



DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
MINISTRY OF PUBLIC WORKS
REPUBLIC OF INDONESIA

PNAAP 398

inv. 33654

497-0249

TUNTANG AND RELATED RIVERS BASINS

DEVELOPMENT PLAN

COMPLETION REPORT

JUNE 1980

SUBMITTED BY

**PRC ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO, U.S.A. SEMARANG, INDONESIA**

TABLE OF CONTENTS

		<u>Page</u>
PART I	AUTHORIZATION	1
	The Contract	1
	Objectives	1
	Services	2
	Commencement	2
	Manpower	2
	Reporting Requirements	3
	Counterparts	3
	Costs	3
	Amendment No. 1	4
	Reporting Schedule	5
	Work Schedule	6
PART II	THE PROJECT	14
	Background of Study	14
	Scope of Work	16
	Project Area	18
PART III	THE PEOPLE	19
PART IV	THE REPORTS	29
	Interim Report	29
	Tuntang/Jragung Rivers Basins Integrated Development Plan - Executive Summary	30
	Tuntang/Jragung Integrated Development Plan - Special Report I - Municipal and Industrial Water Supply	31
	Tuntang/Jragung Integrated Development Plan - Special Report II - Geology	32
	Tuntang/Jragung Integrated Development Plan - Special Report III - Drainage and Flood Control	33
	Tuntang and Related Rivers Basins Development Plan - Status Report	34
	Jratunseluna Basin - Updated Development Plan	34
	Monthly Progress Reports	35
PART V	THE EXPENDITURES	37
	U.S. Dollar Costs	37
	Indonesian Rupiah Costs	37
	Summary of Total Costs	38
PART VI	THE EQUIPMENT	42
PART VII	THE COMMENTS	43
PART VIII	REFERENCES	45

LIST OF TABLES

<u>No.</u>	<u>Title</u>	<u>Page</u>
III-1	Assignment of Counterparts and Technical Personnel	21
III-2	Direct-hire Indonesian Personnel	24
III-3	Assignment of Resident and TDY Staff	25
III-4	Ministry Personnel Overseas Visit	27
V-1	Summary of Budget and Expenditures for Original Contract and Amendment No. 1 To The Contract	39
V-2	Invoice Numbers with Amounts of Expenditures in U.S. Dollars and Monthly Fee Installments During Contract and Amendment Period Between ECI and Ministry of Public Works	40
V-3	Summary of Rupiah Budget Costs Original Contract and Amendment I	41

LIST OF FIGURES

<u>No.</u>	<u>Title</u>	<u>Page</u>
I-1	Consultant Staff Schedule (Original)	7
I-2	Consultant Staff Schedule (As Revised)	8
I-3	Consultant's Manpower Schedule	9
I-4	Project Reports - Schedule of Submittals	10
I-5	Consultant Work Schedule	12
I-6	Consultants Work Schedule (Revised After March 22, Meeting)	13
II-1	Location Map	Unnumbered

PART I - AUTHORIZATION

THE CONTRACT

On May 15, 1979, a notice to proceed was given to PRC Engineering Consultants, Inc. (PRC/ECI) for starting preparation of Tuntang River Basin Development Plan in the Jratunseluna Basin and the contract for the services effective May 15, 1979 was signed between the Directorate General of Water Resources Development (DGWRD) of the Ministry of Public Works, Republic of Indonesia (GOI) and PRC/ECI. This contract, financed by the United States of America acting through the Agency for International Development (U.S. AID) from loan No. 497-T-040 dated July 28, 1976, is registered in DGWRD office with number HK. 02 03 01/B.58/CES/79 dated August 20, 1979.

A development plan of the Jratunseluna Basin was prepared earlier in 1973, which contained recommendations for a staged series of projects to develop the water resources of the area. Since then, action has been underway to implement several of those projects. However, on the Tuntang River, the projects have not yet been studied in detail.

The implementation of the Jragung Dam Project, which has recently been designed, has been postponed and it is felt necessary to investigate the development potential of the combined Tuntang River and the Jragung River. Therefore, a fresh evaluation of the development possibilities of the Tuntang River in conjunction with the Jragung River should be made before proceeding with any new projects in the area. The resulting study should accomplish the following objectives.

