BASIC DESIGN STUDY REPORT
ON
THE DOMESTIC TRANSPORTATION STRENGTHENING PROJECT
IN
WESTERN SAMOA

DECEMBER 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of Western Samoa , the Government of Japan decided to conduct a Basic Design Study on the Domestic Transportation Strengthening Project and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Western Samoa a study team headed by Mr. Yoshikazu Kawasaki, Director of Planning Department, Overseas Coastal Area Development Institute of Japan from July 15th to August 11th, 1984.

The team had discussions with the officials concerned of the Government of Western Samoa and conducted a field survey. 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.

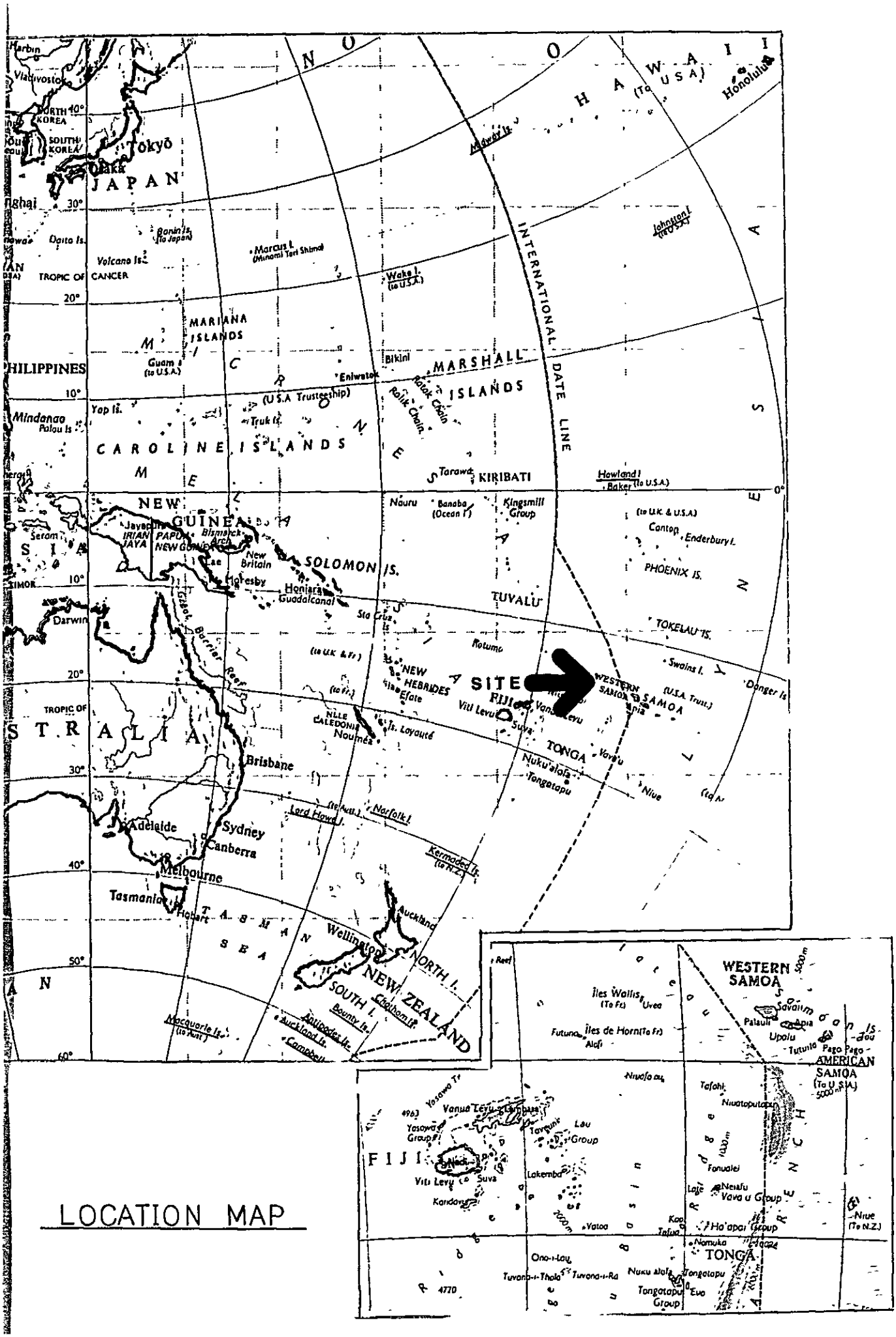
I wish to express my deep appreciation to the officials concerned of the Government of Western Samoa for their close cooperation extended to the team.

December, 1984

Keisuke Arita

President

Japan International Cooperation Agency



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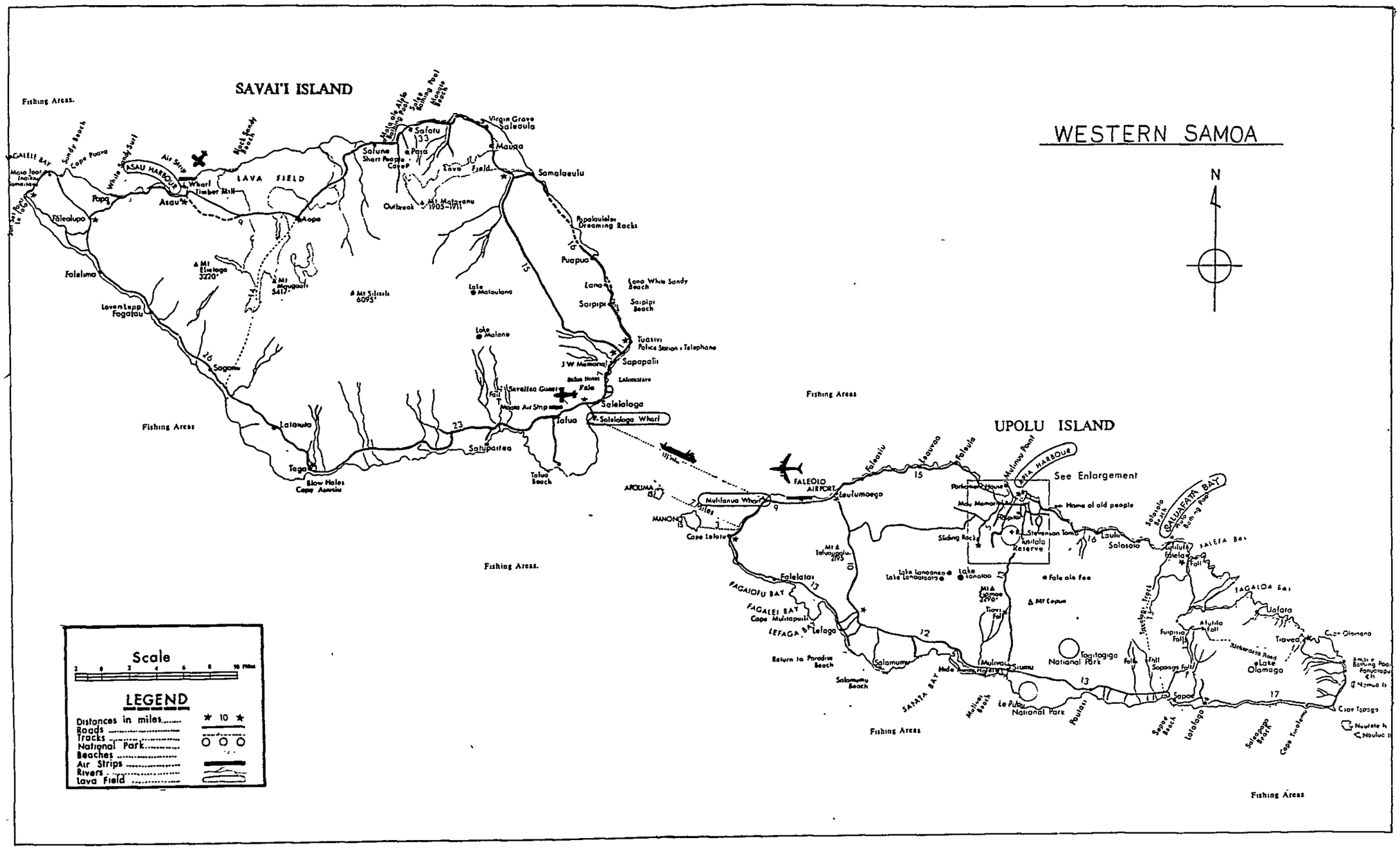
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See Enlargement
ASAU HARBOUR
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FALEOLO AIRPORT
APIA HARBOUR
Scale
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Distances in miles
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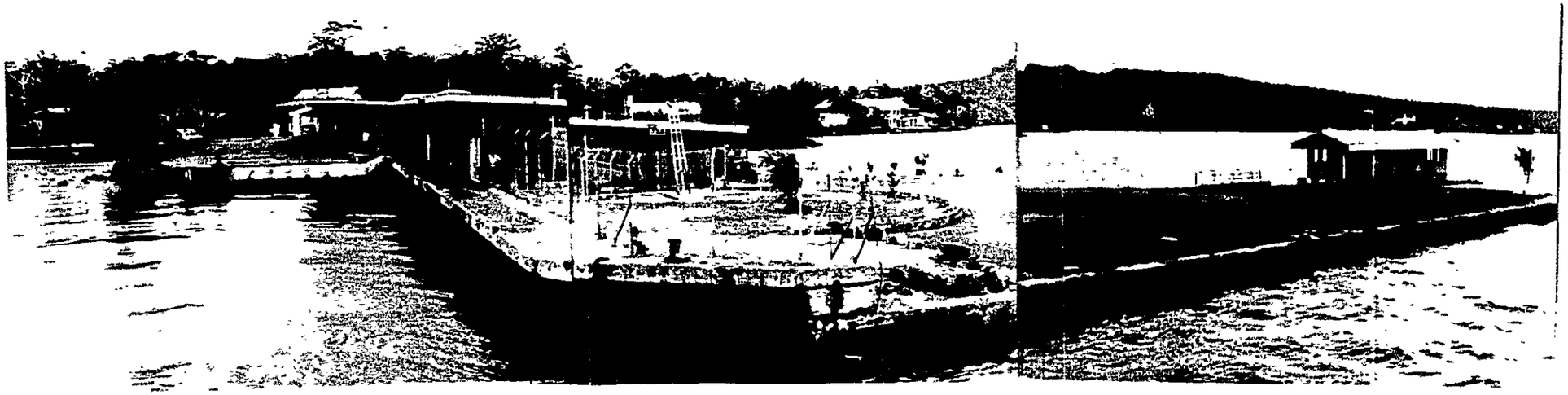
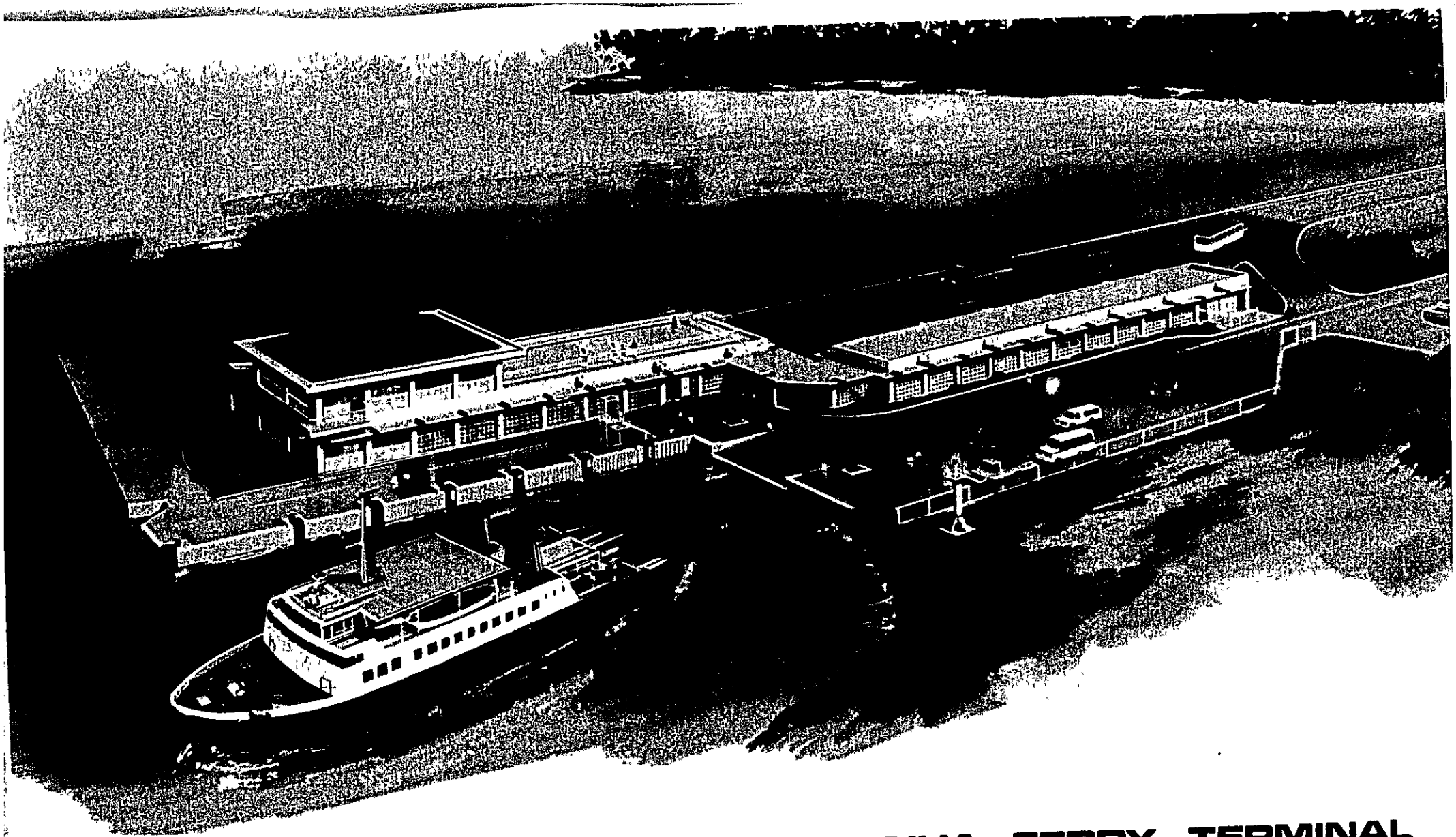
PHOTO EXISTING FERRY TERMINAL
MULIFANUA

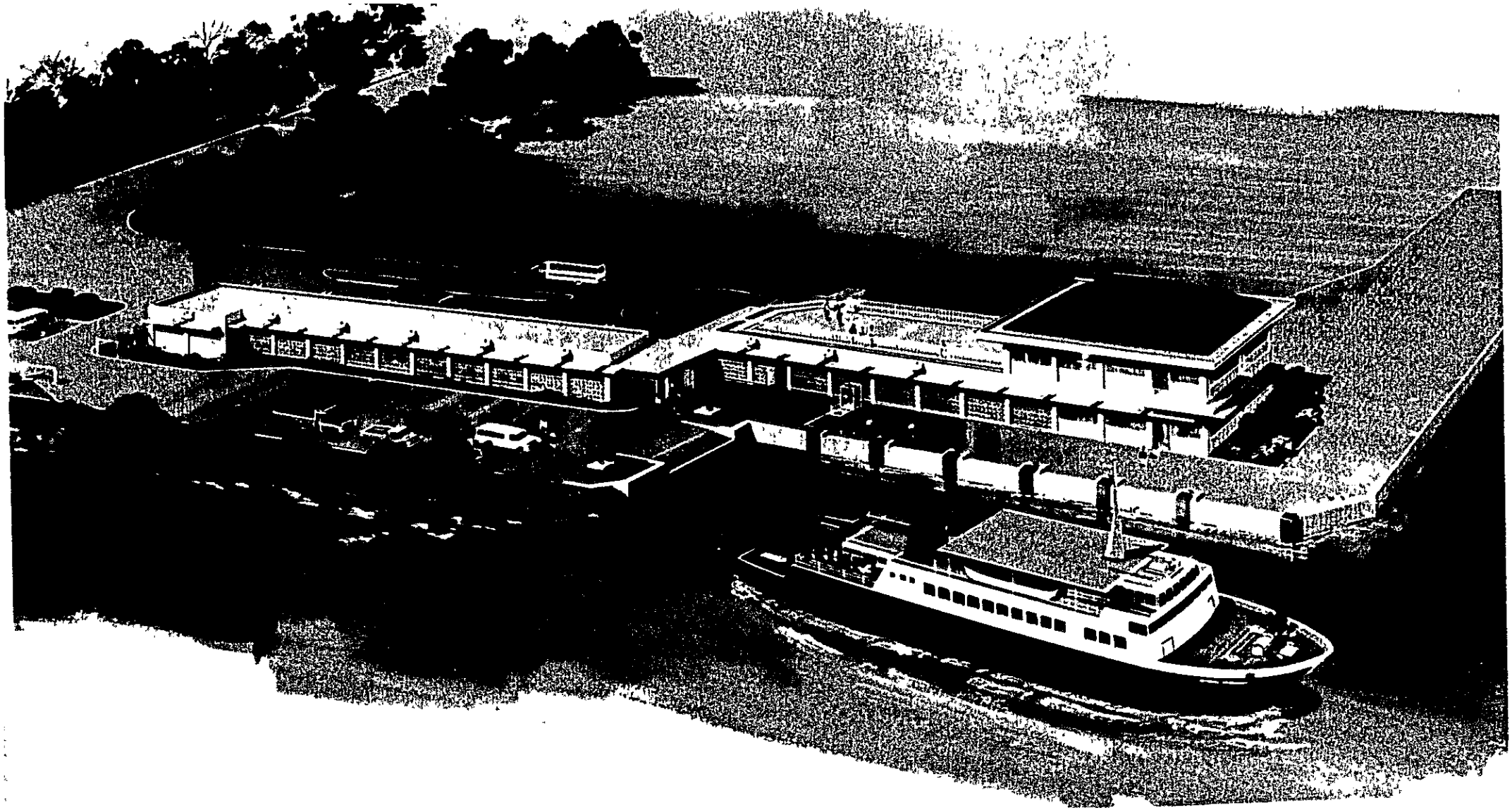
SALELOLOGA





MULIFANUA FERRY TERMINAL

JAPAN INTERNATIONAL COOPERATION AGENCY



SALELOLOGA FERRY TERMINAL

JAPAN INTERNATIONAL COOPERATION AGENCY

BASIC DESIGN STUDY REPORT

ON

THE DOMESTIC TRANSPORTATION STRENGTHENING PROJECT

IN

WESTERN SAMOA

C O N T E N T S

List of Figure and Table

SUMMARY

SUMMARY

Improvement of ferry transportation is one of the most important projects for implementation in the fourth five-year plan (1980-1984).

Since Western Samoa is an island nation, marine transportation plays a very important role in the national development.

Transportation between the two main islands (Upolu and Savai'i) is presently provided by two small ferry boats of the landing craft type.

In order to cope with the increasing demand of passengers and freight traffic, employment of larger ferry boats will be required. Since the present ferry ports are not sufficient to receive larger ferry boats, such as the Queen Salamasia, upgrading of the port facilities is essential and required.

As a related matter, the ferry boats in Western Samoa have been repaired at Fiji and American Samoa because there are no repair facilities in Western Samoa. This repair work performed outside the country has caused economic and time loss.

Faced with this situation, the Government of Western Samoa requested the Government of Japan to extend grant aid for upgrading the ferry ports facilities and for the construction of new ship repair facilities.

The Government of Japan decided to perform a basic design survey for the project based on the request of the Government of Western Samoa. The Japan International Cooperation Agency (JICA) dispatched a survey team, headed Mr. Yoshikazu Kawasaki, Director of Overseas Coastal Area Development Institute, from July 15 to August 11, 1984, and having discussions with the Government of Western Samoa, carried out site survey and data collection.

Based on the results of discussions and surveys, it is believed that improvement of the ferry ports to accommodate larger ferry boats such as the 714 GT Queen Salamasia will significantly strengthen domestic transportation links.

As for the construction of ship repair facilities, the survey team and the Government of Western Samoa recognized the need for further detailed studies including the possibility of technical co-operation to be undertaken as soon as possible.

As a conclusion, it is recommended that the following be implemented for the domestic transportation strengthening project as a grant aid by the Government of Japan.

Upgrading of Salelologa and Mulifanua Port Facilities

(1) Improvement of Channel and Turning Basins

- Dredging

(2) Improvement of Berthing Facilities

- Corrosion protection for steel sheet pile wall
- Berthing and mooring facilities

(3) Construction of Ferry Terminal Facilities

- Terminal building
- Bus terminal

The construction period estimated is about 9.5 months.

With the implementation of the upgrading of port facilities mentioned above, larger ferry boats will be able to ply between the islands, and this will contribute to the development of Western Samoa.

CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1-1 Background

The Government of Western Samoa desires to upgrade ferry port facilities at Salelologa and Mulifanua and to construct ship repair facilities.

To implement this project, the Government of Western Samoa requested grant aid to be extended by the Government of Japan.

The project elements requested by the Government of Western Samoa are as follows:

(1) Upgrading the Port Facilities at Salelologa and Mulifanua

1) Port Facilities

a) Dredging of channel and turning basin

Location	Depth	Width
Inner channel	-3.0m	50m
Intermediate channel	-3.5m	60m
Outer channel	-4.0m	70m
Turning basin	-3.0m	120m diameter

b) Improvement of wharf

Installation of fenders

Installation of wood piles at pier

2) Terminal Facilities

a) Construction of terminal building

b) Construction of Security fence

(2) Construction of Slipway and Ship Repair Facilities

To construct slipway and ship repair facilities to handle 700 GT ferry boats.

1-2 Site Survey

Based on the request of the Government of Western Samoa, the Japan International Cooperation Agency dispatched a survey team from July 15 to August 11, 1984 to perform basic design work.

The survey and discussions with the Government of Western Samoa and related parties covered the following topics:

(1) Background of the project and requirements

(2) Scale and details of the requirements

(3) Sites of the ports and ship repair facilities

(4) Operation and maintenance after upgrading of the port facilities and construction of ship repair facilities.

(5) Social and economic conditions

(6) Natural environmental conditions

(7) Present marine transportation and ferry boat operations

(8) Present condition of Salelologa and Mulifanua port facilities

(9) General construction conditions.

The minutes of discussion of basic design study between the survey team and the Government of Western Samoa are attached in Appendix C for reference.

CHAPTER 2

BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 General Description of Western Samoa

2-1-1 Nature and Society

In 1962, Western Samoa became an independent country covering the region placed under UN trusteeship under the administration of New Zealand. Western Samoa is located about 13°45' S latitude and about 172°W longitude. It lies at a distance of about 2,900 km northeast from New Zealand, at a distance of about 1,300 km east from the Fiji Islands and at a distance of about 1,100 km north from the Tonga Islands.

Western Samoa is a country of islands composed of volcanic rock and coral reefs. It abounds in fresh water. Most of the territory is suitable for cultivation. The total land area of the country is about 2,934 km^2, of which 58% (1,700 km^2) is occupied by Savai'i Island, the largest island, and of which 37% (1,100 km^2) is occupied by Upolu Island, the second largest island. These two islands together total 95% of the land area of the country.

Western Samoa is located in the tropical climate zone. The annual average temperature is about 27°C, while the highest temperature reaches 35°C. During the trade wind season from May to November, the temperature is not high and relatively comfortable. The rainy season lasts from December to April, during which hurricanes occasionally pass over the islands causing damage to houses and agricultural crops. The amount of rainfall is considerable: 3,000 mm is the annual average.

The population of the country as of 1981 was 156,000 of which 99% live on Upolu and Savai'i Islands. The population ratio between the two islands is 7:3. The population of the capital, Apia in Upolu Island is approximately 33,000. About 90% of the total population belongs to the Polynesian race. They use both the Samoan language and English, which is approved as the official language.

2-1-2 Politics

The Head of State after the present one will be elected for a term of 5 years by the Legislative Assembly. The first Head of State, His Highness Malietoa Taumafili II, will continue in office for life.

A Prime Minister is elected in the Legislative Assembly. The Prime Minister designates other Ministers who at present are eight. The Legislative Assembly, which is of the single chamber system, consists of 47 members, of which 45 members are mutually elected from among roughly 11,000 persons having the title of "Matai", and two members are elected by popular vote.

2-1-3 Economy

The per capita GDP of Western Samoa is presumed to be 360 U.S. dollars in 1980. The main exports are agriculture and forestry products such as copra, cocoa, taro, bananas, and lumber.

The manufacturing industries of Western Samoa include lumbering, tobacco production, beer brewing, match manufacture, and soap production. Manufacturing industries account for less than 5% of GDP.

2-2 National Development Plan

The Government of Western Samoa has drawn up a series of five year development plans since 1966 for the economic development of the country. The fourth plan (1980-1984) is now under way. The fifth plan (1985-1989) is now being formulated. The first four development plans included a variety of government development projects; 32% for agriculture, 51% for infrastructure, 6% for industries including the tourist industry, 6% for education and sanitation, and 5% for others. The fourth plan under way includes the following five targets:

(1) To increase production, particularly in the case of village agriculture, by working through existing leadership and social organizations.

(2) To move towards true economic independence and self-reliance.

(3) To provide greater opportunities for Western Samoan citizens to participate more actively in the development process.

(4) To ensure a fair distribution of the fruits of economic development and to satisfy the basic economic, social and cultural needs.

(5) To protect and conserve the environment.

The Government of Westen Samoa has planned to strengthen marine transportation system as one of the most important projects for attaining the above-mentioned five targets.

The marine transportation projects includes the followings:

(1) Port operation, administration and development study

(2) Dry docking or slipway facilities study

(3) Repairs to Apia Wharf

(4) Apolima lighthouse

(5) Training school for seamen

(6) Asau channel development study

(7) Mulifanua and Salelologa harbour development studies

2-3 Condition of Domestic Transportation

2-3-1 Land Transportation

The main roads, including the road between Apia and Mulifanua Port in Upolu Island have been almost all paved.

The south coast road between Salelologa and Asau in Savai'i Island has been completely paved, while the northeast road, which is mostly paved, has a few unpaved portions. The total length of pavement of the main roads is 228 km (56%), while the total length of the unpaved portions is 178 km (44%). The number of cars registered is 3,600 in Upolu Island and 400 in Savai'i Island.

Traffic congestion is occasionally observed in Apia city, but generally it is not a major issue. Public buses run regularly between the main destinations in each island, and serve as an important transportation means for the islanders.

Taxis, microbuses and rental cars are available in Apia City. The country does not have any railway facilities.

2-3-2 Marine Transportation

Main ports are Apia Port (International Trade), Asau Port (lumber shipment) and Salelologa Port (ferry base in Savai'i Island), and Mulifanua Port (ferry base in Upolu Island).

Since Western Samoa is an island country, transportation of commodities, agricultural products, imported goods and general goods and movement of persons between the main islands, Upolu Island and Savai'i Island, (11.7 nautical miles) largely depends on marine transportation for their movement.

Due to promotion of the Government of Western Samoa a Savai'i Island development plan, the volume of transportation by the ferries between Mulifanua Port and Salelologa Port, has increased remarkably over the past few years.

In the first year of the fourth five year plan (1980), the number of passengers transported by the ferries was 76,781, and the number of cars transported, 8,156. In the fourth year plan (1983), the number of

passengers transported by the ferries was 120,602, and the number of cars transported by the ferries was 14,387. Thus, the annual average growth rate in traffic for the past 4 years is 15,000 for passengers transported by the ferries, and 1,700 for cars.

2-3-3 Air Transportation

Western Samoa has four domestic airports (Apia and Faleolo in Upolu Island, and Maota and Asau in Savai'i Island) between which two light airplanes with about 10 seats is operated daily by the Polynesian Airline. The number of passengers transported by air between the two islands was 9,187 in 1982 and 13,286 in 1983. This corresponds to about 10% of the number of passengers transported by the ferries.

2-4 Necessity to Strengthen Ferry Transportation

Two small landing-craft type ferries (Puleono: 229 GT, and Salafai: 121 GT) serve as the only marine transportation means connecting the two principal islands of Upolu island and Savai'i Island. The ferries make only two round trips daily regularly between Mulifanua and Salelologa Ports. Thus, the ferries do not have sufficient capacity to increase number of passengers. On festival days such as Christmas Day, and Independence Day, the number of passengers rushing to the terminals frequently cause congestion at the time of boarding.

It should additionally be noted that the ferries are not equipped with a roof to protect the passengers from the elements or with seats, and passengers have been required to travel under inadequate conditions.

Furthermore, since the ferries are small in size, they are affected occasionally by high waves, leading to a problem of safety and regular operation. Particularly during the rainy season (from December to March) rough sea conditions has caused suspension of the shuttle service of the ferries.

