arcade in Fish Friday is built into the fishery facilities.

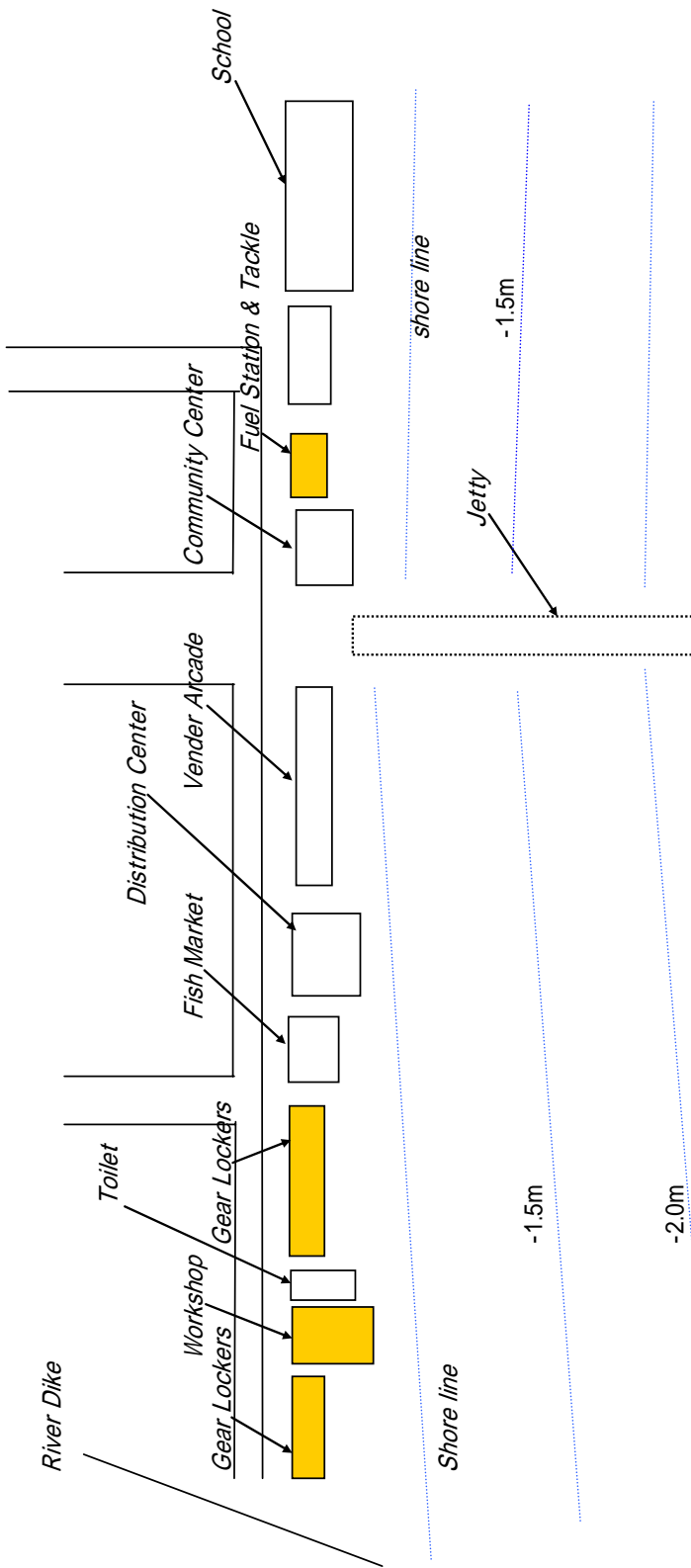
3) Comparison of each option

According to cost estimation for two options for comparison, the cost for Plan A is less than 5% of the cost for Plan B. Plan A is proposed in the respect of the cost. In Plan B, the convenience is high at the time of fish landing and the preparation for fishing since the location of jetty and fish processing facilities are close each other. The main building of Venders' Arcade on Fish Friday has to be relocated to lack the uniformity of landscape including the jetty. Therefore, Plan A is selected as the project plan, since the improvement cost is cheaper and is able to keep the continuity of Fish Friday and the uniformity of the landscape.

As for all the components, operation and management is done by the Anse La Raye Fishermen's Cooperative excluding Venders Arcade on Fish Friday as shown in Table 2-2-1(11).

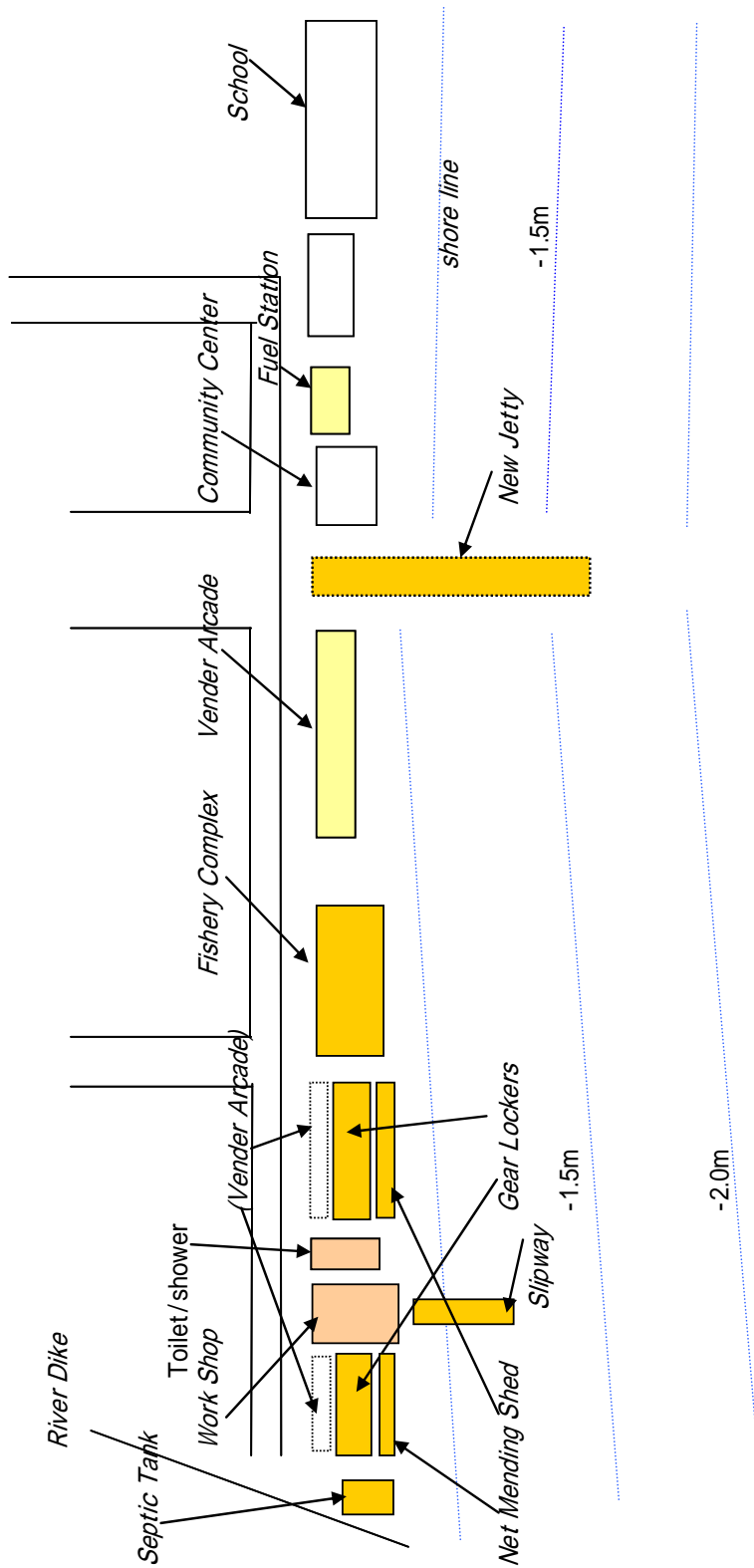
Table2-2-1(11) Operation and Management Bodies of each component

Component	Current	After Completion
1. Jetty	V/C	Fishermen's Cooperative
2.Vender arcade	V/C	V/C
3.Fishery complex	SLFMC	Fishermen's Cooperative
4. Gear Lockers	Fishermen's Cooperative	Fishermen's Cooperative
5.Net Mending Shed	—	Fishermen's Cooperative



Layout of Existing Facilities in Anse La Raye

Facility	Owner	Management
Distribution Center	G	SLFMC
Gear Locker	G	Corp
Net Mending Shed	G	Corp
Work Shop	G	Corp
Septic Tank	G	V/C
Fuel Station	G	Management
Old Jetty	G	Corp
Toilet	G	V/C
Vending stand	G	V/C



Plan-A

Structure	Owner	Management	Owner	Management
Fishery Complex	G	Co-op/DOF	Fuel Station & Tackel shp	Co-op
Gear Locker	G	Co-op	Slope	Co-op
Net Mending Shed	G	Co-op	New Jetty	Co-op
Work Shop	G	Co-op	Toilet/shower	Co-op
Septic Tank	G	Co-op	Vender's Arcade	V/C

2-2-2 Design Policy

(1) Determination of Design Fishing Boat

1) Number of Fishing Boats

The present plan is prepared for the fishing boats in operation at Anse La Raye. Landing berths are planned for the 27 boats except 3 assistant boats as Shalooop, and lay by and preparation berths are for 30 boats with the 3 boats.

