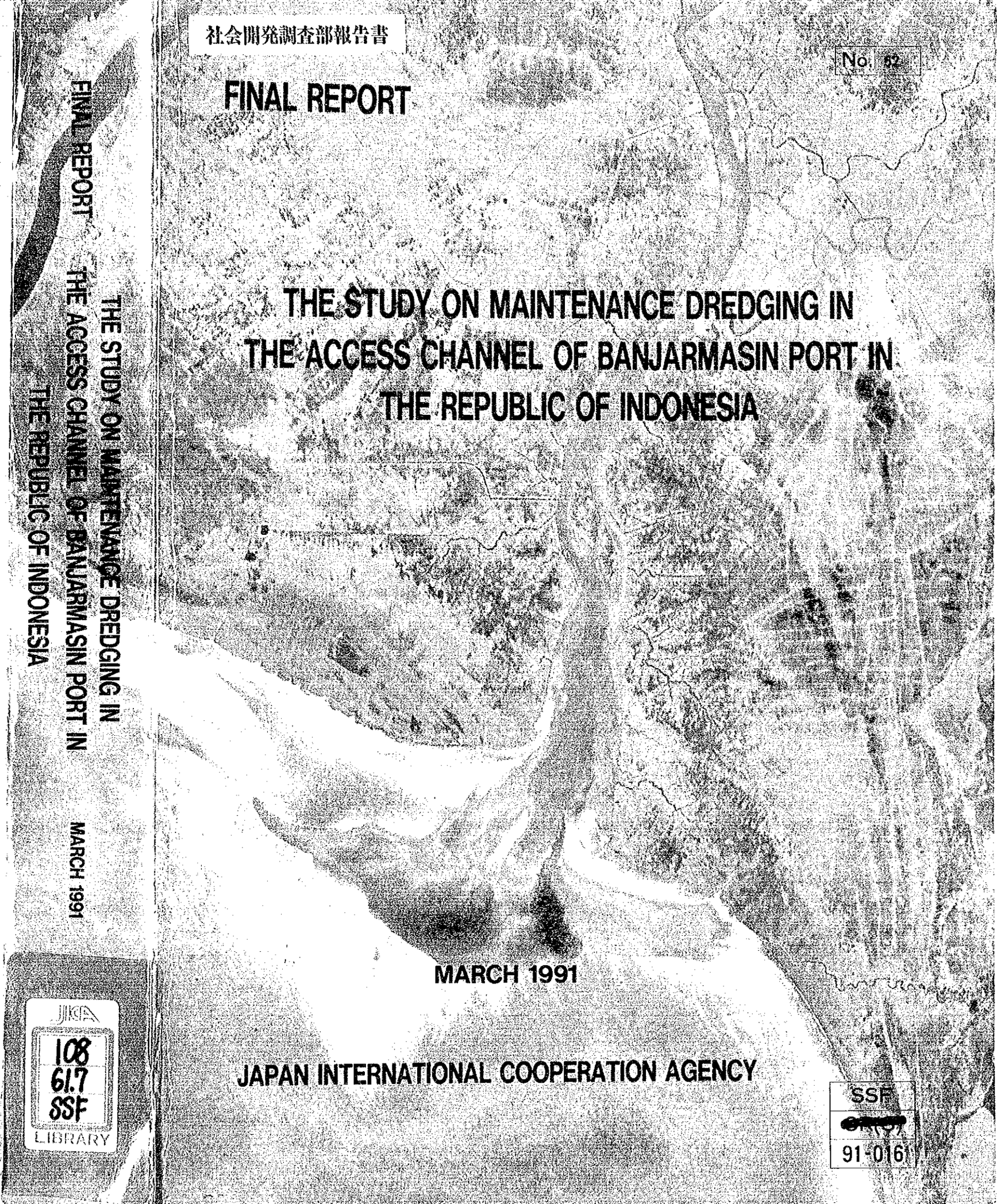
社会開発調査部報告書

No. 82

FINAL REPORT

THE STUDY ON MAINTENANCE DREDGING IN THE ACCESS CHANNEL OF BANJARMASIN PORT IN THE REPUBLIC OF INDONESIA



MARCH 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

FINAL REPORT
THE STUDY ON MAINTENANCE DREDGING IN THE ACCESS CHANNEL OF BANJARMASIN PORT IN THE REPUBLIC OF INDONESIA
MARCH 1991

FINAL REPORT

THE STUDY ON MAINTENANCE DREDGING IN THE ACCESS CHANNEL OF BANJARMASIN PORT IN THE REPUBLIC OF INDONESIA

MARCH 1991

PREFACE

In response to a request from the Government of the Republic of Indonesia, the Japanese Government decided to conduct a study on Maintenance Dredging in the Access Channel of Banjarmasin Port and entrusted the study to the Japan International Cooperation Agency (JICA).

The JICA sent to Indonesia a survey team, headed by Mr. Tamotsu Okabe, and composed of members from the Overseas Coastal Area Development Institute of Japan and Nippon Tetrapod Co., Ltd., eight times during the study period from March 1988 to March 1991.

The team held discussions with the officials concerned of the Government of the Republic of Indonesia, and conducted field surveys. After the team returned to Japan, further studies were made and the present report was prepared.

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 Indonesia for their close cooperation extended to the team.

March 1991

Kensuke Yanagiya

Kensuke Yanagiya

President

Japan International Cooperation Agency

LETTER OF TRANSMITTAL

March 1991

Mr. Kensuke Yanagiya
President,
Japan International Cooperation Agency

Dear Mr. Yanagiya,

It is my great pleasure to submit herewith the report for the Study on Maintenance Dredging in the Access Channel of Banjarmasin Port in the Republic of Indonesia.

At the request of the Japan International Cooperation Agency the Japanese study team, headed by myself and consisted of members from the Overseas Coastal Area Development Institute of Japan (OCDI) and Nippon Tetrapod Co., Ltd. (NTC), conducted surveys in Indonesia eight times from March 1988.

