


BASIC DESIGN STUDY
ON
THE SMALL-SCALE FISHERIES PROMOTION PROJECT
IN
THE REPUBLIC OF VANUATU

MARCH 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

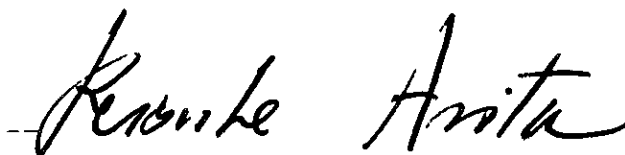
In response to the request of the Government of the Republic of Vanuatu the Government of Japan decided to conduct a survey on basic design for the Small-Scale Fisheries Promotion Project and entrusted the survey to the Japan International Cooperation Agency. The J.I.C.A. sent to Vanuatu a survey team headed by Mr. Shigeo MIYAMOTO from December 7 to December 23, 1981.

The team had discussions with the officials concerned of the Government of Vanuatu and conducted a field survey in Port Vila and Luganville. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

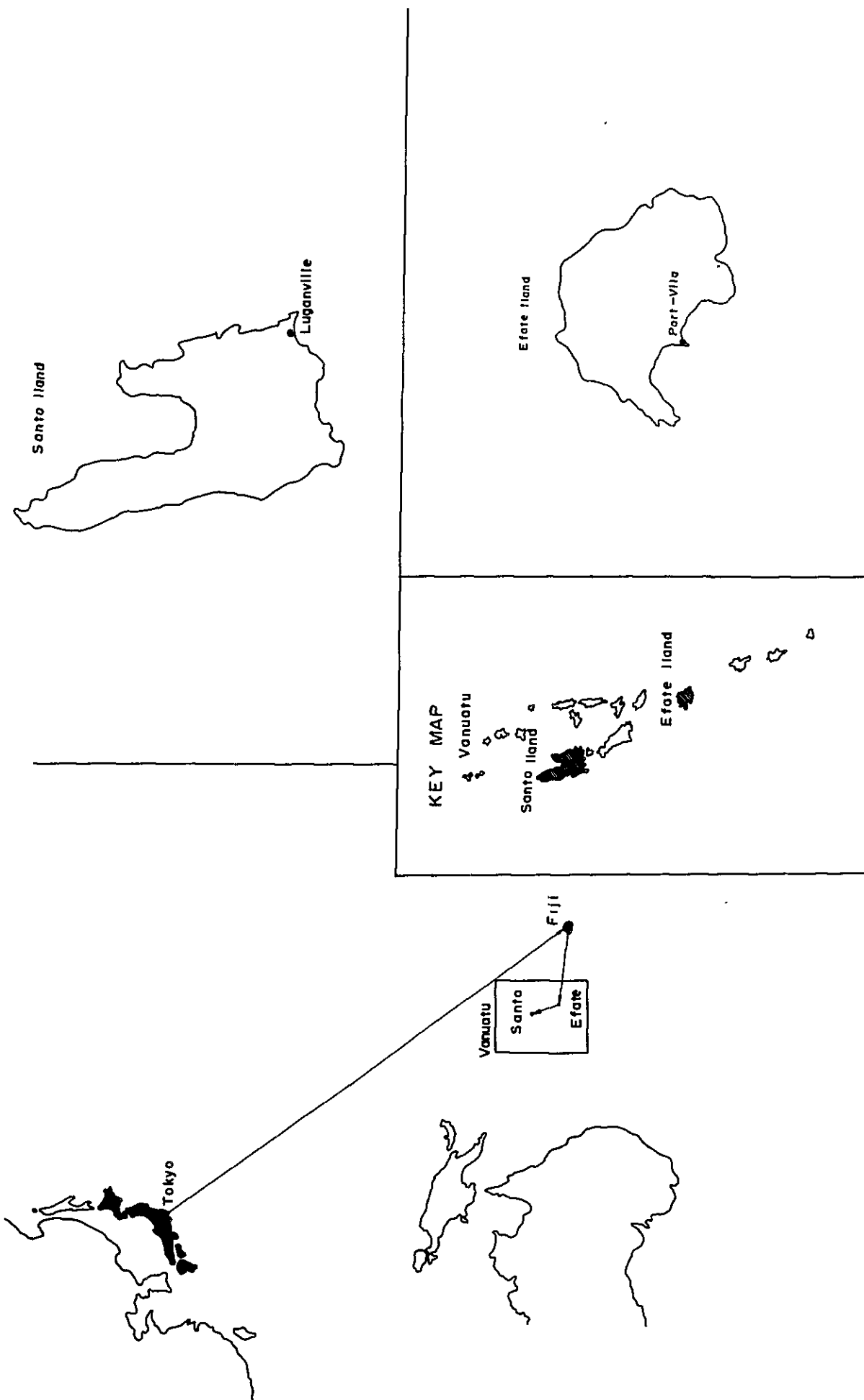
I wish to express my deep appreciation to the officials concerned of the Government of the Republic of Vanuatu for their close cooperation extended to the team.

March , 1982

A handwritten signature in black ink, reading "Keisuke Arita". The signature is written in a cursive style with a horizontal line through the middle of the first name.

Keisuke Arita
President
Japan International Cooperation Agency

LOCATION MAP



CONTENTS

PREFACE

LOCATION MAP

SUMMARY

PART 1 OUTLINE OF THE SURVEY

| | |
|-------------------------------------|---|
| 1-1 Background and Objectives | 5 |
| 1-2 Survey Team | 5 |

PART 2 OUTLINE OF LOCAL FISHERIES

| | |
|---|---|
| 2-1 General Conditions | 6 |
| 2-1-1 Fish Resources | 6 |
| 2-1-2 Fishermen | 6 |
| 2-1-3 Fishing Boats | 6 |
| 2-1-4 Fishing Gear, Methods | 6 |
| 2-1-5 Fish Species | 7 |
| 2-1-6 Consumption of Fish | 7 |
| 2-1-7 Price of Fish | 7 |
| 2-1-8 Distribution Structure | 7 |
| 2-2 Outline of Vanuatu Government's Five Year Plan for Fisheries Development | 8 |
| 2-2-1 Introduction | 8 |
| 2-2-2 Factors Favorable to the Development of Fisheries ... | 8 |
| 2-2-3 Obstacles to the Development of Fisheries | 9 |
| 2-2-4 Objectives of the First Five Year Plan for Fisheries Development | 9 |

PART 3 BASIC PLAN

| | |
|--|----|
| 3-1 Outline of Terms of the Request | 11 |
| 3-1-1 Fish Market (Port Vila) | 11 |
| 3-1-2 Refrigeration and Icemaking Facilities | 11 |
| 3-1-3 Government Fishing Gear Store | 11 |
| 3-1-4 Tools for Repairs | 11 |
| 3-1-5 Jetty, Retaining Wall, Slip Way | 11 |
| 3-2 Examination of Terms of Request | 12 |
| 3-2-1 Analysis of Present Conditions | 12 |
| 3-2-2 Projections for the Future | 16 |
| 3-2-3 Wharf, Retaining Wall, Slip Way, Government Fisheries Store, Repair Tools | 22 |

| | | | |
|---|---|-------|----|
| 3-2-4 | Management Plans | ..... | 22 |
| 3-3 | Basic Principles of Construction | ..... | 23 |
| 3-4 | Outline of Basic Designs | ..... | 24 |
| 3-4-1 | Equipment | ..... | 24 |
| 3-4-2 | Buildings | ..... | 25 |
| 3-4-3 | Jetty, Retaining Wall, and Slip Way | ..... | 27 |
| 3-5 | Basic Layout Designs | ..... | 31 |
| 3-6 | Cost Estimates | ..... | 31 |
| 3-7 | Construction Crew and Schedule | ..... | 32 |
| 3-8 | Maintenance and Management | ..... | 32 |
| PART 4 PROJECT APPRAISES | | | |
| 4-1 | Social and Economic Effects of the Project | ..... | 40 |
| 4-2 | Financial Evaluation of the Fish Market (Port Vila) | .. | 40 |
| 4-2-1 | Conditions | ..... | 40 |
| 4-2-2 | Construction Costs | ..... | 41 |
| 4-2-3 | Volumes of Fish Catches to be handled | ..... | 41 |
| 4-2-4 | Operating Costs | ..... | 43 |
| 4-2-5 | Financial Evaluation | ..... | 46 |
| PART 5 CONCLUSIONS AND RECOMMENDATIONS | | | |
| 5-1 | Conclusions | ..... | 58 |
| 5-2 | Reccomendations | ..... | 58 |

SUMMARY

The Republic of Vanuatu, which gained independence from British-French condominium in 1980, is a nation of islands distributed across a wide expanse of ocean. As such, fisheries assume an extremely important role in the development of its economy. Vanuatu's fishing industry, however, remains at a low level and fishery-related facilities are insufficient. The Government of Vanuatu has accordingly requested an assistance from the Japanese Government, under Fisheries Grant Aid Programme, to help with the establishment of facilities and equipment to encourage fisheries.

The projects covered by the request are: a fish market (requiring fish unloading, refrigeration and icemaking facilities, and sales facilities) in Port Vila, the capital of Vanuatu; ice-making and refrigeration facilities in Luganville, the second-largest town; and a jetty, retaining wall, slip way, government fishing gear store to be installed on the grounds of the Fisheries Department in Port Vila; and repair tools.

In response to the request, the Japanese Government dispatched a survey team through Japan International Cooperation Agency to Vanuatu from Dec. 7 to Dec. 23, 1981, to verify and examine the appropriateness of the terms of the request. The following is an outline of the results of that survey.

Fisheries in Vanuatu are presently on a very small scale, conducted only close to shore with simple boats, fishing gear, and techniques by individual fishermen who generally consume their own catches at home. Catches include mullet, sardines, horse mackerel, and cockle which are mostly with relatively low market price.

There are reports about existence of skipjack, snapper, and grouper in the coastal-to-offshore waters, and similar reports of deep-sea snapper and grouper. According to test operations of the SPC (South Pacific Commission), it is estimated that there are sufficient catchable resources to meet all of Vanuatu's domestic demand.

With this as their objective, the Government of Vanuatu hopes to advance fishery techniques to assist the rapid development of exploitation of these coastal-to-offshore skipjack, deep-sea snapper, and grouper.

Fish is well liked by Vanuatu's consumers, and presently it is estimated that 15 kg per person are consumed in one year. 1/3 of that amount, however, is supplied by canned fish imports.

Based on the 1979 population census, it is estimated that the population of Vanuatu will be: 115,500 people in 1980; 149,300 in 1990; and 193,000 in the year 2000.

Assuming, the yearly per capita consumption of fish comes to 15 kg in 1980 (Fisheries Department estimate); 20 kg in 1990; and 25 kg in 2000, The total demand thereby will amount to: 1,733 tons in 1980; 2,987 tons in 1990; and 4,826 tons in 2000.

Of the total national consumption of 1,733 tons of fish in 1980, 562 tons represent imports of canned fish (Government Bureau of Statistics data), leaving a total domestic production of 1,171 tons. Because this catch level was accomplished with the present primitive methods, it is assumed that this level can easily be maintained in the future. Required production increases, therefore, must amount to 1,816 tons in 1990 and 3,655 tons in 2000.

As indicated in the Government of Vanuatu's Five Year Plan for Fisheries Development, the following strategies for promoting fisheries are required to accomplish the above production increases.

- Improvement of existing small scale fisheries by small fishing boats, in order to advance the level of coastal fisheries.
- In order to promote the offshore and high-seas fisheries to exploit the populations of skipjack, deep-sea snapper, grouper, shrimp and so on, it is necessary to increase the number of power vessels, to provide with larger vessels, and to improve fishing techniques.
- Installation of fish preservation facilities.

Figuring the regional production increase in proportion to regional population, Port Vila should increase production of fish by 240 tons by 1990 and 482 tons by 2000, and Luganville, 80 tons by 1990 and 160 tons by 2000.

Present catches in Port Vila and Luganville are usually consumed by the fisherman and his family or neighbors, and it is expected that proportionate volumes will continue to be distributed in this fashion in the future. Necessary capacities of preservation facilities for both regions are determined to accommodate the required production increases in 1990 as follows.

In respect to the fish market facilities at Port Vila, assuming the need to establish facilities capable of preserving 2/3 of the 240 tons of fish to meet the concentrated processing requirement in 1990 at the Port Vila fish market, this comes to about 160 tons per year, or about 3 tons per week. As the facilities are to be small in scale, standardized water-cooled equipment, using freon (available in Vanuatu) as a coolant, is suitable. The requirements of the icemaking and refrigeration equipment are as follows:

| | |
|------------------------------|--|
| 1 x 500 kg/day | flake ice plant |
| 1 x 1 ton | flake ice storage bin |
| 1 x 200 kg/day | block ice plant |
| 3 x 8 m ³ | walk-in chill room (0°C) |
| 1 x 600 kg/day | air blast freezer (-35°C) |
| 2 x 12 m ³ | cold store |
| 300 x 60 liters (approx.) | fish freeze trays (nesting/stacking, with drainage) |

Other necessary equipment include store display case, etc.

As the fish preservation facilities in Luganville are to handle only 80 tons per year in 1990, or 1/3 of the volume of fish to be handled in Port Vila, the following specifications are deemed suitable.

| | |
|--------------------------------|------------------------|
| 1 x 400 kg/day | block ice plant |
| 1 x 6 m ³ | block ice storage room |
| 20 x insulated ice boxes, etc. | |

As all building construction is on a small scale, materials to be used are, whenever possible, to be procured through local industry. Structures are to be built with due consideration to natural conditions such as climate and other features, and made with reinforced concrete blocks.

The fish market construction site faces Port Vila's main street. To accommodate the flow of the product from unloading at the port to sales in the market, the unloading bay, fish preparation room, refrigeration and ice making equipment room, and so on are to be annexed to the fish market according to the layout, and the total surface area will be 225 m².

Luganville's ice-making and fish preservation facilities, including operating space, will cover a surface area of 40 m².

The government fishing gear store, to be built on the Fisheries Department grounds, will cover an area of 40 m².

The jetty, retaining wall, and slip way are infrastructures needed to complete the facilities necessary for the promotion of fisheries, and are included in the Government's Five Year Plan for Fisheries Development. As these are to be used for the Fisheries Department's vessels, they will be constructed near the Fisheries Department building. The pertinent vessels have a length of 12 m and total tonnage of 10 tons.

To facilitate operation of vessels when nearing the jetty, and to minimize the dredging volume, and for various other considerations, a 18 m long projecting piled jetty is to be built, to a water depth of 3m, with 4m wide wooden planking, level to the surrounding ground (1.5m above mean sea level). The piles will be used steel pipes and they are filled with reinforced concrete.

Because of the good condition of the ground (hard coral) and the fact that a low height is acceptable, an economical gravity-type retaining wall can be built. It is to be 1.8m in height, 50m long, with the crown height at ground level (about 1.5m above the mean sea level).

The slip way is to be 50m long, 7.5m wide, with two rails set into the surface to accommodate a boat trailer. A hand winch is to be installed for pulling boats out of the water. The slope gradient ratio of the rails is to be below 1:6.

The jetty, retaining wall, slip way, government fishing gear store and repair tools have significance within the terms of this grant item as rounding out the facilities necessary for the Government of Vanuatu's encouragement of fisheries.

Financial evaluation of the Port Vila fish market and the Luganville fish preservation facilities have been carried out according to the following terms.

- 1) Construction begins in 1982 and the life of the project is judged to last for 30 years from the beginning of operations in 1983.

- 2) Revenues from fish sales are calculated by multiplying the sales margin by the volume of fish to be handled, and taking into consideration a 10% spoilage rate. (The fish sales margin, determined by on-the-spot surveys, was set at 75 VT/kg. 1 VT = ¥270).
- 3) Projected expenditures include personnel, electricity, water, maintenance, and depreciation costs, and reinvestment is projected for facilities reaching the end of their durable lives.