- Design number of boats: 27
- Lay-by and preparation berths: 30

2) Type of fishing boats

- Pirogue (LOA: 7.7m, Width: 2.2m, Draft: 1.0m): 14
- Canoe (LOA: 7.2m, Width: 1.6m, Draft: 0.8m): 13
- Shalooop (LOA: 4.6m, Width: 1.3m, Draft: 0.5m): 3

(2) Number of berths and their Length

1) Number of berths

Landing berth

The fishermen in Anse La Raye make an in-a-day trip for their operation and no significant difference in operation system is found between major and minor fishing seasons

The interview survey conducted by the study team shows fishing operation patterns as listed below:

- * Average operation rate: 72%
- * Rate of fishing boats to land fish at Anse La Raye: 57.3%
- * Landing time a boat: 30 minutes
- * Rate of operation for less than 4 hours: 48%
- * Rate of operation for less than 6 hours: 44%
- * Average operation time: 5 hours

Number of fishing boats to land fish catch at Anse La Raye in a day is

$27 \text{ boats} \times 0.72 \times 0.573 = 11.11 \text{ boats}$, which shows the number of boats landing fish at the village is 12.

The required number of berths is calculated with dividing the total landing time by fishing operation time as follows:

$$\text{Required number of berths} = (12 \text{ boats} \times 0.5 \text{ hrs/boat}) \div 5.0 \text{ hrs} = 1.2$$

It means the berth number for the plan is 2.

Preparation and Lay-by berth

Average operating fishing boats, rate of which is estimated as 72% of 27 boats as the total number, is calculated as:

$$27 \text{ boats} \times 0.72 = 19.44$$

The result shows average 20 fishing boats are in operation in a day and a plan for berths is based on the number.

The total number of boats is composed of 14 Pirogue and 13 Canoe and each type of the number of 20 boats is 11 pirogues and 9 canoes with applying the above rate.

Canoe boats need landing on the beach for drying the bodies and the frequency of landing is estimated as once in two days. The number of canoes on the sea is calculated as:

$$9 \text{ boats} \times (1-1/2) = 4.5 \text{ boats, which shows 5 fishing boats are on the sea .}$$

The number of pirogues is 11 as landing frequency is included in the rate of no operation as 72%.

The total number of fishing boats on the sea is calculated as 16 with summing up the numbers of 5 and 11.

The berths for preparation and lay-by is planned to accommodate 16 fishing boats. The berth length is determined with minimizing the total length based on comparison between mooring systems as alongside and vertical to a berth.

2) Berth Length

Landing berth

The fishing boats in Anse La Raye are of 14 pirogues, 13 canoes and other 3 boats. "The guideline for design of fishing port facilities and fishing grounds", which is official design manual for fishing facilities in Japan, requires the average length of total fishing boats and the average boat length is calculated with pirogues and canoes since shallop is very shorter than other types. The average length of a boat for planning is:

$$(7.7\text{m} \times 14 + 7.2\text{m} \times 13) / (14 + 13) = 7.5\text{m}$$

The above guideline indicated that a berth length should include allowance of 15% of a boat length and the planned length of a berth is obtained as

$$7.5\text{m} + 7.5\text{m} \times 0.15 = 8.6\text{m}$$

The berth length of the plan is 9m.

Preparation and lay-by Berth

The berth length is determined with comparing total length of berths for mooring alongside and berths for mooring vertically. A basic length of a berth is calculated as follows:

$$\text{Mooring alongside: } LOA \times (1 + 0.15) = 7.5 \text{ m} \times (1 + 0.15) = 8.6 \text{ m}$$

$$\text{Mooring vertically: } \text{Breadth} \times (1 + 0.5) = 2.2\text{m} \times (1 + 0.5) = 3.3 \text{ m}$$

(3) Landing Volume of Fish Catch

In the section 2-2-1, as a result of the interview survey conducted by the study team, fish catch and landing volume of the catch by the 27 fishing boats are estimated at:

Fish catch by fishermen at Anse la Raye: 83..49 tones per year, and

Landing volume at Anse La Raye: 47.84 tones per year

(4) Planning of Facilities for Fishing Boats

1) Basic Policy

There are no facilities for fishermen in Anse La Raye to land fish, prepare fishing operation and moor boats for laying-by, since the existing deck of the jetty is too high to use it for landing fish. This situation causes tough work to the fishermen as landing a boat by 6 persons. These situations, which make fishermen exert efforts and loose time, retard efficient fishing operation. Landing boats on the beach results in increase of damages of boats and expenses for repairing them.

The provision of the facilities for fishermen is required and expected to reduce their efforts and damages of the boats.

The project aims at increasing convenience in fishing operation and reducing their expenses, which will result in fishermen's increase of life quality.

The plan is prepared for necessary functions with minimizing costs, considering the following design policy.

The facilities prepared around the beach will minimize impacts to sand drift.

The end of a new jetty will be designed to be protected from wave action, considering present wave run-up affects the foundation of existing facilities along the beach.

In designing a jetty of a pipe-pile type, open mouths of the concrete deck to reduce uplift pressure caused by waves should be provided for minimizing the construction cost. Timber blocks of "Greenheart timber" will usually be installed for smooth traffic on the deck, while they will be removed in hurricanes.

Considering the present fishing operation and anchoring the fishing boats in Anse La

Raye Bay, the scale of the facilities of berths for landing, preparing and laying by should be minimized but satisfied with the requirements.

No fishing boats should be moored at the berthing facilities of the new jetty in hurricanes.

Appropriate elevation of the landing berths should be prepared to accommodate the operational fishing boats and the facility should provide a safe mooring system.

2) Design Criteria and Standards

No concrete design criteria are in St. Lucia and the following criteria and standards should be applied for the design of the facility.

The Guideline of Fishing Ports (All Japan Fishing Ports Association)

The Guideline for Design of Fishing Ports and Fishing Grounds (All Japan Fishing Ports and Fishing Grounds Association)

Design Standards of facilities for Ports and Harbors (Japan Port and Harbor Association)

3) Design policy for each facility for fishing boats

Berthing facilities for landing, preparation and laying by

Since mooring facilities should minimize blockage of littoral drift along the shoreline, the facilities is recommended to be a jetty type. Effective part of the facility for mooring should be allocated at the offshore part of the facility and the landside part of the facility should be a connection part between the mooring facility and the land.

The length of lay-by berths should be determined for minimizing the scale with examination of mooring methods.

Major consideration on the facility is as follows:

- Elevation of the mooring facility should be determined for meeting the requirements for landing, etc.
- Access of pickup trucks should be capable to transport engines, fishing gears from the gear lockers located apart from the jetty.

For minimizing the construction costs, a temporary work stage will provide land work for marine equipment and silt protection curtains will be provided for preventing water contamination.

Facility for landing boats

The facility should be provided to support landing boats into the workshop. The scale of the facility with the necessary function should be minimized. It will help easy landing boats to park them on the roads in hurricanes.

The beach profile is with flat beach of 7m wide and gradient of 1/10 from the elevation

from +1.0m to -1.5m. Some extent of offshore and littoral drift is recognized around the beach at Anse La Raye.

The type of the facility will be selected through examining several options to be applied to the project.

Other facilities for the berths

A beacon lighting system, fenders, bollards, curbing and lighting will be provided.

* Design Boat

Table2-2-2(1) Dimensions of Design Boat

Design Boat	CANOE, PIROGUE
LOA	7.7m
Breadth	2.2m
Draft	1.0m (including depth of engine)
Approaching Velocity	0.5m/s
Tractive force	10kN

* Surcharge

Table2-2-2(2) Surcharge

	Surcharge (kN/m ²)
Landing	10
Lay by	5

4) Design policy to natural conditions

Temperature and rainfall

There remain no obstacles from the temperature in a range of 25 and 27 in the process of construction work. Number of days with over 10mm of daily rainfall is about 55days, which might affect the progress of the work. It is known that rainfall usually increase during July and December in rainy season.

Tide

Tide conditions are set for designing the facility as follows:

Table2-2-2(3) Tide Conditions

H.W.L.	+0.23m
M.W.L.(St. Lucia Trig. Datum)	±0.0m
L.W.L	-0.23m

Design Waves

The design waves for the facility is determined through detailed examination as follows:

Table2-2-2(4) Design Waves

Design waves		Wave height	Wave period
	Tip of jetty	2.8m	12 seconds
	Tip of Approach	2.1m	12 seconds

Table2-2-2(5) Design Waves for Slipway

Design waves		Wave height	Wave period
	Slipway	2.4m	12 seconds

Sand Drift

It is pointed out that the beach of the Anse La Raye tends to a slow erosion. The situation of the shoreline difference between north and south sides of the jetty shows phenomena of littoral drift on the beach. Moreover, move of turbidity of fine particles of sand is observed offshore.