Under such circumstances, the Government of Western Samoa introduced the ferry "Queen Salamasian" (714 GT) with the aid of the Australian government in 1977. However, since the port facilities are not suitable for such a large ferry, the Queen Salamasina has been utilized as a ferry-boat only for service between Apia Port and Pago Pago Port to the neighbouring country of American Samoa. The Government desires that the Queen Salamasina be urgently utilized as a ferryboat for service between the two principal islands.

Moreover, for achieving an increase in economic production which is a target of the national development project, effective utilization of the territory in overall aspects is required, for which strengthening of transportation-capacity between the two principal islands is essential.

In view of the above and for coping with increasing the volume of transportation and raising the level of traffic, placing the Queen Salamasina into service as a ferry boat exclusively to be used between the two principal islands is urgently needed. Thus, project elements to be urgently tackled for improvement of port for safe and smooth voyage

of Queen Salamasina will include dredging to widen and deepening the existing channel and improvement of the wharfs.

Additionally, the wooden terminal building now used is superannuated. Part of the roof is deteriorated to where rain intrudes into the building. Thus, construction of a new terminal building and enlargement of facilities is required for coping with the anticipated increase in number of passengers and for their safety.

On the other hand, repair and regular inspection of ferry boats have been carried out at the overseas repair facilities because there is no ferry repair dock in Western Samoa. Therefore this repair work Performed outside Western Samoa has a caused big time and economic loss.

So it is considered to be important that the ferry repair dock should be constructed in Western Samoa in order to inspect or repair the ferries regularly and promptly so that the ferries can transport safely and steadily the passengers and vehicles which are expected to increase in the future.

2-5 Operation of Ferry Services

The ferries in service are managed by the Western Samoa Shipping Corporation, which was founded in 1974 based on governmental investment of almost 100%.

The two ferries, (Puleono and Salafai) now in service between Mulifanua and Salelologa Ports each make two round trips daily during weekdays from Monday to Friday and three round trips on Saturdays and Sundays.

The ferry charges are as follows:

Passengers	
Adult	$ 2
Child	$ 1
Vehicles	
7-ton truck	$ 34
3-ton truck	$ 22
American-made pickup	$ 16
Small pickup	$ 12
Sedan	$ 12
Cargo	$ 32 per 1 m^3

The Shipping Corporation pays the Ministry of Transport $400 per ferry per port per month, and 10 Sene per passenger as the levy for wharfage at the Mulifanua and Salelologa Ports.

CHAPTER 3

CONTENTS OF THE PROJECT

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3-1 Objectives

In order to cope with the increasing demand of passengers and freight traffic between Mulifanua and Salelologa ports, employment of larger ferry boats will be required. Since the present ferry ports are not sufficient to receive larger ferry boats, such as Queen Salamasina, UPGRADING OF THE PORT FACILITIES is essential and required. As a related matter, the ferry boats in Western Samoa have been repaired at Fiji and American Samoa, because there are no repair facilities in Western Samoa. In order to provide the necessary degree of comfort and safety, and to prevent the outflow of currency, it is very important and required that SLIPWAY AND SHIP REPAIR FACILITIES to enable adequate inspection, maintenance and repairs of ferries be constructed in Western Samoa.

3-2 Contents

3-2-1 Upgrading of the Port Facilities

(1) Ferry Transportation Plan

a. Forecast of Transportation by Ferry

The number of passengers and vehicles transported by the ferries between Mulifanua and Salelologa Ports during the past nine years from 1975 to 1983 are shown in Fig. 1. The transportation capacity was restricted before 1979, prior to the introduction of the ferry Puleono.

Since 1979, the number of passengers and vehicles transported by the ferries has increased annually by 15,000 and 1,700, respectively. The volume of traffic is anticipated to increase at such high rates for the next few years considering 5 years as the target year of the plan, the annual traffic to be transported by ferries is forecast to reach 200,000 passengers (550 daily on the average) and 22,000 vehicles (60 daily on the average), respectively in 1988, as shown in Fig. 1.

The scale of transport facilities is planned on the basis that the shuttle service alone can accomodate the traffic without any trouble for 90% of the days each year. According to the records for 1983 (see Appendix-B), the number of passengers per day is distributed with a probability of 90% within a range up to about 1.5 times the average number of passengers per day. Accordingly, taking the concentration rate which is set at a level of 150% in this plan, the daily number of passengers and vehicles using ferries in 1988 can be forecast as follows.

Passengers: $\frac{200,000}{365 \text{ days}} \times 1.5 = 822/\text{day}$

Vehicles: $\frac{22,000}{365 \text{ days}} \times 1.5 = 90/\text{day}$

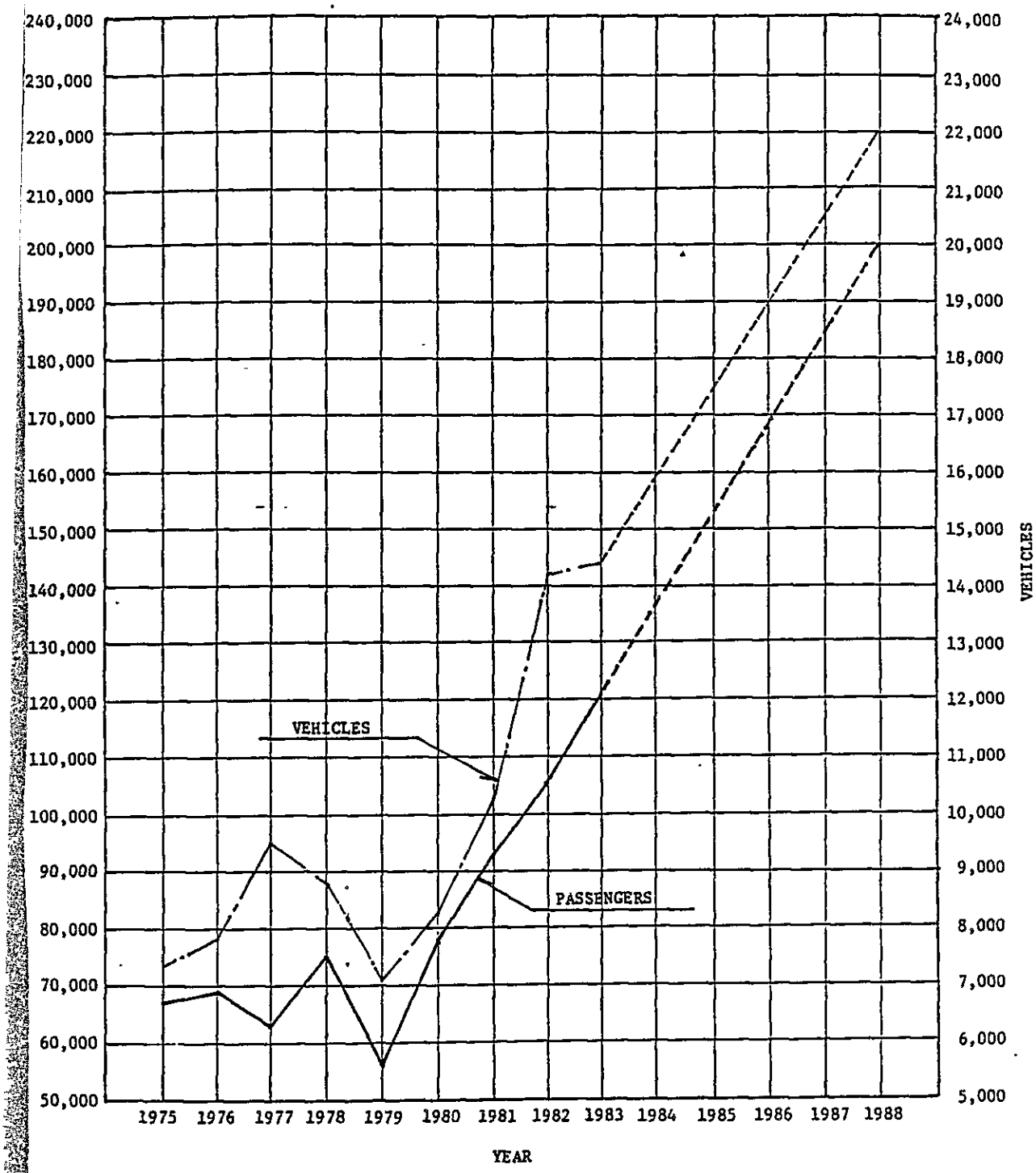
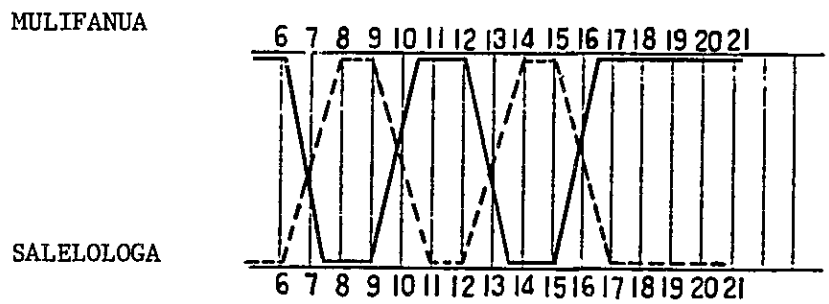


Fig.1 DEMAND FORECAST OF FERRY

b. Transportation Plan

Introduction of the Queen Salamasina for the Mulifanua-Salelologa ferry route will provide the means for transporting 864 passengers and 92 vehicles a day, which coincides with the forecast volume of demand after 5 years, based on a ferry operation schedule as shown in Fig. 2.

Fig. 2 Proposed Ferry Operation Schedule between Mulifanua and Salelologa



Queen Salamasina (Transportation of Passengers 216 per trip)

(Transportation of Vehicles 15 per trip)

Puleono or Salafai (Transportation of Vehicles 15 or 8 per trip)

Volume of Passengers Transported

216 x 4 trip/day = 864/day

Volume of Vehicles Transported

15 x 4 trip/day = 60/day
8 x 4 trip/day = 32/day

Total 92/day

(2) Port Facilities to be upgraded

In order to enable the Queen Salamasina to berth at the ports of Mulifanua and Salelologa, it is required that the port facilities such as channel, turning basin, wharf and terminal facilities be upgraded. The conditions of the existing port facilities and the plans for their upgrading are described as follows.

a. Channel and Turning Basin

Coral reefs extend to about 1.5 km offshore from the wharf in both Mulifanua and Salelologa Ports. The seabed geology is characteristic of coral reefs and there are parts with exposed volcanic rock formations.

The existing channel was dredged in 1972, and the latest hydrographic survey was carried out in 1982. According to the data in the hydrographic survey maps, the channel in Salelologa Ports has a depth of 5.0 m or more and a width of 50 m or more, however, the southwest area of the turning basin has a shoal of 1.2 to 2.0 m in depth which is not sufficient for the Queen Salamasina to navigate.

The minimum depth and the minimum width in the portion of the channel up to about 800 m from the wharf in Mulifanua Ports are 2.4 m and 20m, respectively, which is still not sufficient for the Queen Salamasina, though the portion of the channel over 800 m from the wharf has a depth of 5.0 m or more and a width of 50 m or more. Two shoals (1.2 to 2.0 in depth and 2.9 m in depth), which are also not sufficient for the Queen Salamasina, are located on the east side and the south side, respectively, of the turning basin in Mulifanua Ports. When the Queen Salamasina was introduced into the channel in 1977, an accident occurred and her bottom was damaged in the Mulifanua Port.

Both ports have two leading lights to assist navigation of the ferry.

Channel markers were installed on both sides of the channel in the neighborhood of the wharf to 600 to 900 m offshore. However, some in the Mulifanua Port have been lost.

Moreover, the existing channel markers are without lights causing difficulty in navigation at night. Shuttle service by the ferries during the night is not normally performed at present. However, since the day-time service alone cannot handle the passenger traffic, nighttime service is occasionally performed a few days during the year.

As a result of the survey of the existing channel and turning basin, dredging work should be performed to secure sufficient width and depth to enable ferries of the Queen Salamasina class (700 GT) to navigate.

Table 1 Channel

1) Salelologa Port

		Present Condition	Dredging
a. Turning Basin	Depth Diameter	West East Corner of Turning Basin is -2m ∿ -1.2m	* -3.2 m 120 m
b. Channel	Depth Width	-5.0m or deeper 50 m or more	not required

2) Mulifanua Port

		Present Condition	Dredging
a. Turning Basin	Depth Diameter	East corner of Turning Basin is -1.2m and south -2.9m	* -3.2 m 120 m
b. Channel			
1 500m offshore from berth	Depth	Shallowest -2.5m	* -3.2 m
	Width	30 m	* 50 m
2 500m offshore ∿ 800m	Depth	Shallowest -2.4m	* -3.5 m
	Width	30 m	* 50 m
3 800m offshore	Depth	-5.0m or deeper	not required
	Width	50 m or more	

* Dimensions are explained in Chapter 4.

b. Wharf

The ferry wharves in both ports were built in 1972. The wharves have a length of 45 m with ramps of 9.5 m. The minimum depth in front of the wharf is 3.0 m.

The structure of the wharf is sheet pile type. The splash and tidal zone portions of the steel sheet pile are corroded. Wooden fenders are missing; thus, there is difficulty in berthing.

For emergency use, ramp way should be extended to allow two ferries to berth simultaneously.

Following improvement works of wharf structure should be executed in this project.

Table 2 Improvement Work of Wharf

(per one port)

	Present condition	Works*
a. Corrosion Protection	none	Front surface of steel sheet Pile wall between +2m and -0.5m should be protected with concrete
b. Fender	none	Berthing:400Hx4,000L 1 set Ramp way:400Hx 700L 6 sets Corner :2-250Hx750L 3 sets
c. Mooring Bitt	for 5 ton, 5 sets	for 25 ton 3 sets for 15 ton 6 sets
d. Fender Pile	SSP combined	Steel Pipe Pile with Fender
e. Emergency Berth	None	Ramp Way made of concrete block

* Size and grade of the works are explained in Chapter 4.

c. Terminal Facilities

Both of the ports have substantially the same size of wooden terminal facilities, which are superannuated because they were built more than ten years ago. Their roofs are partially damaged allowing rain to leak into the facilities. On festival days such as on Christmas and Independence Day, as well as weekends, about 1,000 passengers utilize the terminal facilities, which lack waiting rooms, announcement facilities, safety fence and stairs for guiding passengers safely. This causes frequent congestion and trouble at the time of purchasing tickets and in boarding.

The terminal facilities include bus terminals since both ferry terminal facilities are located some distance away from the village, hence, most of passengers use the buses for travel between the town and the terminals.

Following terminal facilities should be planned for the safe operation of ferry terminals.

Table 3 Terminal Facilities

(per each port)

Facilities	Prevent Condition	Works and Equipment
1) Terminal Facilities a. Ferry Passenger Terminal b. Bus terminal	Superannuated wood structure Wall: Wood or Wire Net Floor: Concrete Roof: Sheet Zinc Total Area: 536 m^2	Roof and Column: Reinforced Concrete Wall: Hollow Block, Screen Block Roof: Concrete and Asbestos Board Floor: Concrete a. 560 m^2 b. 240 m^2
2) Security facilities a. Moveable Stair b. Announcement facilities c. Fence d. Gate	Fence (60m) and gate (1 unit) are superannuated. No moveable stair and announcement facilities are provided.	a. Aluminium 1 set b. 1 unit c. Steel 100 m d. Steel 2 units

3-2-2 SLIPWAY AND SHIP REPAIR FACILITY

At present, there are no facilities for the repair of vessels in Western Samoa so that there is no option but to route these three vessels to either Fiji or to American Samoa when periodic inspection or maintenance needs to be performed. This means a significant outflow of currency from the nation of Western Samoa.

The return voyage takes time and since Fiji and American Samoa have the only ship inspection and repair facilities in this region, the facilities themselves are extremely crowded and busy. Vessels are therefore forced to queue for a considerable length of time before they can dock and may have to leave the dock with only emergency repairs performed.

Carrying out vessel repairs overseas, in a manner such as this requires one to one-and-half months means that the vessel is withdrawn from service during this period. This has a particularly great influence on transportation between the two ports of Mulifanua and Salelologa through which the passage of vehicles and passengers which have both increased in recent years.

The vessel "QUEEN SALAMASINA" operating between Port Apia and Port Pago Pago is scheduled to be introduced as the main vessel between the ports of Mulifanua and Salelologa. However, when this vessel goes to Fiji or American Samoa for the purposes of periodic maintenance or repair, the islanders will have no recourse but to depend upon the two small ferries which are operated at present. These vessels are lacking in both safety and comfort and there are times when they cannot keep pace with the transportation demand.

Therefore, in order to increase the passenger and vehicle transpotation capacity between the ports of Mulifanua and Salelologa, and in order to provide the necessary degree of comfort and safety, and to pervent the outflow of currency, it is very important that a repair dock be constructed in Western Samoa to enable adequate inspection, maintenance and repairs to ferries be performed.

On the other hand, to maintain and administer a dock for the repair of ferries, it is necessary for the related industries supporting the vessel repair operations to be available. These related industries include those of steel working, welding, painting, timber work, engine and pump repair works, and electrical equipment repair and electrical wiring works.

However the present situation is such that these ship repair industries are not present in Western Samoa because there is no vessel repair industry at present.

The following factories perform work relating to the maintenance and repair of engines and power generation devices, the welding of steel plates, and painting work and have the technical competence for these tasks, but this cannot be immediately diverted to marine vessel repair.

1) The Vaitele Workship of Public Works Department (repairs and maintenance for heavy and light vehicles)

2) Power generation plant (for preventive maintenance to thermal and hydroelectric power-generation equipment)

3) Automobile repair factory

In addition, there are few technical or skilled jobs available and this results in engineers and technicians leaving Western Samoa for Fiji, American Samoa or New Zealand where there is more opportunity for higher salaries and skilled work. There are few skilled workers who remain in Western Samoa.

In addition to this, there is little being done to foster skilled workers and the Employment Training Center, and the Seamens Training Center which form the only places for the training of skilled workers, are closed.

There is no ship repair facilities, and neither are there any of the industries relating to ship repair. Although there is a valid requirement for a ship repair facilities to be operated in Western Samoa, the necessary skills and technical levels are not readily available at the present time. It is considered premature at this time for a ship repair facilities to be constructed since there will be a time lag for the ship repair workmen to be trained before their skills can be brought to the levels where comprehensive repairs can be performed.

It is necessary to foster the development of related industries, sending persons overseas to other countries for the purpose of receiving technical training at shipyards and vessel repair facilities in order to build up the necessary basis for the ship repair facilities and to establish a management system for the facility when it is eventually constructed.

A model basic design for the facility and the collection of materials was performed on the assumption that the ferry repair dock will be constructed in the near future as described in Appendix C.

CHAPTER 4

BASIC DESIGN

CHAPTER 4 BASIC DESIGN FOR UPGRADING OF THE PORT FACILITIES

4-1 Basis of Basic Design

4-1-1 Channel and Turning Basin

Various dimensions (alignment, width and water depth) of the channel and the turning basin which enable ferries of the Queen Salamasina class to make a safe berthing and operation are determined on the basis of the natural conditions of each port (waves, tide, wind, seabed geology, etc.), and maneuvering conditions.

4-1-2 Wharf

The tidal and splash portions of the steel sheet pile wall wharf will require protection work to arrest further progress of corrosion.

Suitable fenders and their location are designed for enabling the Queen Salamasina to berth safely and easily.

4-1-3 Terminal Facilities

Terminal facilities will be designed to provide safety and convenience for passengers, to accommodate the climate and to facilitate maintenance. The facilities will also be planned to enable passengers to board/alight smoothly and safely even at peak operation of passenger movements.

4-2 Design Criteria

4-2-1 Natural Conditions

(1) Temperature

According to records at Apia observatory the temperature normally reaches 22°C to 35°C, and the monthly average is 26°C - 27°C (see Appendix - F).

(2) Rainfall

The rainy season lasts from December to April, with the dry season from May to November.

According to the records at Apia observatory, the monthly average of rainy days are 13 to 24, while the annual average rainfall reaches 3,000 mm. Hence, it is apparent that the district abounds in rainfall. The Salelologa and Mulifanua districts show a tendency of slightly less of rainfall (2,300 - 2,700 mm) as compared with the Apia district, but have 100 mm or more rainfall on a monthly average even during the dry season (see Appendix - F).

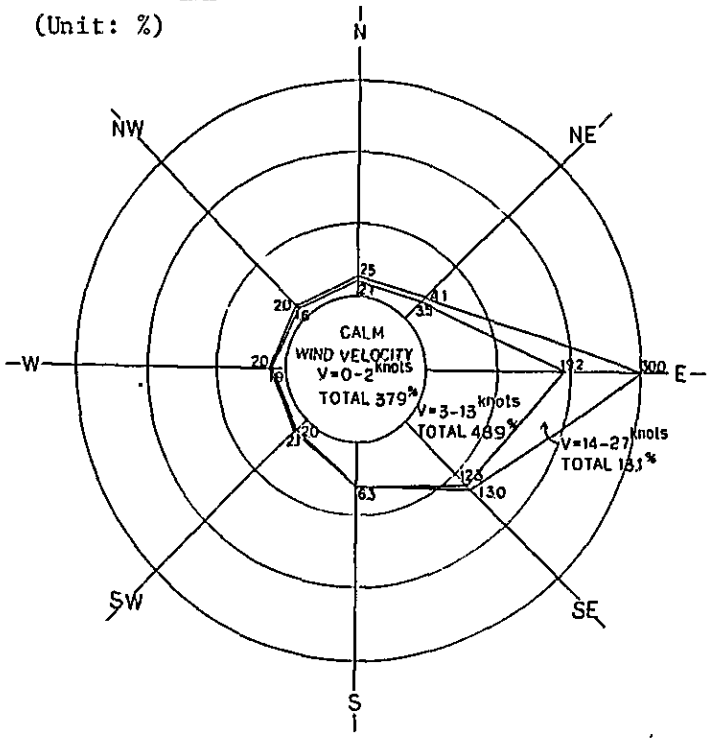
(3) Winds

The wind records of the Apia observatory show that velocities are normally less than 7 m/sec and the frequency of winds less than 7 m/sec is 87% as shown in the figure below. In addition, the frequency of winds from 7 to 14 m/sec velocity is 13%. Thus, it can be said that winds are moderate throughout the whole year.

The direction of winds is most notably (43% in frequency) for the east and southeast directions (see Appendix-F).

Fig. 3 Wind Rose (1951 - 1970)

(Unit: %)



(4) Hurricanes

Hurricanes occur during the rainy season from December to March. According to the records at Apia observatory, the maximum wind velocity reached 40 m/sec (see Appendix: F).

(5) Tidal Level

According to the tidal table and the marine chart, the tidal levels are as follows (see Appendix: F).

H.W.L.	+1.0 m
M.W.L.	+0.5 m
L.W.L.	±0.0 m

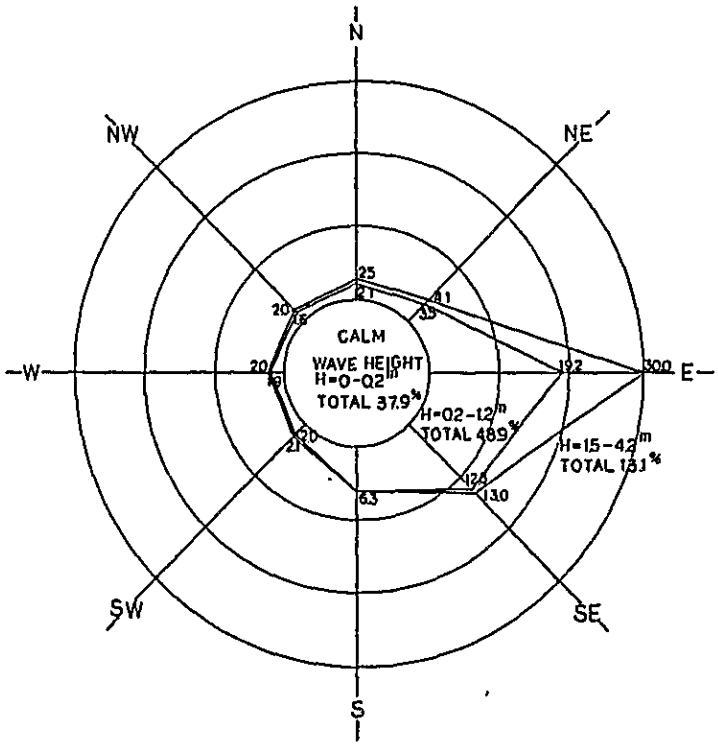
(6) Waves

a. Normal Waves

There are no observation records relating to waves. Therefore, assumptions are made on the basis of data relating to winds in Apia. With reference to the distribution of average wind velocity during the daytime (see Appendix: F) most wind velocity was 13 knots or less during the period from July to November. Wave calculated from wind velocity of 13 knots by the SMB method is 1.2 m in height and 5 seconds period. Coral reefs extened to about 1,500 m offshore from the wharf in Mulifanua and Salelologa Ports. Waves are broken at these reefs and wave height become gradually small; i.e. 10 to 50% of the original wave height. For example 1.2 m high waves are attenuated to less than 0.6 m high waves.

Fig. 4 Wave frequency (1951 - 1970)

(%)



b. Waves at the time of hurricanes

From the data of wind velocity of hurricanes, offshore waves in open sea are presumed to be 7 to 10 m in height with 10 to 12 second periods.

(7) Tidal Current

Tidal current is assumed not to be fast within the coral reefs according to the results of observation using a floater in the site survey and the interviews held with fishermen in the area.

(8) Seabed Geology

According to the results of the site survey on seabed geology, the area insides of the reefs consist mainly of corals, but partially include exposed hard volcanic rocks and sand.

(9) Earthquakes

Western Samoa belongs to the Pacific Earthquake Belt Circle. Small earthquakes often occur, but sometimes earthquakes exceeding Magnitude 7.0 have occurred.

In 1917, a severe earthquake of Magnitude 8.3 occurred offshore 200 km southward Western Samoa.

4-2-2 Dimension of ferries

Table 4 Dimension of Ferries

Dimension	Queen Salamasina	Puleono	Salafai
LOA	42.3 m	36 m	27.1 m
Width	10.4 m	9.6 m	7.2 m
GT	714 ton	229 ton	121 ton
DWT	91 ton	90 ton	85 ton
Draft	2.1 m	1.5 m	1.6 m
Speed	11 knot	9.5 knot	10 knot
No. of Passenger	216	119	60
No. of Vehicles	15	16	8
Ship Ramp	Stern	Bow	Bow

4-3 Basic Design

4-3-1 Channel

In both ports, the channel is surrounded by coral reefs extending 1,500 m offshore from the wharfs, where the influence of waves become smaller as compared with that of offshore waves.

In Mulifanua Port, dredging is required in the area about 800 m in length away from the wharf. However, the offshore portion of the channel has sufficient depth and width, and, hence, does not require dredging. In Salelologa Port the channel has such sufficient depth and width as not having to require dredging with the exception of a part of the turning basin.

(1) Alignment

Channel alignment is planned based on the existing channel direction. The angle of intersection of the central line of the channel in its crooked portion is so designed as not to exceed 30° for easy maneuvering and channel alignment is decided to minimize dredging volume.

(2) Width

The channel is planned as a one-way lane in consideration of the frequency of ferry operation. The width of the standard one-way channel is designed around the length of boats involved. However, the minimum width of the channel was designed to be 50 m, which is about 1.2 times the length of 42 m for the largest ferry, Queen Salamasina, with consideration being given to the following two points.

1) Hard coral reefs or hard rocks exist on both sides of the channel.

2) In order to secure safe navigation against trade winds blowing from the east.

(3) Depth

The depth of the channel is designed in consideration of trim, wave height, and seabed geology (coral reefs, or volcanic rocks). The trim of a 700 GT class boat is around 60 cm. Allowance for the depth (50 cm) is considered. Thus, the minimum depth of the channel near the wharf is determined according to the following formula.

Draft + Trim + Allowance = Depth

2.1 + 0.6 + 0.5 = 3.2 m

For Mulifanua Port, the channel of 500 ~ 800 m from the wharf was designed to be 3.5 m in depth by adding half wave height (0.3 m) in view of the influence of waves (about 0.6 m) entering the channel along the channel entrance.