OBJECTIVES

1. Determine existing and projected water (irrigation and potable) and electrical power requirements for the Jratunseluna Basin.

2. Develop the Tuntang River and the Jragung River as supporting parts of the total water resource potential of the Jratunseluna Basin giving due consideration to the development already proposed of the Serang River system.
3. Optimize the developments of the Tuntang River and the Jragung River basins on an integrated basis.
4. Layout a development plan, utilizing the water resources potential of the Tuntang River and the Jragung River.

SERVICES

The services which the Consultant was required to perform included 1) reviewing existing reports and plans related to the Tuntang and Jragung Subbasins, 2) examine all available data, 3) establish needs for development in the project area, 4) evaluate development possibilities, 5) select development components and 6) develop a work program, to formulate an integrated development plan for the two subbasins.

COMMENCEMENT

The starting date of the contract was May 16, 1979 which was notified to all the concerned parties with letter No. 1196/G/6 - 108/79 dated May 16, 1979. The services were to continue for a period of 6.5 months and the completion date was set at November 30, 1979. However, due to reasons explained later in this report, the contract completion date was extended to June 15, 1980 by an amendment to the contract.

MANPOWER

The total manpower to carry out the terms of contract was estimated to be 33.5 manmonths; composed of 31.0 in Indonesia and 2.5 in the Consultant's home office in Denver, Colorado. Of the personnel time

currency costs; and Rupiah 38,968,690.- for financing local costs plus a Fixed Fee of US Dollars 26,825."

AMENDMENT No. 1

An interim report on the study related to the original contract was submitted by PRC/ECI on August 15, 1979 which was discussed by all the concerned agencies on September 24, 1979 in a meeting held by the DGWRD at Jakarta. In that meeting and in subsequent discussions between PRC/ECI and DGWRD, it was the consensus of opinion of all the participants that the study on the Tuntang/Jragung Rivers should be modified by including the entire Jratunseluna Basin in certain aspects of the study. In that study existing, proposed and the potential development works of the Tuntang/Jragung Subbasins and those of the adjoining subbasins within the Jratunseluna Basin should be examined. Thus, the master plan for the development of the Jratunseluna Basin, which was prepared earlier by NEDECO in the year 1973, would be reviewed and updated. The original contract between the GOI and PRC/ECI for the engineering services was therefore, amended to include the revised scope of work for the modified study. By a letter No. HL. 02.05 dated November 28, 1979, the DGWRD authorized PRC/ECI to proceed with the scope of work agreed upon for the modified study and Amendment No. I was subsequently signed and registered in the DGWRD office with No. HK. 02 03 01/B. 248/CES/80 dated April 23, 1980.

The amendment increased the total number of manmonths to 59.50, out of which the manmonths allocated to Indonesia were 55 and the remaining 4.5 manmonths were for the Consultant's home office. The provision in the contract for the costs, as a result of the amendment, was changed to read as follows.

"The reimbursable cost for the Service is estimated to be \$ 449,280.00 in U.S. currency for financing the foreign currency costs; and Rupiah 67,591,630 for financing local costs plus a Fixed Fee of 47,265 U.S. dollars."

The contract completion date, as a result of the amendment, was set at June 15, 1980. The amended schedule of manpower is given on Figures I-2 and I-3.

REPORTING SCHEDULE

The original reporting schedule as a result of the amendment was changed as follows.

<u>Name of Report</u>	<u>When Done</u>	<u>Number of Copies</u>	
		<u>DGWRD</u>	<u>U.S. AID</u>
Monthly Progress Report	10th day of following month	25	8
Development Plan Interim Report	End of 12th week of study	30	8
Executive Summary	End of 6.5 months	100	8

For the amendment period, the reporting schedule was set as given hereunder.

<u>Name of Report</u>	<u>When Done</u>	<u>Number of Copies</u>	
		<u>DGWRD</u>	<u>U.S. AID</u>
Monthly Progress Report	10th day of following month	25	8
Status Report	April 1, 1980	50	8
Final Report	May 30, 1980	100	8
Completion Report	End of all services	60	8

A total number of 8 different reports and 8 appendices were prepared by the Consultant and submitted to the Ministry and other agencies. In addition 11 monthly reports and two quarterly reports were required. The schedule of submittals of the reports is given on Figure I-4.