Therefore, the structure constructed in the coastline should minimize the sand drift as stated above.

Nature of soil condition

It is understood that the soil in Anse La Raye shows an almost homogeneous soil characteristics of silty sand as a result of the soil investigation conducted by the study team. At a part of vicinity of the existing pier tip, soil from the bottom by 10m in depth is a relatively loose silty sand and deeper than the depth is of comparatively compacted silty sand. N value used for the facilities design is set as follows.

Table 2-2-2(6) N value for Design of Jetty

Elevation	Nature of soil	Obtained N value	Average N value
Shallower than -11.8m	The above part sandy soil layer	3, 7	5
Deeper than -11.8m	Lower sandy soil layer	15, 20,24	20

5) Plan of procurement of local machinery and material

The construction machinery and material is procured as much as possible in St. Lucia. Especially, cement and the aggregate can be procured enough domestically. The material quality is based on JIS or its equivalent standards.

6) Plan of procurement of local construction firms

Marine construction in this country was actually conducted by the firms in Trinidad & Tobago and Barbados in the neighboring country. The construction companies in the country have experiences of road works and small-scale buildings, and have experiences of small-scale harbors construction as subcontractors of the companies from the neighboring country. The local firms will be possibly subcontractors of the overseas contractors though such firms have neither heavy equipment nor engineers necessary for marine works.

7) Plan of construction method

For making construction cost a minimum, marine equipment to be procured from foreign countries is not used, considering local sea conditions and local construction market. The work for constructing a jetty will be conducted with provision of a temporary stage of rubble rocks in the sea.

(5) Architectural plan

1) Basic policy

Design standards

Building standards in St. Lucia are "OECS Building Code, St. Lucia", which is based on "Caribbean Uniform Building Code" (CUBiC), is the criteria for designing buildings and inspecting design documents in the country. The design of all the buildings in this project is based on the criteria on seismic forces and wind loadings from CUBiC, comparing them with Building Standard Law of Japan.

Structural design condition

a) Seismic force

The calculation of the horizontal force caused by the seismic force is provided for referring to "OECS Building Code St. Lucia".

$$V=ZCIKS\bar{W}$$

where,

Z: Numerical coefficient related to the seismicity of a region(0.75)

C: Basic elasticity time of structure coefficient

I: Occupancy importance coefficient of building

K: Coefficient of structural system

S: Coefficient of site -structures resonance

W: Perpendicular load in building (fixed load + lived load)

From the numerical value that corresponds by using the above-mentioned

$$V=0.75 \times 0.12 \times 1.5 \times 0.8 \times 1.0 \times W=0.108W \text{ is obtained.}$$

On the other hand, seismic shear force coefficient C_i : in regulations of Building Standard Law of Japan.

$$C_i = ZRtA_iC_0$$

Where,

Z: Coefficient that the Minister of Land, Infrastructure and Transport provides, the level of the earthquake damage based on the record of an earthquake past in the provinces (1.0-0.7).

Rt: Numerical value calculated with showing vibrational property of building by method established by the Minister of Land, Infrastructure and Transport according to proper period of building and kind of the ground (1.0)

A_i: Numerical value calculated by method established by the Minister of Land, Infrastructure and Transport who shows distribution of direction of height of building of seismic shear force coefficient (1.0)

C₀: Standard shearing power coefficient (0.2 or more)

From the above-mentioned

$C_i=0.7 \times 1.0 \times 1.0 \times 0.2=0.140$ is obtained. The seismic force is obtained by multiplying a perpendicular load (fixed load + lived load) to this seismic shear force coefficient for the standard of Japan and the seismic force is:

$$C_i \times W=0.140W$$

Numerical value C_iW and V calculated according to regulations of the two countries have the same meaning because the concept of numerical value W in a perpendicular load in Building Standard Law of Japan and CUBiC. It is understood that it makes use of the past experiences of big earthquakes in St. Lucia, whilst the standards in Japan have been modified through the large number of earthquakes for many years. Comparing the two values from different standards, the former in St. Lucia is smaller than the latter in Japan. The value of the coefficient is recognized as not to be small because of understanding the background of the CUBiC. Therefore, the numerical value of CUBiC is adopted in this plan.

b) Wind loading

The calculation standard of the horizontal force in Saint Lucia caused by the wind pressure is provided for referring to CUBiC as well as the seismic force as follows by "OECS Building Code St. Lucia".

$$W=(q_{ref})(C_{exp})(C_{shp})(C_{dyn})$$

q_{ref} : Reference velocity per unit area ($q_{ref}=0.76\text{kPa}$).

C_{exp} : Exposure factor against height of building (5m or less in highest height is $C_{exp}=0.9$).

C_{shp} : Aerodynamic shape coefficient ($C_{shp}=\pm 0.7$)

C_{dyn} : Dynamic response factor (It is $C_{dyn}=2.0$ for the principal structural part).

The above is calculated.

$$W=760 \times 0.9 \times 0.7 \times 2.0 = 957.6 \text{ Pa (N/m}^2\text{)}$$

The wind pressure at the side between beams uses velocity pressure q by setting 4.5m in highest height in the case of the building of the gable shape when the wind pressure power is calculated from the definitive method of Japan.

$$q=60\sqrt{4.5}=127.28 \text{ (kgf/m}^2\text{)}$$

$$W=0.9 \times \text{It becomes } q=1,122.61 \text{ Pa (N/m}^2\text{)}.$$

The great divergence adopts the numerical value of CUBiC from the thing that not is in the method of calculating both in this project.

c) Bearing capacity of the ground

The buildings in the project adopt a basic structural system directly according to the independent footing in consideration of the cost. The bearing capacity of ground is 140kN/m^2 from a result of the plate loading test at the site.

Regulatory effluent standard

The effluent control value of BOD is set as 60ppm, referring to the fishing port effluent standard value of Japan since no standard on the matter is available.

The salt damage and white ant measures

Facilities, which face the coast in saline air, receive waves directly at times at the site and should avoid the material with the fear of the rust development as much as possible. However, steel frames and steel roofing will be required because of structural reasons and suitability of material to building parts. The paints with the tolerance of salinity should be applied for preventing rust, and steel frames etc. exposed around eaves should be concealed with anti-saline material.

Moreover, a lot of damages of the white ants are clemently seen in Anse La Raye and no wooden material will be used for the structural frames. White ant measures beforehand in the project should be applied when wooden material be used.

2) Policy to natural conditions

The shoreline at Anse La Raye is in the situations of gradual change of beach profiles, narrow beach width and easy affection of waves caused by hurricanes due to bay configuration being open to Caribbean Sea. Floor elevation should be above about 1 meter from the ground elevation as the existing buildings, considering experiences of damages caused by waves. When the height of the floor is raised by about 1m from the road elevation, the beam supporting the floor slab is exposed to the sea side. In reaching the beams, waves might affect scour of the sand in front of the beam. For preventing the phenomenon, the elevation of the foundation is set at 3 m below the ground elevation with strengthening beams with walls. The structure is normally affected by buoyancy and continuous footings of the buildings will minimize the influence without enlargement of the foundation.

3) Policy of procurement of construction material

There are two fresh concrete plants between Rodney Bay and Castries, and the transportation time from the plants to the site is in the time specified by the quality control standard of Japan. As concrete agitators are locally available, in-situ production of concrete might be conducted according to the required volume of concrete. Concrete blocks, material like steel bars etc. for small buildings are available. Local roofing of buildings is of wide ribbed roof with steel plates and no roofing of steel plates of salt-proof specifications with tight frames. Moreover, the use of caulking necessary for the waterproofing work is not seen at all. The material related to the roof material and the waterproofing work will be provided from Japan or third countries while the use of a local material is basically used.

4) Plan of procurement of local firms

There is no problem in the capacity of the skill and supply of the construction manpower of construction firms, which are from St. Lucia and member countries of CARICOM (Caribbean Economic Community). The findings of the study team are that local workmanship meets the requirements for standard quality of concrete work with supervising the concrete coverage and pitches of steel bars.

The skill of building work with lighter weight steel materials is up to the necessary standard but complex steel frame structures etc. is not accustomed.

5) Policy to industrial method

Buildings of reinforced concrete and concrete blocks with cement mortar finish are very familiar in St. Lucia. The design policy of the buildings in the project aims at applying locally familiar specifications as reinforced concrete structure, concrete block walls and roofing with coloring steel boards of the salt-proof. In the plan of the buildings, special specifications are not considered.

(6) Design of Ice Making Machine with Ice Storeroom and Equipment for Fish Processing Facilities

1) Basic Policy

No physical design standards for design of the machinery are available in St. Lucia in spite of provision of laws and specifications of machinery. The design of machinery imported from Japan will be based on the Japan Industrial Standards (JIS).

