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**Report No. 8408**

**PROJECT COMPLETION REPORT**

**THAILAND**

**INLAND WATERWAYS AND COASTAL PORTS PROJECT  
(LOAN 1889-TH)**

**FEBRUARY 27, 1990**

**Infrastructure Operations Division  
Country Department II  
Asia Regional Office**

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### CURRENCY EQUIVALENTS

Currency Unit -- Thailand Baht (B)

US\$1            - B25 (at completion)  
US\$1            - B20 (at appraisal)

### WEIGHTS AND MEASURES

1 meter (m)                = 3.28 feet (ft)  
1 cubic meter (cu m)      = 1.307 cubic yards (cu yd)  
1 metric ton (ton)         = 0.98 long ton

### GLOSSARY OF ABBREVIATIONS

dwt            -    deadweight tons  
HD            -    Harbour Department  
LWOST        -    Low Water Ordinary Spring Tide  
MOF           -    Ministry of Finance  
MOTC         -    Ministry of Transport and Communications  
OED           -    Operation Evaluation Department  
PCR           -    Project Completion Report  
SAR           -    Staff Appraisal Report  
TA            -    Technical Assistance

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THE WORLD BANK  
Washington, D.C. 20433  
U.S.A.

Office of Director-General  
Operations Evaluation

February 27, 1990

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Thailand  
Inland Waterways and Coastal Ports Project (Loan 1889-TH)

Attached, for information, is a copy of a report entitled "Project Completion Report on Thailand - Inland Waterways and Coastal Ports Project (Loan 1889-TH)" prepared by the Asia Regional Office. No audit of this project has been made by the Operations Evaluation Department at this time.

Attachment

A handwritten signature in black ink, appearing to be 'A. Gray', is written over the word 'Attachment'.

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**PROJECT COMPLETION REPORT**

**THAILAND**

**INLAND WATERWAYS AND COASTAL PORTS PROJECT**  
**(LOAN 1889-TH)**

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**PROJECT COMPLETION REPORT****THAILAND  
INLAND WATERWAYS AND COASTAL PORTS PROJECT  
(LOAN 1889-TH)****PREFACE**

This is the Project Completion Report (PCR) for the Inland Waterways and Coastal Ports Project in Thailand, for which Loan 1889-TH in the amount of US\$ million was approved on July 8, 1980. The loan was closed on March 31, 1989, 4 1/4 years behind schedule. Disbursements under the loan totalled US\$39.662 million, and the final disbursement was made on April 13, 1988, at which time US\$2.038 million was cancelled, US\$11.3 million having been previously cancelled on February 17, 1987.

The PCR was jointly prepared by the Infrastructure Division, Country Department II of the Asia Regional Office (pages 1 to xxiii) and the Borrower (pages 1 to 39) and is based, inter alia, on the Staff Appraisal Report (SAR); the Loan Agreement; supervision reports; the Borrower's own records; correspondence between the Bank and the Borrower; and internal Bank memoranda.

The PCR was read by the Operations Evaluation Department (OED). The draft PCR was sent to the Borrower for comment and they are attached to the Report (Attachment 1).

**PROJECT COMPLETION REPORT**

**THAILAND  
INLAND WATERWAYS AND COASTAL PORTS PROJECT  
(LOAN 1889-TH)**

**BASIC DATA SHEET**

Item	Appraisal Estimate	Actual
Total Project Cost (US\$ million)	80.4	61.1
Loan Amount (US\$ million)	53.0	53.0
Disbursed		39.7
Cancelled (2/17/87)		11.3
Cancelled (4/13/89)		2.0
Repaid (at 3/31/89)		10.7
Date Physical Components Completed	12/31/83	03/20/89
Proportion Completed by Original Completion Date (%)	100%	17%
Proportion of Time Overrun (%)	-	100%
Economic Rate of Return (%)	20%	6%

**Cumulative Estimated and Actual Disbursements  
(US\$ '000)**

BRD FY	1981	1982	1983	1984	1985	1986	1987	1988	1989
Appraisal Estimate	5,720	25,860	45,520	53,000			[1]		[2]
Actual	0	530	6,290	9,860	17,330	22,950	28,200	33,850	39,662
Actual as % of Estimate	0	2	14	19	33	43	68	81	100

Date of Final Disbursement: 04/13/89

Comments: [1] \$11.300 million cancelled from loan on 02/17/87. Revised loan amount = \$41.7 million  
 [2] \$2.038 million cancelled from loan on 04/13/89. Final loan amount = \$39.662 million

Other Project Data

Item	Date		
	Planned	Revised	Actual
First Mention in Files			04/06/76
Inland Waterways			10/21/77
Coastal Ports			10/19/78
Government's Application			08/23/78
Identification (Project Brief)			05/12/80
Loan Negotiations	07/80		07/08/80
Board Approval	09/80	06/25/80	08/27/80
Loan Signature			12/10/80
Loan Effectiveness	11/25/80	3/21/81	
Loan Closing	06/30/84	06/30/85	
		12/31/85	
		12/31/86	06/30/88
Loan Completion	12/31/84		03/31/89
Executing Agency			Harbour Department
Fiscal Year of Borrower			October 1 - September 30
Follow-up Project	None		2nd Inland Waterway Project (proposed)

Staff Inputs  
(staff weeks)

FY	76	77	78	79	80	81	82	83	84	85	86	87	88	89	TOTAL
Preparation			2.2	16.5	4.4										23.2
Appraisal					43.5										43.5
Negotiations					1.7										1.7
Supervision						9.3	4.0	9.5	16.6	10.4	16.4	3.2	7.4	3.4	80.3
Other			0.1	0.2	4.2	0.2				0.1	1.1	0.6		5.7	12.2
<b>TOTAL</b>			2.4	16.7	53.8	9.5	4.0	9.5	16.6	10.6	17.5	3.8	7.4	9.1	160.9

## Mission Data

Stage of Project Cycle	Month/Year	No. of Persons	Days in Field	Specialization Represented[1]	Perf. Rating Status[2]	Types of Problems[3]
Preparation I	05/76	1	3	ECN	—	—
Preparation II	11/77	2	4	EGR/ECN	—	—
Preparation III	11/78	2	5	EGR/ECN	—	—
Preappraisal	02/79	2	9	EGR/FNA	—	—
Preparation IV	06/79	2	5	CHF/ECN	—	—
Preparation V	09/79	1	7	ECN	—	—
Appraisal	11/79	3	18	EGR/ECN/FNA	—	—
Supervision I	11/80	1	4	EGR	1	—
Supervision II	03/81	1	4	EGR	1	M
Supervision III	05/81	1	4	EGR	—	—
Supervision IV	02/82	1	7	EGR	2	M/O
Supervision V	06/82	2	7	EGR/2	2	M/O
Supervision VI	01/83	2	7	EGR/ECN	3	M/O
Supervision VII	04/83	1	2	ECN	—	—
Supervision VIII	06/83	3	9	CHF/EGR/ECN	3	M/F/O
Supervision IX	10/83	2	8	ECN/EGR	3	M/O
Supervision X	05/84	1	10	EGR	3	M
Supervision XI	03/85	2	7	ECN/EGR	2	M
Supervision XII	01/86	2	7	ECN/EGR	2 [4]	— [4]
Supervision XIII	09/87	2	7	ECN/EGR	2 [4]	— [4]
Supervision XIV	02/88	2	7	ECN/EGR	—	—
Supervision XV	09/88	2	5	ECN/EGR	2 [4]	— [4]

NOTES: [1] ECN = Economist, EGR = Engineer, FNA = Financial Analyst, CHF = Division Chief.  
[2] 1 = Problem-free or Minor Problems, 2 = Moderate Problems, 3 = Major Problems.  
[3] M = Management, F = Financial, O = Other.  
[4] Rating systems changed, Problems no longer specified in Form 590 - Supervision Summary.



**PROJECT COMPLETION REPORT****THAILAND  
INLAND WATERWAYS AND COASTAL PORTS PROJECT  
(LOAN 1889-TH)**

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**EVALUATION SUMMARY****Objectives**

The objective of the Inland Waterways and Coastal Ports Project was to develop the inland waterways system with the aims of reducing the transport component of the cost of exports by using a more energy-efficient means of transport and to stabilize the enormous costs of road maintenance (Overview para 2.1). The major components of the project aimed to:

(a) improve the inland waterways system, so that it could function as a major carrier of import and export commodities throughout the year for the central and northern regions;

(b) improve channel maintenance of all coastal ports and undertake capital dredging for two of the more important ports, so that loss of ship time in waiting for tides would be reduced and larger vessels could navigate the channels; and

(c) strengthen the capability of the HD to perform its development and maintenance functions for the inland waterways and coastal ports.

**Implementation Experience**

The Inland Waterways and Coastal Ports project was appraised in November 1979 and the loan became effective in December 1980. The Bank Loan (1889-TH) for the project amounted to US\$53.0 million but, as a result of the deletion of three dredgers from the project, only US\$39.7 million was disbursed; a total of US\$13.3 million was cancelled.

The components of the project (Overview paras 2.3 and 2.5) to be financed under the loan consisted of, for the Inland Waterways, (a) dredging a channel through each of the shoal areas on the upper and lower sections of the Chao Phraya and Nan rivers; (b) constructing river training works to help concentrate the available dry season flow in the reduced width of the river, thus scouring out the new channel and reducing the maintenance dredging required; (c) constructing river ports at Nakhon Sawan and Taphan Hin; (d) procuring a demonstration set of four steel barges and one pusher tug, and maintenance dredging equipment comprising three cutter suction dredgers; (e) providing engineering services for final engineering of the Nan River works, procurement of equipment and supervision of contracts; and (f) providing technical assistance and training to strengthen the HD.

The Coastal Ports component of the project included (a) dredging the entrance channel of the port at Bandon to a depth of 4 m; (b) dredging the

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entrance channel of the port of Pattani to a depth of 2.5 m; (c) carrying out geophysical and hydrographic studies of these channels; (d) procuring a shallow draft self-propelled trailing suction hopper dredger for maintenance; (e) providing engineering services for final engineering, bid evaluation and supervision of contracts; and (f) providing technical assistance and training for the HD.

The project started quite well with contractor prequalification documents being distributed at the time of loan negotiations, and consultants for both components being appointed a month or two ahead of schedule (Overview Table 1). Progress then stalled (Overview para 4.2) and momentum was lost, so that the first river works contract, for the Chao Phraya, was signed nearly 15 months late. The Nan River contract was signed over 32 months late, and that for the coastal ports dredging contract was 36 months late. The equipment procurement and river port contracts suffered even more, being from 40 to 79 months behind schedule, finishing only a few days before the loan eventually closed on April 30, 1989. Technical assistance and training components suffered equally badly. HD was reorganized to form separate Dredging and Maintenance Divisions for Inland Waterways and Coastal Ports, but the manpower required to fill these organizations was not forthcoming for several years. In-house training by consultants was often poorly attended and the overseas training of staff is still in progress.

The main reasons for the delayed implementation (Overview para 4.2) were (a) very slow processing and approval of tender documents, bid evaluations and contract awards; (b) slow land acquisition procedures; and (c) a lack of continuity of Bank staff responsible for the project.

### Results

Because of the lack of maintenance afforded to the completed sections of the rivers (Overview para 5.4), barge owners deemed it was too dangerous to use the improved waterways and traffic in the project area has remained low, contrary to expectations. Traffic through the coastal ports does not appear to have increased to any appreciable extent (Overview para 5.2). The overall economic rate of return is estimated at 6% compared with 20% at the time of appraisal.

### Sustainability

The project has not yet realized its potential benefits and it is important that the Government does not view the inland waterway and coastal ports sectors as being incapable of providing benefits to the economy (Overview paras 6.1 to 6.3), but these benefits will not be felt for many years, and considerably later than expected during appraisal. Operator confidence in the waterway system and in the financial benefits of using different technology and the marketing of the coastal ports are the keys to eventual success.

The main risks of lack of eventual success can be addressed by the provision of a realistic maintenance budget and by further training and manpower reforms to ensure a satisfactory level of competence throughout the institution to carry out effective waterway and coastal port management.

**Findings and Lessons**

The main objectives of the Inland Waterways and Coastal Ports Project have not yet been achieved, but the Government is now more aware of the potential of the inland waterways to provide significant cost savings and this is to be addressed in the proposed Second Inland Waterway Project now under consideration.

The Bank learned some valuable lessons (Overview para 7.3) on project preparation and staff continuity, particularly where weak institutions are involved. The Borrower also learned (Overview para 8.3) that it must support the weaker institutions, particularly those responsible for important sectors of the economy or infrastructure, by ensuring that training is fully implemented and by using appropriate expertise (foreign if necessary) to work alongside government staff to help them develop the operational and maintenance systems that are essential to keep an investment effective.

**PROJECT COMPLETION REPORT****THAILAND  
INLAND WATERWAYS AND COASTAL PORTS PROJECT  
(LOAN 1889-TH)**

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**OVERVIEW****1. Background**

1.1 The Transport Sector. Since the mid-1960s, the Thai economy has been growing at a rapid pace, generating a high demand for transport. During the 1970s, when Loan 1889-TH was being prepared, freight traffic was growing at about 8% p.a. and passenger traffic at about 12% p.a. Overall freight traffic in the late 1970s totalled some 50 million tons and 14 billion ton-km p.a., about 70% of which (in ton-km) was carried by road, 20% by rail and 10% by inland waterways. Government responded to this increase in traffic with large investments, mostly in roadworks, and liberal transport policies which stimulated a competitive road transport industry. By 1980, virtually the entire primary (national) roads system serving interprovincial trade was complete, and significant progress had been made towards the improvement of the secondary (provincial) system. Railways, inland waterways and coastal shipping, confined to specific corridors or locations and handling mostly bulk commodities, also grew, but at a modest rate.

1.2 Sector Development. With the progress made in developing primary and secondary roads, future transport requirements shifted towards (a) development of the tertiary road system in support of the needs of rural communities; (b) the upgrading of the performance of other modes of transport; and (c) the removal of specific capacity bottlenecks in the national transport system such as the Port of Bangkok. Tertiary roads were under-developed and inadequately maintained, while the railways, inland waterways and coastal shipping, for their part, performed at below attainable output and efficiency levels, and their capacity for energy-efficient transport was underutilized. The Port of Bangkok was expected to be critically congested by the early 1980s.