WORK SCHEDULE

After the scope of work provided in the original contract was revised to include the scope of work set forth in Amendment No. I, the Consultant's work schedule was modified accordingly. Both the original and the modified work schedules are presented on Figures I-5 and I-6.

TUNTANG RIVER BASIN DEVELOPMENT PLAN

Figure I-1

CONSULTANT STAFF SCHEDULE

(ORIGINAL)

POSITION	NAME	PROJECT MONTHS							MAN MONTHS					
		1	2	3	4	5	6	7	Ind	H.O.	Total			
1. Project Sponsor	R.B. Campbell	-----	-----	-----	-----	-----	-----	-----	0.5	-	0.5			
2. Team Leader	S.A. Rana	-----	-----	-----	-----	-----	-----	-----	6.5	-	6.5			
3. Project Planning Engineers	Dr. Patterson		-----			-----			2.0	-	2.0			
	Y.A. Yeung	-----		-----		-----			-	1.0	1.0			
4. Hydrologist	J.P. Frey	-----	-----	-----					2.0	-	2.0			
5. Sedimentation/Hydrology	M.A. Stevens		-----	-----		-----			1.5	-	1.5			
6. Dam/Hydropower	G. Parham or Replacement		-----	-----	-----	-----			3.0	-	3.0			
7. Engineering Geologist	R.J. Bielefeld		-----	-----	-----				2.0	-	2.0			
8. Irrigation Engineer	J.G. Nemeč		-----	-----		-----			2.0	-	2.0			
9. Flood/Drainage Engineer	Clarke		-----	-----	-----				2.0	-	2.0			
10. Agricultural Economist	R.L. Berger		-----	-----		-----			2.0	-	2.0			
11. Agricultural Scientist	Dr. Haley		-----	-----					1.0	-	1.0			
12. Watershed Management	H.C. Fletcher		-----	-----	-----				2.0	-	2.0			
13. Environmental Scientist	Dennis			-----	-----				1.0	-	1.0			
14. Municipal/Water Engineer	J. Diebel		-----	-----					2.0	-	2.0			
15. Specialists	M.K. Kuehl	-----	-----	-----	-----	-----	-----	-----	0.25	-	0.25			
	P.L. Strauss	-----	-----	-----	-----	-----	-----	-----	0.25	-	0.25			
Unallocated	-	-----	-----	-----	-----	-----	-----	-----	1.0	-	1.0			
16. Home Office (H.O.)	As Required	-----	-----	-----	-----	-----	-----	-----	-	1.5	1.5			
									TOTAL			31.0	2.5	33.5

7

TUNTANG RIVER BASIN DEVELOPMENT PLAN

Figure I-2

CONSULTANT STAFF SCHEDULE
(AS REVISED)

POSITION	NAME	PROJECT MONTHS							MAN MONTHS		
		1	2	3	4	5	6	7	Ind	H.O.	Total
1. Project Sponsor	R.B. Campbell	-----	-----	-----	-----	-----	-----	-----	0.5	-	0.5
2. Team Leader	S.A. Rana	-----	-----	-----	-----	-----	-----	-----	6.5	-	6.5
3. Project Planning Engineers	Dr. Patterson	-----	-----	-----	-----	-----	-----	-----	2.5	-	2.5
	Y.A. Yeung	-----	-----	-----	-----	-----	-----	-----	-	1.0	1.0
4. Hydrologist	J.P. Frey	-----	-----	-----	-----	-----	-----	-----	2.5	-	2.5
5. Sedimentation/Hydrology	M.A. Stevens	-----	-----	-----	-----	-----	-----	-----	1.5	-	1.5
6. Dam/Hydropower	G. Parham or Replacement	-----	-----	-----	-----	-----	-----	-----	3.0	-	3.0
7. Engineering Geologist	R.J. Bielefeld	-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
8. Irrigation Engineer	J.G. Nemeo	-----	-----	-----	-----	-----	-----	-----	1.5	-	1.5
9. Flood/Drainage Engineer	Clarke	-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
		-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
10. Agricultural Economist	R.L. Berger	-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
11. Agricultural Scientist	Dr. Haley	-----	-----	-----	-----	-----	-----	-----	1.0	-	1.0
12. Watershed Management	H.C. Fletcher	-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
13. Environmental Scientist	Dennis	-----	-----	-----	-----	-----	-----	-----	1.0	-	1.0
14. Municipal/Water Engineer	J. Diebel	-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
15. Socioenvironmentalist	S. Steenrod	-----	-----	-----	-----	-----	-----	-----	1.0	-	1.0
16 Specialists	Chief Engineer	-----	-----	-----	-----	-----	-----	-----	0.25	-	0.25
	Chief Geologist	-----	-----	-----	-----	-----	-----	-----	0.25	-	0.25
	Unallocated	-----	-----	-----	-----	-----	-----	-----	0.50	-	0.50
17. Home Office (H.O.)	As Required	-----	-----	-----	-----	-----	-----	-----	-	1.5	1.5
TOTAL								32.00	2.5	34.50	