2) Capacity of Machinery and Equipment

a) Ice Making Machine and Ice Storeroom

- Capacity of Ice Making Machine: 1 tons/day
- Capacity of Ice Storage: 2 tons

b) Primary Processing Tables and Sinks

- Transportable type of tables and sinks

c) Insulated Fish Box

- To store fish with ice for a night: 0.1 c. m

2-2-3 Basic Design

2-2-3-1 Basic Design of Facilities for Fishing Boats

(1) Mooring Facilities

Structure Type

The structure of the jetty should not affect sand drift on the seashore, which is recognized by the phenomenon that the abutment of the existing jetty blocks littoral drift. For the purpose of easier transmission of sand and water currents, two types of the steel pipe pile and floating pontoon are proposed as shown below:

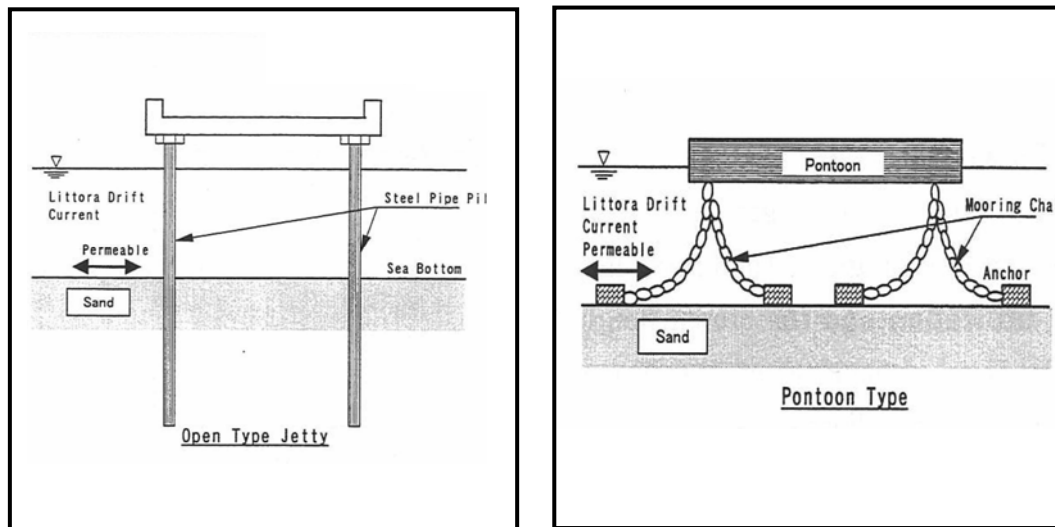


Fig..2-2-3(1) Permeable Types of Jetty

The characteristics of the types are shown in Table 2-2-3(1).

As indicated in the table, some measures are required for the both types in the design stages and maintenance stages. In examining the necessary measures to avoid damages caused by the rough seas, a pier type is recommended from a view point of suitability in rough sea and the costs for shifting and maintaining a pontoon. The structure of steel pipe piles is applied to the facility of the project with considering the will of the Government of St. Lucia.

Table 2-2-3(1) Characteristics of Permeable Structures

Type	Natural conditions	Strength & Weakness	Measures against Weakness
Pier	<ul style="list-style-type: none"> *Suitable to earthquake-proof facility on the soft soil ground *Difficulty in driving piles into a hard soil ground. *Damages caused by uplift of waves to a concrete slab 	<ul style="list-style-type: none"> *Weakness in horizontal forces but very little force be applied. 	<ul style="list-style-type: none"> *Open mouths of the concrete deck to release uplift pressures. *Capable driving piles to silty sand soil.
Pontoon	<ul style="list-style-type: none"> *Unsuitable structure to wave agitation. *Low resistance to waves. *Suitable at calm waters with a wide tidal range. 	<ul style="list-style-type: none"> *Low capability to absorb impacts and tractive load by boats. *The weakness to be recovered with bigger fenders and bollards. *Suitable to moor small boats in a wide tidal range. 	<ul style="list-style-type: none"> *In high waves, shift to calm waters by a tug boat be needed with lifting its anchors. * Required high maintenance cost. *High cost for repair and maintenance of a pontoon and chains *High cost with many responsibilities for maintenance to the organization.

Design of Jetty

The mooring berths of a jetty should be provided in the waters with sufficient depth for the design boat and a part of the jetty in the shallower waters should be an approach to the mooring berths, which will not be used for mooring boats.

a) Required depth of mooring berths

● Landing berth

A maximum draft of the design boat is set to be 1.0m with adding 70cm of a boat draft to 30cm of surplus depth of outboard engine. According to the “Guideline for Design of Fishing Ports and Fishing Ground”, the design berth depth should be enough depth of the maximum draft plus allowance of 0.5m as calculated below:

$$\text{Design depth} = 1.0\text{m} + 0.5\text{m} = 1.5\text{m: MSL} - 1.73\text{m}$$

The landing berth of the jetty will be located at the part deeper than MSL-1.73m.

● Preparation and Lay-by berths

A draft of an FRP fishing boat in preparation for fishing operation is 40cm from the team’s inspection. The design depth is calculated with adding the allowance 0.3m and the draft as below:

$$\text{Design depth} = 0.4\text{m} + 0.3\text{m} = 0.7\text{m: MSL} - 0.93\text{m}$$

The preparation and lay-by berths of the jetty will be located at the part deeper than MSL-0.93m.

b) Allocation of the Jetty

● Landing berths

The jetty is designed to accommodate 30 fishing boats at Anse La Raye for landing, preparing and idling. The jetty provides mooring berths at the both sides.

Mooring systems of boats, which are for berthing alongside and for berthing vertically to facilities, are examined for finding the minimum scale of the mooring berths.

The required length of a mooring berth is instructed in the above-mentioned Guideline as follows:

$$\begin{aligned} \text{Berth length for mooring alongside: LOA} + \text{allowance (LOA} \times 0.15) \\ = 7.5\text{m} + 7.5\text{m} \times 0.15 = 8.6\text{m} \end{aligned}$$

$$\begin{aligned} \text{Berth length for mooring vertically: Width} + \text{allowance (Width} \times 0.5) \\ = 2.2\text{m} + 2.2\text{m} \times 0.5 = 3.3\text{m} \end{aligned}$$

In designing the mooring berths, activities of fishing boats around the berths and natural conditions should be considered. The length of the landing berth is easily calculated, however comprehensive examination on the combination of the above two mooring systems and alternatives should be necessary for finding out the minimum scale of the jetty. Table 2-2-3(4) shows the result of examination. The 3rd Option is shown as a minimum type through examining several combination of the above two systems. The total length in the table indicates the total length of a jetty with a mooring part and an

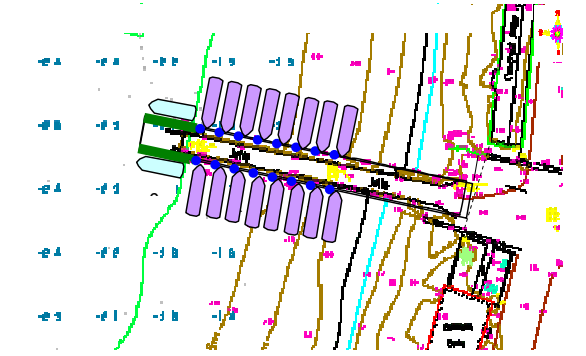
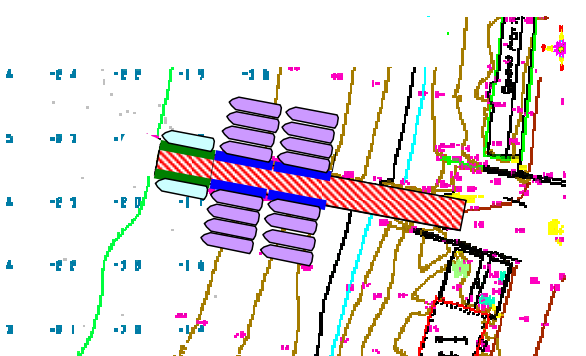
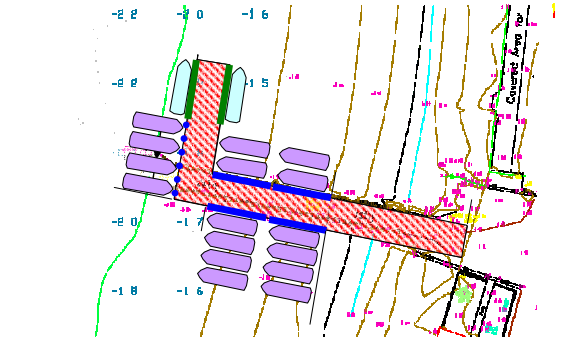
approach.

The table shows Option 2 will be constructed in a minimum cost and it should be basic plan for further consideration. The dimensions of the effective berths are shown in Table 2-2-3(2).

