NO.

BASIC DESIGN STUDY REPORT

ON

THE PROJECT FOR REINFORCEMENT OF THE DREDGING CAPABILITIES FOR BEIRA PORT

IN

THE REPUBLIC OF MOZAMBIQUE

DECEMBER 2004

JAPAN INTERNATIONAL COOPERATION AGENCY
SHIPBUILDING RESEARCH CENTRE OF JAPAN

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PREFACE

In response to a request from the Government of the Republic of Mozambique, the Government of Japan decided to conduct a basic design study on the Project for Reinforcement of the Dredging Capabilities for Beira Port in the Republic of Mozambique and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Mozambique a study team from 17th June to 6th July, 2004.

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

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Mozambique for their close cooperation extended to the teams.

December 2004

Seiji Kojima
Vice President
Japan International Cooperation Agency

December, 2004

Letter of Transmittal

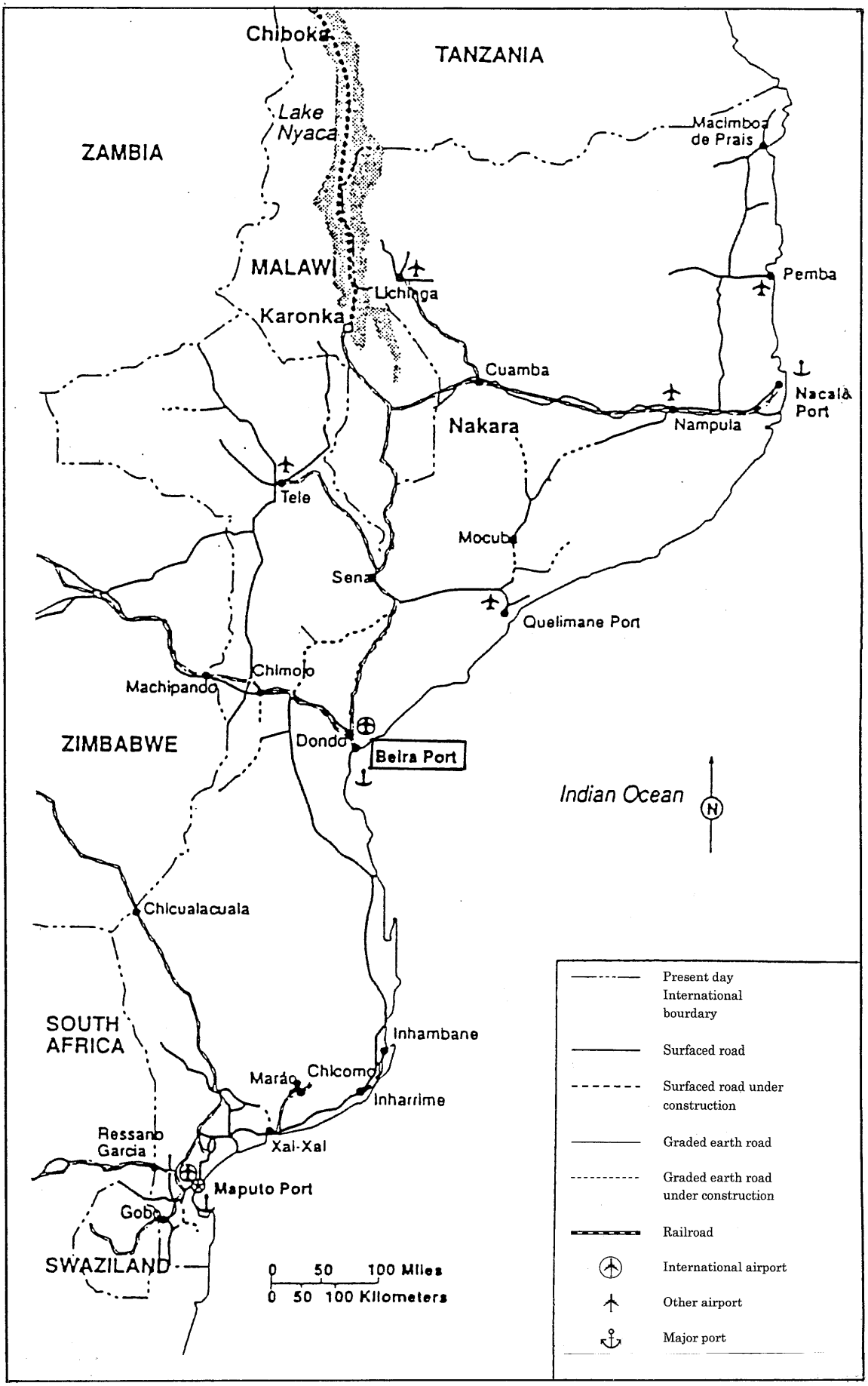
We are pleased to submit to you the basic design study report on the Project for Reinforcement of the Dredging Capabilities for Beira Port in the Republic of Mozambique.

This Study was conducted by Shipbuilding Research Centre of Japan, under a contract to JICA, during the period from June, 2004 to December, 2004. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Mozambique and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

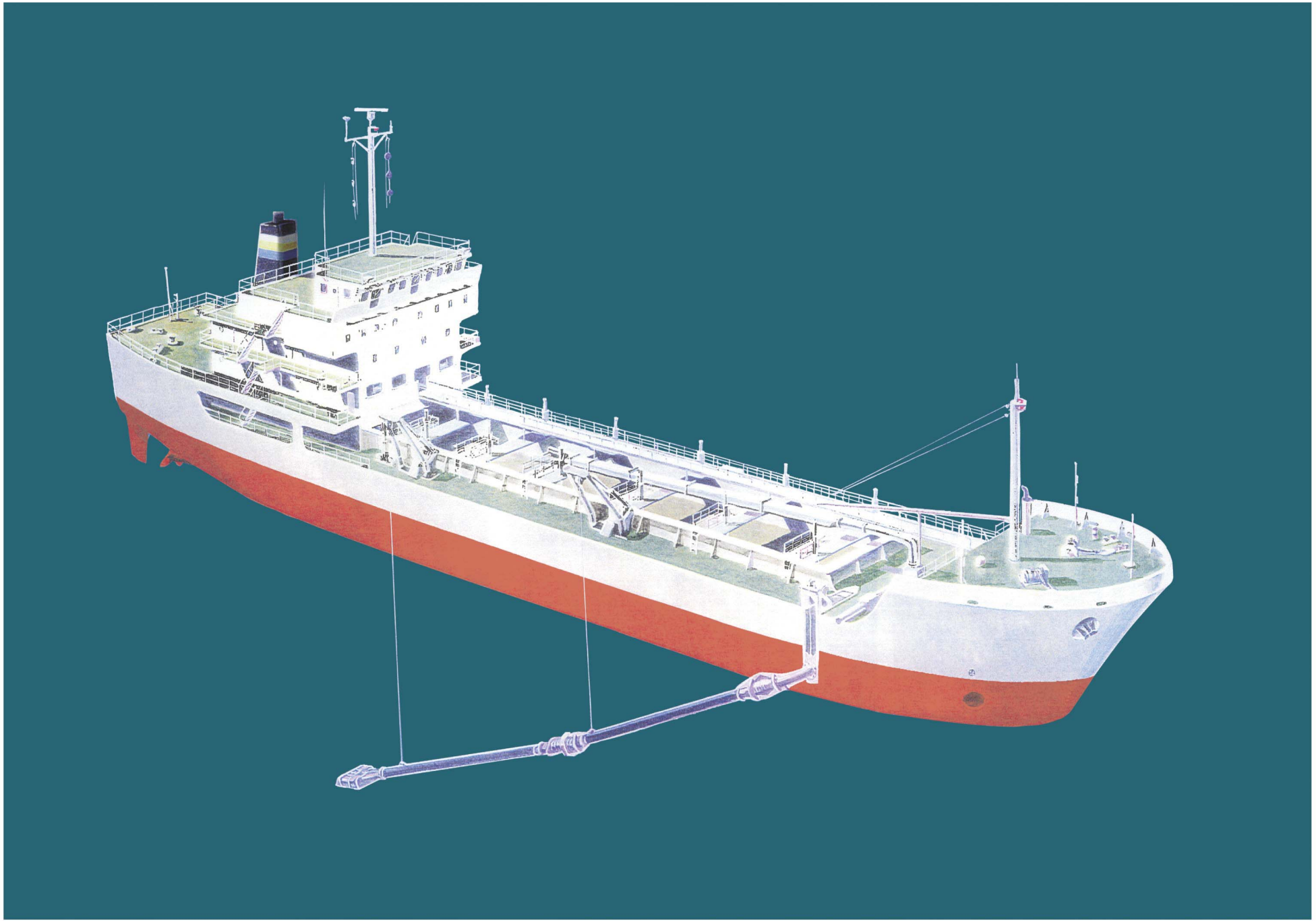
Very truly yours,

Tadashi Ikeba
Chief Consultant,
Basic design study team on
The Project for Reinforcement
of the Dredging Capabilities for Beira Port
Shipbuilding Research Centre of Japan



Location Map of Beira Port, Mozambique

Perspective of Self Propelling Trailing Suction Hopper Dredger



ABBREVIATIONS

BCA	Beira Corridor Authority
BV	Bureau Veritas (French Classification Society of Shipping)
CFM	Portos e Caminhos de Ferro de Moçambique
CFM-C	CFM-Center
EMODRAGA	Empresa Moçambicana de Dragagens
HF	High (Range) Frequency
Loa	Length Overall
Lpp	Length between Perpendiculars
MF	Medium (Range) Frequency
MTC	Ministry of Transport and Communications
SADC	Southern African Development Community
VHF	Very High (Range) Frequency

SUMMARY

The people in the Republic of Mozambique, one of the poorest countries in the world, which became an independent country leaving from the Portuguese Republic in 1975, have been compelled to live in hard lives in consequence of an overall political, economic, and social destructions that the civil has destroyed since her Independence.

A huge scale of economic assistances from the European countries and other developed countries started in the late 1980's have been helping to improve and restructure those ruined foundations, and in 1992, the ending of the civil war for peace time became a trigger to begin a full scale economic reconstruction.

Today, 10 years since such a full scale economic reconstruction, Mozambique, where GNI is said US$ 3,800 million and GNP per capita US$ 210 (the World Bank data, 2001), still remains in a group of the poorest countries. However, the economic growth rate of Maputo, the capital city and its surrounding areas, is rather high as 13.9% which have been due to cultural and economic influences from the Republic of South Africa, and such tendency is expected to gradually spread widening down to other remote areas in Mozambique.

Mozambique is therefore seeking of a variety of economic assistances from the developed countries to strengthen the economic and other sector foundations as well while expecting further national economic development aiming at improvement of standard of life in the country.

Of main ports in Mozambique, both the Port of Beira and the Port of Maputo are playing pivotal roles not only for physical distribution bases for the country itself, but also for the gate way of ocean transport for the neighboring inland countries with which Mozambique is keeping close economic ties. In particular, the Port of Beira is an important port for such inland countries as Zimbabwe, Malawi, and Zambia since it is located quite geographically close to them and where ports, railways, and road networks are relatively well maintained. It is only 600 Km from the Port of Beira to Harare, the capital city of Zimbabwe, and the trunk road connecting the both cities are called Beira Corridor, which is one of the most important international routes in Southern African region.

In Mozambique, Empresa Moçambicana de Dragagens (hereinafter referred to as EMODRAGA) under the supervision of Ministry of Transport & Communications (hereinafter referred to as MTC) has been conducting dredging work in all ports nation widely on a contract basis with Portos e Caminhos de Ferro de Moçambque (hereinafter referred to as CFM).

There was the assistances extended by the Government of Dutch during 1989/90 periods to the Port of Beira, and the water depth around entry/exit points dredged became 8 m, and the facilities developed have made the port capable of accommodating 30,000 ton-type vessels.

Nevertheless, the dredging program afterwards has not been carried out properly; hence the access channel has been again packed in heavy silt materials. The worst area is a bending part, so called as Macuti Bend, and CFM constructed a new provisional access channel, approximately 200 m south of the existed channel (old channel) in 1996. "Aruangwa" -1000 m^3 type Trailing Suction Hopper Dredger (hereinafter referred to as TSH dredger) - which the Government of Japan provided under the grant aid scheme in 1999 in response to the request from the Government of Mozambique, has been continuing reasonable dredging work for the past 4 years attaining the target set at the beginning – an average annual dredging of 1,022,000 m^3,however, as dredging work done by "Aruangwa" has passes, the bending part of provisional channel has turned out to be consisting of gravel at the bottom that "Aruangwa", TSH type dredger is hard to cope with efficiently. To make matters worse, there have been grounding cases occurred at the spot and that a great number of complains from ship owners/operators are getting noticed.

Of late, the ship sizes calling at the Port of Beira have been growing bigger thus making the draft necessary at enter/exit operation remarkably deep, and consequently there are many ships that have to wait for high tide. Nowadays it even can be seen that some ship owners/operators who are extremely unsatisfied with such port conditions avoid calling at the Port of Beira and load/unload their cargoes down south at the Port of Durban in South Africa. This is a critical issue for economy of Mozambique and neighboring inland countries as well.

In the circumstance, the Government of Mozambique made a grant aid request to construct a new dredger to the Government of Japan with the objectives to have the new dredger work together with "Aruangwa" at the old channel and revive it the main channel to the Port while abandoning the problematical provisional channel. In response to the request, the Government of Japan decided to undertake the basic design study and Japan International Cooperation Agency (hereinafter referred to as JICA) sent the basic design study team to Mozambique from June 17th, 2004 to July 6th, 2004

so as to carry out the field survey. In the course of the field survey, the team studied various matters, among others, hopper capacity of a new dredger requested, organization of executing agency, management and operation system, overall goal of the project, relations with other donor countries, problems of port management of the Port of Beira, natural conditions, and environmental impacts, and collected other data and information concerned. The team also collected data on hydrographs and bottom sediment of entry/exit channel and dumping areas by dint of a survey handled by a sub-contracted local consultant.

JICA sent the same team again to Mozambique from October 21st, 2004 to October 30th, 2004 to explain the outline of basic design study. The team held discussions on its contents and reached mutual understanding with the Mozambique side.

The study estimated the existing silt volume at the channel through the data obtained from hydrographic and bottom sediment surveys. The silt volume necessary to be dredged is estimated 5,184,000 ㎥ in order to make the old channel 8 m deep, which CFM is expecting to regain shortly. Working with " Aruangwa", the new dredger will have to dredge the said silt volume plus 2,500,000 ㎥ of silt which is estimated to be accumulated constantly every year. Taking the past dredging record of " Aruangwa " into careful analysis, the dredging volume stated herein above can be achieved in 3 years to come on a operation condition that two units of 1,000 ㎥ TSH dredger will operate 24 hours in 12-hour shifts.

The principal specifications of the dredger studied and planned in order to maintain the access channel with 8m depth under this basic design study is outlined as follows.

Item	Specifications
Number of ship	1
Type of ship	Trailing suction hopper dredger
Classification	Bureau Veritas (B.V)
Principal particulars	
Length overall : Loa	Abt. 70.00 m
Length between perpendicular : Lpp	65.00 m
Breadth (mold) :B	14.00m
Depth (mold) :D	4.70m
Draft : d	4.00m
Dead Weight Ton (DWT)	Abt. 1,800 tons
Hopper Capacity	Abt. 1,000 m^3
Service Speed	Abt. 10.2 knots
Dredging Speed	Abt. 6.0 knots
Complement	36 persons

The responsible executing agency for this project in the recipient country is MTC in the Government of Mozambique. CFM under the supervision of MTC has been in charge of management and operation of ports and railways in transport sector, and EMODRAGA on a contract basis with CFM will operate the new dredger to restore the function of the ports.
The maintenance and operation fee of the new dredger shall be covered by the income that EMODRAGA will receive from CFM in the form of dredging fee.

The project cost as a rough estimate for Japanese side shall be of ¥ 2,167,000,000. The project cost to be borne by the part of recipient country is so far not expected. The necessary project duration shall be expected respectively as 8 months for detail designing and 17 months for construction, transport, and delivery of the dredger at the recipient country.

The benefits expected from implementation of this project shall be as follows:

1. Direct benefits
   (1) To secure the old channel is 8m deep that, at present, are impassable.
   (2) To shorten the waiting time for high tide.
   (3) To eliminate the number of such marine accidents as groundings happening at bending parts of the channel
2. Indirect benefits
   (1) To activate physical distribution in Mozambique and the neighboring countries. (To increase the number of calling vessels and volume of handling cargoes at the Port of Beira)
   (2) To help supply the commodities of life on a regular flow to the neighboring inland countries (Zimbabwe, Malawi, and Zambia)
   (3) To upgrade the technical levels of engineers with respect to dredger navigation, dredging operation, dredger maintenance, etc through additional deployment of the new dredger

Since the implementation of the project for Reinforcement of the Dredging Capabilities for Beira Port will no doubt be expected to improve marine transport efficiency and create favorable effect not only on economy in Mozambique, but also economic developments in those neighboring countries relying on the Port of Beira, it is considered duly appropriate to execute the project under the grant aid scheme in due course.

CONTENTS

[Appendices]

Chapter 1　Background of the Project

CHAPTER 1. BACKGROUND OF THE PROJECT

Situated at the estuary of Pungue and Buze River, Beira Port is a commercial port that handles approximately 2.3 million tons of cargos annually, with total length of 1.7km of births having the water depth of 10m for general cargo ships, 12m for container ships and 13.5m for oil tankers.

Access channel had been dredged to 8m deep during 1989 and 1990 by assistance of Netherlands so as the port can accommodate ships up to 30,000 Dead Weight Tons.
However, no appropriate maintenance dredging has been carried out thereafter due to insufficient dredging capability available.
As the consequence, the channel has become shallow at many parts due to incessant sedimentation of silts and sands, especially at the curved part of the channel (so-called Macuti Bend) showed worst conditions among other part. Taking the critical situation into mind, in 1996, CFM decided to shift the curved part approximately 200m to South as a provisional route where is the deeper than the previous channel.

EMODRAGA, an independent dredging public enterprise, is the exclusive organization in charge of dredging work in Mozambique.
EMODRAGA operates Trailing Suction Hopper Dredgers (hereafter referred to as “TSH dredger”) “Aruangwa” which is granted by the Government of Japan in 1999 and aged “Rovuma” (43 years old). The two TSH dredgers have been operating well to dredge out the huge amount of sedimentation along the navigation channel. However, of late, gravels that can hardly be dredged by the TSH dredger at Macuti Bend were observed as deepen the curved part, become the most serious issue for EMODRAGA. CFM therefore, finally decided that channel at Macuti Bend should be shift back to the original route by dredging even voluminous dredging is required, since there were no gravels observed.

To cope with such critical issue, in September 2002, Mozambican government have made official request to Japanese government to supply another 1,000m^3 TSH dredger in order to reinforce their dredging capability. In response to the request, Japanese government dispatched the Basic Design Study Mission to Mozambique under the Grant Aid scheme in June 2004.

Mozambican government expects that through implementation of this reinforcement project, eventually the provisional channel can be set back to the original route and be kept with 8m deep.

Chapter 2　Contents of the Project

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the project

Beira port is a one of the major ports in Mozambique that handled 2.32 million tons of cargos in 2003 playing vital role as the entrance of the trade for South African countries exclusively for neighboring inland countries such as Zimbabwe, Malawi and Zambia connected by the Beira Corridor. Situated at the estuary of Pungue and Buze River, Baira port which is developed as the port to accommodate ships up to 30,000 DWT, is now facing serious problem due to accumulating sedimentation of silt at the access channel. Most of ships calling the port are forced to be long waited for adequate tide level and some ships are agrounded the Macti Bend.