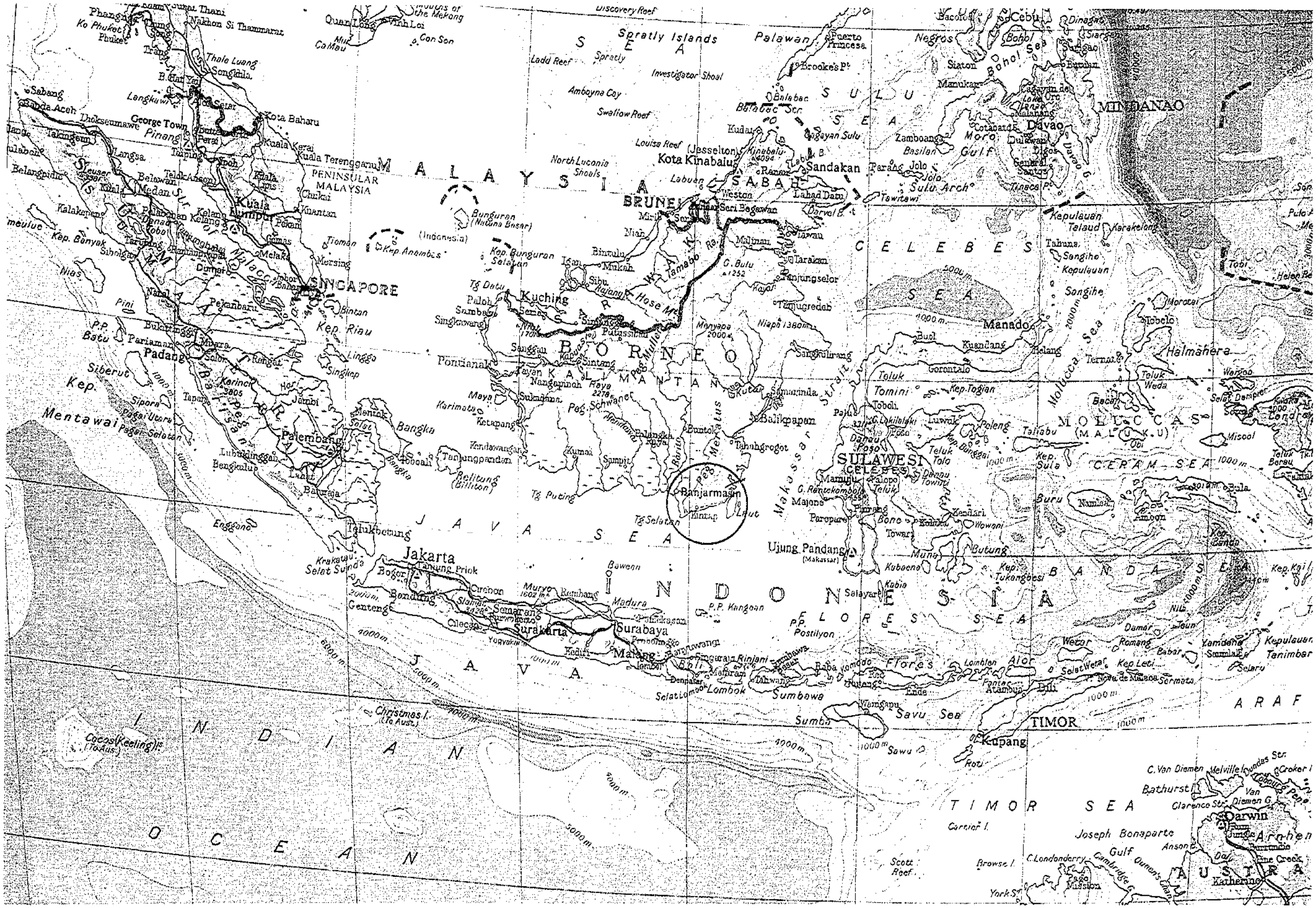
This report presents the result of the Study on the measures how to reduce silutation and how to improve dredging efficiency in the channel and proposes the Comprehensive Plan toward the year 2000 and the First-stage Plan until 1995. The result shows that the project is extremely important, and so I hope that it will be executed promptly.

On behalf of the Japanese study team, I would like to express my deepest appreciation to the Government of the Republic of Indonesia and the various organizations concerned with the study for their sustained cooperation and assistance, and for the warm hospitality which were extended to the team during our stay in Indonesia.

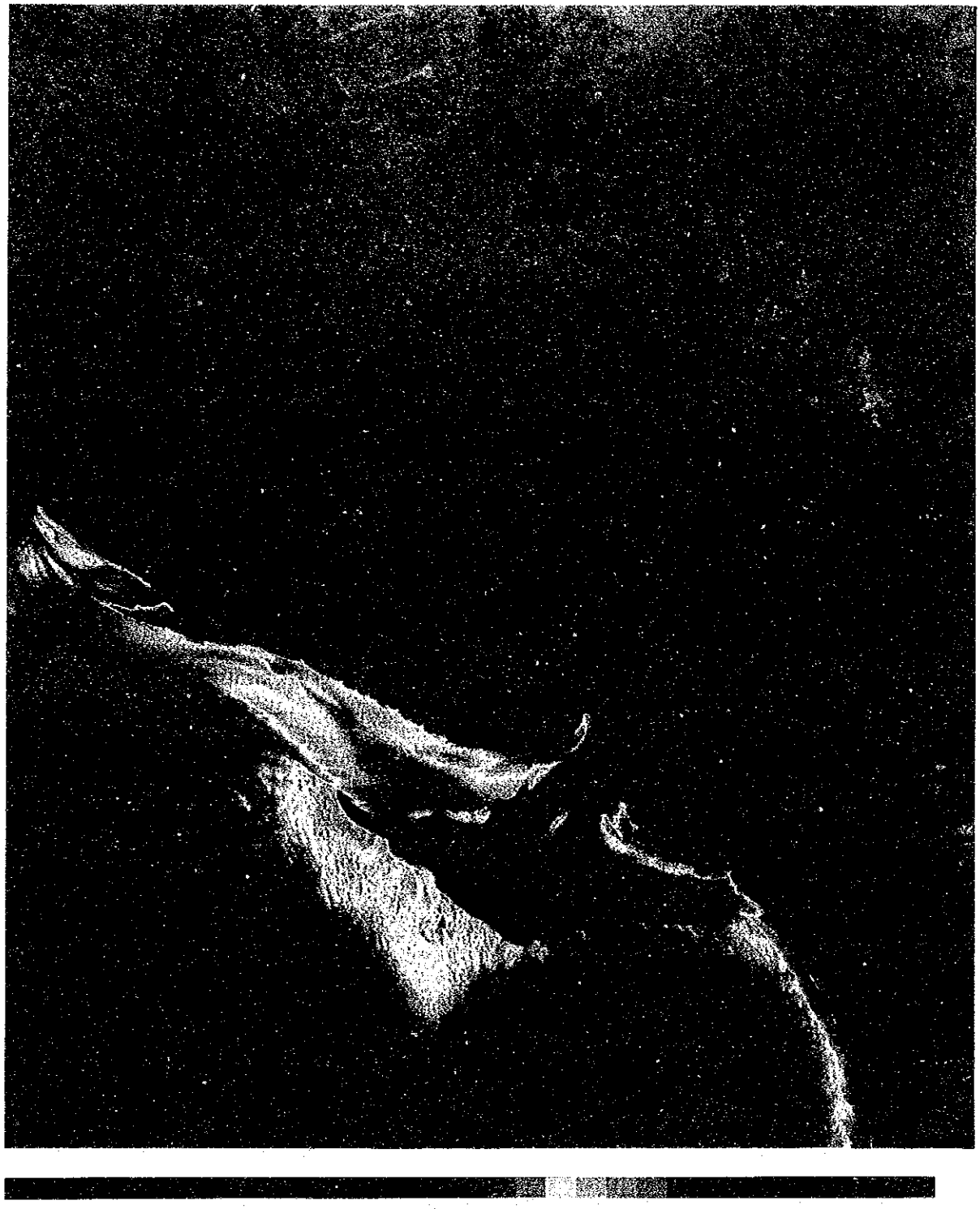
I am also grateful to the Japan International Cooperation Agency, the Ministry of Foreign Affairs, the Ministry of Transport, and the Embassy of Japan in Indonesia for their valuable suggestions and assistance during the field surveys and the preparation of this report.