(4) Summary of Design Channel Dimension

Table 5 Basic Design of Channel

Area	Channel Plan	Existing Condition	Dredging Volume
1) Saleologa			
Turning Basin	Depth -3.2 m	Depth -0.9∿15.4m	2,500 m^3
	Diameter 120 m	Diameter 120 m	Thickness 2.3∿0m
2) Mulifanua			
a. Turning Basin	Depth -3.2 m	Depth -1.3∿-3.6m	4,000 m^3
	Diameter 120 m	Diameter 120 m	Thickness 1.9∿0m
b. Channel			12,900 m^3
Wharf ∿	Depth -3.2 m	Depth -1.5∿-3.4m	Thickness 1.7∿0m
500 m offshore	Width 50 m	Width 50 m	
off 500 m ∿	Depth -3.5 m	Depth -2.2∿-4.8m	Thickness 1.3∿0m
800 m offshore	Width 50 m	Width 50 m	

4-3-2 Wharf

(1) Corrosion Protection

Corrosion-protection methods in the splash and tidal portions of steel sheet pile wall include using a covering material such as concrete material, paint, organic lining material, or metal lining material. Here, a concrete material is to be applied, due to ease of application and availability of local materials.

The thickness of concrete is to be 15 cm considering a minimum concrete covering on steel in seawater and method of placing concrete under seawater.

(2) Fenders

The berthing energy of a boat can be calculated from the following equation:

$$W = \frac{Wv^2}{4g}$$

where, E : Berthing energy (t-m)

W : Virtual weight of boat (t)

V : Berthing velocity (v = 0.3 m/sec)

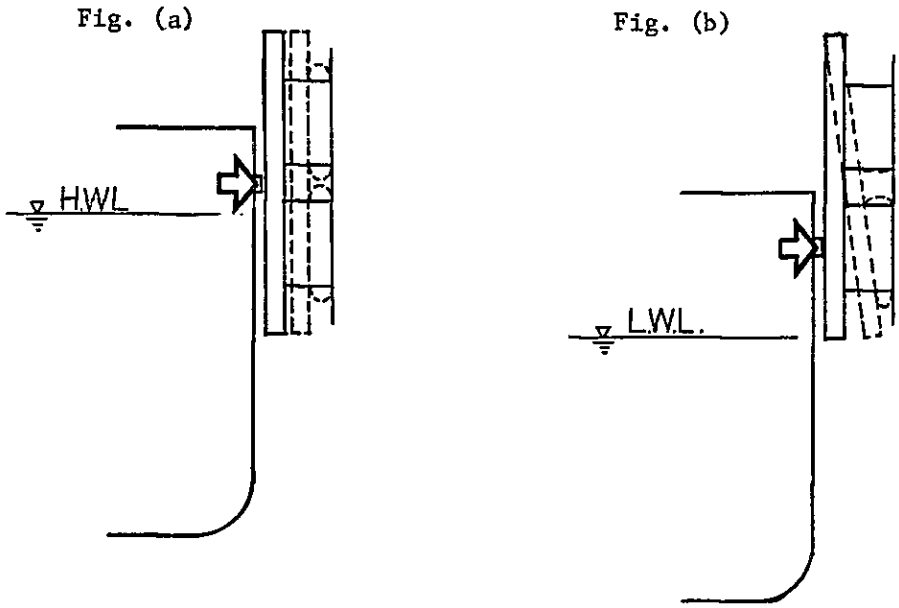
g : Gravity Acceleration (g = 9.8 m/sec^2)

The berthing energy of Queen Salamasina is calculated as 2.6 t-m based on the above equation.

The elevation and location of fenders are determined to allow a boat to come in contact with the fenders at the berthing time with consideration for the tidal levels, the drafts of boats, etc.

In case the point of contact of a boat with a fender is as shown in Fig. (b), two pieces (one piece = 400W x 700L) are to be installed.

Fig. 5 Setting Elevation of Fenders



(3) Bitt

Bitt consists of 15-ton mooring bitt and 25-ton mooring bitt necessary for mooring the Queen Salamasina. The location of the bitts are determined relative to the positions of mooring ropes of the boats.

(4) Fender Pile

To assist ferry berthing, a fender pile will be provided at the location indicated in the plan. The fender pile consists of steel pipe piles with rubber fender.

(5) Emergency Berth

Ramp way will be extended to allow two ferries to berty simultaneously. The ramp way consists of concrete block.

(4) Summary of Wharf Improvement

Table 6 Basic Design of Wharf Improvement

(per one port)

Construction	Plan	Existing Condition	Construction
1) Corrosion Protection	To be protected by concrete covering in the splash and tidal portions of steel sheet pile wall	No corrosion protection The steel sheet pile are corroded	Concrete Lining: t = 15 cm thickness Range : +2.0 ∿ -0.5 m Length : 70 m wharf
2) Fenders	To be installed fenders for front, side and corner portion	No fender Wooden fenders are missing	Front : 400H x 4,000L or Equivalent 1 unit Side : 400H x 700L " 6 units Corner : 2-250H x 750L " 1 unit
3) Bitts	To be installed new bitts	5 ton bitt x 5 pcs are superannuated	25 ton : 3 units 15 ton : 6 units
4) Fender Pile	To be constructed fender pile at oposite side of wharf	The steel sheet pile (2 pcs) are superannuated	Steel pipe piles 3 x dia 406.4 mm with Rubber Tire
5) Emergency Berth	To be constructed another ramp for emergency use	None	Concrete Block: Width : 10m

4-3-3 Terminal Facilities

(1) Layout

The layout of the terminal facilities are designed to place a bus terminal and a ferry waiting room separately as shown in the drawing with consideration to avoid cross flow of passengers and vehicles, ease of control at the time of congestion, etc.

(2) Areas of Buildings

1) Terminal Building

The required area of a ferry terminal is calculated according to the following equation:

$$A = a\ n\ N\ \alpha\ \beta$$

where, A: Area of ferry terminal building (m^2)

a: Unit area per capita ($a = 1.2\ m^2$/person)

n: Number of passengers per boat ($n = 216$ for Queen Salamasina)

N: Number of boats departing or arriving at the same time ($N = 1$)

α: Concentration rate ($\alpha = 1.6$, in case of a fluctuating trend for the whole day)

β: Fluctuation rate ($\beta = 1.2$ in case of annual fluctuation trend)

Thus, the terminal area required is as follows:

$$A = 1.2 \times 216 \times 1 \times 1.6 \times 1.2 = 500\ m^2$$

The ferry terminal building includes a waiting room, sanitary facilities, passages, staircase, etc. In addition to above, office and control room of 60 m^2 is accomodated in order to manage ferry operation and to control navigation. Therefore the total area of the Terminal Building will become approxmately 560 m^2.

Roof space of the waiting room will be used as a welcome and send-off deck.

2) Bus Terminal

Although almost all passengers disembarking from the ferry are expected to go directly on to a bus, 240 m^2 of Bus Terminal area will be provided.

(3) Other Facilities

1) Moveable Stair

Moveable stairs are provided for smooth and safe embark/disembarking for passengers. This stair is so designed to move as the entrance elevation of the ferry changes. The material of the stairs is made of aluminium for easy movement and anti-corrosion.

2) Announcement Facilities

To safely guide passengers and vehicles, public announcement facilities are to be provided.

3) Fence and Gate

To secure the safe flow of passengers and vehicles, fence and gates are provided.

(4) Construction Materials

Ferry terminals are planned to be constructed of reinforced concrete column, beam and roof considering durability, ease of maintenance and availability. Concrete block produced at the site is used for walls. The walls in the waiting room and bus terminal consist of a screen block considering lighting and cooling, while other walls consist of hollow block.

Since the terminal is located on the shore, hardware such as handrails, window frames and doors use aluminium which is anti-corrosive. The office roof will be fabricated of asbestos board which is light in weight and very durable. As to building finishes, no painting is applied to the screen block, while vinyl painting is planned for exterior finish, and emulsion paint for interior finishes.

(5) Summary of terminal facilities design

Table 7 Basic Design of Terminal Facilities

(per each port)

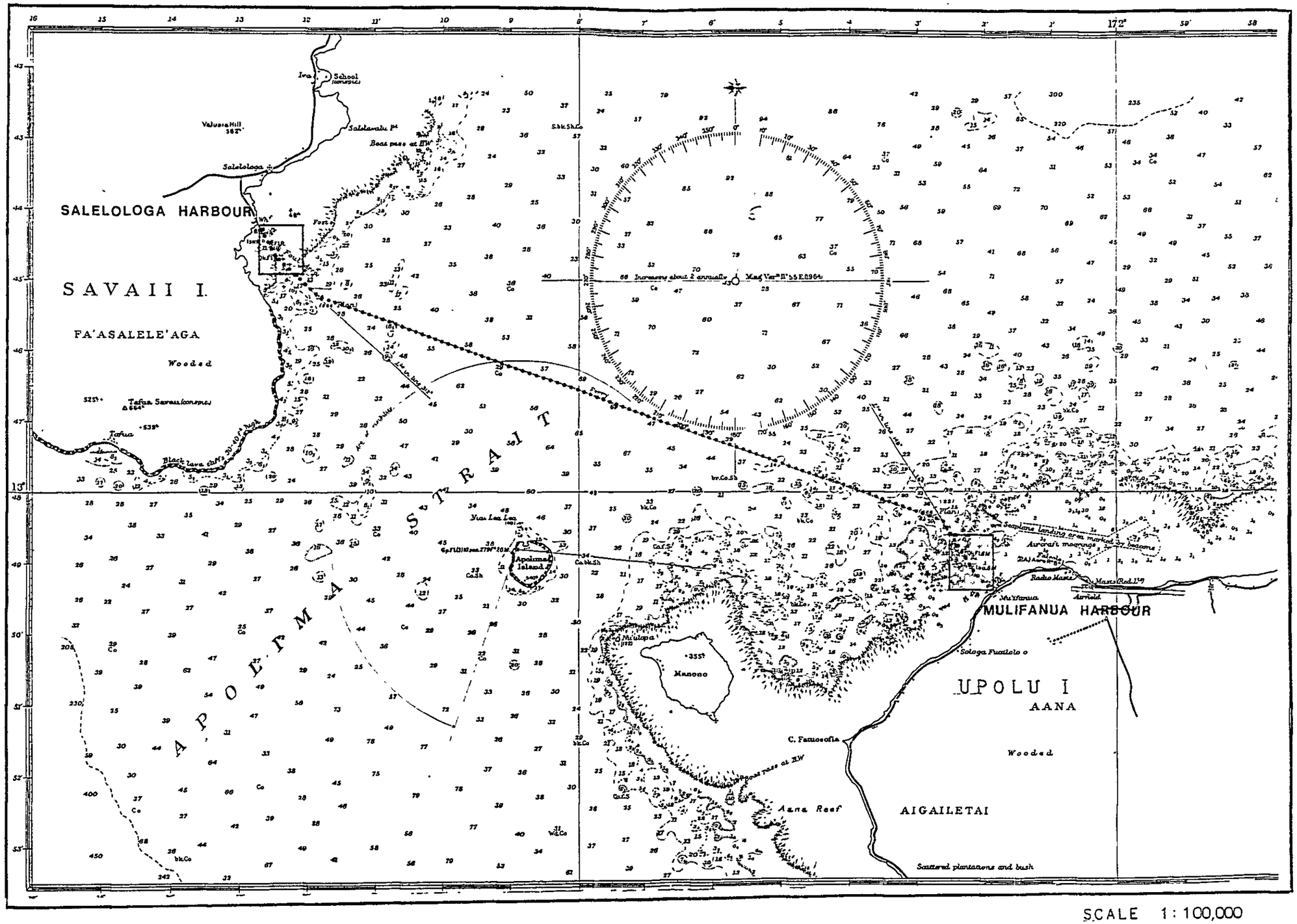
Facilities	Plan	Existing Condition	Construction
1) Terminal Facilities a. Ferry Passenger Terminal b. Bus terminal	To construct new waiting room etc. for ferry passengers, offices for ferry operation and control and bus terminal Total area 800 m^2	Superannuated wood structure Wall: Wood Wire Net Floor: Concrete Roof: Zinc Coated Sheet Steel Total Area: 536 m^2	Roof and Column: Reinforced Concrete Wall: Hollow Block, Screen Block Floor: Concrete a. 560 m^2 b. 240 m^2
2) Security facilities a. Moveable Stair b. Announcement facilities c. Fence d. Gate	To provide facilities to secure the safety of passenger and vehicles	Fence (60 m) and gate (1 unit) are superannuated. No moveable stair and announcement facilities are provided.	a. Aluminium 1 set b. 1 unit c. Steel 100 m d. Steel 2 units

(6) Drawings of Basic Design

Drawings of basic design of upgrading Mulifanua and Salelologa Port facilities are shown as follows:

Fig. 6 Existing Route of Ferry
Fig. 7 Channel of Mulifanua Harbour
Fig. 8 Channel of Salelologa Harbour
Fig. 9 Layout of Mulifanua Wharf
Fig. 10 Layout of Salelologa Wharf
Fig. 11 Installation of Fender and Bitt, etc.
Fig. 12 Layout of Mulifanua Ferry Terminal
Fig. 13 Plan of Mulifanua Terminal Building
Fig. 14 Elevation of Mulifanua Ferry Terminal
Fig. 15 Layout of Salelologa Ferry Terminal
Fig. 16 Plan of Salelologa Terminal Building
Fig. 17 Elevation of Salelologa Ferry Terminal

FIG. 6 EXISTING ROUTE OF FERRY



SCALE 1 : 100,000

FIG.7 CHANNEL OF MULIFANUA HARBOUR

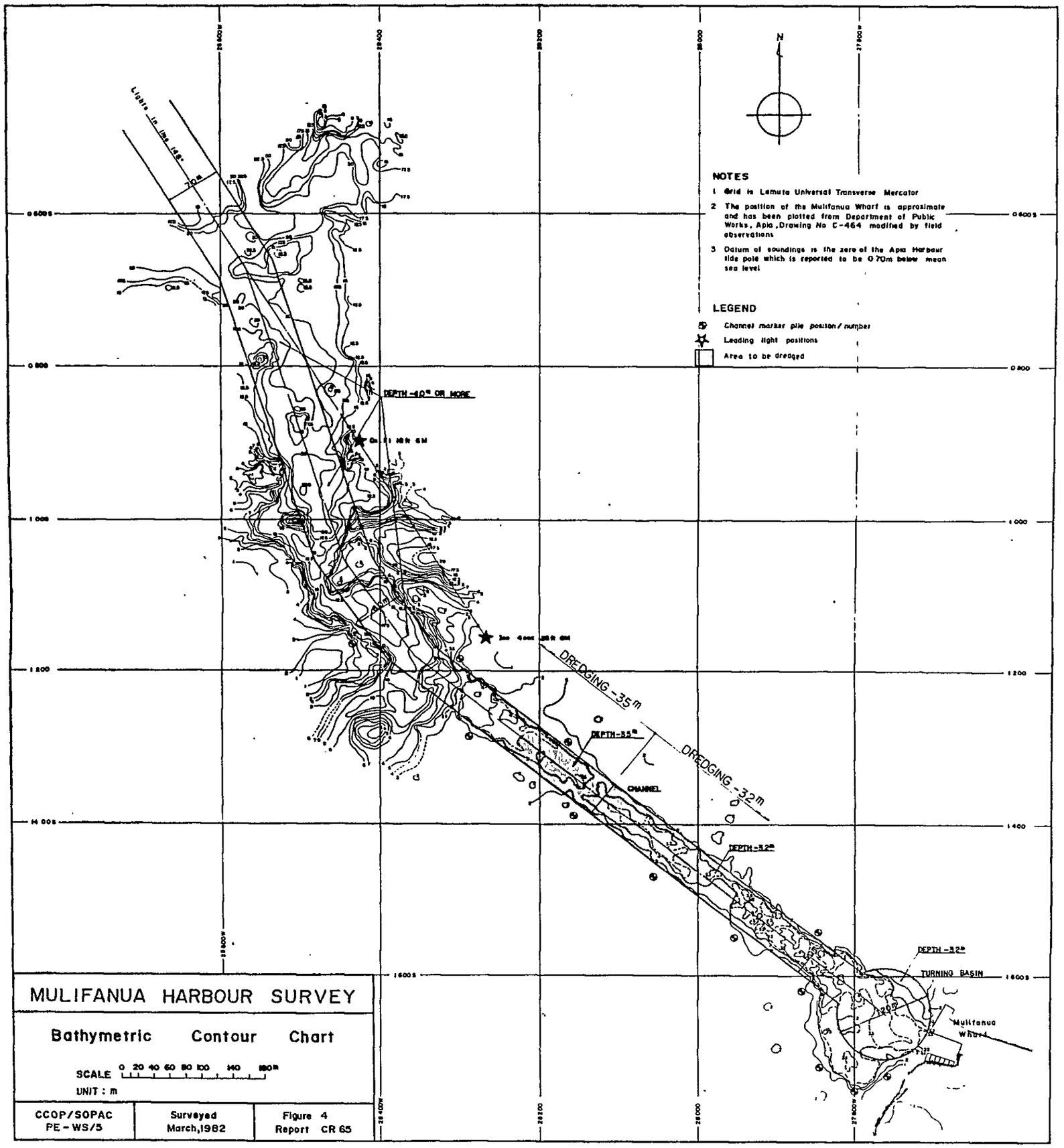
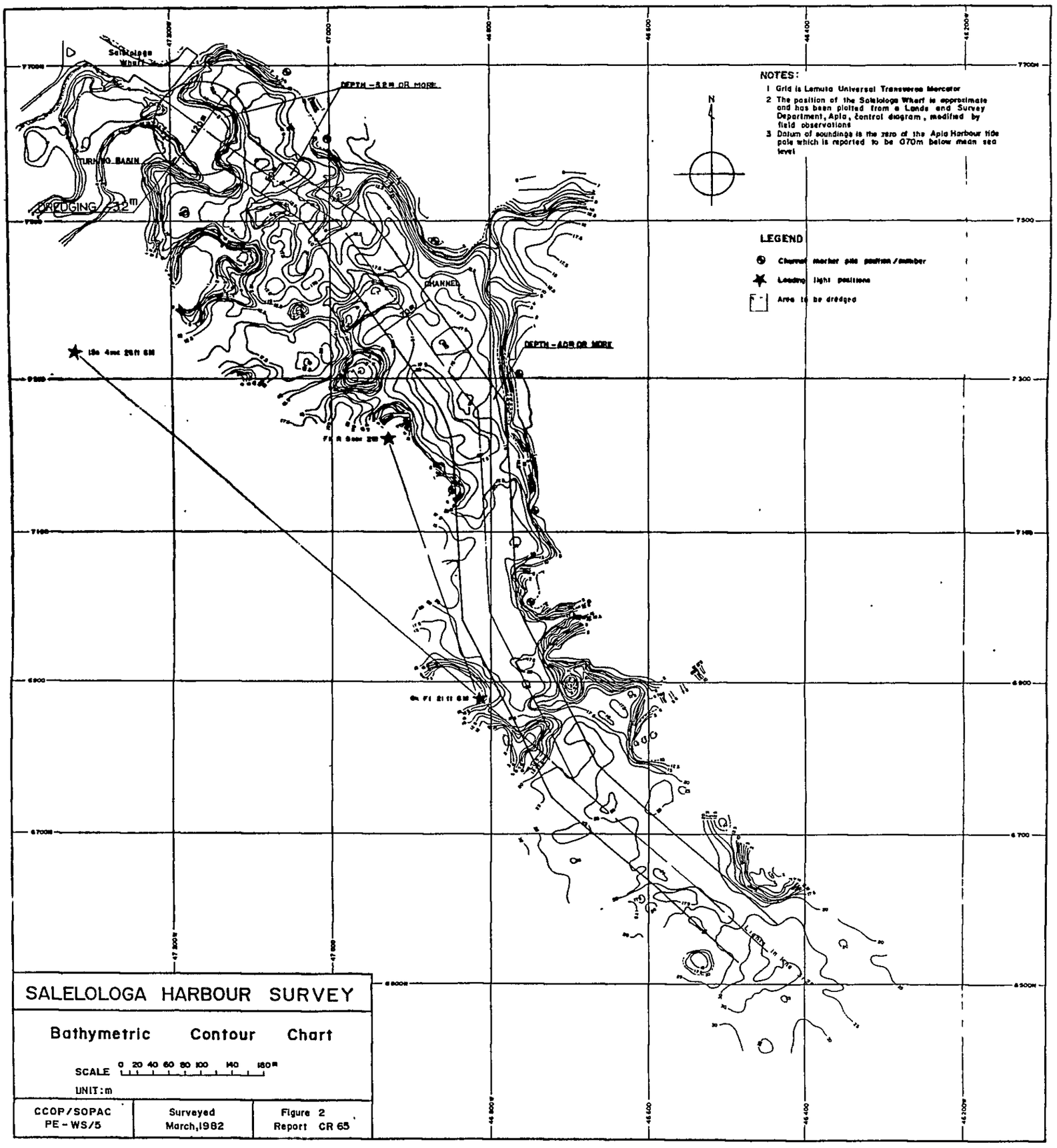


FIG. 8 CHANNEL OF SALELOLOGA HARBOUR



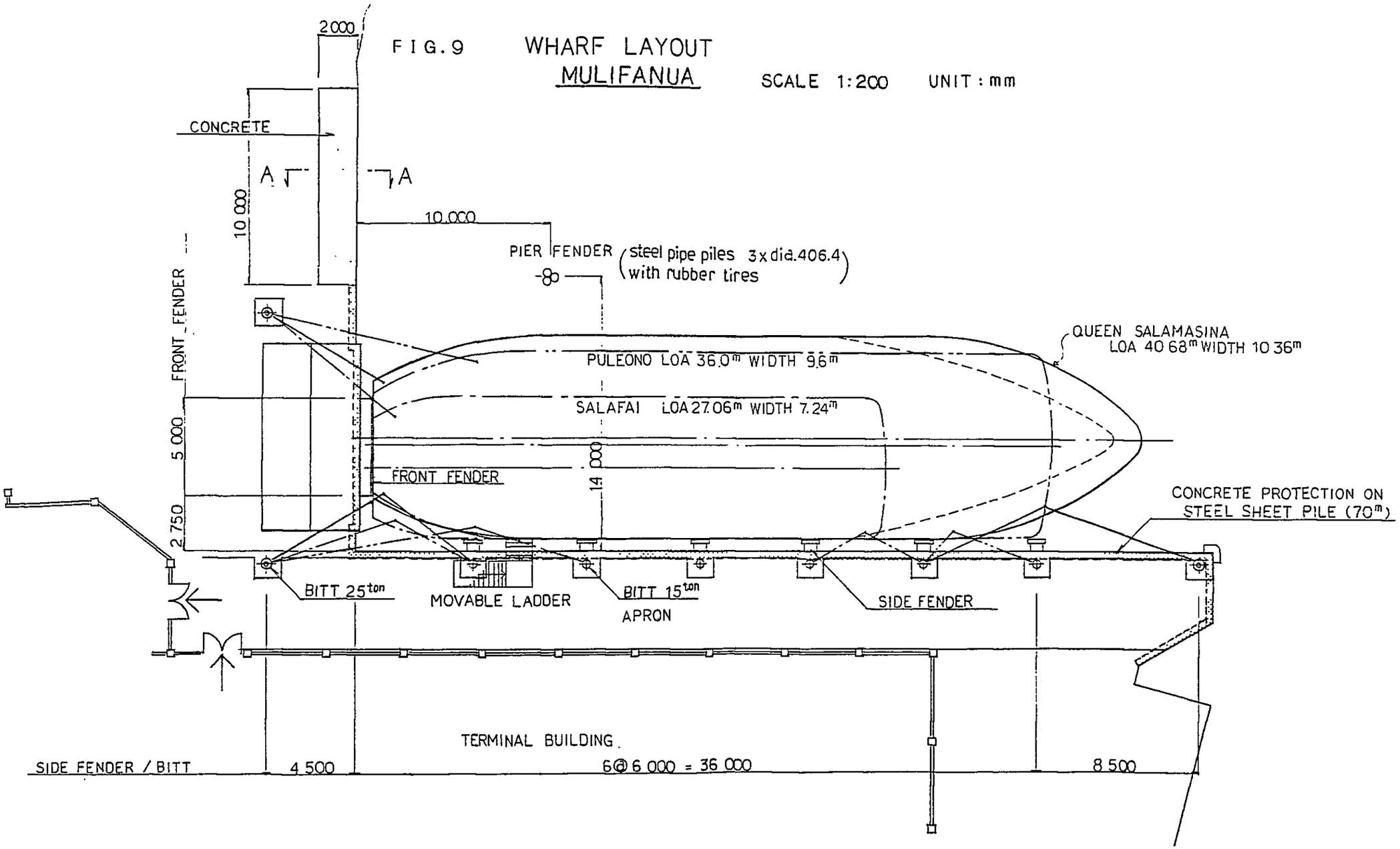


FIG. 9 WHARF LAYOUT
MULIFANUA
SCALE 1:200 UNIT : mm
2000
CONCRETE
A
A
10 000
10 000
PIER FENDER (steel pipe piles 3x dia.406.4 with rubber tires)
FRONT FENDER
5 000
2 750
QUEEN SALAMASINA
LOA 40.68m WIDTH 10.36m
PULEONO LOA 36.0m WIDTH 9.6m
SALAFAI LOA 27.06m WIDTH 7.24m
14 000
FRONT FENDER
CONCRETE PROTECTION ON
STEEL SHEET PILE (70m)
BITT 25ton
MOVABLE LADDER
BITT 15ton
APRON
SIDE FENDER
TERMINAL BUILDING
SIDE FENDER / BITT
4 500
6@6 000 = 36 000
8 500