Since, improvement of the transport infrastructures is the principal development policy of Mozambican government, there was the assistance extended by the Government of Dutch during 1989/90 periods to the Beira port, and the water depth around entry/exit points dredged to became 8m. Nevertheless, the dredging program afterwards has not been carried out properly mainly due to lack of capacity of dredging equipment of EMODRAGA, hence the access channel has been again packed in heavy silt materials.

To cope with this issue, Mozambican government made an official request to Japanese government to supply one dredger under the Grant Aid scheme. Upon request, Japanese government carried out the study on this subject in the period of 1997 to 1998, and as a result of the studies, Japanese government supplied one TSH dredger of 1,000 ㎥ capacity “Aruangwa” through the Japanese Grand Aid. Aruangwa has been working in good order after the delivery up to now. However, there are still the difficulty remained for dredging at the Macuti bend area of the channel because of the soil nature, in spite of continuous work of dredging for 4 years. Many ship operators have raised their claims against frequent grounding accidents at Macuti bend area and forced to be waited for high tide that enable ships entering the port safely.

The objective of this project is to recover the bend area to original channel route and maintain the water depth 8m along the whole access channel co-operation with a new supplied TSH dredger and Aruangwa.

Should the case that the Project is implemented and dredging work is done properly, it is expected that the most of ships calling Beira port would never be waited, number of accident would be reduced that makes increasing cargo volume handled at Beira port thereby

contributing development of economic activities not only for Mozambique but also for the region.

2-2 Basic Design of the Requested Assistance

2-2-1 Design Policy

(1) Consideration on the Environmental Conditions

1) Climatic and Oceanic Conditions

Beira port is a good harbor with comparatively calm climatic and oceanic conditions, rarely hit by a cyclone. Therefore, the design conditions of wind force of 10m/s and wave height 2m are set in accordance with the past observation data, so that the number of unworkable days is limited up to 10 days in a year.

Beira port has a comparatively large range of tide, and past data shows the low water tide 1.5m and the high water tide 6.7m. Considering such range of tide and distance between the chart datum level and sea bed, the design conditions have been determined that (1) ship's draft be 4m, (2) minimum water depth at dumping site be 6m and (3) length of the drag arm be sufficient for dredging depth of 20m at the angle of 45 degrees.

As the sea current at the access channel, combined with the river current from the Pungue river, amounts to 4 knots, the dredger is designed to be capable of carrying out dredging as planned against the head current of 3.5 knots.

2) Composition of Soil

The sea bed soil consists of 32% of silt and 68% of sand. Their specific gravity in situ is 1.5 for silt and 1.8 for sand. The dredging plan will be made on the assumption of the density (situ) when pumped and stored in the hopper of the dredger.
The ratio of stored soil volume against the hopper capacity is set at 55% for silt and 75% for sand, given the overflowing of supernatant water in the hopper being made.

(2) Working time and manning plan

Working time is planned on the basis of 36 crews to be onboard and work for 24 hour

operation for five (5) days a week from Monday through Friday. The work shall be done by two (2) gangs of which consist of 18 crews per each gang and 12 hours for one operation. Actual working time is estimated at 19.2 hours/day because the actual effective time of dredging work has to be presumed to be 80%, namely 9.6 hours per gang/day, taking into account the time required the dredger to and from the base to site and other time for preparatory works.

Saturdays shall be spent for routine maintenance of machinery/equipment and Sundays for holiday. Each gang will stay onboard for 2 weeks continuously and then be ready for next mission for one week on shore. This manning requires 3 gangs of 18 crew i.e. 54 crews in total.

Dredging work shall be carried out for 44 weeks annually (Total annual workable days:220 days, total annual workable hours:4,224 hours). As for the remaining 8weeks, 4 weeks will be reserved for annual docking and the other 4 weeks for elbow room for repairing works and non-operational days due to rough weather condition.

(3) Dredging cycle

Dredging cycle plan shall be made based on the required volume of dredging and areas to be dredged.

The output of propulsion engine shall be decided so as the dredger can work at a speed of 3 knots under the condition of the head current of 3.5 knots and to navigate at 10.2 knots at fully loaded condition and at 10.5 knots at unloaded conditions after dumping.

Required time for dredging in one cycle is set at 1.0 hour for silt and 1.25 hours for sand, and dumping time at 0.15 hour for silt and 0.25 hour for sand.

The maintenance dredging plan is made on the basis of above design conditions, i.e. soil volume to be dredged, necessary time for dredging and dumping, distance to and from dumping sites established in regard to respective dredging and prescribed dumping sites.

(4) Ship's Automation and Remote Control

The dredger is basically so designed as to be remotely controlled from the bridge in respect of machinery/equipment for maneuvering and dredging work, such as revolution control of

main engine and dredge pump driving engine, opening/closing of dredge valves, lifting/lowering of drag arm, opening /closing of hopper doors, start/stop and propulsion control of bow thruster. Electric-hydraulic type will be adopted for the remote control system as far as possible for easier maintenance. Adoption of automation will be limited to the range of ship safety maintenance.

(5) Ship's Structure and Machinery/Equipment

In view of the ship's operation at a shallow water depth where the distance between ship's bottom and sea bed is very small, consideration will be given so that the ship can be kept even in its heel and trim as much as possible and have a hull form making smoother the inflow of water into her propellers.

As for the ship's structure, consideration will be given to its robustness, with particular attention to anti-corrosion measures for the outer shell of her bottom and sides.

For her machinery/equipment, the ones that do not need peculiar or complicated skill for operation will be adopted.

Further more, in selection of manufacturers of her machinery/equipment due attention will be given to the possibility of procurement of their spare parts domestically or from the Republic of South Africa for the convenience of after-delivery maintenance and repair of the dredger, as far as there would be no disadvantage in respect of their quality, delivery time and price.

(6) Local Condition

As the BEIRANAVE shipyard located near EMODRAGA quay will become a principal repair yard for the dredger, the facilities and capability of this shipyard will be taken into consideration in designing the dredger.

2-2-2 Basic Plan

2-2-2-1 Planning of Access Channel

(1) Current Status of Ships Calling Beira Port

Figure 2-1, 2-2, 2-3 shows the number of ship calling Baira port with cargo handling volume for 9 years period during 1995 to 2003. The average number of ships calling the port accounts about 400 per year for last 5 years. As found from the figures, cargo handling volume by one vessel becomes gradually increased while total number of ships is decreasing slightly.

Since there is no detailed data on ships calling Beira port available, the size of ships is estimated by utilizing number of ships and cargo volume, and assessed the trend of enlargement of the ship size.

Cargo volume carried by container ships and bulk carrier is steeply increased for last five years. Among others, average cargo volume carried by bulk carrier is increased from 2,278 tons/ship to 9,122 tons/ship in 1998 and 2003 respectively. This tendency may prove that the ship size become larger in these years since, tramper i.e. bulk carrier is put on the route where the bulk of cargoes are exists taking the load ratio into mind.

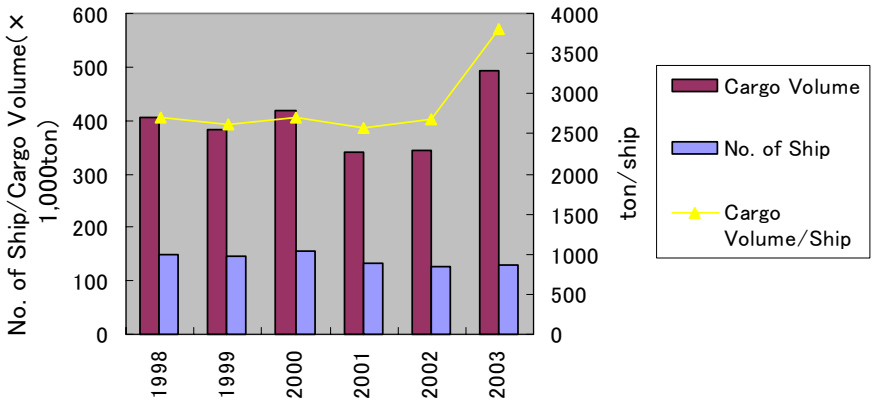


Fig.2-1 Cargo Volume, No. of Ship, Cargo Volume/Ship: Container Ship

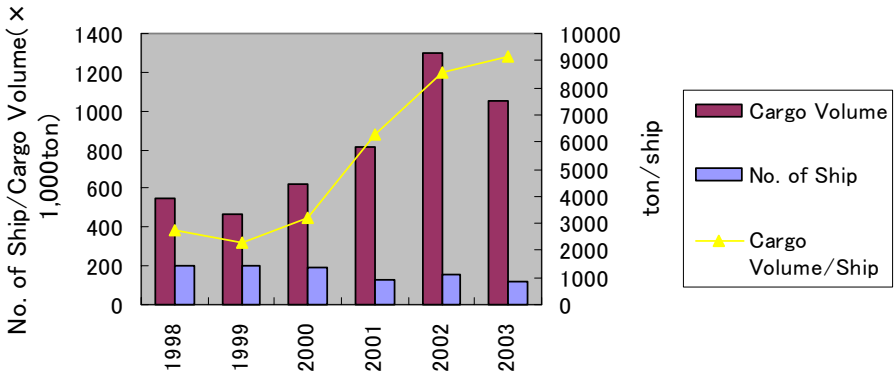


Fig.2-2 Cargo Volume, No. of Ship, Cargo Volume/Ship: Bulk Carrier

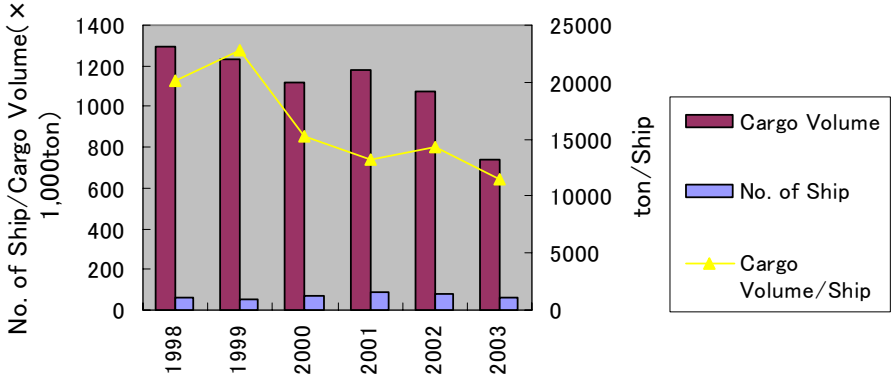


Fig.2-3 Cargo Volume, No. of Ship, Cargo Volume/Ship: Tanker

Particulars of ship called Beira port in 1996 and 2003 (estimated) by type of ship are shown on the Table 2-1 below.

Table 2-1 Particulars of ship called Beira port in 1996 and 2003 (estimated) by type of ship

Particulars \ Type of Ship		Tanker	Bulk Carrier	Container	General Cargo	Others
Max. DWT	1996	30,611	26,040	24,472	19,370	5,084
	2003(est.)	30,611	29,950	23,900	-	-
Ave. DWT	1996	19,106	12,362	8,429	7,703	863
	2003(est.)	17,927	14,209	8,229	-	-
Max. Length over all (m)	1996	189.0	194.8	206.1	197.9	109.2
	2003*(est.)	189.0	204.1	204.5	-	-
Ave. Length over all	1996	166.0	151.3	138.0	123.2	63.7
	2003*(est.)	162.5	158.5	136.9	-	-

The 2003 data shows the trend of enlargement of ships size in terms of bulk carrier. It is however, length overall of ship in 1996 intensively be around 160~180m, and that of 2003 is 203m for bulk carrier and 189m for tanker. This meant the ship entering Beira port is mostly within the limitation of access channel of 200m length even the draft of the channel is varied.

(2) Waiting Time for Tide

Most of all big ships entering Baira port are forced to be waited till the water tide level become high as they can safely pass the channel. Prohibition of night passing the channel is also one of the causes of long waiting time. Other factors affected for long time waiting are non-vacancy of quay and/or preparation for berthing.

Table 2-2 shows the total time of ship called at Beira port (include waiting time for tide, enter/leaving of port, loading/unloading). Since 2000, total time at port has been sharply increasing. The time accounts 6,089 hours in 1999 with 425 ships and 2.14 million tons of cargo handled become 21,901 hours with 401 ships and 2.76 million tons of cargo.

Table 2-2 Total Time of Ships Calling at Beira Port

Year / Type	1996	1997	1998	1999	2000	2001	2002	2003
Container	1,990.83	3,189.43	2,147.40	1,620.67	2,635.17	1,639.32	2,006.62	2,171.57
Bulk/G.C	4,853.48	2,776.77	1,319.48	320.18	2,860.95	2,322.82	7,951.63	9,675.32
Tanker	2,616.67	2,112.50	1,384.80	1,776.33	6,834.80	7,035.67	8,569.27	3,943.38
Others	493.87	254.13	358.83	382.27	789.08	3,403.93	1,371.03	53.22
Total	11,950.85	10,329.83	7,208.52	6,098.45	15,120.00	16,402.73	21,900.55	17,846.49

Further, there is clear correlation between the waiting time and cargo volume/ship particularly in case of bulk carrier. It is assumed that as cargo volume is increased ship size is enlarged proportionally, resulted the waiting time for tide to enter the port increased.

Table 2-3 Waiting time for tide and Cargo Volume/Ship

Year / Type	1999	2000	2001	2002	2003
Bulk/G.C waiting time for tide (h)	320.18	2,860.95	2,322.82	7,951.63	9,675.32
Bulk/G.C Cargo Volume/Ship (ton)	2.278	3.228	6.302	8.539	9.122

Table 2-4 shows the average waiting time of ships at Beira port by type. In average, 78.66 hours, 15.51 hours, 46.95 hours for Bulk carrier/General Cargo, Container Ship, Tanker respectively were spent for waiting.

Table 2-4 Waiting Time of Ship Calling at Beira Port (2003)

Type	No.	DWT		Waiting Time		At quay (Load/unload) Total	Average Waiting Time	
		Total	Average	Total	Average ①		At Quay ②	At Port ①+②
Domestic Craft	0	0	0	0.00	0.00	0.00	0.00	0.00
Bulk Carrier	123	1,747,698	14,209	9,675.32	78.66	30,858.63	250.88	329.54
Container	140	1,152,098	8,229	2,171.57	15.51	6,432.63	45.95	61.46
Tanker	84	1,505,844	17,927	3,943.38	46.95	5,143.15	61.23	108.17
Fishing Boat	9	2,178	242	18.97	2.11	654.21	72.69	74.80
Tug Boat	1	736	736	0.00	0.00	115.50	115.50	115.50
Pleasure boat	2	237	119	34.25	17.13	144.17	72.08	89.21
Survey Vessel	3	516	172	0.00	0.00	56.42	18.81	18.81
Total	362	4,409,307	12,180	15,843.48	43.77	43,404.71	119.90	163.67

(Source:CFM)

Table 2-5 Waiting Time by cause(2003)

Cause	Time (h)	%
Cause of Ship	3,502.48	22.2%
Arrive at Night	3,369.05	21.4%
Waiting Cargoes	308.92	2.0%
Waiting Quay	3,137.30	19.9%
Waiting fo Pilot	10.45	0.1%
Waiitng for tide	5,051.25	32.1%
Rough Weather	153.87	1.0%
	1.33	0.0%
Others	212.25	1.3%
Total	15,746.90	100.0%

Table 2-6 Waiting Time by Ship Type

Type of Ship	Waiting Time (h)
Domestic Craft	0
Bulk Carrier	25.23
Container	4.98
Tanker	15.06
Fishing Boat	0.68
Tug Boat	0
Pleasure Boat	5.49
Survey Vessel	0
Average	14.04

The average waiting time for tide was 6.2 hours in 1991 when the initial dredging was carried out up to 8m, became 15.0 hours in 1996 and 69.95 % of ships calling Beira port has to be waited for rising tide. In 2003, there are still 14.04 hours of waiting time for tide.

This waiting time evidenced that there are still serious issues remained at the access channel of Beira port due to sedimentation of silt and countermeasures against this issue is eagerly be waited.

(3) Forecast of Number of Ship and Waiting Time for Tide

Based on the forecast of cargo demand up to 2025, number of ships calling Beira port and their waiting time in the future is forecasted.

1) Forecast of Cargo Volume

SATCC published forecast of transit cargo volume at port for 2002, 2007 and 2017 based on the real data at 1995. By the forecast, annual average growth rate of the 2002, 2007 and 2017 is 2.6% p.a. up to 2007 and 3.7% p.a. respectively.

Total cargo volume handled by Beira port varied depend on the economic situation of the neighboring inland countries even macro-economics of Mozambique is stable with the figure of 7.7% growth rate for the year 2002. In 2003 the growth rate of cargo volume was drastically dropped as -15.91% because of the stagnant of Zimbabwe economy drag down the total volume of Beira port.

Taking these indigenous factors into consideration, forecast of cargo volume at Beira port is made subject that domestic economy will steadily grow.

Table 2-7 shows the forecast of cargoes up to 2025 by type and origin of cargoes. Cargo volume to Zimbabwe is underestimated as 0% growth up to 2007 and the growth rate is estimated to be low onward. Therefore, average growth rate of total cargo volume from 2004 to 2025 is moderately forecasted as 2.76% p.a.