The result of the financial evaluation, based on the above, indicates that the projects at Port Vila and Luganville, when considered collectively, will show a deficit for the early stage, but will show profits in annual proceeds by the third year (1985), and show an overall profit by the fourth year (1986).

The Financial Internal Rate of Return (FIRR) is set at 9.4%. As the initial investment is in the form of a grant from the Japanese Government, precluding the necessity of borrowing at the outset, if the FIRR is a positive figure, it is likely that the project will be viable.

The results of the sensitivity analysis of the FIRR show that a sales margin of 57 VT/kg is the bottom line for profit.

PART 1 OUTLINE OF THE SURVEY

1-1 Background and Objectives

Since gaining independence from British-French condominium of the New Hebrides in 1980, the Republic of Vanuatu has concentrated its efforts on the establishment of a firm foundation for the economy. As a nation of islands spread out across a wide stretch of ocean, fisheries hold the most important position, for the development of the economy.

The level of the fishing industry, however, remains quite low, and fishery-related equipment and facilities are insufficient. The Government of Vanuatu, therefore, has asked the Japanese Government for economic cooperation in grant form as regards construction of fishery-related facilities and supply of equipment necessary to promote the fishing industry.

This survey, based on the above request by the Government of Vanuatu, involved the dispatching of a survey team to Port Vila, the capital city on Efate Island, and other intended project sites to investigate and to confer with local Government officials concerning the specifics of their plan to promote fisheries, to examine the appropriateness of the project as a recipient of aid from the Japanese Government, and to establish a suitable basic plan.

1-2 Survey Team

The survey was conducted by a six-man committee headed by Mr. Shigeo Miyamoto, from Dec. 7 to Dec. 23, 1981. This committee held discussions with the Vanuatu Government concerning the survey. The appended minutes of these discussions were mutually agreed upon.

PART 2 OUTLINE OF LOCAL FISHERIES

2-1 General Conditions

The following is a general outline of the state of fisheries based on the Government of Vanuatu's Five Year Plan for Fisheries Development and on-the-spot investigation.

2-1-1 Fish Resources

For the most part, SPFC (South Pacific Fishing Co., Ltd.; the only fishery company in Vanuatu) does not handle fish catches from the coastal waters around Vanuatu, and there is no history of specialized fisheries in the region. As a result, detailed information regarding the quantity of fish is unavailable, but, as is pointed out in the Five Year Plan, judging from the catches of coastal fishermen employing (deep bottom) drop line, snapper, grouper, skipjack, deep-sea shrimp and other species look promising. It is unofficially estimated that there are sufficient resources to meet all of Vanuatu's domestic demand.

2-1-2 Fishermen

As there have been traditionally no attempts at fisheries as a specialized industry, until now, fishing has been limited to the immediate necessity of feeding one's family. Extra fish have been distributed among neighbors or taken to be sold to restaurants and supermarkets, and occasionally fishing has been performed on demand. Only in recent years have some people begun to make serious attempts at fisheries as a livelihood.¹

2-1-3 Fishing Boats

Canoes and outboard motor-powered aluminum boats are used, but as there is no system of registration, detailed information is not available.

2-1-4 Fishing Gear, Methods

Gill net, cast net, spear, pole and line, and bare hand fishing methods are employed by the coastal inhabitants.

2-1-5 Fish Species

Principal species presently being caught by local fishermen are mullet, horse mackerel, sardine, and skipjack, among others.²

In addition, the Fisheries Department has singled out for rapid exploitation some species of deep-sea fish living near the coast at 200-300m depth, principally *Etelis carbuncuhis* and *Pristipomoides filamentosus*, and including red snapper and a species of grupper.

Prominent crustaceans include spiny lobster and blue crab, and species of shellfish include oyster, trochus, and green snail. About 4000 species of shellfish are known for their use as souvenirs.

2-1-6 Consumption of Fish

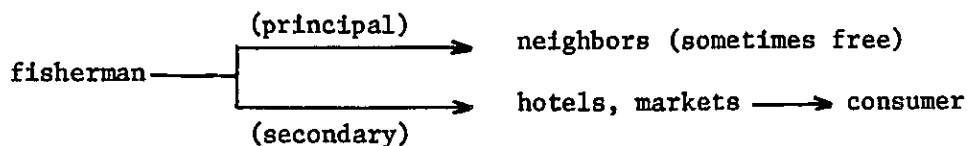
Although there are no official statistics, the Fisheries Department estimates that in the area around Port Vila, approximately 15kg of fish are consumed per person per year. Of the 15kg, 5kg represent canned goods and 10kg fresh fish.

According to information obtained from the Port Vila Bureau of Statistics, imports of fish products for 1980 included a net weight of 562 tons of canned mackerel, sardine, and cuttlefish. Figuring the population at 120,000 people, this means that the average person consumes 4.7kg of imported canned fish per year. The Vanatua Government's request is therefore largely based upon a desire to substitute domestically-produced seafood for imports. Most of the canned fish is packed in tomato sauce and, at 40-50 VT/200g, the total yearly cost comes to about 11.24 million VT (roughly \$135,000-165,000). That a major portion of this country's available foreign currency reserves is used up in this way cannot be ignored.

2-1-7 Price of Fish

The price of fish in supermarkets is around 250-300 VT/kg., which is not cheap compared with the price of meat: about 200 VT/kg. On the other hand, the price for fish bartered between neighbors is quite low: mullet sardines, and horse mackerel go for about 150 VT/kg., snapper and grouper for about 200 VT/kg.

2-1-8 Distribution Structure



As can be seen above, the distribution structure is extremely primitive. Fish is also sometimes transported to local markets together with vegetables and fruits. Imported canned fish are

- 1 For example, one fisherman living in Port Vila with two fishing boats operating 15-20 days per month, year-round, on a daily outing basis, takes in 700-1000 kg. of bottom fish (snapper) per boat per month, using.
He distributes his catches in Port Vila market.
- 2 SPFC survey.

distributed through each island's sales guild and sold at about 200-250 VT/kg.

2-1-9 Food Consumption Trends and Consumption of Fish

The principal foods are vegetables, fruits, beef, etc. There is probably a problem of nutritional imbalance, but in fact it is not thought to be a problem. The raising of pigs is widespread, but as large numbers of these are slaughtered all at once during certain ceremonies, they do not represent a daily source of protein.

Fish is well-liked. It is likely that the role of fish as a source of protein in the diet will increase greatly in the future.

2-2 Outline of Vanuatu Government's Five Year Plan for Fisheries Development

2-2-1 Introduction

Domestic fishery activity is basically on the level of personal consumption--quite underdeveloped in comparison with fisheries in other Pacific island nations.

Concerning fishery resources, because no significant fishery activity has occurred previously, information is extremely limited. Most available information is based on tests conducted by the South Pacific Commission (SPC).

2-2-2 Factors Favorable to the Development of Fisheries

Favorable factors for the development of fisheries are as follows:

(a) Coastal fisheries

--Snapper and grouper are, according to tests in progress, abundant enough to meet the demand in all of Vanuatu.

--There is room for progress in the development of pelagic and bottom fish fisheries in the many regions around sea mountains.

--Concerning crustaceans, there may be enough spiny lobster to allow for export of surplus. It means that the development of refrigeration methods and promotion of fisheries will be needed in Vanuatu.

--Small coastal fish provides potential live bait for skipjack fishing.

(b) High seas fisheries

--There is potential for the establishment of purse seine and pole and line fisheries of skipjack.

2-2-3 Obstacles to the Development of Fisheries

Obstacles to the development of fisheries in Vanuatu are as follows:

- The Fisheries Department is small in scale and lacking in experienced staffs.¹
- In the past only coastal fishing for personal consumption has prevailed; offshore and deep-sea fishery have not been practiced.
- There is a lack of information concerning fish resources.
- There are virtually none of the infra-structures necessary to facilitate the development of fisheries, such as fish markets, refrigeration facilities, and specialized transport systems.
- There are no suitable fishing vessels.
- Laws for the control of fisheries have not yet to be established.¹

2-2-4 Objectives of the First Five Year Plan for Fisheries Development

Objectives of the first Five Year Plan for Fisheries Development are as follows:

(1) Offshore fisheries

- Establishment of infra-structures and training facilities which will make the fishing industry profitable and attractive to the local people.
- Production of enough fresh fish to satisfy domestic demand.
- Development of small-scale exporting of fish products wherever possible.

(2) High seas fisheries

- Development of local fishing ports to serve as a base for the exploitation of tuna within a range of 200 nautical miles around Vanuatu.
- Development of domestic tuna processing facilities if suitable locations for such facilities can be found.

(3) Administration

- Securing of sufficient staffs for the Fisheries Department in order to lead and encourage the spread of fishery in Vanuatu.

1 The Fisheries Department was established in 1978 by the government and the United Nations UNDP. Since then, the government has given it little support. There are five members only one of whom possesses real knowledge of fisheries.

1 The only existing controls on fishery are regulation of spiny lobster, trochus, and green snail catches and a ban on the use of explosives.

(4) Research

--Preparing estimates of the quantity of important fish resources in the region.

2-2-5 Project of Fisheries Development

In order to attain the above objectives, the first Five Year Plan includes the following four programs.

(1) Encouragement of coastal fisheries

Program 1 consists of seven projects: training of fishermen; development of village fishery; construction of boats; conservation of fish; shipping and transport of fish to the market place; fishing gear; plan to gather fish.

(2) Encouragement of high-seas fisheries

Program 2 consists of two projects: test operations concerning skipjack; purse seine fisheries (as a joint venture).

(3) Development of government agency services

Program 3 consists of five projects: acquisition of sufficient personnel for the Fisheries Department; supportive government services; enlargement of the Fisheries Department headquarters; increasing the number of Fisheries Department vessels; establishment of fishery regulations.

(4) Research

Program 4 consists of seven projects: aerial investigations to be conducted by ORSTOM; ORSTOM marine biologist; live bait research; investigation of fishery around sea mounts; tuna processing research; artificial incubation plant for trochus; deep-sea shrimp investigations.

PART 3 BASIC PLAN

3-1 Outline of Terms of the Request

The terms of the government of Vanuatu's request are outlined as follows.

3-1-1 Fish Market (Port Vila)

To encourage coastal fishery and improve distribution, the Government of Vanuatu attaches the highest importance to this. Facing the main street of Port Vila, a building of 150-170m² is to be constructed, with space for retail shop, wash room, fish preparation room, loading and unloading bay, and fish preservation facilities, equipped with the necessary machinery, and designed especially to harmonize with the surroundings and to minimize noise pollution and unpleasant odors.

3-1-2 Refrigeration and Ice-making Facilities

The market place of the second-largest city in Vanuatu, Luganville on Santo Island, is to be equipped with small-scale refrigeration and ice-making equipment intended to preserve the freshness of fish and to improve distribution.

3-1-3 Government Fishing Gear Store

To be built next to the Fisheries Department in Port Vila, a building of approximately 40m², with the purpose of supplying people involved in the fishing industry with the finest fishery equipment at the lowest possible prices.

3-1-4 Tools for Repairs

Principally for the maintenance and repair of government-owned fisheries research vessels tools of various kinds, from cutting pliers and screw-drivers to electric welding devices, are to be stored in the existing Fisheries Department warehouse.

3-1-5 Jetty, Retaining Wall, Slip Way

These are to serve as infra-structures for the Fisheries Department itself. The jetty is to be about 2m wide, 15m long, in depth of up to 4m of water, and is to be used by the government's fisheries research vessels. The approximately 40m long concrete retaining wall is to provide space between the Fisheries Department building and the shoreline. The slip way, to be constructed adjacent to the jetty, is intended for repair and maintenance of fisheries research vessels and other Fisheries Department-owned vessels.

3-2 Examination of Terms of Request

After analyzing the state of fisheries in Vanuatu with regard to demand, production, distribution and so on, using data acquired through on-the-spot research to estimate future demand, production, and distribution capabilities and comparing this, along with needs for storage of catches at Port Vila and Luganville, with the terms of Vanuatu's request, we examined the appropriateness of the request.

3-2-1 Analysis of Present Conditions

(1) Demand

The Fisheries Department of the Government of Vanuatu estimates that consumption of fish is at a level of approximately 15 kg/person/year. This is an average level for Pacific island nations.¹ Vanuatu's population was 112,596 in 1979, according to the General Population Census² and the yearly rate of increase in population is 2.6%, according to data compiled by the Government of Vanuatu Bureau of Statistics.³ Calculating from these figures, the population in 1980 comes to 115,523, which means a total consumption of 1,733 tons of fish in 1980.

Again, according to the Bureau of Statistics, imports of mackerel, sardine, and cuttlefish, canned in tomato sauce, came to a total of 562 tons net weight in 1980. Thus, of the total demand of 1,733 tons, about 32% was supplied by imports. Development of domestic production to substitute for imports is therefore a high-priority issue.

(2) Production

Based on the calculations of consumption figures, subtracting the 562 tons of imported fish from the 1,733 tons of total consumption, domestic production of fish came to 1,171 tons in 1980. These fish were caught close to shore by canoes and small aluminum boats, and sometimes with gill net, cast net, spear, bare hand techniques with or without the use of fishing vessels. As was previously indicated, specialized fishermen as such do not exist.

Principal catches include such low-priced species as mullet, sardine, horse mackerel and cockle, although a few higher-priced species such as spiny lobster and blue crab, are caught on a smaller scale. Snapper and grouper live in

-
- 1 "Projected Demand, Supply, and Trade of Marine Products--1985", FAO Fisheries Department, JAMARC No. 16 (1973,3).
 - 2 "Provisional Results of the General Population Census, 15-16 Jan. 1979", New Hebrides Government of National Unity.
 - 3 "Statistical Indicators 1981", Government of Vanuatu, Bureau of Statistics, 28 Sept. 1981.

relatively deep waters, and since there is also some cause for concern about ciguatera poisoning, exploitation of these has been limited.

Data concerning fish resources is quite insufficient; but, because of the outdated fishing techniques, the lack of specialists and the relatively low level of efforts expended, it is likely that the volumes of catches of hitherto exploited species can easily be maintained.

With existing boats, fishing gear, and fishing methods, catches of coastal-to-slightly-offshore skipjack, snapper, and grouper are rate, but the populations of these are roughly on a par with those of the regions around other Pacific island nations. It is known that schools of skipjack are sometimes sighted (Keary, E., 1979--see table 3.1).

Concerning deep-sea snapper and grouper, a positive indicator is that compared with surrounding island nations, there is a rather respectable record of catches. According to Rancurel, P. (1979)¹, around the rough sea bottom of the rocky New hebirides coast it has been established that there are sizeable populations of two species of genus *Etelis* (see table 3.2). Available information² concerning deep-sea fish shows that one hour of using one (deep bottom) drop line yielded catches which compare favorably with catches taken according to the same procedure in other island nations (see table 3.3).

To efficiently exploit the skipjack, snapper and grouper populations, however, is extremely difficult with the existing fishing techniques. The objective of the Government of Vanuatu in this regard is to raise the level of technology to rapidly develop the offshore fisheries of skipjack, deep-sea snapper, and grouper.