FIG.10 WHARF LAYOUT
SALELOLOGA SCALE 1:200 UNIT : mm

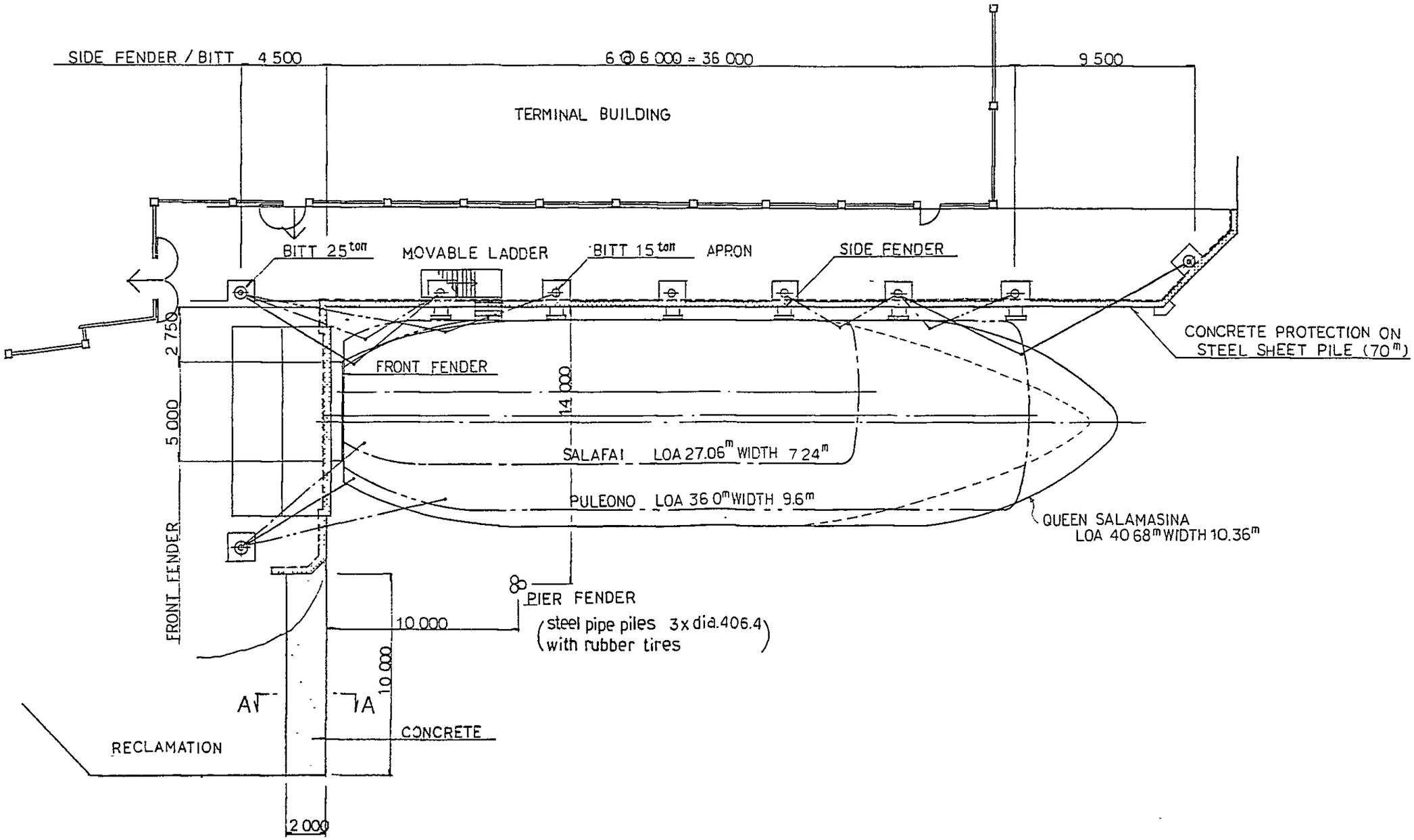
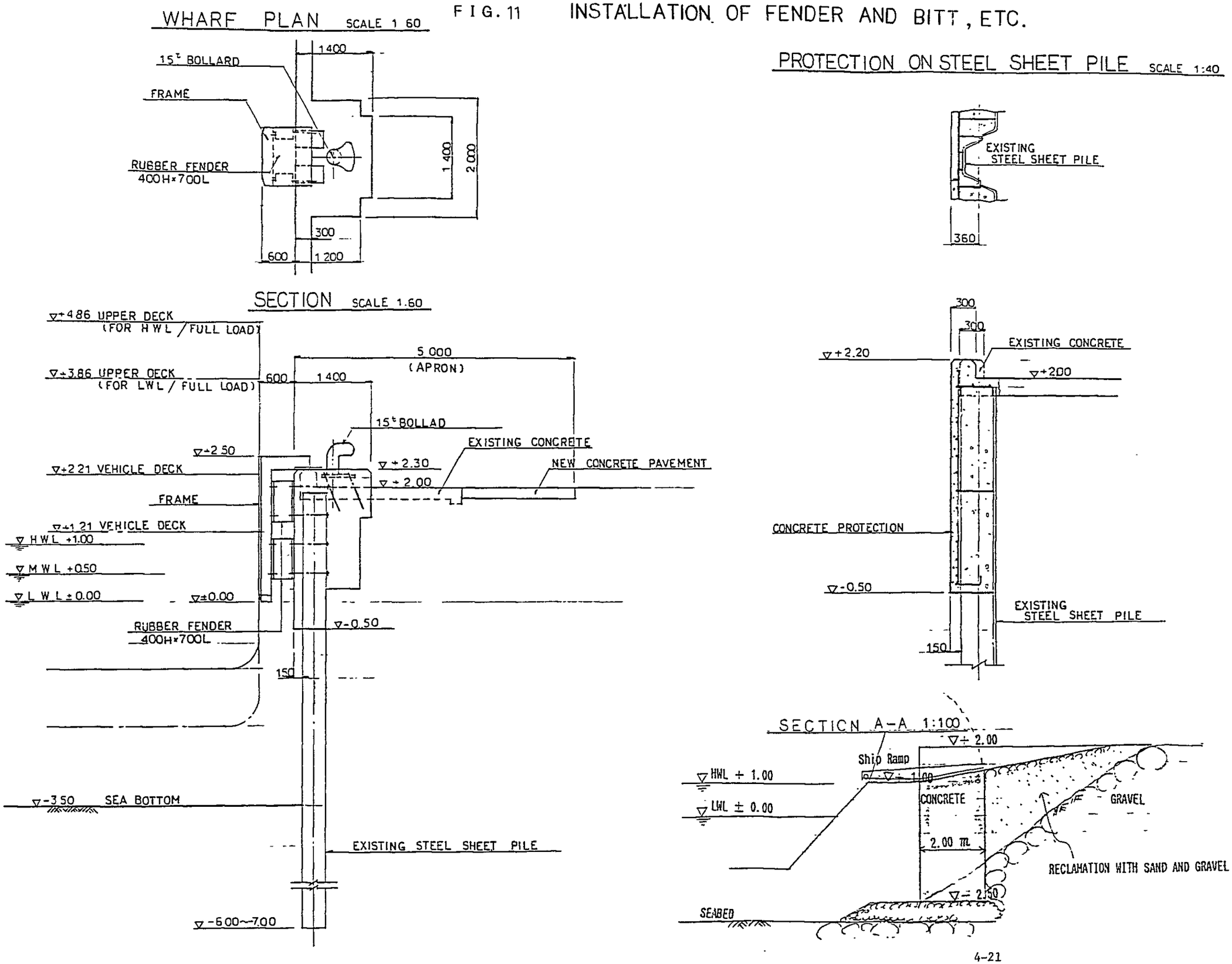
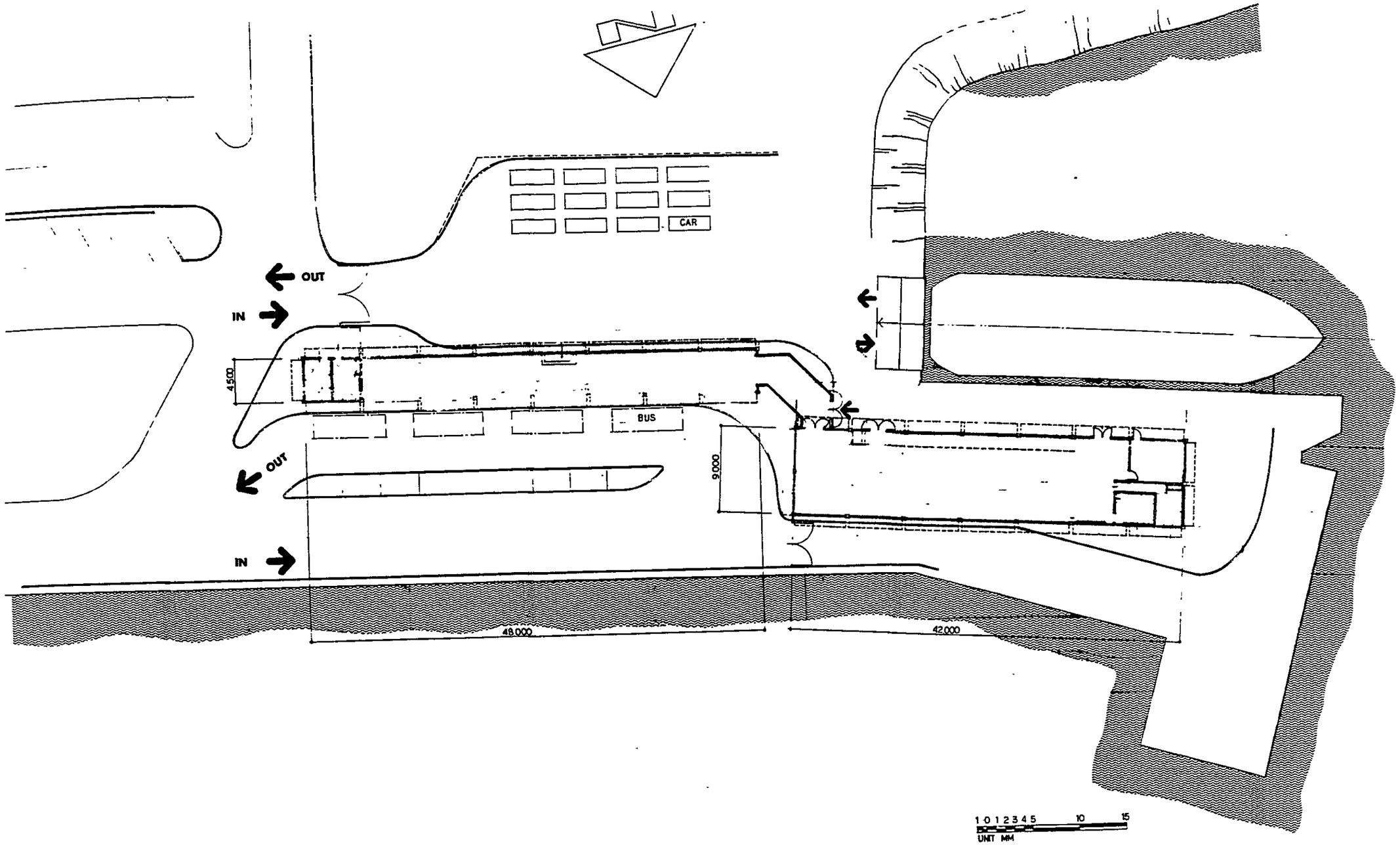


FIG. 11 INSTALLATION OF FENDER AND BITT, ETC.

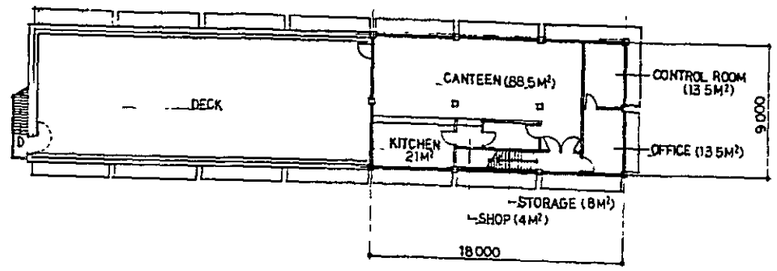




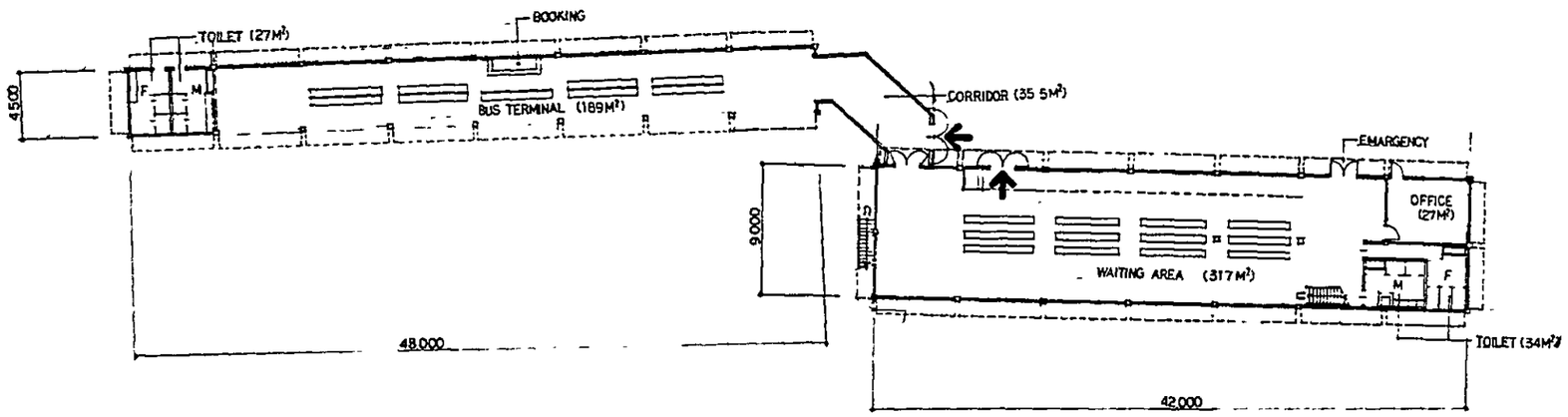
FLOOR AREA SCHEDULE

1F	629.5
2F	162.0
TOTAL	791.5 M²

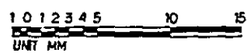
FIG. 12 **MULIFANUA FERRY TERMINAL**



2ND FLOOR PLAN



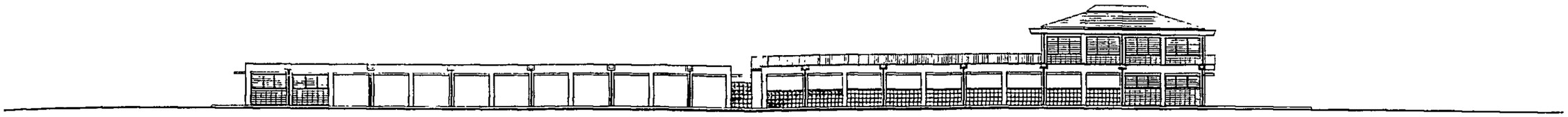
1ST FLOOR PLAN



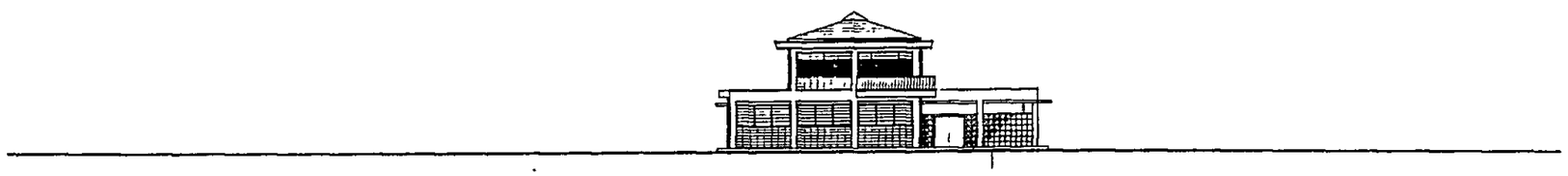
FLOOR AREA SCHEDULE

1F	629.5
2F	162.0
TOTAL	791.5 M²

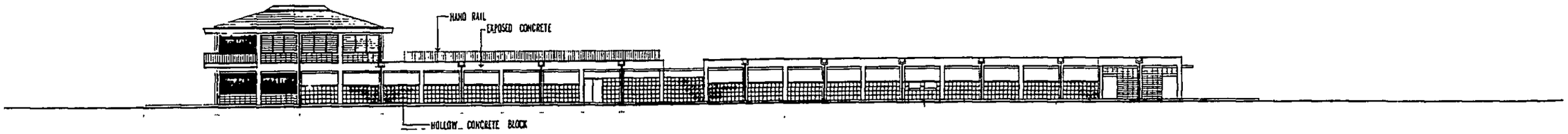
FIG. 13 **MULIFANUA FERRY TERMINAL**



NORTH ELEVATION



WEST ELEVATION



SOUTH ELEVATION

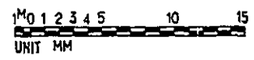
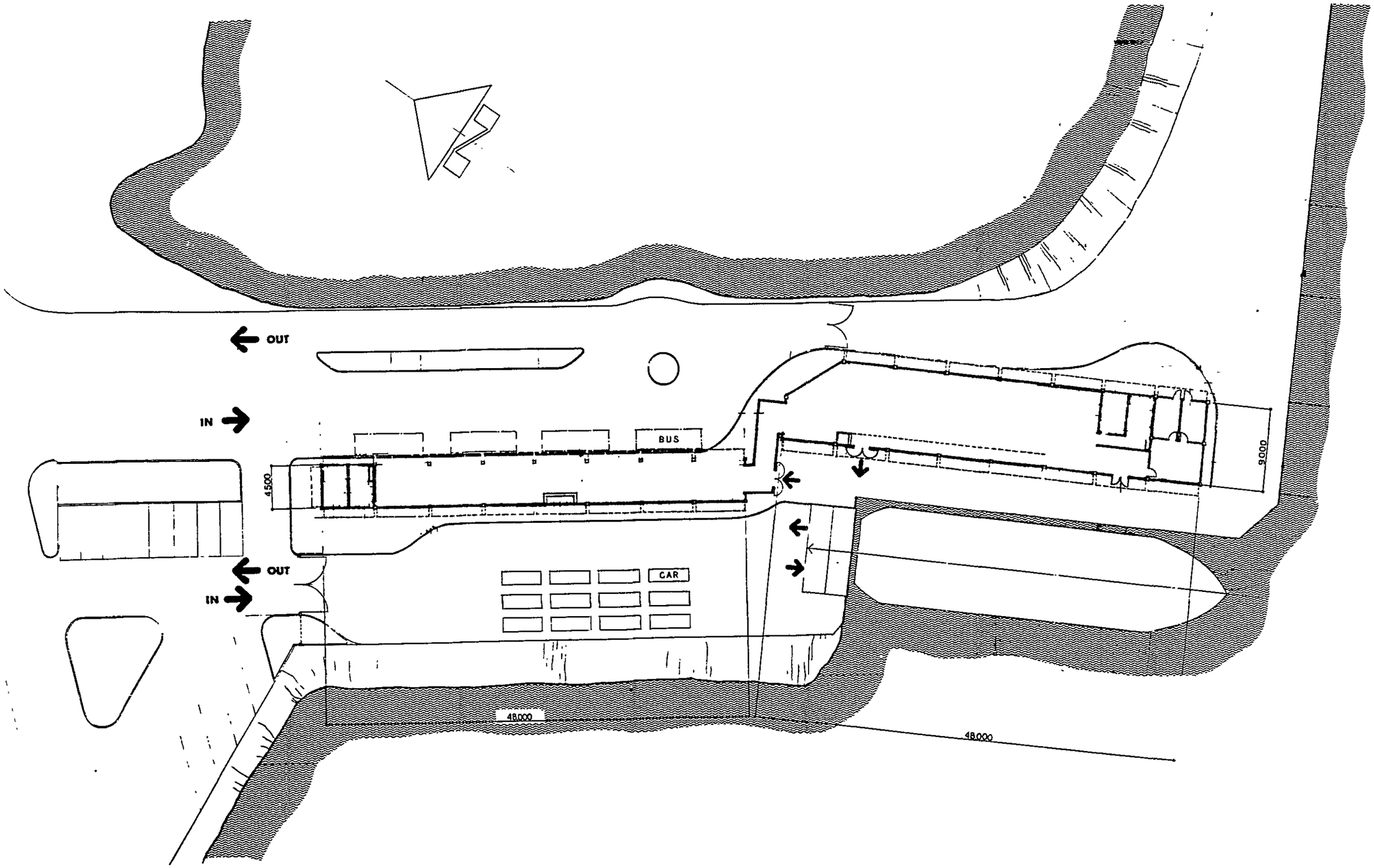


FIG. 14 **MULIFANUA FERRY TERMINAL**

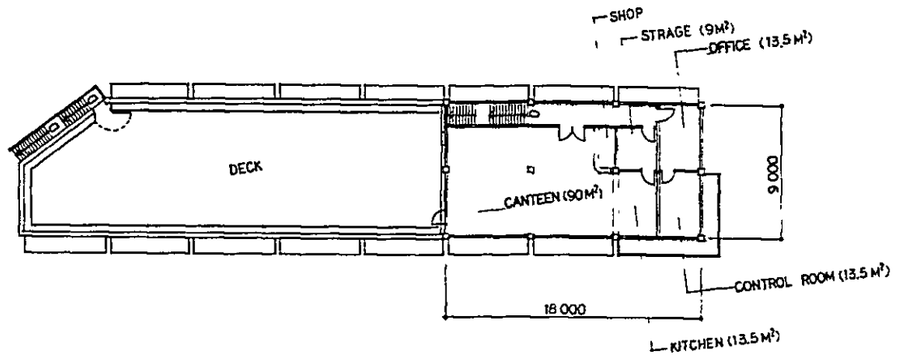


1 0 1 2 3 4 5 10 15

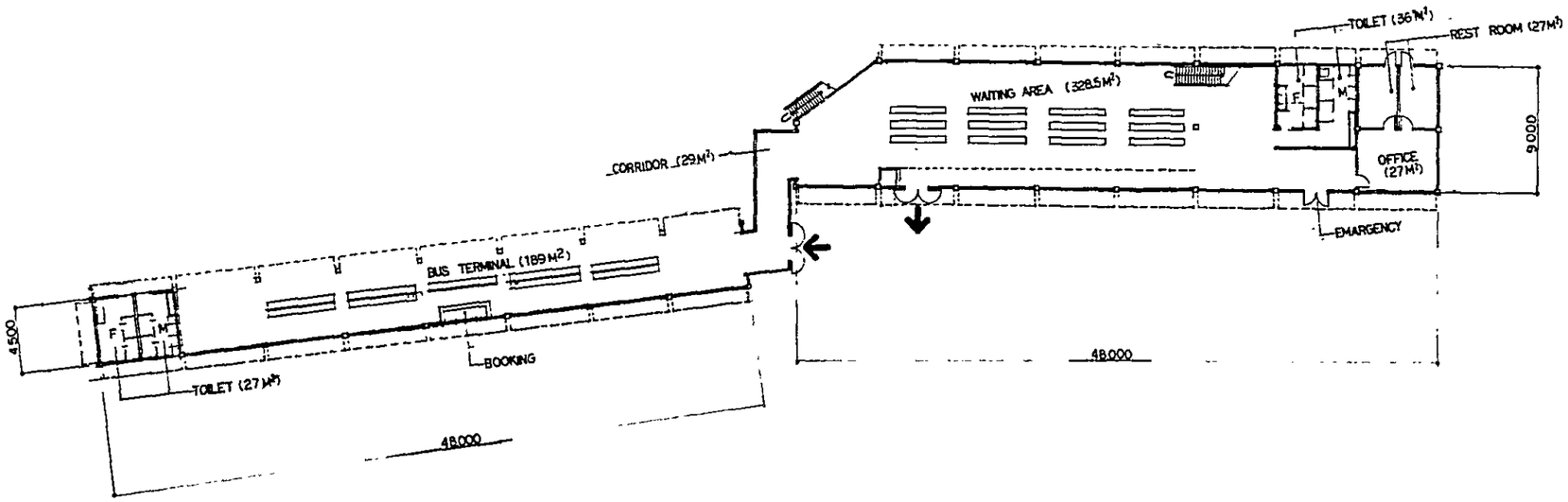
FLOOR AREA SCHEDULE

1F	663.5
2F	162.0
TOTAL	825.5 M²

FIG. 15 **SALELOLOGA FERRY TERMINAL**



2ND FLOOR PLAN



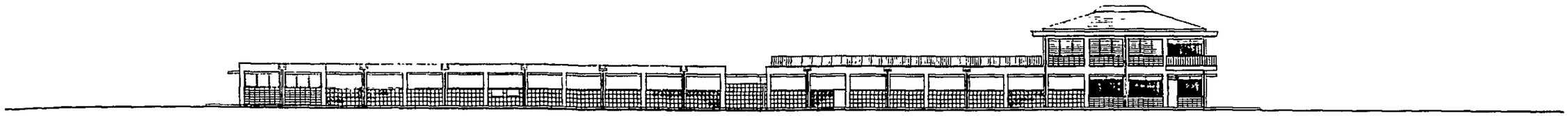
1ST FLOOR PLAN

1 0 1 2 3 4 5 10 15

FLOOR AREA SCHEDULE

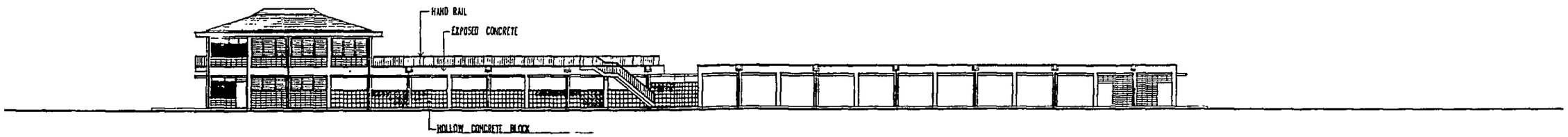
1F	663.5
2F	162.0
TOTAL	825.5 M²

FIG. 16 **SALELOLOGA FERRY TERMINAL**

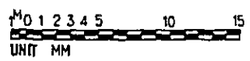


SOUTH ELEVATION

EAST ELEVATION



NORTH ELEVATION



F I G. 17: **SALELOLOGA FERRY TERMINAL**

4-4 Project Cost

Cost of the works to be executed by the Government of Western Samoa is estimated as follows:

- Demolish Existing Facilities	$ 44,000
- Temporary Waiting Room	$ 32,000
- Temporary Office	$ 15,000
Total	$ 91,000

CHAPTER 5

IMPLEMENTATION PROGRAMME

CHAPTER 5 IMPLEMENTATION PROGRAMME

5-1 Executing Agency

The executing agency of this project is the Ministry of Works, the Government of Western Samoa.

The contracts to be concluded under the agreement will comprise a consultant contract (detailed design, preparation of tender documents, supervision, etc.) and a construction contract.

The consultant contract will be concluded between the Government of Western Samoa and Japanese consultants, and the construction contract between the Government of Western Samoa and a Japanese contractor.

Upon completion of the project, management and maintenance will be performed by the Ministry of Transport. This project is primarily concerned with the improvement of existing facilities which are already managed and maintained by the Ministry of Transport, there will be no need to establish a new organization. The present organization chart of the Marine and Shipping Bureau, Ministry of Transport is indicated in Fig. 16.

5-2 Implementing Plan

5-2-1 Scope of Consultant Services

A consultant contract will be concluded between the Government of Western Samoa and a Japanese consulting firm.

Scope of consultant services are as follows:

(1) Detail Site Survey
- Topographic Survey and Sounding
- Geological Survey by boring

(2) Detailed Design
- Preparation of detailed drawings
- Preparation of Bills of Quantities

(3) Estimation of construction cost

(4) Preparation of tender documents (including Specification)

(5) Assistance for prequalification of contractors and tender evaluation

(6) Supervision of construction work

5-2-2 Tender and contract for construction

Bidding for construction work including channel dredging, wharf rehabilitation and the construction of a terminal, will be performed by prequalified tenderers from Japanese contractors. After tenders have been evaluated, a construction contract will be concluded between the Government of Western Samoa and the successful tenderer.

5-2-3 Construction method

(1) Channel dredging

Channel dredging will be performed to a depth of -3.2 to -3.5m. The sea bottom of the planned channel area to be dredged consists of coral reef and volcanic rock. The work plan was formulated on the basis of available depth charts and the record of dredging conducted in 1972, assuming that the undredged section consists of hard rock. At the stage of detailed design, however, it will be necessary to conduct borings to confirm the

geological formation of the area concerned. Dredging of the coral reef and volcanic rock will be conducted by employing the following construction methods.

1) Coral reef

Dredging will be conducted by direct excavation of the reef with a backhoe or grab bucket on pontoon. The crushed reef will be transported by barge or pontoon to a specified dumping area for disposal.

2) Hard coral reef and volcanic rock

The reef or the volcanic rock will be crushed either by heavy weight rammer or with explosives. Grushed materials will be dredged either by grab bucket or backhoe on pontoon and transported by barge or pontoon to a specified dumping area.

Since the present ferry service will operate during the time dredging work is performed, it will be necessary to take adequate safety measures such as the installation of markers so as not to interfere with navigation.

Since the sea bottom consists of coral reef and volcanic rock, no extensive turbidity or pollution of seawater is anticipated during dredging. However, it will be necessary to conduct dredging cautiously paying attention to preserving the environment.

Also, the dumping area should be selected carefully to avoid pollution.

3) Wharf rehabilitation

Since the existing wharf will be closed during the period of rehabilitation work, it will be necessary to provide appropriate berthing facilities before rehabilitation work starts.

In case of Mulifanua, the pile structure located opposite the existing wharf can be used easily as another wharf by installing a vehicle ramp.

In case of Salelologa, it will be necessary to construct another ramp neighboring existing ramp to be used as a temporary wharf.

As for corrosion protection work, the corrosion on steel sheet piles should be removed and watertight forms should be used to prevent the leakage of concrete coating or encasement.

4) Terminal facilities

The existing facilities will be entirely demolished, and it will be necessary to provide a temporary waiting room or to demolish partially in stages to use the remaining facilities as a temporary waiting room for passengers during construction.

5-3 Scope of work

5-3-1 Works of grant aid

Scope of work involved in the grant aid project are as follows:

(1) Channel and turning basin dredging work

(2) Corrosion protection work for steel sheet pile

(3) Installation of fenders

(4) Installation of mooring posts

(5) Installation of channel markers (Markers for dredging work will be installed as channel markers)

(6) Terminal facilities

(7) Fence and gate to control flow of passengers and vehicles

5-3-2 Works by the Government of Western Samoa

It was agreed in the Minutes of Discussion, dated on July 28, 1984, between the Government of Western Samoa and the JICA Survey Team that the following items are to be undertaken by the Government of Western Samoa.

1) To clear the sites of the Project when needed

2) To provide facilities as follows:

   2.1 Distribution line of electricity to the sites

   2.2 City water distribution main to the sites

   2.3 Drainage city main (for storm, sewer and others) to the sites

   2.4 Telephone trunk line to the main distribution frame/ panel of the buildings

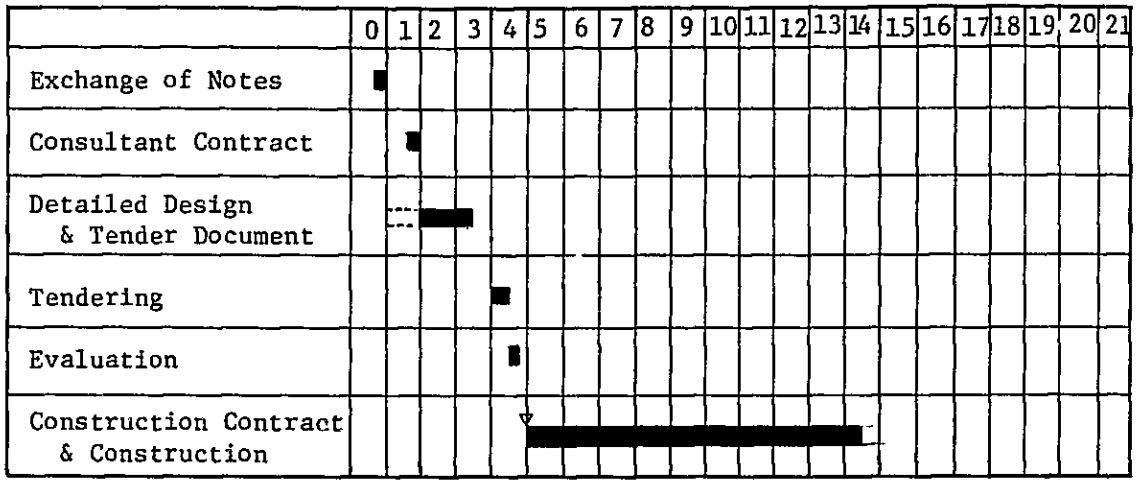
   2.5 Furniture for general office use

3) Temporary office and waiting room during the construction work.