1.3 Traffic. The direction, composition and size of the traffic flows for each of the modes of transport reflected the country's generally rural character, the agricultural strength of the Central Region and Bangkok's central location and dominance as the country's principal port and consumption center. 30-50% of all freight was agricultural produce, of which about one half was exported, most of it through the Port of Bangkok and the eastern seaboard loading facilities.

1.4 Transport Planning. The Ministry of Transport and Communications (MOTC) is responsible for transport policy, coordination and planning. During the Third and Fourth Five-Year Plans (1972-81) public sector investment in transport was about B 49 billion of which 80% was devoted to roads. In 1980, it was expected that transport investment for the period 1982-86 would still

concentrate on roads, but, given the worsening energy situation, that more attention would be paid to the development of energy-efficient modes, such as railways, inland waterways and coastal shipping.

**1.5 Inland waterways.** Thailand has a comprehensive and developed inland waterways system which covers well over one-third of the country and extends over some 1,300 km of navigable waterways. Most of this length is in the Northern Corridor between Bangkok and Uttaradit along the rivers which serve the central plain, principally the Chao Phraya and Nan. The remainder is along the Mekong river on the Thai-Laotian border. Ease of navigation on these rivers is seasonally influenced, with water levels rising in May with the arrival of the monsoon, reaching a peak in August or September. After the end of the wet season in October water levels decline to December and remain low for the remainder of the dry season. These influences are to some extent modified by a system of irrigation canals and single or multi-purpose dams. In 1980, more than 100 larger terminals and a greater number of minor loading facilities were located along the waterways. Their density is highest near population centers and major sources of agricultural products. All are privately owned and operated and most handle only one commodity. Two of the larger existing loading points on the Chao Phraya-Nan system are Nakhon Sawan and Taphan Hin. Their capacity, however, was inadequate to handle the expected traffic increase resulting from the improvement of the waterways.

**1.6 Waterway Traffic.** In 1976, barge traffic in the entire Northern Corridor totalled about 8.6 million tons, of which 6 million tons were sand, 1.3 million tons were rice, maize and other crops and 0.7 million tons were cement. Average barge haul was 200 km. Thailand's inland waterways transport industry was, and is, highly competitive and free from regulation. The barge fleet consisted of about 4,000 units with capacities of between 40 and over 300 deadweight tons (dwt) with a total capacity of 350,000 dwt. There were also about 2,000-3,000 smaller units. The barges were of traditional design, those below 100 dwt capacity were made of wood, whereas the larger vessels were steel hulled. All barges were moved by tugs pulling a train of up to about 8 units, which necessitates the barges being crewed.

**1.7 Coastal Ports.** Despite the improvements in land transport, coastal ports and shipping remained essential parts of the transport and economic system, especially in Southern Thailand. There are about 40 shallow draft seaports and inlets ranging from small fishing and cargo wharves of purely local importance to larger regional ports with annual volumes of several hundred thousand tons of cargo. Most of these ports are located on the southern peninsula and are owned and managed by local governments or private operators. These ports also serve as bases for the marine fishing industry on which the economic well-being of coastal communities depends. About 2.5 million tons of cargo and petroleum products and over 1 million tons of fish were annually loaded or discharged at these ports. The shallow depth of the port access channels was, and still is, the principal constraint under which coastal shipping operated.

**1.8 Harbour Department.** The agency responsible for the management of all inland waterways and coastal ports is the Harbour Department (HD) of MOTC. It has never been a strong organization, has little independence (unlike the Port Authority of Thailand) and its limited budgetary and manpower allocations did

not enable it effectively to manage and maintain the inland waterways and coastal ports for which it was responsible.

## **2. Project Objectives and Description**

**2.1 Project Objectives.** Having, in the past, concentrated largely on roads to develop the transport system required for the rapidly growing national economy, the Government decided, at the end of the 1970s to give closer attention to other transport modes, which had potential for development, with the ultimate aim of reducing the transport component of the cost of exports by using more energy-efficient methods of transport and of stabilizing the enormous costs of road maintenance. The main objectives of Loan 1889-TH were to (a) improve the inland waterways system, so that it could function as a major carrier of import and export commodities throughout the year for the central and northern regions; (b) improve channel maintenance of all coastal ports and undertake capital dredging for two of the more important ports, so that loss of ship time in waiting for tides would be reduced and larger vessels could navigate the channels; and (c) strengthen the capability of the HD to perform its development and maintenance functions for the inland waterways and coastal ports.

### **Description of the Project**

**2.2 Inland Waterways.** During the dry season, partly because of excessive sand dredging, parts of the Chao Phraya river upstream of Bangkok became so shallow as to be virtually impassable, especially below the Chainat Dam. As a result, barge traffic was forced to reduce payloads, or bypass the lower Chao Phraya on slow and more costly routes along the Noi and Tha Chin rivers, or cease operations. There is no bypass to the upper Chao Phraya and Nan rivers and traffic was therefore severely affected on these sections. Large quantities of agricultural bulk commodities, which are better suited to barge traffic, had to be carried by road.

**2.3** The Inland Waterways component of the project included (a) dredging a channel 40 m wide and 2.2 m deep (1.7 m available depth) through each of the shoal areas on the upper and lower sections of the Chao Phraya and Nan rivers; (b) constructing river training works comprising bottom panels and/or groins and low dikes at each of the dredged shoal areas to help concentrate the available dry season flow in the reduced width of the river, thus scouring out the new channel and reducing the maintenance dredging required; (c) constructing river ports at Nakhon Sawan and Taphan Hin with both alongside and dolphin type berths, cargo handling facilities, mechanical equipment and survey and miscellaneous maintenance equipment; (d) procuring a demonstration set of four 700 ton, 45 m steel barges and one 550 hp pusher tug, maintenance dredging equipment comprising three cutter suction dredgers complete with floating delivery pipes and three attendant tugs; (e) providing engineering services for final engineering of the Nan River works, procurement of equipment and supervision of contracts; and (f) providing technical assistance and training to strengthen the HD.

**2.4 Coastal Ports.** To have provided deeper access channels for the majority of the 40 coastal ports, besides resulting in a huge quantity of capital

dredging and an insupportable maintenance load for HD, such an undertaking was totally unjustified on the basis of the traffic using the ports. Only a few handled an appreciable level of traffic and most of these were eliminated as being uneconomic or because their traffic forecasts were adversely affected by the proposed construction of the two major regional ports at Songkhla and Phuket.

2.5 The Coastal Ports component of the project included (a) dredging the entrance channel of the port at Bandon to a depth of 4 m at low water ordinary spring tide (LWOST) with a channel 60 m wide and 20 km long; (b) dredging the entrance channel of the port of Pattani to a depth of 2.5 m at LWOST with a channel 60 m wide and 5 km long; (c) carrying out geophysical and hydrographic studies of the channels at Bandon and Pattani including borings and tracer studies to determine dumping areas for dredged soil; (d) procuring a shallow draft (2 m), 400 m<sup>3</sup> capacity, self-propelled trailing suction hopper dredger for maintenance; (e) providing engineering services for final engineering, bid evaluation and supervision of contracts; and (f) providing technical assistance and training for the HD.

### 3. Project Design and Organization

3.1 Although Thailand had developed a comprehensive and efficient transport system based on the extensive construction of roads and the encouragement of the trucking industry, it was becoming apparent, in the late 1970s, that, given the rapid rise in fuel costs and the huge highway maintenance load being imposed by an ever-increasing number of (frequently overloaded) trucks, close attention would have to be paid to more energy-efficient methods of transport, which had been somewhat neglected in recent years. The concept, therefore, of improving the capacity and efficiency of the inland waterway system and of encouraging coastal shipping, was fully in line with Government thinking and the Bank's objectives of increasing a nation's competitiveness by the reduction of transport costs for its principal exports and of preserving the environment through a reduction in energy consumption.

3.2 A Bank mission identified a possible project in April 1973 when a combined Inland Waterway and Port Project was being considered, but interest waned until it was resurrected in April 1976. A number of missions followed during the ensuing three years leading up to appraisal, with the coastal ports element being introduced in November 1977 to supplement the inland waterway and deep-water port (Bangkok and Sattahip) components. The project was appraised in November 1979, but before negotiations in May 1980, the inland waterways and coastal ports components were separated from the Bangkok and Sattahip ports component and they became separate projects. A loan for US\$53 million was approved by the Board on July 8, 1980.

3.3 The project was prepared by the HD with the assistance of its consultants financed under the Sixth Highway Project (Loan 1519-TH). The French and Australian consultants undertook feasibility studies on the respective components during 1979, and although not all recommendations put forward were adopted, there was agreement on the project components by all involved parties.

Preparation was thorough, despite the lack of up-to-date statistics on barge traffic and the concept of training long lengths of the Chao Phraya River was innovative in a country where river transport had traditionally been a seasonal activity ruled by the monsoonal climate. These works were, however, soundly designed using accepted training techniques well within the experience of the responsible consultants, so the unsatisfactory outcome of the project cannot be attributed to any shortfall in its design except as discussed below (para 6.3). The project implementation schedule, which was put forward by HD and its consultants, and adopted in the appraisal report, did turn out to be optimistic as discussed below (para 5.2).

3.4 This was the first Bank project undertaken by the HD and it was realised from the outset that HD's inherent institutional weakness and lack of experience in managing such projects would require the close attention of the Bank's project officer. Though roles and responsibilities were clearly defined, these defects in the organization were contributory factors in the slow implementation of the project.

#### 4. Project Implementation

4.1 The project started quite well with contractor prequalification documents being distributed in May 1980, at the time of loan negotiations, and consultants for both components being appointed in October and November 1980, a month or two ahead of schedule (see Table 1). Progress then stalled (para 5.2) and momentum was lost, so that the first river works contract, for the Chao Phraya, was not signed until February 1982, nearly 15 months late. The Nan River contract was not signed until June 1985, over 32 months late, and that for the coastal ports dredging contract until October 1984, 36 months late. The equipment procurement and river port contracts suffered even more, being from 40 to 79 months behind schedule, finishing only a few days before the loan eventually closed on April 30, 1989. Technical assistance and training components suffered equally badly. HD was reorganized to form separate Dredging and Maintenance Divisions for Inland Waterways and Coastal Ports, but the manpower required to fill these organizations was not forthcoming for several years. In-house training by consultants was often poorly attended and the overseas training of staff is still in progress with completion scheduled for July 1989.

4.2 One of the main reasons for the delayed implementation was the very slow processing and approval of tender documents, bid evaluations and contract awards as compared to that expected at appraisal. This was aggravated at one stage by the necessity to resolve differences between the Bank's Procurement Guidelines and those produced by the Ministry of Finance (MOF) for use on Bank funded projects, and by a disagreement within Government itself over the contents of the MOF's standard bidding documents based on their guidelines. In addition, land acquisition for the river ports proved to be a far lengthier process than had been forecast, taking several years in each case. A lack of continuity of Bank staff responsible for the project was also a contributory factor (see para 8.1 below, also PCR for Loan 1918-TH, dated June 30, 1988, which ran in parallel with Loan 1889-TH), as historical perspective and institutional memory were lost and decisions and findings arising out of one supervision mission were not necessarily followed up during the next.



## 5. Project Results

5.1 At the time of writing, although some of the works were completed over three years ago (Table 1), the inland waterways component of the project appears to have had little impact on the growth of barge traffic or on the reduction of transport costs within the northern corridor. For the reasons discussed below, fewer barges than expected are using the lower Chao Phraya, especially during the flood season, which is normally the most popular time to navigate that part of the river, many preferring instead to continue using the slow, narrow and heavily locked Noi and Tha Chin rivers. All the civil works, especially the port works have been completed to a good standard. The total cost of the inland waterway component was about US\$48.4 million (Table 2) which is about 24% less than the appraisal estimate. The design of the river training works was modified during construction, at no cost to the Borrower, to incorporate the latest technology and post-construction surveys have shown that their design has been effective in keeping the channels scoured out, dredging requirements being 25% less than predicted. Procurement of the equipment has been completed, but little of it has yet been put into service. The three cutter suction dredgers were taken out of the project when the Government received an offer from KfW (West Germany) to finance them. There is still no firm delivery date for these dredgers and the lack of them is having a serious effect on the annual maintenance program, with the result that the newly dredged channels, though silting up less rapidly than expected are not kept at their design depth and some users have had trouble negotiating the river even with a draft of less than 1.7 m. During the project, a floating pile-driving rig was added to the scope of supply of maintenance equipment to meet a need for such equipment within HD. The ports and the demonstration barge train have not yet been leased to private operators, because Nakhon Sawan port has no water supply because of delays by the local water authority, and Taphan Hin port and the Barge Train have only recently been completed. The new maintenance division in HD is more effective than the original combined division, but the training was not very effective and is not yet showing results.

5.2 Most of the elements of the coastal ports component were completed over 3 years ago (Table 1). The total cost was about US\$12.7 million (Table 2), which is about 31% less than the appraisal estimate. From the scant data available, it appears that traffic at the more important of the two ports, Bandon, has increased roughly in line with the lower estimate of the appraisal report, due perhaps, in part, to completion being some 3 years late. The trailing suction hopper dredger was delivered 42 months late, but has now been in service for more than 3 years. As in the case of the inland waterways, the new coastal ports maintenance division has not yet realised the potential expected from the training, some of which is still in progress.

5.3 As a result of lower than expected bid prices, the deletion of the cutter-suction dredgers and a 25% change in the exchange rate, a total of about US\$13.3 million, or about 25% of the total, was cancelled out of the loan amount of US\$53 million (Table 3). The final contributions of both IBRD and the Government were about 75% of those planned in the Loan Agreement.