Table 2-7 Forecast of Cargo Volume at Beira Port by Type of Cargo and Origin of Cargo – 1/2

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Growth Rate		−12.92%	−6.22%	1.95%	7.81%	17.22%	−15.91%	16.11%	1.30%	1.34%	1.38%	2.60%	2.62%	2.63%
Total	**2,624.8**	**2,285.6**	**2,143.5**	**2,185.4**	**2,356.1**	**2,761.8**	**2,322.5**	**2,696.6**	**2,731.6**	**2,768.2**	**2,806.5**	**2,879.5**	**2,954.8**	**3,032.6**
Domestic Cargo	**31.3**	**30.4**	**7.0**	**14.7**	**24.5**	**74.2**	**44.1**	**46.1**	**48.1**	**50.2**	**52.4**	**54.8**	**57.2**	**59.7**
								4.43%						
International	**2,157.7**	**1,849.6**	**1,753.2**	**1,750.9**	**1,991.1**	**2,687.6**	**2,278.4**	**2,310.0**	**2,343.0**	**2,377.5**	**2,413.5**	**2,478.3**	**2,545.2**	**2,614.3**
Outgoing	**464.0**	**193.5**	**179.4**	**335.9**	**468.1**	**703.0**	**553.4**	**557.2**	**561.3**	**565.4**	**569.8**	**582.5**	**595.5**	**608.9**
Domestic Exp.	46.4	52.3	66.1	18.1	39.5	104.2	86.8	90.6	94.7	98.8	103.2	107.8	112.6	117.5
								0.00%				1.74%		
Transit	**417.6**	**141.2**	**113.3**	**317.8**	**428.6**	**598.8**	**466.6**	**466.6**	**466.6**	**466.6**	**466.6**	**474.7**	**482.9**	**491.3**
S.Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swadiland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zimbabwe	363.2	95.9	61.1	260.6	392.6	477.2	336.1	336.1	336.1	336.1	336.1	341.9	347.9	353.9
Malawi	15.4	15.9	11.8	54.2	2.5	120.4	125.5	125.5	125.5	125.5	125.5	127.7	129.9	132.2
Zambia	39.0	29.4	40.4	3.0	33.5	1.2	5.0	5.0	5.0	5.0	5.0	5.1	5.2	5.3
Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incoming	**1,693.7**	**1,656.1**	**1,573.8**	**1,415.0**	**1,523.0**	**1,984.6**	**1,725.0**	**1,752.8**	**1,781.8**	**1,812.1**	**1,843.7**	**1,895.8**	**1,949.7**	**2,005.4**
Domestic Imp.	237.4	289.5	270.8	323.7	499.7	585.0	627.4	655.2	684.2	714.5	746.1	779.1	813.6	849.6
							1.0725							
Transit	**1,456.3**	**1,366.6**	**1,303.0**	**1,091.3**	**1,023.3**	**1,399.6**	**1,097.6**	**1,097.6**	**1,097.6**	**1,097.6**	**1,097.6**	**1,116.7**	**1,136.1**	**1,155.8**
S.Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swadiland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zimbabwe	1,408.6	1,327.4	1,278.0	1,067.2	953.4	1,113.5	784.3	784.3	784.3	784.3	784.3	797.9	811.8	825.9
Malawi	33.1	35.1	15.0	22.2	66.1	280.9	292.7	292.7	292.7	292.7	292.7	297.8	303.0	308.2
Zambia	12.7	4.1	10.0	0.7	3.8	5.1	20.2	20.2	20.2	20.2	20.2	20.6	20.9	21.3
Others	1.9	0.0	0.0	1.2	0.0	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Container	**435.8**	**405.6**	**383.3**	**419.8**	**340.5**	**0.0**	**0.0**	**340.5**	**340.5**	**340.5**	**340.5**	**346.4**	**352.4**	**358.6**
Domestic	10.1	10.6	15.7	26.2	23.0	0.0	0.0	23.0	23.0	23.0	23.0	23.4	23.8	24.2
International	73.0	88.1	100.0	164.6	101.4	0.0	0.0	101.4	101.4	101.4	101.4	103.2	105.0	106.8
Transit	352.7	306.9	267.6	229.0	216.1	0.0	0.0	216.1	216.1	216.1	216.1	219.9	223.7	227.6

Table 2-7 Forecast of Cargo Volume at Beira Port by Type of Cargo and Origin of Cargo – 2/2

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Growth Rate	2.65%	2.66%	2.68%	2.70%	2.71%	2.73%	2.74%	3.39%	3.40%	3.41%	3.41%	3.42%	3.42%	3.43%	3.44%
Total	**3,112.9**	**3,195.8**	**3,281.4**	**3,369.8**	**3,461.2**	**3,555.6**	**3,653.2**	**3,777.1**	**3,905.5**	**4,038.5**	**4,176.3**	**4,319.0**	**4,466.9**	**4,620.2**	**4,779.0**
Domestic Cargo	**62.4**	**65.1**	**68.0**	**71.0**	**74.2**	**77.4**	**80.9**	**84.5**	**88.2**	**92.1**	**96.2**	**100.4**	**104.9**	**109.5**	**114.4**
International	**2,685.7**	**2,759.5**	**2,835.8**	**2,914.7**	**2,996.3**	**3,080.6**	**3,167.8**	**3,277.1**	**3,390.2**	**3,507.5**	**3,629.2**	**3,755.2**	**3,885.9**	**4,021.4**	**4,161.9**
Outgoing	**622.6**	**636.7**	**651.2**	**666.2**	**681.5**	**697.2**	**713.5**	**735.8**	**758.8**	**782.7**	**807.3**	**832.7**	**858.9**	**886.1**	**914.1**
Domestic Exp.	122.7	128.2	133.9	139.8	146.0	152.4	159.2	166.2	173.6	181.3	189.3	197.7	206.4	215.6	225.1
								2.76%							
Transit	**499.9**	**508.6**	**517.4**	**526.4**	**535.5**	**544.8**	**554.3**	**569.6**	**585.3**	**601.4**	**618.0**	**635.0**	**652.5**	**670.5**	**689.0**
S.Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swadiland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zimbabwe	360.1	366.3	372.7	379.2	385.7	392.4	399.3	410.3	421.6	433.2	445.1	457.4	470.0	483.0	496.3
Malawi	134.4	136.8	139.2	141.6	144.0	146.5	149.1	153.2	157.4	161.8	166.2	170.8	175.5	180.3	185.3
Zambia	5.4	5.4	5.5	5.6	5.7	5.8	5.9	6.1	6.3	6.4	6.6	6.8	7.0	7.2	7.4
Others	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incoming	**2,063.1**	**2,122.8**	**2,184.6**	**2,248.5**	**2,314.8**	**2,383.4**	**2,454.4**	**2,541.3**	**2,631.4**	**2,724.9**	**2,821.9**	**2,922.5**	**3,027.0**	**3,135.3**	**3,247.8**
Domestic Imp.	887.2	926.5	967.5	1,010.3	1,055.1	1,101.8	1,150.6	1,201.5	1,254.7	1,310.2	1,368.2	1,428.8	1,492.0	1,558.1	1,627.0
Transit	**1,175.9**	**1,196.3**	**1,217.1**	**1,238.2**	**1,259.7**	**1,281.6**	**1,303.8**	**1,339.8**	**1,376.7**	**1,414.7**	**1,453.7**	**1,493.8**	**1,534.9**	**1,577.3**	**1,620.7**
S.Africa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swadiland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zimbabwe	840.2	854.8	869.7	884.8	900.1	915.8	931.7	957.4	983.8	1,010.9	1,038.7	1,067.4	1,096.8	1,127.0	1,158.1
Malawi	313.6	319.0	324.6	330.2	335.9	341.8	347.7	357.3	367.1	377.3	387.7	398.3	409.3	420.6	432.2
Zambia	21.6	22.0	22.4	22.8	23.2	23.6	24.0	24.7	25.3	26.0	26.8	27.5	28.2	29.0	29.8
Others	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6
Container	**364.8**	**371.1**	**377.6**	**384.1**	**390.8**	**397.6**	**404.5**	**415.6**	**427.1**	**438.9**	**451.0**	**463.4**	**476.2**	**489.3**	**502.8**
Domestic	24.6	25.1	25.5	25.9	26.4	26.9	27.3	28.1	28.8	29.6	30.5	31.3	32.2	33.1	34.0
International	108.6	110.5	112.4	114.4	116.4	118.4	120.5	123.8	127.2	130.7	134.3	138.0	141.8	145.7	149.7
Transit	231.5	235.5	239.6	243.8	248.0	252.3	256.7	263.8	271.1	278.5	286.2	294.1	302.2	310.5	319.1

2) Forecast of Number of Ship

Forecast of number of ships by type is made based on the data of 2003. Table 2-8 shows the result of the forecast. Number of ships calling at Beira port is forecasted by utilizing the cargo volume forecasted and actual record of number of ships in 2003.

Table 2-8 Forecast of Number of Ship by Type

Year / Type	2003	2008	2013	2018	2023	2025
Container	130	162	166	191	226	242
Bulk, G.Cargo	115	143	147	169	200	214
Tanker	65	81	83	96	113	121
Others	63	80	82	94	111	119
Total	373	466	478	550	650	696

3) Forecast of Waiting Time for Tide

Based on the forecast of number of ships, waiting time for tide by draft of the channel is forecasted.

a) Premises

Assumption of the waiting time is made with the condition of:

- minimum tide level that ship can be safely pass should be the draft of ship plus 1.0m as the safety clearance.
- Night passing of the channel is not considered

b) Result of the Calculation

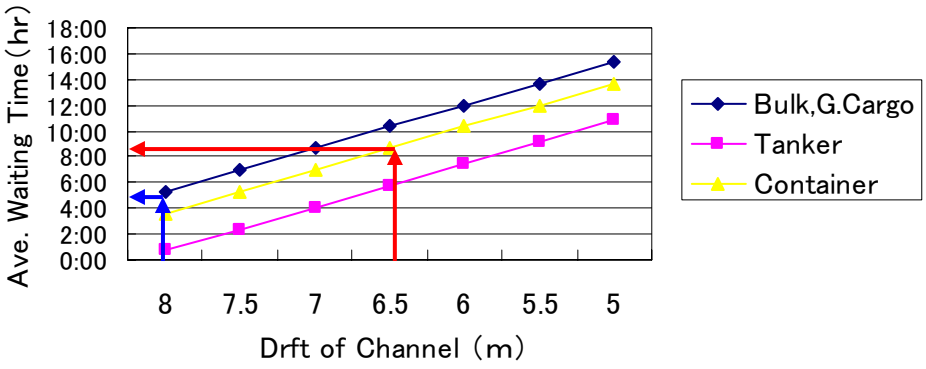


Fig. 2-4 Average Waiting Time by Type of Ship

Table 2-9 Average Waiting Time by Ship Type and Depth of Channel

Type	Draft Max. (m)	Ave. Waiting Time by Tide	
		2003年（5m）	8m
Bulk :14209DWT	9.45	25:14	5:16
Tanker:17927DWT	8.13	15:04	0:43
Container:1000TEU	8.95	4:59	3:36

Citing from CFM data in 1996, out of 364 ships called, there were 44 ships (12 %) which have over 9.5m draft. Since the average mean tide level at Beira is CD+3.5 m, should the channel keeps 8m depth, real depth of 11.5m (8.0m +3.5m) could be secured and ever deepest draft of 10.5m could also enter the port without waiting long time.

Total waiting time for tide by depth of Channel up to 2025 is estimated as shown on the table 2-10。

Table 2-10 Total Waiting Time by Depth of Channel

Depth / Year	Total Waiting Time (hr) by Depth of Channel (m)						
	8	7.5	7	6.5	6	5.5	5
2003	1,194	1,820	2,447	3,074	3,700	4,327	4,953
2008	1,491	2,274	3,057	3,840	4,623	5,406	6,188
2013	1,530	2,333	3,136	3,939	4,742	5,545	6,348
2018	1,760	2,684	3,608	4,532	5,456	6,380	7,304
2023	2,080	3,172	4,264	5,356	6,448	7,540	8,632
2025	2,227	3,396	4,566	5,735	6,904	8,074	9,243

(4) Draft of Channel

Access channel of Beira port can only accept ship with its length of 200m and 30,000DWT and its draft is limited to 9.5m as maximum in general.

Average draft of Container ship of such size is 9.2 m, General Cargo is 11.2m, and Bulk Carrier/Tanker is 11.8m. Besides, the average draft of the 30,000DWT type cargo ships by Lloyds' statistics shows 10.1m.

Taking these assumptions into consideration, target ship size of the channel is set as 30,000DWT with 11m draft.

The required depth to accommodate such target ship can be calculated as follows.

Draft 11.0 m + 10% margin (for heel, trim, squatting) – available high tide level at neap tide 4.2m = 7.9m ≒CD－8.0 m

As the conclusion channel depth of 8m is rational and justified from the view point of size of target ship and is expected great effect to improve the waiting time.

2-2-2-2 Assessment of Sediment Volume

(1) Soil volume to be dredged（Initial Dredging）

Measurement data of “Council for Geoscience” show the total amount of soil volume to be dredged is 5,184,000 ㎥ at original access channel.

Total amount of soil volume was calculated on the condition of

Channel breadth: 200m

Depth to be dredged: Up to 8m

Area range: Access channel of Beira Port

Table 2-11 Required Volume of Sedimentation to deepen 8m Channel for the Previous Channel

Section	Difference from Surface (m)	Vol./200m (m^3)	Average Volume of 2 sections (m^3)	Channel Length (m)	Required Volume (m^3)
			0	352	0
CH-1	0.0005	0	0	2,887	0
CH-2	0.0038	0	188.29	1,479	278,443.25
CH-3	1.8829	376.58	361.58	1,620	585,651.13
CH-4	1.7329	346.58	381.34	1,690	644,502.73
CH-5	2.0805	416.1	468.76	1,880	881,362.55
CH-6	2.6071	521.42	881.71	1,070	943,782.38
CH-9	6.21	1242	1,098.86	1,014	1,114,244.04
CH-10	4.7786	955.72	671.15	648	434,838.09
CH-11	1.9329	386.58	215.99	1,056	228,150.24
CH-12	0.227	45.4	22.70	2,465	55,948.69
CH-13	0	0	0	2,077	0
CH-14	0	0	0	1,183	0
CH-15	0	0	0	1,831	0
CH-16	0	0	0	1,866	0
CH-17	0	0	6.50	1,761	11,443.25
CH-18	0.065	13	6.69	775	5,182.07
CH-19	0.0019	0.38	0.19	866	164.58
CH-20	0	0	0	211	0
Total Required Volume（m^3）					5,183,713.00

This figure means the soil volume accumulated so far, and also the initial soil amount to be dredged.

Content of soil was found to be mainly the rich gravel zone with clay, distributed around Macuti bend region, and to be sand or mud zone around the entrance and inside channel

(2) Soil volume to be dredged (Maintenance Dredging)

In order to estimate annual volume of accumulated silt, the estimation chart described in the "Study for Maintenance and Improvement Plan of Access Channel of Beira Port in the Republic of Mozambique" was applied at this time in order to make the assessment of actually accumulated soil amount, since no definite data were available so far. This drawing is shown in Fig.2-5

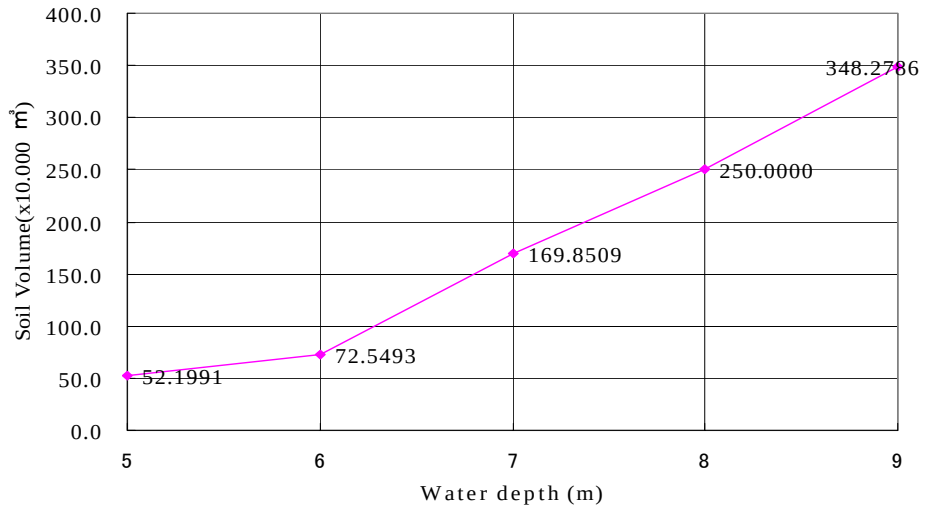


Fig.2-5 Annual accumulating soil amount

On the other hand, it was confirmed that there was almost no influence of cyclone flood in 2000 to the channel, and no particular difference of water depth between the data of 2003 and 2004.

Therefore, it is concluded the necessary annual dredging amount is deemed as about 2,500,000 ㎥, which is mainly distributed around Macuti bend region and upper part of the channel by the measurement result of this time.

(3) Study on hopper capacity of new dredger

As a starting point, actual dredging capability of Aruangwa was set up to be 1,022,000 ㎥/year. Annual turnover of dredged amount reported by EMODRAGA, 1,362,815 ㎥/year, was seemed to be too much, because loading ratio in the hopper reaches to about 90% with this soil amount. Therefore, 75% of reported amount was applied as adjustment as follows.

1,362,815×0.75=1,022,000 ㎥

With 2 TSH dredgers, the annual necessary soil amount to be dredged was calculated as shown in the Table 2-12, simulating the initial dredging period from 1 to 3 years.

Table 2-12 Necessary soil amount to be dredged

	Water depth	Necessary dredge amount (1,000 ㎥)		Necessary dredge amount at initial stage (1,000 ㎥)		
		Initial ①	Maintenance ②	For 1 year (①+②)	For 2 years (①/2+②)	For 3 years (①/3+②)
Original channel	8.0m	5,184	2,500	7,684	5,092	4,228

Based on the required dredging volume shown on the Table-2-12, necessary hopper capacities are calculated and tabled as shown in Table 2-13, where the conditions of the calculation are:

Ratio of operation: Actual figure of Aruangwa was set to 1.0, and 2 dredgers will be operated at the same ratio.

Dredge capability : Dredging capability of 1,000 ㎥ TSH dredger at working ratio 1.0 is 1,022,000 ㎥.

Dredging Cycle : One (1) Dredging cycle consists of dredging, turning, navigation, dumping and navigation is applied to all cases irrespective of the hopper capacity.

1) Necessary dredging capability for initial dredging

As the result, necessary capability of TSH dredger to dredge to 8m deep is shown on the Table 2-13. Based on the outcome of the calculation, it is understood that recovery of the original access channel to 8m deep can be achieved in case that two (2) 1,000 ㎥ TSH dredgers will be operated with their operational ratio of 2.0 (2 shifts) for 3 years continuous dredging.

Table 2-13 Study of hopper capacity

		Necessary Dredge amount (1,000 ㎥) ③	Necessary capability (1,000 ㎥)		Necessary hopper volume (H ㎥)				
			Aruangwa ④	New dredger ⑤ (③−④)	Rate of operation (e)				
					1.0	1.2	1.5	1.7	2.0
Necessary capability for 1 year									
Original	8.0m	7,684	1,022	6,662	6,520	5,270	4,010	3,420	2,760
Necessary capability for 2 years									
Original	8.0m	5,092	1,022	4,070	3,980	3150	2,320	1,930	1,490
Necessary capability for 3 years									
Original	8.0m	4,228	1,022	3,206	3,140	2,450	1,760	1,430	1,070

Note : H={ (③−④・e) ／④・e}×1000, Rate of operation: 1.0 at 12hr. dredge and 2.0 at 24 hr. dredge

Table 2-14 Dredging capability at initial dredging

	Hopper volume (㎥)				
	Rate of operation				
	1.0	**1.2**	**1.5**	**1.7**	**2.0**
Original channel (8m) : 3 years	3,140	2,450	1,760	1,430	1,070
Original channel (8m) : 1 year	6,520	5,270	4,010	3,420	2,760

Fig.2-6 shows the correlation of hopper capacity, operational ratio and operation period to complete the initial dredging to deepen original channel to 8m depth.