5-4 Implementing Schedule

Implementing Schedule after E/N is as below.

Fig. 18 Implementing Schedule of Upgrading of Port Facilities



5-5 Management Programme

The Ministry of Transportation is responsible for management, maintenance and control of the present port facilities in the two ports. Nine staff personnel are assigned to each port (see organization chart of the Ministry of Transportation).

On the other hand, Western Samoa Shipping Corporation is responsible for the shipping operations. Thus, the staff of corporation issue tickets, guide vehicles, and passengers, and perform maneuvering and maintenance of ferries.

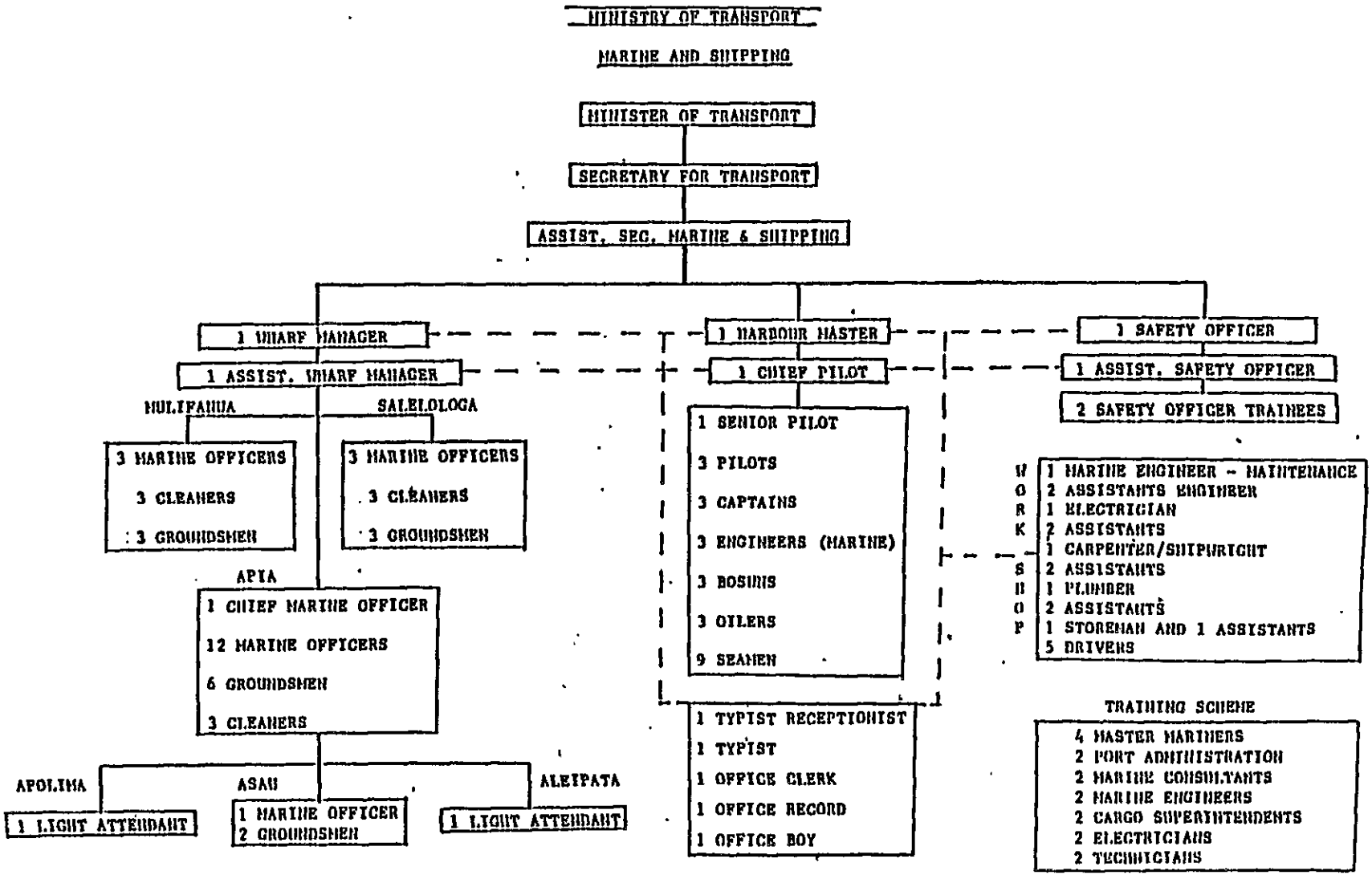
After implementation of this plan, it will be possible for the present number of staff to continue to manage the facilities to be built since they will not be substantially different compared with the existing facilities.

The cost of operating and maintenance of the ports facilities after completion of upgrading work is estimated based on material costs in 1983.

Table 8 Operating and Maintenance Cost of Ports

	Mulifanua	Salelologa
Staff Salary	$ 7,100	$ 7,100
Wages	$ 500	$ 500
Electricity	$ 5,000	$ 5,000
Water supply	$ 400	$ 400
Maintenance	$ 9,000	$ 9,000
Total	$22,000	$22,000

Fig 19 ORGANIZATION CHART OF MARINE AND SHIPPING DIVISION



5-6 Procurement

The following are the main construction equipment and materials to be mobilized from Japan.

Construction equipment	Construction Material
Dredger	Cement
Dump barge	Steel plate for staging
Tug Boat	Watertight forms
Anchor Boat	Underwater concrete
SEP Barge (for boring)	Glass and frames
	Material for water Supply system
Welder	Material for electrical
Air compressor	Construction
Sand blaster	Material for Sanitary facilities
Concrete breaker	Reinforcing bars
Generator	Fender

CHAPTER 6

PROJECT APPRAISAL

CHAPTER 6 PROJECT APPRAISAL

The execution of upgrading of the port facilities will enable utilization of a larger ferry boat such as the Queen Salamasina between the ports of Mulifanua and Salelologa. This will greatly strengthen the transportation link between two ports and have the following development effects.

(1) The strengthened transportation between these two islands will envigorate interchange between them, and the flow of both inhabitants and goods will increase. This will greatly contribute to the economic development of Western Samoa.

(2) The easy and safe transportation to Savai'i Island will increase and add to further promotion of the economies of both islands. More balanced development of the national resources will therefore be brought about.

(3) The introduction of an adequate ferry service will make possible safe and comfortable transportation for travellers.

(4) The congestion in transportation movement will be alleviated and there will be less trouble at the terminal.

(5) Travel to the capital, Apia, on the island of Upolu will be easier for the citizens of Savi'i Island, and therefore promote advancement in their standard of living.

In view of the significance of this project, its implementation is highly recommended.

CHAPTER 7

CONCLUSION AND RECOMMENDATION

CHAPTER 7 CONCLUSION AND RECOMMENDATION

7-1 Conclusion

As stated in Chapter 6 relating to project appraisal, the implementation of the project to upgrade the port facilities is important for not only strengthening the transportation route between the two main islands, but also has great significance as regards the economic development of the country as a whole. The project will also make a great contribution towards the fostering of goodwill between Western Samoa and Japan. For this reason it is recommended that this project be carried out as a grant-aid project of the Government of Japan.

7-2 Recommendation

Upgrading port facilities will lead to the provision of the basis for adequate ferry transportation, but it is also desirable that the programme described below, be performed in order to obtain the maximum effect from the introduction of a larger ferry to the main transportation route.

(1) The two ferries which are presently being operated are not intended for use as passenger vessels. It is therefore recommended that in the future, passengers only use the Queen Salamasina and these two ferries be used only for the transportation of vehicles.

(2) Surveys and inspection and maintenance will have to be performed in order to ensure safe and long-term ferry operation.

(3) It is necessary to execute a plan for appropriate vessel operation and to establish procurement plan in accordance with the life of the vessel, in order to strengthen transportation capacity.

(4) Night-time operation is considered necessary in order to cope with the future peak demand, and this will require the installation of lighted navigation aids.

(5) The training of technicians and the promotion of related industries is urgently recommended for the ultimate goal of the construction of the repair facility in the near future.

APPENDIX

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Lists of Figure

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Appendix A

Member of Survey Team

APPENDIX A MEMBER OF THE SURVEY TEAM

Mr. Yoshikazu KAWASAKI	Team Leader, Project Supervisor/ Port Planner	Overseas Coastal Area Development Institute
Mr. Toru MIYAZAWA	Project Supervisor/ Dock Planner	Ministry of Transport
Mr. Katsuji ONODA	Project Coordinator	Japan International Cooperation Agency
Mr. Isamu HOTTA	Port Facilities Planner	Pacific Consultants International
Mr. Sadao ORISHIMO	Port Facilities Designer	Pacific Consultants International
Mr. Azusa KIKAWADA	Dock Designer	Pacific Consultants International
Mr. Shigeru AWATA	Expert on Natural Conditions Survey and Hydraulic Civil Facilities	Pacific Consultants International
Mr. Moritsuna OHGI	Expert on Utilities and Equipment	Pacific Consultants International

Appendix B

Schedule of Site Survey

APPENDIX B SCHEDULE OF SITE SURVEY

July	15	Sunday	Mr. Kawasaki, Team Leader, Mr. Miyazawa and Mr. Onoda departed Narita to Sydney at 19:00 by CX 505.
July	16	Monday	Mr. Kawasaki and other two persons arrived at Sydney at 09:55, Mr. Hotta, Mr. Orishimo, Mr. Kikawada Mr. Awata and Mr. Ohgi departed Narita to Sydney at 21:30 by JL 771.
July	17	Tuesday	Mr. Hotta and other 4 persons arrived at Sydney and joined Mr. Kawasaki's group. Mr. Kawasaki and other 7 persons departed Sydney at 09:45 and arrived at Wellington at 14:40 by FQ 47. Mr. Kawasaki explained the Outline of Study to Mr. M. Yamashita, First Secretary of Japanese Embassy in New Zealand and Mr. Yamashita explained the site condition of Western Samoa to JICA Mission.
July	18	Wednesday	Mr. Kawasaki and other 7 persons visited Mr. Akiyama, Ambassador of Japanese Embassy in New Zealand and explained the Outline of Study. The Mission departed Wellington at 13:55 and arrived at Auckland at 14:55 by NZ 448. Departed Auckland at 17:10 to Apia in Western Samoa by PH 742. (Passed over the International Date Line)
July	17	Tuesday	Arrived at Apia at 23:10.
July	18	Wednesday	Meeting was held between JICA Mission and member of Ministry of Transport (MOT). JICA Mission investigated Saluafata Bay, one of the sites proposed for ferry repairing dock, in the morning and Mulifanua Port, Ferry terminal, in the afternoon.
July	19	Thursday	JICA Mission paid courtesy visit to Minister of Transportation and presented inception Report Stating the Outline at the conference room.

			Mission had the Meeting with MOT, discussing the schedule of the study. Visit to Maritime Consultant of MOT to supply the information. Meeting discussing the Project with the member of MOT, Foreign Affairs, Economic Development Dept., Treasury Dept. and Public Work Dept.
July	20	Friday	Site Investigation of Salelologa Port, ferry terminal in Savai'i Island.
July	21	Saturday	Study of collected data, planning for survey area and estimation of construction cost.
July	22	Sunday	Confirmation of survey schedule, study of data collected and estimation of construction cost.
July	23	Monday	Collection of the data relating to ship, ferry boats, foreign and domestic trade at MOT office. Request for Western Samoa Shipping Corporation (W.S.S.C.) to supply the data relating to the ferry boats in service.
July	24	Tuesday	Meeting discussing the survey schedule and the proposed plan based on the survey result at MOT. Receipt of the data relating to the service schedule and repairing status of ferry boats from W.S.S.C.
July	25	Wednesday	Discussing Minutes of Discussions with MOT office. Study the data relating to the engines of the ferry boats in service, number of passengers and volume of cargo by the ferry boats.
July	26	Thursday	Discussion of Plan and Minute of Discussion with member of MOT, Public Work Dept., Foreign Affairs and Economic Development Dept. at Fishing Center. Collection of the data relating the ferry boats in service. Redraft the Minutes of Discussion at the hotel.

July	27	Friday	Finalize the Minutes greeting at MOT Receipt of the general information relating to Western Samoa and South Pacific Countries from United Nation Development Programme (UNDP). Receipt of the ferry repairing data from W.S.S.C. Study the collected data at the hotel.
July	28	Saturday	Signing of the Minutes between JICA Mission and Government of Western Samoa (Representative of MOT, Foreign Affairs and Treasury Dept.) Arrangement of survey schedule and confirmation of survey items to be carried out at the hotel.
July	29	Sunday	Team Leader Mr. Kawasaki, Mr. Miyazawa and Mr. Onoda departed to Auckland by PH 743 at 12:00 (Passed Over the International Date Line)
July	30	Monday	Team Leader Mr. Kawasaki and other 2 persons arrived at Auckland. Departed there and arrived at Wellington.
July	31	Tuesday	Team Leader Mr. Kawasaki and other 2 persons visited Japanese Embassy in New Zealand and explained the outline of site investigation and the Minutes of Discussion between JICA and Government of Western Samoa to Ambassador Mr. Akiyama and First Secretary Mr. Yamashita. Departed to Auckland by NZ474, arrived at Auckland and departed to Narita by JL776.
August	1	Wednesday	Team Leader Mr. Kawasaki and other 2 persons arrived at Narita.
July	29	Sunday	Mr. Hotta and other 4 persons arranged the data and planned the survey schedule.
July	30	Monday	Preparation of survey. Request for Apia Observatory to supply the meteological and sea condition. Survey of Salufata Bay, one of the sites proposed for ferry repairing dock. Collection of the information about Air transportation from MOT,

			Labour Status from Labour Dept., Statistic data from Statistics Dept., repairing facilities from pump repair work shop and general information about construction from Public Work Dept., G.M. Meredith & Associates and Pacific International.
July	31	Tuesday	Land Survey and sounding at Saluafata Bay. Study of the Construction Contract and organization of Western Samoa Government at MOT office. Inspection of work shop of Public Work Dept. Study of the supply condition of construction material and electric power at Apia Concrete Product, Lee Brothers, Fire and Hydraulic Power Station.
August	1	Wednesday	Survey around Salelologa port in Savai'i Island, one of the sites proposed for ferry repairing dock. Study of the construction status and material at Lee Brothers and Special Project Development Corporation.
August	2	Thursday	Sounding, land and current survey around Salelologa Port. Request for civil Aviation of MOT to supply the data about domestic air transportation. Inspection of Vaitele Work Shop.
August	3	Friday	Survey of the wharf and facilities at Salelologa Port. Survey around Mulifanua Port in Upolu Island. Receipt of the data relating for domestic air transportation, maintenance and repair cost of port. Confirmation of the implemented project in the Fourth Five Development Plan. Arrangement of collected data.
August	4	Saturday	Sounding, land and current survey around Mulifanua Port. Investigation of Asau Port, Timber Import Harbour.
August	5	Sunday	Sounding around Mulifanua Port.

August 6	Monday	Survey of wharf and facilities at Mulifanua Port. Inspection of Queen Salamasina and explanation of ship and repair from the captain.
August 7	Tuesday	Arrangement of Survey result and collected data.
August 8	Wednesday	Collection of meteological data from observatory. Arrangement of survey result and collected data.
August 9	Thursday	Mr. Hotta and other 4 persons departed Apia to Sydney by PH885. (Passed over the International Date Line)
August 10	Friday	Mr. Hotta and other 4 persons arrived at Sydney by PH885 and departed to Narita by QF021.
August 11	Saturday	Mr. Hotta and other 4 persons arrived at Narita.

Appendix C

Minutes of Discussion

APPENDIX C MINUTES OF DISCUSSIONS

MINUTES OF DISCUSSIONS ON BADIC DESIGN STUDY
FOR DOMESTIC TRANSPORTATION STRENGTHENING
PROJECT IN WESTERN SAMOA

The Government of Japan, through Japan International Co-operation Agency (JICA), has despatched a survey team (hereinafter referred to as "the Team" to Western Samoa for the purpose of conducting the basic design study on the Domestic Transportation Strengthening Project (hereinafter referred to as "the Project") from 17 July to 9 August 1984.

The Team headed by Mr Yoshikazu Kawasaki, Director of Planning Department, Overseas Coastal Area Development Institute, has carried out a field survey, held a series of discussions and exchanged views with the officials of the Western Samoa Government concerned with the Project (hereinafter referred to as "the Officials").

As a result of the Team's field survey and discussions with the Officials, both parties have agreed to recommend to their respective Government that the result of discussions attached herewith should be examined toward the realization of the Project, especially the Upgrading of the Salelologa and Mulifanua Ports Facilities component to be implemented in 1984/1985 fiscal year.

Regarding the Construction of the Slipway and the Ship Repair Facilities, both parties have recognised the need for further detailed studies including the possibility of technical co-operation to be undetaken as soon as possible.

(Yoshikazu Kawasaki)
HEAD OF JAPANESE SURVEY TEAM
JICA

for:

(Peseta P. Smith)
ACTING SECRETARY FOR TRANSPORT
GOVERNMENT OF WESTERN SAMOA

DATE: 28 JULY 1984

DATE: 28 JULY 1984

ATTACHMENT

1. The objective of this Japanese Grant Aid Programme is to provide necessary facilities, buildings and equipment for the Domestic Transportation Strengthening Project.

2. The Project consits of two components namely the Upgrading of the Salelologa and Mulifanua Port Facilities (hereinafter referred to as "the Port") and the construction of Slipway and Ship Repair facilities.

3. The proposed sites of the Port are shown in Annex I, II.

4. The purpose of the Port is to upgrade port facilities of Mulifanua in Upolu island and Salelologa in Savaii island for utilizing large scale ferry such as M.V. "QUEEN SALAMASINA".

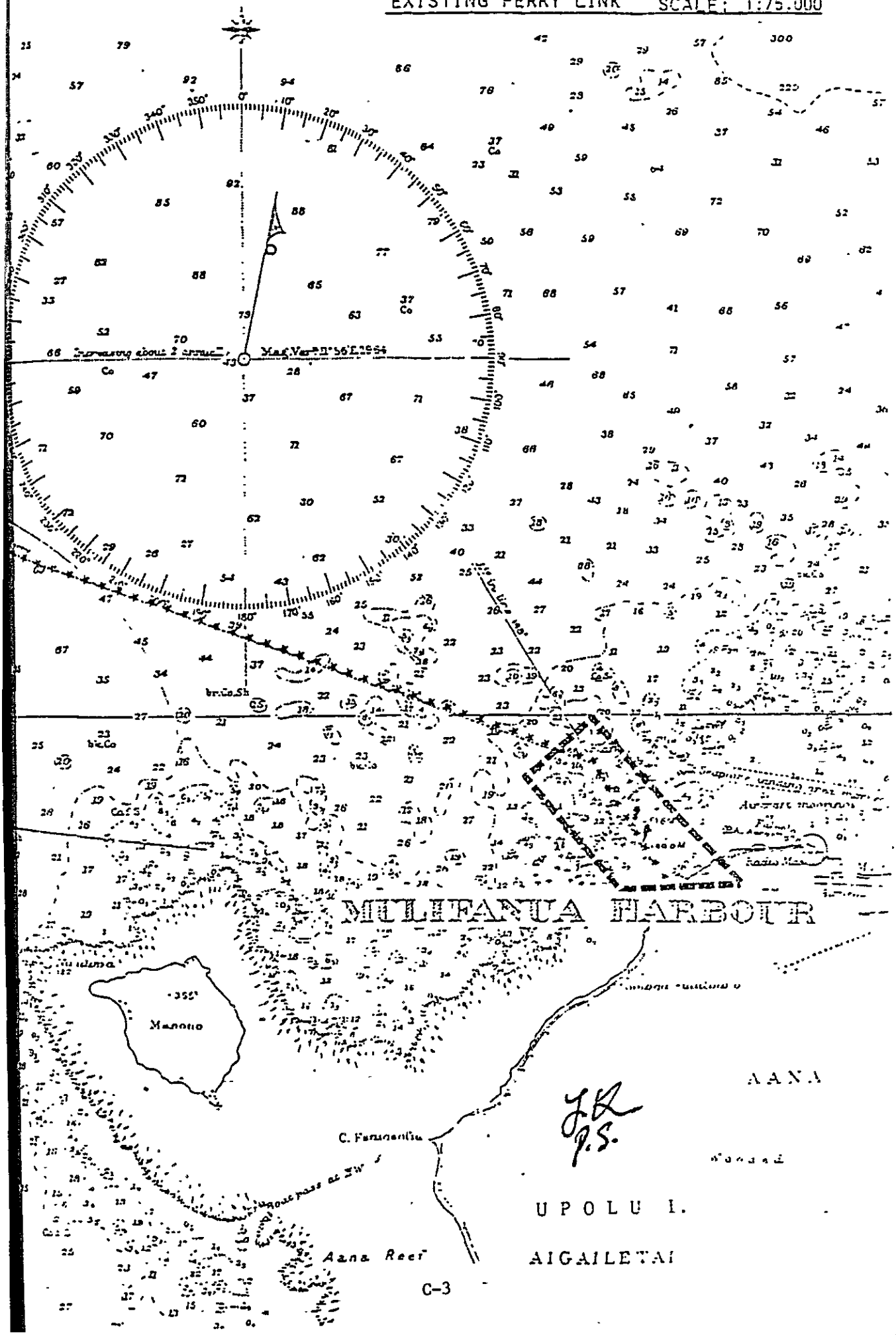
5. The Team will convey the desire of the Officials to the Government of Japan that the former will take necessary measures to co-operate with the Government of Western Samoa in implementing the Ports for construction of facilities and other items as listed in Annex III, with priority within the scope of Japan's Economic Co-operation Programme.

6. The Western Samoa Officials were informed by the Team of the Japan Grant Aid System and the Principle of Using a Japanese Consultant Firm and Contractor for Project implementation.

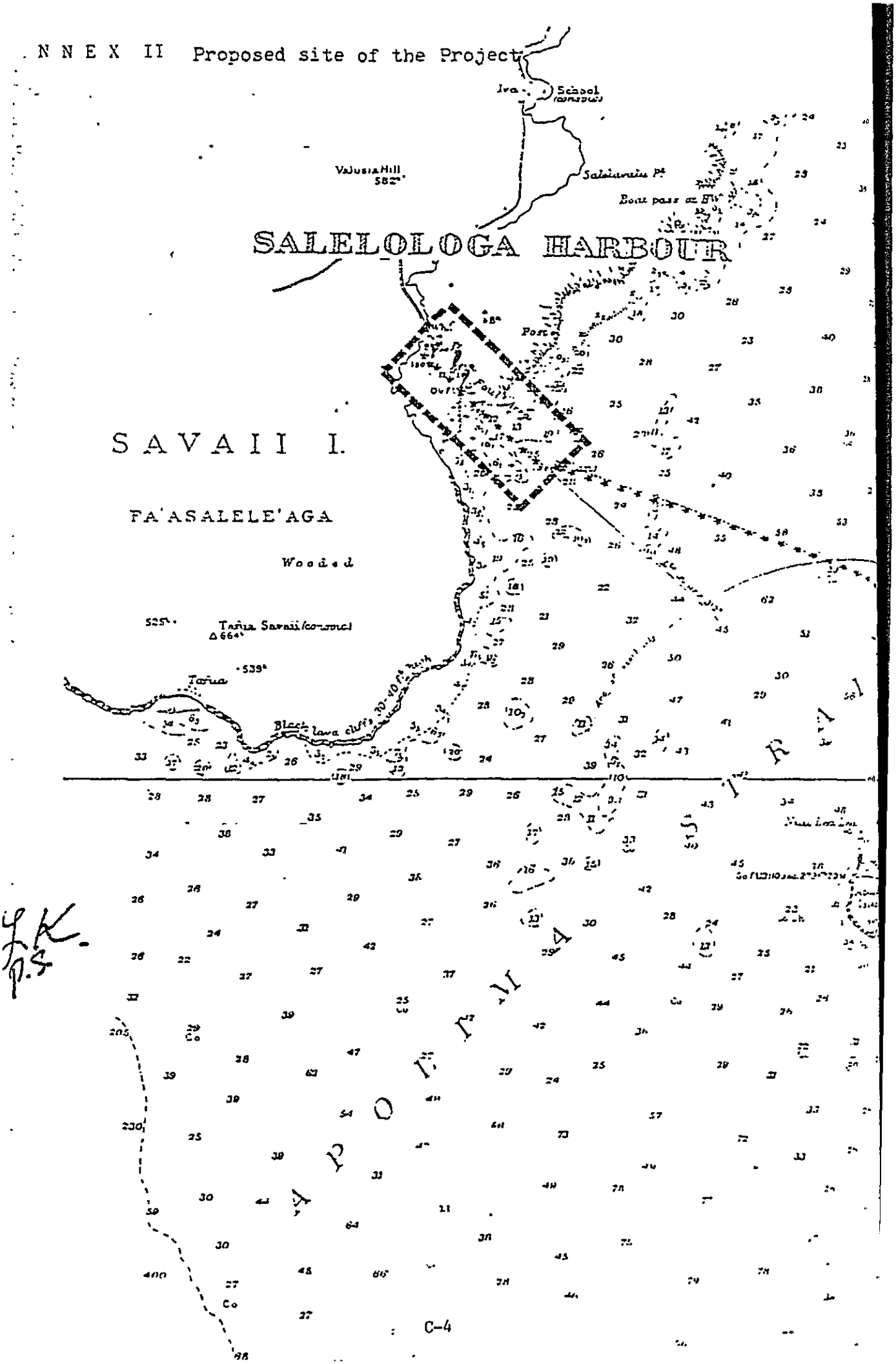
7. The Officials have advised that the Government of Western Samoa will endevour to take the necessary measures as listed in Annex IV on condition that the grant aid by the Government of Japan is extended to the Project.

ANNEX I Proposed site of the Project

EXISTING FERRY LINK SCALE: 1:75.000



N N E X II Proposed site of the Project



F.K.
P.S

ANNEX III

A. Facilities (both ports)

1. The protected inner channel

depth : 3 metres

width : 50 metres (with gradual increase in width at the in-shore and near the turning basin)

2. The immediate channel

depth : 3.5 metres

width : 60 metres (to allow for increased wave activity)

3. The outer channel

depth : 4 metres

width : 70 metres (to allow for increased wave activity)

4. The turning basin

minimum depth : 3 metres

minimum diameter ; 120 metres

In case of Mulifanua port, the inner channel should be widened with emphasis on the in-shore end and the turning basin also should be extended in a north eastern direction to a line about 60 metres back from the channel centre line immediately beyond the line of the northwest face of wharf.

In case of Salelologa port, the shallow area at the entry of the berth should be deepened to give a clear entry width of at least 40 metres.

5. Fender

6. Wooden piles at piers

7. Security fence

B. Building (both ports)

1. Terminal Building

C. Others

Y.K.
P.S.

ANNEX IV

Major undertaking to be taken by the Government of Western Samoa.

1. To clear the sites of the Project when needed

2. To provide facilities as follows

   2.1. Distributing line of electricity to the sites

   2.2. City water distribution main to the sites

   2.3. Drainage city main (for storm, sewer and others) to the sites

   2.4. Telephone trunk line to the main distribution frame/panel of the buildings

   2.5. Furniture for general office use

3. To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

   3.1. Advising commission of Authorization to Pay.

   3.2. Payment commission.

4. To ensure unloading, customs clearnace and customs duty exemption of the products at the port of disembarkation in Western Samoa.

5. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Western Samoa and stay therein for the performance of their work.

6. To maintain and use properly and effectively that the facilities constructed and equipment purchased under the Grant.

7. To bear all the reasonable expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and the installation of the equipment.

Y.K.
Q.S.