Best Available Document

TUNTANG RIVER BASIN DEVELOPMENT PLAN
AMENDMENT No. 1

Figure I-3

CONSULTANTS MANPOWER SCHEDULE

POSITION	NAME	PERIOD (MONTHS)								MANMONTHS (EXTENSION)		
		Original Contract	Extended Contract Period							Indo-nesia	H.O.	Total
		NOV. 1979	DEC.	JAN. 1980	FEB.	MAR.	APR.	MAY	JUN. 1-15			
1. Project Sponsor	Campbell	-----	-----	-----	-----	-----	-----	-----	-----	-	-	-
2. Team Leader	Rana	-----	-----	-----	-----	-----	-----	-----	-----	4.0	1.5	5.5
3. Hydrologist/Interim Team Leader	Youssef	-----	-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
4. Planning Engineer	Patterson	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-	3.5
5. Economist	Berger	-----	-----	-----	-----	-----	-----	-----	-----	2.0	-	2.0
6. Design Engineer	Parham	-----	-----	-----	-----	-----	-----	-----	-----	3.75	-	3.75
7. Watershed Erosion Control	Wymore	-----	-----	-----	-----	-----	-----	-----	-----	3.0	-	3.0
8. Environmentalist	Steenrod	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-	1.0
9. Irrigation Engineer	Baskett	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-	1.0
10. Materials Engineer	Kerkes	-----	-----	-----	-----	-----	-----	-----	-----	0.5	-	0.5
<u>11. Specialists</u>												
(i) Chief Engineer	Kuehl	-----	-----	-----	-----	-----	-----	-----	-----	0.75	-	0.75
(ii) Sedimentation	Stevens	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-	1.0
(iii) Unallocated		-----	-----	-----	-----	-----	-----	-----	-----	0.5	-	0.5
12. Home Office	As needed	-----	-----	-----	-----	-----	-----	-----	-----	-	0.5	0.5
Total		-----	-----	-----	-----	-----	-----	-----	-----	23.0	2.0	25.0

PROJECT REPORTS - SCHEDULE OF SUBMITTALS

<u>Name of Report</u>	<u>Date Due</u>	<u>Status</u>	<u>Date Submitted</u>
1. Monthly Progress Report	10th Day of the following month	Schedule being met	
2. Quarterly Progress Report	20th Day of the following month	Schedule being met	
3. Development Plan Interim Report	August 15, 1979	Submitted	August 14, 1979
4. Tuntang/Jragung Development Plan Final (Executive Summary)	December 15, 1979	Submitted	December 12, 1979
5. Special Reports I, II, & III	December 31, 1979	Submitted	December 12, 1979
6. Tuntang/Jragung Development Plan Appendices: A,B,C,D Part I (Draft Form)	December 31, 1979	Submitted	December 18, 1979
Appendices: E,F,G Part I (Draft Form)		Submitted	January 5, 1980
7. Status Report	April 16, 1980	Submitted	April 7, 1980
8. Final Report Upgraded Jratunseluna Development Plan	May 31, 1980	Draft	May 26, 1980
Appendix A - Hydrology		Final	June 15, 1980
Appendix B - Agriculture & Irrigation		Final	June 15, 1980
Appendix C - Dams & Hydropower		Final	June 15, 1980
Appendix D - Project Planning		Final	June 15, 1980