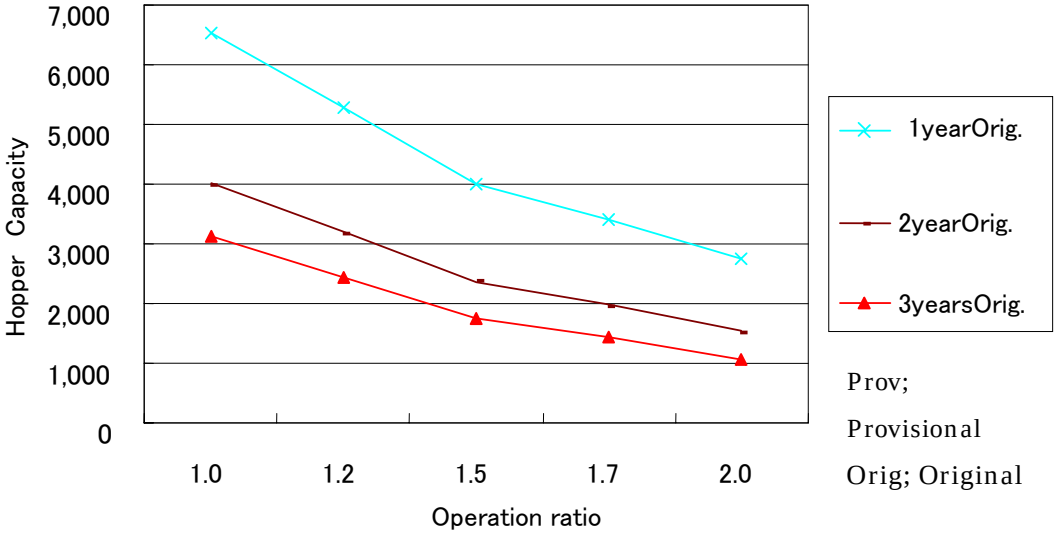


Fig. 2-6 Correlation figure of hopper capacity and ratio of operation

2) Capability for maintenance dredging

Annual dredging of 2,500,000 ㎥ is considered to maintain the channel 8m deep, and two of 1,000 ㎥ type hopper dredger will be enough to carry out the necessary operation with a little improvement, such as increase the number of cycle, operational days or operational over time.

3) Necessary hopper capacity

In short, it is the most appropriate plan to deploy the new TSH dredger of 1,000 ㎥ type, take the fact that the initial dredging can be done by two TSH dredgers and the minimum operational for the maintenance dredging thereafter, are taken into consideration. Furthermore, following points are enumerated as advantages of 1,000 ㎥ type TSH dredger.

a) To enjoy the merits of effect of sister ship of Aruangwa

- Compatibility of spare parts and consumables, cost reduction in logistics of parts and time saving of warehouse management.
- Flexibility for allocation of crew onboard from Aruangwa to new TSH dredger

because of the similarity of the 2 dredgers, and easy to start the OJT training for new cadets.

b) The largest vessel to be accommodated into BEIRANAVE dry dock for periodical inspection of the Classification Society or repair works.

4) Others

Measurement data show that the soil accumulation of access channel is not distributed around the whole area, but is severely concentrated around Macuti bend area. Therefore, concentrate dredging to this area with 2 dredgers is urgently suggested, followed by the whole dredging of the channel.

Apart from the above, accumulated soil around the wharf is also the matter to be overcome urgently at next step, although these area was not included in the measurement objectives this time.

2-2-2-3 Basic Plan of General and Hull Part

The vessel shall be a trailing suction hopper dredger, which will be employed to maintenance dredging of the access channel of Beira Port. The vessel shall be designed for operation to dredge of sea bed material consist of silt, fine sand and coarse sand.

The vessel's hull shall be constructed with steel, provided with 5 bladed fixed pitch twin propellers driven by one marine diesel engine each through the line of shafting and twin rudders. One set of dredging pump shall be arranged in forward pump room and driven by exclusive diesel engine. One drag arm shall be provided on starboard side. Dredged material stored in the hopper shall be dumped out through bottom doors.

Forecastle deck, poop deck and deck house shall be constructed. One mud hold (Hopper) of 1,000 ㎥ shall be provided at the mid-body of the vessel.

(1) Flag, Port of Registry:Mozambique, Beira

(2) Classification: BV(Bureau Veritus), I 3/3 E+, Hopper Dredger Coastal Waters, Dredging within 8 miles from shore

(3) Principal Dimensions

Length, o.a.	abt.70m
Length.b.p.	65.0m
Breadth, mld	14.0m
Depth, mld	4.7m
Working draft, mld	4.0m

(4) Deadweight

Deadweight at designed draft	abt.1,800t

Deadweight at designed draft shall be as follows

Soil	1,600t
Fuel oil	120t
Fresh water	50t
Constant and other	30t

(5) Cargo Carrying Capabilities

Mud hold capacity.	abt.1,000 m^3

(6) Tank Capacity

Fuel oil	abt.150 m^3
Fresh water	abt. 60 m^3
Water ballast	abt.140 m^3

(7) Speed, Fuel Consumption and Endurance

Free running speed	abt. 0.2kt
Dredging speed	abt.6.0kt

at designed draft with maximum output of main engine without sea margin

Designed fuel consumption	abt. 9.2t/day

Maximum endurance	abt.2,200 sea miles

on the basis of the above mentioned free running speed and fuel oil capacity (90% full)

(8) Accommodation

Captain, Chief Engineer	4 persons

Officer class		8 persons
Crew class		24 persons
	Total	36 persons
Public space:	Officer's mess	
Crew's mess		
Recreation room		

(9) Others

Bow thruster	200kw	1 set
Derrick (onto foremast)	4t	1 set
Steering machine	Electro-hydraulic 8t	2 sets
Windlass	Electro-hydraulic 5t x 9m/min	2 sets
Life raft		as per rule

2-2-2-4 Dredging Part

(1) System and Particulars

1) System: Side drag type (Starb'd side)

2) Maximum dredging depth: 20m
at light load condition with drag arm inclination of abt. 45 degree

3) Dredge pump: 4,000 ㎥/h x abt.20m TH 1 set

4) Drag head: Modified California type
Drag arm: Internal dia. 600mm x 18mm wall thickness

5) Swell compensator: Hydraulic pneumatic type
Cylinder stroke: max.1.8m

6) Dredge pipe: Suction pipe: Nominal dia. 600mm
Discharge pipe: Nominal dia. 550mm
with 18mm wall thickness

7) Hopper door: Hinged type, hydraulic cylinder driven 12 sets

8) Drag arm hoisting system: Drag head davit and winch (hydraulic)
Trunnion carriage, winch (hydraulic)
Intermediate joint davit & winch (hydraulic)

(2) Automation and Remote Control

1) Dredge pump
Remote speed control of dredge pump engine from wheelhouse
Start and stop of the engine at machine side

2) Drag arm
Remote hoist and lower from wheelhouse
Start and stop of hydraulic pump for drag arm at machine side

3) Dredge valve
Remote open and shut from wheelhouse
Start and stop of hydraulic pump for dredge valve at machine side

4) Hopper door cylinders
Remote open and shut from wheelhouse
Start and stop of hydraulic pump for operating cylinder at machine side

2-2-2-5 Machinery Part

(1) System and Particulars

1) Main engine: Vertical, single acting, 4 cycle, turbo-charged, non-reversible marine diesel engine
Rating: abt.1,200ps
No.: 2 sets

2) Propeller: Nickel aluminum bronze fixed pitch, 4 bladed
No.: 2 sets

3) Reduction gear: with reversible function2 sets

4) Dredge pump engine:

Vertical, single acting, 4 cycles, turbo-charged,
marine diesel engine 1 set

Rating: abt. 680ps

5) Main generator engine:

Vertical, single acting, 4 cycle, turbo-charged,
marine diesel engine 2 sets

Rating: abt. 435ps, 290kw

6) Harbour use generator engine 1 set

Rating: abt. 150ps, 100kw

(2) Auxiliary Machinery

Main engine cooling S.W. pump	2
Main engine cooling F.W. pump	2
Bilge and ballast pump	1
Fire and general service pump	1
Main engine stand-by L.O. pump	2
Gear box stand-by L.O. pump	2
Engine room F.O. transfer pump	2
L.O. transfer pump	1
Engine room oily bilge pump	1
Waste oil transfer pump	1
Sluice valve flushing pump	1
Pump room oily bilge pump	1
Pump room F.O. transfer pump	1
Pump room waste oil transfer pump	1
Pump room fire and bilge pump	1
Emergency fire pump	1
Air con. ref. cooling S.W. pump	1
Gland sealing water pump	1
Main air compressor	2
Main air reservoir	2
Pump room air reservoir	1
Emergency shut off air reservoir	1
Main engine jacket cooling F.W. cooler	2

Oily water separator	1
Fresh water pump	1
Sanitary water pump	1

(3) Automation and Remote Control

1) Automatic start and stop of:
Fuel oil transfer pump at F.O. service tank low/high level
Main air compressor
Fresh water pump
Sanitary water pump

2) For bow thruster
Remote start, stop and impeller pitch control from wheelhouse

3) For main engine and gear box
Remote speed and reversing control from wheelhouse
Start and stop of main engine at machine side

2-2-2-6 Electric Part

(1) Supply System

Power	AC 380V 50Hz 3phase
Lighting:	AC 220V 50Hz 1phase
Communication:	AC 220V 50Hz 1phase / DC24V
Instrument:	AC 220V 50Hz 1phase / DC24V
Navigation and Radio equipment:	AC 220V 50Hz 1phase / DC24V

(2) Electric Equipment

Main switchboard	Deadfront type	1 unit
	Transformer	1 unit
	Storage battery	1 unit

(3) Lighting

Accommodation space:	Fluorescent lamp

Machinery space:		Fluorescent lamp
Deck:	400W	Mercury floodlight
Search light:	1,000W	1 set

(4) Communication and Navigation Equipment

Sound power telephone	1 set
Public addresser	1
Steering control console	1
Radar	1
Echo sounder	1
Wind wiper	1
General alarm and fire alarm system	1
Position fixing equipment	1

(5) Radio Equipment

MF/HF radio telephone	1 set
VHF radio equipment	1
TV receiver with video tape deck	1
Broad casting radio receiver	1

(6) Dredging Instrument

Dredge pump pressure indicator	1 set
Drag arm remote control console	1
Drag arm indicator	1
Dredge remote control console	1

2-2-2-7 Miscellaneous

When the onboard survey of Aruangwa at the basic design study was carried out by the consultant team at Beira port, several items to be modified for improvement of performance had been proposed by EMODRAGA's representative.

These items have been incorporated to the specification of new dredger, depending on the results of separate investigation respectively.

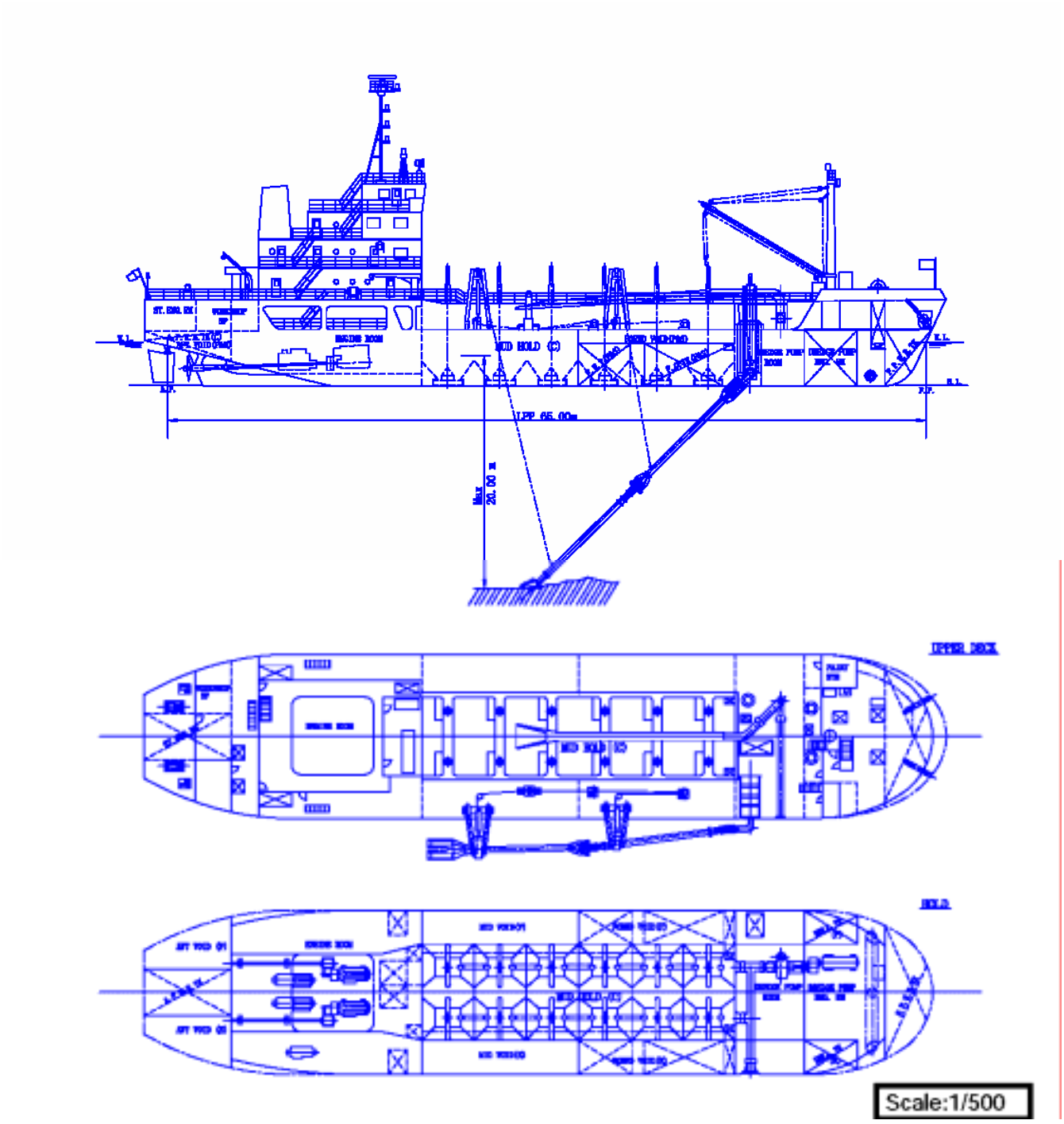
Major items are as follows.

- Output of dredge pump engine to be increased to 680ps from 600ps.
- Total head of dredge pump to be increased to 20m from 17.5m.
- Stroke of swell compensator to be modified to 1.8m from 1.25m.
- Increase of drag arm winch speed
- Additional provision of sea water suction strainer

2-2-3 Basic Design Drawing

The General Arrangement of the TSH Dredger is as follows.

GENERAL ARRANGEMENT PLAN



2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

After conclusion of the Exchange of Notes for the Project, Mozambican government and the selected consultant shall develop detailed design of the dredger based on the concept of basic design and invite qualified shipbuilders for bidding the construction of the dredger,.

As the dredger is a work ship employed for the special duty, the remarkable engineering and techniques are required not only for its design but also for the construction works.

To construct the dredger, the strict quality control and construction schedule control are essential. To meet with these requirements, the construction of the dredger should be planned to do at one of the Japanese shipbuilding companies, who has technique and experience in building and repairing of similar type of dredgers and also has enough engineering capability.

The selected shipbuilder by the tender shall enter into the shipbuilding contract, and carry out construction works under the inspection and supervision of the classification society and consultant. And also the shipbuilder shall arrange instruction and training program for crew at the shipyard and manufacturers to become proficient in handling the machinery and equipment installed on the vessel during construction works.

After completion of the construction of the dredger, the shipbuilder shall transport her at his expense and risk to Mozambique, and handover to the Mozambican government after the confirmation of her function is appropriate.

2-2-4-2 Implementation Conditions

In implementation of the project, the following attention should be paid.

(1) Quality Control

As the dredger will be employed in Mozambique and classed under the foreign classification, the Consultant, as the representative of Executing Agency, shall have close contact with the shipbuilder to make sure the construction schedule and inspection procedures, and shall visit the shipyard to attend and/or supervise the tests of material and equipment, as necessary.

(2) Schedule Control

As the vessel is a trailing suction self-propelled hopper dredger with specialized equipment, schedules of procurement, installation and calibration of the equipment utilized for construction shall be thoroughly checked with special attention. When some machinery or equipment are imported from foreign countries, it is recommendable to make a detailed schedule for control of procurement and installations schedule.

2-2-4-3 Scope of Work

When the Project will be executed in Japan's Grant Aid program, the scope of works of Mozambique and Japan shall be as follows.

(1) Scope of works shared by Japan

1) To carry out the consulting services from the detailed design of the planned dredger, assistance of tendering works, and supervision of the construction works of the vessel at the shipyard.
2) To undertake construction of the dredger, procurement of material, machinery, equipment and spare parts, and required tests and trial in Japan.
3) To assist training of crew for operation technique of the dredger and for handling the dredging equipment.
4) To transport the dredger to Beira Port after completion.

(2) Scope of works shared by Mozambique

1) To obtain the provisional nationality certificate and necessary documents for the transportation of the dredger from Japan to Mozambique.
2) To secure the quay for safe mooring of the dredger.
3) To prepare and execute all the necessary procedure, i.e. to accept the dredger quickly into Beira Port when she arrives from Japan, to import the dredger and its equipment, and to register her in Mozambique.
4) To bear all expenses for operation and maintenance cost of existing and new dredgers, with 2 shifts and 3 gangs system. This clause should be most important basis on the Project.

5) To carry out the OJT training for recruiting of new crew onboard.

2-2-4-4 Consultant Supervision

To assist the Executing Agency, a Japanese consultant will execute consistent consulting services from detailed design until delivery of the planned dredger, including provision of tendering works, conclusion of the building contract, check and approval of key drawings, and supervision and inspection of the construction works.

During the construction of the dredger, the consultant, with their experts for construction and outfitting of hull part, outfitting of machinery and dredging parts, will carry out supervision, including attendance to tests and trials and give instruction, advice and recommendation as necessary in consideration of the schedule of construction works. Furthermore, the guidance and advice on the method of operation of the dredger will be given by the time of delivery.

2-2-4-5 Procurement Plan

Considering the dredger will be built in Japan, Japanese material, machinery and equipment shall be adopted as much as possible in general to enjoy economical advantages, and also to actualize merits easily on negotiation with manufacturers, assurance of delivery time, attendance to tests at factories, education and training of crew at factories, etc. However, import of machinery and equipment will be considered, if their performances are reliable and prices are reasonable. Further, for an easy replacement of spare parts, a supplement of consumables, maintenance and repair in Mozambique in future, special attention shall be paid to import from manufacturers who have agents in Mozambique or neighboring countries.

2-2-4-6 Quality Control Plan

(1) Schedule Control

Periodical tracing activity will be carried out without delay, in accordance with the construction schedule arranged separately. Actual results of the work and delivery of the equipment delivered from respective manufacturers shall be controlled in comparison with planned schedule and delivery time result.

Close communications with the shipyard will be essential to take the necessary measures to meet the situation, such the case that some unforeseen accidents would happen.

