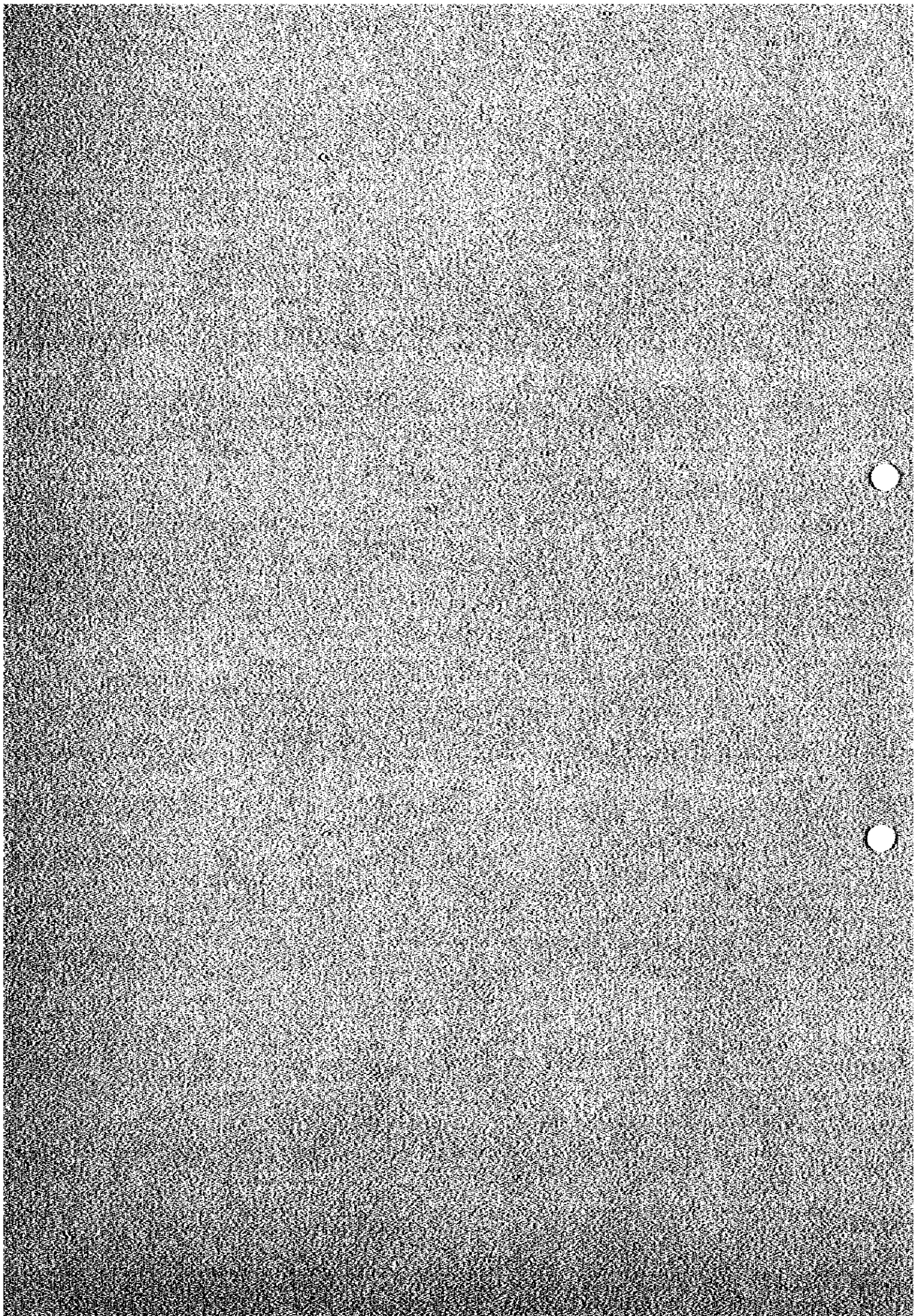


APPENDIX



APPENDIX I

NONG PLA LAI WATER CONVEYANCE SYSTEM

DRAFT TERMS OF REFERENCE FOR
ENGINEERING SERVICES

1. BACKGROUND AND OBJECTIVE

1.1 The Government of Kingdom of Thailand (the Government) is intending to implement the Nong Pla Lai Water Conveyance System (the Project), which aims at supplying the raw water for the domestic and industrial use from Nong Pla Lai reservoir to Chon Buri-Pattaya area.