Sincerely yours,

Tamotsu Okabe
Leader,
Japanese Study Team on the Maintenance Dredging in the Access Channel of Banjarmasin Port
(President, the Overseas Coastal Area Development Institute of Japan)

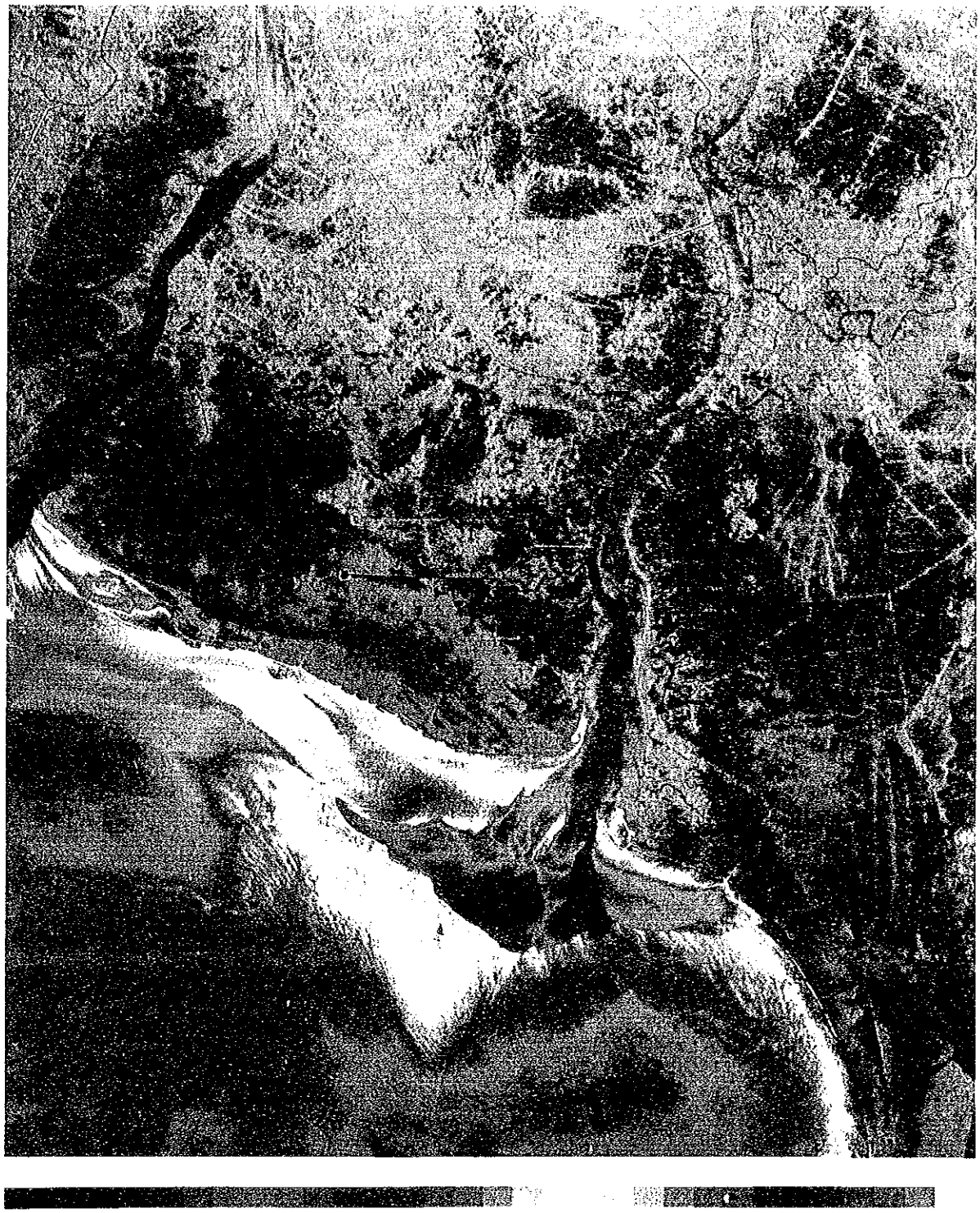


MALAYSIA
INDONESIA
BORNEO
KALIMANTAN
SARAWAK
SABAH
BRUNEI
SINGAPORE
PENINSULAR MALAYSIA
SUMATRA
JAVA
SULAWESI (CELEBES)
MOLUCCAS (MALUKU)
MINDANAO
TIMOR
AUSTRALIA
INDIAN OCEAN
JAVA SEA
CELEBES SEA
SULU SEA
BANDA SEA
FLORES SEA
CERAM SEA
TIMOR SEA
Molucca Sea
Makassar Strait
Savu Sea
Kuala Lumpur
Kuching
Kota Kinabalu
Sandakan
Banjarmasin
Balikpapan
Samarinda
Pontianak
Jakarta
Surabaya
Surakarta
Semarang
Bandung
Palembang
Padang
Medan
Jambi
Manado
Ujung Pandang
Kupang
Darwin
Davao
Cebu
Bangka
Belitung
Lombok
Sumbawa
Sumba
Flores
Madura
Halmahera
Buru
Christmas I.
Cocos (Keeling) Is.
Spratly Islands
Palawan
Kep. Mentawai
Siberut
Nias



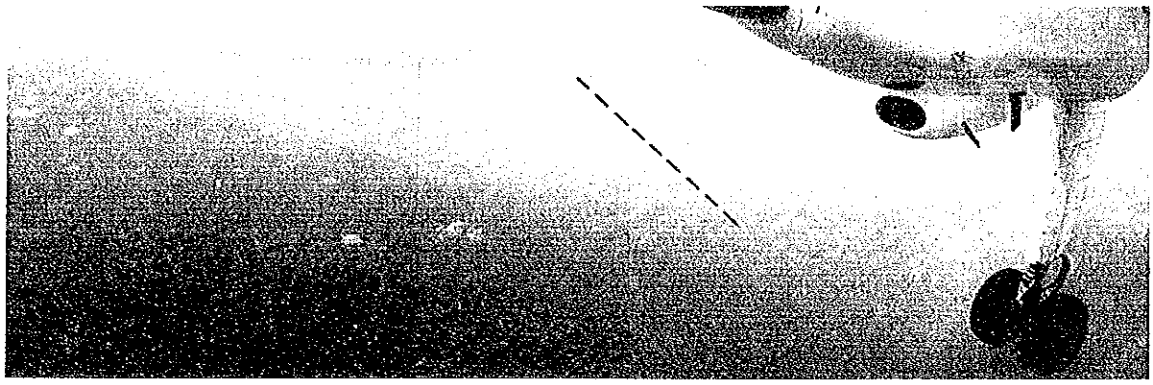
Relative Turbidity (slight) ——————————► (heavy)