Table 2-2-3(2) Summary of Design Berths

Type of services	Number of berth	Length of a berth	Total length
Landing	2	9m	18m
Preparation & Laying- by	4	9m	36m
TOTAL	6		54m (27mx2)

Table2-2-3(3) Examination of Layout Options

	Option 1	Option 2	Option 3
General Layout			
Berth Length	<p>*Landing : 9m x 2 berths (alongside) * Prepr. & lay-by : 27m(8 boats) x 2 (vertically) * Approach : 21m</p> <p>Total length : 57m</p>	<p>* Landing : 9m x 2 berths (alongside) * Prpr. & lay-by : 9m(4 boats) x 4 (alongside) * Approach : 21m</p> <p>Total length : 48</p>	<p>* Landing : 9m x 2 berths (alongside) * Prpr. & lay-by : 9m(4 boats) x 2 (alongside) 9m(2 boats) x 2 (alongside) 13m(4 boats) * Approach : 21m Total length : 48</p>
Cost Ratio	1.1	1.0 (Base Cost)	1.3

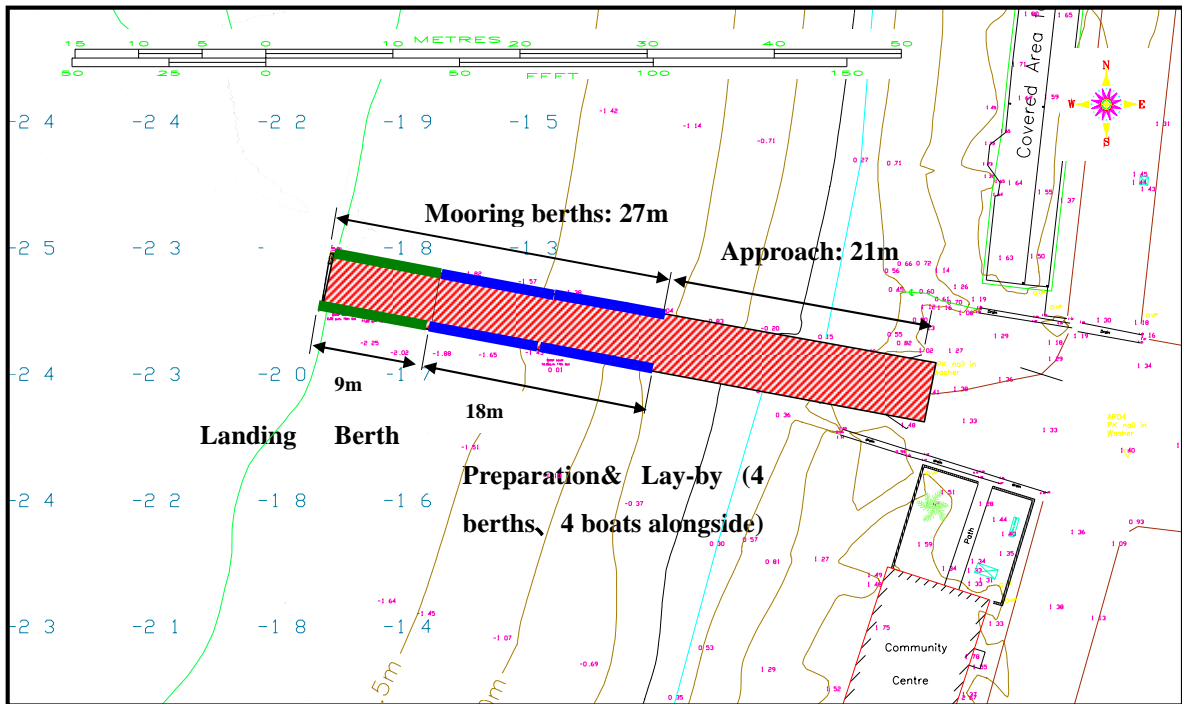


Fig. 2-2-3(2) Allocation of Berth Services

As shown in Fig.2-2-3(2), landing services are allocated at the offshore side and lay-by services etc. are at the onshore side of the jetty. The allocation automatically defines the end of the jetty and the length.

Shoreline gaps between the both sides of the jetty will be normalized in demolishing the existing jetty. The design of the new jetty will be conducted on the basis of the survey result.

- Approach

The approach extends to the elevation of MSL-1.0m from the land and the length is 21m.

Design of Jetty Elevation

In designing the elevation of the berths as mentioned above, HWL is the key tide since no services will be available in hurricanes. Considering that the existing jetty is not used for fishing boats because of high elevation of the deck, the elevation of the new jetty is designed for operating boats at Anse La Raye.

- a) Design height of the landing berth (by the Guideline)

The Guideline of Japan instructs the height of the berth as shown in Table 2-2-3(4) in consideration of the convenience of the fishing boats for the services.

Table 2-2-3(4) Additional Height from the Design Tide

Tidal Range (H.W.L. - L.W.L.)	Fishing Boat Weight (GT)			
	0 ~ 20tonnes	20 ~ 150tonnes	150 ~ 500tonnes	More than 500tonnes
<u>0.0m ~ 1.0m</u>	<u>0.7m</u>	1.0m	1.3m	1.5m
1.0m ~ 1.5m	0.7m	1.0m	1.2m	1.4m
1.5m ~ 2.0m	0.6m	0.9m	1.1m	1.3m
2.0m ~ 2.4m	0.6m	0.8m	1.0m	1.2m
2.4m ~ 2.8m	0.5m	0.7m	0.9m	1.1m
2.8m ~ 3.0m	0.4m	0.6m	0.8m	1.0m
Surplus to Lay-by Services	<u>0m</u>	0 ~ 0.5m	0.5 ~ 1.0m	1.0m

Elevation of the Berth: H.W.L. + (Applicable Figure in the table)

$$= (\text{M.S.L.} + 0.23\text{m}) + 0.7\text{m} = \text{M.S.L.} + 0.93\text{m}$$

b) Design Height (by wave conditions)

In designing a jetty the height of top deck is set with some allowance at the elevation which design waves do not reach. The elevation is calculated the following equation.

Elevation of the berth = Thickness of Upper Deck + Required clearance

Required clearance = Design tide level + Design wave height + allowance

In assumption of the Thickness as 0.5m, the elevation is:

$$\text{Elevation of the berth} = 0.5\text{m} + \text{M.S.L.} + 0.23\text{m} + 2.8\text{m} + 0.47\text{m} = \text{M.S.L.} + 4.0\text{m}$$

c) Conclusion of Design Height

The calculation of the height is conducted in two methods as above. It is clear that the latter is for preventing collapse of a jetty by waves and that complete difference remains. A design of a jetty for satisfying the both conclusions will be capable to set the elevation from the former method at the both sides of a jetty and to set it from the latter at the center of a jetty.

In consideration of the conditions that no services of a jetty will be available in hurricanes, minimizing the construction cost by lowering the center elevation will be realized with open mouths for reducing the uplift force under the wave conditions of running on the top deck. The idea of the structure for lowering the elevation has been applied to the jetty at Soufriere. The key idea is to minimize the extracting force against piles caused by uplift force with reducing the wave force by open mouths of the deck. Usually the mouths are covered with timber blocks of “Greenheart Timber” to be fixed

with bolts on the concrete deck, while the timber blocks will be removed from the deck in hurricanes. Even if the blocks are blown away by waves, they will be purchased in the local market.

An elevation of the center part of the jetty is set to be L.W.L. +2.00m, which is higher than that of the landing berth, for reducing uplift force at usual rough seas. Fig.2-2-3(3) shows the cross section the jetty. The elevation of the center part of the jetty is L.W.L. +2.00m and the elevation of the landing berth is L.W.L. + 1.20m (M/S.L. + 0.97m). The both parts are connected with steps.

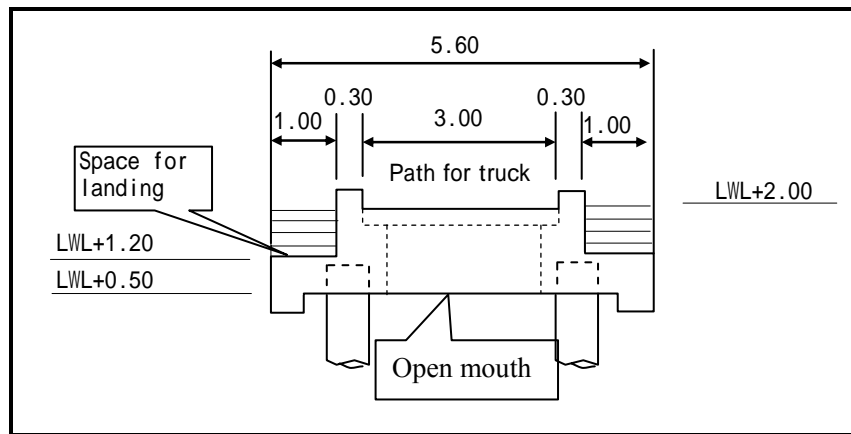


Fig.2-2-3(3) Cross Section of Jetty

Width of Jetty

The followings are considered for designing the jetty.

- Fishermen in Anse La Raye usually peddle landed fish with their pickup trucks around the villages in the Anse La Raye District.
- Pickup trucks will be needed to transport fishing gears and engines from the gear lockers being apart from the jetty.

Considering the above situations, a path for a pickup truck will be provided on the jetty. The width of the path should be 3m for a single lane as specified in the Guideline stated above. Curbing of reinforced concrete will be provided to separate the path from the fishermen's working places inside of the along the jetty. Since the working space requires 1m width, the overall width of the jetty has to be 5.6m.