5.4 The design for the river training works on the Chao Phraya and Nan rivers involved the use of groins, bottom panels and low dikes, which were constructed of a core of steel beams driven into the river bed with vertical concrete panels spanning between them, the groins then being surrounded by dredged soil and quarry-run rock to stabilize them against the fast currents of the wet season. Buoys were positioned at each structure to clearly locate them and to mark the navigable channel. A large number of marker buoys were quickly lost, largely because their design allowed weed to accumulate on them, which eventually overloaded the mooring and they broke loose. Also their boat-like design (aimed at reducing drag in fast currents) and fibreglass construction was attractive to the local populace and many were stolen. A redesigned steel buoy of more traditional shape was tested and incorporated into the later stages of the Nan River works. Lack of maintenance by HD meant that the various structures, unmarked and submerged during the wet season, posed a serious hazard to barges, especially as some scour and settlement around the structures allowed the steel piles to protrude well above the concrete panels and protecting rock fill. As a result, the barge owners lost confidence in the lower Chao Phraya as a safe channel in the wet season and diverted to the Noi and Tha Chin rivers, despite their narrowness and numerous locks. In the dry season, when the structures are visible, the Chao Phraya is used by empty barges, but owners of loaded barges prefer to continue using the Noi and Tha Chin as they offer deeper water, because they are used as irrigation feeder canals and are therefore kept full of water and hence allow a greater payload. The Chao Phraya, on the other hand, is deprived of water to the agreed minimum of 80 m<sup>3</sup>/s to provide the designed navigable depth of 1.7 m, which results in barges having to operate part-loaded.

5.5 This situation will persist until HD can regain the confidence of the barge owners in the safety of the Chao Phraya. HD have already fabricated and deployed large numbers of buoys of the new design, which overcomes the shortcomings of the originals, but budgetary constraints prevent the imminent replacement of all lost buoys. Also HD must change their maintenance methods which have traditionally allowed them to not do any work in the wet season, when there was ample water for the barges to operate, and instead adopt a system of regular daily maintenance patrols of the entire river throughout the year and have boats and crews readily available to immediately replace any missing navigation markers. Unless and until these measures are implemented, supported by the necessary budgetary allocations and publicity campaign and the barge owners see they are working, confidence will not be regained and the traffic will not return to the lower Chao Phraya and it will be wary of using the upper Chao Phraya and Nan rivers where there is no alternative route.

5.6 The economic rate of return (ERR) for the project calculated at appraisal was 20%. While the coastal ports component has a satisfactory ERR (Table 4), it remains below appraisal expectations. Because of maintenance problems on the Chao Phraya, traffic levels have remained low, yielding an estimated ERR of only 4%. The overall benefits from the project, at the present time, therefore remain low with an estimated ERR of 6% (Table 4). Once the river maintenance is effective, the river ports are operating and the demonstration barge train has had an effect on the composition of the barge fleet, project benefits should show a higher return on the investments already made. These measures will, however, take several years to take effect as private operators will have made

alternative investments, mainly in trucks, to transport their goods and agricultural produce.

## **6. Project Sustainability**

6.1 The project has not yet realised its potential benefits and it is important that the Government does not view the inland waterway and coastal port sectors as being incapable of providing benefits to the economy. Appreciable benefits should accrue once the components of the project have been fully implemented and they have been given time to take effect. Because of the delays in completing most of the components these benefits will not be felt for many years, and considerably later than expected during appraisal.

6.2 Given an adequate level of maintenance, an aggressive publicity campaign for inland waterways and coastal ports and a successful demonstration of the benefits of the push-tow system, there is no reason why higher benefits should not be obtained in the long term. Operator confidence in the waterway system and in the financial benefits of using different technology are the keys, especially as these new barges can be used to deliver direct to the Eastern Seaboard loading terminals or to the new port of Laem Chabang. The coastal ports should also be aggressively marketed.

6.3 The main risks are (a) the denial of adequate maintenance funding to HD; and (b) the cutting back on measures designed to strengthen HD as an institution and to strengthen its ability to effectively manage Thailand's inland waterway and coastal port assets. These risk factors can be addressed by the provision of a realistic maintenance budget and by further training and manpower reforms to ensure a satisfactory level of competence throughout the institution to carry out effective waterway and coastal port management.

## **7. Bank Performance**

7.1 Bank performance during the preparation and supervision of this project has been mixed. Performance during preparation and appraisal was good, but during the supervision phase, a high rate of staff turnover resulted in supervision being provided by five different engineers and three economists in a period of three years, a situation that elicited adverse comment from the Borrower. In addition the Borrower had to deal with 5 different division chiefs. The lack of continuity did not help the Bank's working relationship with the Borrower and executing agencies, and it is to the credit of all those involved that the relationship remained as good as it did.

7.2 The project was well designed and its objectives were realistic in that they reflected the need to reduce transport costs in an environment of rapidly rising fuel prices and represented one of several effective ways of addressing the problem. There were, however, three areas where the Bank made misjudgments. These were in assessing (a) the capability of HD to manage the project efficiently and to provide the maintenance input required for the completed river works; (b) the time required to negotiate the lengthy procurement procedures; and (c) the time needed to acquire the land for the river ports.

**7.3 The lessons to be learnt by the Bank are:**

- a. Continuity of staff responsible for a project is essential for its smooth implementation and for the creation of a mutually beneficial relationship with the Borrower;**
- b. The time needed for procurement processes and land acquisition should be more realistically appraised; alternatively, the receipt of bids for major components and land acquisition could be made a condition of Board presentation, where possible; and**
- c. Where weak institutions are involved in a project, the Bank should press for more technical assistance and training than would normally be necessary and they should be treated more as major components, rather than being tacked on as an afterthought.**

**8. Borrower Performance**

**8.1 During the preparation and appraisal phase of the project, MOTC and HD performed well and were enthusiastic, even anxious, to get the project underway as soon as possible, though, because of a lack of management in the past, the traffic data available to the Bank was skimpy. This performance was possible because of a small number of more experienced people in HD, who were able to devote enough time to enable the preparations for the project to go ahead smoothly. Once the project got under way and it was necessary to involve other staff in the project management, the institutional weakness of HD became apparent and many important aspects of the project were not followed up or executed as expeditiously as they should have been.**

**8.2 HD had to transform itself during the project from an organization that carried out some seasonal channel and river maintenance, pilotage and fee collection to one that had to effectively manage the inland waterways all the year round, as well as fulfill its responsibilities for coastal ports and licensing. It is clear that it could not attract the calibre of staff required to achieve this transformation, even in the time frame of the extended project, and the training provided under the project was either poorly attended or not implemented on the scale that had been intended. Whereas the use of expatriate management advisors has been extensively used in the Thai private sector successfully to assist in managing the booming economy, there is a reluctance by Government to bring such advisors into public sector organizations and reap the benefits from such a move.**

**8.3 The lessons to be learnt by the Borrower are:**

- a. They must do more towards strengthening those weaker institutions which are responsible for important sectors of the economy or infrastructure and place due emphasis on full implementation of training components contained in projects, in order to gain the maximum benefit from the institution-strengthening components included; and**
- b. They should give further consideration to the use of expatriate management advisors, who would work alongside government staff to help them develop the operational and maintenance systems that are essential to keep an investment effective.**

**9. Project Relationship**

9.1 Some good relationships were built up during this project, but the rapidly changing Bank staff situation meant that they could not be used to their full advantage to progress the project, as much staff time was spent on the learning curve and in developing relationships.

**10. Consulting Services**

10.1 HD made much use of consulting services for both the inland waterways and coastal ports components of the project, for feasibility studies (Table 5), design and supervision. In each case, HD chose the firms, which carried out the original feasibility studies, to do the design work, supervision and studies that were part of the project. Both firms of consultants performed adequately, although the French firm responsible for the inland waterways had some difficulty in preparing acceptable tender documents.

10.2 The contractors carrying out the river works, river ports and channel dredging all performed satisfactorily, with only the contractor for Taphan Hin port exceeding the contract period. The standard of workmanship at Nakhon Sawan port was very good.

10.3 Firms supplying equipment being procured under the project produced varying performances, with the overseas suppliers doing rather better than the Thai shipyards involved in constructing some of the floating equipment, some of which has been seriously delayed.

**11. Project Documentation and Data**

11.1 The Loan Agreement contained a number of covenants (Table 6), which were reasonable and which have all been largely complied with by the end of the project, albeit very late, with some actions still in progress.

11.2 The Staff Appraisal Report provided a good framework for the implementation of the project, although it was optimistic on timings.

11.3 Data collection during and since the project has been haphazard and it has not been possible to obtain any consistently monitored traffic figures.

TABLE 1. Project Implementation

Items	Appraisal Estimate			Actual (or PCR Estimate)		
	Contract Signing	Start Date	Completion Date	Contract Signing	Start Date	Completion Date
<b>INLAND WATERWAYS</b>						
Civil Works -						
River Works -						
Chao Phraya	12/01/80	01/01/81	06/30/82	02/26/82	04/12/82	08/22/85
Nan River	11/01/82	12/01/82	06/30/83	06/11/86	07/25/86	09/08/88
Port Works -						
Nakhon Sawan	05/01/82	06/01/82	12/31/83	01/15/87	03/01/87	08/19/88
Taphan Hin	05/01/82	06/01/82	06/30/83	03/20/87	04/06/87	03/20/89
Equipment -						
Cutter Dredgers	04/01/81	04/01/81	03/31/82	Deleted from Project		
Pile Driver Unit	04/01/81	04/01/81	03/31/82	02/13/87	02/13/87	08/15/88
Survey Eqpt	04/01/81	04/01/81	03/31/82	02/26/87	03/27/87	09/15/87
Barges & Tug	04/01/81	04/01/81	03/31/82	12/04/86	01/09/87	02/15/89
Inspection Launches	04/01/81	04/01/81	03/31/82	10/22/85	12/01/85	02/28/88
Cargo Handling Eqpt	01/01/82	01/01/82	12/31/82	07/12/88	07/12/88	01/31/89
Consultant Services -						
Supervision -						
Chao Phraya	12/01/80	01/01/81	09/30/82	09/17/82	03/04/82	08/22/86
Nan River	12/01/80	10/01/82	06/30/83	06/13/86	07/20/86	09/25/88
Port Works	12/01/80	06/01/82	12/31/83	09/17/82	03/01/87	03/31/89
Feasibility & Design	NA		09/17/82	03/04/82	02/28/83	
Prefeasibility Ph 2		NA		04/19/82	04/29/82	01/27/83
Feasibility Ph 2		NA		10/31/86	11/01/86	05/26/88
TA & Training -						
TA for Har Dept	03/01/81	04/01/81	09/30/82	11/29/85	01/13/86	12/31/87
Overseas Trg	03/01/81	04/01/81	09/30/82	11/29/85	01/13/86	12/31/87
<b>COASTAL PORTS</b>						
Civil Works -						
Dredging Works						
	10/01/81	11/01/81	09/30/82	10/09/84	11/14/84	11/13/85
Equipment -						
Hopper Dredger						
	06/01/81	07/01/81	04/30/82	10/10/84	11/10/84	10/09/85
Consultant Services -						
Supervision						
	05/01/81	06/01/81	09/30/82	08/28/81	09/25/82	12/31/85
TA & Training -						
TA for Har Dept						
	03/01/81	04/01/81	09/30/82	06/30/88	07/30/88	07/89
Overseas Trg						
	03/01/81	04/01/81	09/30/82	06/30/88	07/30/88	07/89

**TABLE 2. Project Costs**  
(US\$ '000)

	Appraisal Estimate			Actual		
	Local	Foreign	Total	Local	Foreign	Total
<b>INLAND WATERWAYS</b>						
Civil Works -						
River Works	10,250	10,250	20,500	20,393	9,767	30,160
Port Works -						
Nakhon Sawan	3,400	4,750	8,150	4,496	1,126	5,622
Taphan Hin	1,750	2,000	3,750	1,389	1,389	2,778
Mechanical Equipment -						
Cargo-handling Eqpt	100	700	800	1,127	0	1,127
Maintenance Eqpt	150	600	750	226	1,013	1,239
Floating Craft	350	5,400	5,750	808	0	808
Consulting Services	0	2,250	2,250	0	5,430	5,430
Technical Assistance & Training	50	750	800	43	115	158
<b>Subtotal Basic Costs</b>	<b>16,050</b>	<b>26,700</b>	<b>42,750</b>	<b>28,482</b>	<b>18,840</b>	<b>47,322</b>
Physical Contingencies	2,200	2,750	4,950	0	0	0
Price Contingencies	4,950	8,350	13,300	0	0	0
<b>Subtotal Contingencies</b>	<b>7,150</b>	<b>11,100</b>	<b>18,250</b>	<b>0</b>	<b>0</b>	<b>0</b>
Land for River Ports	1,100	0	1,100	1,100	0	1,100
<b>Total Inland Waterway</b>	<b>24,300</b>	<b>37,800</b>	<b>62,100</b>	<b>29,582</b>	<b>18,840</b>	<b>48,422</b>
<b>COASTAL PORTS</b>						
Dredging Works	1,550	4,500	6,050	815	3,260	4,075
Floating Craft	500	5,000	5,500	65	6,216	6,281
Consulting Services	0	800	800	245	1,536	1,781
Technical Assistance & Training	0	1,000	1,000	56	493	549
<b>Subtotal Basic Costs</b>	<b>2,050</b>	<b>11,300</b>	<b>13,350</b>	<b>1,181</b>	<b>11,505</b>	<b>12,686</b>
Physical Contingencies	300	1,400	1,700	0	0	0
Price Contingencies	750	2,500	3,250	0	0	0
<b>Subtotal Contingencies</b>	<b>1,050</b>	<b>3,900</b>	<b>4,950</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total Coastal Ports</b>	<b>3,100</b>	<b>15,200</b>	<b>18,300</b>	<b>1,181</b>	<b>11,505</b>	<b>12,686</b>
<b>TOTAL</b>	<b>27,400</b>	<b>53,000</b>	<b>80,400</b>	<b>30,763</b>	<b>30,345</b>	<b>61,108</b>

**TABLE 3. Project Financing**

Source	Planned (Loan Agreement) (US\$ '000)	Final		Comments
		(US\$ '000)	%	
<b>IBRD</b>				
Civil Works -				
River Works & Inland Ports	17,000	19,264	113%	
Dredging for Coastal Ports	4,500	3,048	68%	
Equipment	12,000	8,086	67%	
Consultant Services & Training	4,800	9,264	193%	
Unallocated	14,700	0	0%	
Subtotal IBRD	53,000	39,662	75%	
Government	27,400	21,446	78%	
<b>TOTAL</b>	<b>80,400</b>	<b>61,108</b>	<b>76%</b>	