Relative Turbidity Map of Landsat Image (June 21, 1988)

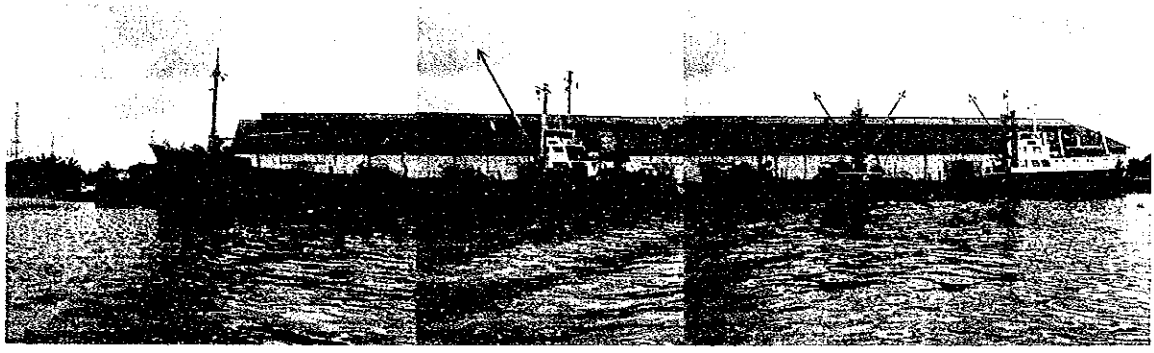


Relative Turbidity (slight) ——————————————————————————► (heavy)

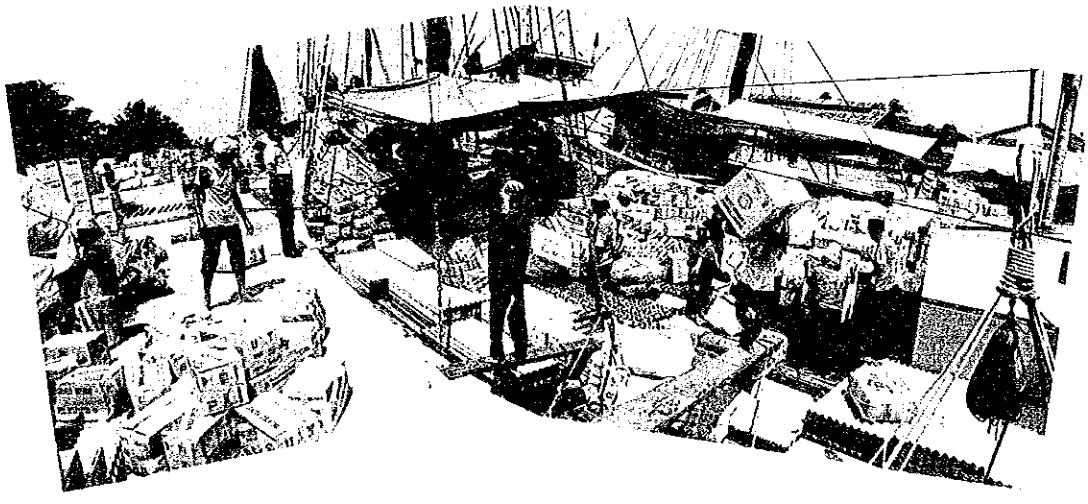
Relative Turbidity Map of Landsat Image (June 21, 1988)



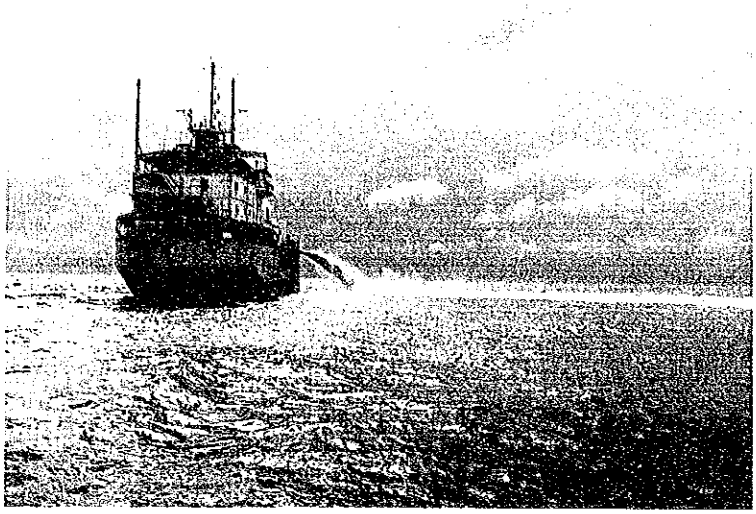
General View of the Channel and Diffusion of River Water
(Viewing the River Mouth from the South-west, December 9, 1989.
The Dotted Line Indicates the Channel.)



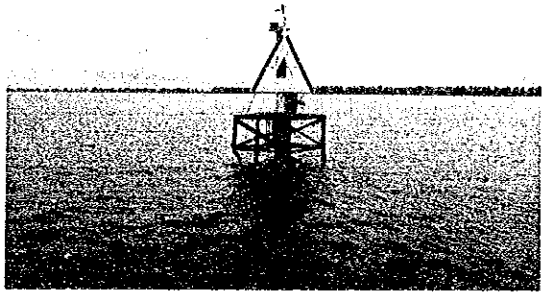
Trisakti Wharf



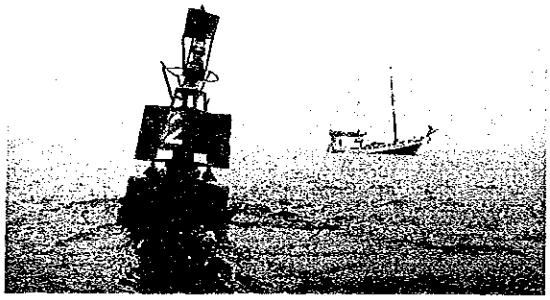
Martapura Wharf



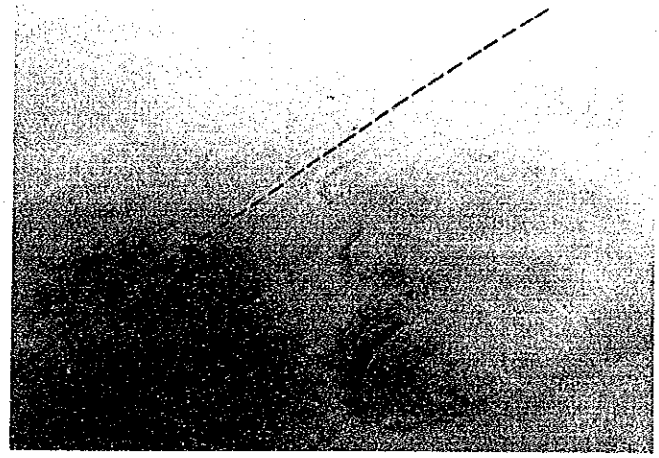
Maintenance Dredging in the Channel by HALMAHERA