Protection of the beach around the approach

For a smooth connection, some gradient will be needed between the elevations of the jetty of M.S.L. +1.77m (L.W.L. +2.00m) and the ground of M.S.L +1.50m. In raining sand around the end of the jetty will be scoured to be trenches for a flow of rain water

and a gap might be made between the jetty and the ground.

The beach sand under the approach jetty might be scoured by waves due to reflection from the deck concrete and flow of sea water.

The protection of the beach and the ground around the jetty will be provided for prevention of the above.

(2) Facility for Landing Boats

A gradient of a normal slipway is designed to be during 1/6 and 1/10 as instructed by “The Guideline for Design of Fishing Ports and Fishing Ground”. A slipway of steeper than 1/10 will not be constructed, since the slope of the beach at Anse La Raye is 1/10 from the elevation of M.S.L. +1.1m with 7m width. Provision of a concrete slipway directly on the Anse La Raye beach, where sand drift occurs, should be avoided to cause no change of the beach configuration.

As an alternative structure against the above, a trestle type which is supported with piles in the ground is proposed and the general cross section of the structure is shown in Fig.2-2-3(4).

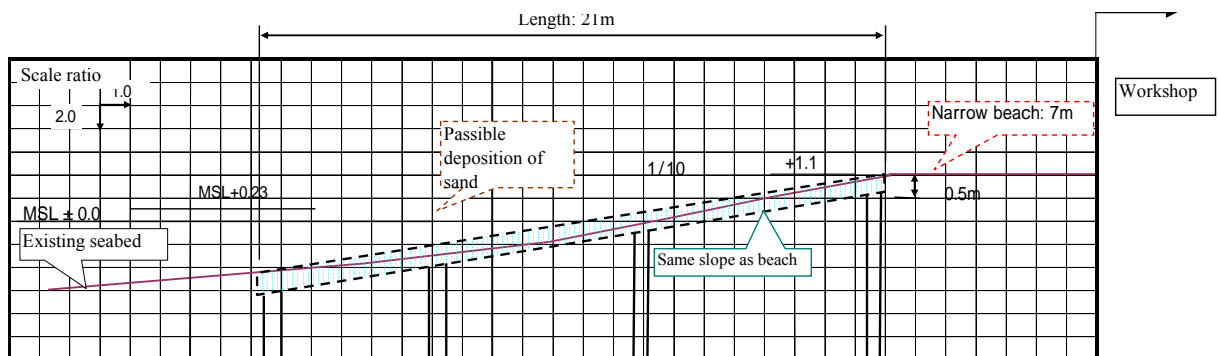


Fig.2-2-3(4) Cross Section of Piled Slipway

The Figure shows dimensions of the tip elevation of M.S.L.-1.23m (L.W.L. -1.0m), a gradient of 1/10 and the elevation of a flat part to be M.S.L +1.1m. The Figure indicates that the slope seems to be on the beach profile and some degree of sand deposit might be expected on the slope, which would cause serious difficulties for maintenance. For releasing the sand deposit, possible raise of elevation of a slope would require extension of the slope and make steeper slope in front of the workshop, however it would not bring about effective solutions.

The above consideration results in the conclusion that both slipway structures of a concrete slab on the beach and a piled type are not applicable to the facility at Anse La

Raye.

With consideration of the natural conditions at the site, most realistic option is to provide simple sliders, which release friction between a boat and sand beach, with assistance of a winch for hauling a boat. The concept of the method is illustrated in Fig.2-2-3(5). The process of hauling a boat is:

- Lay a boat on a silder
- Haul a boat with a winch on discontinuous slides which be replaced to the workshop

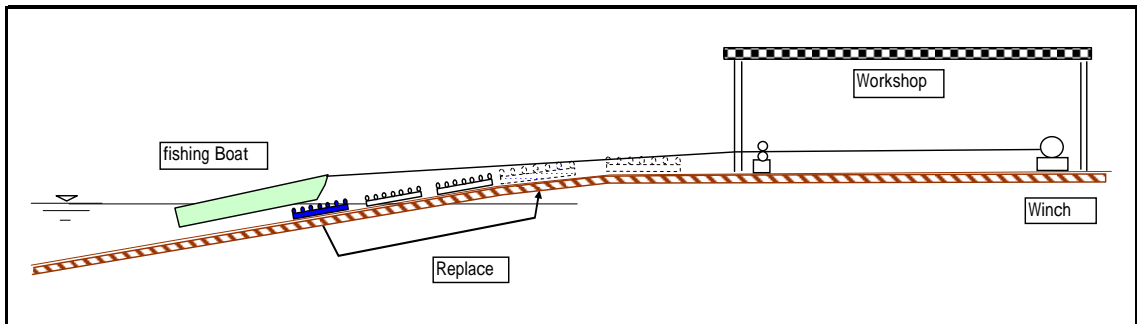


Fig.2-2-3(5) Concept of System for Hauling a Boat

The transportable slide is of the structure as shown Fig.2-2-3(6), which is made with stainless steel for rigidity to a boat load and plastic slides. The dimensions of the slide system are determined to be 3 m \times 0.5m on the basis of beach length, weight and width of a boat bottom. For hauling a boat, 3 pieces of the slide are required and other 3 pieces of the slide should be provided for placing a boat in the workshop.

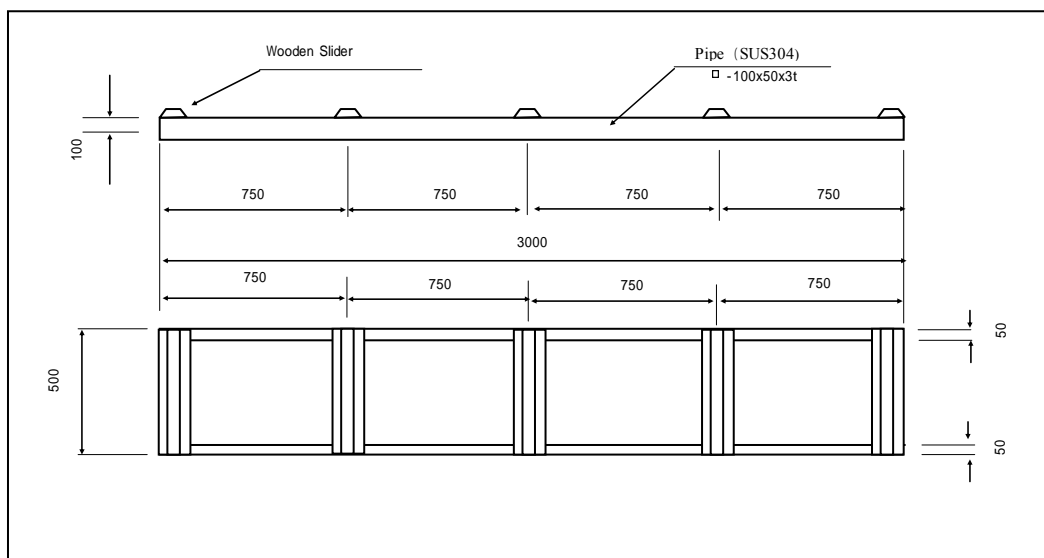


Fig. 2-2-3(6) Dimensions of Slide

3) Other Equipment

Rubber Fender

Rubber fenders should be installed at an interval of 3m, since 2 fenders, at least, should support a boat of 7.5m long mooring alongside the berth for all services.

A fender is of V-type (with 100H) for a fishing boat and it extends from the bottom to the top of the concrete deck for accommodating a small fishing boats.

Light Beacon

A light beacon will be provided at the tip of the jetty installed from the land to offshore for safe navigation for fishing boats. A reach of the light is 3miles for fishing boats to recognize it.

Table 2-2-3(5) Specifications of Light Beacon

Location	Number	Type	Source of light	Color	Flashing time	Range
Jetty tip	1	Vertical	LED lantern w/solar battery	White	Fl.4s (0.5+3.5)	3.0 miles

Mooring Post

For operating and mooring boats, mooring posts will be provided along the berths. Table 2-2-3(6) shows the tractive forces and approaching speed of fishing boats and the force is obtained to be 10kN, with which capacity of a post should be satisfied. The interval of the mooring posts should be 5m, however, accurate intervals would not be set due to the approach steps between the service places and mooring rings will be installed near the steps as aids for insufficient number of posts.

Table 2-2-3(6) Tractive Forces and Approach Speed of Fishing Boat

Weight (G.T.)	LOA (m)	Breadth (m)	Speed (m/s)	Tractive Force (kN)
3GT	9.0m	2.4m	0.5m/s	1.0tf(10kN)
5GT	11.0m	2.3m	0.5m/s	1.0ft(10kN)
10GT	13.0m	3.5m	0.5m/s	1.0ft(10kN)

Table 2-2-3(7) Interval of Mooring Post

Depth of Berth	Interval of Post
Shallower than -3m	5.0m
Deeper than -3m ~ shallower than -5m	7.5m
Deeper than -5m	10.0m

Curbing

An interval of curbing should be 0.3m along the both sides of whole jetty to secure safe traffic on the jetty.