**Comments:** \$11.3 million cancelled on 02/17/87  
\$2.038 million cancelled on 04/13/89



**TABLE 4. Economic Impact**

	Appraisal Estimate	Actual
Economic Rate of Return - Inland Waterways	20%	4%
Coastal Ports - Bandon	16%	13% - based on limited traffic data
Pattani	17%	12% - estimated - no traffic data
Overall (weighted)	20%	6%

**TABLE 5. Studies**

<b>Studies</b>	<b>Purpose as Defined at Appraisal</b>	<b>Status</b>	<b>Impact of Study</b>
<b>Feasibility and Design of Nan River works</b>	<b>Feasibility and Design of Nan River works</b>	<b>Complete</b>	<b>Nan River works included in project</b>
<b>Prefeasibility of Inland Waterways Phase II Project</b>	<b>Not included</b>	<b>Complete</b>	<b>Followed by Feasibility Study</b>
<b>Feasibility of Inland Waterways Phase II Project</b>	<b>Not included</b>	<b>Complete</b>	<b>Phase II Project under preparation</b>

TABLE 6. Status of Covenants

Covenant	Subject	Deadline for Compliance	Status
3.02	Employ consultants and experts acceptable to the Bank	—	Complied
3.04(c)	Prepare Project Completion Report	Within 6 months of completion	Complied
3.05	Acquire all land required for the construction and operation of the facilities included in the project	12/31/81	Completed
3.06	Lease the tug and barges to an experienced, efficient and financially sound operator	03/31/82	In Progress
3.07	Establish and maintain a Waterways Management Division in the Harbour Department	12/31/81	Completed
3.08	Prepare and carry out a training program for the staff of the Harbour Department	03/31/81	In Progress
3.09	Prepare and implement an annual maintenance program for inland waterways and provide details of the program until 1988	06/30/83	Complied
3.10	Prepare and implement an annual dredging program for coastal ports and provide details of the program and channel surveys until 1988	06/30/83	Complied
3.11	Carry out a study on user charges	10/31/81	Completed
4.02	Maintain records on the operations, resources and expenditures in the project	—	Complied
4.03	Maintain and operate machinery and equipment in accordance with appropriate administrative, engineering, navigational and financial practices	—	Complied
4.04	Require the agencies controlling release of water from various dams to ensure that except in abnormally dry years the following amounts of water are available downstream: Below Chainat Dam, 80 cu m/sec Below confluence of Nan and Ping, 200 cu m/sec Below Phrom Phiram Dam, 70 cu m/sec	—	Complied
4.05	Prohibit commercial sand dredging in the Chao Phraya between Ayutthya and Chainat Dam	—	Complied

THAILAND

INLAND WATERWAYS AND COASTAL PORTS PROJECT  
(LOAN 1889-TH)

PROJECT COMPLETION REPORT

I - INTRODUCTION

This Report deals with the second part of the Phase III of the Inland Waterways Project, the so-called Inland Waterways Phase III Construction Project.

This phase is the last touch of the development of Inland navigation on the Chao Phraya and lower Nan Rivers : it consisted of project implementation, following previous phases focussing successively on identification, pre-feasibility and final design.

The Inland Waterways Project was basically aimed at strengthening the transportation system in the Central Plains of Thailand (see map herewith, Appendix 3). It supplements existing road and rail systems connecting Bangkok, Nakhon Sawan and Taphan Hin and provides excellent transport facilities for such goods as agricultural products (rice, maize, tapioca, etc.), mineral ores, petroleum products and construction materials.

Its hinterland covers the whole northern part of Thailand, thanks to the transshipment facilities built under the project at Nakhon Sawan and Taphan Hin.

This project was given a high priority by the Thai government, and as such it was made part of the country's development plan. It was undertaken by the Harbour Department of the Ministry of Communications of the Kingdom of Thailand.

Designed as a means to revive a traditional, cheap and energy-saving mode of transport, it covered all aspects of Inland Waterways development, namely :

- River improvement, by means of river training works designed to provide satisfactory navigation conditions in the channels concerned (Chao Phraya and lower Nan) all year round : the goal was to attain a target, depth of 1.70 m. minimum for standard low flows throughout the project area, thanks to
  - (i) capital works and
  - (ii) subsequent yearly recurrent dredging. The designed channel width is 40 m minimum.
- Inland port construction, at Nakhon Sawan on the Chao Phraya river and Taphan Hin, the uppermost limit of the project on the lower Nan river
- Modernization of the fleet operated through the introduction in Thailand of a pilot pushed-convoy
- Procurement of Maintenance Equipment, including
  - (i) three cutter-suction dredgers, for channel maintenance,
  - (ii) a Pile Driving Unit for the maintenance of river training works and
  - (iii) miscellaneous river maintenance and survey equipment.
- Procurement of Port Equipment for both ports mentioned above
- Institutional adjustments within the Harbour Department (setting up of a division in charge of operation and maintenance of Inland Waterways)
- Training aspects

**This Project Completion Report is based on the various completion and Final Reports submitted by the Consultants in charge of the Inland Waterways Project i.e. :**

- **Inland Waterways, Phase I, Final Report (BCEOM, December 1975)**
- **Inland Waterways, Phase II, Final Report (BCEOM, March 1977)**
- **Inland Waterways, Phase III, Feasibility Study and Final Design, Final Report (BCEOM-CNR-UECC, December 1979)**
- **Inland Waterways, Phase III, Feasibility Study and Final Design of the Nan River Works and Port of Taphan Hin, Final Report (BCEOM-CNR-KECD, October 1984)**
- **Chao Phraya River Works, Final Report (BCEOM-CNR-KECD, 1985)**
- **Supervision of Chao Phraya River Maintenance, Final Report (BCEOM-CNR-KECD, 1986)**
- **Nan River Works, Final Report (BCEOM-CNR-KECD, 1988)**
- **Supply of a Pile Driving Unit, Final Report (BCEOM-CNR-KECD, 1988)**
- **Port of Nakhon Sawan, Final Report (BCEOM-CNR-KECD, 1985)**
- **Other Interim Reports.**

## II - PROJECT IDENTIFICATION, PREPARATION AND APPRAISAL

### II.1 IDENTIFICATION

The project was originally formulated following experimental river training studies and tests on the Chao Phraya River in the sixties (setting up of bottom panels across shallow reaches, under French assistance).

After transferring the responsibility of Inland Waterways to the Harbour Department, the Thai government engaged in a process of development of inland navigation : the high potential of inland waterways indeed was recognized at that time of high cost of energy. The successive phases of the project were as follows (see also summary of documentation and reports above) :

- (a) Inland Waterways Phase I : prepared by the Harbour Department, financed by the French government.

This phase was a review of the Inland Waterways system in the Central plains of Thailand, and an identification of the most suitable projects.

- (b) Inland Waterways Phase II : prepared by the Harbour Department, financed by the French government.

This Phase was the pre-feasibility study of the development of the so-called Northern corridor, i.e. the Chao Phraya/Nan axis. This project, identified as part of the Phase I, proposed an overall development of the Chao Phraya and Nan rivers up to Uttaradit (see map, appendix 3), including :

- (i) river improvement
- (ii) port construction
- (iii) port equipment
- (iv) maintenance equipment
- (v) modernization of the river craft
- (vi) institutional improvements

This phase was completed early 1977. Favourable findings and bright prospects caught the attention of the Thai Government and of the World Bank. This led to the Phase III as mentioned hereafter.

(c) Inland Waterways Phase III - Feasibility Study and Final Design prepared by the Harbour Department, financed by IBRD.

This phase focussed on the sections of the Northern corridor bearing the highest return according to the findings of the Phase II, i.e. :

- River up-grading on the Chao Phraya, up to Nakhon Sawan (380 km from river mouth)
- Construction of a port at Nakhon Sawan and provision of port equipment.
- Preliminary design of three dredgers for channel maintenance, and of a modern push-tow boat and associated barges adapted to Thai river conditions.

This phase was completed in December 1979, along with the drafting of all specifications and tender documents for the Civil Works to be undertaken (river and port).

It also included proposals for institutional adjustments necessary to allow the Harbour Department to manage, operate and maintain waterways and inland ports.

(d) Inland Waterways Phase III - Construction : financed by IBRD, prepared by the Harbour Department.

This phase includes the following items :

- (i) Bidding for and implementation of projects dealt with in the Feasibility Study and Final Design stage referred to in (c) above.
- (ii) Feasibility Study and final design of the Lower Nan River Works and of the Port of Taphan Hin, and then bidding and construction thereof.



- (iii) Final Design of a pilot pushed convoy, three dredgers, and port equipment for both ports mentioned above, and then bidding, construction and delivery thereof.
- (iv) Final Design, bidding, construction and delivery of additional maintenance equipment, namely a Pile Driving Unit and miscellaneous survey and maintenance equipment.

This Phase was therefore restricted to the first section of development of the Northern corridor, i.e. covering the Chao Phraya River and the Lower Nan River up to Taphan Hin only.

This phase as described in (d) herein is that which is specifically dealt with in this Report. Further development of Inland Navigation on the Nan River up to Uttaradit is therefore left for the future, and not concerned with this phase of the Inland Waterways Project.

## II.2 PREPARATION AND APPRAISAL

- (a) The Inland Waterways Phase III - Construction Project is very complex as it involves both (i) feasibility and final design studies and (ii) bidding and construction of civil works and equipment as mentioned above, for a total of nine sub-projects recalled hereafter in a logical sequence :
  1. Chao Phraya River Works
  2. Port of Nakhon Sawan
  3. Lower Nan River Works
  4. Port of Taphan Hin
  5. Constructiton and delivery of a push tow boat and four barges
  6. Construction and delivery of three cutter-suction dredgers

7. Supply of a Pile Driving Unit
8. Supply of miscellaneous River Maintenance and Survey Equipment
9. Procurement of Port Equipment for the ports of Nakhon Sawan and Taphan Hin.

All these sub-projects were prepared by the Harbour Department and implemented with the assistance of Consultants and Contractors/suppliers.

They were originally all part of the loan agreement between the IBRD and the Thai government.

However, the construction and delivery of three cutter-suction dredgers has been removed from the scope of the IBRD-financed project, following proposals from the KfW of Germany.

At the time of drafting of this Report, the fate of this item is still under consideration by the Thai Government.

Besides, three sub-projects are not substantially completed as yet, namely :

- The Port of Taphan Hin, construction of which has suffered significant delays.
- The Push-tow boat and four barges, construction of which has also suffered significant delays (this project is already almost one-year behind schedule)
- Port Equipment for both ports, due to be delivered early 1989.

(b) Generally speaking, the project implemented under this phase III Construction followed closely the principles set forth in the previous phase.

Indeed, rivers were developed by means of free-flow development works. Ports constructed at Nakhon Sawan and Taphan Hin were so at the sites originally planned, and based on the original plans except for some adjustments at Taphan Hin due to land acquisition problems. The river craft was built in line with the original plans, except for some technical adjustments.

The major changes to the project originally defined were in fact

- (i) the removal of the construction and delivery of the three cutter suction dredgers from the scope of the project, as mentioned above,
- (ii) the addition to that scope of the Pile Driving Unit and miscellaneous river maintenance and survey Equipment (items 7 and 8 above). This latter change was readily decided and agreed during the overall project implementation, as it answers to basic maintenance needs identified in the Final Design stage (Final Report, Inland Waterways Phase III, BCEOM/CNR/UECC, December 1979).
- (iii) significant delays suffered in most of the sub-projects, mainly linked to land acquisition-related and administrative problems.

Project results were affected accordingly. Three items are worth noting with this respect

- Firstly, the delay in delivery of the three cutter-suction dredgers has made maintenance campaigns ineffective over the whole Chao Phraya river since completion of related works in July 1985. As a consequence, recurrent dredgings after the high waters of 1985, 1986 and 1987 have been below standard and problems linked to shallow reaches have been repeatedly met in subsequent dry season.

This made navigation difficult and hampered traffic growth. The same is expected in 1988 and probably also in 1989 and, further, as long as there will be a lack of Equipment unless other steps be taken (e.g. contracting out these works).

- Secondly, the Port of Nakhon Sawan was substantially completed by mid 1988, i.e. three years after the Chao Phraya River Works. And even then, this port still lacks its connection to the public water supply system to be built by the Provincial Waterworks Authority (PWVA). This means that transshipment facilities have been missing for three years after completion of the channel of the Chao Phraya, hampng traffic growth accordingly.
  - Thirdly, the pilot pushed convoy aimed at demonstrating to potential private operators the advantages and low operating cost of this modern technique, has not been delivered as yet, due to constructional problems. In the meantime, the lack of economically effective vessels specifically adapted to the conditions of the waterway is another factor hampering traffic growth.
- (c) Besides, institutional improvements have been undertaken rather slowly, and have been hindered by a certain lack of experienced professional staff and adapted equipment. Training and Technical Assistance are still required, and such questions as contracting out part (or all) of the maintenance activities are still open.

Related problems are extremely important since basically the success of the project depends on the performance of management and operation and maintenance activities : the major questions, already outlined at design stage (Final Report, BCEOM/CNR/KEC<sup>TM</sup>, December 1979) are :

- adequate maintenance of the river channel : this covers all aspects of river maintenance, with particular emphasis on
  - (i) dredging requirements (timing and capacity) and
  - (ii) maintenance of Aids to Navigation.
- release by other agencies concerned (RID, EGAT) of the minimum flows required in dry season, i.e. :
  - . 80 m<sup>3</sup>/s in the lower Chao Phraya, below chainat dam
  - . 200 m<sup>3</sup>/s in the Upper Chao Phraya
  - . 70 m<sup>3</sup>/s in the lower Nan River

Further improvements are still necessary within the Harbour Department so that the above requirements, essential for the success of the project, be satisfied. They include

- (i) strengthening of the River Dredging and Maintenance Division of the Harbour Department (organization and planning)
- (ii) Technical Assistance for O&M activities
- (iii) possibly, re-consideration of the principles of maintenance and operation tasks (contracting out part of the works, in particular dredging and Aids to Navigation, under supervision by qualified engineers).
- (d) Although some of the sub projects have suffered significant delays, with overall project completion now expected about 4 years behind the originally planned schedule, the time elapsed between pre-feasibility stage and final completion (about 13 years) is reasonable for this type of project. The Chao Phraya River Works proper have been speedily designed and built : this sub project was completed in three years, which is very short for river training works of such magnitude, and only 9 years after pre-feasibility stage.