Since relatively low-priced species are presently being caught with unrefined boats and gear, the long-range plan is therefore to encourage the fisheries of hitherto unexploited, relatively high-priced species by venturing further off shore equipped with suitable boats, gear, and techniques (see table below).

| | mullet, sardine, horse mackerel (approx. 150VT/kg)* | skipjack, deep-sea snapper, grouper deep-sea shrimp (approx. 200VT/kg)* |
|---|---|--|
| coastal fisheries | ○ status quo | × |
| coastal, offshore, high seas fisheries | × | ○ |

* SPFC survey

Table 3.1 Frequency of Sightings of Skipjack and Yellowfin Schools

| COUNTRY | NUMBER OF SCHOOLS SIGHTED PER HOUR | | | | POSITIVE RESPONSE TO CHUMMING | TOTAL NO. OF SCHOOLS SIGHTED PER HOUR |
|-----------------------------|------------------------------------|-----------|------------------------|---------------------|-------------------------------------|---|
| | Skipjack | Yellowfin | Skipjack+ Yellowfin | Others+ unident. | | |
| New Caledonia | .46 | .04 | .03 | .15 | 46.15 | 0.67 |
| Vanuatu | .34 | 0 | .06 | .17 | 73.33 | 0.56 |
| Fiji | .22 | .07 | .11 | .45 | 50.00 | 0.85 |
| Tonga | .14 | 0 | .08 | .27 | 50.00 | 0.49 |
| Wallis and Futuna | .37 | .01 | .02 | .47 | 70.00 | 0.87 |
| Western Samoa | .38 | .02 | .04 | 1.71 | 60.00 | 2.16 |
| American Samoa | .19 | 0 | 0 | .81 | 16.67 | 1.00 |
| Tuvalu | .40 | .01 | .06 | .63 | 43.55 | 1.06 |
| Gilbert Islands | .48 | .03 | .03 | .70 | 55.93 | 1.24 |
| T.T.P.I. | .05 | .02 | .03 | .34 | 24.24 | 0.44 |
| Tokelau | .04 | 0 | .02 | 2.02 | 42.86 | 2.07 |
| Cook Islands | .22 | 0 | .02 | 1.10 | 36.11 | 1.31 |
| French Polynesia | .21 | .02 | .02 | .46 | 44.16 | 0.71 |
| Average for the entire year | .23 | .02 | .04 | .55 | 45.01 | 0.83 |

The figures on this chart include sightings which occurred when no bait was on hand and catches were insufficient.

1 Rancurel, P., 1979: Fisheries Newsletters No. 18, SPC.

2 Rancurel, P., 1980: Fisheries Newsletters No. 21, SPC.

Table 3.2 Species and Numbers of Fish Caught

| | | | |
|--------------------------------|----|---------------------------|----|
| <u>Etelis oculatus</u> | 17 | <u>Mustelus manazo</u> | 5 |
| <u>Etelis carbunculus</u> | 34 | <u>Galeorhinus sp.</u> | 2 |
| <u>Centrophorus scalpratus</u> | 50 | <u>Hexanchus vitulus</u> | 2 |
| <u>Squalus megalops</u> | 13 | <u>Pristipomoides spp</u> | 11 |
| <u>Squalus sp.</u> | 21 | <u>Others</u> | 9 |

Rancurel P. 1979
 Fisheries Newsletters No. 18, SPC

Table 3.3 Quantity (kg) of fish (by species) caught in one hour with one stake net during deep-sea fishery development projects in regions around various Pacific island nations.

| | Lut- janidae | Ser- ranidae | Caran- gidae | Lethri- nidae | Gem- pylidae | Others | Total |
|------------------|-----------------|-----------------|-----------------|------------------|-----------------|--------|-------|
| American Samoa | 3.0 | 0.1 | 0.2 | 1.0 | | 0.1 | 4.4 |
| Kosrac | 4.3 | 0.6 | 1.7 | 0.2 | 1.0 | 1.9 | 7.2 |
| New Caledonia | 3.3 | 1.0 | 0.3 | 2.1 | 0.0 | 0.9 | 7.6 |
| Vanuatu | 2.1 | 0.6 | 0.1 | 0.0 | 0.0 | 0.3 | 3.1 |
| Niue (1978) | 1.3 | 0.7 | | 0.7 | 0.0 | 0.1 | 2.8 |
| Niue (1979) | 3.2 | 1.2 | 0.0 | 0.0 | 1.3 | 1.3 | 7.0 |
| Papua New Guinea | 3.9 | | 0.4 | 0.0 | 0.0 | 0.6 | 4.9 |
| Palau | 1.8 | 0.4 | 0.4 | 0.1 | 0.2 | 0.4 | 3.3 |
| Tonga (1978) | 0.8 | 0.1 | 1.1 | 0.1 | 1.2 | 0.4 | 3.7 |
| Tonga (1979) | 2.7 | 0.5 | 0.3 | 0.6 | | 1.7 | 5.8 |
| Truk | 2.8 | 0.1 | 0.8 | 0.2 | 0.1 | 0.2 | 4.2 |
| Yap | 2.7 | 1.8 | 1.8 | 0.2 | 0.3 | 0.1 | 6.7 |

1. Tanna
 2. West New Britain
 3. Less than 0.1 per cent.
 1980: Fisheries Newsletters No. 21 SPC.

(3) Distribution, shipping, marketing place

Infrastructures relating to distribution, shipping, and market places are in the state of pre-development described below.

--Fishing ports and landing facilities responsive to the demands of domestic production are completely lacking at present.

--Permanent, equipped fish markets do not exist. In port Vila, the weekly open-air vegetable market includes a small quantity of marine products. In Luganville, the thrice-weekly vegetable market includes only a few marine products.

--There are no ice-making and refrigeration facilities for marine products.

--There is no fisheries cooperative association, there are no specialized fishermen, and catches are usually consumed by the fisherman and his family.

(4) Government Strategy

The Government of Vanuatu's strategy is laid out in the Five Year Plan for Fisheries Development as follows:

- a) To attain self-sufficiency in meeting domestic demand.
- b) To obtain foreign currency through exports (on a small scale).
- c) To promote coastal fisheries.

--by establishing village fisheries in 25 locations over a period of three years beginning in 1981 for the purpose of exploiting (deep-bottom) dropline catches (snapper, grouper), and equipping them with fish preservation facilities;

--by training fishermen;

--by providing assistance for the building of fishing boats;

--by supplying high-quality fishing gear to fishermen at low cost;

--by developing new offshore fishing techniques (purse seining for skipjack, as a joint venture with a foreign enterprise);

--by concentrating on distribution by creating a network of ice-making facilities for preservation of fish, and improving systems of transport and shipping of fish to market places.

3-3-3 Projections for the Future

(1) Demand estimates

(a) Domestic demand

--Future population estimates are based on the 1979 population census¹ and data concerning the rate of population growth supplied by the Bureau of Statistics.

--Per capita GDP was US\$590 in 1979. GNP estimates were arrived at using the World Bank's per capita GNP growth rate estimates of 2.7% for 1970-80, and 2.2% for 1980-90 (for

cases of low adaptability), and assuming that the rate of growth will remain constant for the entire period from 1980-2000.

The "low adaptability" rate was employed for the period after 1980 because the proportion of foreign aid (particularly British and French) contributing to Vanuatu Government finances has been high, and within five years of independence, British and French aid will cease to be available; and because there is no outstanding rapidly developing post-independence industry to be found as of yet.

--In relation to estimates of per capita fish consumption, the figure 0.7 was chosen for the income elasticity index because it corresponds to figures for other island nations of the same income levels--Ceylon, 0.8; Phillipines, 0.7 (FAO, 1967: Agricultural Commodities--Projections for 1975 and 1985)--and corresponds as well to the income elasticity index for Japan (0.7) during the low income level years 1951-1961.

The Government of Vanuatu has arrived at a tentative figure of 24 kg/person/year for 1990, but by calculating at this rate of growth until the year 2000, have come up with a figure of 33 kg/person/year, making for considerable disparity.

In this report we have elected to use median figures of 20 kg/person/year for 1990 and 25 kg/person/year for 2000 to determine domestic demand. The results are recorded on the table below.

Table 3.4 Projected Estimates of Domestic Fish Consumption in Vanuatu

| ITEM | 1980 | 1990 | 2000 |
|----------------------------------|---------|---------|---------|
| Population | 115,523 | 149,328 | 193,026 |
| Per capita GDP (US\$) | 606 | 754 | 938 |
| Demand for fish (kg/person/year) | 15 | 20 | 25 |
| Total demand (tons) | 1,733 | 2,987 | 4,826 |

Thus, projections for total demand by year are as follows:

| | |
|------|------------|
| 1980 | 1,733 tons |
| 1990 | 2,987 tons |
| 2000 | 4,826 tons |

- 1 "Provisional Results of the General Population Census 15-16 Jan. 1979", New Hebrides Government of National Unity.
- 2 "Statistical Indicators 1981", Government of Vanuatu Bureau of Statistics, 1981.

(b) Exports

At present there are no exports of fish, but skipjack, deep-sea snapper, grouper, and shrimp may offer export possibilities in the future if the following conditions are met:

- Advancement of fishery techniques and alteration of attitudes;
- Encouragement of fisheries through construction of larger fishing vessels;
- Creation of fishing ports;
- Establishment of infra-structures for the market places and distribution systems which will permit large-scale transport and sales;
- Installation of large-scale shipping operations equipment.

(2) Production estimates

1) Nationwide

In order to cease dependence on imports and halt the drain on foreign currency reserves, and to achieve production capable of satisfying domestic demand, the following increases in nationwide production are necessary:

by 1990: 2,987 - 1,171 = 1,816 tons

by 2000: 4,826 - 1,171 = 3,655 tons

To realize these increases, the followings are probably necessary:

- Strengthening and improvement of the present petty-scale small-boat coastal fishery;
- Encouragement of offshore and high seas fisheries of skipjack, deep-sea snapper, grouper, and shrimp by increasing the number of power vessels, increasing the size of boats, education and training of fishermen, and formulation of suitable measures to facilitate progress;
- Installation of refrigeration equipment to accommodate large-volume catches.

2) Project sites

Considering the lack of specially established fishing villages and the fact that most personal consumption is of fish which does not pass through markets, production in a given region should be in proportion to that region's population. Nationwide production has thus been broken down in proportion to regional population, and the results are shown on table 3.5.

As can be seen, new resources exploitation for Port Vila will account for 240 tons in 1990 and 482 tons in the year 2000; for Luganville, 80 tons in 1990 and 160 tons in 2000.

(3) Estimation of future marketing, distribution, and shipping needs

Table 3.5 Marine Production (in tons) by Region

| | | 1980 | 1990 | 2000 | 1980 |
|---------------------------|---------------------------------|-------|-------|-------|---------|
| nationwide | present production | 1,171 | 1,171 | 1,171 | |
| | projected additional production | 0 | 1,816 | 3,655 | 114,848 |
| | total | 1,171 | 2,987 | 4,826 | (100%) |
| Project site port Vila | present production | 151 | 151 | 151 | |
| | projected additional production | 0 | 240 | 482 | 15,097 |
| | total | 151 | 391 | 633 | (13%) |
| Luganville | present production | 46 | 46 | 46 | 5,042 |
| | projected additional production | 0 | 80 | 160 | |
| | total | 46 | 126 | 206 | (4%) |
| Others | present production | 974 | 974 | 974 | 94,709 |
| | projected additional production | 0 | 1,496 | 3,013 | (83%) |
| | total | 974 | 2,470 | 3,987 | |

(3) Estimation of future marketing, distribution, and shipping needs

It is likely that distribution and shipping of catches will assume the following forms:

1) Present catch volumes

In 1980, the catches for the surveyed project sites, 151 tons for Port Vila and 46 tons for Luganville do not follow large-scale distribution routes, but, rather, are consumed by the fishermen and their families or sold to neighbors. It is believed that a like volume will continue to follow this dispersed distribution pattern in the future. For the present volumes of catches, special distribution systems, market places, and shipping facilities are unnecessary.

2) Increased catch volumes (due to newly exploited fish resources)

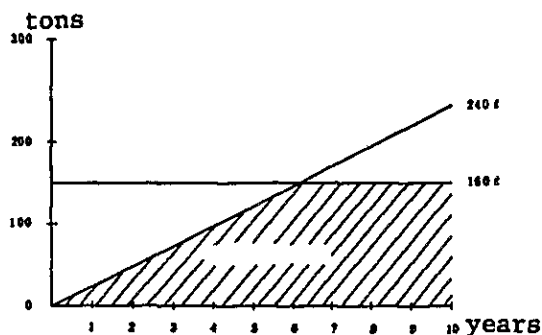
In Port Vila, it is projected that the increased volume of catches resulting from newly exploited resources will amount to 240 tons in 1990 and 160 tons in 2000. In regard to this, a fishing boat construction project has already begun on Santo Island (in August, 1981). Also, as part of the three-year project to encourage village fisheries units in 25 locations throughout the nation, each unit to be equipped with one fishing boat, a complete set of fishing gear, and fish preservation facilities. Through such collective units, large-volume catches may be distributed throughout each local region to correct the balance of supply and demand.

From the standpoint of relative population size, three of these units are projected for the area around Port Vila and one for the area around Luganville.

3) Volumes requiring preservation in Port Vila and Luganville

a) The fish Market in Port Vila

Of the approximately 240 tons of fish to receive concentrated management at Port Vila in 1990, if we assume 2/3 to be within the range of the provisions of this grant, this means that equipment with preservation-storage capacity of 160 tons is called for.



As can be seen on the above chart, fish preservation capacity and the new catch volumes coincide after six years. It is desirable that until that time the extra storage capacity be put to various uses. After six years, the surplus volumes will have to be managed by the Vanuatu Government.

The items necessary for refrigeration facilities which will accommodate 3 tons of fish per week are as follows.

- i) For handling fresh fish, two parts ice are needed for one part fish. An ice-making plant capable of producing about one tone of flake or block ice per day is therefore required.
- ii) Flake ice storage bin.
- iii) In order to handle 3 tons of fresh fish per week, after icing fish in trays, temporary storage is necessary, from which fresh fish can be sold directly or, if not sold, returned to refrigeration. For this purpose, a walk-in chill room (0°C) with a capacity of 9 tons (3 tons of fish and 6 tons of ice) is required.
- iv) Air-blast freezer (-35°C). 3 tons of fish per 5-day week means a capacity of 600 kg/day is required.
- v) Cold storage unit (-20°C). To preserve 3 tons/week of quick-frozen fish will require a cold storage unit with a capacity of 12 tons/month. Calculating the volume/weight ratio of fresh fish at 2.5m³/ton and the volume/weight ratio of frozen fish at 2.0m³/ton, ice-making and refrigeration equipment of the following specifications are required:

| | |
|--------------------------|--|
| Port Vila (Fish Market) | |
| 1 x 500 kg/day | flake ice plant |
| 1 x 1 ton | flake ice storage bin |
| 1 x 200 kg/day | block ice plant |
| 3 x 8 m ³ | walk-in chill room (0°C) |
| 1 x 600 kg/day | air-blast freezer (-35°C) |
| 2 x 12 m ³ | cold store (-20°C) |
| 300 x (approx.) 60 liter | fish trays (nesting/stacking, with drainage) |

Other items include the retail store display case and equipment listed in 3-3-1 Equipment (1) Port Vila.

b) Luganville

The quantity of fish to receive concentrated management at Luganville in 1990 is extremely small--80 tons/year--and from the standpoint of economy, the need for facilities is relatively low. Nonetheless, in order to preserve freshness of fish, ice-making and ice storage facilities are clearly needed.



The volume of fish to be managed at Luganville being only about 1/3 that of Port Vila, the following equipment is deemed adequate:

| | |
|----------------------|-----------------------|
| Luganville | |
| 1 x 400 kg/day | block ice plant |
| 1 x 6 m ³ | block ice storage bin |
| 20 x | insulated ice box |

Other items are listed in 3-3-1 (2) Luganville.

3-2-3 Jetty, retaining wall, slip way, government fisheries store, repair tools

As was previously mentioned, the Government of Vanuatu places great importance on encouragement of the fishing industry in its attempts to develop the economy. It is hoped that fishery will serve to stimulate all industry and, as a producer of import substitutes and exports, help to increase foreign currency reserves. The Fisheries Department is taking the initiative in planning projects to boost the fisheries.

Established in 1979, the Fisheries Department is operating with a little equipment and a few facilities. In 1980, with \$80,000 in aid from Canada, the small building which presently houses its offices was built. The wharf, retaining wall, slip way, etc. which are included in the present request (Program 3 of the Five Year Plan), are desired in order to complete the Department's facilities and to serve for the long-term benefit of Vanuatu.

3-2-4 Management plans

- 1) Fish market (Port Vila) and ice-making and refrigeration facilities (Luganville)

The Government of Vanuatu had no plan for self-management of the above facilities at the time of our survey, intending to search for an experienced individual or enterprise to handle the management on a lease basis.