Lighting

A 2-2-5lux light of around Venders' Arcade and the end of the jetty will be installed for assistance to operation at the jetty in the dark. Lighting system with eaves of gear lockers and fishery complex will help illumination intensity around the facilities.

2-2-3-2 Basic Design of Buildings

(1) Design and layout of facilities

The project site at Anse La Raye, which is surrounded by hills of north, east and south, is in the rat-tailed land between the shoreline and a road in the village. The almost of the one-story houses in the village raise the floor elevations against the floods. The Community Center is of a two-stories building. New facilities with lowering building height and extending continuous roofs toward both sides will match up with the present landscape in viewing the village from the sea. The building of the fishery complex, the highest building, will be located in the center of the group of the buildings.

Consideration of "Fish Friday" should be necessary in designing the facilities, since the event mutually depends on fishing activities in the village. Tourists from overseas countries do not seek new buildings but historical or old buildings in the village. It is understood that colors and shapes of the new buildings will attract the tourists without constructing old buildings and constructing the wooden buildings. The design policy will produce accordance of old and new building which are located at both sides of the street in the village.

A fish training hall in the fishery complex and a little extension of eaves of new buildings will provide services of shelters from rain for tourists in the event of Fish Friday.

(2) Scale of Buildings

1) Fishery Complex (with Ice making machine, Ice store, Fish processing facility, Fishermen's Hall, Office for extension Officer, Office for Co-op. Tackle Shop, Store room)

Design Concept

a) Ice making machine, Ice store, Fish processing facility

An ice making machine should be installed on the floor above an ice store for automatically storing ice from the machine. The tables with sinks for primary processing fish and sale of fish will be installed with a space for selling ice. The above facilities will be contained in the same room for functioning efficiently.

Floor concrete will be resinated for easy drain and prevention of blood penetration. The wall will be plastered with concrete mortar on it with processing the surface for easy cleaning. The roofing material will not be exposed without ceiling.

b) Fishermen's Hall

The facility will not provide closed room but open space with a roof to accommodate many fishermen for conference.

c) Offices for Fisheries Extension Officer and Co-op Staff

Interior finishing of the office for an extension officer will be made with plastering concrete mortar on the concrete blocks. Finishing of the office for the two cooperative staff is the same.

d) Tackle Shop

The shop will be with a sale counter with glass partition and a store room for fishing gears.

The above facilities will be involved in the same building for mutually functioning and minimizing the cost.

e) Water Tank

Water supply facility will need assistance to raise low water pressure as a high pressure water tank. A high pressure tank is available near the gear locker but a enough space in the project site is not available for a larger water tank for the new facilities. The tank with a pressure pump will be prepared at the basement of the fishery complex, which will be efficiently constructed in the deep foundation space, considering the efficient utilization of building space.

Scale and Dimensions of the Facilities

The space requires an area of 64sq. m of 8.0m x 8.0m for accommodating an ice machine, ice store to be installed under a ice machine, space for selling ice, tables and

sinks for primary processing fish and an insulated ice box.

The fishermen's training hall needs 90sq. m for 60 persons, using a unit space of 1.5s.m per person.

The office for the fisheries officer will be about 10 sq. m for accommodating a fisherman for an interview with using design criteria of unit space between 5 and 15 sq. m per person. The office for the cooperative staff will be 13 sq. m for accommodating 2 staff.

The area of the tackle shop needs about 10 sq. m for a person and the same area will be for the store room.

The toilet room will equip a toilet bowl for both sexes and a urinal for men.

A water tank will be installed at the basement which is laid among the foundation of southern part of the building.

2) Fishing Gear Lockers

Design Concept

The foundation parts of the steel columns of the existing lockers are lost due to serious rusts and the collapse of the locker seems to occur. If the facilities were repaired, the following steps would be required:

- Removal of the every parts and their disassembly
- Assembly parts with replacing damaged parts with the new
- Installation of columns into concrete with breaking old concrete foundation

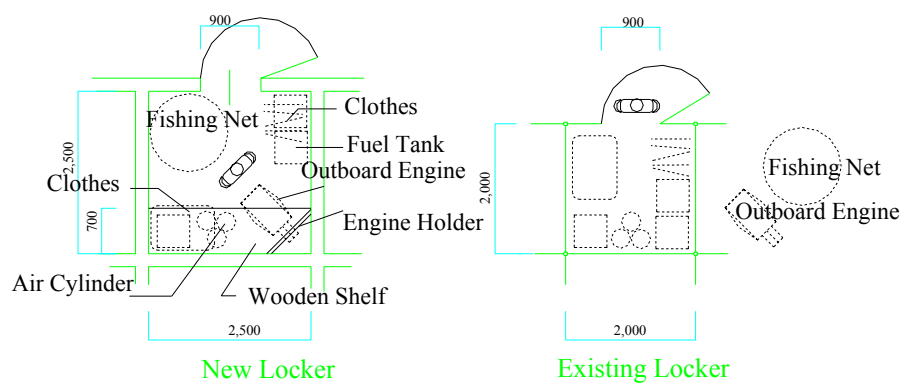
The net fences used for the existing lockers should not be applied because of vulnerable material against salinity and weathering.

Breakage of connected parts for re-use definitely seems to be hard. An outboard engine would not be stored in the locker of the same specifications as the existing without any holder for the engine. From an engineering view point on the quality of columns, it is understood that maintenance of the material will be completely difficult because required strength of the material would be reduced if rusted surfaces were removed as a result of finding of rust in the course of usual maintenance activities. The above view results in understanding of difficulty of repairing the existing lockers. If repair of the existing locker were made, complete replacement of material for structural frames and walls would be required, which means the repair of the existing almost equals the new building works. Hence the new fishing gear lockers will be provided with specifications of reinforced concrete structure and of concrete blocks plastered with concrete mortar and painting on it. For usual ventilation of the inside, downward flows of air will be naturally caused with hollow blocks for walls. A separation walls will be equipped

between lockers for security.

Scale of the facility

There remain two constraints in the existing lockers which are short on strength of wall for holding an engine and short on space for storing fishing gears. Since the fishing methods and enlargement of fishing gears have caused the shortage of room of the existing lockers. The Figure below shows the standard storage of a fisherman's equipment and the space is not enough to store an engine and nets. The space in a locker should be of 2.5m x 2.5m for storing his outboard engine and fishing gears with space for his moving.



Inside of Gear Storage

Fig.2-2-3(7) Layout of Fishing Gear Locker

3) Toilet and Shower

Design Concept

The study team understands that the existing piping system from the toilet to the septic tank might be broken down and prompt repair might be necessary. A new septic tank will be provided and the piping system from the existing will be connected to the septic tank.

4) Workshop

Design Concept

The scope of repair of the existing workshop will cover removal of rust on the surfaces of steel structure. It also covers replacement of the rusted roofing with new roofing of anti-salinity and of rusted steel tight frames with stainless steel frames.

5) Fire Hydrant

Design Concept

A fire hydrant at the site will be installed with extending the 130m line from the main

water pipe of 100mm in diameter located at the entrance of Anse La Raye Village. Increase of pressure with a pump will be required for supplying water to a fire hydrant.

(2) Design of Layout

1) Fishery Complex

A room for an ice making machine with high ceiling will be located at the end of a building for Fishery Complex. An evaporative condenser for the machine is recommended to be located outside of the building, but it should be installed in the room for preventing damages from seawater. For minimizing damages to the building from water spread from the water cooling tower, the cooling system will be in a room without ceiling, which is completely separated from other inside rooms. A counter of a tackle shop will face the seaside for fishermen's convenience and a store room with no window will be prepared.

As an approach for the above room, a pedestrian deck facing the seaside along the building will be arranged for access to the open space, Fishermen's Hall.

The toilet rooms for both sexes working in the building will be provided.

2) Fishing Gear Lockers

The area at the site would accommodate only 3 continuous lockers if doors faced south or north for fair services to fishermen. Considering the narrow site area stretching from south to north, layout of the facilities should be made along the stretching direction to utilize the area as much as possible. Hangers of H-shaped frames made of stainless steel will be installed for drying or mending fishing nets in front of the walls along the lockers' building.

The area of the each facility in the project is shown in the following table.

Table 2-2-3(8) Area of Each Facility

Name of Facility	Floor area (m ²)			Total floor area (m ²)	Total floor area + area outside of floor part (m ²)
	B1F	1F	2F		
A) Fishery Complex (New)	68.00	239.36	34.00	341.36	396.00
B) Gear Locker - 1 (New)		132.30		132.30	242.50
C) Gear Locker - 2 (New)		128.10		128.10	235.50
D) Workshop (Repair)		79.20		79.20	117.00
E) Venders' Arcade (Repair)		194.26		194.26	275.2
F) Toilets/ Showers (Repair)		40.50		40.50	40.50
G) Septic Tank	36.48			36.48	36.48

(3) Design of Cross-sectional Structure and Elevation of Facilities

1) Fishery Complex

Elevation of the floor of the facility will be 800mm higher than the street elevation. Height of ceiling of offices is 2,600mm and only the ceiling height of an ice machine room is 5,600mm. A Water cooling tower located in very adjacent to the ice machine will be on the floor which has a gradient for discharging water spread from the cooling machine. A partial slope around the floor mouth will have a slight slope for discharging water through a drain system.