Other delays encountered mostly resulted from land-acquisition problems, beyond control and more or less unavoidable, from administrative problems linked to contradiction existing between guidelines of the IBRD and of the Thai Ministry of Finance, and from constructional problems.

But otherwise, the decision-making process was reasonably speedy, resulting in final completion within a very reasonable time after project identification as said above.

- (c) Consultants have been used throughout the project (in fact from identification till final completion), for all studies required (feasibility and final design), bid evaluation assistance and construction supervision. Construction in general has adhered to design principles, apart from technical adjustments necessary because of (i) changing site conditions and/or (ii) technical improvements over the whole project time frame and various other improvements. All such adjustments have been proposed and accepted at construction supervision stage, and made possible thanks to the good cooperation between consultants, contractors and Inspection Committees.

Consultants have also been involved in training activities, both within the project and under separate contracts.

- (f) Identification, preparation and appraisal have concentrated throughout on the right issues :
- . The development of Inland Waterways in Thailand has from the beginning been considered useful and beneficial.
  - . The Phase III - Construction project was devised as a very comprehensive project, covering all components of Inland Waterways.
  - . Designs have been based on most economic investment costs in respect of expected traffic : this led to selecting free-flow developments against more sophisticated projects (dams and locks).
  - . Construction in general has been according to the capacity of the Harbour Department, and satisfactory (except for specific constructional problems for the Port of Taphan Hin and the push-tow boat and barges). Technical results of the river development works have even been excellent : maintenance requirements, in particular recurrent dredging, are well below design estimates, pointing to a very good functioning of the improved channel.
  - . Institutional and related training aspects have been pinpointed at an early stage, and steps have been taken to strengthen the capability of the Harbour Department to manage, operate and maintain the project works. But there is still ample room for improvements in this respect, and further technical assistance requirements should be considered, as well as ways to improve operation and maintenance procedures.

### II-3 Targets and goals

- (a) The goal of the project is to improve inland navigation on the Chao Phraya and Nan river, from the river mouth up to Taphan Hin. This involves all components of Inland Waterways Development, namely (i) river and channel upgrading, (ii) construction of transshipment facilities at carefully-selected sites, (iii) provision of operation and maintenance equipment, (iv) modernization of the fleet, and, finally, (v) training and organizational aspects.
- (b) The limitations of the project were clearly set out in the Final Design Report of 1979. These limitations result from the type of river development proposed (free-flow scheme) as more sophisticated and costly projects (dams and locks) were not considered economically feasible at this stage in respect of traffic forecasts. These are reserved as long-term development prospects depending on the evaluation of economic conditions.

The main limitation is the depth restriction in dry season, down to 1.70m minimum over the whole project area from Ang Thong to Taphan Hin. This depth is understood for standard low flows as indicated in II-2 (c) above, it results from hydraulic constraints.



- (c) Maintaining this minimum depth over the whole dry season requires recurrent dredgings, to be carried out every year at the end of the flood recession period. The project is entirely based on the assumption that these recurrent dredgings are properly performed, river training works and vessels were designed accordingly. The economic evaluation also was based on this assumption.

As mentioned in II-2 (f) above, the design of the channel proved good and viable technically speaking as evidenced by post-project investigations pointing to a satisfactory behaviour of the channel (recurrent dredging requirements are about 25% below the estimated requirements). The project as completed is altogether a fine technical achievement, it makes a sound basis for navigation improvement : it is now the main target to improve O&M so that the project work satisfactorily. Such improvement is essential.

- (d) The Inland Waterways Phase III Construction project is part of a long-range program of Inland Waterways Development.
- It is the first step of the development of The 'Northern Corridor' up to Uttaradit on the Nan River. The original master plan indeed provides for river up-grading up to Uttaradit, about 270 km. north of Taphan Hin, and for the construction of Port facilities at Pitsanulok and Uttaradit.

It is part of a system of waterways comprising the Pasak river and various canals connecting waterways of the Central plain. Within this system, the Chao Phraya is the backbone of central Thailand, the main artery linking the rich agricultural regions of central and northern Thailand to the Bangkok hub and the Gulf of Thailand. The project thus opens direct links between these regions, the Bangkok area and the deep-sea ports of the Eastern-sea board, allowing sizable transport cost reductions and favouring export-oriented activities.

This project is therefore highly beneficial to the transport sector, and to the country's economy in general.

- (e) Reasonably reliable information was available at design time to allow realistic assumptions and results based on sound forecasts and projections. However, the economic content has significantly changed during the time elapsed between feasibility stage and final completion :
- the country's growth has been rapid
  - energy prices have fluctuated. These are an important factor of the project feasibility, the present situation should be re-assessed accordingly.
  - the time taken for completion has been much longer than originally expected. As a result (i) maintenance procedures have been erratic, (ii) maintenance of the river and appurtenant works should be organized and personnel trained for maintenance of the the river and of the Port of Nakhon Sawan and (iii) traffic growth has been hampered as reported in II-2 (b) above.

- (f) Since the investments required for river improvements and port construction have been made, priority should now be given to management and O & M aspects. A complete re-assessment of (i) the economic situation, (ii) the adequate O & M procedures to be set up, (iii) technical adjustments and/or improvements which would be possible after completion and (iv) further training and technical assistant requirements should be undertaken.

Technical adjustments advisable to this stage include the following :

- to investigate the possibility of eventually increasing the minimum guaranteed depth thanks to systematic maintenance procedures as such a possibility seems to exist according to technical post-project investigations.
- to improve the Aids to Navigation and to improve the existing and to reduce future maintenance costs and facilitate the task of maintenance teams.
- to revise the optimum type and size of river craft taking into account present economic conditions.
- to develop maintenance centers for the Equipment operated by the Harbour Department.
- to improve the economic data collection system in accordance with the previous Consultant's recommendations.

All this may involve additional investments (river works, maintenance centers, etc.) strengthening of the organization in charge of river management and O & M, promoting the waterway including broad publicity regarding the river craft and the hydro-information.

### III - PROJECT IMPLEMENTATION AND COST

Construction of the first of the 9 sub-projects making up the Inland Waterways Phase III Project started in March 1982. The original time frame of 37 months for the whole project has been extended, final completion of the last sub-project is now expected early 1989 i.e. with an almost 4 years delay.

#### III - 1-START-UP

Whereas decisions were rather speedily taken in the start-up period, problems of land acquisition at Nakhon Sawan and Taphan Hin soon faced the Harbour Department. A time-consuming process was engaged, which finally resulted in the following :

- at Nakhon Sawan, construction was delayed until final settlement of the problem. Port works finally started in January 1987, i.e. with an approximate 3.75 years delay (see section III-3 hereafter).
- at Taphan Hin, construction also was delayed until final settlement of the problem. Port works finally started in April 1987, i.e. with an approximate 4 years delay (see section III-3 hereafter).

In addition, and owing to the specified land conditions at Taphan Hin, construction of this port was split into 2 stages : the first stage to be started first on plots of land available, including only (i) the administration area and (ii) port of the general cargo area. Both areas were separated by unavailable land plots, and the road and rail access road as well as the overall port platform could not be made part of this stage.

Happily, after the commencement of the works, most of the land plots required for the 2nd stage were made available, and most of the 2nd stage works were finally added to the on going 1st stage works. This included inter alia (i) the main access road (ii) the completed general cargo area

- (iii) the platform between general cargo and administration areas and
- (iv) the extension of the slope protection all along the port waterfront.

### III - 2-REVISIONS

Implementation of the construction project proper was based on the following:

- Final design made as part of a previous study phase (feasibility study and final design, BCEOM/CNR/UECC, 1979). This concerned the Chao Phraya River Works and the Port of Nakhon Sawan.
  - Final design made as part of studies included in this phase of the project (feasibility study and final design of the Nan River Works and Port of Taphan Hin, BCEOM/CNR/KECD, 1982-1983). This concerned the Nan River Works, the Port of Taphan Hin, Port Equipment, a Pile Driving Unit, a Push-tow Boat and four barges, miscellaneous river maintenance and survey equipment, three cutter-section dredgers.
- (a) all sub-projects mentioned above, including those whose Final Design was carried out as a component of this project, were finally implemented except the three cutter-section dredgers. This item has already been mentioned in section II above, construction of the dredgers have been taken out of the current project following proposals from the Government Federal Republic of Germany to finance this sub-project through a loan from KFW.
- (b) Major changes in the project scope, except for schedules which are separately dealt with in III-3 hereafter, have already been mentioned herein :

1. removal of the construction of 3 cutter-section dredgers from the scope of the project.
2. addition of the construction of a Pile Driving Unit and miscellaneous River Maintenance and survey equipment to the scope of the project.
3. other changes are mostly technical adjustments due to various reasons as detailed hereafter.

Besides, changes mentioned in 1 and 2 above, as well as a drastically modified schedule have required significant changes in the supervision services of the Consultants. Altogether, 6 Addenda and two Memoranda extending supervision services have been signed between the Harbour Department and Consultant as detailed hereafter.

The following paragraphs successively deal with (i) technical changes brought during construction, for all sub-projects concerned, and (ii) changes to the scope of the Consultants' services.

- (c) Technical revisions during the course of construction have mostly been the result of (i) adjustments necessary due to changes in site conditions during design stage and construction stage, (ii) adjustments necessary to stick to latest engineering standards as required in various contract, (iii) improvements brought about in the light of experience at specific sites, or by late technological advances and (iv) external requirements (such as for instance conformity with standards or requirements of external agencies and/or problems of availability on the local market).

It is worth noting that none of the technical changes, except those resulting from additional works required by the Harbour Department or proposed by the Consultants and approved by the Harbour Department,

have resulted in cost increases and/or overruns as they have been made with a permanent concern for cost-related aspects. This means that improvements brought into some parts of the work for any sub-project and causing cost increases, have been compensated by equivalent saving on the items of the same sub-projects made possible by experience and technical advances, without in any way lowering the quality of works in other works, the only final sub-project cost increases recorded have been the sole result of variations of quantities, changes of legislation and price escalation, while the quality of the works has been kept in accordance with the standards of the specifications and, in a number of cases, significantly improved.

The main technical revisions are summarized hereafter :

- Chao Phraya River Works

The main change concerned the strengthening of most groynes (particularly those filled with sand) by additional rock rip rap protections. Based on investigations made during the course of works (one year after commencement), it was decided to modify the design of groynes by adding much protections all along the groynes, which allowed to reduce the driven length of steel piles forming the core of the groynes. The modified design was worked out on the basis of test made in river, during construction, which pointed to a better behaviour of groynes otherwise prone to erosion when submerged.

This was made in accordance with the contract, which provided for such possibility. The extra-cost due to the additional quantity of rock rip rap was entirely compensated by savings on pile length. The revision thus allowed better technical results at no additional cost.

**- Port of Nakhon Sawan**

A number of design revisions were proposed by the Consultants and/or the Contractor, and approved by the Harbour Department. Altogether, they were improvements compared to the original design, mostly due to the long time gap between the Final Design (drafting of Specifications and Tender Document in 1979) and commencement of works (in 1987). The overall additional cost due to these changes was nil the total actual project cost being very slightly below the Contract Price.

Items worth a mention are as follows :

- the wharf has been strengthened.(additional piles) so as to conform to the latest standards issued after drafting of the Specifications.
- the slope protection has been smootened. with a final slope at 3/2 instead of 4/3. This revisio<sup>n</sup> was necessary because of erosions recorded in the river since completion of the design phase, refusing the overall bank height to be increased.
- the drainage system access both road and rail access has been significantly changed, so as to take into account physical changes which took place after completion of the design phase : the construction of a road running along the port site, modifying the drainage conditions of the whole lowland area situated behind the port. The revised design took into account this road and its drainage system.
- the port drainage was modified, and additional drainage and utility outlets were placed across the railroad on the area left for future extension. This step will allow to avoid excavations under that railroad in the future, when the time comes to extend the port facilities.
- the design of the railroad and rail access was revised to take into account the requirements of the State Railways of Thailand (subbase, turnouts, slopes, etc.)



- The water supply system was changed, so as to take into account the recent extension of the previously non-existing public water supply system : reservoirs recently built by the Provincial Waterwork Authority of Thailand were considered a better source of water than the well/water tower system originally designed, and it was decided to connect the Port to this new public system. Related connection works, to be by the Provincial Waterworks Authority of Thailand are still to be completed.
- earth-slopes along the port area, the road access and the railroad access have been further protected against damages caused by rainwater, by means of additional top-soil covers and grassing.
- the number and location of dolphins originally provided for along the future extension area have been modified so as to (i) allow proper mooring space for barges waiting for loading/unloading and (ii) keep future developments open on the extension area.
- the Fender system was improved according to the proposal of the Contractor. This tender system was finally made of steel, instead of wood as originally provided for.
- other miscellaneous modifications of products/materials entering construction local products have been used as far as practicable and in so far as Contract provisions and standard so allowed.
- Nan River Works

Design modifications proper have been scarce, and mostly the result of (i) adaptation to site conditions and (ii) experience drawn from the Chao Phraya River Works.

Characteristics of groynes in general were conform to the Contract design, but details and dimensions were adapted to the Conditions prevailing at the time of construction, according to revised designs made by the Consultants as provided for in the Contract.

The main modifications worth a mention are as follows :

- signs on land have been made of aluminium boards tied on concrete legs, instead of steel as originally designed.
- a new type of buoy has been tested during construction. This buoy was designed by the Consultants so as to avoid as far as practicable the trapping of weeds, floating plants and debris flowing down river in medium and high water stages. Tests performed gave satisfactory results, and a total of 30 such buoys were finally placed. Long term behaviour of the system however still has to be monitored, and compared with that of other types of buoys.
- inclined staff gauges have been designed, in place of vertical ones.
- Besides, a total of 4 new bank protection sites have been added to the project at the request of the Harbour Department. These additional bank protections concerned sensitive and critical areas. Three of them have been built according to conventional designs by the Consultants, the fourth one has been fitted with concrete steps forming protection and providing recreational space in town. This bank has been further reinforced with a shoulder raised above low water levels due to the very poor quality of soil material, after soil investigations made at the request of the Consultants and approved by the Harbour Department.