<u>Name of Report</u>	<u>Date Due</u>	<u>Status</u>	<u>Date Submitted</u>
Appendix E - Economics		Final	June 15, 1980
Appendix F - Soil and Water Conservation		Final	June 15, 1980
Appendix G - Social and Environmental Assessment		Final	June 15, 1980
Appendix H - Sedimentation Studies (Jragung Watershed)		Final	June 15, 1980

ACTIVITY	YEAR	1979														
	MONTH	NOVEMBER				DECEMBER				JANUARY				FEBRUARY		
	WEEK	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I HYDROLOGY / SEDIMENTATION Collect Existing Hydrological Data Other Subbasins Review & Process Data Set up Sediment Measurement Program Process & Analyze Measured Data Prepare Report																
II IRRIGATION / AGRICULTURE Review Existing Irrigation Schemes Study Small Scale Schemes Propose Cropping Patterns & Cropping Calendars Prepare Report																
III PLANNING Study Existing & Proposed Projects Other Basins Set up Conceptual Plans Set up Computer Model Operation Studies Finalize Conceptual Plans Recommendations Prepare Report																
IV DESIGN Design Rowa Pening Works Design Glapan Barrage Works Design Other Small Scale Projects Prepare Report																
V SOILS / FOUNDATIONS INVESTIGATIONS Study Needs & Set up Program Field Work (Continuing)																
VI ECONOMICS Evaluate Projects Benefits Set up Analyses Prepare Report																
VII WATERSHED EROSION CONTROL Study Existing Reports Propose General Measures in Total Project Area Propose Site / Sites For Demonstration Farms Prepare Topographical Maps Design Demo Farms Prepare Drawings Prepare Report																
VIII SOCIO - ENVIRONMENTAL STUDIES Complete Work on Rowa Pening Study Glapan / Gunung Wulan General Study of Area Report																
IX REPORTS Submit Interim Status Report Discuss & Review Submit Final Report Submit Completion Report																

12

BASIN DEVELOPMENT PLAN

Figure I-5

D TUNTANG CONTRACT

WORK SCHEDULE *

1980																			REMARKS
FEBRUARY				MARCH				APRIL				MAY				JUNE			
3	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
[Gantt bar: Feb 14-16]																		Part II of Appendix A and Appendix H	
																		Part II of Appendix B	
[Gantt bar: Feb 14-20]																		Part II of Appendix D	
								[Gantt bar: Apr 21-28]										Note: These Will be Feasibility / Preliminary Designs based on the available Data Part II of Appendix C	
												[Gantt bar: May 25-30]							
												[Gantt bar: May 25-30]						To be done by Jralunseluna Proyek Forcee under ECI Material Engineer's guidance	
												[Gantt bar: May 25-30]						Part II of Appendix E	
				[Gantt bar: Mar 17-20]				[Gantt bar: Apr 21-28]										Part II of Appendix F	
												[Gantt bar: May 25-30]							
												[Gantt bar: May 25-30]						Part II of Appendix G	
								[Gantt bar: Apr 21-28]				[Gantt bar: May 25-30]				[Gantt bar: Jun 29-30]			

12a

ACTIVITY	YEAR	1979										
	MONTH	NOVEMBER				DECEMBER				JANUARY		
	WEEK	1	2	3	4	5	6	7	8	9	10	11
I HYDROLOGY / SEDIMENTATION Collect Existing Hydrological Data Other Subbasins Review & Process Data Set up Sediment Measurement Program Process & Analyze Measured Data Prepare Report												
II IRRIGATION / AGRICULTURE Review Existing Irrigation Schemes Study Small Scale Schemes Propose Cropping Patterns & Cropping Calendars Prepare Report												
III PLANNING Study Existing & Proposed Projects Other Basins Set up Conceptual Plans Set up Computer Model Operation Studies Finalize Conceptual Plans Recommendations Prepare Report												
IV DESIGN Upgrade Rawa Pening Design Upgrade Glapan Barrage Design Design Other Small Scale Projects Prepare Report												
V SOILS / FOUNDATIONS INVESTIGATIONS Study Needs & Set up Program Field Work (Continuing)												
VI ECONOMICS Evaluate Projects Benefits Set up Analyses Prepare Report												
VII WATERSHED EROSION CONTROL Study Existing Reports Propose General Measures in Total Project Area Propose Site / Sites For Demonstration Farms Prepare Topographical Maps Design Demo. Farms Prepare Drawings Prepare Report												
VIII SOCIO - ENVIRONMENTAL STUDIES Complete Work on Rawa Pening Study Glapan / Gunung Wulan General Study of Area Report												
IX REPORTS Submit Interim Status Report Discuss & Review Submit Final Report Submit Completion Report												