Appendix D

List of Personnel Interviewed

APPENDIX D LIST OF PERSONNEL INTERVIEWED

WESTERN SAMOA

- Ministry of Transport	Minister	Hon Lauofo Meti
- Ministry of Transport	Acting Secretary	Mr. Peter Smith
- Ministry of Transport	Executive Officer	Mr. Nofo Va'aelua
- Ministry of Transport	Marine Pilot	Mr. Sammy Stewart
- Ministry of Transport		Mr. Andy Herd
- Ministry of Transport	Maritime Consultant	Mr. Pollard J. Moore
- Foreign Affairs		Mr. Alan Wendt
- Foreign Affairs		Mr. Feturi Elisala
- Treasury Dept	Acting Secretary	Mr. Epa Tuioti
- Treasury Dept		Miss. Pisaina Leiua
- Economic Development		Mr. Misiolo Sofe
- Public Work Dept		Mr. Tuuu Ieti Taulealo
	Building Engineer	Mr. Leti Tarrleale
- Public Work Dept.		Mr. Anato Reupena
- Public Work Dept.		Mr. Tusi Tamasese
- Labour Dept.	Deputy Commissioner	Mr. Tate Simi
- Statistic Dept.		Mr. Magele
		Mr. M.B. Crowley
- Western Samoa Shipping Corp.	General Manager	Mr. Oscar Peter Betham
- Western Samoa Shipping Corp.	Chief Accountant	Mr. Gustan Chr Lung
- Western Samoa Shipping Corp.	Chief Engineer	Mr. David R Meredith
- Special Project Development Corp.	General Manager	Mr. John A Muhary
- United Nation Development Programme	Resident Representative	Mr. Hasegawa
- United Nation Development Programme		Miss. Hanazawa
- Generating Power Plant	Manager	Mr. Penn
- G.M. Meredith & Associates		Mr. George Meredith
- Apia Concrete Product	Managing Director	Mr. Tupua Wetzell
- Lee Brothers	Managing Director	Mr. Eddie Lee
- JICA	Resident Representative	Mr. Kusano

NEW ZEALAND

- Japanese Embassy in New Zealand	Ambassador	Mr. Teruji Akiyama
- Japanese Embassy in New Zealand	First Secrefary	Mr. Minoru Yamashita
- Japanese Embassy in New Zealand		Mr. Tohru Sawa

Appendix E

List of Date Collected

APPENDIX E LIST OF DATA COLLECTED

(1) Natural Condition

- Tropical Storms and Hurricanes in the Southwest Pacific Nov. 1939 to Apr. 1969	New Zealand Meteorological Service
- Tropical Cyclones in the Southwest Pacific Nov. 1969 to Apr. 1979	"
- Summaries of Climatological Observations to 1980	"
- Meteorological Observations for 1981 Pacific Island Stations	"
- Report on the Storm and Floods of Nov. 16 - 18, 1974	Apia Observatory
- Meteorological Note Summary of Wind at Apia Period 1941 - 1970	Meteorological Office
- Meteorological Data	
- Times and Heights of High and Low Waters (Jan. 1984 - Dec. 1984) Sunrise and Sunset for Apia, 1984 Phases of the Moon for the Year, 1984	Apia Observatory
- Siltation Problem and Desiability of Relocation of Apia Harbour	

(2) Socio - Economic Condiiton

- Western Samoa's Fourth Five Year Development Plan 1980 - 1984	Economic Development Department
- Statistical Abstract, 1982	Department of Statistics
- Annual Statistical Abstract, 1983	"
- Socio Economic Situation Development Itrategy and Assistance Needs	Government of Western Samoa
- Western Samoa Transportation Study	Government of Western Samoa
- Report on the Eighth Conference of the South Pacific Port Association Held in New Caledonia 7th - 10 Oct., 1981	Ministry of Transport
- Substantial New Program of Action Project Profil	Department of Economic Development
- Tenth Annual Report, 1982	Electric Power Corporation, Western Samoa
- Annual Reports for the Years Ending 1979, 1980, 1981	Western Samoa Shipping Corporation Ltd.
- 1978 Annual Report	"
- 1977 Annual Report	"
- Balance Sheet as at 31st December, 1983	"

- Airport Traffic	
- Faleolo Airport Extension Report, 1983	Government of Western Samoa
- Financial Assistance Report (Terminal, Freight IIS, Five Services) Faleolo International Airport Development 1984	Government of Western Samoa
- Faleolo International Airport Extension Project Evaluation Report February, 1984	"
- Labour and Employment	"
- Shipping	"

(3) Sea Transportation

- ESCAP Review of Developments in Shipping Ports and Inland Waterways - 1984	Statistics Department
- Economics Statistics of Shipping, 1980	Department of Statistics
- Economics Statistics of Shipping, 1984	"
- Proceedings of Seminar - Cum - Study Tour on Coastal Shipping	United Nations
- M.V. "Queen Salamasina" Trial Data Report	Illingham Shipyard (W.A) PTY Ltd.
- M.V. "Queen Salamasina"	
- From Ship Registration Book	Government of Western Samoa
- Ship Registration	
- Limulimutau Repair	Ministry of Transport
- Container - Port of Apia	Ministry of Transport
- Port Authority and Cargo Handling Operation	
- Review of Port Control Regulations - 1966	C.F. Vae'su
- Essential Development in the Port of Apia	Peter Smith Assistant Secretary
- The needs of Funds for - Recurrent & Capital Works Ports & Harbors Proposed Port Improvements	Ministry of Transport

- New Wharf Facilities for Home Trade Vessels and Inter Island Ferries Port of Apia	
- Short Paper on Coastal/Interisland: Shipping in Western Samoa	Ministry of Transport
- Charter Hire - MV "Forum Samoa"	"
- Port Charge Regulations 1983 Arrangement of Provisions	"
- Western Samoa Port Charges Regulations, 1983	"
- Western Samoa Port Charges Regulations, 1983	"
- Port Charge Regulations, 1984 Arrangement of Provisions	"
- Report on Mulifanua and Salelologa Approach Channels in Relation to the Operation of the Vessel Queen Salamasina	Government of Western Samoa
- Container Park Study Apia Harbour/ Western Samoa Final Report	United Nations Conference on Trade and Development
- Apia Wharf Reconstruction	Department of Housing & Construction
- Operation Schedule, Condition of Ferry. Data of Ship Repair and Others	Western Samoa Shipping Corporation
- The Establishment of the Western Samoa Ports Authority	Government of Western Samoa
- Information of Vaitele Workshop	

(4) Items related to Construction Work

- Retail Price List	New Samoa Industry Limited
- Price List of Timber	Aamoa Forest Products, Ltd.
- Price List of Construction Material	Pacific International Limited
- Price List of Concrete Products and Building Material	Apia Concrete Product, Ltd.
- Estimate of borehole drilling	G.M. Meredith & Associates
- Brochur of Carpenters Industrial	Carpenters Industrial
- Brochure of G.M. Mereditch & Associates	GM Mereditch & Associates
- Tender Prequalification Data Building and Civil Engineering Construction Project	The Special Projects Development Corporation
- Western Samoa Telephone - Telex Directory, 1984	

(5) Drawings

- Site Plan Mulifanua Ferry Terminal	Department of Public Works
- Mulifanua Wharf Passenger Way & Fence Layout	"
- Mulifanua Layout of Sheet Piling	"
- Mulifanua Site Preparation Detail	"
- Site Plan Salelologa Ferry Terminal	"
- Salelologa Wharf Passenger Way & Fence Layout	"
- Salelologa Wharf Passenger Way of Fence Details	"
- Salelologa Layout of Sheet Piling	"
- Salelologa Road Legality	Department of Land & Survey
- Mulifanua Harbour Survey Bathymetric Contour Chart	Ministry of Transport
- Mulifanua Harbour Survey Bathymetric Sounding Chart	"

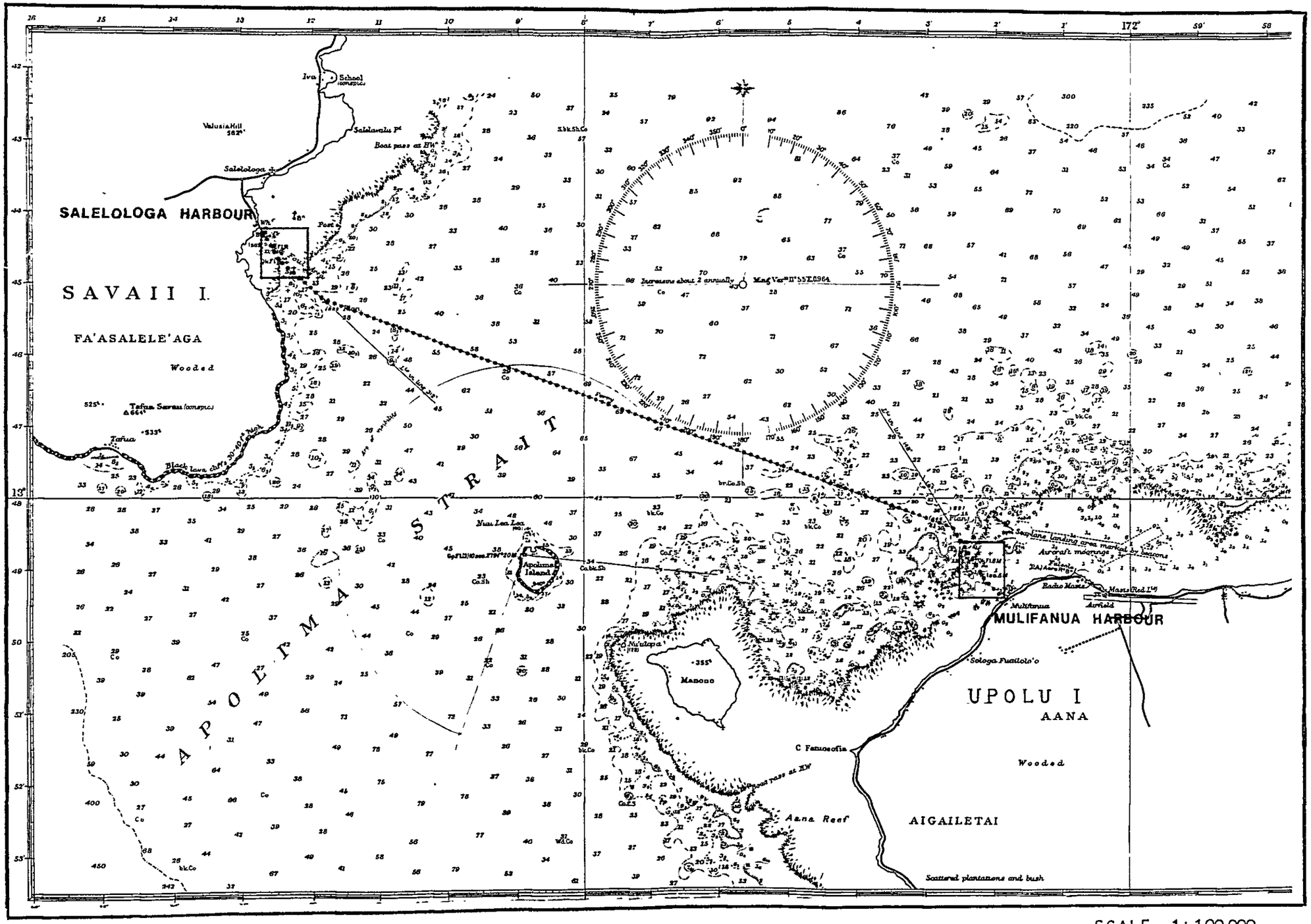
- Salelologa Harbour Survey Bathymetric Contour Chart	Ministry of Transport
- Salelologa Harbour Survey Bathymetric Sounding Chart	"
- Apia Harbour Bathymetric Chart 1981 Survey	"
- Apia Harbour 1975 Survey	"
- Queen Salamasina Profile & Decks	Western Samoa Shipping Corporation Ltd.
- Queen Salamasina General Arrangement-sht.2	"
- Salafai General Arrangement 85 Landing Barge	"
- Limulimutau Self Propelled Runle Carrying Barge (No.N37) Piping Plan	"
- Ministry of Transport Marine and Shipping Description of Organization Chart	Ministry of Transport
- Borehole Sections Apia Fishing Port	"

- Chart Samoa or Navigator Islands	Ministry of Transport
- Chart New Zealand to Fiji and Samoa Islands	"
- Chart Apia Harbour	"
- Chart Plans in Samoa Approaches to Apia	"
- Topographical Map Western Samoa	"
- Map of Apia and Environs	"
- Topographical Map Mulifanua	Department of Land & Survey
- Topographical Map Salelologa	"
- Topographical Map Luatuanuu	"
- Topographical Map Solaua	"
- Topographical Map Nofoali'i	"
- Topographical Map Asau	"

Appendix F

Data Collected

FIG. F-1 EXISTING ROUTE OF FERRY



SCALE 1:100,000

FIG. F-2 BATHYMETRIC CONTOUR CHART MULIFANUA HARBOUR

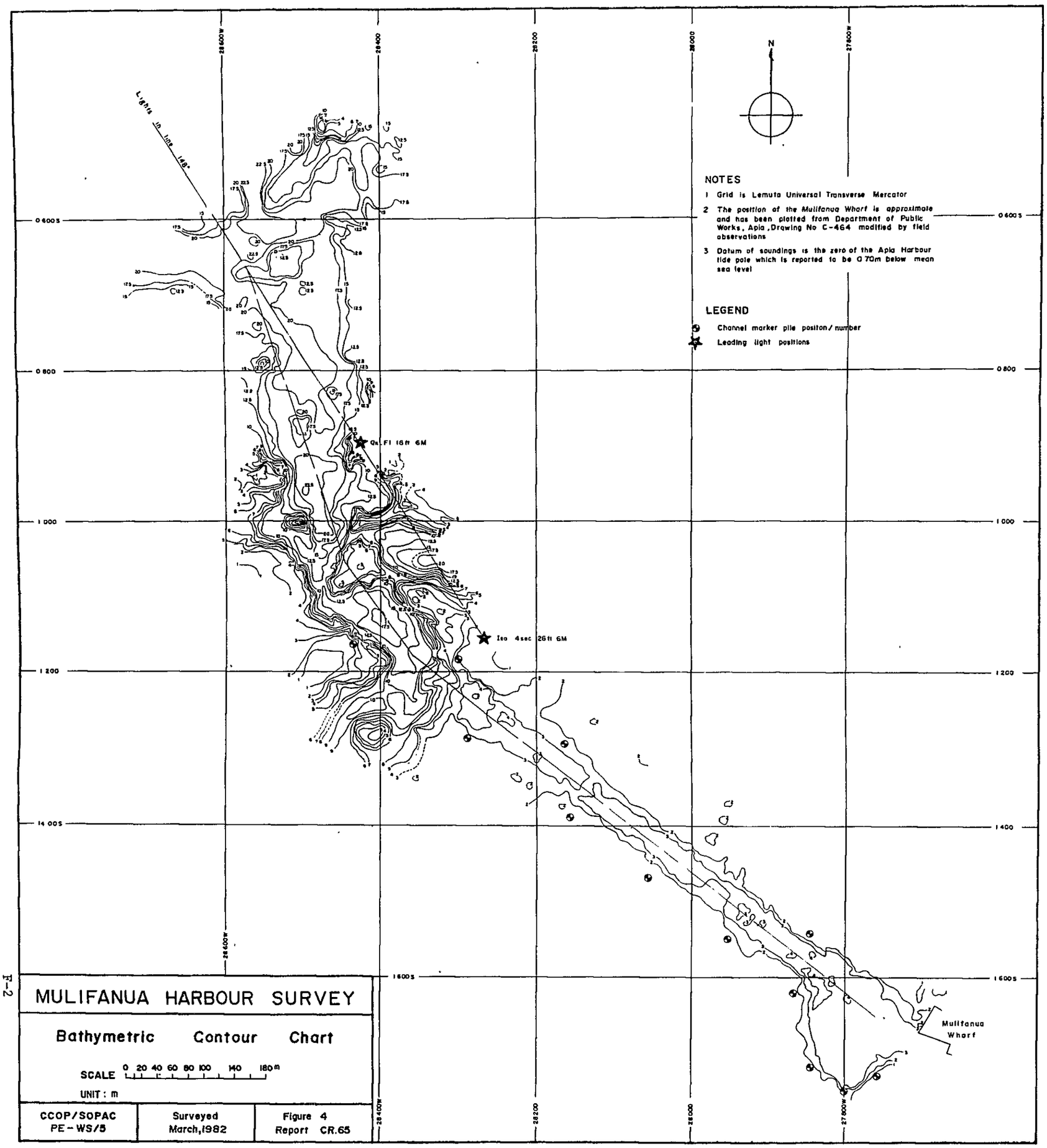
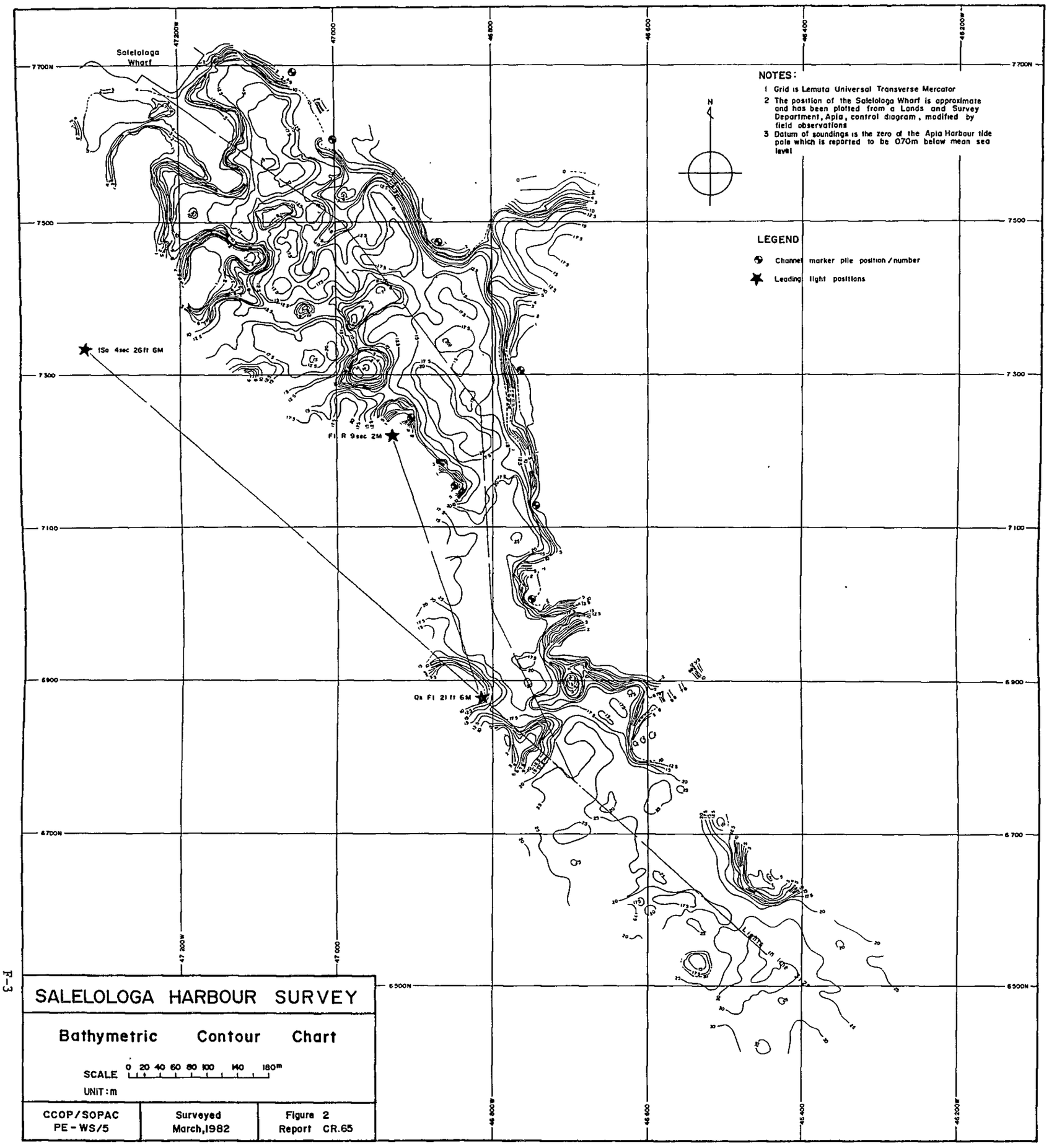


FIG. F-3 BATHYMETRIC CONTOUR CHART SALELOLOGA HARBOUR



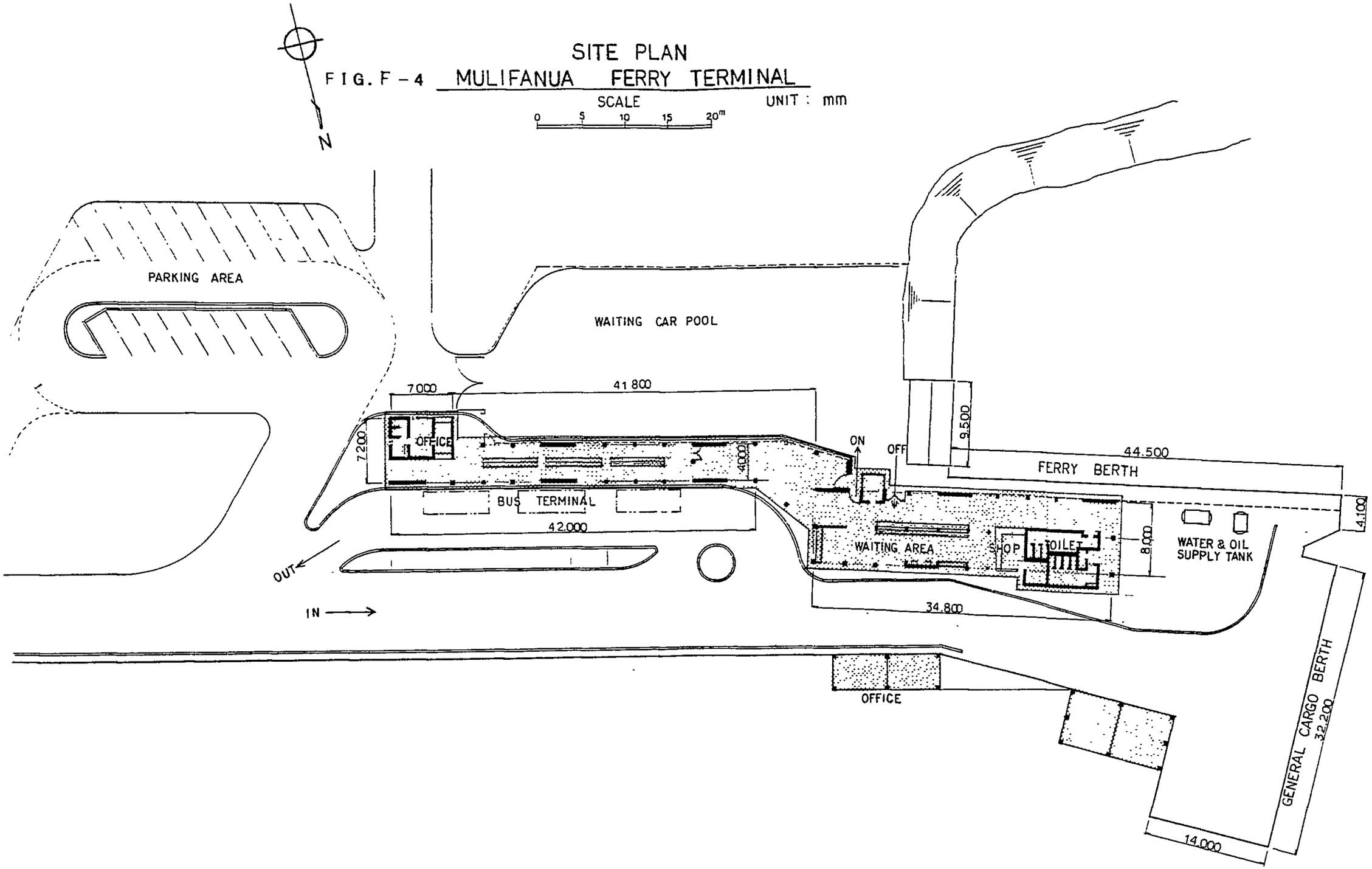
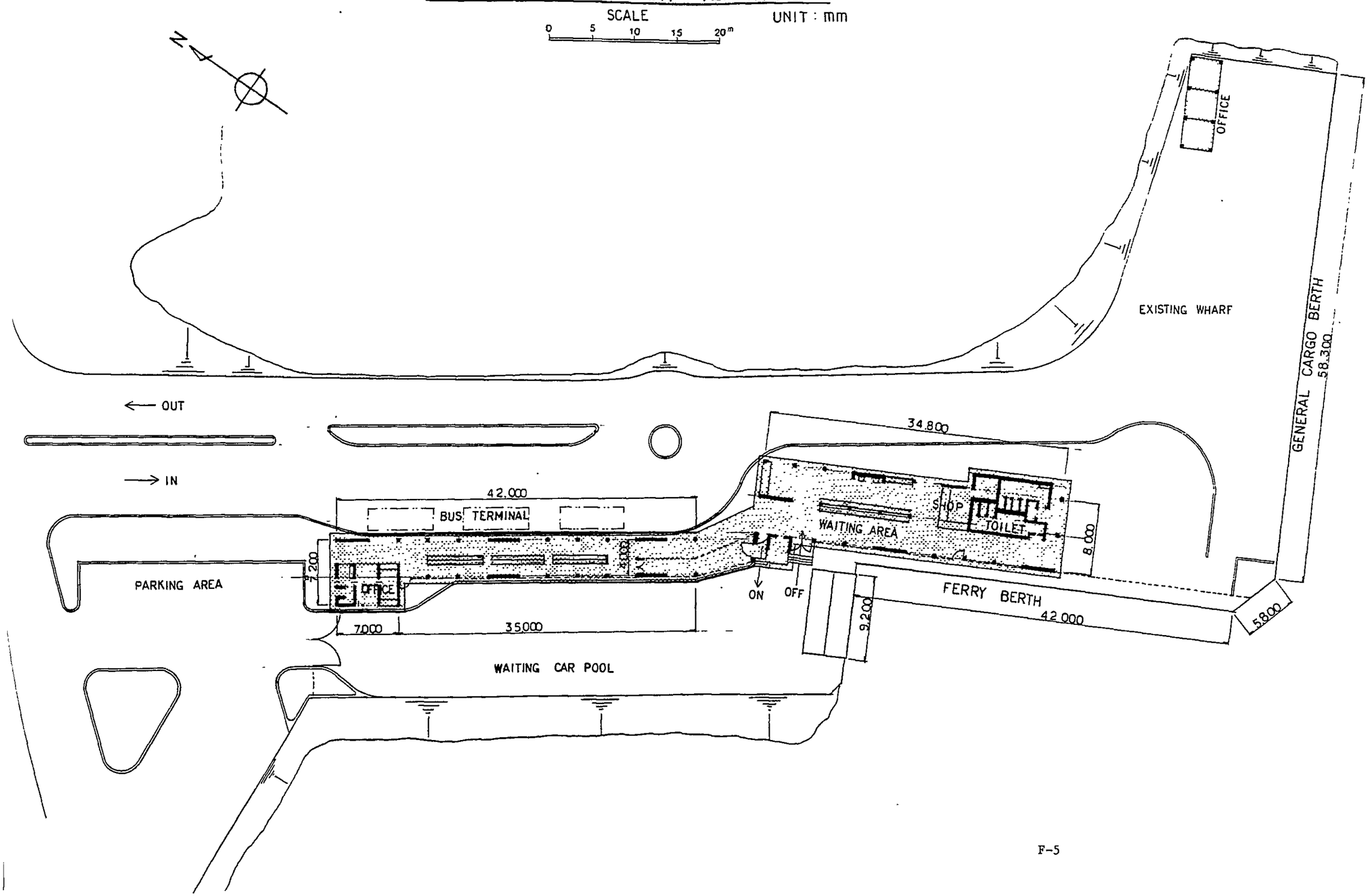

SITE PLAN
FIG. F-4 MULIFANUA FERRY TERMINAL
SCALE
UNIT : mm
0 5 10 15 20m
N
PARKING AREA
WAITING CAR POOL
7000
41 800
OFFICE
7200
4000
BUS TERMINAL
42,000
OUT
IN
ON
OFF
9,500
44.500
FERRY BERTH
4,100
WATER & OIL SUPPLY TANK
WAITING AREA
SHOP
TOILET
8,000
34,800
OFFICE
GENERAL CARGO BERTH
32,200
14,000

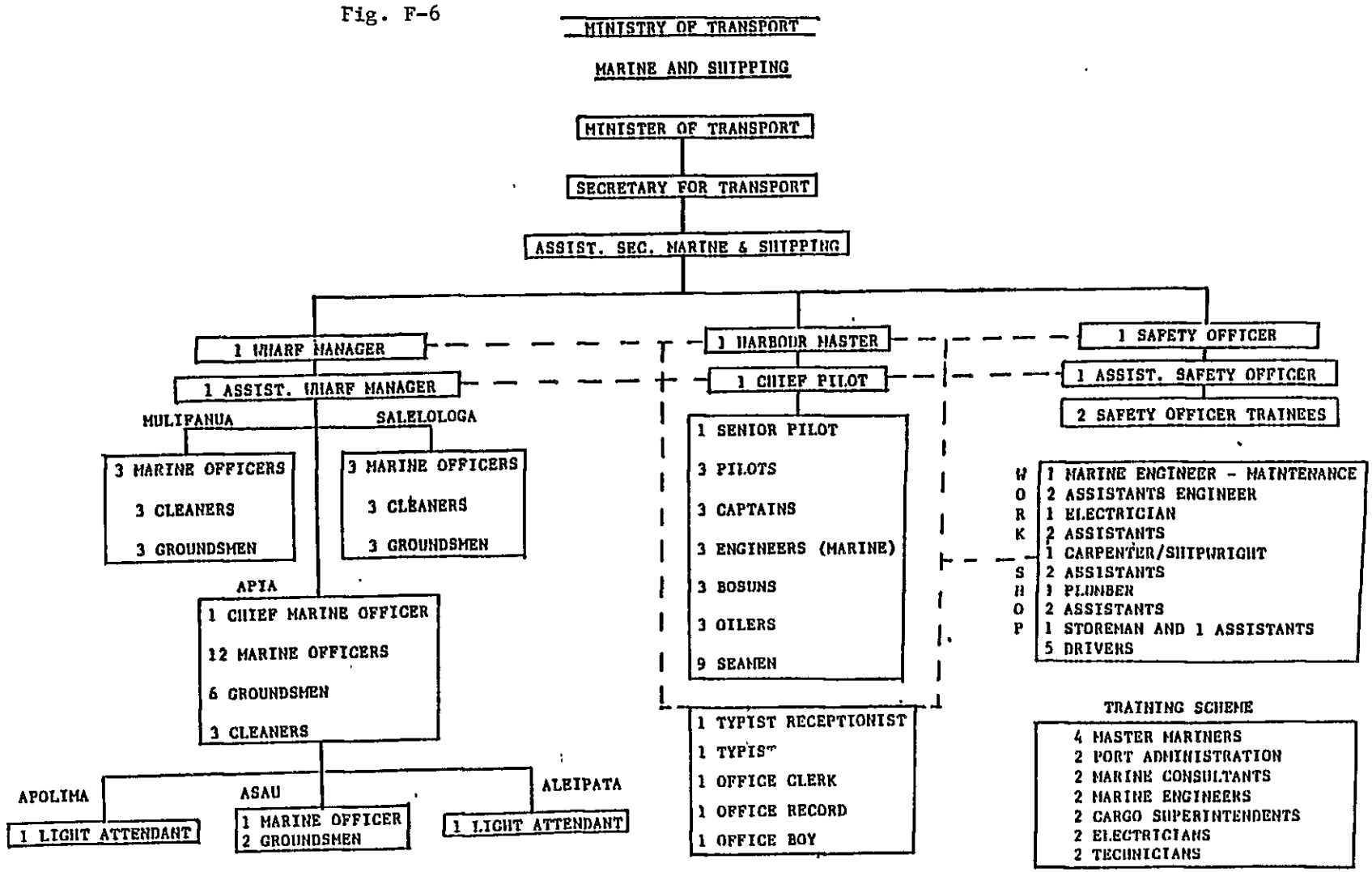
FIG. F-5 SITE PLAN SALELOLOGA FERRY TERMINAL



2. Basic Related Information

(1) ORGANIZATION CHART OF MARINE AND SHIPPING

Fig. F-6



(2) The Projects Relating to Maritime Transportation in Fourth Five Year Development Plan

Port operation, administration and development study (MA 1)

As a result of the increased use of containers and other changes the arrangement of the cargo handling and storage area, range of equipment and methods of operation at the Port of Apia requir revision. Moreover there is the possibility that Apia could become a regional transhipment centre. A study will be commissioned in order to improve present working arrangements and define the best strategy for the larger term. Total cost $150,000.