- Port of Taphan Hin

The general layout of this port had been modified as part of the Final Design study (1982 - 1983) at the request of the Harbour Department so as to allow works to start on land plots available (see III-1 above).

First stage works were then launched in April 1987, but land availability conditions in subsequent months finally allowed to include most of the 2nd stage works within this project and at no additional cost (see II-1 above). The main related additions were thus :

- the construction of the main access road : originally excluded from the first stage works because of land unavailability, this road was finally built after soil investigations were carried out in accordance with the Contract.
  - the platform between the Administration area and General Cargo area was finally completed, allowing a slight extension of the General Cargo area according to the final layout of the 2nd stage.
  - the slope protection has been extended all along the waterfront of the port, in accordance with the 2nd stage requirements. Besides, the slope have been graded at 3/2 instead of 4/3.
  - the Fender system has been improved : the design is similar to that approved at Nakhon Sawan, and adapted to specific conditions of Taphan Hin.
  - other miscellaneous modifications of lesser importance, concerning mostly products and/or materials entering construction (sand for fills, additional filter layer, etc.). Local products have been used as far as practicable and in so far as Contract provisions and standards so allowed.
  - Push-tow boat and four barges  
There is no major deviation compared to the original Tender, except for some technical adjustments linked to (i) latest models produced by certain suppliers (ii) availability or unavailability of certain products and (iii) classification society requirements.
  - Pile Driving Unit  
See above 'Push-tow boat and four barges'.
  - River Maintenance and Survey Equipment  
No change compared to Tender proposals.
  - Port Equipment  
This item has not been delivered yet, however no change is expected in the scope of supply compared to the Contract requirements based on the Final Design findings.
- (d) Change in the Consultants' services  
The Consultants' services have been adapted throughout the implementation period to best fit actual supervision requirements. Change in Consultants' services were therefore linked to (i) supervision requirements and (ii) actual schedules of various sub-projects.

Altogether, the Consultants' services were expected to last 37 months. Although the actual completion date is still unknown, it is anticipated that the total time frame will finally cover 82 to 85 months.

As already mentioned, the Consultant's original Contract has been supplemented with 6 Addenda and 2 Memoranda of Understanding as follows :

- Addendum No.1 (1984) : This addendum provided for the removal of supervision services concerning the Nan River Works from the original Contract. This Addendum was the result of the delay of the Nan River Works.
- Addendum No.2 (1985) : This addendum provided for an extension of the Consultants' services to cover the time-extension granted to the Contractor in charge of the Chao Phraya River Works.
- Addendum No.3 (1986) : This addendum provided for additional Consultant's services required to supervise the maintenance period of the Chao Phraya River Works.
- Addendum No.4 (1986) : This addendum covered the supervision of the delayed and revised Nan River Works.
- Addendum No.5 (1987) : This addendum covered the additional services required for (i) bid evaluation assistance and (ii) construction supervision of the Port of Nakhon Sawan and Taphan Hin.
- Addendum No.6 (1988) : This addendum covered additional Consultants' services required for the supervision of construction of (i) a Pile Driving Unit and (ii) River Maintenance and Survey Equipment, Delivery of Port Equipment and bid evaluation assistance thereof.

- Memorandum of Understanding for the extension of the supervision of the Nan River Works (1988) : This memorandum provided for the extension of the Consultants' services required for the supervision of extended Nan River Works.
- Memorandum of Understanding for the extension of the supervision of the Taphan Hin Port Work (1988) : This memorandum concerns Consultants' supervision services extended to cover delayed Port Works at Taphan Hin.

All additional and extended Consultants' services as described above were justified according to actual working and timing requirements.

### III - 3- IMPLEMENTATION SCHEDULE

The comparison of actual and expected schedules is summarized in the Table 1 of Appendix 1 herewith.

- (a) As can be seen only the Chao Phraya River Works were almost completed within the original schedule. None of the other sub-projects started on or before the original completion date.

Note that (i) Port works were delayed as aforesaid mostly because of problems related to land acquisition.

(ii) The Nan River Works were then delayed accordingly, pending approval of this sub-project linked to the implementation of the Port of Taphan Hin Works.

(iii) Procurement of Port Equipment was delayed according to Port Civil Works.

(iv) The Push-tow boat and barges construction was delayed mostly for administrative reasons, such as late approval of Tender Documents and differences between Tender Conditions as

required by IBRD and those of the Ministry of Finance of the Government of Thailand.

(v) The Pile Driving Unit and River Survey and Maintenance Equipment were not part of the original plan. However, both were completed before all other Equipment supplies.

(vi) Further delays for the Nan River Works, Port Works and Procurement of Equipment have been due to differences between Tender Conditions and guidelines issued by IBRD on one hand and those of the Thai Ministry of Finance on the other hand.

(vii) Constructional delays linked to slow and erratic progress by some Contractors and/or Suppliers (Port of Taphan Hin, Push-tow boat and barges) have sizably increased the time taken by corresponding sub-projects, and will finally bring about an additional overall project delay estimated to between 6 and 9 months under the present circumstances.

- (b) Some of the causes of delays as reported above had been anticipated to some extent : schedule for land acquisition process, and for (i) approval and (ii) administrative process proved optimistic. The real nature of most causes of delays above however shows that these were more or less unavoidable, or beyond control.
- (c) Delays and disruptions in the project can be considered to have sizable effects on the project results, in terms of potential traffic lost. Traffic losses are difficult to evaluate, they may result either from loss of confidence of private users in the waterway, or from alternative investments made by private users in other transport modes (rail and road). Once traffic has been diverted away from the river, it is difficult to get it back to the river within a short period.

- (d) In summary, the original time schedule can be considered as optimistic.

### III - 4-PROCUREMENT

- (a) The major problem which faced the Harbour Department during project implementation resulted from conflicting guidelines between IBRD and the Ministry of Finance.

The Harbour Department is required to follow the guidelines of the Thai Ministry of Finance according to the regulations in force. The loan agreement with IBRD on the other hand implies that IBRD's guidelines be adhered to. Reconciling somewhat conflicting guidelines proved difficult and time-consuming. Related delays in some sub-projects are estimated to be several months.

- (b) There was no major disagreement or claim so far in procurement and Contract procedures with Consultants, Contractors and Suppliers, except those related to slow and erratic progress (Contractor for the Port of Tsphan Hin, Supplier for the Push-tow boat and barges).

- (c) The extent of local procurement proved greater than expected : all Civil Works were contracted to Thai Contractors. shipyards in charge of the Construction of the Push-tow boat, 4 barges and the Pile Driving Unit were all Thai shipyards. Local products were used as far as practicable and to a large extent in all Civil Works and only goods having no local equivalent of required standards have been imported.

- 2.2% for physical contingencies.

Besides, the bid price in bahts was about 5.9% above the Engineer's estimate corresponding to economic conditions of August 1979.

Converted into US dollars, the bid price was lower than the estimated cost of August 1979 because of variations of exchange rates in the meantime.

2. Port of Nakhon Sawan : the final cost was almost equal to the Contract Price. Price and physical contingencies actually needed were therefore nil.

The bid price was about 33.5% below the Engineer's estimate.

3. Nan River Works : the final cost was about 14.7% above the bid price. These 14.7% break down into :

- 4.7% for price contingencies.
- 10% for physical contingencies. These 10% result from the additional bank protection works ordered by the Harbour Department. Without such additional works, the final cost of this sub-project would have been 5.5% below the bid price.

The bid price was about 24.2% below the Engineer's estimate.

4. Port of Taphan Hin : the latest estimated cost is within the Contract Price, although a number of items have been added to the 1st stage works as mentioned herein. Price and physical contingencies actually needed were therefore nil.

The bid price was about 35.3% below the Engineer's estimate.



Bid prices and final costs of (i) the Port of Nakhon Sawan, (ii) the Nan River Works and (iii) the Port of Taphan Hin are all below the prices estimated at appraisal, i.e. at Final Design stage (August 1987 for Nakhon Sawan, July 1982 for the Nan River and the Port of Taphan Hin).

5. Equipment : none of the Equipment concerned was subjected to any price increase due to either price or physical contingencies. But liquidated damages were paid by suppliers for :
- (i) the Push-tow boat and four barges (10% of Contract Price)
  - (ii) the Pile Driving Unit (7.8% of Contract Price)

There was consequently no cost overrun for these items.

Bid prices for (i) the Push-tow boat and four barges and (ii) the Pile Driving Unit were well below the Engineer's estimate (respectively 10 % and 41%). This was mostly due to low prices proposed by local suppliers, much cheaper than those of foreign firms.

The bid prices of Port Equipment were closed to the Estimate ( 3.9 %).

The bid prices of River Maintenance and Survey Equipment was about 35% above the Engineer's Estimate : this was principally due to wide fluctuations of exchange rates at the time of bidding (in particular concerning the Swiss Franc and the Japanese Yen, the main currencies involved in the bid).

- (d) Generally speaking, international competitive bidding raised up keen interest among Contractors, and competition has appeared fair and stiff : most of the Civil Works and goods procured have been so at prices well below the Engineer's estimates.
- Bid evaluation has been conducted systematically first on technical grounds, then based on price comparison for responsive bidders. For all Civil Works, the lowest bidder was selected according to whether proposals were responsive. For the procurement of goods, the lowest responsive bidder has been selected. As aforesaid, problems have been encountered for two items :-
- the Port of Taphan Hin
  - the Push-tow boat and barges
- (e) Consultants engaged under the project were groups of Consultants formed between foreign and local consulting firms. This procedure is in accordance with the Thai regulations.

### III-5 COSTS

The comparison of actual costs and original estimates is summarized in the Table 2 of Appendix 2 herewith.

- (a) Actual costs are real costs as paid under the various sub-projects, for all such sub-projects already completed. For others (Port of Taphan Hin, Push-tow boat and barges, Port Equipment), they are the latest estimates. For Consultant services, costs are also the latest estimates.

The range of accuracy of actual costs is as follows :

- Chao Phraya River Works, Nan River Works, Port of Nakhon Sawan, Pile Driving Unit, River Maintenance and Survey Equipment : the related costs are real costs.
- Port of Taphan Hin : the actual cost given in the Appendix 2 is the latest estimated cost, considered to be within 5% of the final cost. Besides, the amount of liquidated damages remains uncertain.
- Push-tow boat and barges : the actual cost given in the Appendix 2 is the estimated final cost, taking into account 10% liquidated damages due by the Seller. Further possible cost variations resulting from problems at delivery are not considered here.
- Port Equipment : the actual cost given in the Appendix 2 is the final cost for this "off-the-shelf" Equipment (except in the case where liquidated damages would be due).
- Consultants' services : the actual cost is the latest estimated cost, it does not take into account possible extra services linked to the supervision of delayed items (Port of Taphan Hin, Push-tow boat and barges). It can be considered within to be 5% of the actual final cost.

(b) Physical and price contingencies at appraisal were adequate, as evidenced by the following details by sub-project :

1. Chao Phraya River Works : the final cost was only about 7.5% above the bid price. These 7.5% break down into :
  - 5.3% for price contingencies, including 1.1% paid to the Contractor in compensation of business tax increase after bidding, as required in the Contract (under the heading "change in costs and legislation").

6. Consultants' services : the final cost of these services is noticeably in excess of the original Contract. This is due to :

(i) additional services requested by the Harbour Department and/or necessary for proper supervision : this concerns the additional services provided for the supervision of the maintenance period of the Chao Phraya River Works, the supervision of the Nan River and Port Works, the extension of supervision of the Chao Phraya River Works, and the supervision of Equipment not included in the original scope (Pile Driving Unit, River Maintenance and Survey Equipment).

(ii) Constructional delays and general project delays.

### III-6 FINANCIAL SOURCES

Financing of the Project was under the loan agreement between IBRD and the Thai Government relating to the "Inland Waterways and Coastal Ports Project".

Consultants' services were financed 100% by the World Bank, whereas Civil Works and Procurement of Equipment were financed partly by the World Bank and partly by the Thai Government, in accordance with the provisions of the loan agreement.

(a) Final expenditures were less than the original expectations, due to (i) the low prices of most sub-projects compared to original estimates and (ii) the very small amount of price and physical contingencies actually used.

- (b) Expenditures were delayed according to delays of the various sub-projects. Reasons for these delays have already been dealt with herein (section III-3).

#### III-7 PERFORMANCE OF CONSULTANTS' CONTRACTORS AND SUPPLIERS

- (a) the contribution of Consultants was very comprehensive, including project design and revisions thereof, construction supervision, inspection upon delivery, commissioning, tests and trials, and partial training of Harbour Department staff.

The services provided were excellent throughout, a fact evidenced by the satisfactory behaviour of the river channel and training works in general and the adequacy of supplies.

- (b) the construction of (i) the Chao Phraya River Works (ii) the Nan River Works and (iii) the Port of Nakhon Sawan gave rise to no constructional problem. Construction proceeded smoothly, and the performance of Contractors was satisfactory.

- (c) the same applies to the supply of River Maintenance and Survey Equipment and, to some extent, to the Pile Driving Unit, although delivery of the latter was effective with about 2.5 months delay.

- (d) Construction the Port of Taphan Hin, not completed yet, has proved erratic, slow and has given rise to a number of constructional and other problems. Strict and very close control from the Consultants has been necessary to maintain satisfactory standards of construction, and the final constructional delay is estimated to about 6 to 8 months.

- (e) Construction of the Push-tow boat and barges also has proved erratic and slow. The delay at present is almost one year compared to the Contract schedule, and the performance of the equipment as tested upon delivery is below the requirements of the Contract. Remedial measures are therefore necessary, this will bring about further delays.

#### IV - TRAFFIC AND OPERATIONS

Owing to (i) various disruptions in sub-projects scheduled sequences and to (ii) the overall project delay, traffic has not grown as rapidly as expected. It is in fact too early to assess the actual traffic growth generated by the project, for the main following reasons :

1. Parts of the project are not completed or delivered : Port of Taphan Hin Civil Works, Water Supply connection of the Port of Nakhon Sawan, Port Equipment delivery at both Ports, Push-tow boat and four barges.

This latter item is considered essential to boost the interest of the private sector : waterways will be viable only if the river craft is modernized.