The head of the Fisheries Department, Mr. J Crossland, expressed reluctance to place a burden on the Government, and the head of the Bureau of Financial Affairs, Mr. P. Harrison, earnestly requested assistance in management, but the survey team explained the position of the Japanese Government in regard to the nature of economic cooperation grants.

- 2) The government fishing gear store, repair tools, jetty, retaining wall, and slip way are planned for installation on the Fisheries Department's land or adjoining properties. As for their management, with three experts (supplied by FAO and the Canadian Government) presently residing in Vanuatu, suitable personnels and systems are available.

3-3 Basic Principles of Construction

In addition to the obvious principles of attractiveness, convenience, durability, low cost, etc., the following principles were also taken into consideration in response to the particular conditions pertaining to these structures.

1. Determination of construction methods

Construction methods will be determined taking into consideration the lack of heavy construction machinery and specially skilled workers in Vanuatu.

2. Durability

Most of these structures are commonly in contact with sea water. Considering the fact that it is desirable to keep repair and maintenance costs as low as possible, the structures are to be of corrosion-resistant construction.

3-4 Outline of Basic Designs

- 1) Equipment

- a) Refrigeration and ice-making facilities

The two sites of these are the Port Vila market and the vicinity of the Luganville market. (see Fig. - 3.1 & 2)

- b) Tools

Because repair tools and fishing gear are to be managed-by the Fisheries Department, they will be stored in the Department's warehouse.

- 2) Buildings

These are 3 buildings: The Port Vila Market and refrigeration and ice-making facilities; the Luganville refrigeration and ice-making facilities; the government fishings gear. (see Fig. - 3.1 & 2 for construction sites)

3) Port facilities

These three facilities are the jetty, the retaining wall, and the slip way (see Fig. - 3.1 for construction sites)

3-4-1 Equipment

(1) Design requirements

- 1) capacity: listed in 3-2
- 2) outside temperature: maximum 35°C
- 3) humidity: maximum 90%
- 4) cooling method: water-cooled
- 5) electricity: 380 - 420 v
3 phase 50 cycle
(lights, etc. 220 - 240 v)

(2) Port Vila

Designing the equipment according to the above requirements results in the following:

1) Ice-making equipment

a) Flake ice plant

ice-making capacity: 500 kg/day
cooling capacity: 4,600 k-cal/hour
generating power: 3.0 kw

b) Block ice plant

ice-making capacity: 200 kg/day
cooling capacity: 3,400 k-cal/hour
generating power: 2.4 kw

2) Refrigeration facilities

a) Ice storage bin

ice storage method: assuming insulation is adequate, a cooling system is not needed
capacity: 2.8 m³

b) Chill room -- 3 units

capacity: 8 m³ x 3 = 24.0 m³
cooling capacity: 4,200 kcal/hr x 3 = 12,600 kcal/hr
generating power: 12.0 kw (total)
inside temperature: 0°C

c) Air-blast freezer

freezing capacity: 600 kg/day
cooling capacity: 7,700 kcal/hr

generating power: 16.8 kw
inside temperature: -35°C

d) Cold store -- 2 units

capacity: 1,800 kcal/hr x 2 = 3,600 kcal/hr
generating power: 7.0 kw (total)
inside temperature: -20°C

(3) Luganville

Refrigeration and ice-making facilities are to be installed near the existing market.

1) Block ice plant

ice making capacity: 400 kg/day
cooling capacity: 5,200 kcal/hr
generating power: 3.4 kw

2) Ice storage bin

capacity: 6.0 m³
cooling capacity: 2,100 kcal/hr
generating power: 2.8 kw
inside temperature: 0°C

3) Chill room

capacity: 8.0 m³
cooling capacity: 2,900 kcal/hr
generating power: 2.4 kw
inside temperature: 0°C

(4) Tools

repair tools: 1 set
fishing gear: 1 set

3-4-2 Buildings

Buildings included in the assistance grant request from the Government of Vanuatu are the fish market, the various ice-making and refrigeration facilities, and the government fisheries store in Port Vila, and the ice-making, ice storage and refrigeration facilities in Luganville.

These structures are to be designed and built according to the following principles.

--They are to be distinctly functional in layout, with architectural, and installation designs suitable to the environment.

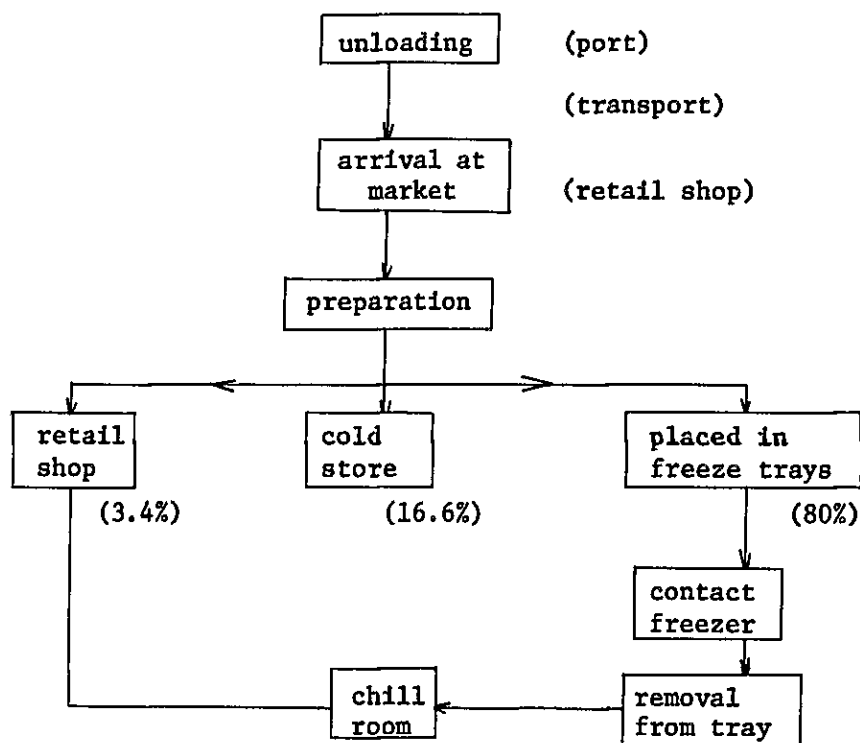
--Since construction is on an extremely small scale, wherever possible, materials to be used are to be procured through local contractor.

--The design and materials are to be chosen with due consideration to the natural conditions such as climate and terrain.

(1) Layout

--Fish market (Port Vila)

The proposed construction site is on the town's main street. The fish market is to handle a future flow of 3 tons of fish per week. The following chart shows the flow route, from unloading at the port to sales in the market.



As this flow chart demonstrates, the retail shop, fish preparation room, refrigeration and ice-making equipment, chill room, cold store, and so on must be laid out so as to be annexed to the fish market. The fish preparation room will be the most frequently used by workers. In order to maximize efficiency of operation, it has been placed as in Fig. - 3.4. --The government fisheries store is to be built on the Fisheries Department's grounds. It is to have shelves for displaying fishing gear for sale, and space for desks for clerical work. It has been laid out as in Fig. - 3.6. --Luganville's refrigeration and ice-making facilities are to be constructed with ice storage bin and chill room on one side and ice-making machine and operation space on the other, as in Fig. - 3.5.

(2) Structural design

As the structures are small, concrete block construction, the preference of the Vanuatu Government, was possible, but since the construction sites at Port Vila and Luganville are in regions of frequent earthquakes, it was decided to use reinforced concrete blocks according to Japanese architectural standards.

The foundation bed is capable of supporting weights of 5 tons tons/m². The following is a description of the structure and finish of each section.

- Roof: wooden truss; color steel corrugated sheet (insulated)
- Exterior walls: concrete block; mortar plastering and paint finish
- Interior walls: as above; wall tile, mortar plastering, paint finish
- Floors: concrete base layer; chemcrete finish
- Ceiling: asbestos board; paint finish
- Foundation and framework: reinforced concrete

(3) Installation layout

1) Electrical installations

--Illumination wiring installation

Wiring will be installed from the power board through the secondary lighting switches to the outlets, allowing for separate, small-scale use of electricity for each room.

--Power wiring installation

Plans call for wiring to pass from the power board through the secondary piping and wiring installations.

--Design standards

frequency: 50Hz 1 ϕ 220v 3 ϕ 380v

2) Water Supply and sewerage installation

Water is available near the planned construction sites. The necessary pipes will be laid.

Waste water will pass through a septic tank and into the sewerage system.

3-4-3 Jetty, retaining wall, and slip way

(1) Choice of construction sites

The construction sites shown on Fig. - 3.1 were chosen for the following reasons:

- 1) Because the Fisheries Department will support and maintain these facilities, and because the facilities are to be used for the Department's boats, it was desirable that they be located near the Fisheries Department Building.
- 2) This area is calm year-round, and the facilities are not likely to be adversely affected by waves.
- 3) The sea bottom falls off relatively steeply, allowing for the jetty's length to be minimized.
- 4) The foundation bed is coral--strong enough to support the retaining wall directly.

(2) Design requirements

- 1) Pertinent vessels: vessel length: 12m
total tonnage: 10 tons
- 2) Tide range: 1.50 m
- 3) Tidal current: not considered as factor
- 4) Earthquake magnitude: $kh = 0.15$
- 5) Ground condition: coral
- 6) Permissible stress: according to JIS regulations

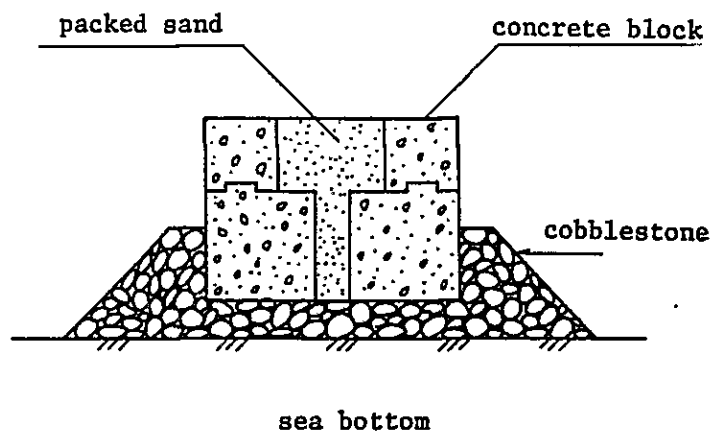
(3) Jetty

- 1) Choice of structural type

Optional structural types were piled jetty type and wall jetty type (concrete block and sheet pile).

- a) Wall jetty type

- i) Concrete block

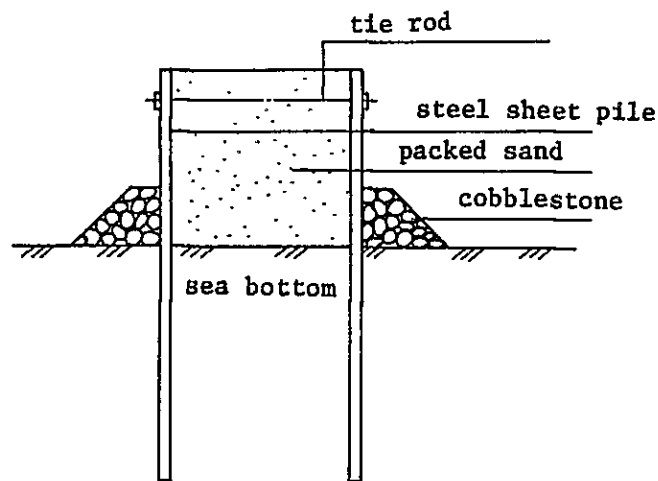


With this method, concrete blocks are first made on land, then, after the sea bottom has been leveled, the blocks are laid. Construction costs for this method are high for the following reasons:

- The sea bottom drops off steeply, requiring a great deal of in-water operations.
- Large machinery for carrying and setting the blocks is required.
- It is necessary to construct in such a way as to prevent slippage.

ii) Sheet pile

With this method, packed sand is set between two rows of steel sheet piles which are driven into the sea bottom, causing it to function as a jetty.



Because the bottom is coral, however, it would be difficult and expensive to drive in the steel sheet piles. This method was therefore judged unsuitable.

b) Piled jetty type

In this method, a concrete beam is supported by a foundation of steel piles and covered with a wooden planking. The space thereby created permits berthing.

Because this structure type is not easily affected by tide and waves, it is possible to extend its length further off shore. The advantages of this are:

- Operation of vessel alongside piled jetty is facilitated.
- The quantity of dredged soil is minimized.
- Usable berthing length is increased.

Construction costs are also low compared with other structural types.

For these reasons, we selected the piled jetty type structure for the berthing facility. The piles for

this type of structure may be concrete or steel; because of the hard coral foundation bed, we have chosen the steel pile because of its strength.

2) Dimensions

- a) Jetty length: 18.0 m, to ensure a water depth of 3.0 m
- b) Jetty width: 4.0 m, to permit a small truck to back onto it
- c) Crown height: 1.5 m above mean sea level; even with ground level

(see Fig. - 3.8)

(4) Retaining wall

1) Choice of structural type

The options for structural type were sheet pile type, concrete block type, inverted T type and gravity type. The foundation bed being coral, however, direct foundation construction is required, limiting the options to concrete block, inverted T, and gravity types.

a) Sheet pile

As with the jetty, this method is unsuitable, the driving of the steel sheet piling being judged too problematic.

b) Concrete block

The required block carrying equipment, crane, etc. would result in high construction costs.

c) Inverted T

The need for reinforced concrete makes this method too expensive.

d) Gravity

This type is deemed most suitable.

2) Dimensions

- a) Crown height: ground level (1.50m above mean sea level)
- b) Foundation depth: low water level

(see Fig. - 3.9 for other dimensions)

(5) Slip way

Two rails set into the surface will provide a track for the boat trailer. A winch is to be installed for pulling boats out by hand. Such being the case, the gradient of the rails is to be under 1:6.

(see Fig. - 3.10 for other dimensions)

3-5 Basic Layout Designs

Fig. - 3.4 through Fig. - 3.10 give the basic layout designs.

3-6 Cost Estimates

Cost estimates are given in the following table:

3-7 Construction Crew and Schedule

In order to keep construction costs low, local workers will be used wherever possible. Japanese personnel to be dispatched are: two engineers; two scaffolding workers (for setting up the pile-driver frames); and one coordinator.

Considering the three months necessary to ship the equipment and materials from Japan, the schedule of construction has been set at one year. (see Fig. - 3.11)

3-8 Maintenance and Management

1. Fish market (Port Vila) and fish preservation facilities (Luganville)

As previously mentioned, the Government of Vanuatu has no plan for autonomous management of the project. Financially speaking, assistance will be necessary to meet maintenance costs at the outset of operation. But since these facilities are important for the encouragement of domestic production of protein sources, and because of the lack of experienced staffs to manage the facilities, it is urgent that the Government take positive steps to help itself by training personnel for management and maintenance.