The Project includes the following components:

- (i) An intake located at the outlet of the river outlet of the Nong Pla Lai dam.
- (ii) A 53 km long conveyance pipeline between the intake and Nong Kho reservoir, including various appurtenant structures.
- (iii) One booster pumping station.
- (iv) Head Tank, 2,327 m³ capacity.

1.2 The Government will engage the Consultants for a period of months to prepare the detailed design, drawings and tender documents for the construction and implementation of the Project, including detailed surveys, field investigation and laboratory tasks and whatever else is required to meet the objective.

2. EXECUTIVE AGENCY

- 2.1 The Government will appoint an executive agency for the performance of the engineering services.
- 2.2 The Center for the Integrated Plan of Operation of National Economic and Social Development Board will be appointed by the Government as a coordinator of the other activities to be taken by the Eastern Seaboard Committee.
- 2.3 The Public Water Works Authority is responsible for the supply of treated water for domestic, commercial and industrial use in the Project area.

3. SCOPE OF WORKS

3.1 Review of Report and Data

The Consultant shall review the available reports and documents relevant to the Project, including evaluation on validity of the previous surveys and investigations, review the domestic and industrial water demand projection. Based on the review, the Consultants shall prepare a detailed programme for the additional surveys and investigations required for the performance of the detail design of the Project.

3.2 Detailed Surveys and Investigations

The detailed surveys and investigations may consist of, but not be limited to the following:

- (a) Route alignment surveys along the proposed pipeline.
- (b) Topographical and geological surveys and mapping on the site of major structure.
- (c) Soil and foundation investigations, including test pitting, penetration test, and other field tests.

3.3 Pipeline Location and Sizing

- 3.3.1 The Consultant shall conduct a study on alignment of pipeline, taking into account the topographical and geological conditions and right of way. The alignment of the pipeline shall be subject to the approval of the executive agency prior to the commencement of the detail design.
- 3.3.2 In sizing the pipeline, the Consultants shall carefully review the previous studies in comparison to the latest projected water demand and thereafter recommend the most appropriate implementation plan to the executive agency.
- 3.3.3 The Consultants shall recommend the executive agency the most economical configuration of the Project by means of the economic comparative study of various configurations.

3.4 Detail Design

The Consultant shall prepare the detailed design of the various components of the Project.

- 3.4.1 The detailed design shall include complete and detailed drawings and design computations relating to structure, foundations and hydraulics.
- 3.4.2 The hydraulic analysis shall include:
 - (a) Simulation analysis of hydraulic pressure in accordance with the variation of water flow, and
 - (b) Simulation analysis of water hammer caused by the operation of pumps and valves.

3.4.3 The design drawing shall be prepared in necessary and sufficient details for international bidding.

3.4.4 The bill of quantities shall be prepared for the respective component of the Project and thereafter the construction cost shall be estimated, which shall be divided into foreign currency component and local currency component. The unit prices should be supported by detailed analysis and based on competitive prices prevailing in the local and international market.

3.5 Report, Drawings and Tender Documents

3.5.1 The Consultants shall prepare the under-listed documents for each component of the Project:

- (a) Design Report
- (b) Detailed Design Drawings
- (c) Tender Documents, including:
 - Pre-qualification Document
 - Instruction to Tenderers
 - Form of Tender
 - Form of Bid Bond
 - General Conditions of Contract
 - General Specifications
 - Technical Specifications
 - Bill of Quantities
 - Form of Agreement
 - Form of Performance Bond

The above report, drawings and documents shall be submitted by the Consultant in draft form for review by the executive agency.