(2) Quality Control

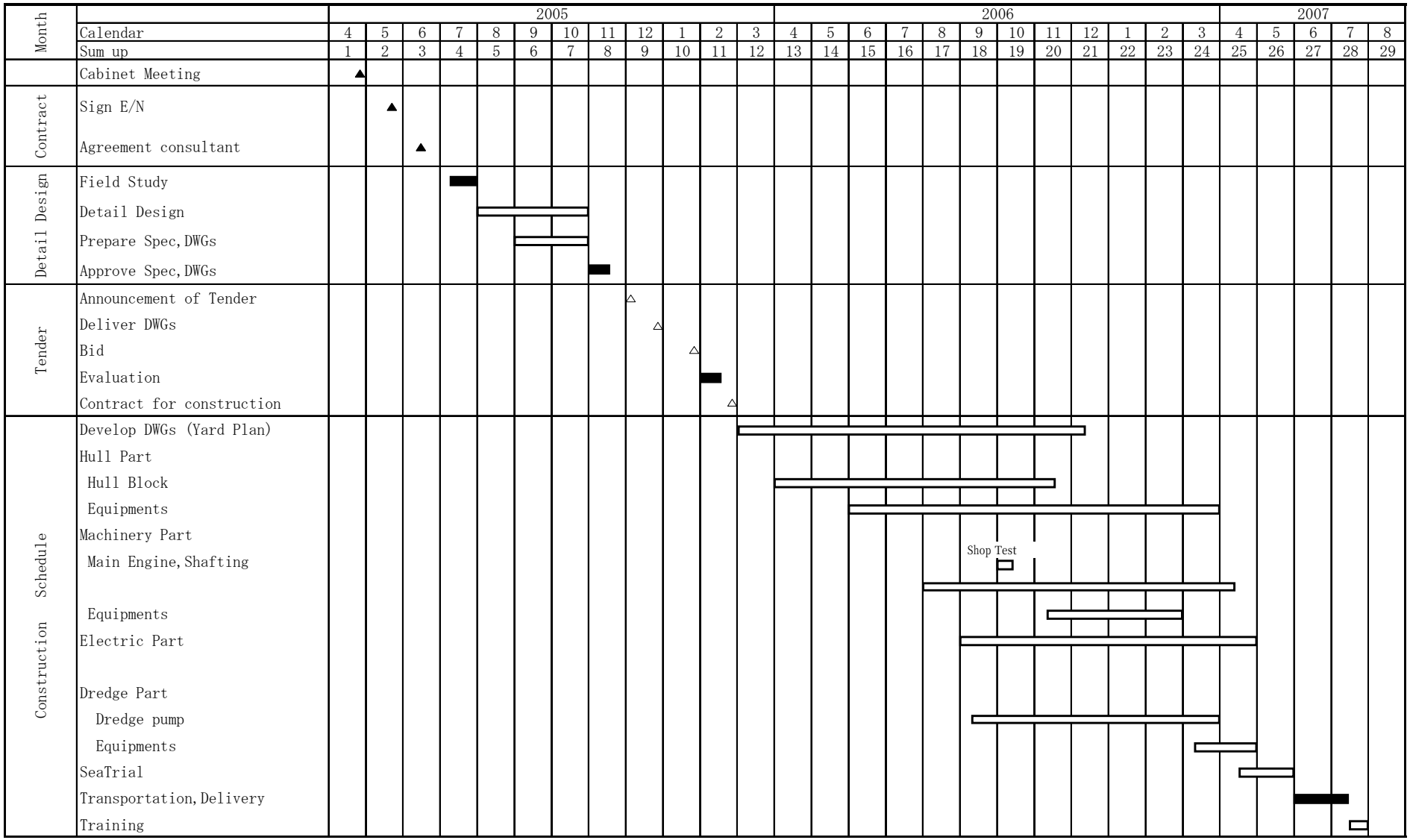
Inspections, not only at the shipyard but at the each manufacturer workshop, are important to maintain the sufficient quality level, in order to meet the rules and regulations of the registered government and the classification society. Therefore, the consultants will take the necessary action of inspection, depending on the case.

2-2-4-7 Implementation Schedule

Detailed design work for the dredger will be completed in about 5 months after the conclusion of the Exchange of Notes. The shipbuilding contract will be signed after about 4 months from completion of the detailed design. About 17 months will be required for the construction, and further about 2 months will be necessary for transportation from Japan to Beira Port and her delivery.

The Implementation schedule is shown on the Table 2 -15.

Table2-15 Implementation Schedule



2-3 Obligations of Recipient Country

Following are the items as “the major undertakings to be taken by the recipient country” which were confirmed in writing between both countries.

(1) To bear the following commissions to the Japanese bank for banking services based upon the B/A
   1) Advising commission of A/P
   2) Payment commission

(2) To obtain the provisional nationality certificate and necessary documents for the transportation of the dredger from Japan to Mozambique.

(3) To secure the quay for safe mooring of the dredger.

(4) To prepare and execute all the necessary procedure, i.e. to accept the dredger quickly into Beira Port when she arrives from Japan, to import the dredger and its equipment, and to register her in Mozambique.

(5) To bear all the expenses for operation and maintenance cost of existing and new dredgers, with 2 shifts & 3 teams system, based upon working plan which was developed by the Survey Team.

(6) To carry out the OJT training for the new crew onboard.

There are no particular budgets to be allocated by the recipient country.
However, in case the expenses are needed during the procedure of the recipient country, those shall be borne by them.

2-4 Project Operation Plan

(1) Operation Plan

EMODRAGA shall undertake the operation, maintenance and repair work of new dredger.

1) Daily operation work

As stated in aforementioned in “(2), 2-2-1 Working time and manning plan”, 2 teams of

crew are always on board and join the 2 shift of dredging work. Another 1 team of crew is engaged in the separate work on shore.

2) Periodical maintenance

Crew of the dredger is engaged in the maintenance and repair work of equipment or machineries every Saturday.

3) Periodical inspection and repair

Periodical inspection and repair work are scheduled to be carried out in BEIRANAVE shipyard every year.

4) Temporally repair or change of equipment parts

When the repair work is necessary with the main engine stop, it is carried out alongside the quay of EMODRAGA.

The flow of this operation work is shown in Fig. 2-7.

(2) Repair facility

1) Mooring quay

For the convenience of crew and easy handling of equipment and consumables into the dredger, exclusive quay of EMODRAGA shall be utilized as the mooring quay, where they are currently mooring Aruangwa.

2) Maintenance shop

BEIRANAVE shipyard has a dry dock (110m length x 17m width x 6.5m depth) is located nearby EMODRAGA quay, and this dock will become the main repair base of new dredger. BEIRANAVE is an affiliated company of Portuguese major shipbuilding company LISNAVE has been assisting in ship repairing and new building techniques.

3) Other facilities

EMODRAGA has the warehouse and small repair shop in Beira. CFM has also machine shop where is available for the repair work. When large repair work is required, South African Shipyard in Durban of South Africa is available.

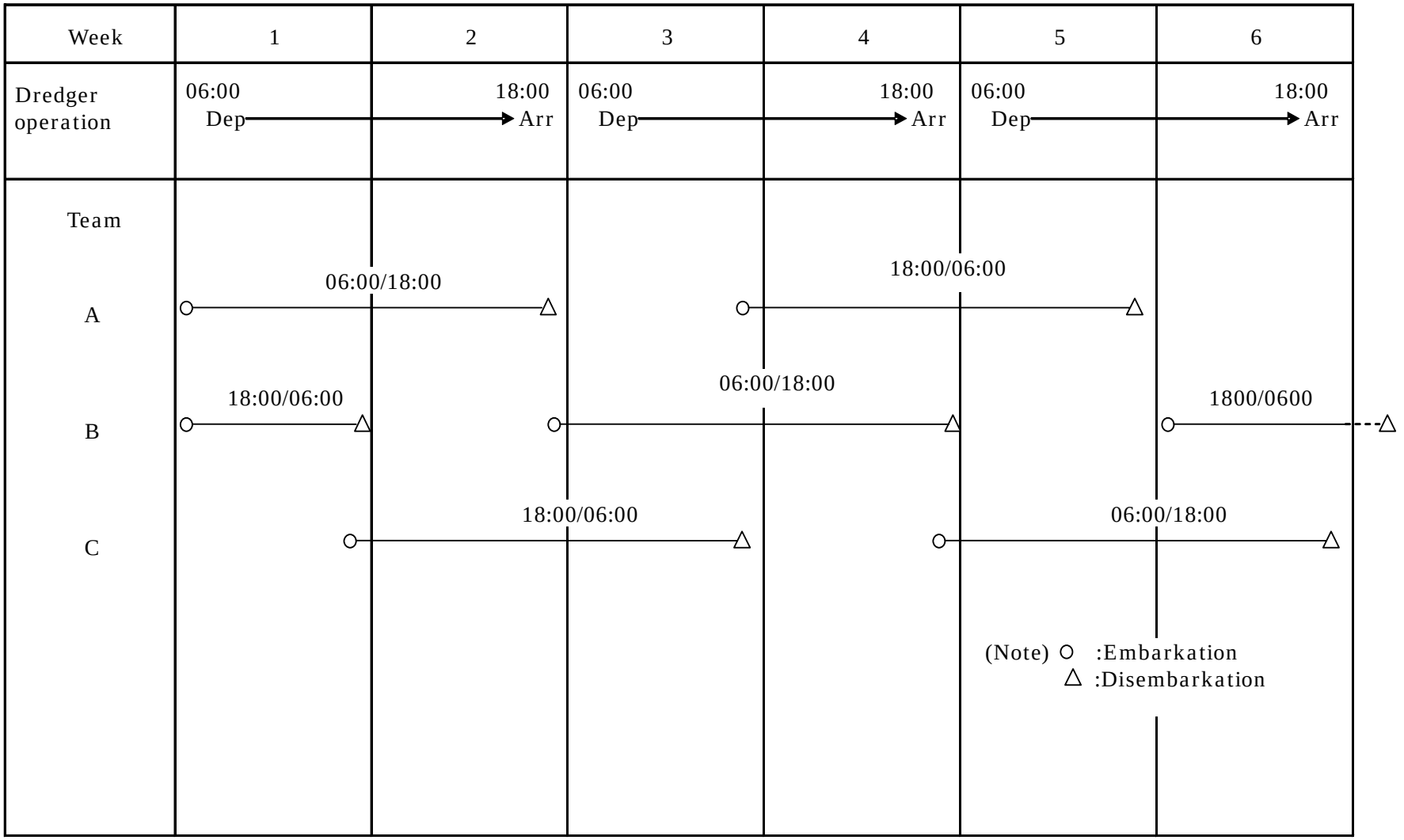


Fig.2-7 2 Shifts Operation

(3) Rough Estimate Cost of Dredger

The approximate cost of dredger was roughly estimated under the following conditions.

1) The dredger will be built by the Japanese Shipbuilder.
2) Delivery of the dredger will be in the middle of 2007.
3) Exchange rate is 108.40 Yen/US$.

Rough estimated cost about 2,167 Million Japanese Yen

One (1) TSH Dredger with hopper capacity of 1,000 ㎥

Item		Rough Estimated Cost (Million Japanese Yen)		
Facility	Construction cost	2,061	2,100	2,100
	Transportation (Japan to Mozambique)	39		
Design and Supervision expenses				67

This cost estimates is provisional and would be further examined by the Government of Japan for the approval of the Grant.

(4) Operation and Maintenance Cost

The expenses of EMODRAGA for operation and maintenance work are born by CFM as the returns of dredging operation in the way of navigation channel and the wharfs in Beira port.

When the inspections on board the dredger Aruangwa were carried out, the maintenance and adjustment work were considered well performed as for dredging equipment, propulsion engines, electric generators and miscellaneous pumps, etc. Generally, it can be understood that maintenance works on dredger operation are executed without any difficulties.

The purchase of major spare parts such as parts of main engine, generator, main valve, etc are placed an order with each manufacturer once a year periodically, after reviewing the stocks in the warehouse.

Ordinary consumables such as rope, illumination lamp, paint, etc are purchased from neighboring countries, such as South Africa, etc.

Dry-docking and repair work are carried out every year in BEIRANAVE dockyard. It is considered that necessary inspection and repair works are carefully done without delay.

Actual figures of operation and maintenance cost of Aruangwa in the past 4 years are shown in table 2-16 below, and annual budgets are deemed to be 1.4 to 1.5 million US$ per year.

Table 2-16 Operation & Maintenance Cost of Aruangwa (Unit: 1,000US$)

Expenditure	2000	2001	2002	2003
Salaries and wages	23	24	23	23
Insurance	82	82	116	122
Fuel	90	224	208	186
Food for crew	20	16	20	28
Material purchased	20	28	40	75
Services purchased	1	3	4	19
Annual docking	0	69	99	86
Tax and other duties	0	0	4	5
Depreciation	1,288	942	913	911
Other cost	0	1	7	8
Total	1,526	1,391	1,433	1,463

Source: EMODRAGA document

After the new dredger is incorporated in the new dredging scheme of Beira Port, new working schedule (Joint operation of two (2) 1,000 ㎥ TSH dredgers, 2 shifts for 3 years) shall be undertaken in order to fulfill the target of the original channel water depth 8m.

Based on the actual figures of operation and maintenance costs of Aruangwa, additional budget on top of the current budget is estimated about 1.5 million US$ per year and the required budget for operation and maintenance for two (2) 1,000 ㎥ TSH dredgers is estimated as shown on the Table 2-17.

Table 2-17 Operation & Maintenance Cost for 2 x 1,000 ㎥ TSH dredgers

Operation & Maintenance Cost for 2 x 1,000 ㎥ TSH dredgers	US$/Year
Annual Docking Fee	170,000.-
Material & Services Fee	82,500.-
Total	225,500.-

Therefore, sound and firm new budget appropriation by CFM is duly essential and the key point of success of this project.

Chapter 3 Project Evalution and Recommendations

CHAPTER 3
PROJECT EVALUTION AND RECOMMENDATION

3-1 Project Effect

Aruangwa has continuously been carried out the dredging work to achieve the water depth of 6.5m at the access channel, since she started to dredge in 2000.
However, in spite of the continuous performance of Aruangwa, there still remains the insufficient zone of water depth about 5m, particularly around Macuti bend area, and initial project target that is aimed at 83% of ships calling Beira port can enter/leave the port without any extra waiting time at the mean water level, has not been reached to the satisfaction.

Actually several grounding accidents are still happening at the area of Macuti bend, and many ships have to wait for high tide before entering the channel inward.

According to the estimation based on CFM report in 2003, average waiting time for high tide was about 13 hours when channel depth was 5m. After the channel depth will be deepened to 8m, average waiting time can be drastically reduced to about 3 hours, and t is predicted that the ships of 30,000DWT with 10m draft can pass the channel smoothly without loss time.

By saving in tide waiting time, the number of ships calling Beira port is expected to be increased and total volume of cargoes will be increased which eventually leads to profit growth of the port. Besides, large- sized ships with a high demurrage cost and container ships bound to keep service regularity that have been refraining from calling at this port will expected to call the port again.

By maintaining the water depth of 8m, large-size ship that could not enter the port with fully loaded condition can be made possible to enter the port with their maximum draft without or with less waiting time for tide, leads not only for the stable supply of livelihood and daily commodities to Mozambican citizen but also reduction of transportation cost, eventually contributes improvement of socio-economy of Mozambique.

(1) Direct effect

1. Water depth 8m of access channel will be maintained.
2. Waiting time for high tide will be reduced by about 10 hours/ship.
3. Grounding accidents at channel bend area will be reduced.

(2) Indirect effect

1. Logistic activities to neighboring countries will be encouraged.
2. Stable distribution of daily commodities to inland countries will be maintained.
3. Technical level of the crew on board will be raised efficiently through actual operation of new dredger.

3-2 Recommendation

EMODRAGA has operated two TSH dredgers in Beira Port for a long time, and has the know-how of ship operation and personnel of dredging work.
Therefore the following tasks are enumerated as the recommendation to achieve the afore-mentioned project effects.

(1) Training of crew for new dredger

Technology transfers that are considered necessary for the safe and efficient operation of the dredger in terms of ship-maneuvering, dredging, machinery operation, and planning and management of dredging work need to be carefully planned on the basis of observations of EMODRAGA's own training plan and its capability of implementing them. In addition, the result of such technology transfer should be followed up during the subsequent two or three years in order to determine whether it should be supplemented or not.

(2) Compilation of education curriculum and systematic practice

Special technique for dredging work shall be taught for the graduates of seaman's school in accordance with this educational philosophy.

(3) Training and familiarization of dredge equipment operation

Technical instructors of next generation shall be brought up through the training of equipment operation or overhaul repair in the equipment manufacturers.

(4) Education of managers

Managers in each section shall be strongly requested to acquire the method of plan/follow system in respect of dredge planning, ship operation, equipment control, inspection, repair, procurement, logistics, warehouse management, etc.

(5) Support and corporation of Government Organizations concerned

In respect of necessary budget appropriations for the operation and maintenance of the new dredger, EMODRAGA should be fully supported by CFM who is in a position to manage Beira Port operation and to place orders from EMODRAGA for dredging work. Though CFM is committed to such full support, appropriate supervision by MTC is also required so that MTC can deal with problems should anomalous matters occur which are impossible for EMODRAGA to secure necessary budget fund.

Appendix 1. Member List of the Study Team

1. MEMBER LIST OF THE STUDY TEAM

(1) Basic Design Study

Leader	KOYANAGI Yoshimoto	Traffic Infrastructure team, Project Management Group II Grant Aid Management Department, International Cooperation Agency
Chief Consultant/Operation & Management Planner	IKEBA Tadashi	Shipbuilding Research Centre of Japan
Dredge & Equipment Designer	WAKAMATSU Yoshiro	Ditto
Shipbuilding Planner/Cost Estimator	SUEOKA Hidetoshi	Ditto
Natural and Environment Specialist	UEMURA Taiji	Ditto
Interpreter(Portuguese)	TODA Saho	Ditto

(2) B.D. Draft Final

Deputy Leader	KOYANAGI Yoshimoto	Traffic Infrastructure team, Project Management Group Ⅱ Grant Aid Management Department, International Cooperation Agency
Chief Consultant/Operation & Management Planner	IKEBA Tadashi	Shipbuilding Research Centre of Japan
Dredge & Equipment Designer	WAKAMATSU Yoshiro	Ditto

Appendix 2. Study Schedule

2. STUDY SCHEDULE

(1) Basic Design Study

	Date	Day of The Week	Survey Activities
1	6/16	Wed	Lv. Narita
2	6/17	Thu	Ar. Maputo via Hong Kong and Johannesburg
3	6/18	Fri	Courtesy call to EOJ, JICA Moz. EMODRAGA Maputo Lv. Maputo Ar. Beira
4	6/19	Sat	Visit Beira Port and EMODRAGA facilities Boarding on TSH"Aruangwa"and observe dredging operations
5	6/20	Sun	Visit BEIRANAVE drydock , observe EMODRAGA facilities
6	6/21	Mon	Courtesy call to Director of Sofala Prov., Mayor of Beira city Explanation of Inception Report and discussion with EMODRAGA
7	6/22	Tue	Prepare a draft of M/D Lv. Beira Ar. Maputo
8	6/23	Wed	Signing of the M/D Report to EOJ, JICA Moz.
9	6/24	Thu	Lv. Maputo(Koyanagi) Stay Maputo for collecting materials (Uemura, Toda) Lv. Maputo Ar. Beira(Ikeba, Wakamatsu, Sueoka Lv)
10	6/25	Fri	Ar. Narita(Koyanagi) Boarding on TSH"Aruangwa" for investigations
11	6/26	Sat	Hearing of CFM-C
12	6/27	Sun	Reorganize Materials and Data Lv. Maputo Ar. Beira (Uemura, Toda)
13	6/28	Mon	Discussion of the technical matters with EMODRAGA Reorganize data
14	6/29	Tue	Ditto
15	6/30	Wed	Signing on the Memorandum of Technical Discussions
16	7/1	Thu	Discussion on Hydrographic survey Reorganize materials and data
17	7/2	Fri	Preparation on Hydrographic survey Reorganize Materials and data
18	7/3	Sat	Ditto

19	7/4	Sun	Lv. Beira Ar. Maputo
20	7/5	Mon	Final report to EOJ, JICA Moz.
21	7/6	Tue	Lv. Maputo
22	7/7	Wed	Ar. Narita via Johannesburg and Hong Kong

(2) B.D. Draft Final

	Date	Day Of The Week	Activities
1	10/20	Wed	Lv. Narita
2	10/21	Thu	Ar.Maputo via Johannesburg, Singapore/Hong Kong
3	10/22	Fri	Courtesy call to EOJ,JICA Moz Lv. Maputo Ar. Beira
4	10/23	Sat	Explanation on B.D. Draft Final
5	10/24	Sun	Arrangement on materials
6	10/25	Mon	Discussion with CFM-C and EMODRAGA
7	10/26	Tue	Ditto Lv. Beira Ar. Maputo
8	10/27	Wed	Discussion on M/D
9	10/28	Thu	Signing on M/D Final Report to EOJ, JICA Moz.
10	10/29	Fri	Lv. Maputo(Koyanagi) Final confirmation with EMODRAGA
11	10/30	Sat	Ditto Lv. Maputo(Ikeba, Wakamatsu) Ar. Narita(Koyanagi)
12	10/31	Sun	Lv. Johannesburg(Ditto)
13	11/1	Mon	Ar. Narita (Ditto)

Appendix 3.
List of Parties Concerned in the Recipient Country

3. LIST OF PARTY CONCERNED IN THE RECIPIENT COUNTRY

・MOZAMBIQUE

Ministry of Transport and Communications (MTC)

Tomaz Augusto Salomão	Minister
Olivio Manuel Mendes Pinto	National Director of Surface Transports

Portos e Caminhos de Ferro de Moçambique(CFM)

Rui Cirne P.C.Fonseca	President and Chairman of the Board
Domingos F. Lopes Bainha	Executive Board Director
Joaquim Verissimo	Managing Director, CFM-C
Amir A. Amade	Port Director, CFM-C

Empresa Moçambicana de Dragagens(EMODRAGA)

Rassul Khan G. Mahomed	Chairman and Managing Director
Tayob Abudul C. Adamo	Board Director, Maputo
Simões Tomas Francisco	Deputy Director

Sofala Province and Beira City

Orlando Sharves	Director of Plan and Finance
Daviz Mbepo Simango	Mayor

CORNELDER

Carlos Mesquita	Managing Director

・JAPAN SIDE

Embassy of Japan

Kanji Tsushima	Ambassador Extraordinary and Plenipotentiary
Ichiro Muto	Secretary
Kenji Ohhira	Official in Charge

JICA Mozambique Office

Noboru Tsutsui	Resident Representative
Katsuyoshi Sudo	Deputy Resident Representative
Saeko Kameyama	Staff in Charge

Appendix 4. Minutes of Discussions

Minutes of Discussions
on the Basic Design Study
on the Project for Reinforcement of the Dredging Capabilities for Beira Port
in the Republic of Mozambique

In response to the request from the Government of the Republic of Mozambique (hereinafter referred to as "Mozambique"), the Government of Japan decided to conduct a Basic Design Study on the Project for Reinforcement of the Dredging Capabilities for Beira Port (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Mozambique the Basic Design Study Team (hereinafter referred to as "the Team"), headed by Mr. Yoshimoto Koyanagi, an officer of the Traffic Infrastructure Team, Project Management Group II, the Grant Aid Management Department, JICA, and is scheduled to stay in the country from June 17, 2004 to July 6, 2004.