2. Although the Chao Phraya River Works were completed in 1985, traffic growth has been hampered by (i) the non-existence of port facilities (the Port of Nakhon Sawan was completed three years after the Chao Phraya, by mid 1988, and still lacks its connection to the public water supply system).

(ii) the insufficiency of operation and maintenance activities. This is mostly due to an obvious lack of equipment (dredgers necessary for the project have not been supplied as yet), and to a certain extent to a lack of adapted organizational facilities and trained staff. The administrative red tape makes it difficult to cope with the day-to-day maintenance requirements, particularly during the critical periods.

V - FINANCIAL PERFORMANCE OF THE EXECUTING AGENCY

It is too early to deal with this item.

VI - ECONOMIC REEVALUATION

It is too early to deal with this item.

VII - CONCLUSIONS

- (a) The Inland Waterways - Phase III - Construction Project is not completed yet, but indications already exist concerning (i) the technical results and (ii) steps to be taken to develop traffic and attract users.
- (b) This project has been marked by significant delays due to various reasons, in particular land acquisition problems and constructional delays. Altogether, it will be completed almost 4 years behind schedule.

- (c) Technically speaking, parts of the project already completed are satisfactory : the channels behave better than expected, recurrent dredging requirements are below the estimates, river training works work well. Ports have adequate facilities, and equipment supplied are up to the required standards. Aids to Navigation however will require improvements, to be made as part of the maintenance activities, and according to tests made under the Nan River Works (see III-2-(c)). Costs have been kept within the estimates.
- (d) Traffic growth so far has been hampered by (i) project delays and disruptions, (ii) delays of delivery of the pilot pushed convoy and (iii) insufficient maintenance.
- (e) Emphases should now be placed on operation and maintenance activities, particularly as regards river works : recurrent channel dredging (planning, timing, execution ) and related tasks (hydrographic surveys, hydrologic records), maintenance of Aids to Navigation and of river structures.
- Adequate operation and maintenance procedures should be re-considered, such as the possibility to contract out part of the maintenance tasks, as well as further technical assistance requirements.
- (f) Maintenance works should be facilitated through a reinforcement of the facilities of the Harbour Department : this includes maintenance centers that could be set up for the Inland Waterways.
- (g) Promotion is still badly needed, in particular as regards (i) the conditions of navigation, available draft, etc. (ii) the information systems to be developed and (iii) suitable river craft to be developed.



APPENDIX 1 - TABLE 1

INLAND WATERWAYS PHASE III - CONSTRUCTION PROJECT  
ACTUAL AND EXPECTED PROJECT IMPLEMENTATION

PROJECT COMPONENT	CONSULTANT		CONTRACTOR		DATES OF								% of work completed by expected completion date
	NAME	NATIONALITY	NAME	NATIONALITY	Bid Receipt		Contract Award		Beginning of Work		Completion of Work		
					Actual	Expected	Actual	Expected	Actual	Expected	Actual	Expected	
1. Chao Phraya River	BCEOM/CNR KECD	French/Thai	Italian- Thai D.C.	Thai	JUL 81	JUL 81	MAR 82	MAR 82	MAR 82	MAR 82	JUL 85	MAR 85	Approx. 95%
2. Nakhon Sawan Port	"	"	"	"	MAY 86	JUL 82	JAN 87	APR 83	JAN 87	MAY 83	APR 88	AUG 84	OX
3. Nan River	"	"	"	"	NOV 85	JUL 83	JUN 86	DEC 83	JUL 86	JAN 84	JAN 88 (3)	JUL 84	OX
4. Taphan Hin Port	"	"	RET SER/ ASAE J.V.	Taiwan/Thai	AUG 87	NOV 82	MAR 87	APR 83	APR 87	MAY 83	FEB 89	MAY 84	OX
5. Push-Tow Boat & Four Barges	"	"	Thonburi Shipyard	Thai	JAN 86	JUN 83	DEC 86	OCT 83	JAN 87	NOV 83	FEB 89 (3)	SEP 84	OX
6. Pile Driving Unit	"	"	R.T.S. Engineering	"	MAY 86	N/A	MAR 87	N/A	MAR 87	MAR 87	JUN 88	MAR 88	-
7. River Maintenance & Survey Equipment	"	"	3 separate suppliers for imported goods	Thai	(1) OCT 86	N/A	MAR 87	N/A	MAR 87	MAR 87	SEP 87	SEP 87	-
8. Port Equipment	"	"	4 separate suppliers for imported goods	Thai		AUG 83	JUL 88	FEB 84	JUL 88	MAR 84	JAN 89 (3)	AUG 84	OX

(1) Second Bidding

(2) Substantial completion

(3) Estimated completion date (item still not completed)

APPENDIX 2 - TABLE 2

INLAND WATERWAYS - PHASE III - CONSTRUCTION PROJECT

ACTUAL AND ORIGINAL ESTIMATES OF PROJECT COSTS

	ACTUAL COST			CONTRACT AMOUNT IN US\$ EQUIVALENT	ORIGINAL ESTIMATE OF COST			ACTUAL COST AS A PERCENTAGE	
	LOCAL (IN BAHT)	FOREIGN (IN US\$)	TOTAL IN US\$ EQUIVALENT		LOCAL COMPON. (IN BAHT)	FOREIGN COMP. (IN US\$)	TOTAL IN US\$ EQUIVALENT	ORIGINAL EST. COST	CONTRACT AMOUNT
1. CHAO PHRAYA RIVER <sup>(1)</sup>	370,300,000	6,943,000	23,100,000	21,500,000	344,648,000	6,450,000	22,683,000	101.8%	107.5%
2. PORT OF NAKHON SIAM	114,660,000	1,125,500	5,622,000	5,622,000	172,400,000	1,630,000	8,450,000		
3. NAN RIVER <sup>(2)</sup>	108,018,000	2,824,000	7,060,000	6,157,000	165,660,000	1,624,000	8,121,000		
4. PORT OF TAPHAN HIN <sup>(3)</sup>				2,777,500					
5. PUSH TOW BOAT & BARGES				808,000					
6. PILE DRIVING UNIT <sup>(2)</sup>	5,751,300	646,000	871,500	871,500					
7. RIVER SURVEY EQUIPMENT <sup>(2)</sup>			367,000	367,000			256,000 <sup>(3)</sup>	143.4%	100%
8. PORT EQUIPMENT <sup>(2)</sup>									
9. CONSULTANTS' SERVICES					13,112,000	2,698,000	3,336,600		

(1) USING AN EXCHANGE RATE OF US\$ 1 = 22.9 BAHTS FOR ACTUAL COSTS AND CONTRACT AMOUNT AND US\$ 1 = 20.5 BAHTS FOR ORIGINAL ESTIMATE OF COSTS.

(2) USING AN EXCHANGE RATE OF US\$ 1 = 25.5 BAHTS FOR ACTUAL COSTS, CONTRACT AMOUNT AND ORIGINAL ESTIMATE OF COSTS.

(3) EXCLUDING CUSTOMS DUTIES AND TAXES ON IMPORTED GOODS.



No. 0509/ 000788

Harbour Department,  
1278 Yetha Road, Talardnoi,  
Samphanthawong District,  
Bangkok 10100, Thailand.

๒ February B.E. 2533 (1990)

Dear Sir,

Subj: THAILAND - Inland Waterways and Coastal Ports Project  
(LOAN 1889 TH) Project Completion Report

We acknowledged the receipt of your letter dated December 20, 1989 with sincere thanks for the project completion report. The Harbour Dept. would like to draw your attention to the following comments :

1. The survey of water transport volume in the Central Basin area was exhaustively done in 1976 before the project commencement in order to obtain data for preparation of an appropriate scheme for water transport and a long-term water transport development plan. The study was carried out for 18 months (January 1976 - June 1977) under the sponsorship of the French Government with the purpose to study the cargo volume, types of cargoes transported by inland waterways, ship's movement, and the types of vehicles used in the inland waterways.

Normally our project has to follow the following procedures :

1. Conception
2. Formulation
3. Analysis and Appraisal
4. Approval
5. Implementation
6. Reporting and Feedback
7. Transition to Normal Administration
8. Evaluation

Mr. Graham Donaldson,  
Chief Agriculture, Infrastructure and  
Human Resources Division,  
Operations Evaluation Department,  
IBRD 1818 H. Street N.W.,  
Washington D.C. 20433,  
U.S.A.

With regard to the Inland Waterways Development Project, it is now on the seventh procedure i.e. transition to normal administration as the subproject for the supply of dredgers has not yet been finished.

Upon the completion of the selection of operators for Nakhon Sawan and Taphan Hin Ports and a set of four steel barges and a pusher tug, the project will step into the eighth procedure i.e. evaluation of the project. At this stage, the exhaustive study of data and information will be collected again for the purpose of evaluation. Hence, it is likely too fast to state in the IBRD's report that the project appraisal is currently only 6% compared with the primary appraisal of 20%.

2. The project implementation was long delay beyond what had been plan, this was due to the conflict between the Thai Ministry of Finance's regulations and the IBRD's guidelines concerning the purchase and commission. To reconcile each case was rather difficult and time consuming. Moreover, there was a lack of continuity of the staff of the Thai Ministry of Finance who supervised the implementation, each change caused somewhat delay on each step to be taken.

3. The Harbour Department has stipulated one important condition of the project which has already been accepted by the Cabinet i.e. the hydrographic situation shall be maintained as follows :

- a minimum flow of 300 cubic meters per second above the Chao Phraya dam

- a minimum flow of 80 cubic meters per second below the Chao Phray dam

In actual situation, the Royal Irrigation Department could not conform to the above-mentioned condition since 1987 as there were the scarcity of rain for 3 years consecutively (1987 - 1989) which resulted in the unequal distribution of water to different sectors i.e. agriculture, electricity and transportation. Moreover, the water demand for agriculture in the dry season had increased tremendously due to the policy of second croppings and the attractive price of rice in the world market. In practice, the agricultural sector always obtain the first priority from the Government.

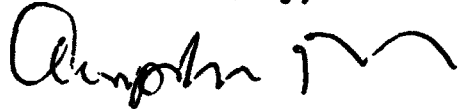
In view of the problems mentioned above, the channel's depth is unable to be maintained at the level of 1.7 m. as determined in the project.

4. In short, the IBRD's report is acceptable to the Harbour Department and the recommendations emanating from the report will be implemented to improve our efficiency. The proposal for further technical assistance in training of our staff is very much appreciated.

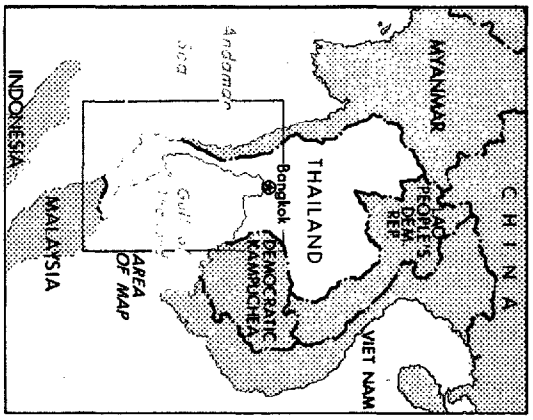
We wish to thank you very sincerely for your time and energy devoted to our project. We look forward to having an opportunity to work with the IBRD's staff again. Kindly inform all concerned of our heartfelt gratitude for what they have done for us.

With our best regards.

Yours sincerely,

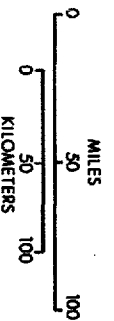
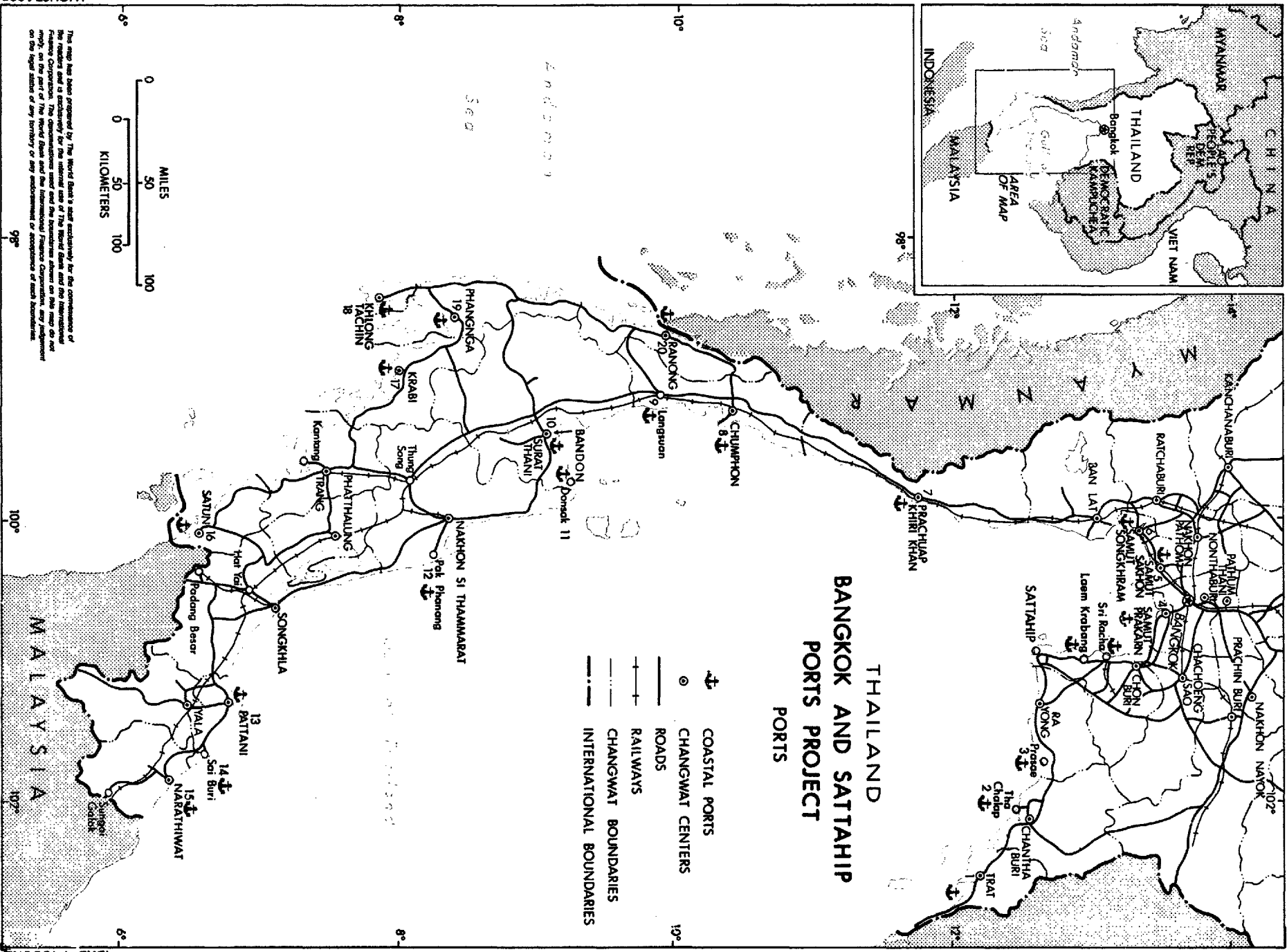