LUNA BASIN DEVELOPMENT PLAN

MODIFIED TUNTANG CONTRACT

CONSULTANT WORK SCHEDULE

Revised After March 22, Meeting)

1980																				REMARKS		
JANUARY				FEBRUARY				MARCH				APRIL				MAY					JUNE	
10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		30	
[Work bars for Part II of Appendix A and Appendix H]																					Part II of Appendix A and Appendix H	
[Work bars for Part II of Appendix B]																					Part II of Appendix B	
[Work bars for Part II of Appendix D]																					Part II of Appendix D	
[Work bars for Part II of Appendix C]																					Note: These Will be Preliminary Designs based on the available Data Part II of Appendix C	
[Work bars for Part II of Appendix E]																					To be done by Jratunselund Proyekt Forces under ECI Material Engineer's guidance	
[Work bars for Part II of Appendix F]																					Part II of Appendix F	
[Work bars for Part II of Appendix G]																					Part II of Appendix G	
[Work bars for Part II of Appendix H]																						

PART II - THE PROJECT

BACKGROUND OF STUDY

The Jratunseluna Basin Development Plan [1], formulated by NEDECO in the year 1973, contained recommendation for building dams and other engineering works on the rivers in the basin for the purpose of providing water for irrigation, generating hydropower and effecting flood control in their respective areas. The development on each river system was planned individually and the coordinated use of the combined water resources of the basin was not studied in that plan.

Prior to the presentation of NEDECO's Development Plan a study for developing the waters of the Dolok, Penggaron and Jragung Subbasins was done [2] as a result of which preliminary feasibility reports for building dams on these three rivers were presented. The most notable projects identified in that plan are a dam on the Jragung River at Jragung; a dam on the Serang River at Ngrambat or Kedungombo; a dam on the Tuntang River at Glapan; and a possible dam on the same river at Gunung Wulan. Towards implementation of the Development Plan, feasibility studies of the Jragung [4], Glapan [7], Ngrambat Dam [6] were carried out followed by preparation of detailed designs for the Jragung and the Kedungombo (Ngrambat) Dam [5, 11].

In addition to the abovementioned Development Plan, the potential for development of Rawa Pening, a natural lake in the head waters of the Tuntang River, was studied at feasibility level by NEDECO in the year 1971/72 [8], as a result of which certain short-term and long-term measures were recommended for the exploitation of the potential storage capacity of the lake for irrigation development and hydropower generation. Also, a Master Plan was prepared by Burns and McDonnells in the year 1976 [10] for supplying municipal and industrial water to the city of Semarang. In that plan, demand for water was placed on certain water resources developments of the Jratunseluna Basin which was not accounted for in the original Development Plan. It was important that the M & J water

supply from the water resources of the surrounding basins, including the Jratunseluna Basin on which the city of Semarang depends should also be included in the development plan.

On the Jragung River, a dam was studied at feasibility level and final designs were prepared for construction. In that study it was found that for the development of water resources of rivers draining small subbasins, it is prudent to consider integrated development of the subbasins by making coordinated use of waters of adjoining subbasins by transbasin or interservice-area diversions. Similarly, for the development of the Serang River System [11], it was recognized that the plan of development should also consider the Lusi River System for an integrated development of the water resources of both river systems. Likewise the waters of the Serang and the Tuntang Rivers could be put to optimum use by integrated and coordinated development. A similar prospect exists to the west of the Jragung River, where the Dolok and Penggaron Rivers had existing wet season irrigation in service areas which could be combined into one block, and part of that area could be integrated with the Jragung Service Area.

Inasmuch as the coordinated development of the water resources of the Jratunseluna Basin would yield considerably more benefits, as compared with the case in which the water resources of the constituting subbasins are individually exploited, it was concluded that a fresh evaluation should be made of the development possibilities of all the Jratunseluna Basin. A study originally started for the subbasins of the Tuntang and the Jragung Rivers was consequently extended to include all the subbasins of the Jratunseluna Basin.