Navigational Aid (Leading Light Fore)



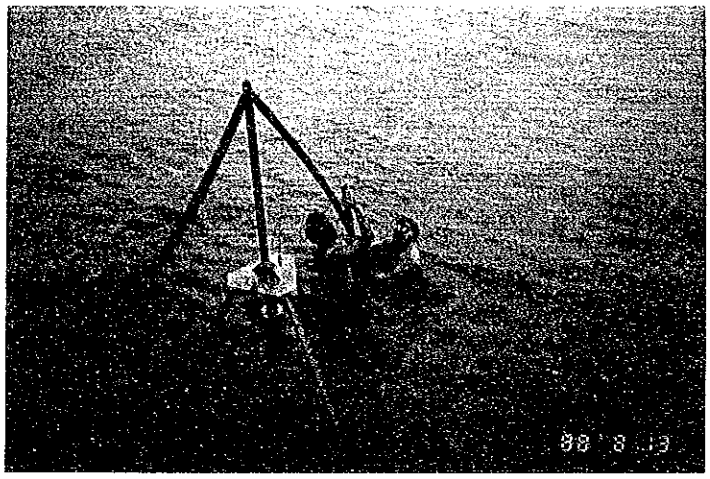
Buoy No. 2 and a Stranded Rakyat



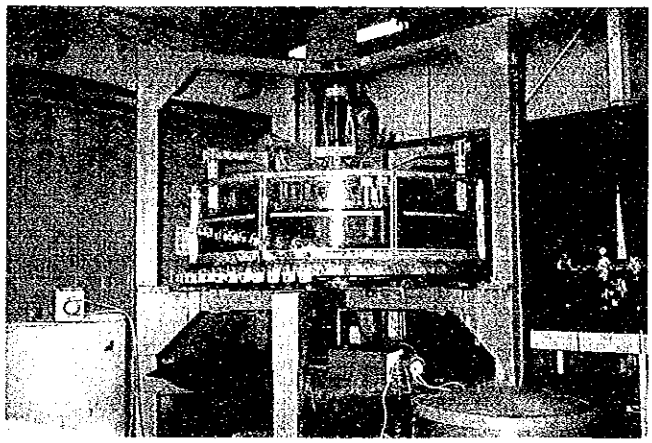
Sand Spits at the West of the Channel

(Viewing Southward from the River Mouth, October 18, 1989.

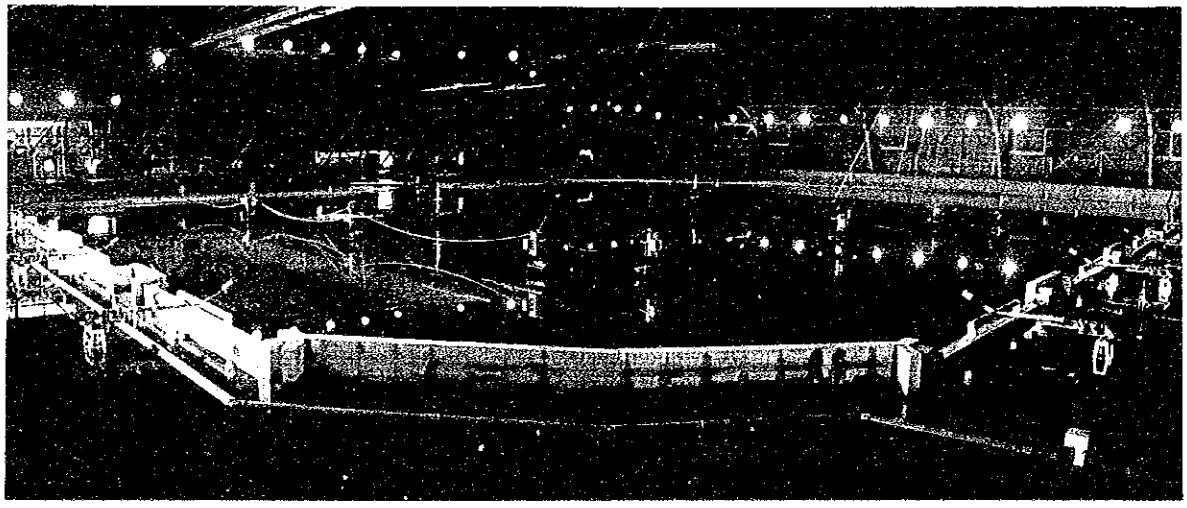
The Dotted Line Indicates the Channel.)