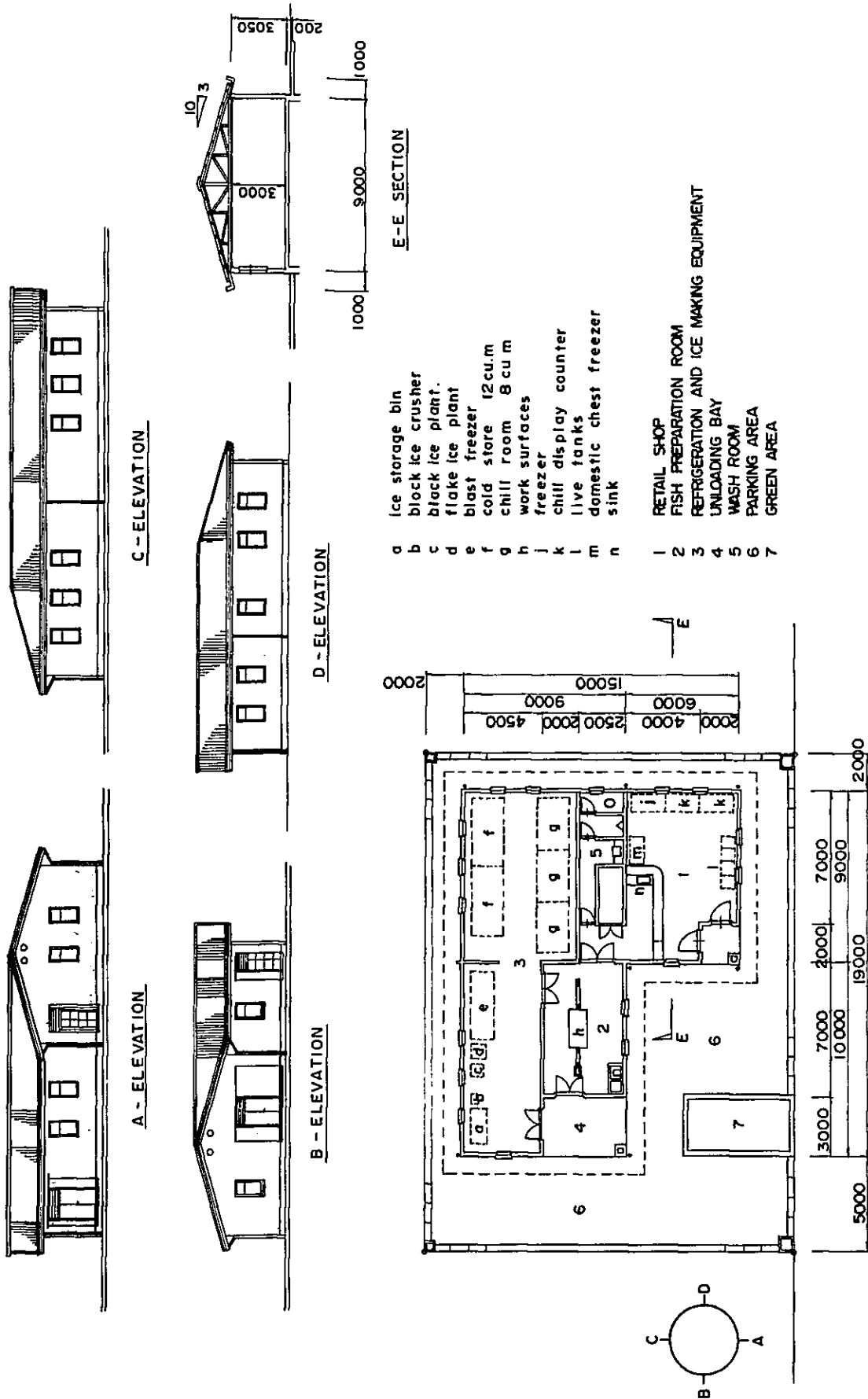
Necessary management personnel include, for the fish market in Port Vila, at least one manager, one equipment operator, one person for fish preparation, and one salesperson: a total of four employees. For the fish preservation facilities at Luganville, 1.5 persons are need (one full-time and one part-time worker).

2. Port facilities, fisheries store and tools

The port facilities, barring any unusual occurrence, will not require maintenance or repair for at least thirty years. But management personnel are required for the training of fishermen.

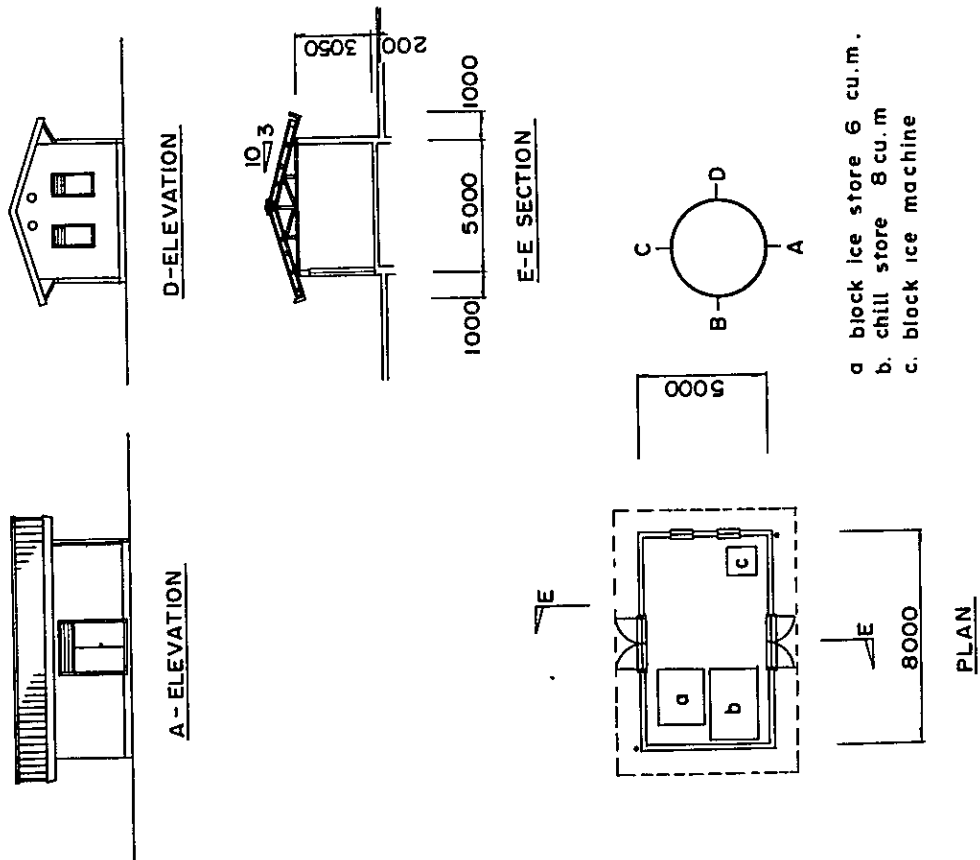
Management of the port facilities, fisheries store and tools can most suitably be performed by the three specialists (supplied by FAO and Canadian government assistance) who are presently stationed in Vanuatu.

Fig - 3.4 Building for Port Vila Market



- E-E SECTION**
- a ice storage bin
 - b block ice crusher
 - c block ice plant.
 - d flake ice plant
 - e blast freezer
 - f cold store 12 cu.m
 - g chill room 8 cu m
 - h work surfaces
 - i freezer
 - j chill display counter
 - k live tanks
 - l domestic chest freezer
 - m sink
 - n
- 1 RETAIL SHOP
 - 2 FISH PREPARATION ROOM
 - 3 REFRIGERATION AND ICE MAKING EQUIPMENT
 - 4 UNLOADING BAY
 - 5 WASH ROOM
 - 6 PARKING AREA
 - 7 GREEN AREA

Fig -3 5 Building for Fish Preservation Facilities
in Luganville



- a block ice store 6 cu.m.
- b. chill store 8 cu.m
- c. block ice machine

Fig - 3 6 Building for Shop of Fishing Tackle

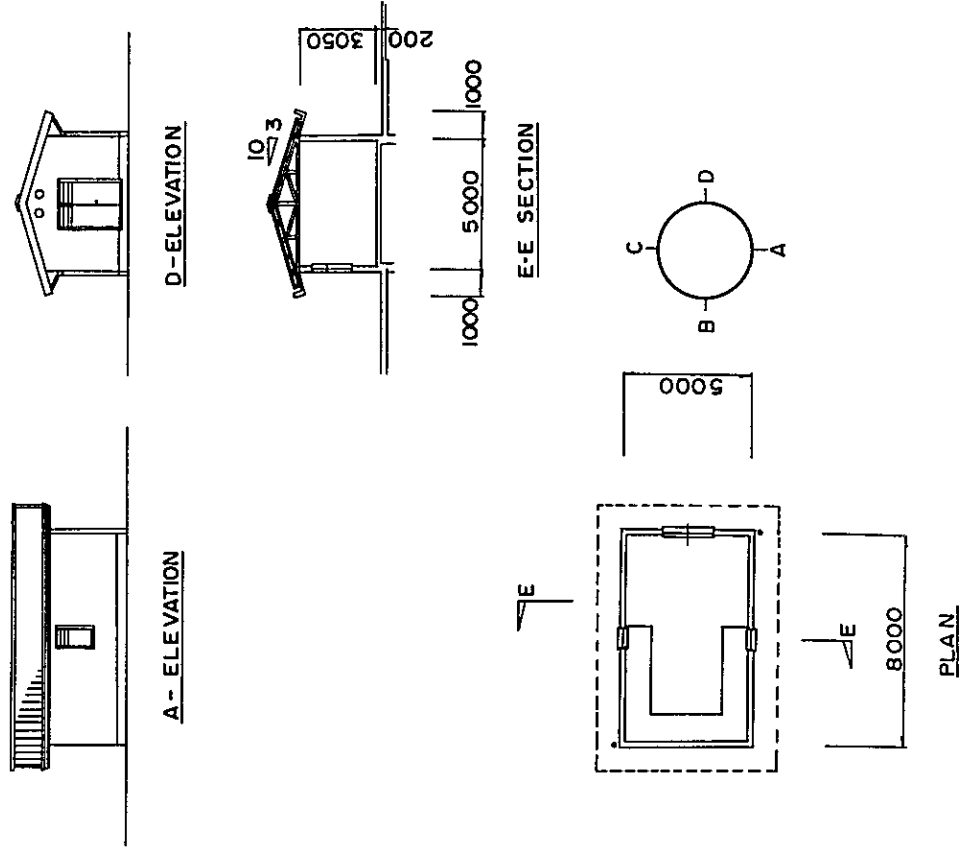


Fig - 3 7. General Layout of Port Facilities

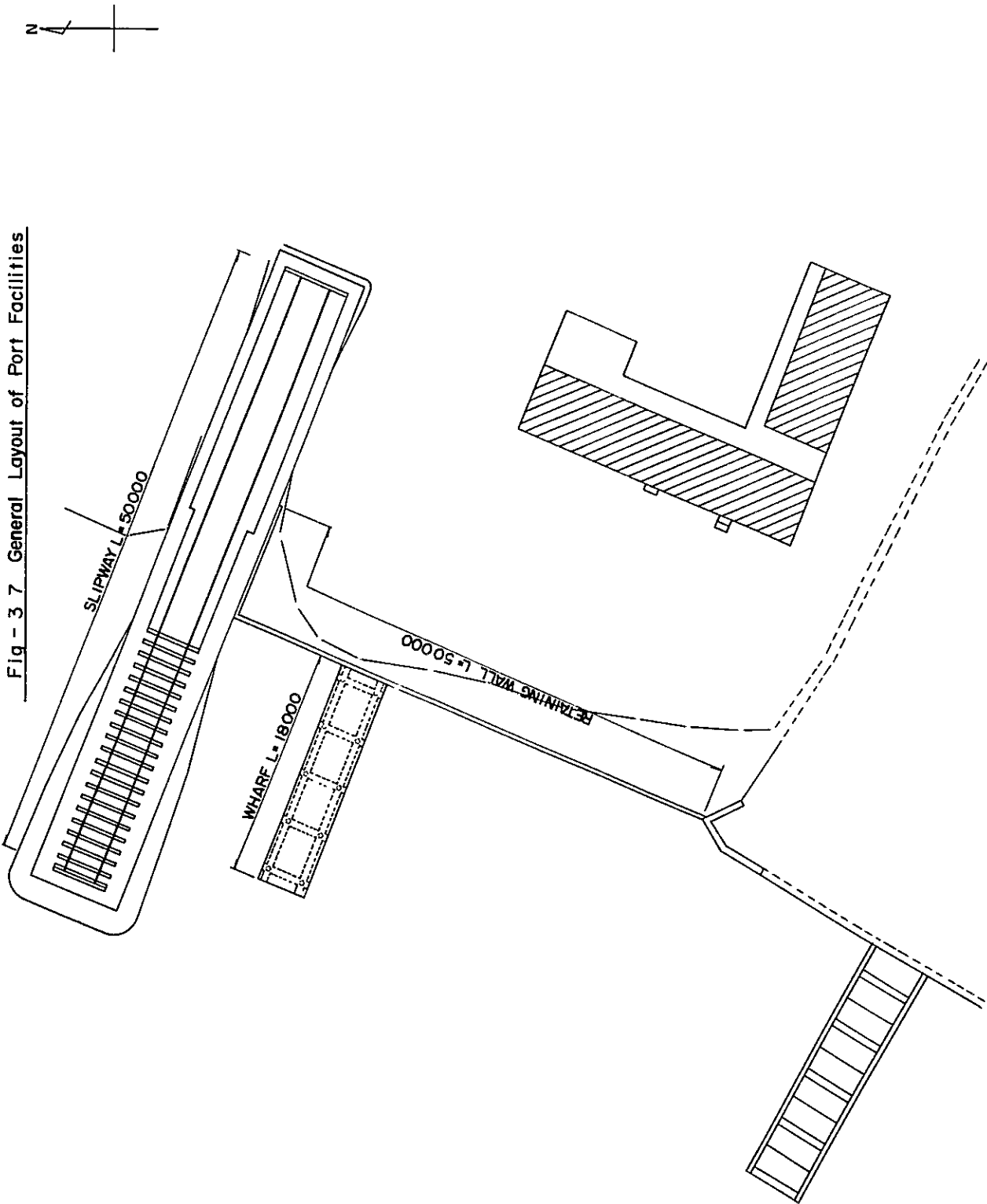
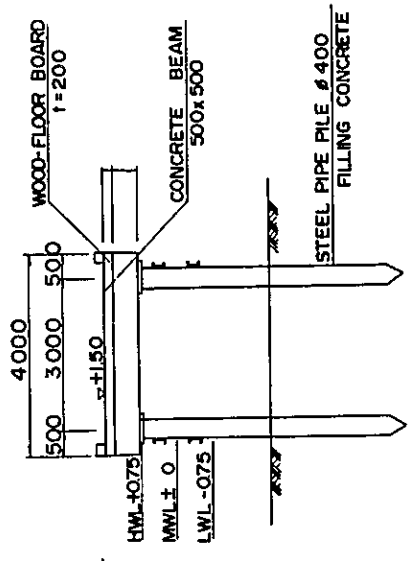
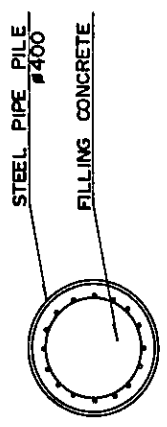