3.4.2 The Consultant shall submit an Inception Report, summarizing the result on review of the previous studies and available documents and the plan of operation.

3.4.3 The Consultant shall submit quarterly progress report of his work to the executive agency throughout the period of the services.

4. REPORTING

4.1 Inception Report (20 copies)

Within ___ months after commencement of the services.

4.2 Draft Design Report, Draft Design Drawings and Draft Tender Documents (20 copies)

Within ___ months after the Inception Report.

4.3 Final Design Report, Final Design Drawing and Final Tender Documents (50 copies)

Within ___ months after receipt of comments on the draft documents by the executive agency.

4.4 Quarterly Progress Report (10 copies)

At the end of each three-month period after commencement of the services.

APPENDIX II

KHLONG YAI DAM AND IRRIGATION SCHEME

DRAFT TERMS OF REFERENCE FOR ENGINEERING SERVICES

1. BACKGROUND AND OBJECTIVE

1.1 The Government of Kingdom of Thailand (the Government) is intending to implement the Khlong Yai Dam Scheme (the Scheme) and Ban Khai Extension Irrigation Scheme (the Irrigation Scheme), which are located in Rayong Province. The Scheme aims at constructing a multiple-purpose dam on the Khlong Yai river. The Irrigation Scheme aims at developing irrigation and drainage system for 7,700 ha (net) of lands. The Schemes include the following components:

Khlong Yai Dam

- (i) A main dam, an earth-fill type, 17.3 m high above the river bed, 3,980 m long and spillway.
- (ii) A saddle dam, an earth-fill type, 8.0 m high above the original ground surface, 500 m long.

Irrigation and Drainage System

- (i) Two headworks.
- (ii) Two main canal systems, approximately 45 km in total length, including various appurtenant structures.
- (iii) Lateral canal systems, approximately 123 km in total length, including various canal structures.
- (iv) Approximately 124 km long drainage channel, including an improvement of existing small streams.
- (v) On-farm development over 7,700 ha of lands.

1.2 The Government will engage the Consultants for a period of approximately ____ months to prepare the detailed design, drawings and tender documents for the construction and implementation of the Scheme, including detailed surveys, field investigations and laboratory tests and whatever else is required to meet the objective.

2. EXECUTIVE AGENCY

2.1 The Government will appoint Royal Irrigation Department (RID) as an executive agency for the performance of the engineering services.

2.2 The Center for the Integrated Plan of Operation (the CIPO) of National Economic and Social Development Board will be appointed by the Government as a coordinator of all the other activities to be taken by the Eastern Seaboard Committee.

3. SCOPE OF WORKS

3.1 Review of Data and Report

The Consultant shall review the available reports and documents relevant to the Scheme, including evaluation on validity of the previous surveys and investigations, hydrological and other design studies. Based on the review, the Consultant shall prepare a detailed programme for the additional surveys and investigations required for the performance of the detail design of the Scheme.

3.2 Detailed Surveys and Investigations

The detailed surveys and investigations may consist of, but not be limited to the following:

- (a) Geological investigation, including drilling, field permeability tests, standard penetration test, grouting and other field tests.
- (b) Soil and foundation investigations.
- (c) Investigation on quality and quantity of materials for embankment fill.
- (d) Investigations of materials for concrete aggregates, filter and rock riprap.
- (e) Topographical and geological surveys and mapping on the site of major structures.
- (f) Aerial-photo mapping covering the entire irrigation service area.
- (g) Hydrological investigation.
- (h) Investigations on environmental and ecological impacts.

3.3 Detail Design

The Consultant shall prepare the detailed design of the various components of the Scheme.

3.3.1 The Consultant shall prepare several alternatives of the dam design based on the detailed surveys and investigations and recommend the best alternative for the detailed design considering both technical and economical aspects.

3.3.2 The detailed design of the dam and its appurtenant structures and irrigation and drainage facilities shall include complete and detailed drawings and design computations relating to hydraulics, structures and foundations.