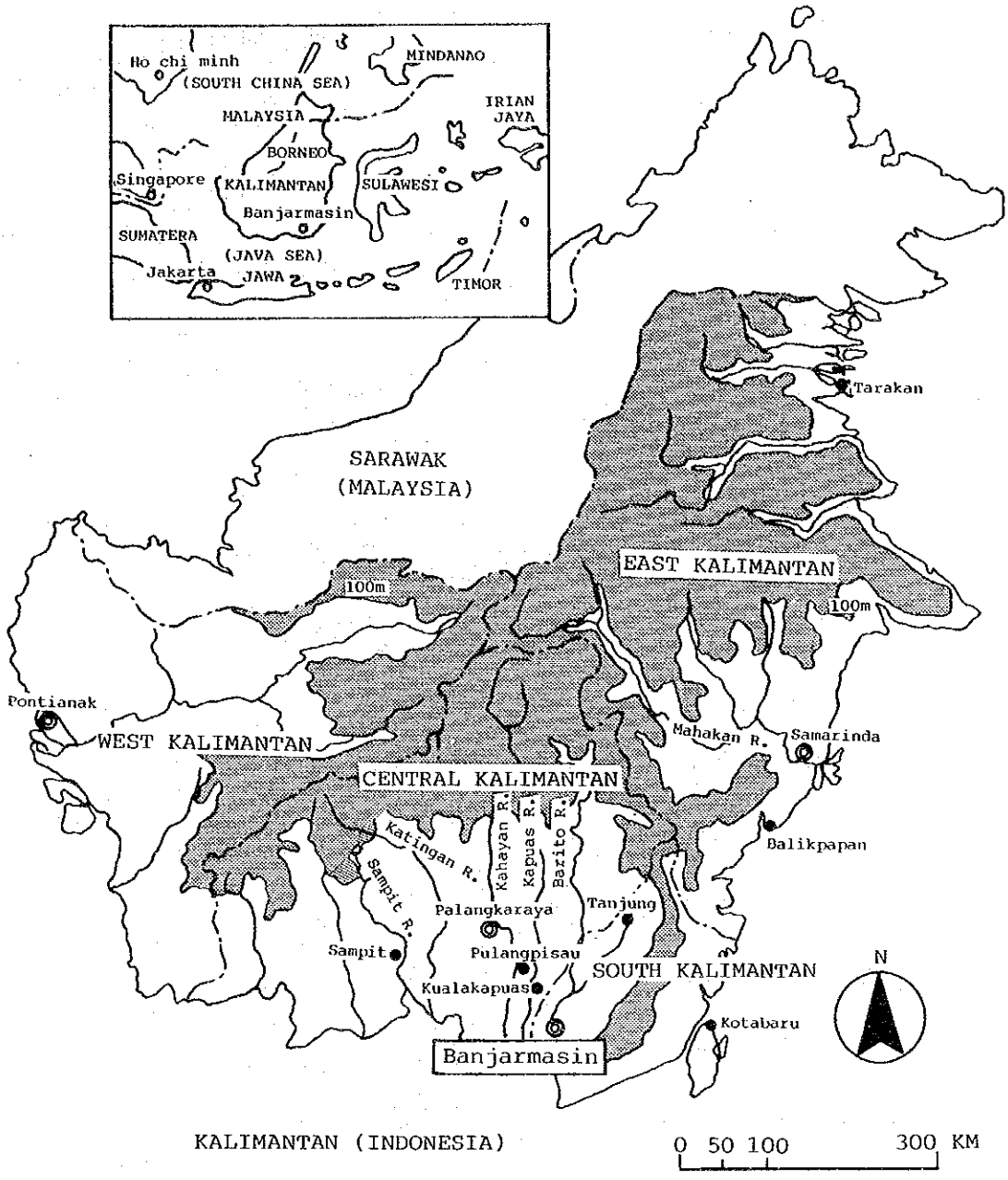
Field Survey for Natural Conditions (Installation of Current Meter)



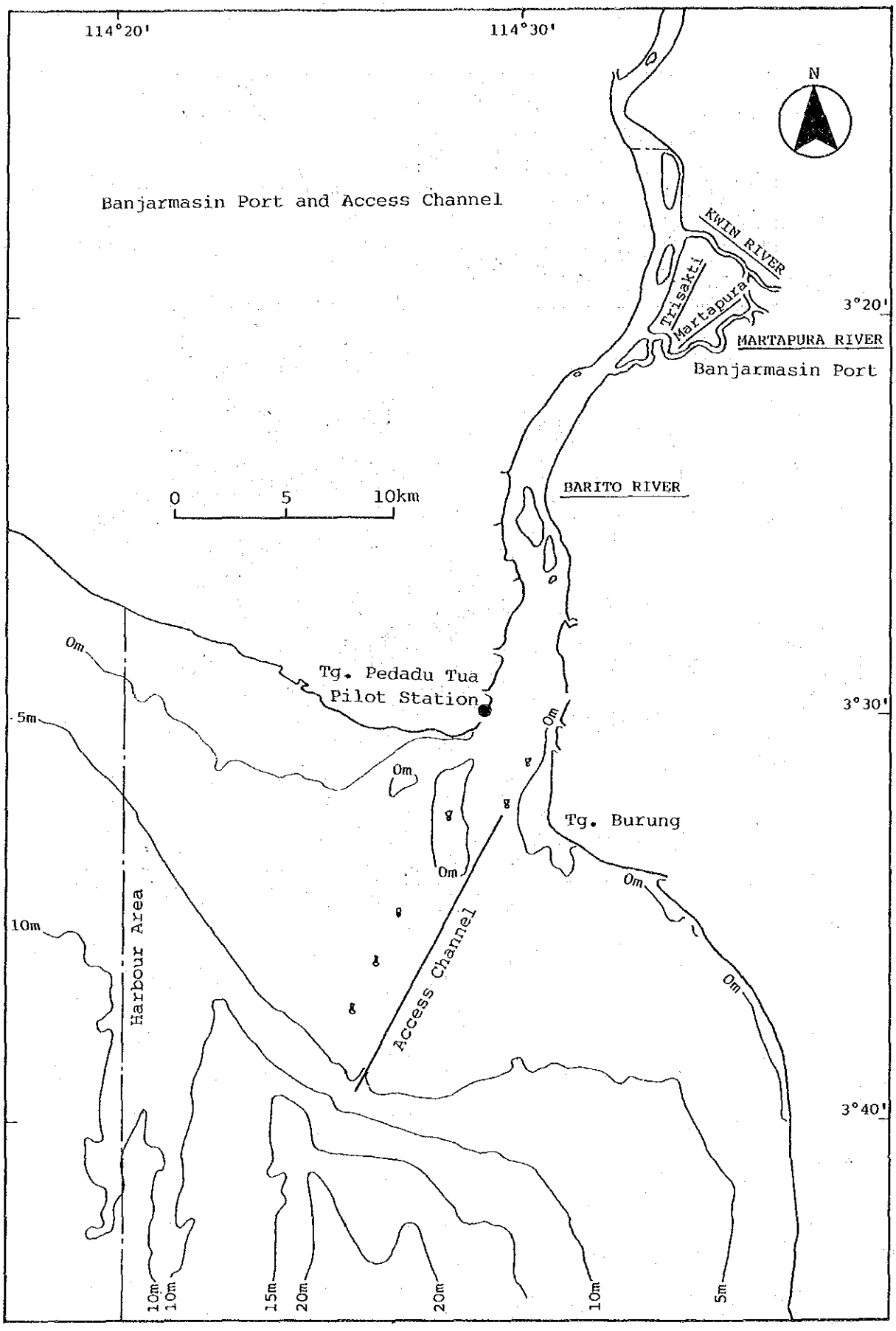
Laboratory Test (Annular Flume Test)



Hydraulic Model Test



Map of Indonesia and Location of Banjarmasin


114°20'
114°30'
N
Banjarmasin Port and Access Channel
KWIN RIVER
Trisakti
Martapura
3°20'
MARTAPURA RIVER
Banjarmasin Port
0 5 10km
BARITO RIVER
Tg. Pedadu Tua
Pilot Station
3°30'
Tg. Burung
Harbour Area
Access Channel
3°40'
0m
5m
10m
15m
20m

Foreign Exchange Rate

US$ 1 = Rp. 1,849

YEN 1 = Rp. 12.69

(As of 1st August, 1990)