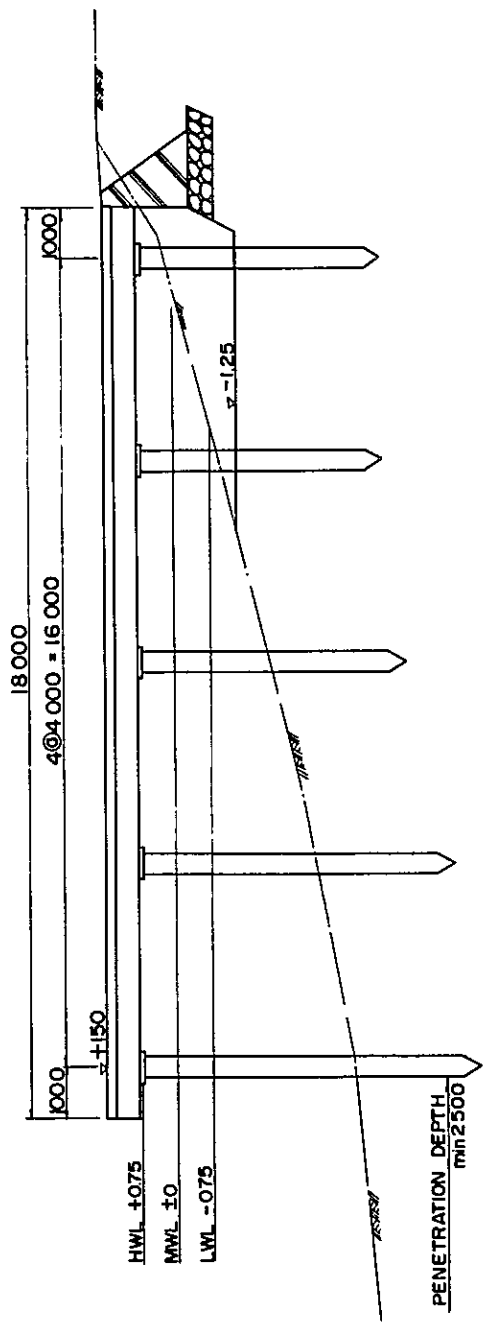
Fig-3.8 Je y



STAND SECTION 1 : 100



PILE SECTION 1 : 15



VERTICAL SECTION 1 : 100

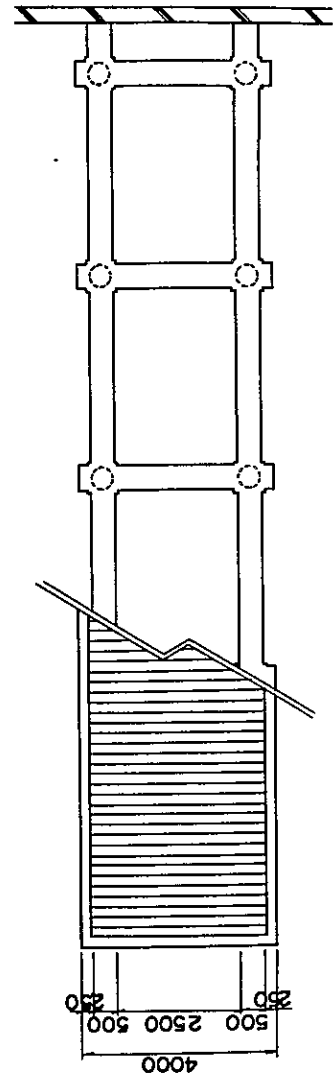


Fig-3-9 Retaining Wall

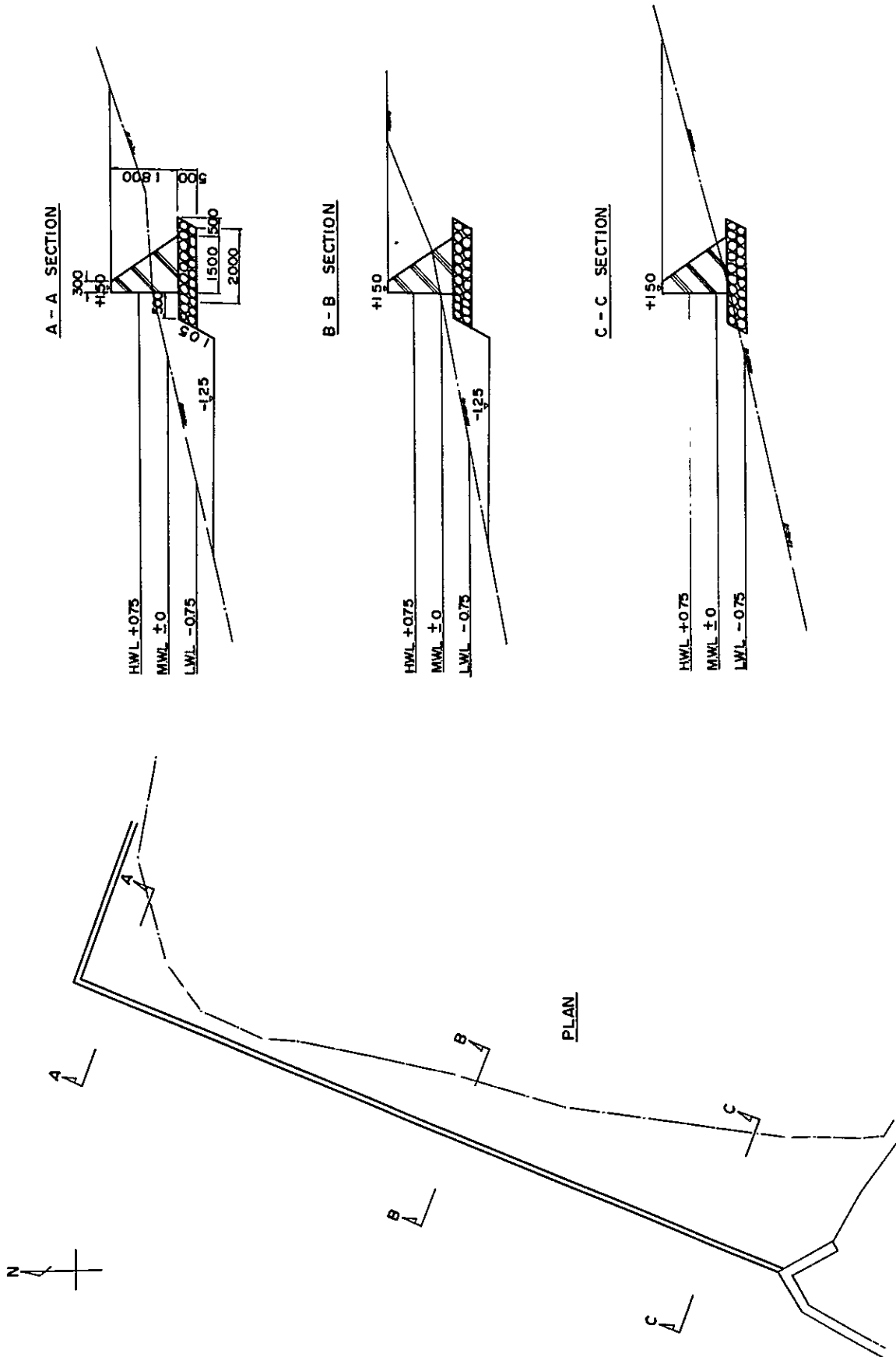
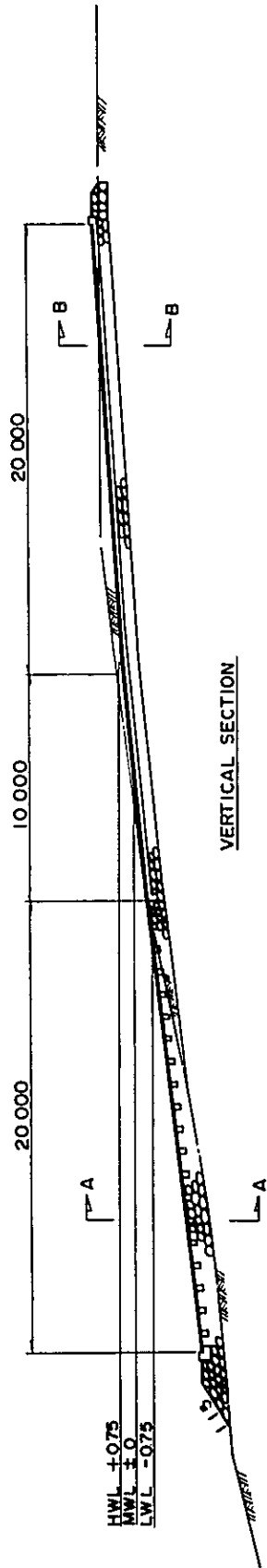
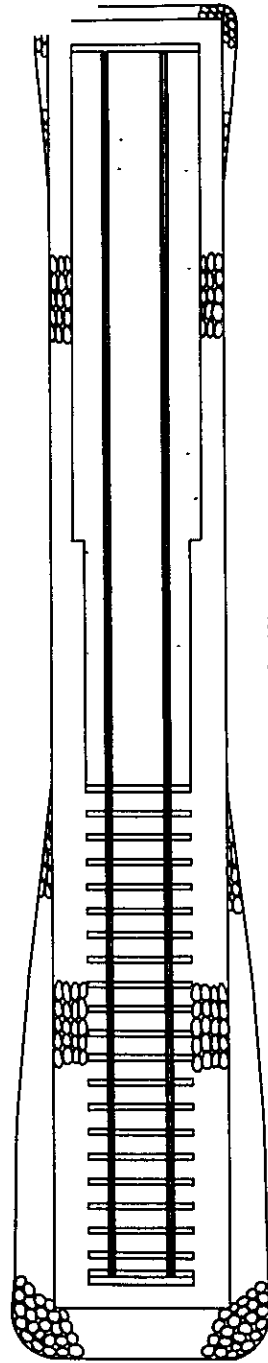


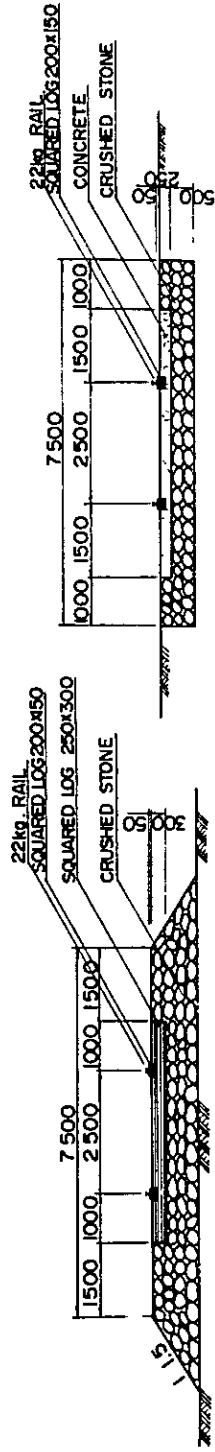
Fig - 3 10 Slipway



VERTICAL SECTION



PLAN



A-A SECTION

B-B SECTION

Fig. - 3.11 Work Schedule

| Item | First Year | | | | | | | | | | | | Second Year | | | | | |
|--|------------|------------------|-----|-----|-----|---|-----|-----|-----|------|--------------|------|-------------|-----|-----|-----|-----|--|
| | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th | 11th | 12th | 1st | 2nd | 3rd | 4th | 5th | |
| Contract with Consultant | | | | | | | | | | | | | | | | | | |
| Geological Survey (Boring) | | Preparation Work | | | | | | | | | | | | | | | | |
| Topographic Survey (inc. sounding) | | Preparation Work | | | | | | | | | | | | | | | | |
| Detail Design | | Preparation Work | | | | | | | | | | | | | | | | |
| Making of Specification and Tender Documents | | | | | | | | | | | | | | | | | | |
| Contract with a Contractor | | | | | | | | | | | | | | | | | | |
| Preparation Works (in Japan) | | | | | | Preparation Work | | | | | | | | | | | | |
| Building Work | | | | | | | | | | | | | | | | | | |
| Refrigeration and Ice-making Facilities | | | | | | Construction Material & Parts Dispatch Period | | | | | Installation | | | | | | | |
| Port Facilities Work | | | | | | | | | | | | | | | | | | |
| Miscellaneous Work | | | | | | | | | | | | | | | | | | |

PART 4 PROJECT APPRAISAL

4-1 Social and Economic Effects of the Project

The general effects of this project can be thought of as being as follows:

- Increase in marine production
- Increase in freshness of marine products
- Advancement of fishery techniques
- Increase in employment opportunities
- Reduction of foreign currency expenses
- Acquisition of foreign currency

The jetty, retaining wall, slip way, government fisheries store, and repair tools included in the project signify many things for Vanuatu.

This project, the result of the government of Vanuatu's foresight in giving high priority to the encouragement of fisheries, will serve to increase the GNP. The Government, by promoting the fishing industry, also hopes to increase the foreign currency reserves with exports of marine products, albeit on a small scale.

The Fisheries Department, founded in 1979, is operating with small staffs and a few facilities. The present small Department building was built with \$80,000 in economic aid from Canada, but the jetty, retaining wall, slip way, etc. contained in the present request are needed to complete the facilities at the department's command to ensure its long-term effectiveness. The government fishing gear and repair tools are also meaningful in this respect.

4-2 Financial Evaluation of the Fish Market (Part Vila) and Ice-making and Refrigeration Facilities (Luganville)

Below are the results of a financial analysis of the fish market in Port Vila and the ice-making and refrigeration facilities in Luganville, conducted to determine if they can become financially sound enterprises.

4-2-1 Conditions

(1) Terms of the evaluation

The projects in Port Vila and Luganville are to be evaluated independently, as separate projects, and collectively, as one unified project.

(2) Time period of the project (project life)

The project is to be established in 1982. Relating the life of the project to the depreciation of construction costs, we can define the project life as having a duration of 30 years.

(3) Revenues

It is expected that some revenues will be obtained through the sales of fish.

(4) Expenditures

Foreseeable operating costs include personnel expenditures, electricity charges, water charges, maintenance costs and depreciation of structures, and during the project life, reinvestment will have to be made in facilities which have reached the end of their durable years.

(5) Exchange rate

The exchange rate of the Japanese yen and Vanuatu's VT has been calculated at

$$\begin{aligned} 1 \text{ ¥} &= 0.37 \text{ VT} \\ 1 \text{ VT} &= 2.70 \text{ ¥} \end{aligned}$$

4-2-2 Construction costs

Construction costs are shown of table 4.1. Construction is to begin in 1982.

Table 4.1 Construction Costs

Unit: ¥
(VT)

| Item | Port Vila | Luganville | |
|-------------------|----------------------------|---------------------------|-----------------------------|
| Construction Cost | 79,187,220 (29,328,600) | 17,221,950 (6,378,500) | 96,409,170 (35,707,100) |
| Contingency | 7,027,965 (2,602,950) | 1,528,470 (566,100) | 8,556,435 (3,169,050) |
| Total | 86,215,185 (31,931,550) | 18,750,420 (6,944,600) | 104,965,605 (38,876,150) |

The durable life of the refrigeration and ice-making facilities is 10 years. As a result, 10 and 20 years after the completion of construction (1992 and 2002), reinvestment will be necessary.

4-2-3 Volumes of fish catches to be handled

Table 4.2 shows the volumes of fish catches to be handled, based on the examination of the terms of the request.

Table 4.2 Volume of Fish Catches to be Handled (tons/year)

| Year | Port Vila | Luganville | total |
|------|-----------|------------|-------|
| 1983 | 72 | 24 | 96 |
| 1984 | 96 | 32 | 128 |
| 1985 | 120 | 40 | 160 |
| 1986 | 144 | 48 | 192 |
| 1987 | 156 | 52 | 208 |

(2) Fish sales margin

The present median price for fish dealed between residents is 175 VT/kg. The retail price for fish at supermarkets is 250-300 VT/kg. Calculating from the lowest retail price, the sales margin is as follows:

buying price: 175 VT
 selling price: 250 VT
 sales margin: 75 VT
 percentage of
 sales margin: 42.9%

(3) Revenues from fish sales

By multiplying the volume of fish by the sales margin and taking into consideration a 10% spoilage rate, revenues from the sales of fish can be calculated as follows:

Revenues = [volume of fish handled X (1 - 0.1)] X margin

The revenues from sales of fish by successive years are as indicated in the following table.

Table 4.3 Fish Sales Revenues (1,000 VT)

| Year | Port Vila | Luganville | Total |
|------|-----------|------------|--------|
| 1983 | 4,860 | 1,620 | 6,480 |
| 1984 | 6,480 | 2,160 | 8,640 |
| 1985 | 8,100 | 2,700 | 10,800 |
| 1986 | 9,720 | 3,240 | 12,960 |
| 1987 | 10,530 | 3,510 | 14,040 |

4-2-4 Operating costs

(1) Personnel expenditures

(a) Number of employees; personnel expenditures

In Port Vila, one manager, two persons for equipment operation and fish preparation and sales, and one retail salesperson are required. In Luganville, two persons are needed for equipment operation and fish preparation and sales, but one of these may be part-time, on a half-day basis.

The following table is a calculation of personnel expenditures based on an on-the-spot survey concerning local wages.