For preventing the flow of water with fish guts by primary processing, a grease trap with nets will be installed as a safety wall to the septic tank.

Roof gutters will gather rainwater from the roof and discharge it to the side ditch.

The floor for evaporative condenser and a control panel box will be elevated to 100mm above the floor elevation.

A 900mm x 900mm entrance to the basement with steps will be made on the floor for maintenance of a water reservoir tank and a pressure pump in the basement.

2) Fish Gear Locker

Considering smooth handling of fishing gears and an outboard engine for a fisherman, floor elevation should be within 200mm above the road elevation. A floor with a slope toward an entrance from the inside makes easy discharge of water from the inside. Floor will be made of concrete with hardeners to protect the surfaces from heavy equipment. 2,500mm will be secured for height of eaves with a gentle slope of the roof.

(4) Design of Structure

The structure of each facility is shown in the Table-2-2-3 (9).

Table 2-2-3(9) Structure of Facilities

Facility	Foundation	Floor Slab	Column, Beam	Wall	Roof Frames
A) Fishery Complex	RC	RC	RC	CB	S
B) Fishing Gear Locker1	RC	RC	RC	CB	S
C) Fishing Gear Locker1	RC	RC	RC	CB	S
G) Septic Tank	FRP	RC			

Note: RC: Reinforced concrete CB: Concrete blocks S: Steel

(5) Design of Electrical and Mechanical Services

1) Electrical Installation

Underground cables of electricity will be extended to a hand hole close to the street from a near electric pole, which will be made by the Government of ST. Lucia. An electrical control panel will receive necessary power from the outside and distribute it to the every facility. The power will be supplied to an ice machine, an ice store, lighting equipment, wall sockets, air-conditioners and a pressure pump in the building. Total electricity will be 25KVA.

A fluorescent lamp will be fixed in each gear locker and lamps at the eaves will be installed. A wattmeter will be installed for each building of Fishermen’s Gear Lockers.

Lamps at the eaves should be for public utility. Total electricity will be 8KVA.

A stand-by generator will not be supplied due to rare blackout.

The following table shows the list of electrical installation in the project.

Table 2-2- 3(10) List of Electrical Installation

Facility	Room	Lighting	Sockets	Air-conditioner	Ventilation	Pipe for phone lines
Fishery Complex	Water pump					
	Ice Machine					
	Co-op Office					
	Fisheries Office					
	Tackle Shop					
	Store Room					
	Toilets					
machine	Fishermen’s Hall		(Water-proof)			
Gear Locker	Locker Room					
Workshop			(Water-proof)			

2) Water Supply System

A water supply system will be installed for an ice machine, primary processing of fish and toilets. Due to low pressure of water supply in the village, a water reservoir tank will be installed to store water, which will be supplied to the facilities with increasing

water pressure by a water pump. The tank capacity will be 20 c. m for accommodating 15 c. m for an emergent fire hydrant.

The required quantity of water for the facilities is shown in the following table.

Table 2-2- 3(11) Required Water Quantity

Facility	Required quantity
Ice Machine	1.5 t/day
Primary Processing of Fish	2.0t/day
Floor Cleaning in Fish Processing Facility	1.0 t/day
Toilets	0.5 t/day
Total	5.0 t/day

3) Drain System of Waste Water

The site area is too narrow and close to water fronts to accommodate a standard septic tank with spread pipes recommended by Ministry of Health. As an another option for the standard, a septic tank of an aeration system, which is generally applied in Japan, will be permitted by Ministry of Health with conditions of diluting chloride density of discharging water from the tank. Hence the septic tank of the aeration system will be applied to the project.

The septic tank should accommodate waste water from not only the facilities provided by the project but the existing toilets/showers building and Venders' Arcade.

The waste water to be considered in the project is comprised of non-contaminated water from a reservoir tank and rainwater and waste water from the processing room and from toilets. The first water will be discharged to the river after collecting. The second waste water will be discharged with the water from toilets after removing oil and solid material.

Processing capacity of waste water in a septic tank is calculated on the basis of “the Guideline of Calculation of Number of Person for Processing Waste Water in Septic Tank” in Japan.

Waste water from Fishery Complex is summarized below in quantity and BOD weight.

- Water from primary processing: 2.0 c. m/day x 800mg/ltr = 1.6kg
- Water from floor cleaning in ice machine Room: 1.0 c. m/day x 100mg/lit. = 0.1kg
- Water from toilets: 10 persons x 50 lit. x 260mg/ltr = 0.13kg
- Water from the existing toilets: 4.53 c. m 0.65kg

(Figures from calculation result below)

The sum of the above is shown in the following table.

Quantity of waste Water	8.03 c. m
Incoming BOD density	$2.48\text{kg} / 8.03 \text{ c. m} \times 1,000 = 308 \text{ mg / lit.}$
Discharging BOD density	20 mg/lit.
Discharging BOD density	20 mg/lit.

Calculation Sheet for Waste Water from Existing Toilets/ Showers

- Number of use

- Closet bowl

$$nr = 0.0412 \times t \times p \times f$$

where,

nr : Number of use (time/day)

0.0412 (time/person/hr)

t: Staying time of guests (hr / day)

p: Number of guests (person)

f: Coefficient (0.5)

- Urinal

$$n\mu = (0.216 + 0.325 / t) \times t \times p$$

where,

nμ: Number of use (time/day)

0.216 (time/person/hr)

t: Staying time of guests (hr / day)

p: Number of guests (person)

- Equations for calculating BOD load

$$\text{BOD of solid sewerage (g/day)} = 8.74\text{g} \times nr$$

$$\text{BOD of urine (g/day)} = 0.73\text{g} \times n\mu$$

Guests on Fish Friday: 600

Staying time: 1.5 hours

- Quantity of used water

- Number of closet bowl use & water quantity used by the guests
of use of bowl: $0.0412 \times 1.5 \text{ hrs} \times 600 \times 0.5 = 18.54 \text{ times}$
Water quantity: $18.54 \times 12 \text{ lit.} = 222.48 \text{ lit.}$ (a)
 - Number of urinal use & water quantity used by the guests
Number of use of urinal: $(0.216 + 0.325/1.5) \times 1.5 \text{ hrs} \times 600 = 213.9 \text{ times}$
Water quantity: $213.9 \times 8 \text{ lit.} = 1,711.2 \text{ lit.}$ (b)
Therefore, (a) + (b) = 1,933.68 lit. (A)
 - Quantity of BOD
 - Closet bowl: $18.54 \text{ times} \times 8.74\text{g/time} = 162.04\text{g}$ (c)
 - Urinal: $213.90 \text{ times} \times 0.734\text{g/time} = 157.00\text{g}$ (d)
 - Therefore, (c) + (d) = 319.04g (B)
- The above calculation from (A) and (B) results in the BOD density as:
 $319.04 / 1,933.68 \times 1,000 = 164.99 \text{ mg/lit.}$

2-2-3-3 Basic design of Ice Making Machine, Ice Storeroom and Fish Processing Equipment

(1) Ice Making Machine and Ice Storeroom

An ice making machine producing 1.0ton per day and an ice storeroom accommodating 2 ton ice will be installed. A system of the machine should be selected with consideration of easy maintenance and replacement of parts.

1) Compressor

An open type compressor will be applied to the ice making machine. In open equipment for a compressor and a drive engine are installed independently, but linked with each other via a power transmission device such as a V-belt and a caprin. This structure is adopted for most large-scale cooling unit. Because of the nature of its mechanical structure, a equipment for cold storage in this type requires somewhat large room, but it is advantageous in its easy repair. The type is applied to almost of all ice machines in St. Lucia and engineers from SLFMC are experienced with the machine type.

2) Refrigerant Medium

Ammonia, a natural refrigerant medium, will be used instead of alternatives to R-22, hydro chlorofluorocarbon, considering the following conditions:

- In leakage of a refrigerant medium, which results in the loss of the design ability of the machine, replacement of all media will be required with the new and it will increase maintenance cost.

- A compressor specified for hydro chlorofluorocarbon should be required.
- No reliable production policy of the media is available.

3) Procurement of Spare Parts

The list for the spare parts for each cooling unit and equipment for the ice machine and ice storeroom should be prepared and it should clarify names of manufacturers, responsible section, address, telephone number, fax number, and e-mail address.

(2) Equipment for Fish Processing Facility

As an important function of the facility, primary processing tables with sinks and an insulated fish box will be provide.

1) Primary Processing Tables and Sinks

* Sinks of stainless steel

Main usage is to rinse fish which have been processed at the first stage. Hence, the material must be strong enough and easy to be washed up after the work, so that a stainless sink is planned.

* Primary processing tables of stainless steel

Main usage is to primarily process fish. Thus, as in the case of stainless sink, the material must be strong enough and easy to be washed after the work, so a stainless work table is planned.

2) Insulated Fish Box

Two boxes will be provided for storing fish with ice for a night in the Fish Processing Facility. The insulated box of 100 liters' capacity will be able accommodate larger fish like king fish.