LIST OF ABBREVIATIONS AND INDONESIAN-LANGUAGE TERMS

ADB	Asian Development Bank
ADPEL	Administrator of Pelabuhan
Av.	Average
BAPPEDA	Badan Perencanaan Pembangunan Daerah (Provincial Development and Planning Board)
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Economic Development Board)
Bext	Breadth Extreme
Biro	Bureau
BKI	Biro Klasifikasi Indonesia (Indonesian Classification Bureau)
BPS	Biro Pusat Statistik (Central Statistics Bueau)
C.D.L.	Cardinal Datum Level
CIF	Cost, Insurance & Freight
D/D	Detail Design
DF/R	Draft Final Report
DIP	Daftar Isian Proyek (Decided Project Table of the Government Budget)
DL	Datum Level
D.G.S.C.	Direktorat Jendral Perhubungan Laut (Directorate General of Sea Communication)
Dmax	Maximum Draft
D.W.T.	Dead Weight Ton
EIRR	Economic Internal Rate of Return
E/S	Engineering Service
F/C	Foreign Currency
F.O.B.	Free on Board
F/R	Final Report
FIRR	Financial Internal Rate of Return
G/C	General Cargo
GDP	Gross Domestic Product
GNP	Gross National Product
GRDP	Gross Regional Domestic Product
GRP	Gross Regional Product

GRT	Gross Registered Tonnage
G.T.	Gross Tonnage
$H_{1/3}$	Significant Wave Height
Hmax.	Maximum Wave Height
H.W.L.	High Water Level
I.I.	Inter Island Ship
INPRES 4/1985	Instruction of the President No. 4 Year 1985
I.M.O.	International Maritime Organization
IRR	Internal Rate of Return
IT/R(1)	Interim Report (1)
IT/R(2)	Interim Report (2)
JICA	Japan International Cooperation Agency
JMAT	Japan Maritime Advisory Team, DGSC
K1	Luni Solar Diurnal Component
K2	Luni Solar Semidiurnal Component
KANWIL	Kantor Wilayah Perhubungan (District Office of Communications)
KH	Horizontal Seismic Coefficient
KK	Dredger
LC	Local (Local Vessel)
L/C	Local Currency
LAT	Latitude
LCM	Local Motor (Motorized Local Vessel)
LCT	Landing Craft Type Vessel
Loa	Overall Length
Loc.	Local Ship
LWL	Low Water Level
LWS	Low Water Spring
M2	Principal Lunar Semidiurnal Component
Max	Maximum
MOC	Ministry of Communications
MOF	Ministry of Fisheries
MOT	Ministry of Transport, the Government of Japan
MSL	Mean Sea Level
MT	Tanker
MV	Motor Vessel
MW	Medium Wave

MWL	Mean Water Level
N	The Number of Blows by Standard Penetration Test
N2	Larger Lunar Elliptic Semidiurnal Component
NB	Nautical Bottom
ND	Nautical Depth
NM	Nautical Mile
NRT	Net Registered Ton
NTC	Nippon Tetrapod Co., Ltd.
Nusantara	Inter Island Vessels in Indonesia (I.I.)
O1	Principal Lunar Diurnal Component
OCDI	Overseas Coastal Area Development Institute of Japan
OECF	Overseas Economic Cooperation Fund of Japan
O.G.	Oceangoing Ship
P1	Principal Solar Diurnal Component
p.a.	Per Annum
Perumpel	Perusahaan Umum Pelabuhan (Port State Enterprise)
Perumpen	Perusahaan Umum Pengerukan (Dredging State Enterprise)
P.H.R.I.	Port and Harbour Research Institute, MOT, Japan
PL	Perahu Layar (Sailing Vessel=Rakyat)
PLM	Sailing Vessel with Engine
ppm	parts per million (mg/l)
P.T.	Perseroan Terbatas (Limited Company)
qu	Unconfined Compressive Strength
R, r	Correlation Ratio
Racon	Radar Beacon or Radar Transponder
Rakyat	Sailboat
Repelita	Five Year National Development Plan
Rp.	Rupiah
$	Dollar
S2	Principal Lunar Diurnal Component
Samudra	Oceangoing Vessel
Spot, Sp.	Spot Number of the Access Channel
S.P.T.	Standard Penetration Test
S.I.	Special Industry Ship
SS	Suspended Solids

SSB	Single Side Band Wave
TB	Tugboat
TEU	Twenty Foot Equivalent Unit
TKG	Tongkang (Barge/Pontoon)
tg.	tanjung (Cape, peninsula)
ton/m^3	Tons or Cubic Meters (mixed units for cargo statistics)
YUKA	Yayasan Usaha Karya
	(Stevedoring Labour Corporation)
VHF	Very High Frequency

CONTENTS

PART V EVALUATION OF ALTERNATIVE PLANS

PART VI THE COMPREHENSIVE PLAN

LIST OF TABLES (SUMMARY)

LIST OF FIGURES (SUMMARY)

LIST OF TABLES

LIST OF FIGURES

LIST OF TABLES (APPENDICES)

LIST OF FIGURES (APPENDICES)

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

This Study on Maintenance Dredging in the Access Channel of Banjarmasin Port commenced in 1988 to develop measures to reduce siltation volume, to develop effective measures for maintenance dredging and to formulate a comprehensive plan toward 2000 and a first-stage plan until 1995. The conclusions of this Study are summarized below.

1. Importance of Measures to Maintain the Access Channel of Banjarmasin Port

Siltation in the Banjarmasin channel is among the heaviest in Indonesia. It has been thought that maintenance dredging with a volume of around 3 million m^3/year is necessary to maintain a channel depth of 6m and width of 60m. In reality, dredging of about 2 to 3 million m^3 every year could hardly maintain the above profile. Through the analyses of this Study, it is estimated that the required dredging volume will reach more than 4 million m^3/year and, if the channel is to be kept to 6m in depth and 100m in width as the original channel plan specifies, more than 5 million m^3/year.

On the other hand, cargo throughput and the number of ship calls at the port have increased drastically in the past five years, i.e., 11.3% and 5.1% p.a., respectively. The average ship size during the said period did not increase, due possibly to the limit of the channel depth. Accidents in the channel happened were not rare, i.e., 21 in the past four and a half years, including wrecks, collisions and strandings. Minor grounding accidents seem to have been occurring frequently.

In the future, cargo volume as well as containerization are expected to increase. A development project now under construction at Trisakti will be completed by the end of 1991 to add new wharves of 9m in depth with 120m in length and 5m in depth with 350m in length.

It is imperative to keep the channel in accord with the port development plan, to accommodate future traffic and to secure navigational safety. In order to realize these goals it is important to decrease maintenance costs by means of reducing siltation volume and improving dredging efficiency economically, which eventually will contribute to the economic development of the port as well as that of Indonesia.