(Mr. Amphon Tiabhorn)  
Director General  
Harbour Department

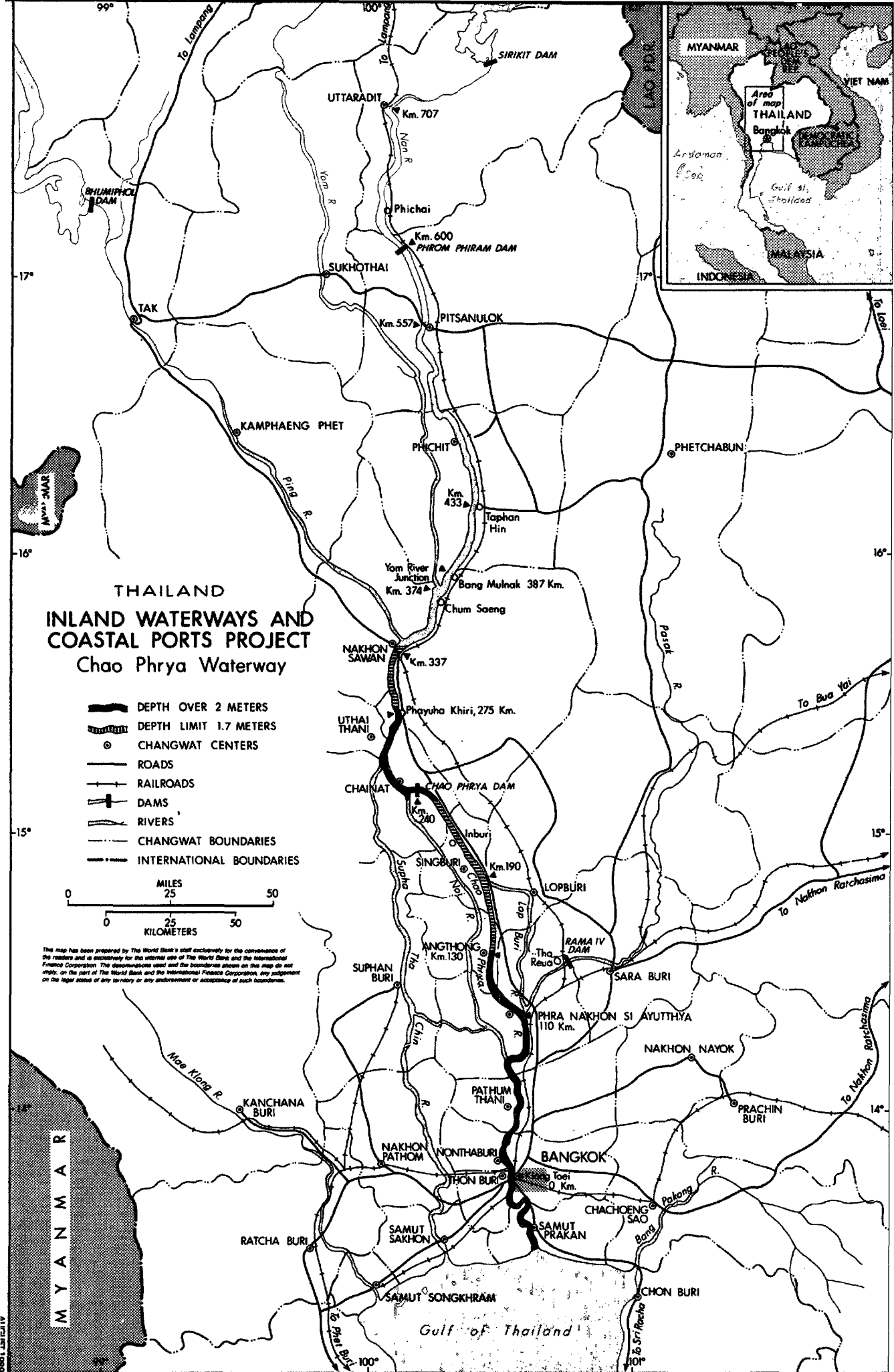


## THAILAND BANGKOK AND SATTAHIP PORTS PROJECT PORTS










- COASTAL PORTS
- CHANGWAT CENTERS
- ROADS
- RAILWAYS
- CHANGWAT BOUNDARIES
- INTERNATIONAL BOUNDARIES

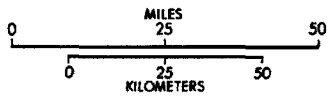


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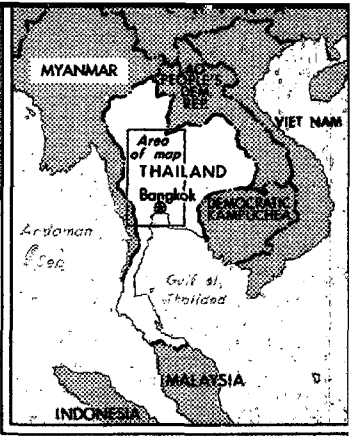


# THAILAND INLAND WATERWAYS AND COASTAL PORTS PROJECT Chao Phya Waterway

-  DEPTH OVER 2 METERS
-  DEPTH LIMIT 1.7 METERS
-  CHANGWAT CENTERS
-  ROADS
-  RAILROADS
-  DAMS
-  RIVERS
-  CHANGWAT BOUNDARIES
-  INTERNATIONAL BOUNDARIES

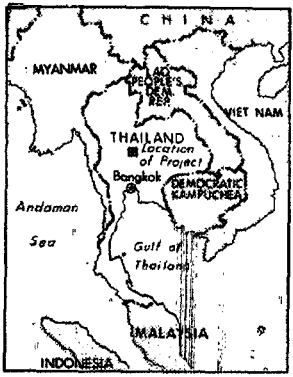


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M Y A N M A R

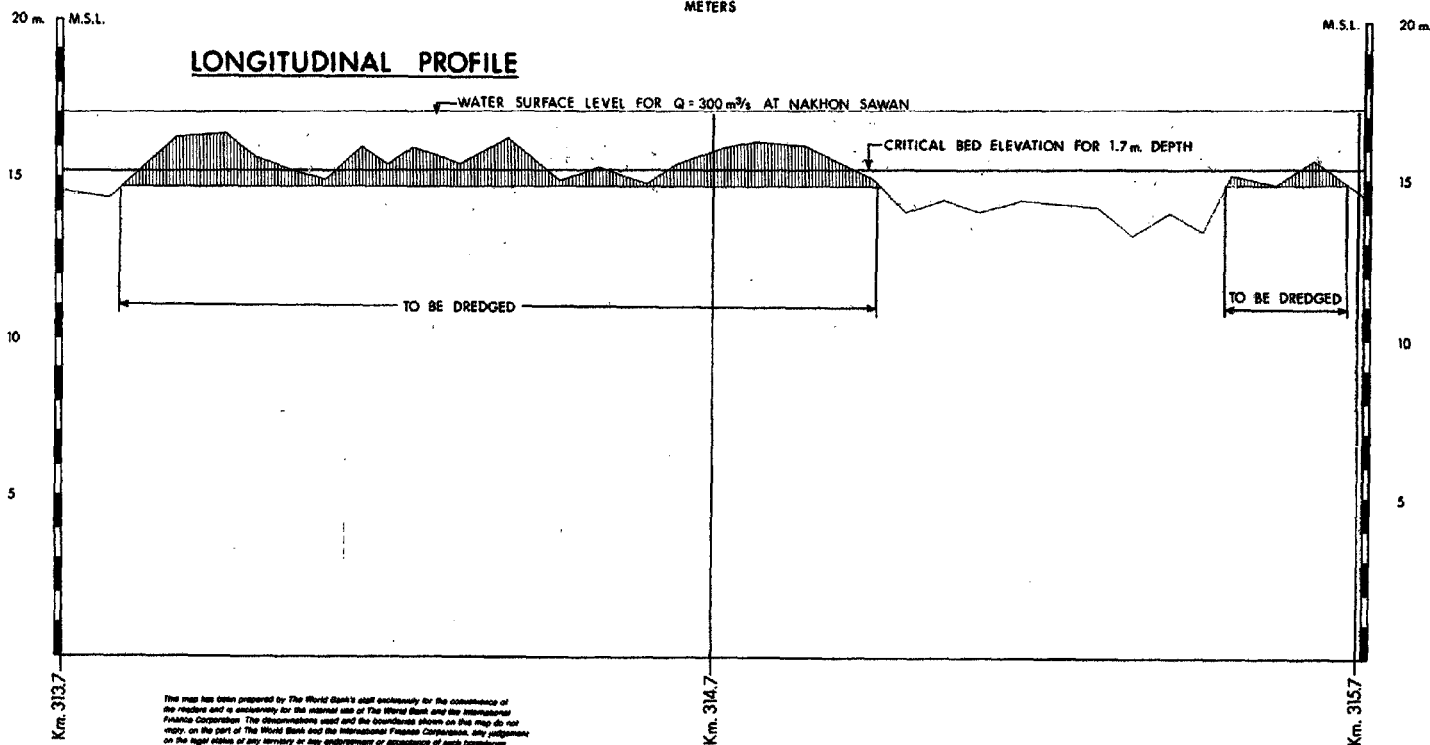
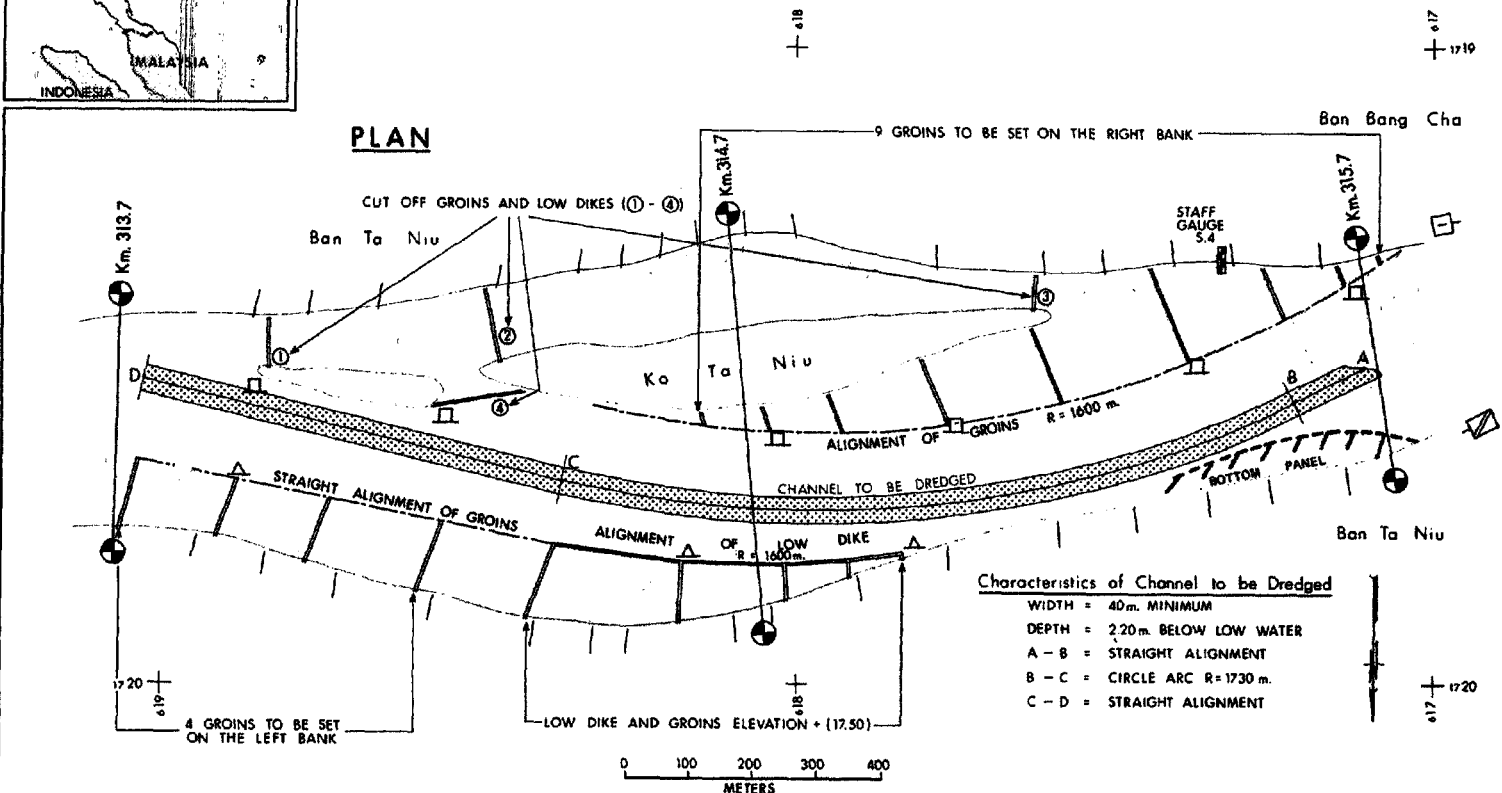
Gulf of Thailand



THAILAND

# INLAND WATERWAYS AND COASTAL PORTS PROJECT

Typical Use of Groins, Low Dikes and Bottom Panels



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