Table 4.4 Work Force and Personnel Expenditures

| Sub-project | | No. of workers | Wage VT/month |
|-------------|--|----------------|---------------|
| Port Vila | manager | 1 | 15,000 |
| | equipment operation fish preparation and sales | A | 14,000 |
| | | B | 10,000 |
| | retail sales | 1 | 6,000 |
| | subtotal | 4 | 45,000 |
| Luganville | equipment operation fish preparation and sales | A | 14,000 |
| | | B* | 5,000 |
| | subtotal | 2 | 19,000 |
| total | | 6 | 64,000 |

* part-time (half-day)

(b) Yearly personnel expenditures

Foreseeing a 10% allowance, yearly personnel expenditures are calculated as follows:

| | | |
|-------------|--------------------------------|----------------|
| Port Vila : | 45,000 VT/mo. X 12 mo. X 1.1 = | 594,000 VT/ye. |
| Luganville: | 19,000 VT/mo. X 12 mo. X 1.1 = | 250,800 VT/yr. |
| | total | 844,800 VT/yr. |

(2) Electricity charges

(a) Unit cost

Electricity charges are broken into three categories. As can be seen, they are generally quite high.

| Port Vila | Luganville |
|--------------|--------------|
| 33.86 VT/kwh | 27.45 VT/kwh |
| 22.09 | 20.60 |
| 20.32 | 18.85 |

In view of the public nature of the project, the Vanuatu Government should apply the lowest rate for each location. That is, 20.32 VT/kwh at Port Vila and 18.85 VT/kwh at Luganville.

(b) Volume of electricity consumption

The yearly consumption of electricity is calculated as follows:

(b)-1 Port Vila

| | |
|-------------------|---------------------------|
| --Full operation: | 22,000.3 kwh/mo. X 12 mo. |
| | = 264,003.6 kwh/year |
| --2/3 operation : | 17,662.1 kwh/mo. X 12 mo. |
| | = 211,945 kwh/year |

(b)-2 Luganville

| | |
|-------------------|------------------------|
| --Full operation: | 4,692 kwh/mo. X 12 mo. |
| | = 56,364 kwh/yr. |
| --2/3 operation : | 4,212 kwh/mo. X 12 mo. |
| | = 50,544 kwh/yr. |

(c) Electricity charges

Based on the electricity unit costs and the volume of electricity consumption described above, the following table indicates the yearly electricity charges for the projects.

Table 4.5 Electricity charges

| Operating condition | Sub-project | Unit cost (VT/kwh) | Yearly consumption (kwh/year) | Charges (VT/year) |
|-------------------------|-------------|--------------------|-------------------------------|-------------------|
| 2/3 operation (1983-84) | Port Vila | 20.32 | 211,945 | 4,306,722 |
| | Luganville | 18.85 | 50,544 | 952,754 |
| | total | | 262,489 | 5,259,476 |
| Full operation (1985--) | Port Vila | 20.32 | 264,003.6 | 5,364,480 |
| | Luganville | 18.85 | 56,304 | 1,061,330 |
| | total | | 320,307.6 | 6,425,810 |

(3) Water charges

(a) Unit cost

Water charges per m³ are as follows:

--Port Vila : 33 VT/m³
--Luganville : 18.5 VT/m³

(b)-1 Water for personal use

This includes water used by employees for flush toilets, wash basins, clean-up, miscellaneous. This is calculated at 40 liters per person per day.

Putting the number of operation days per year at 264 days (5-day week), the volume of water used for personal functions is calculated as follows:

Port Vila : $40.1./\text{man}/\text{day} \times 4 \text{ men} \times 264 \text{ days}/\text{year} \div$
 $1,000 \text{ l.}/\text{m}^3 = 42.24 \text{ m}^3/\text{year}$
Luganville: $40 \text{ l.}/\text{man}/\text{day} \times 1.5 \text{ men} \times 264 \text{ days}/\text{year} \div$
 $1,000 \text{ l.}/\text{m}^3 = 15.84 \text{ m}^3/\text{year}$

total : 58.08 m³/year

(b)-2 Operations water (refrigeration, fish preparation)

For one ton of fish the volume of water required for operations being about 2 m³, the yearly volume of water used for operations is calculated as follows:

Table 4.6 Yearly Volume of Operations Water Used

| | (m ³ /year) | | |
|--------|------------------------|------------|-------|
| Year | Port Vila | Luganville | Total |
| 1983 | 158.4 | 52.8 | 211.2 |
| 1984 | 211.2 | 70.4 | 281.6 |
| 1985 | 264.0 | 88.0 | 352.0 |
| 1986 | 316.8 | 105.6 | 422.4 |
| 1987-- | 343.2 | 114.4 | 457.6 |

(c) Yearly water charges

Table 4.7 show the yearly charges of water for the projects, including personal use and operation water.

Table 4.7 Yearly Water charges (VT/year)

| Year | Port Vila | Luganville | Total |
|--------|-----------|------------|--------|
| 1983 | 6,621 | 1,270 | 7,891 |
| 1984 | 8,364 | 1,495 | 9,959 |
| 1985 | 10,106 | 1,921 | 12,027 |
| 1986 | 11,848 | 2,247 | 14,095 |
| 1987-- | 12,720 | 2,409 | 15,129 |

(4) Maintenance costs

Estimating maintenance costs at 1.5% of construction costs (including contingency), they are calculated as follows:

--Port Vila : 28,632,450 VT X 0.015 = 429,487 VT/year

--Luganville: 6,227,100 VT X 0.015 = 93,407 VT/year

total = 522,887 VT/year

(5) Depreciation costs

Table 4.8 indicates depreciation costs, calculated by setting the values of the facilities at zero at the end of their durable years (30 years for structures, 10 years for refrigeration equipment, etc.).

Table 4-8 Construction and Depreciation Costs (VT)

| Sub-project | Structures | | Facilities | | Total | |
|--------------|-------------------|----------------|-------------------|------------------|-------------------|------------------|
| | Const. | Deprc. | Const. | Deprc. | Const. | Deprc. |
| Port Vila | 13,736,250 | 457,875 | 14,896,200 | 1,489,620 | 28,632,450 | 1,947,495 |
| Luganville | 2,767,600 | 92,253 | 3,459,500 | 345,950 | 6,227,100 | 458,203 |
| Total | 16,503,850 | 550,128 | 18,355,700 | 1,855,570 | 34,859,550 | 2,385,698 |

* Construction costs include 10% contingency.

4-2-5 Financial evaluation

- (1) Tables 4.9 - 4.11 show the estimated expenditures and revenues based on the preceding. The size of the operation in Port Vila is large in comparison to that in Luganville, but the profitability is not so good. Though annual proceeds will continue to be in the red for the three years from 1983 to 1985, however, the annual proceeds for 1986 will be in the black, and by 1987 total proceeds will have shown a profit, making the project at Port Vila a viable enterprise.

Luganville shows high profitability. Annual proceeds and total business showings will both register a profit by the second year (1984).

Looking at Port Vila and Luganville as one collective project, by the third year (1985) annual proceeds will show a profit and by the fourth year (1986), total business showings will be in the black.

It is therefore quite possible that both projects, separately and collectively, will become viable enterprises.

Considering Port Vila and Luganville as one single project, in the first year, earnings before depreciation will be in the red, and there will be a lack of operating funds, but any investment by the government or banks can be repaid with interest by the second year.

(2) Financial Internal Rate of Return (FIRR)

The Financial Internal Rate of Return (FIRR) is determined from the annual expenditures--construction costs (initial investments and reinvestments) and operating costs (excluding depreciation)--and the annual sales revenues (fish sales margin). (see tables 4.12 - 4.14)

FIRR is calculated in the following way and determines what interest rate is applicable to investments made during the life of the project.

$$\sum_{t=0}^n \frac{R_t - C_t}{(1+i)^t} = 0$$

R_t : t X yearly receipts
 C_t : t X yearly expenditures
 i : FIRR
 n : duration of project

The FIRR of each sub-project separately and both collectively, from tables 4.15 - 4.17, are as follows:

Port Vila : 6.6%
 Luganville : 19.8%
 Port Vila and
 Luganville : 9.4%

Because initial investment in this project is to be supplied by Japan in the form of an economic cooperation grant, no money will be borrowed at first. If the FIRR is positive, therefore, the project represents a viable enterprise.

In this financial evaluation, fish sales margins were set at 75 VT/kg, but sensitivity of the FIRR in relation to the decrease of revenues is indicated in Fig. - 4.1.

For Port Vila, a sales margin of 62VT/kg (17% decrease), for Luganville 42 VT/kg (45% decrease), and for Port Vila and Luganville collectively 57 VT/kg (24% decrease) are the bottom lines for profit.

Table 4-9 Operating Costs and Revenues

| | | (VT) | | | | |
|----------|--------------------------------|-----------|-----------|-----------|-----------|------------|
| Year | | 1983 | 1984 | 1985 | 1986 | 1987 |
| Revenues | Fish Sales | 4,860,000 | 6,480,000 | 8,100,000 | 9,720,000 | 10,530,000 |
| Costs | Personnel expenditures | 594,000 | 594,000 | 594,000 | 594,000 | 594,000 |
| | Electricity | 4,306,722 | 4,306,722 | 5,364,480 | 5,364,480 | 5,364,480 |
| | Water | 6,621 | 8,364 | 10,106 | 11,848 | 12,720 |
| | Maintenance | 429,487 | 429,487 | 429,487 | 429,487 | 429,487 |
| | Depreciation | 1,947,495 | 1,947,495 | 1,947,495 | 1,947,495 | 1,947,495 |
| | Total | 7,284,325 | 7,286,068 | 8,345,568 | 8,347,310 | 8,348,182 |
| | Interest (before depreciation) | 476,830 | 1,141,427 | 1,701,927 | 3,320,185 | 4,129,313 |
| | Profit | 2,424,325 | 806,068 | 245,568 | 1,372,690 | 2,181,818 |
| | Total profit | 2,424,325 | 3,230,393 | 3,475,961 | 2,103,271 | 78,547 |

Table 4-10 Operating Costs and Revenues

| | | (VT) | | | | |
|----------|--------------------------------|-----------|-----------|-----------|-----------|-----------|
| Year | | 1983 | 1984 | 1985 | 1986 | 1987 |
| Revenues | Fish Sales | 1,620,000 | 2,160,000 | 2,700,000 | 3,240,000 | 3,510,000 |
| Costs | Personnel expenditures | 250,800 | 250,800 | 250,800 | 250,800 | 250,800 |
| | Electricity | 952,754 | 952,754 | 1,061,330 | 1,061,330 | 1,061,330 |
| | Water | 1,270 | 1,595 | 1,921 | 2,247 | 2,409 |
| | Maintenance | 93,407 | 93,407 | 93,407 | 93,407 | 93,407 |
| | Depreciation | 438,203 | 438,203 | 438,203 | 438,203 | 438,203 |
| | Total | 1,736,434 | 1,736,759 | 1,845,661 | 1,845,987 | 1,846,149 |
| | Interest (before depreciation) | 321,769 | 861,444 | 1,292,542 | 1,832,216 | 2,102,054 |
| | Profit | 116,434 | 423,241 | 854,339 | 1,394,013 | 1,663,851 |
| | Total profit | 116,434 | 306,807 | 1,161,146 | 2,555,159 | 4,219,000 |

Table 4-11 Operating Costs and Revenues

| | | (VT) | | | | |
|----------|--------------------------------|-----------|-----------|------------|------------|------------|
| Year | | 1983 | 1984 | 1985 | 1986 | 1987 |
| Revenues | Fish Sales | 6,480,000 | 8,640,000 | 10,800,000 | 12,960,000 | 14,040,000 |
| Costs | Personnel expenditures | 844,800 | 844,800 | 844,800 | 844,800 | 844,800 |
| | Electricity | 5,259,476 | 5,259,476 | 6,425,810 | 6,425,810 | 6,425,810 |
| | Water | 7,891 | 9,959 | 12,027 | 14,095 | 15,129 |
| | Maintenance | 522,894 | 522,894 | 522,894 | 522,894 | 522,894 |
| | Depreciation | 2,385,698 | 2,385,698 | 2,385,698 | 2,385,678 | 2,385,698 |
| | Total | 9,020,759 | 9,022,827 | 10,191,299 | 10,193,297 | 10,194,331 |
| | Interest (before depreciation) | 155,061 | 2,002,871 | 2,994,469 | 5,152,401 | 6,231,367 |
| | Profit | 2,540,759 | 382,827 | 608,771 | 2,766,703 | 3,845,669 |
| | Total profit | 2,540,759 | 2,923,586 | 2,314,815 | 451,888 | 4,297,557 |

Table 4-12 Expenditures and Receipts by years

Port Vila (1000VT)

| Expenditures | | | | |
|--------------|-------------------|-----------------|--------|----------|
| Year | Construction Cost | Operating Costs | Total | Receipts |
| 1982 | 31,932 | 0 | 31,932 | 0 |
| 1983 | 0 | 5,337 | 5,337 | 4,860 |
| 1984 | 0 | 5,339 | 5,339 | 6,480 |
| 1985 | 0 | 6,398 | 6,398 | 8,100 |
| 1986 | 0 | 6,400 | 6,400 | 9,720 |
| 1987 | 0 | 6,401 | 6,401 | 10,530 |
| 1988 | 0 | 6,401 | 6,401 | 10,530 |
| 1989 | 0 | 6,401 | 6,401 | 10,530 |
| 1990 | 0 | 6,401 | 6,401 | 10,530 |
| 1991 | 0 | 6,401 | 6,401 | 10,530 |
| 1992 | 14,896 | 6,401 | 21,297 | 10,530 |
| 1993 | 0 | 6,401 | 6,401 | 10,530 |
| 1994 | 0 | 6,401 | 6,401 | 10,530 |
| 1995 | 0 | 6,401 | 6,401 | 10,530 |
| 1996 | 0 | 6,401 | 6,401 | 10,530 |
| 1997 | 0 | 6,401 | 6,401 | 10,530 |
| 1998 | 0 | 6,401 | 6,401 | 10,530 |
| 1999 | 0 | 6,401 | 6,401 | 10,530 |
| 2000 | 0 | 6,401 | 6,401 | 10,530 |
| 2001 | 0 | 6,401 | 6,401 | 10,530 |
| 2002 | 14,896 | 6,401 | 21,297 | 10,530 |
| 2003 | 0 | 6,401 | 6,401 | 10,530 |
| 2004 | 0 | 6,401 | 6,401 | 10,530 |
| 2005 | 0 | 6,401 | 6,401 | 10,530 |
| 2006 | 0 | 6,401 | 6,401 | 10,530 |
| 2007 | 0 | 6,401 | 6,401 | 10,530 |
| 2008 | 0 | 6,401 | 6,401 | 10,530 |
| 2009 | 0 | 6,401 | 6,401 | 10,530 |
| 2010 | 0 | 6,401 | 6,401 | 10,530 |
| 2011 | 0 | 6,401 | 6,401 | 10,530 |
| 2012 | 0 | 6,401 | 6,401 | 10,530 |

Table 4-13 Expenditures and Receipts by years

Luganville (1000VT)

| Expenditures | | | | |
|--------------|-------------------|-----------------|-------|----------|
| Year | Construction Cost | Operating Costs | Total | Receipts |
| 1982 | 6,945 | 0 | 6,945 | 0 |
| 1983 | 0 | 1,298 | 1,298 | 1,620 |
| 1984 | 0 | 1,299 | 1,299 | 2,160 |
| 1985 | 0 | 1,407 | 1,407 | 2,700 |
| 1986 | 0 | 1,408 | 1,408 | 3,240 |
| 1987 | 0 | 1,408 | 1,408 | 3,510 |
| 1988 | 0 | 1,408 | 1,408 | 3,510 |
| 1989 | 0 | 1,408 | 1,408 | 3,510 |
| 1990 | 0 | 1,408 | 1,408 | 3,510 |
| 1991 | 0 | 1,408 | 1,408 | 3,510 |
| 1992 | 3,460 | 1,408 | 4,868 | 3,510 |
| 1993 | 0 | 1,408 | 1,408 | 3,510 |
| 1994 | 0 | 1,408 | 1,408 | 3,510 |
| 1995 | 0 | 1,408 | 1,408 | 3,510 |
| 1996 | 0 | 1,408 | 1,408 | 3,510 |
| 1997 | 0 | 1,408 | 1,408 | 3,510 |
| 1998 | 0 | 1,408 | 1,408 | 3,510 |
| 1999 | 0 | 1,408 | 1,408 | 3,510 |
| 2000 | 0 | 1,408 | 1,408 | 3,510 |
| 2001 | 0 | 1,408 | 1,408 | 3,510 |
| 2002 | 3,460 | 1,408 | 4,868 | 3,510 |
| 2003 | 0 | 1,408 | 1,408 | 3,510 |
| 2004 | 0 | 1,408 | 1,408 | 3,510 |
| 2005 | 0 | 1,408 | 1,408 | 3,510 |
| 2006 | 0 | 1,408 | 1,408 | 3,510 |
| 2007 | 0 | 1,408 | 1,408 | 3,510 |
| 2008 | 0 | 1,408 | 1,408 | 3,510 |
| 2009 | 0 | 1,408 | 1,408 | 3,510 |
| 2010 | 0 | 1,408 | 1,408 | 3,510 |
| 2011 | 0 | 1,408 | 1,408 | 3,510 |
| 2012 | 0 | 1,408 | 1,408 | 3,510 |