SCOPE OF WORK

The development of water resources of the Jratunseluna Basin has been studied in the past and a number of reports have been issued by various consultants and other agencies containing the data related to, and the results of, those studies. Some of these were carried out to prefeasibility level [2, 8], some to feasibility level [4, 6, 7], and storage dams on the Jragung River and the Serang River have been studied through final design [5, 11]. In light of the reasons stated in the preceding Section 1.2., a study was implemented and contracted to PRC/ECI on the preparation of an integrated development plan for the Tuntang and the Jragung Rivers. The study was limited to reviewing all available data and existing reports, to carrying out field reconnaissance to verify critical factors, reconnaissance level geological investigations and geotechnical data evaluation in order to identify alternative scheme for development. PRC/ECI carried out multiple reservoir operation studies for that purpose on a computer model of the subbasins.

In the subsequently amended scope of work, the studies which originally were started on the Tuntang/Jragung Rivers were to be extended to cover the entire Jratunseluna Basin.

In consideration of the limited time and funds available for this contract, it was decided to restrict the study to the preparation of a conceptual basin development plan by upgrading the original Master Plan conceived by NEDECO. The upgraded plan would consist of a combination of small scale projects for near term development and large scale projects for future development. The optimization for the development plan would be done by enlarging the computer model prepared originally by PRC/ECI for the Tuntang/Jragung Rivers Basins to encompass the entire Jratunseluna Basin and to simulate the operation of the proposed storage reservoirs in the system on an integrated and coordinated fashion.

The original scope of work also envisaged preparation of a conceptual

layout and configuration of the Glapan Barrage on the Tuntang River and investigation of designs of levees, drainage schemes and raising of the Jelok Weir for the development of Rawa Pening for water storage to as much detail as would be possible using existing maps and subsurface data. The investigation would also be concerned with the technical, economic and socio-environmental aspects of the proposed raising of Rawa Pening and the planned construction of the Glapan Barrage.

During the course of the study the scope of work was discussed with the DGWRD in the light of data and maps which were available, and it was decided that more emphasis should be placed on evaluating in more detail than was originally contemplated, the small scale works and projects on the Lusi River system and areas related to the Tuntang River Basin. To allow time for this work, it was decided that the scope of work on the Rawa Pening and the Glapan Barrage designs should be reduced to only producing conceptual design sketches for the two works. The DGWRD has planned to carry out detailed feasibility level investigations leading to preparation of final designs and contract documents for the Rawa Pening works and the Glapan Barrage as a follow up work after the completion of the present study.

Furthermore, it was contemplated as part of this study, that a general scheme for soil conservation and erosion control would be prepared for the basin, including design criteria, typical measures to be used for the different types of terrain, soils and geology, and typical drawings for various erosion control measures. Also, a pilot project for demonstration of soil conservation and erosion control measures would be identified and designed in the Jratunseluna Basin.

The scope of work for this study also includes training of the personnel of the Directorate General of Water Resources Development (DGWRD) in obtaining and analyzing river sediment data and assisting in operating the sediment laboratory at Semarang. The purpose of this effort was to enable DGWRD personnel to continue the training program started