The Team held discussions with the concerned officials of the Government of Mozambique. In the course of the discussions, both sides have confirmed the main items of described in the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Maputo, June 23, 2004

小柳 恒泉

Yoshimoto Koyanagi
Leader
Basic Design Study Team
Japan International Cooperation Agency

Olivio Manuel Mendes Pinto
National Director of Surface Transports
Ministry of Transport and Communications
Republic of Mozambique

Rassul Khan G.Mahomed
Chairman & Managing Director
Mozambique Dredging Company, EMODRAGA
Republic of Mozambique

Rui Cirne P.C.Fonseca
Chairman
Mozambique Ports and Railways (CFM)
Republic of Mozambique

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve dredging capabilities for Beira Port.

2. Project Site

The Project site is Beira Port in Sofala Province, shown in Annex-1.

3. Responsible and Implementing Organizations

(1) The responsible ministry is the Ministry of Transport and Communications.
(2) The supervising agency is the Mozambique Ports and Railways.
(3) The implementing agency is the Mozambique Dredging Company, EMODRAGA.
The organization chart of the implementing agency is shown in Annex-2.

4. Items Requested by the Government of Mozambique

After discussions with the Team, the items described in Annex-3 were finally requested by the Mozambican side. JICA will assess the appropriateness of the request and will report to the Government of Japan.

5. Japan's Grant Aid Scheme

(1) The Mozambican side understood the Japan's Grant Aid scheme and the necessary measures to be taken by the Government of Mozambique explained by the Team as described in Annex-4.
(2) The Mozambican side will take necessary measures, as described in Annex-5, for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

6. Schedule of the study

(1) The consultants will proceed to further studies in Mozambique until July 5, 2004.
(2) JICA will prepare the draft report in English and dispatch a mission to Mozambique in order to explain its contents around the beginning of October 2004.
(3) In case that the contents of the report is accepted in principle by the Government of Mozambique, JICA will complete the final report and send it to the Government of Mozambique by January 2005.

7. Other Relevant Issues

(1) The Mozambican side shall allocate the appropriate budget in a timely manner for undertakings to be done by the Mozambican side described in Annex-5.
(2) The Mozambican side shall make a dredging plan including the new dredger at Beira Port for several years and forward it to the Team by the end of July 2004.
(3) The Mozambican side shall make assignment plan and technical training plan for crew of the new dredger and forward it to the Team by the end of July 2004.
(4) The Mozambican side shall secure a wharf and a dock for the new dredger and inform it to the Team by the end of July 2004.

(5) The Mozambican side understood that it is necessary to assign an appropriate number of counterpart personnel(s) during the official sea trial for dredging part of the new dredger at Beira Port to obtain the operation skills from the Japanese side.

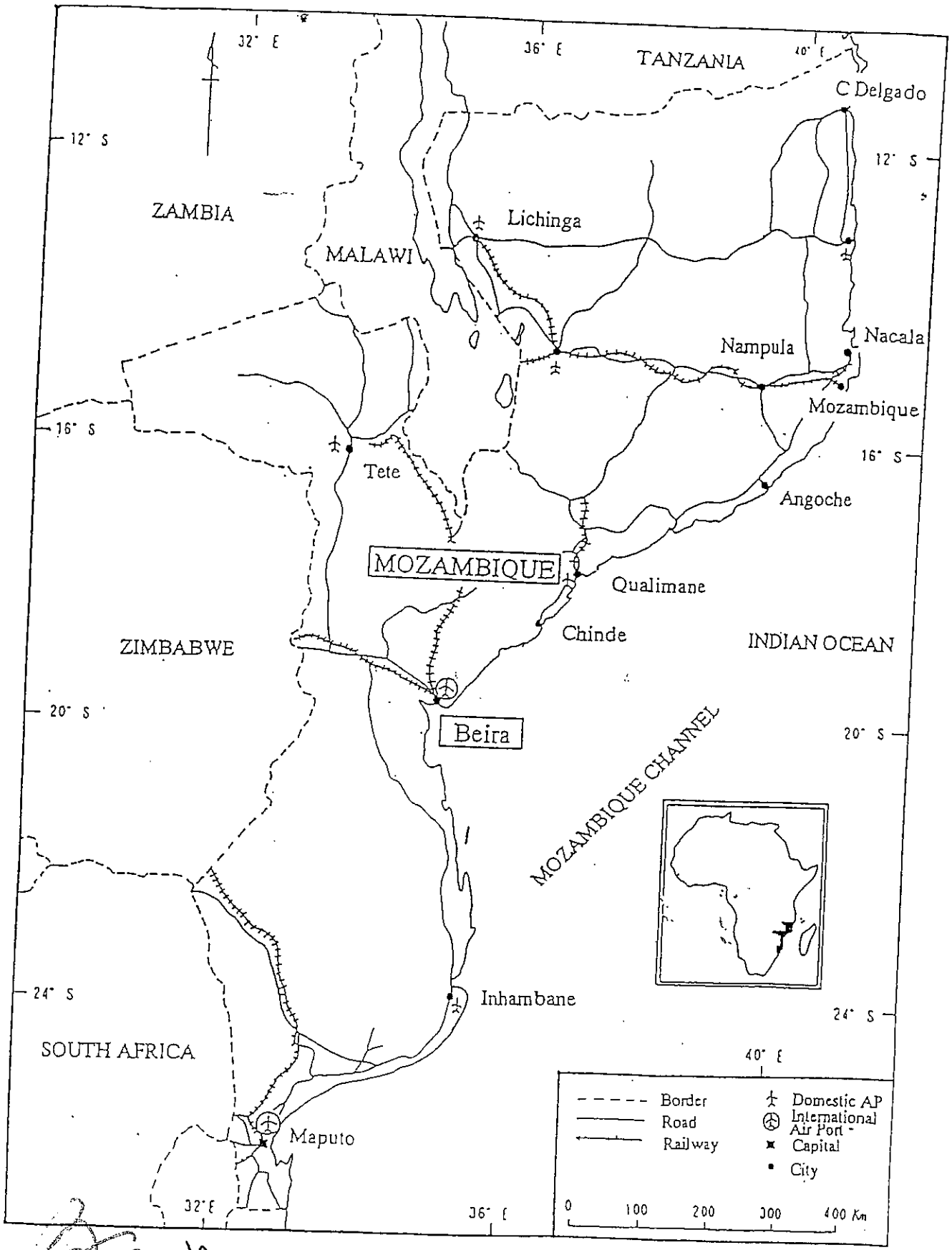
(6) The Mozambican side shall complete necessary procedures based on the Mozambican maritime law for the new dredger.

(7) The Team explained the outline of JICA Environmental and Social Considerations Guidelines (hereinafter referred to as "the JICA Guidelines") to the Mozambican side. The Mozambican side took the JICA Guidelines into consideration, and shall complete the necessary procedures. If the approval of IEE (Initial Environmental Examination) is required, the Mozambican side shall get it from the Ministry of Environment by the end of September 2004, and if EIA (Environmental Impact Assessment) is required, the Mozambican side shall get an approval of EIA by the end of November 2004.

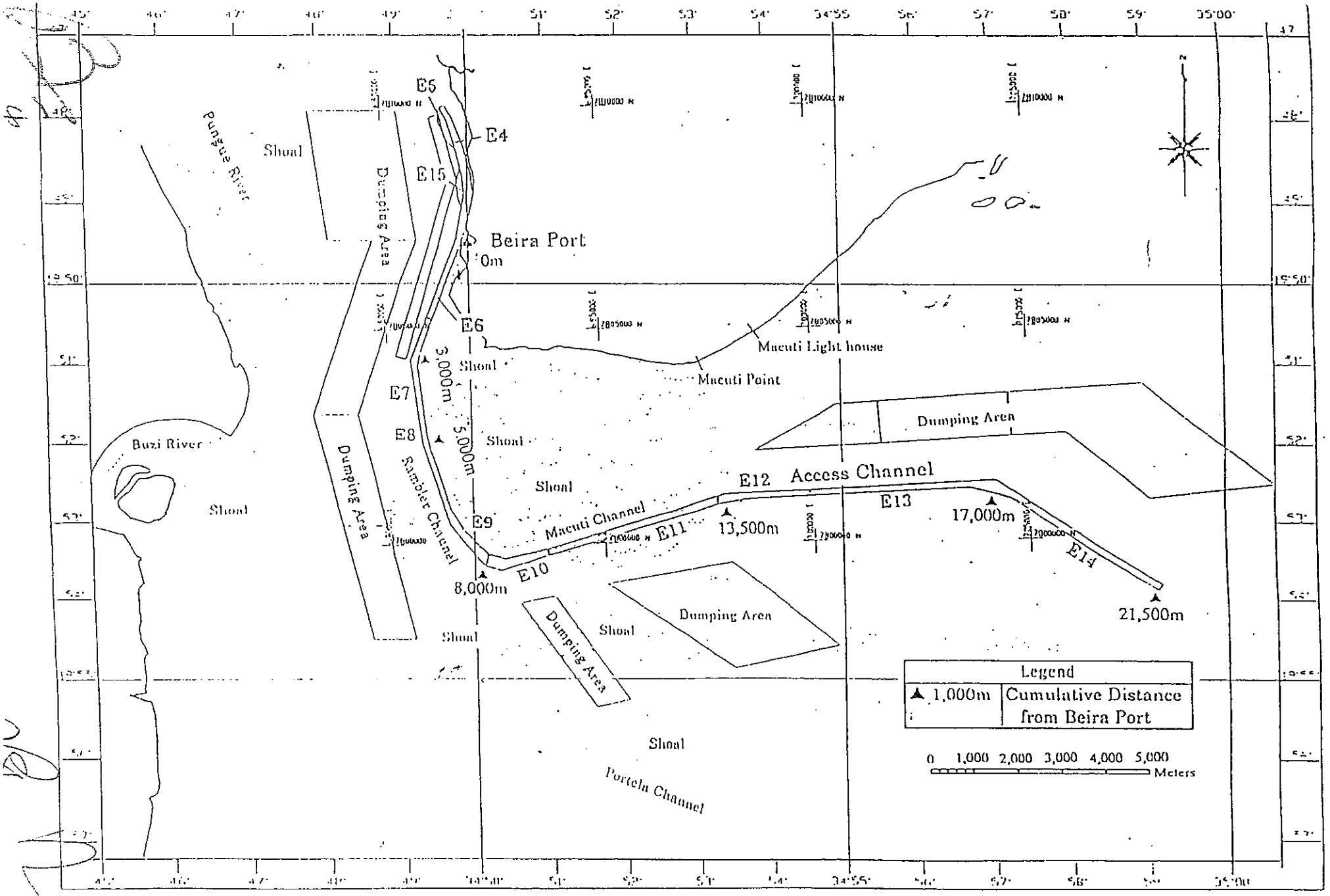
(8) The Mozambican side stressed the need for technical cooperation for the Project, and understood they will need to submit official request to JICA Mozambique Office.

(9) The Mozambican side shall submit answers in English to the Questionnaire, which the Team handed to the Mozambican side, by June 28, 2004.

(10) The Mozambican side shall provide necessary number(s) of counterpart personnel to the Team during the period of their studies in Mozambique.



Location Map of Beira Port, Mozambique



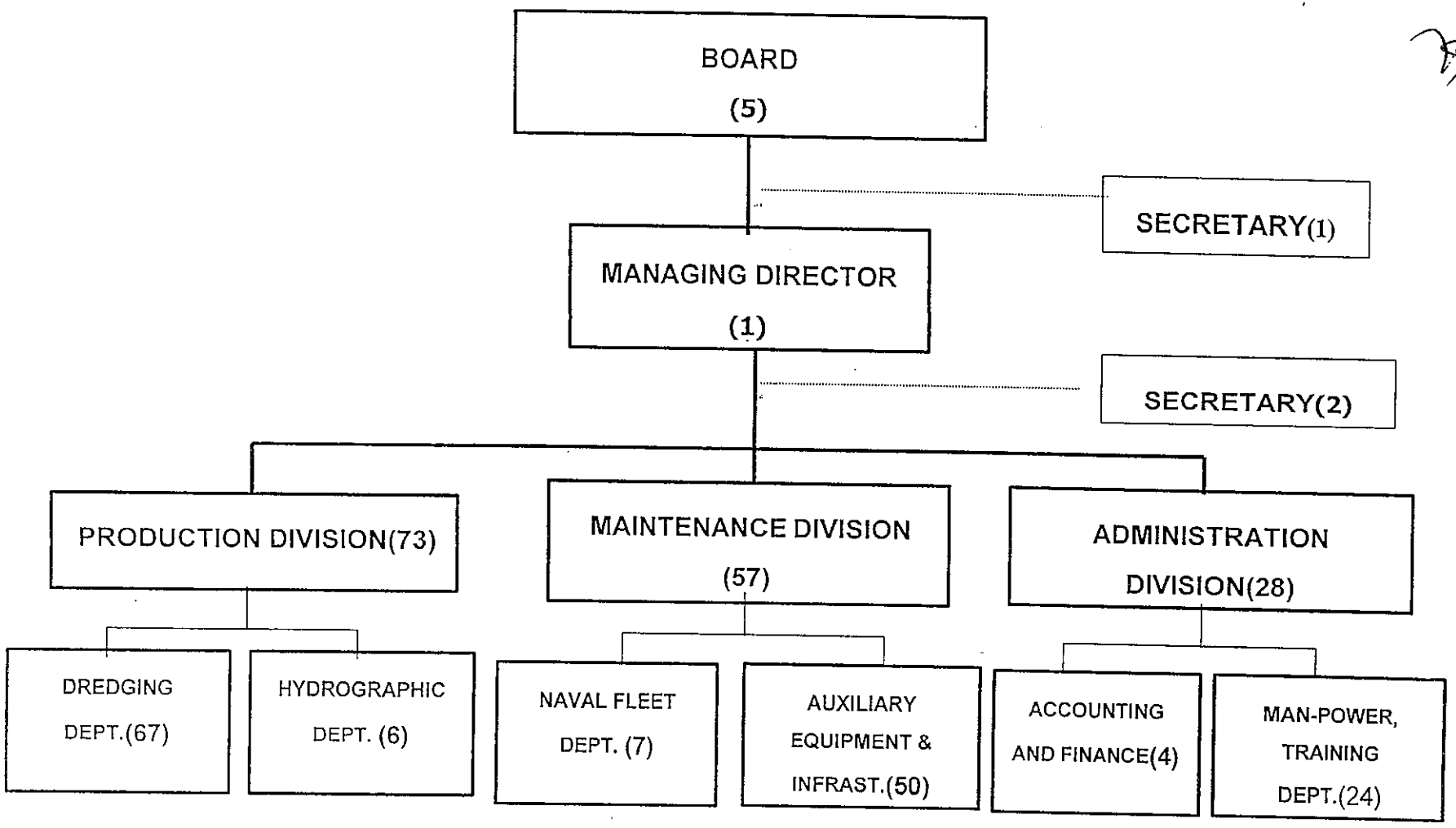
Location of Beira Port and the Access Channel

Source : Map of Approaches to Porto da Beira No.1003

Location of Beira Port and the Access Channel

EMODRAGA EP

EMPRESA MOÇAMBICANA DE DRAGAGENS



Annex-2

Outline of the dredger

Type: Trailing suction hopper dredger

Principal Particulars

Length, o.a.	abt. 70 m
Length, b.p.	65.0 m
Breadth, mld	14.0 m
Depth, mld	4.7 m
Working draught, mld.	4.0 m

Deadweight at designed draught abt. 1,800 t

Main Engine

Marine diesel engine	Rating	abt. 1,200 ps
	Number	2 sets

Propeller

Nickel aluminum bronze fixed pitch, 5 bladed 2 sets

Mud hold capacity abt. 1,000 m³

Speed

Free running speed	abt. 10.2 knots
Dredging speed	abt. 6.0 knots

Endurance abt. 2,200 sea miles

Accommodation

Captain, Chief Engineer	4 persons
Officer class	8 persons
Crew class	24 persons
Total	36 persons

JAPAN'S GRANT AID

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japan's Grant Aid Scheme is executed through the following procedures.