2. Target of Channel Planning

Based on the demand forecast and other analyses of this Study, targets of the channel plan are set as follows:

a. Cargo and vessel traffic demands

In 1995, cargo volume: 6.8 million ton/m^3

vessel traffic: 9,600 ships

In 2000, cargo volume: 8.7 million ton/m^3

vessel traffic: 10,600 ships

b. Design ship until 2000

6,500 GRT (10,000 DWT) class cargo vessels, including container ships.

c. Size of the channel

Water depth: DL -6m, bottom width: 100m, and

side slope: 1/8 and 1/10.

3. Measures of Siltation Reduction

The following alternative plans have been selected to evaluate their effect on reducing siltation volume in the channel:

For the present channel alignment:

(1) Principal Plan (Depth -6m, width 100m; No facility)

(2) Submerged Wall Plan (Various length, location, height and wall distance)

(3) Training Wall Plan (Length 3,100m)

(4) Trap Plan (Additional width 70m; No facility)

(5) Long (Coastal) Jetty Plan (Length 6km)

For a new channel alignment:

(6) New N-S Alignment Plan (Depth -6m, width 100m; No facility)

For comparison to the above alternative plans:

(7) Present Condition (Depth -6m, width 60m; No facility)

(8) Expansion Plan (Depth -8m, width 120m; No facility)

Based on the results of site surveys of natural conditions for one year and laboratory tests on bed soil characteristics, effects in terms of halting siltation are assessed by means of:

a. Numerical simulations (Multi-layer suspension-diffusion model),

b. Hydraulic model tests (Three-dimensional high density flow model) and

c. Combination of a. and b. (a. and fluid mud model).

Comparison and evaluation of the effects are made among the alternative plans from the viewpoints of planning soundness, technical viability and cost effectiveness, with the conclusion being that the most promising siltation reduction plan is the one involving long submerged walls (Depth -6m, bottom width 100m, wall distance 240m, height 1.5m above the bottom, length from Spots Nos. 2,000 to 13,000; Siltation reduction effect: about 45%) on both sides of the channel as the Comprehensive Plan toward 2000 and the non-continuous submerged walls (Same size, length from Spots Nos. 3,000 to 7,000 and 10,000 to 13,000; Siltation reduction effect: about 30%) as its First-stage Plan until 1995.

4. Measures for Improvement of Dredging Efficiency

Various methods to improve dredging operations, equipment, survey, control and management are discussed from the viewpoints of technical viability and cost effectiveness.

It is concluded that the following measures are very effective and feasible:

a. Making a turning basin at the center of the channel (Dredging capacity improvement: about 17%).

b. Fixing spades to dragheads (about 14%).

c. Introducing a tugboat equipped with a blade and survey equipment (about 5%).

d. Installing a draghead position indicator in a dredger.

e. Introducing measurement devices, a fast survey boat, a personal computer, a survey platform and two tide poles.

There are other measures identified from the managerial point of view such as rationalization of maintenance and repair of equipment, speedy procurement of spare parts and improvement related to organization, personnel, procedures, etc..

5. The Comprehensive Plan

Toward the year 2000, submerged walls (from Spots Nos. 2,000 to 13,000) on both sides of the channel are planned to be constructed to reduce siltation volume.

Arrangement of navigational aids and procurement of a pilot boat are planned to secure navigational safety.

The measures regarding dredging listed above in 4. a. to e. are planned to improve dredging efficiency.

The total cost for the plan is roughly estimated to be US$51.1 million.

6. The First-stage Plan

For siltation reduction, two pairs of submerged walls (from Spots Nos. 3,000 to 7,000 and 10,000 to 13,000) on both sides of the channel are planned until 1995 to cover areas where relatively high siltation occurs in the Comprehensive Plan.

The navigational safety measures planned are similar to those stipulated in the Comprehensive Plan because of their importance and urgency.

The same dredging efficiency improvement measures of 4. a. to e. will be carried out from the First-stage Plan, taking into consideration their significant effects.

The total cost is roughly estimated to be US$37.8 million.

The plan has values of 13.2% of economic internal rate of return (EIRR) and 5.0% of financial internal rate of return (FIRR) and is judged to be feasible.

RECOMMENDATIONS

Based on the findings and analyses carried out in this Study, the Study Team would like to submit the following recommendations to the Government of Indonesia for the sake of successful implementation of the Plans and development of the port:

1. Principles of Channel Maintenance

The access channel at Banjarmasin should be planned and maintained with a profile of 6m in depth and 100m in bottom width.

The proposed project of the First-stage Plan should be implemented, i.e., measures to reduce siltation in the channel (non-continuous submerged walls), to secure navigational safety and to improve dredging efficiency because of their importance and effectiveness.

2. Siltation Reduction Measures

The implementation program should be prepared paying attention to the importance of engineering services throughout the project period from preparatory studies to follow-up surveys. In planning the submerged walls, detailed design should be carefully executed based on in-depth boring and review of the design conditions. Regular observations and surveys of wind, tides, waves, current, river discharge, floating and bottom materials, and bottom topography should be carried out at appropriate intervals as long as possible, utilizing the survey equipment provided in this Study and project.

Execution of submerged wall construction should be done also carefully and flexibly. Step by step construction and monitoring surveys should be planned to examine local adaptability and possible improvement of the design and execution during the construction steps, taking care of preservation of the function against accumulation/erosion of the seabed.

Follow-up surveys shall be undertaken to confirm the function and effect, and to judge the necessity of the maintenance, if any, of the submerged walls.

It is recommended that every effort be made to continue surveying, collecting and analyzing the data, statistics and characteristics of siltation in the channel.

3. Dredging Efficiency Improvement Measures

From the mechanical viewpoint, maintenance and repair of dredging equipment should be made smoothly and effectively through preparation of spare parts, history sheets, and maintenance/inspection standard of the equipment.

From the operational viewpoint, trial side-casting over the submerged wall and trial dumping at the river mouth should be carried out to clarify their effects and influences. It is fundamental to make every effort to develop survey methods and to improve their accuracy in terms of the planning and control of dredging.

From the managerial viewpoint, introduction of monitoring systems of equipment maintenance and expansion of training programs along with organization and personnel of the dredging sections in the Government should be strengthened.

The introduction of a computerized dredging management system is recommended. The executing organization, i.e., Perum Pengerukan (Perumpen), should endeavor to rationalize cumbersome procedures, establish maintenance and repair program, expedite procurement of spare parts, etc.

4. Financial Measures

It is a matter of course that the Government should secure enough funds for the maintenance of the channel every year so as to be able to dredge the required volume as assessed in this Study.

As this is one of the fundamental national projects in Indonesia, the project funds should be allocated on favourable terms.

5. Navigational Safety Measures

Hearing requests from and asking the cooperation of channel users, i.e., pilots, ship crews, shipping agents, etc., the Government should keep the navigational aids in good condition, and strengthen guidance and