- 3.3.3 The design drawing shall be prepared in necessary and sufficient details for international bidding.
- 3.3.4 The Consultant shall carry out the laboratory test of spillway and other major facilities deemed to be model-tested.
- 3.3.5 The Consultant shall prepare the bill of quantities for the respective component of the Scheme and shall thereafter estimate the construction cost, which shall be divided into foreign currency component and local currency component. The unit prices to be used should be supported by detailed analysis and based on competitive prices prevailing in the local and international market.

3.4 Report, Drawings and Tender Documents

3.4.1 The Consultant shall prepare the under-listed documents for each component of the Scheme:

- (a) Design Report
- (b) Detailed Design Drawings
- (c) Tender Documents, including:
 - Pre-qualification Document
 - Instruction to Tenderers
 - Form of Tender
 - Form of Bid Bond
 - General Conditions of Contract
 - General Specifications
 - Technical Specifications
 - Bill of Quantities
 - Form of Agreement
 - Form of Performance Bond

The above report, drawings and documents shall be

submitted by the Consultant in draft form for review by the RID.

3.4.2 The Consultant shall submit an Inception Report, summarizing the result on review of the previous studies and available documents and the plan of operation.

3.4.3 The Consultant shall submit quarterly progress report of his work to the RID throughout the period of the services.

4. REPORTING

4.1 Inception Report (20 copies)

Within ____ months after commencement of the services.

4.2 Draft Design Report, Draft Design Drawings and Draft Tender Documents (20 copies)

Within ____ months after the Inception Report.

4.3 Final Design Report, Final Design Drawing and Final Tender Documents (50 copies)

Within ____ months after receipt of comments on the draft documents by the RID.

4.4 Quarterly Progress Report (10 copies)

At the end of each three-month period after commencement of the services.

APPENDIX III

ADDITIONAL SURVEYS & INVESTIGATION

I. Future Survey and Investigation

The following survey and investigation are deemed necessary for the performance of detail design of the respective scheme.

(1) Topographic Survey

Description	Unit	Quantity
(a) <u>Dam & Reservoir</u>		
Topo-mapping	10 ³ m ²	100
(b) <u>Water Conveyance System</u>		
Topo-mapping	10 ³ m ²	72
Route alignment survey	km	56
(c) <u>Irrigation and Drainage System</u>		
Aerial-photo-mapping	km ²	100
Topo-mapping	km ²	1.5
Route alignment survey		
Main canal	km	53
Lateral canal	km	34
Drain	km	37

(2) Geological Investigation

Description	Unit	Quantity
(a) Core Drilling with S.P.T. and Permeability Test, @ 30 m, at Damsite		
	m	1,500
(b) Trench Cutting at Damsite		
	m	400

(3) Material Survey

Description	Quantity	
<u>(a) Borrow Area for Earth Embankment</u>		
Test Pit	5 m x 3 spots	(15 m)
Auger Boring (Core Drilling)	5 m x 15 spots (75 m)	(75 m)
Moisture Content	10 Nos. x 18 spots	(180 Nos.)
Specific Gravity	3 Nos. x 18 spots	(54 Nos.)
Gradation	- ditto -	
Atterberg's Limit	- ditto -	
Compaction	- ditto -	
Triaxial Comp. (\bar{C}_U)	- ditto -	
Permeability	- ditto -	
<u>(b) Borrow Area for Drain Material</u>		
Specific Gravity	3 Nos.	
Gradation	9 Nos.	
Relative Density	9 Nos.	
Triaxial Comp. (\bar{C}_U)	3 Nos.	
<u>(c) Foundation</u>		
Test Pit	5 m x 3 spots	(15 m)
Sampling	3 Nos. x 3 spots	(9 Nos.)
Moisture Content	5 Nos. x 3 spots	(15 Nos.)
Specific Gravity	5 Nos. x 3 spots	(15 Nos.)
Gradation	- ditto -	
Atterberg's	- ditto -	
Triaxial Comp. (\bar{C}_U)	- ditto -	
Triaxial Comp. (\bar{U}_U)	- ditto -	
Consolidation	- ditto -	