Table 4-14 Expenditures and Receipts by years

Port Vila and Luganville (1000VT)

| Expenditures | | | | |
|--------------|-------------------|-----------------|--------|----------|
| Year | Construction Cost | Operating Costs | Total | Receipts |
| 1982 | 38,876 | 0 | 38,876 | 0 |
| 1983 | 0 | 6,635 | 6,635 | 6,480 |
| 1984 | 0 | 6,637 | 6,637 | 8,640 |
| 1985 | 0 | 6,806 | 7,806 | 10,800 |
| 1986 | 0 | 7,808 | 7,808 | 12,960 |
| 1987 | 0 | 7,809 | 7,809 | 14,040 |
| 1988 | 0 | 7,809 | 7,809 | 14,040 |
| 1989 | 0 | 7,809 | 7,809 | 14,040 |
| 1990 | 0 | 7,809 | 7,809 | 14,040 |
| 1991 | 0 | 7,809 | 7,809 | 14,040 |
| 1992 | 18,356 | 7,809 | 26,165 | 14,040 |
| 1993 | 0 | 7,809 | 7,809 | 14,040 |
| 1994 | 0 | 7,809 | 7,809 | 14,040 |
| 1995 | 0 | 7,809 | 7,809 | 14,040 |
| 1996 | 0 | 7,809 | 7,809 | 14,040 |
| 1997 | 0 | 7,809 | 7,809 | 14,040 |
| 1998 | 0 | 7,809 | 7,809 | 14,040 |
| 1999 | 0 | 7,809 | 7,809 | 14,040 |
| 2000 | 0 | 7,809 | 7,809 | 14,040 |
| 2001 | 0 | 7,809 | 7,809 | 14,040 |
| 2002 | 18,356 | 7,809 | 26,165 | 14,040 |
| 2003 | 0 | 7,809 | 7,809 | 14,040 |
| 2004 | 0 | 7,809 | 7,809 | 14,040 |
| 2005 | 0 | 7,809 | 7,809 | 14,040 |
| 2006 | 0 | 7,809 | 7,809 | 14,040 |
| 2007 | 0 | 7,809 | 7,809 | 14,040 |
| 2008 | 0 | 7,809 | 7,809 | 14,040 |
| 2009 | 0 | 7,809 | 7,809 | 14,040 |
| 2010 | 0 | 7,809 | 7,809 | 14,040 |
| 2011 | 0 | 7,809 | 7,809 | 14,040 |
| 2012 | 0 | 7,809 | 7,809 | 14,040 |

Table 4-15 FIRR Calculation Table (Port Vila)

| IRR = 6.6% | | | | (1000VT) |
|------------|-------|---------|--------|---------------------|
| YEAR | COST | BENEFIT | (B-C) | PRESENT VALUE (B-C) |
| 1982 | 31932 | 0 | -31932 | -31932 |
| 1983 | 5337 | 4860 | -447 | -447 |
| 1984 | 5339 | 6480 | 1141 | 1004 |
| 1985 | 6398 | 8100 | 1702 | 1405 |
| 1986 | 6400 | 9720 | 3320 | 2571 |
| 1987 | 6401 | 10530 | 4129 | 3000 |
| 1988 | 6401 | 10530 | 4129 | 2814 |
| 1989 | 6401 | 10530 | 4129 | 2640 |
| 1990 | 6401 | 10530 | 4129 | 2476 |
| 1991 | 6401 | 10530 | 4129 | 2323 |
| 1992 | 21297 | 10530 | -10767 | -5682 |
| 1993 | 6401 | 10530 | 4129 | 2044 |
| 1994 | 6401 | 10530 | 4129 | 1918 |
| 1995 | 6401 | 10530 | 4129 | 1799 |
| 1996 | 6401 | 10530 | 4129 | 1688 |
| 1997 | 6401 | 10530 | 4129 | 1583 |
| 1998 | 6401 | 10530 | 4129 | 1485 |
| 1999 | 6401 | 10530 | 4129 | 1393 |
| 2000 | 6401 | 10530 | 4129 | 1307 |
| 2001 | 6401 | 10530 | 4129 | 1226 |
| 2002 | 21297 | 10530 | -10767 | -2999 |
| 2003 | 6401 | 10530 | 4129 | 1079 |
| 2004 | 6401 | 10530 | 4129 | 1012 |
| 2005 | 6401 | 10530 | 4129 | 949 |
| 2006 | 6401 | 10530 | 4129 | 891 |
| 2007 | 6401 | 10530 | 4129 | 835 |
| 2998 | 6401 | 10530 | 4129 | 784 |
| 2009 | 6401 | 10530 | 4129 | 735 |
| 2010 | 6401 | 10530 | 4129 | 690 |
| 2011 | 6401 | 10530 | 4129 | 647 |
| 2012 | 6401 | 10530 | 4129 | 607 |
| TOTAL | | | | -158 |

Table 4-16 FIRR Calculation Table (Luganville)

| IRR = 19.8% | | | | (1000VT) |
|-------------|------|---------|-------|---------------------------|
| YEAR | COST | BENEFIT | (B-C) | PRESENT VALUE (B-C) |
| 1982 | 6945 | 0 | -6945 | -6945 |
| 1983 | 1298 | 1620 | 322 | 269 |
| 1984 | 1299 | 2160 | 861 | 600 |
| 1985 | 1407 | 2700 | 1293 | 752 |
| 1986 | 1408 | 3240 | 1832 | 889 |
| 1987 | 1408 | 3510 | 2102 | 852 |
| 1988 | 1408 | 3510 | 2102 | 711 |
| 1989 | 1408 | 3510 | 2102 | 594 |
| 1990 | 1408 | 3510 | 2102 | 495 |
| 1991 | 1408 | 3510 | 2102 | 414 |
| 1992 | 4868 | 3510 | -1358 | -223 |
| 1993 | 1408 | 3510 | 2102 | 288 |
| 1994 | 1408 | 3510 | 2102 | 241 |
| 1995 | 1408 | 3510 | 2102 | 201 |
| 1996 | 1408 | 3510 | 2102 | 168 |
| 1997 | 1408 | 3510 | 2102 | 140 |
| 1998 | 1408 | 3510 | 2102 | 117 |
| 1999 | 1408 | 3510 | 2102 | 97 |
| 2000 | 1408 | 3510 | 2102 | 81 |
| 2001 | 1408 | 3510 | 2102 | 68 |
| 2002 | 4868 | 3510 | -1358 | -37 |
| 2003 | 1408 | 3510 | 2102 | 47 |
| 2004 | 1408 | 3510 | 2102 | 39 |
| 2005 | 1408 | 3510 | 2102 | 33 |
| 2006 | 1408 | 3510 | 2102 | 28 |
| 2007 | 1408 | 3510 | 2102 | 23 |
| 2008 | 1408 | 3510 | 2102 | 19 |
| 2009 | 1408 | 3510 | 2102 | 16 |
| 2010 | 1408 | 3510 | 2102 | 13 |
| 2011 | 1408 | 3510 | 2102 | 11 |
| 2012 | 1408 | 3510 | 2102 | 9 |
| TOTAL | | | | 11 |

Table 4-17 FIRR Calculation Table
(Port Vila and Luganville)

| IRR = 9.4% | | | | (1000VT) |
|------------|-------|---------|--------|---------------------------|
| YEAR | COST | BENEFIT | (B-C) | PRESENT VALUE (B-C) |
| 1982 | 38876 | 0 | -38876 | -38876 |
| 1983 | 6635 | 6480 | -155 | -142 |
| 1984 | 6637 | 8640 | 2003 | 1674 |
| 1985 | 7806 | 10800 | 2994 | 2287 |
| 1986 | 7808 | 12960 | 5152 | 3597 |
| 1987 | 7809 | 14040 | 6231 | 3976 |
| 1988 | 7809 | 14040 | 6231 | 3635 |
| 1989 | 7809 | 14040 | 6231 | 3322 |
| 1990 | 7809 | 14040 | 6231 | 3037 |
| 1991 | 7809 | 14040 | 6231 | 2776 |
| 1992 | 26165 | 14040 | -12125 | -4938 |
| 1993 | 7809 | 14040 | 6231 | 2319 |
| 1994 | 7809 | 14040 | 6231 | 2120 |
| 1995 | 7809 | 14040 | 6231 | 1938 |
| 1996 | 7809 | 14040 | 6231 | 1771 |
| 1997 | 7809 | 14040 | 6231 | 1619 |
| 1998 | 7809 | 14040 | 6231 | 1480 |
| 1999 | 7809 | 14040 | 6231 | 1353 |
| 2000 | 7809 | 14040 | 6231 | 1237 |
| 2001 | 7809 | 14040 | 6231 | 1130 |
| 2002 | 26165 | 14040 | -12125 | -2011 |
| 2003 | 7809 | 14040 | 6231 | 944 |
| 2004 | 7809 | 14040 | 6231 | 863 |
| 2005 | 7809 | 14040 | 6231 | 789 |
| 2006 | 7809 | 14040 | 6231 | 721 |
| 2007 | 7809 | 14040 | 6231 | 659 |
| 2008 | 7809 | 14040 | 6231 | 603 |
| 2009 | 7809 | 14040 | 6231 | 551 |
| 2010 | 7809 | 14040 | 6231 | 504 |
| 2011 | 7809 | 14040 | 6231 | 460 |
| 2012 | 7809 | 14040 | 6231 | 421 |
| TOTAL | | | | -179 |

PART 5 CONCLUSIONS AND RECOMMENDATIONS

5-1 Conclusions

Most of the Republic of Vanuatu's industries remain at the level of the individual producer-consumer. Copra, marine products, beef, small-scale mining, and the tourism all present potential means of obtaining foreign currency, but exports of copra and beef will be difficult to increase, and mining resources (manganese) will likely be depleted after several years.

Up to this point, fisheries within the 200 nautical miles of waters around Vanuatu has not progressed beyond one-man operations as an industry, but residents have a high regard for fish as a food, and estimates of present consumption levels put consumption of fish at 15 kg/person/year, about 1/3 of which is supplied by imported canned fish. The Government of Vanuatu is therefore planning the promotion of coastal fisheries, and part of their plan is already being implemented.

Looking at the projects included in the present request and their long-range effects, the results can be categorized as follows:
--an increase in national production levels
--domestic production of goods as import substitutes
--possible acquisition of foreign currency

The fish market in Port Vila and the ice-making and refrigeration facilities in Luganville represent the model projects for essential infra-structures, and will undoubtedly provide a great stimulus to domestic coastal fisheries, as planned by the government of Vanuatu.

The government fishing gear store, repair tools, jetty, retaining wall and slip way, all under the jurisdiction of the Fisheries Department, are also extremely useful infra-structures for the government-led promotion of fisheries. Because electricity rates are unusually high, however, it is important that the government apply the lowest possible rates to the project facilities.

5-2 Recommendations

Concerning follow-up operations:

- (1) Fishing ports (for the village fishing units) and larger fishing boats (boat construction), and so on represent essential infra-structures necessary for the increased production of marine products, and must be encouraged as planned.
- (2) This project will cover 70% of volumes of fish deal in Port Vila in future, not the whole. So Vanuatu's determination to help itself by its own efforts is indispensable to the long-range success of this project.

(3) Management operations

To encourage the sound management systems of the fish market (Port Vila), and the ice-making and refrigeration facilities (Luganville), due care must be taken in over-seeing the training of technicians and the comission system, etc.

Again, particularly in regard to electricity rates, careful consideration would seem to be of high priority.

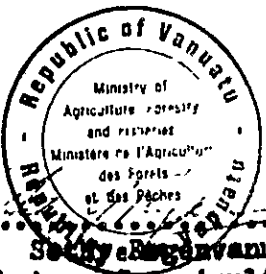
MINUTES OF DISCUSSIONS

In response to the request made by the Government of the Republic of Vanuatu for the Project of Fisheries Development at Port Vila and Luganville. (hereinafter referred to as "the Project"), the Government of Japan has sent, through the Japan International Co-operation Agency (hereinafter referred to as "JICA"), a team headed by Shigeo Miyamoto to conduct a basic design survey for 12 days from December 9th 1981. The team had a series of discussions and exchanged views with the authorities concerned.

As a result of the study and discussions, both parties have agreed to recommend to their respective Governments to examine the results of the survey attached herewith towards the realization of the Project.

December 18th, 1981

Shigeo Miyamoto
.....
Shigeo Miyamoto
Team Leader
The Japanese Survey Team


Sallye Rugevanni
Minister Of Agriculture,
Forestry, Fisheries & Land.

M I N U T E S

1. The proposed sites of the Project will be Fisheries Department and Market Place in Port Vila and Market Place in Luganville (hereinafter referred to as "the Project Sites").
2. The object of the Project is to provide necessary facilities and equipment for fisheries development at the Project Sites.
3. The Japanese Survey Team will convey to the Government of Japan the desire of the Government of the Republic of Vanuatu that the former takes necessary measures to co-operate in implementing the Project and provides the facilities and equipment listed in Annex I within the scope of Japanese economic co-operation in grant form.
4. The Government of the Republic of Vanuatu will take necessary measures, in the event that the grant assistance by the Government of Japan is extended to the Project -
 - (a) to provide data and information necessary for the design and the construction of the facilities.
 - (b) to secure lands necessary for the construction of the facilities.
 - (c) to clear and level the Project Sites before the start of the construction.

S-M.

- (d) to provide the other items listed in Annex II
- (e) to ensure prompt unloading and customs clearance in the Republic of the Vanuatu of imported materials and equipment for the construction, and to facilitate their internal transport.
- (f) to exempt the Japanese nationals concerned from customs duties, internal taxes and other fiscal levies imposed in the Republic of Vanuatu for the supply of goods and services for construction.
- (g) to provide and accord necessary permissions, licenses and other authorization deemed advisable for carrying out the Project.

A N N E X I

Items requested by the Government of Vanuatu
the cost of which will be borne by the Government of Japan
and the priority order, is shown as follows -

1) Facilities

- (a) Fish market
- (b) Fish preservation facilities
- (c) Retaining wall
- (d) Jetty
- (e) Small boat slipway
- (f) Government fisheries store

2) Equipment to be supplied for :

- (a) Fish market
- (b) Fish preservation facilities
- (c) Small boat slipway
- (d) Government fisheries store

3) Tools and equipment for Fisheries Department's
vessels and fishing gear.

S. M.

A N N E X I I

Items the cost of which will be borne by the Government
of Vanuatu.

- (1) Water supply mains to the Project Sites.
- (2) External drainage and sewage line to the
Project Sites.
- (3) Electrical power main line to the Project
Sites.
- (4) Exterior facilities like access roads,
fencing, parking and landscaping.
- (5) Provision of space necessary for such
constructions as temporary offices,
working area, stock yards, and others.
- (6) Items (1) and (3) shall be completed
prior to the start of site works.

J. M.

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