Application	(Request made by the recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal &Approval	(Appraisal by the Government of Japan and Approval by the Cabinet)
Determination of Implementation	(The Note exchanged between the Governments of Japan and recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study) using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the study

The aim of the Basic Design Study (hereafter referred to as "the Study") conducted by JICA on a requested project (hereafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA. The consultant firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3.Japan's Grant Aid Scheme

(1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(2) "The period of the Grant Aid" means the one fiscal year, which the Cabinet approves, the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However, in case of delays in delivery, installation or construction due to unforeseen factors such as national disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, consulting, constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

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

(5) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as the following:

a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction,

b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,

c) To secure buildings prior to the procurement in case the installation of the equipment,

d) To ensure all the expenses and prompt excursion for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

f) To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(6) "Proper Use"

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

(7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

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

(End)

Annex-5

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
2	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the final handover point to the project site		●
3	To accord Japanese nationals whose service may be required in connection with the supply of the products and the services under the verified contact, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		●
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
6	To bear all the expenses, other than those to be borne by the Grant Aid.		●

(B/A: Banking Arrangement, A/P: Authorization to pay)

Minutes of Discussions
on the Project for Reinforcement of the Dredging Capabilities for Beira Port
in the Republic of Mozambique
(Explanation on the Draft Report)

In June 2004, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Reinforcement of the Dredging Capabilities for Beira Port (hereinafter referred to as "the Project") to the Republic of Mozambique (hereinafter referred to as "Mozambique"), and through discussions, field survey and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult with the concerned officials of the Government of Mozambique on the contents of the draft report, JICA sent to Mozambique the Basic Design Explanation Team (hereinafter referred to as "the Team"), which is managed by Mr. Kyojin Mima, Group Director, Project Management Group II, Grant Aid Management Department, JICA, and headed by Mr. Yoshimoto Koyanagi, from October 21 to 29, 2004.

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

Maputo, October 27, 2004

小柳 桂泉

Yoshimoto Koyanagi
Basic Design Study Team
Japan International Cooperation Agency

Olivio Manuel Mendes Pinto
National Director of Surface Transports
Ministry of Transport and Communications
Republic of Mozambique

Rassul Khan G.Mahomed
Chairman & Managing Director
Mozambique Dredging Company, EMODRAGA
Republic of Mozambique

ATTACHMENT

1. Contents of the Draft Report

The Mozambican side agreed and accepted in principle the contents of the Draft Report explained by the Team.

2. Japan's Grant Aid Scheme

The Mozambican side reconfirmed the Japan's Grant Aid scheme and the necessary measures to be taken by the Government of Mozambique explained by the Team as described in Annex-4 and Annex-5 of the Minutes of Discussions (M/D) signed by both sides on June 23, 2004.

3. Schedule of the Study

JICA will complete the Final Report in accordance with the confirmed items and send it to the Mozambican side by January 2005.

4. Other Relevant Issues

(1) The Mozambican side shall secure the personnel and allocate the necessary budget for executing the dredging work based on the new dredging plan by two dredgers (existing "ARUANGWA" and the new dredger) with 24-hour operation.

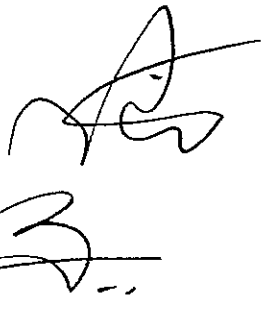
(2) The Mozambican side shall obtain the provisional nationality certificate and necessary document for the transportation of the dredger from Japan to Mozambique by March 2007.

(3) The Mozambican side shall secure the quay for safe mooring of the dredger by May 2007.

(4) When the dredger arrives at Beira Port from Japan, the Mozambican side shall prepare and execute all the necessary procedures for quick acceptance of the dredger into Beira Port, custom clearance of the dredger and its equipment, and registration of the dredger.

(5) The Mozambican side requested the Team to carry out the counterpart training in Japan on the operation and maintenance of the new dredger as a technical cooperation by JICA, and the Mozambican side understood that another official request will be necessary to submit from the Mozambican side to the Japanese side through the JICA Mozambique Office.

(6) The Mozambican side shall execute the "On the Job Training" for the new crew to obtain the operation and maintenance skill of the dredger.



Appendix 5. Memorandum of Technical Discussions

5. MEMORANDUM OF TECHNICAL DISCUSSIONS

MEMORANDUM OF TECHNICAL DISCUSSIONS
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR REINFORCEMENT OF DREDGING CAPABILITIES FOR BEIRA PORT
IN
THE REPUBLIC OF MOZAMBIQUE

From 18th June to 3rd July 2004 , at Maputo and Beira, the Study Team held a series of technical discussions with EMODRAGA's officials and conducted a field survey at study area.

As a result of the discussions and field survey, both side confirmed the items described in the attached sheets and annexes.

Beira, 3rd July 2004

Rassul Khan Gulamo Mahomed
Chairman & Managing Director
Mozambican Dredging Public Enterprise
-EMODRAGA-

Tadashi Ikeba
Chief Consultant
Basic Design Study Team

1. New dredger specifications

1.1 Review on the existing dredger "Aruangwa"

The team embarked on "Aruangwa" and investigated the dredging operation work on 29th June 2004.

Based on EMODRAGA's request as shown in Annex-1, the team confirmed on the following items on-board including the hearing from crew.

1) Electronic solenoid valve for operating bottom door (item 5)
   - Often damaged and renewed. Damage happens in case of sand working.

2) Cooling pipe and expansion joint of main engine (item 1&3)
   - Experience of damage of pipe hole and expansion crack

3) Impeller of sea water pump (item 2)
   - Damaged due to shellfish invasion. Filter set-up and open type impeller instead of closed type preferred.

4) Heeling when one side tank empty for reserve tanks (item 4)
   - Equalizing pipe line preferred to avoid heeling

As for other items, the crew requested as follows.

5) Shore discharge line –Provision requested.
6) Dredging pump - High suction head and countermeasure for vibration.
7) Height of mud hold overflow level- 2 level position, high and low, preferable.
8) Hoisting speed of drag arm winch- Quick response preferable.
9) Height of wheel house level- Lower height preferable
10) Counter measure for upper deck wetness
   - Deck winch, electric junction box, exhaust pipe of dredge pump engine
11) Reflection mirror in wheel house- To lower position for easy watching

Reflecting the requests mentioned above, the team will study them further in Japan under consideration of budget limitation.

1.2 Outline specification of the new dredger

The EMODRAGA explained the future plan for dredging of Beira port and access channel, the most critical area of which is Macuti Bend, by the existing 1000m^3 TSHD "Aruangwa" and a new dredger replacing the existing old aged 1500m^3 TSHD "Rovuma" and requested the desired performance of a new dredger including land discharge system.

The Team reviewed their request for a new dredger and the actual dredging operation of " Aruangwa" on the dredged soil's volume and working hours.

Concerning the volume of the present sediment at Beira port and access channel, the Team asked Marine Geoscience Unit (MGU) to measure the conditions in order to evaluate the necessary volume to be dredged.

Even though the result by MGU has not been obtained yet, the Team understood that the most important issue to be solved is to dredge the Macuti Bend judging from the information by CFM, EMODRAGA and other data.

After the review, EMODRAGA and the Team discussed the outline specifications of a new dredger and reached the same understanding that, considering the compatibility of operation and maintenance which contribute the improvement of dredging efficiency, the new dredger shall be as similar to the existing dredger "Aruangwa" as possible, the outline specifications of which are as shown in Annex.-2.

The Team will proceed to study the design of a new dredger in Japan based on the outline specification proposed by Basic Design Study as well as the EMODRAGA's request such as land discharge system.

2. Technical cooperation

EMODRAGA officials explained recruit plan for new dredger crew as shown in Annex-3.
The team agreed the plan and will study application of (2) shift operations in Japan.

EMODRAGA stressed the need for technical training for the new dredger.
The team explained existing training scheme of JICA and within the Shipbuilding Contract as shown in Annex- 4.

After held discussions on training purpose, scheme, discussion, etc, EMODRAGA requested additional training cooperation as shown in Annex-3.

The team explained that number , occupation and duration of trainees will be determined in the further study in Japan.
The team will stress to the Contractor on acceptance of trainee as much as possible.

EMODRAGA need to submit official request on the technical assistance of JICA scheme through diplomatic channel.

3. Maintenance and cost

Almost all small spare parts, such as lighting fixtures, packings or rope, are generally purchased through the South African company.

Major parts such as spare parts of engines, main valves, electric equipments, etc, are ordered directly from Japan by EMODRAGA.

In general, delivery of parts seems to be no major stagnation and needs about (3) months at maximum.

The contents of " Operation and Maintenance Cost" are shown in Annex-5 for the past (4) years , and they show "Aruangwa" had been dry-docked every year and was maintained carefully.

4. Others

4.1 Construction schedule

Anticipated construction schedule of new dredger is as shown in Annex-6.

It takes about (19) months just after contract including navigation of new ship to Beira, Mozambique.

4.2 Request of EMODRAGA

EMODRAGA officials stressed that they would like to get high quality and high productivity dredger as under-mentioned.

1) EMODRAGA need "Tough" dredger. "Tough" means high productivity of dredge system.
2) "Aruangwa" seems to be a silt carrier, and strong and robust dredger would be eagerly desired.
3) Several malfunctions on "Aruangwa" should be reflected to the design of new dredger.
4) EMODRAGA would like to operate the new dredger as soon as possible, preferably in 2005.

4.3 Natural condition

Beneficial information was gathered from EMODRAGA, INAHINA, INAM, etc. in Maputo and Beira. In addition to previous JICA report, the report is completed.

4.4 Hydrographic survey

Survey team from South Africa will arrive at Beira at the beginning of July. They will start the bathymetric survey and sediment sampling in a week. After finishing the work, alignment of the channel and the volume of dredging necessity will be defined and calculated.

4.5 Environmental and social consideration

Important information was gathered from MICOA and IIP in Maputo and Beira. Environmental Impact Assessment regulation is not put into practice now. But the guideline is already prepared by MICOA. By this guideline, dredging and dumping in

port area is not aimed for the subject of EIA.

By the interview for MICOA and IIP, any protect area for wildlife or habitat of endangered species in near port area could not be found..

Some water quality item at June 30th and July 1st at near Beira port and access channel was observed. By the results of these observations, high turbidity regularly was observed, but it's not effective to dissolved oxygen. It means dumping sand is not bring the organic pollutant for the dumping area and bottom habitat.

Therefore, EIA for dumping area will not be required.

Dear Sir:

Along the time the we plows exploring the dredger goes they haul of those that were rectified and noted adds anomalous that we would like that you took in consideration to they build the. Second dredger, being them the following:

1. COOLING SYSTEM (sea water)

- From the first year we have been coming across small or big holes in the pipes.

2. PROPOSAL

We propose that you mast study our conditions of the sea to determiner the material composition for the pipe from the sea water.

Some manufacturers in his/her composition have beer applying an internal covered of zinc.

For these subject we have two proposed for your reconciliation:

- To set up filters before the S. W. pumps (the same outline of gland sealing water-pump)

- To apply other turbine type A or B at moment we are using the turbine type D (see annexed Drawing). We are facing problems because of shellfishes enter in his interior doing with that pump loses the income normal and the filter should be fixed after de pump.

3. MAIN ENGINES

- We would like if you can verify why the expansion joints and indicator cock are suffering premature danification.

4. RESERVE TANKS (Fuel and drinking water).

- We propose that the tanks of reserve of the same nature, must communicated amongst themselves, because he would help a lot when doing ballast of the ship.

5. ELECTRICAL SYSTEM

- Always we are facing problems on this matter: 24 V or 220 Volts – "low insulation".
  We propose you to re-check this system.
  The electrical installation to be done according with our whether condition.

  Due the rain and humidity all the electrical apparatus on the deck must be very good covered/protected.

  Respect fully yours.

LEADING PARTICULARS

OF

A 1,000 m^3 TRAILING SUCTION HOPPER DREDGER

1. GENERAL

This Vessel shall be a trailing suction hopper dredger, which is employed to dredge a range of bed materials consisting of silt, fine and coarse sand, designed for operation in rivers, coastal water and coastwise sailing.

The Vessel shall be of steel, provided with fixed pitch type twin propellers and twin rudders and driven by two (2) sets of main diesel engine. One set of dredging pump shall be arranged in forward pump room and driven by exclusive diesel engine. One drag arm shall be arranged on deck, starboard side.

One (1) complete deck, forecastle deck, poop deck and deck house shall be constructed. One (1) mud hold of 1,000m^3 shall be provided at the mid part of the Vessel as shown on the General Arrangement.

One (1) bow thruster and one (1) derrick shall be provided forward.

2. CLASSIFICATION

BV, I 3/3 E+, Hopper Dredger Coastal Water, Dredging within 8 miles from shore

3. PRINCIPAL DIMENSIONS

Length, o. a.	----------	abt. 68.7m
Length, b. p.	----------	65.00 m
Breadth, mld	----------	14.00 m
Depth, mld	----------	4.70 m
Designed draught, mld	----------	4.00 m

4. DEADWEIGHT AND SOIL WEIGHT

Deadweight at designed draught	----------	abt. 1,900 metric tons

5. CARGO CARRYING CAPABILITIES

Mud hold capacity	----------	abt. 1,000 m^3

6. TANK CAPACITY

Fuel oil	----------	abt.	180 m^3
Fresh water	----------	abt.	70 m^3
Water ballast	----------	abt.	250 m^3

7. SPEED

Free running speed ---------- abt. 10.7 knots

on designed draught condition at maximum output of main engine without sea margin

8. ACCOMMODATION

Captain class	: 4- Single berth cabin with private lavatory (4 persons)
Senior officer class	: 4- Double berth cabin (8 persons)
Junior officer class	: 2- Double berth cabin (4 persons)
Crew class	: 5- Four berth cabin (20 persons)

Total 36 persons

9. DREDGING SYSTEM

System	: Side drag system (Starboard side only)	
Maximum dredging depth	: 20 m on light load condition with drag arm inclination of 45 deg.	
Dredge pump	: 4,000 m^3/h x 17.5 mTH	1 set
Dredge pump engine 600 PS	: 4 stroke diesel engine	1 set
Drag arm	: Inside diameter 600mm	1 set

10. MACHINERY PARTICULARS

Main engine	: 4 stroke, single acting, marine diesel engine	
1,200 PS	2 sets	
Propeller	: 4 blades, fixed pitch propeller	2 sets
Main generator engine	: 4 stroke, single acting, marine diesel engine	
435 PS	2 sets	
Harbour generator engine	: 4 stroke, single acting, marine diesel engine	
156 PS	1 set	

11. ELECTRIC SOURCE

Main generator	: AC 400V 290 kw	2 sets
Harbour generator	: AC 400V 100 kw	1 set
Transformer		1 set
Storage battery		1 set
Main switchboard		1 set

12. LIGHTING

Accommodation space	: Fluorescent lamp in general
Machinery space	: Fluorescent lamp in general
Deck	: 400W mercury floodlight
Search light	: 1,000W, 1 set

13. COMMUNICATION AND NAVIGATION EQUIPMENT

Sound powered telephone	1 set
Public addresser	1 set
Steering control	1 set
Radar & gyro compass	1 set
Echo sounder	1 set
General alarm and fire alarm system	1 set
Position fixing equipment	1 set

GPS—Navigation

DGPS—Dredging

14. RADIO EQUIPMENT, ETC.

MF/HF Radio telephone	1 set
VHF Radio	1 set
TV with video tape deck	1 set
Broad casting radio receiver	1 set

15. DREDGING INSTRUMENT

Dredge pump vacuum and delivery pressure indicator	1 set
Drag arm remote control desk	1 set
Drag arm indicator	1 set
Draft and load indicator	1 set
Dredge remote control deck	1 set

(end)

EMODRAGA EP

EMPRESA MOÇAMBICANA DE DRAGAGENS

GABINETE DO PRESIDENTE DO CONSELHO DE ADMINISTRAÇÃO

CREW FOR THE NEW DREDGER

N°	CATEGORY	TASK	AVAILABLE	TO BE RECRUITED
1	1st Chief Officer	Captain	-	x
2	3rd Pilot Officer	1st Mate	x	-
3	3rd Pilot Officer	1st Mate	-	x
4	Dredge Master	Master	x	-
5	Dredge Master	Master	-	x
6	1st Sailor	Helmsman	x	-
7	1st Sailor	Helmsman	x	-
8	1st Sailor	Pipe Operator	x	-
9	1st Sailor	Pipe Operator	x	-
10	1st Sailor	Sailor-General	x	-
11	2nd Sailor	General Assistant	x	-
12	Seaman – Cook	Cook	x	-
13	Seaman – Cook Assistant	Cook Assistant	x	-
14	1st Machinery Officer	Chief Engineer	x	-
15	3rd Machinery Officer	Engineer	-	x
16	3rd Machinery Officer	Engineer	-	x
17	Mechanical Engineer	Engineer	x	-
18	Mechanical Engineer	Engine Driver	-	x
19	1st Engineer	Engine Driver	x	-
20	1st Engineer	Engine Driver	-	x
21	2nd Engineer	Engine Driver	x	-
22	2nd Engineer	Engine Driver	x	-
23	Electrician	Electrician	-	x
24	Welder	Welder	x	-

Note: With above mentioned crew, two (2) shifts can be implemented if required.

Beira, June, 2004

Technical Cooperation

1. JICA scheme

	No.	Max. duration(month)
Group Training	1	12
Counterpart training	1	1
Soft-component training	1	-
Dispatch of specialist	1	3

Note: The Mozambican side stressed need of at least 3 specialist for 3 months.

2. Acceptance by the Contractor

	No.	Max. duration(month)
Familiarization training to new ship	3	1

Note: The Mozambican side stressed need of minimum 5 trainees for 1 month.