Dry docking or slipping facilities study (MA 2)

A privately owned slipway of 50 ton capacity is the only facility available for repair and maintenance of shipping in Western Samoa. Engineering investigations were undertaken in 1974 to establish the feasibility and costs of a slipway of 500 ton capacity but no economic or financial analysis was done. Since that time, interest has turned to the provision of a mechanical lift or synchron-lift capable of handling vessels of up to 1,000 tons. Apia, Asau, Saluafata and Salelologa have been suggested as locations. Location and the feasibility of such a facility require study. Total cost $50,000.

Repairs to Apia Wharf (MA 3)

Following the discovery of cracking in some concrete piles under the wharf an investigation of the structural adequacy and remedial requirements was made with the assistance of Australian aid in late 1977. The investigation reported no structural problem of significance but recommended cathodic protection of the piles, fibreglassing of surface cracked areas and replacement of the fendering system to reduce wear on the wharf face cap. Total cost $125,000.

Apolima lighthouse (MA 4)

Since early 1978 the wind-powered landfall on Apolima Island has been out most of the time, representing a hazard to shipping and involving the Marine Department in heavy costs to relight it. A more reliable solar-powered replacement will be substituted. Total cost $50,000.

Training school for seamen (MA 5)

This is an ongoing project under the aid programme with the Federal Republic of Germany. The buildings for the school were completed at Faleolo during 1979 and instruction is scheduled to commence in 1980. The project is to train Samoans as seamen to accepted international standard for duty on merchant vessels, including the Pacific Forum Line. The school would process 48 students per year who would also receive training at sea as part of the programme. Total cost $3.73 million.

Asau channel development duty (MA 6)

Reference is made in Chapter 22 (Forestry) to the need to determine the most beneficial use of the low grade timber resources on Savaii. There appears to be a number of options, of which woodchipping is one possibility. From preliminary investigations the economics of a woodchipping industry are strongly influenced by shipping costs and to be viable would require much larger ships than the present channel can accommodate.

Further investigation is required to define the hardness of the reef material so that the costs of channel development can be more accurately defined for the wood chip industry analysis. Total cost $105,000.

Mulifanua and Salelologa harbour development studies (MA 7)

It is intended to develop Mulifanua and Salelologa harbours and the associated channel in order to enable the "Queen Salamasina" to run a passenger service between Upolu and Savaii. The ship was originally intended for that service, but it turned out that the turning basins and the channel were inadequate. However, as neither the costs nor the benefits of this development are known, it will be necessary to conduct a study first. Total cost $50,000.

(3) Specification of Ferry Boats

Table F-1

Name	Queen Salamasins	Puleono	Limulumutau	Salafai
Ship Builser	Dillingham Australia	Robin Shipyard Singapore	Carrington Australia	Index Eng. Australia
Build in	1977	1975	1967	1970
L O A (m)	42.25	36	33.9	27.06
Width (m)	10.36	9.6	10.2	7.24
Gross Tonnage	714	229	248	121
D W T	91	90	80	85
Draft (m)	2.14	1.5	1.45	1.59
Speed (knots)	11	9.5	9.5	10
No of Passergers	216	119	150	60
No of Vehicles	15	16	12	8
Fuel Consumption	50gals/mile	24gals/mile	14gals/mile	18gals/mile
Operation Commencement	Dec.1978	Jan.1979	Sept.1974	Mar.1984
Classification	Lloyds	Bureau Veritas	Brieau Veritas	Lloyds

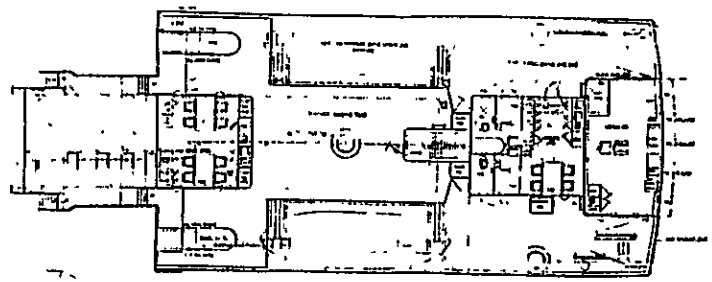
Source: Western Samoa Shipping Corporation

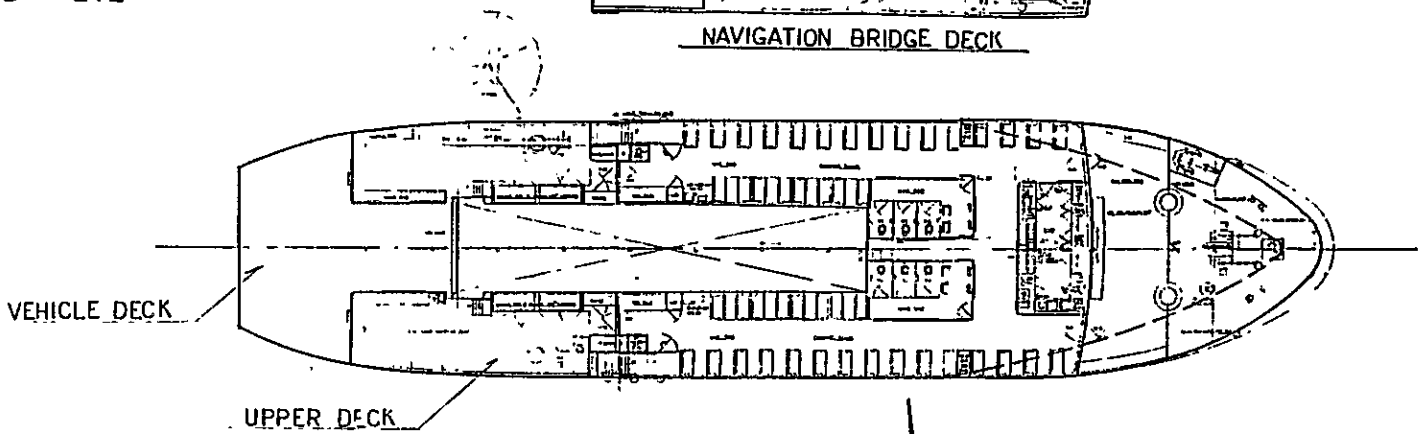
(4) QUEEN SALAMASINA

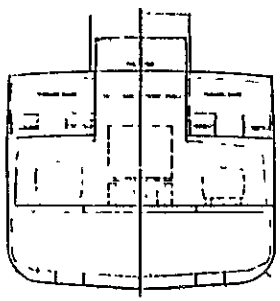
Fig. F-7

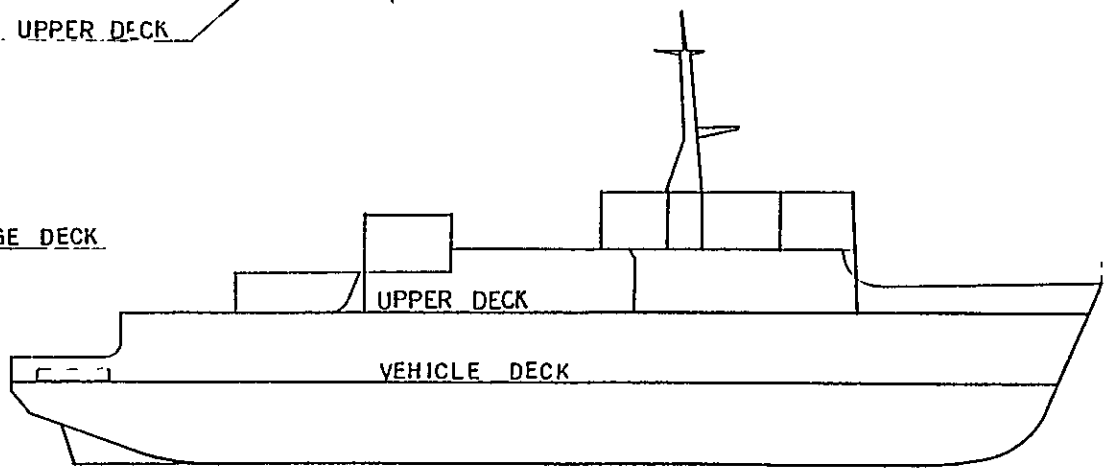
DIMENSIONS

LENGTH W L	39.60M
BREADTH MLD	10.35M
DEPTH MLD TO VEH DK	3.35M
DEPTH MLD TO UPPER DK	6.00M
DESIGN DRAUGHT MLD	2.14M
LLOYDS BP LENGTH	38.40M
SCANTLING DRAUGHT MLD	2.25M



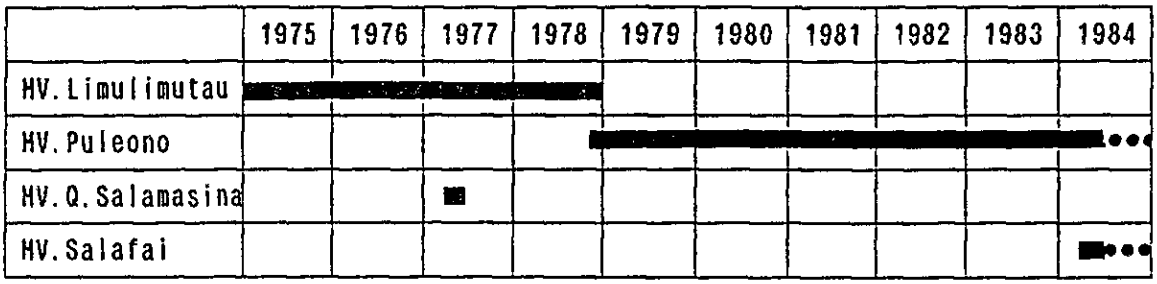






(5) Vessels operated between Hulifanua and Salelologa

Fig. F-8



TARIFF OF FERRY Hulifanua - Salelologa

Passenger

Adult	$ 2.0
Child	$ 1.0

Vehicle

7ton Truck	$ 34.0
3ton Truck	$ 22.0
American Pickup	$ 16.0
Small Pockup	$ 12.0
Sedan	$ 12.0

Cargo

$ 32.0 per ㎥ or $40.0 per Cubic feet

Source : Western Samoa Shipping Corporation

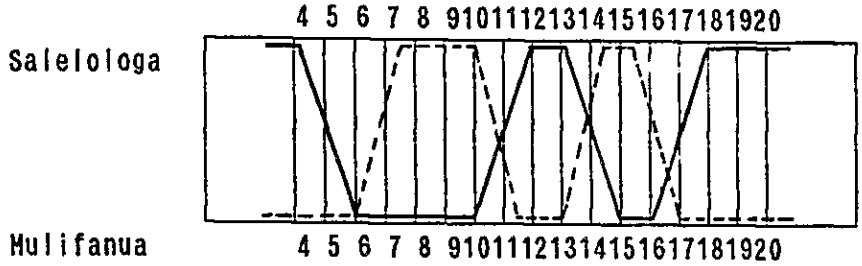
(6) PRESENT OPERATING SCHEDULE BETWEEN MULIFANUA AND SALELOOGA

Fig. F-9

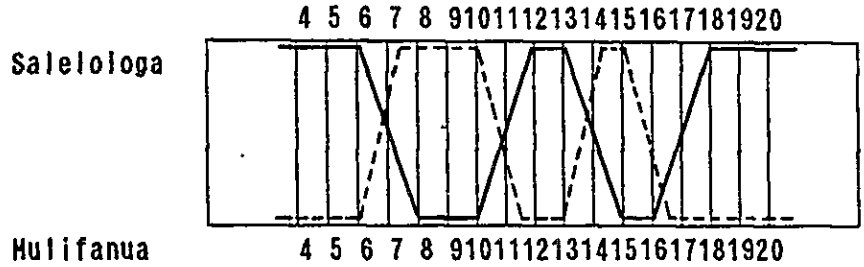
——— PULEINO

- - - - SALAFAI

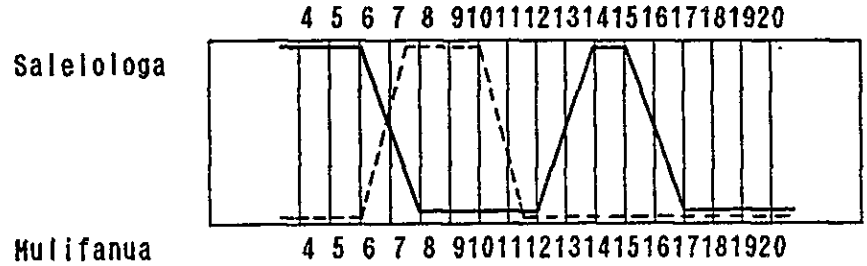
MONDAY



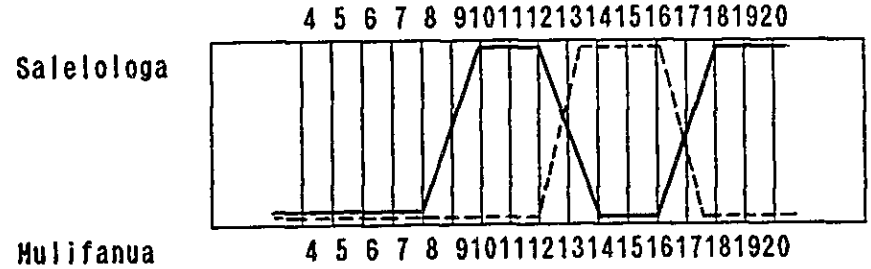
TUESDAY - FRIDAY



SATURDAY



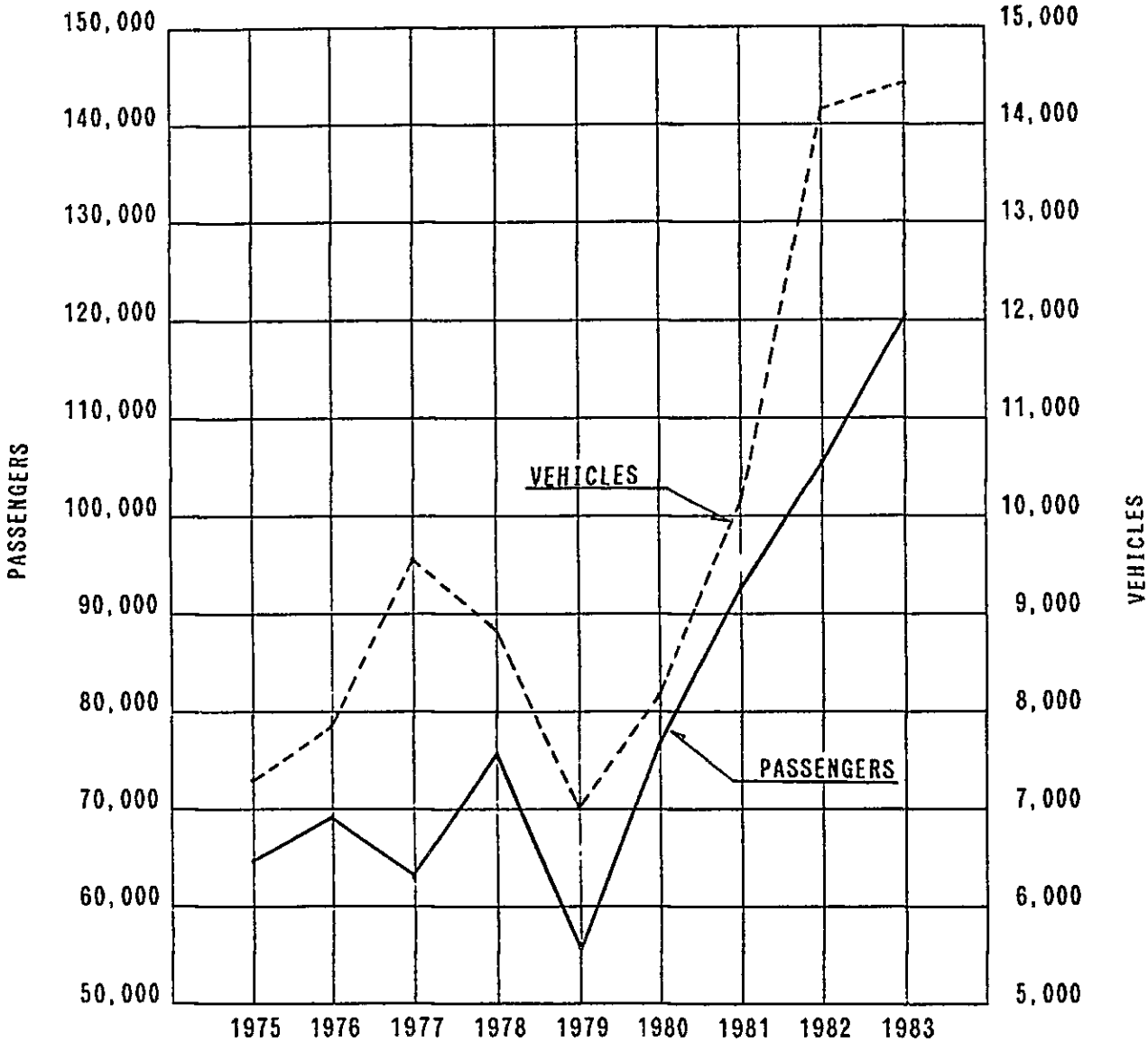
SUNDAY



Source : Western Samoa Shipping Coporation

(7) NUNBER OF VEHICLES AND PASSENGERS TRANSPORTED BY FERRY (1975 - 1983)

Fig. F-10



Source : Western Samoa Shipping Corporation

86

(8) Number of Passengers per day by Ferry

Unit : days

Table F-2

1983

Number of Passengers	M → S	S → M	Total	%
0 - 100	53	65	118	16.5
101 - 200	210	193	403	56.4
201 - 300	66	56	122	17.1
301 - 400	16	23	39	5.5
401 - 500	8	8	16	2.2
501 - 600	3	4	7	1.0
601 - 700	1	0	1	1.3
701 - 800	2	1	3	
801 - 900	1	1	2	
901 - 1000	1	0	1	
1001 - 1100	0	1	1	
1101 - 1200	0	1	1	
1201 - 1300	1	0	1	
Total	362	353	715	100

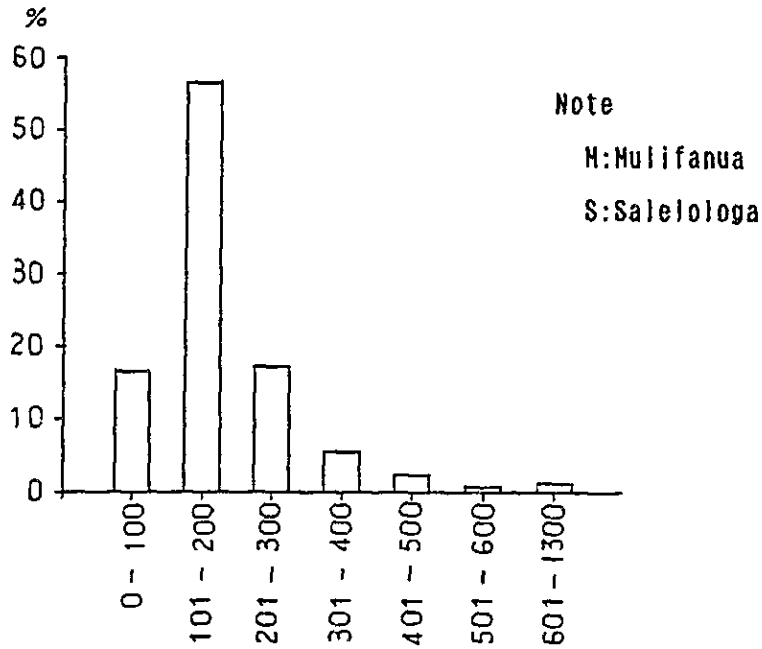


Fig. F-11 Number of Passengers

(9) OPERATION COST OF FERRY

Table F-3

Name	Queen Salamasina	Puleono	Limulimutau	Salafai
1978	$ 217,919	$ 4,840	$185,510	-
1979	$ 277,319	$211,933	$146,122	-
1980	$ 395,067	$238,733	$159,294	-
1981	$ 391,881	$290,759	$198,021	-
1982	$ 626,218	$426,526	$ 19,857	-
1983	$ 608,597	$373,621	$ 46,364	-

Source : Western Samoa Shipping Corporation

(10) Data of Ferry Repairing

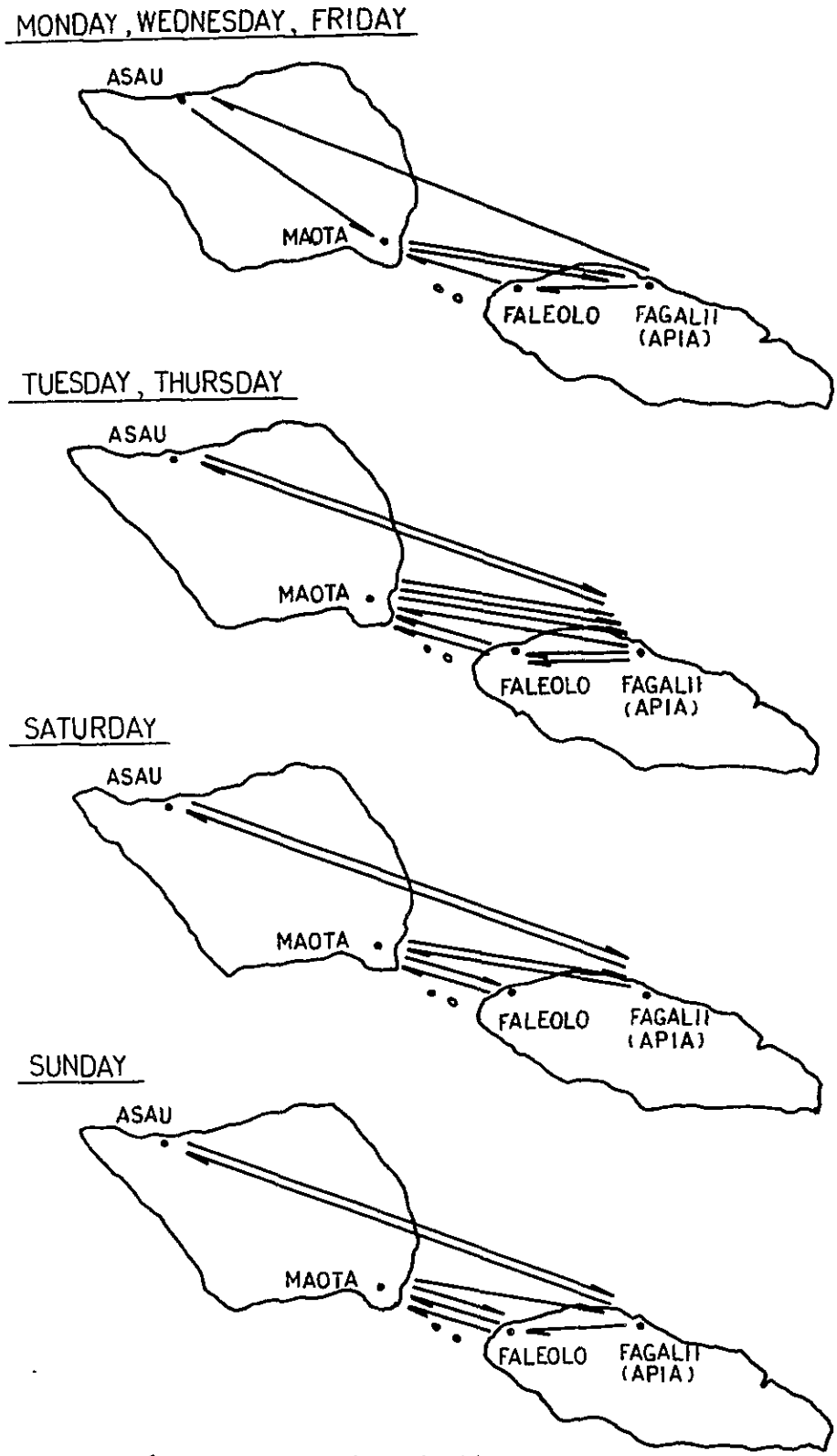
Table F-4

Year	Items	Q. Salamasina	Puleono	Limlimutau
1980	Place	Suva	Pago Pago	Pago Pago
	Period	4 Weeks	4 Weeks	4 Weeks
	Kind of Repair	Survey	Survey	Survey
	Cost	F$40,000	US$35,000	US$26,000
1981	Place	Suva	Pago Pago	Pago Pago
	Period	7 Weeks	4 Weeks	4 Weeks
	Kind of Repair	Survey	Survey	Survey
	Cost	F$152,000	US$42,000	US$30,000
1982	Place	Suva	Pago Pago	-
	Period	3 Weeks	4 Weeks	-
	Kind of Repair	Survey	Survey	-
	Cost	F$62,000	US$38,000	
1983	Place	Pago Pago	-	-
	Period	1 Week	-	-
	Kind of Repair	Hole in Keel	-	-
	Cost	US$20,000	-	-
1984	Place	Pago Pago	Pago Pago	Apia
	Period	2 Weeks	5 Weeks	6 Months
	Kind of Repair	Rudder & Ramp	Survey	Survey
	Cost	US$36,000	US$116,000	WS$70,000

Source: Western Samoa Shipping Corporation

(11) DOMESTIC AIR TRANSPORTATION

Fig. F-12



Source: Polynesian Air Line

(12) NUMBER OF PASSENGER BY AIR TRANSPORTATION

Table F-5

AIR WAY	1982	1983
* FAGALII - ASAU	2,721	3,302
* FAGALII - MAOTA	3,051	3,796
FAGALII - FALEOLO	NIL	NIL
* FALEOLO - MAOTA	3,103	5,408
* FALEOLO - ASAU	312	780
MAOTA - ASAU	35	58
Total	9,222	13,344
* (UPOLU - SAVAII)	(9,187)	(13,286)

Source : Polynesian Air Line

(13) TARIFF OF AIR TRANSPORTATION

Table F-6

AIR WAY	ONE WAY	RETURN
FAGALII - MAOTA	$ 16.0	$ 32.0
FAGALII - ASAU	$ 29.4	$ 58.8
FALEOLO - MAOTA	$ 10.4	$ 20.8
FALEOLO - ASAU	$ 26.3	$ 52.6
FAGALII - FALEOLO	$ 14.8	$ 29.6

: Polynesian Air Line

(14) Survey of the Site Proposed for Slipway and Ship Repair Facilities

The survey of the site proposed for slipway and ship repair facilities by Western Samoa Government was carried out at Saluafata Harbour in Upolu Island and Salelologa Harbour in Savaii Island. The contents of survey were topographic and hydrographic survey, current observation and rough sub-soil survey, as shown in below.
For reference, a similar survey was carried out at Mulifanua Harbour ferry terminal in Upolu Island.