EMODRAGA EP MOZAMBICAN DREDGING COMPANY

DREDGER ARUANGWA

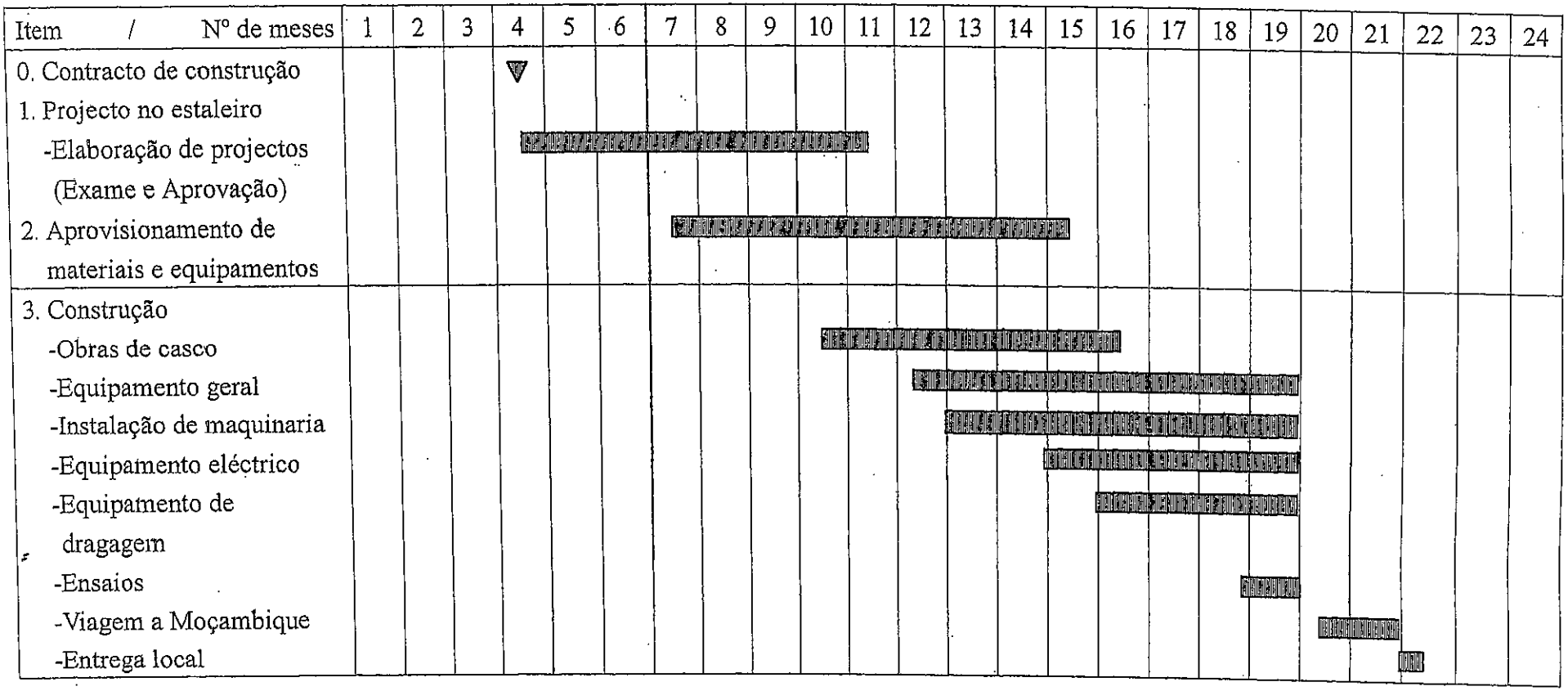
OPERATION & MAINTENANCE COSTS

UN: USD

EXPENDITURE	2000	2001	2002	2003	TOTAL
Salaries and Wages	23.065,47	24.360,19	23.306,73	23.278,65	**94.011,04**
Insurance	82.384,37	82.384,37	115.883,47	122.225,00	**402.877,20**
Fuel	90.127,22	223.749,68	208.125,70	185.584,31	**707.586,91**
Food for Crew	20.480,96	16.312,28	19.815,02	27.973,09	**84.581,35**
Materials Purchased	19.822,89	28.076,91	39.555,68	74.759,56	**162.215,04**
Services Purchased	916,02	2.693,38	4.069,68	19.247,39	**26.926,46**
Annual Docking	0,00	69.458,69	98.961,00	86.045,00	**254.464,69**
Tax and Other Duties	138,86	8,72	3.600,41	4.879,95	**8.627,94**
Depreciation	1.288.331,44	942.423,99	913.345,50	911.030,14	**4.055.131,07**
Other Costs	435,01	1.206,10	6.728,04	7.634,55	**16.003,70**
TOTAL	**1.525.702,24**	**1.390.674,29**	**1.433.391,22**	**1.462.657,65**	**5.812.425,40**

Beira, 19th April 2004

Cronograma de Trabalhos de Construção



Annex-6

Appendix 6. Access Channel to the Beira Port

APPENDIX I

ACCESS CHANNELS TO THE BEIRA PORT

DESIGN, ACTUAL TECHNICAL CONDITION AND STRATEGY TO BE ADOPTED

1. Channel Design

Dredging areas:	E3, E4, E5, E6, E15 (inner area) E7, E8, E9, to E14 (outer area)
Channel Length:	27 Kms
Channel With :	135 – 250 m
Channel Depth :	8.0 – 9.4 m (CD)
Side slope :	1/10

(Please see attached drawing – annex 3)

2. Volume to be dredged annually

(annual siltation - in situ) from 2.000.000 to 2.200.000 m³

3. Dumping Area

The only one available dumping area is D4, located 12 Km from E9 and approx. 23 Km from the Inner areas (E3, E5, E15) – port area.
D4 is 3.5 meter deep bellow CD.

P.S.: * The shallow waters in the dumping area and the dredging areas requires a very shallow draft vessel preferable with a loaded draft of 3.5 to 4.0 m.

4. Characteristics of Soils

- Silty sand	32 %	(Inner area)
- Medium to coarse sand	54 %	(E9, E10, E11)
- Medium to hard clay	14 %	(E9, E10, E11)

Bulk Density (ton/m³)

Soil	In Situ	In Hopper (after overflow)
Silt	1.5	1.29
Silty sand	1.6	1.32
Sand	1.9	1.70
Clay with some gravel		Testes not available

5. Actual Technical Condition

The design depth has been reduced from 8.00 m to 4.00 m (CD) and the width from 135 to 75 m in the most parts of the access channels.

The main crucial areas are:

E12, E11, E10 (Macuti Bend) and E9 and E8 between buoys 1, 3, 6, 5, 5A, 8, 9 and 11.

Due to the huge amount of siltation which has been occurred in the past years and also due to the unavailability of the dredging capacity, the channel at the Macuti Bend has been shifted about 350 m to the south of the original channel (please see annex 1).

The soils on this by pass channel consists of very coarse sand, gravel and very hard clay (> 30 Mpa) and only can be dredged with a powerful cutter suction dredger which besides the very high costs has many other inconveniences likewise working in the narrow navigable channel with high waves and very far from the dumping areas.

The two turning are complete silted up and + 1 m (CD) dry during low water tide.

Along the berths basins (length of approximately 1900 m) the depth has been reduced from 10.0 m to 7.00 m (CD).

The total accumulated volume to be dredged in order to establish the channel to the design depth is estimated about 8.000.000 cu. m.

6. Action Plan - Scope of the Works

6.1 - Strategy to be adopted

Carry out a full survey covering both channels and the existing dumping areas. Some other information like soils, currents, tide and waves already exists and will be used for definition of the channel alignment and design.

Based on our experience we advise to re-dredged the original channel which had been to a minimum depth of – 8.00 m (CD). Soils are well know and can be dredged by a trailing suction hopper dredger(s).

6.2 - 1st Phase – Dredging the Macuti Bend

Dredging a 150 meter wide channel with slopes 10 to 1, length 4 kilometer to a depth of -5 meter CD in the original channel location.
The total quantity to be dredged inclusive 300.000 m^3 siltation and an average vertical tolerance of 0.50 meter bellow theoretical bottom, is 2.500.000 m^3. Actual depth is -2.0 meter CD.

The works will be executed by using a small trailing suction hopper dredger "Aruangwa" and a new 1.500 m^3 trailing suction hopper.

The material to be dredged consists of medium to coarse sand and will dumped at a disposal area (D4) at 12 Kilometer sailing distance.

6.3 - 2nd Phase – Re-Dredging the Entire Original Channel

The original channel will be dredged to a depth of -6.0 m CD. The channel has been divided in 5 zones. The layout of the channel is indicated on drawing as annex 2.

The total volume to be dredged is estimated at 4.657.500 m^3. This can only be done by acquisition of additional capacity and by increasing the working regime of the already existing dredgers (24 hrs/day and 6 days/week) which will be possible after 2 years of operation and training . Sundays will be used for maintenance , changing crews and bunkering.

7. Proposed Equipment

7.1. Considering the lower capital investment and exploitation costs (per tonne load capacity) and based on the same annual maintenance work load (2.500.000 m^3), we consider as the best solution the acquisition of a trailing suction hopper dredger (sand carrier) with a hopper capacity of 1.500 m^3.

9

7.2. Estimates of the production capacity for a T.S.H.D. with 1.500 cu.m. are indicated on the following table:

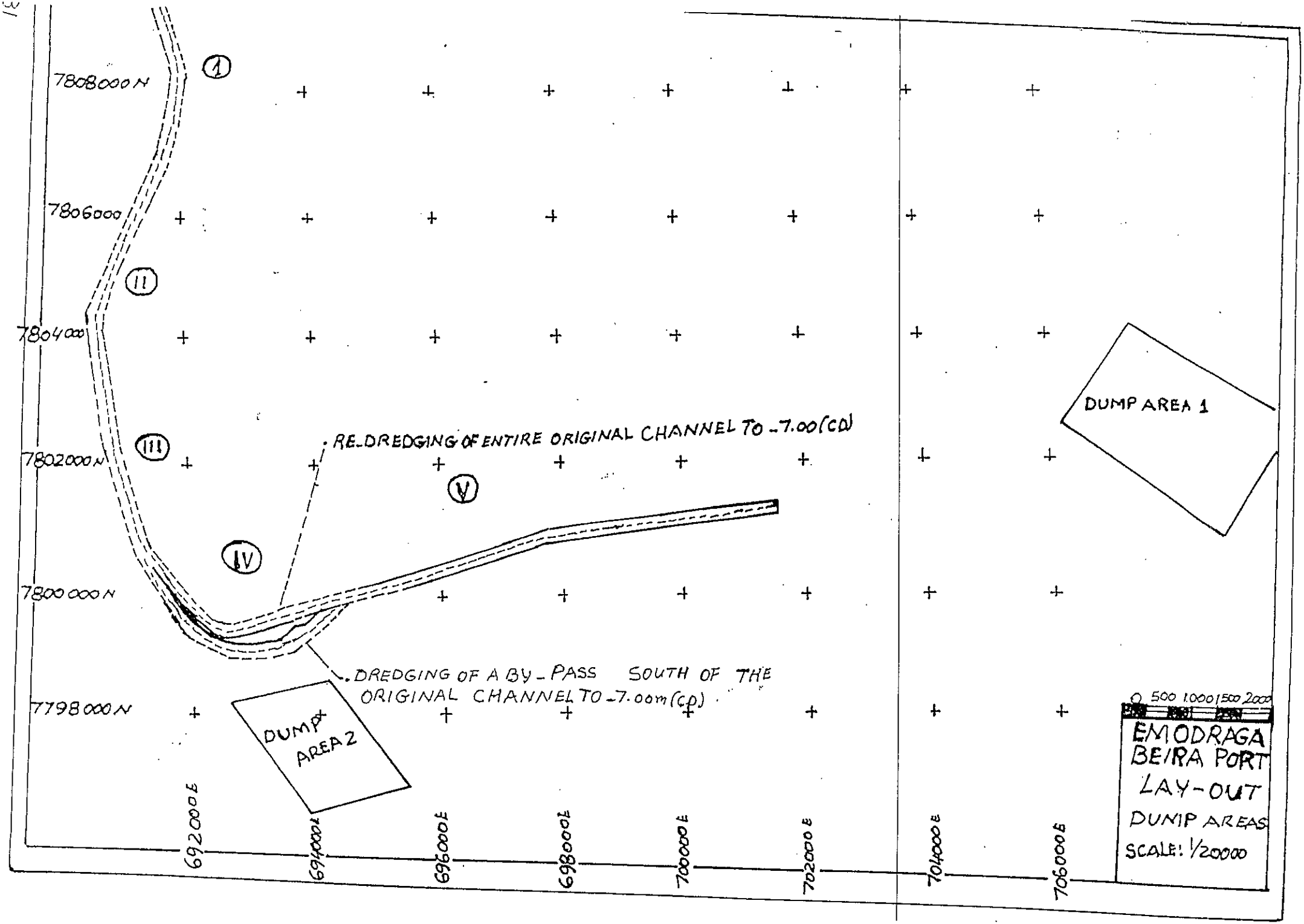
Hopper volume	**1500**
In situ/hopper factor	0,75
In situ volume (m^3)	1125
Dredging time per cycle (m^3)	25
To disposal (minutes)	25
Disposal time (minutes)	10
From disposal (minutes)	25
Cycle time (minutes)	85
Production (hours/day)	12
Number of cycles/day	7
Production days/year	225
Production: per day (m^3)	7.875
Production: p.a. (m^3)	1.800.000

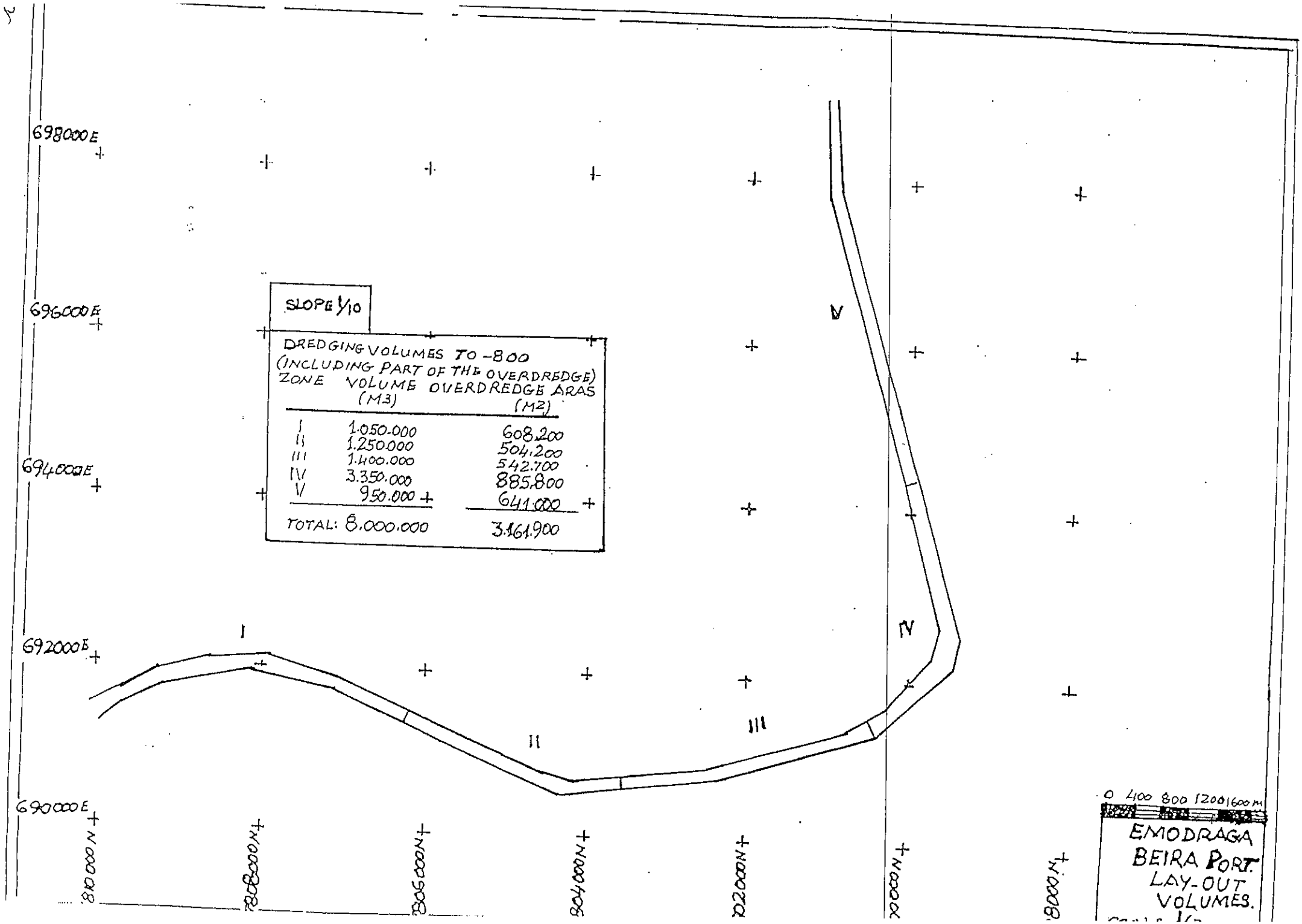
7.3. For proper monitoring, controlling and eficiency of the dredging works we have also included the acquisition of a two (2) full sets of the survey equipment. Further technical details can be seen on the attached brochures.

8. Graving Dock in Beira (for emergencies and annual docking)

Main Dimensions

Length : 110 m
With : 17 m
Depth : 6.5
Rail Crane : 10 Tons.
Mobile Crane : 10 Tons.


7808000 N
7806000
7804000
7802000 N
7800000 N
7798000 N
692000 E
694000 E
696000 E
698000 E
700000 E
702000 E
704000 E
706000 E
I
II
III
IV
V
RE-DREDGING OF ENTIRE ORIGINAL CHANNEL TO -7.00 (CD)
DREDGING OF A BY-PASS SOUTH OF THE ORIGINAL CHANNEL TO -7.00m (CD)
DUMP AREA 1
DUMP AREA 2
0 500 1000 1500 2000
EMODRAGA
BEIRA PORT
LAY-OUT
DUMP AREAS
SCALE: 1/20000


698000E
696000E
694000E
692000E
690000E
SLOPE 1/10
DREDGING VOLUMES TO -800
(INCLUDING PART OF THE OVERDREDGE)
ZONE VOLUME (M3) OVERDREDGE ARAS (M2)
I 1.050.000 608.200
II 1.250.000 504.200
III 1.400.000 542.700
IV 3.350.000 885.800
V 950.000 641.000
TOTAL: 8.000.000 3.161.900
I
II
III
IV
V
0 400 800 1200 1600 M
EMODRAGA
BEIRA PORT.
LAY-OUT
VOLUMES.

Appendix 7. References

7. REFERENCES

NO.	TITLE	FORM (Book, Video, Map, Photo, etc.)	ORIGINAL or COPY
1	PORTO DA BEIRA ESTATICA DE NAVIOS 2003,2004	Book	Copy
2	Beira Oil Terminal	〃	〃
3	Cargo handled by Beira Port,2001-2003	〃	〃
4	Cargo Volume handled at Beira Port	〃	〃
5	Volume Dredged 2001-2003	〃	〃
6	Necessity and importance of improvement in the Sector, Which lead to formation of the Project	〃	〃
7	Appendix I ICCESS SHANNELS TO THE BEIRA PORT	〃	〃
8	FUNDO DISPONIVEL HORAS PARA OPERACÃO DE DRAGAGENS	〃	〃
9	METAS DE PRODUCÃO(PLANIFICADA/REALIZADA)1996/1998	〃	〃
10	INFORMACÃO SOBRE O CANAL DE ACESSO AO PORTO DA BEIRA	〃	〃
11	Note of Protest	〃	〃
12	BLANCO DE ACTIVIDADE DO C.A.e CONTAS(2001)	〃	〃
13	Ditto (2002)	〃	〃
14	Ditto (2002)EMODRAGA	〃	〃
15	METAS DE PRODUCÃO PORTUARIA(2002/2003/2004)	〃	〃
16	Sena Line Traffic Flow Prospect	〃	〃
17	Project de Areias	〃	〃
18	DRY DOCK REPAIR LIST OF M,V.ARUANGWA(2004) (12/03/04-22/03/04)	〃	〃
19	Ditto (2002)(19/03/02-02/03/02)	〃	〃
20	Ditto (2003)(21/02/03-02-03/03)	〃	〃
21	ELECTRICAL MAINTENANCE CHARTER(ARUANGWA)	〃	〃
22	MAINTENANCE CHARTER(ARUANGWA)	〃	〃
23	HARBOUR MASTER'S INFORMATION(MARCH,2000)	〃	〃
24	BANCO DE MOÇAMBIQUE,PREÇOS E CONJUNTURA FINANCEIRA (Jurho/2003)	〃	〃
25	Ditto (Marco/2003)	〃	〃
26	Ditto (Septembro/2003)	〃	〃
27	Ditto (Dezembro/2003)	〃	〃
28	English Translation of Environmental Law Approved 28/7/97	〃	〃
29	Beira Port Transport System(BPTS)Programme (Nordic Consulting Group A/S)	〃	〃
30	METAS DE PRODUÇÃO (PLANIFICADA/REALIZADA)(1996/1998)	〃	〃
31	FUNDO DISPONÍVEL HORAS PARA OPERAÇÃO De DRAGAGEM	〃	〃
32	Operation Report for The Hydrographic and Bottom Sediment Survey at Beira Port	〃	Original
33	TABELA DE MARÉS	〃	〃