SURVEY METHOD/CONTENTS

Topographic and Hydrographic Survey	For Mulifanua and Saluafata Harbour Area: 200^m onshore x 400^m offshore For Salelologa Harbour Area: 200^m onshore x 200^m offshore
Current Observation	Observation was conducted with three wooden floaters which were dropped into the sea.
Rough Sub-Soil Survey	Rough Survey of Seabed meterial was carried out using hand auger.

SURVEY RESULT

Item	Salelologa Harbour	Saluafata Harbour	Mulifanua Harbour
Topographic and Hydrographic Survey	until about 100^m offshore : depth 4.0 - 6.0^m more than 100^m offshore : shoal of depth about 1.0^m	until 100^m offshore : depth mean 0.5^m there is coral reef on 100^m offshore more than 100^m offshore : depth 3.0^m or more	turning basin : depth 3.0 - 4.0^m inside turning basin (radius 60^m) : shoal of depth about 2.0^m
Current Observation	shift of floater : from east to west distance about 50^m per 3^{hr} it can be assumed that there is no remarkable current.	shift of floater : from northeast to southwest distance about 50^m per 3^{hr} it can be assumed that there is no remarkable current.	shift of floater : from northeast to southwest distance about 200^m per 3^{hr}
Rough Sub-Soil Survey	Seabed : almost all coral and rock sand is piled up in part surface only	Seabed : until 100^m offshore rock : more than 100^m offshore sand	Seabed : almost all coral and rock

Fig. F-13

TOPOGRAPHIC AND HYDROGRAPHIC SURVEY DWG

SALELOLOGA HARBOUR

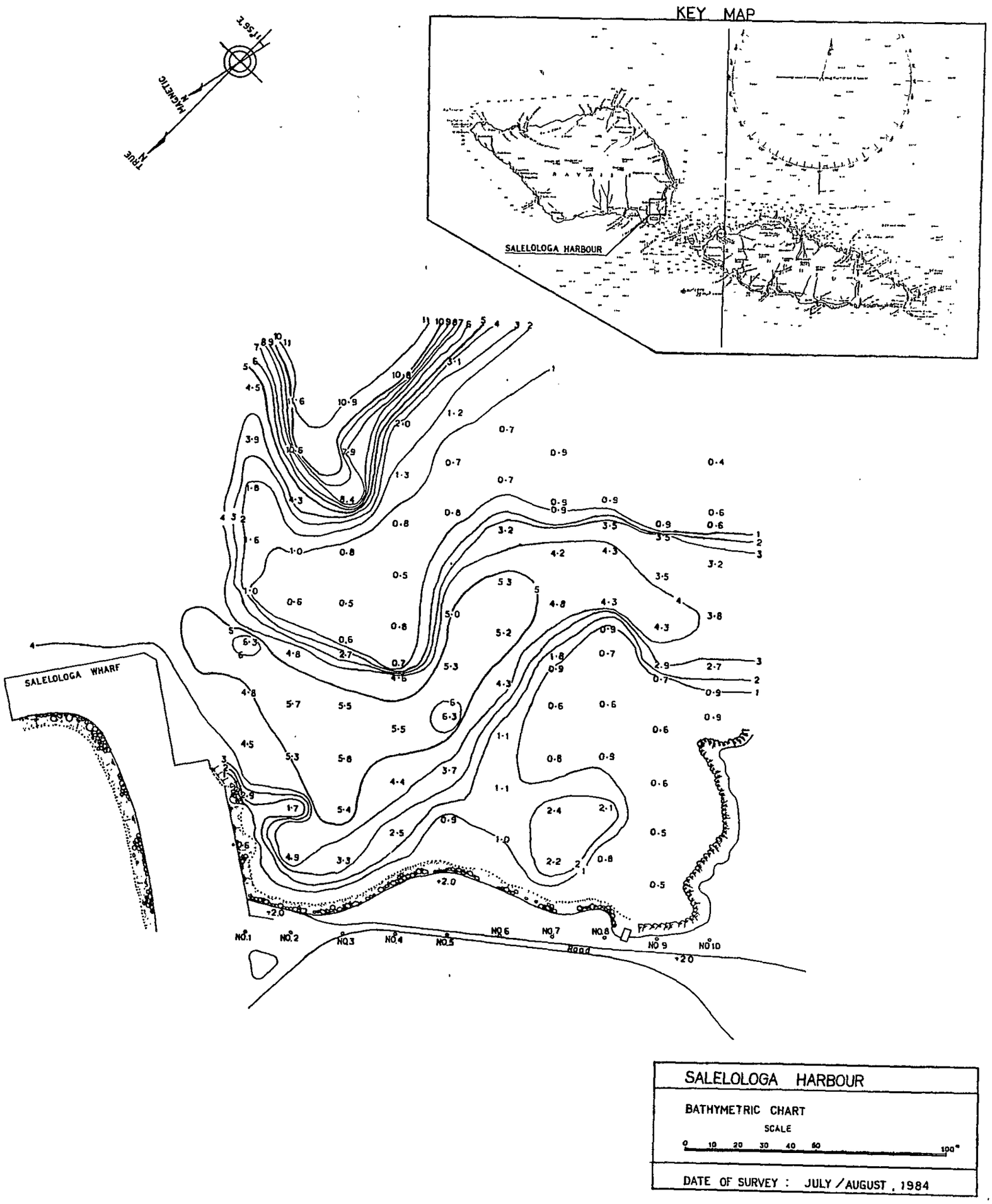
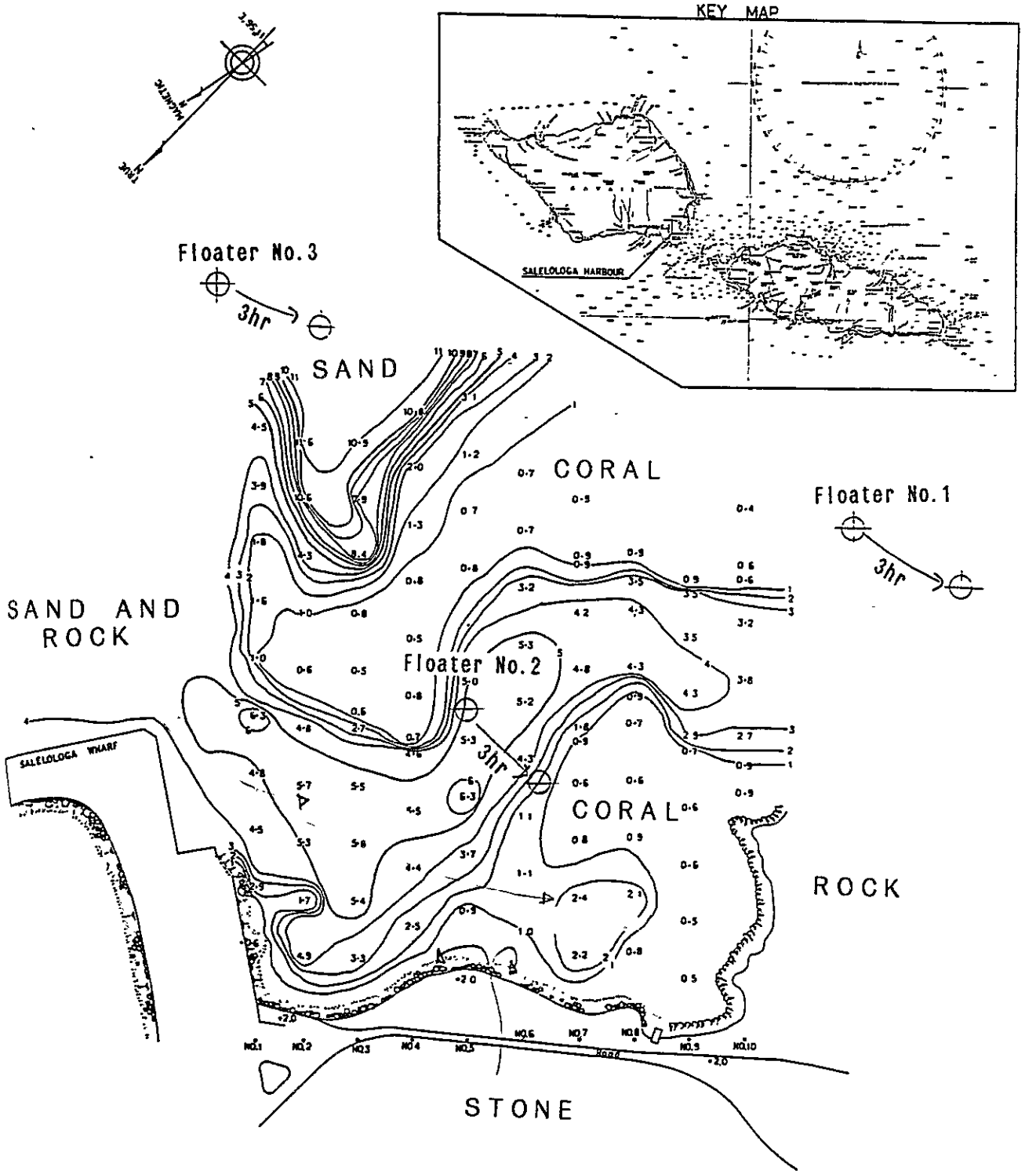


Fig. F-14 CURRENT OBSERVATION /SUB-SOIL SURVEY

SALELOLOGA HARBOUR



SALELOLOGA HARBOUR

BATHYMETRIC CHART

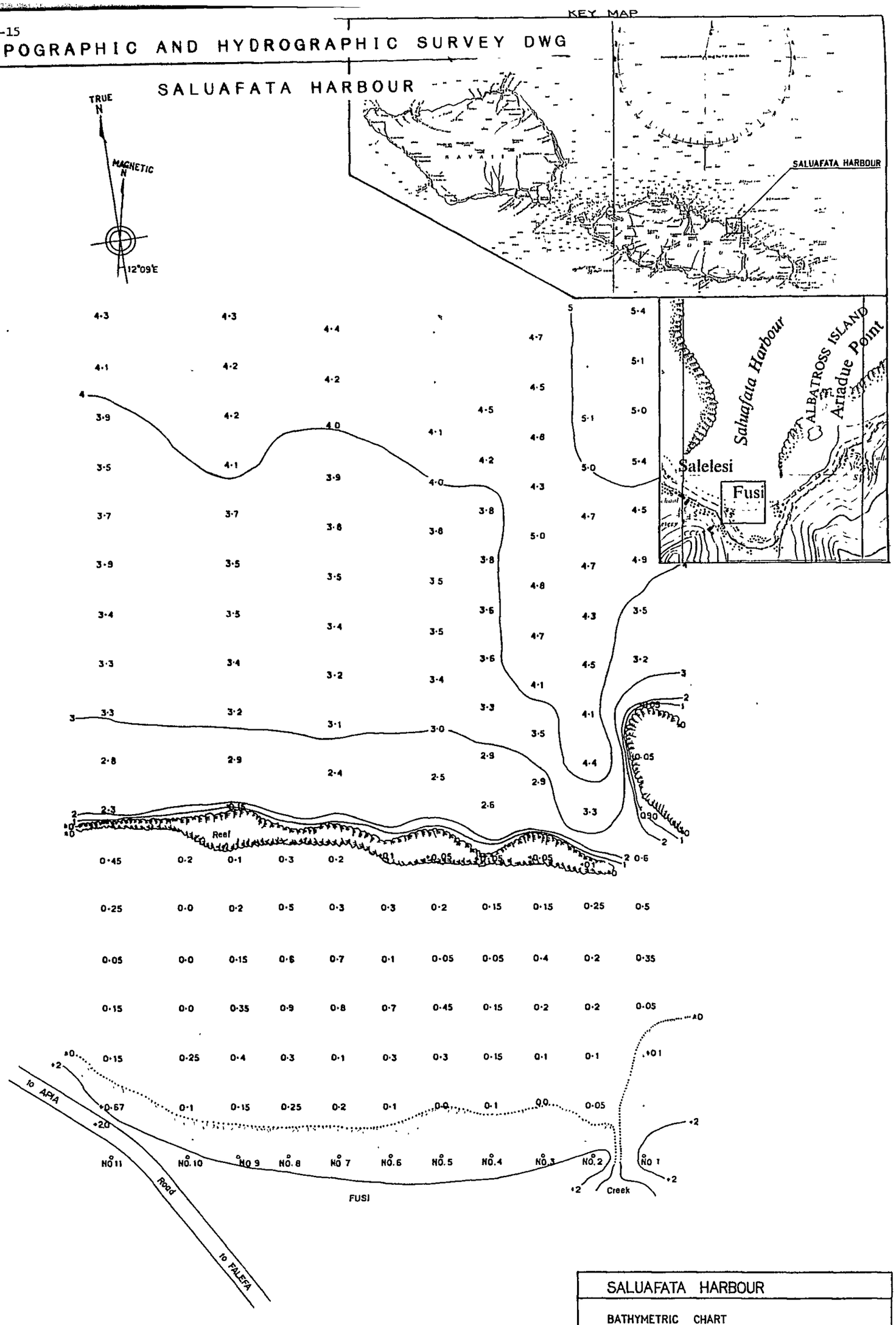
SCALE = 1 : 2,000

DATE OF SURVEY : JULY / AUGUST , 1984

Fig. F-15

TOPOGRAPHIC AND HYDROGRAPHIC SURVEY DWG

SALUAFATA HARBOUR



SALUAFATA HARBOUR

BATHYMETRIC CHART

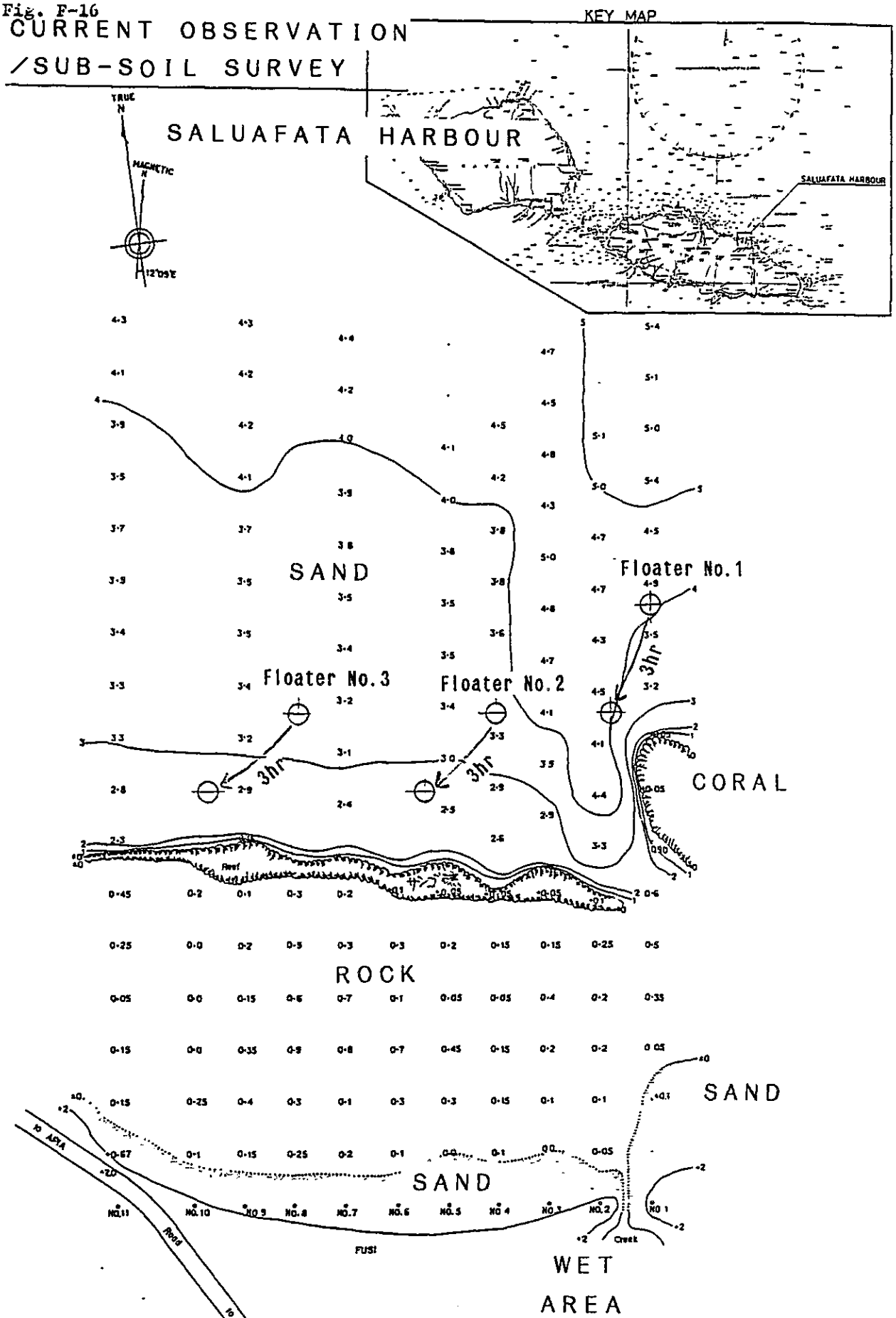
SCALE

0 10 20 30 40 50 100m

DATE OF SURVEY : JULY/AUGUST , 1984

Fig. F-16

CURRENT OBSERVATION /SUB-SOIL SURVEY



SALUAFATA HARBOUR

BATHYMETRIC CHART

SCALE : 1:2,000

DATE OF SURVEY : JULY/AUGUST, 1984

Fig. F-17

TOPOGRAPHIC AND HYDROGRAPHIC SURVEY DWG

MULIFANUA HARBOUR

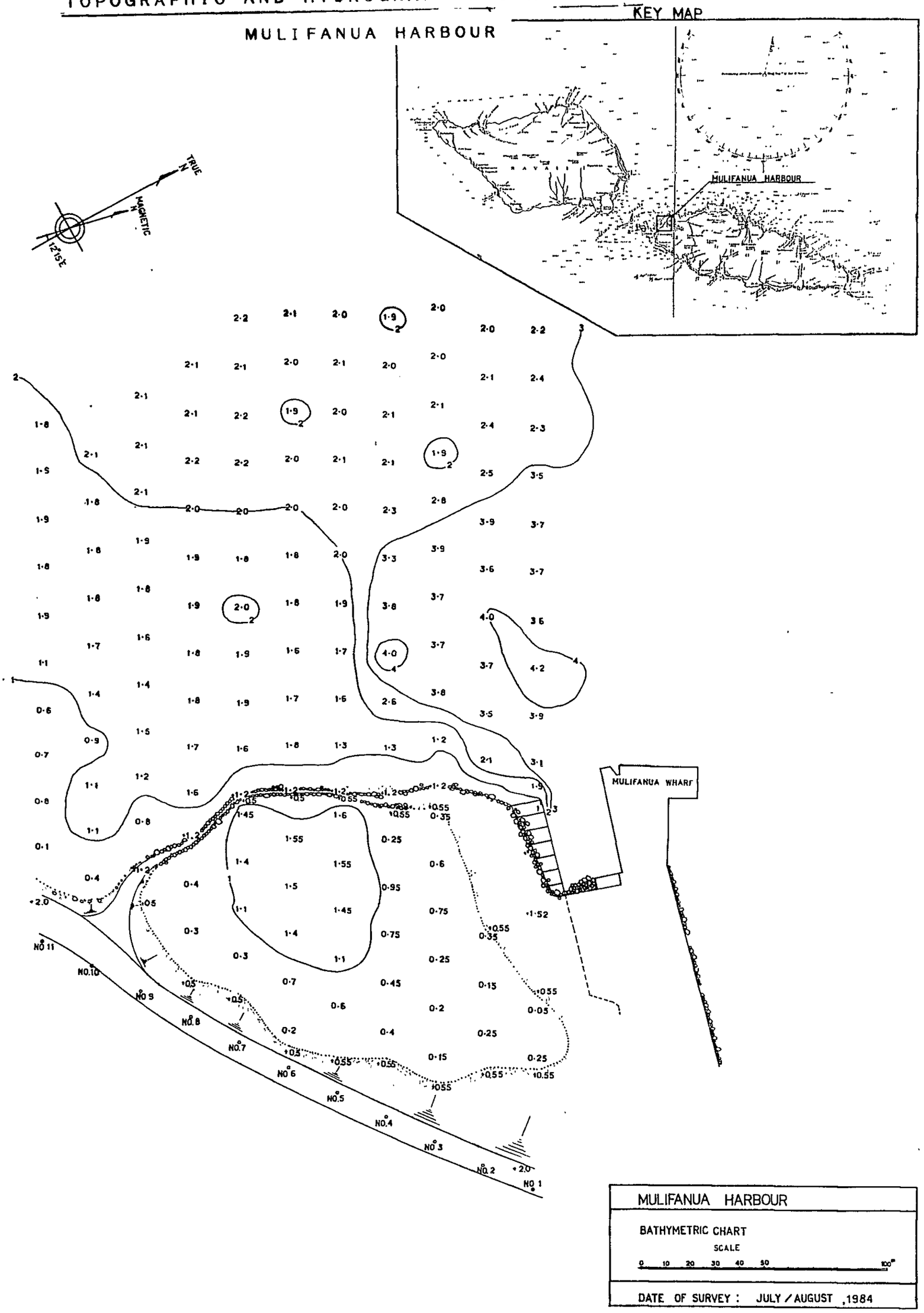
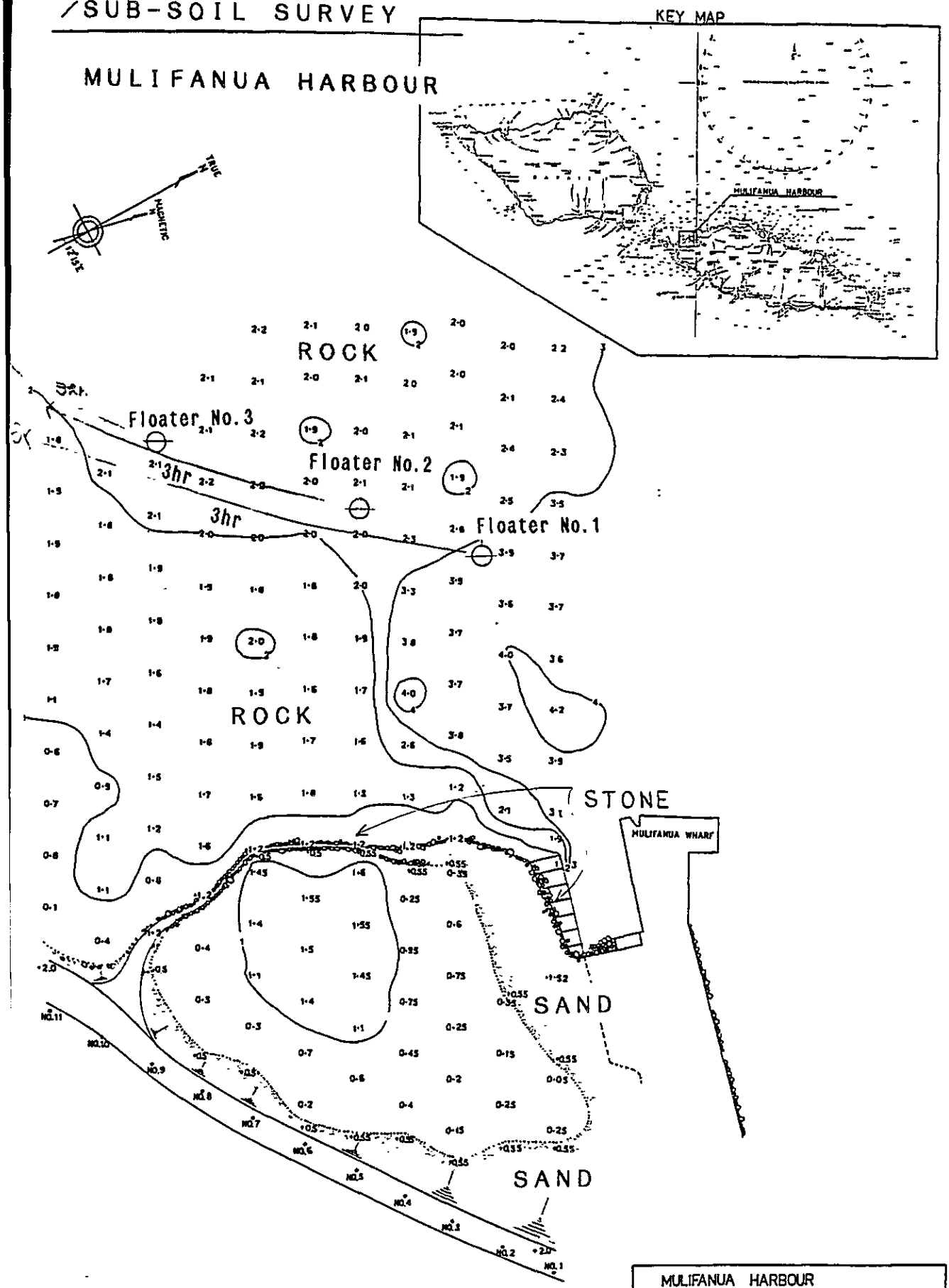


Fig. F-18

CURRENT OBSERVATION /SUB-SOIL SURVEY

MULIFANUA HARBOUR



3. Social, Economic and Natural Condition

3-1 Social Condition

(1) Population

Table F-7 Population Growth 1961 - 1981

Year	Population	Annual Increase (%)	Net-Out Mingration Average per Year	Natural Increase (%)
1961	114,427			
1966	131,377	2.8	1,200	3.9
1971	156,627	2.2	1,400	3.5
1976	151,983	0.9	3,100	3.0
1981	156,349	0.6	3,683	2.7

Source: Socio-Economic Situation Development Strategy and Assistance Needs, December 1982

Table F-8 Population by Age and Sex 1981

Age	Total	Male	Female
0 - 4	14.6	14.9	14.3
5 - 9	14.6	14.8	14.4
10 - 14	15.0	15.4	14.7
15 - 19	13.4	13.5	13.2
20 - 24	9.6	9.7	9.5
25 - 29	6.2	6.1	6.2
30 - 34	4.4	4.2	4.6
35 - 39	3.9	3.8	4.1
40 - 44	3.8	3.7	4.0
45 - 49	3.3	3.2	3.4
50 - 54	3.1	3.1	3.2
55 - 59	2.5	2.6	2.5
60 - 64	1.8	1.8	1.9
65 - 69	1.2	1.2	1.2
70 - 74	0.8	0.7	0.8
75 and over	1.0	0.8	1.2
Unknown	0.6	0.6	0.5

Source: Annual Statistical Abstract, 1983