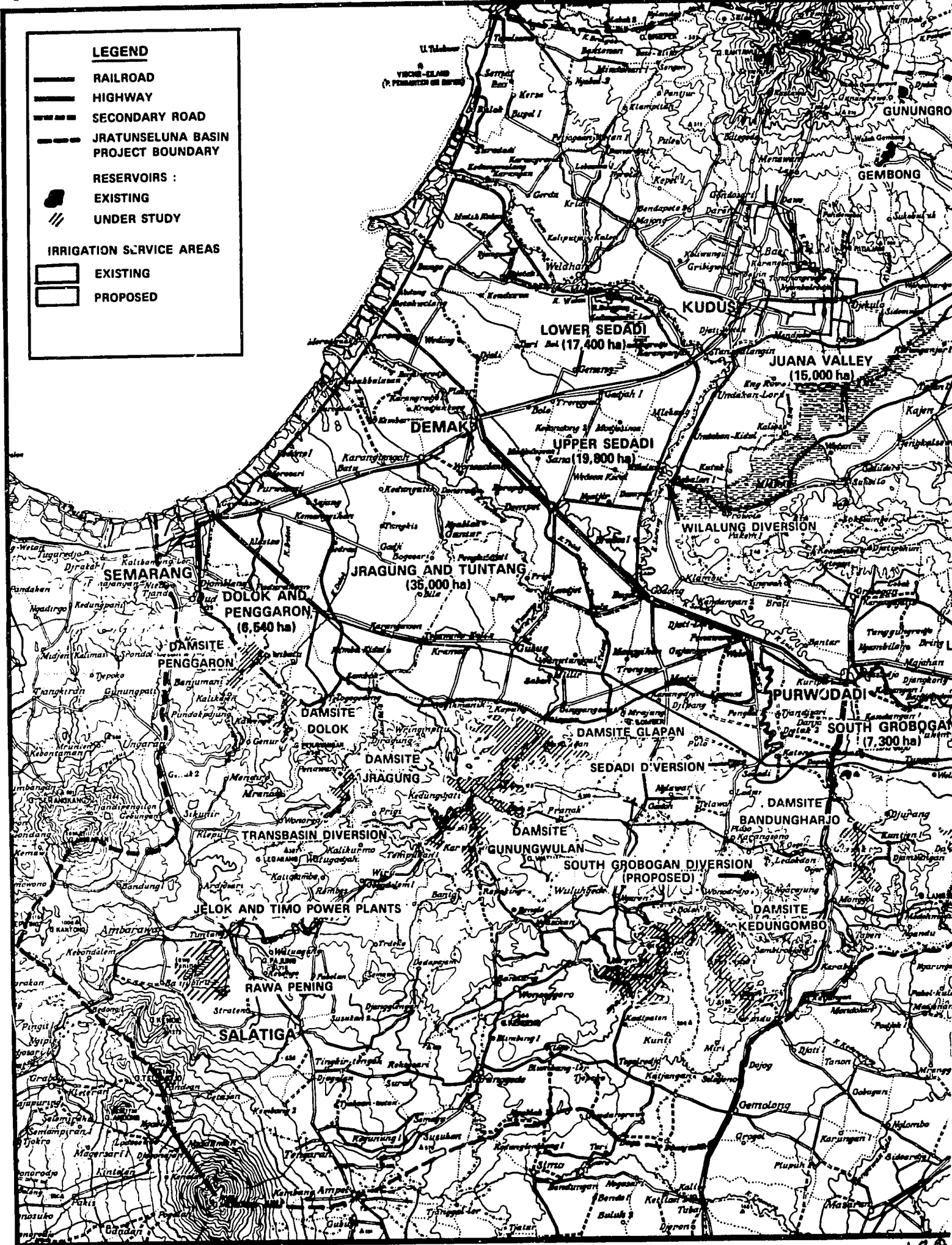
by NEDECO for measurement of sediment in the main rivers of the Jratunseluna Basin, to analyze data for determining sediment yields in the watershed and to make realistic estimates of sedimentation in the reservoirs proposed in the development plan. This training program was done on a larger scale and in more details by PRC/ECI for the Tuntang and the Jragung Rivers during the years 1977 to 1980. The results of the erosion and sedimentation studies are not presented in this main report; however, the excessive sediment yields from the watersheds of the proposed storage reservoirs have been mentioned where considered relevant. The detailed results of the Erosion and Sedimentation Study are given in Appendix H of this report.

PROJECT AREA

The Jratunseluna Basin is formed by the morphological action of the five main rivers of Central Java, namely, Jragung, Tuntang, Serang, Lusi and Juana. Two other small rivers falling within the basin but draining directly into the Java Sea are the Dolok and the Penggaron Rivers. Besides this system of main rivers, there are a number of tributary streams which are part of the total water resources potential of the basin.

The Jratunseluna Basin covers an area of about 7,700 km² including part or all of the following seven Kabupatens (Regencies): Semarang, Blora, Demak, Purwodadi, Pati, Kudus and the Kotamadya (Municipality) of Semarang. The basin is bounded by the slopes of the volcanoes Ungaran, Telomoyo and Merbabu on the south west, by volcano Muria on the north, highlands from where the Lusi River originates on the east and the south, and by the Java Sea on the remaining sides. The watersheds of most of the streams in the basin are located on the slopes of the above named extinct volcanoes.

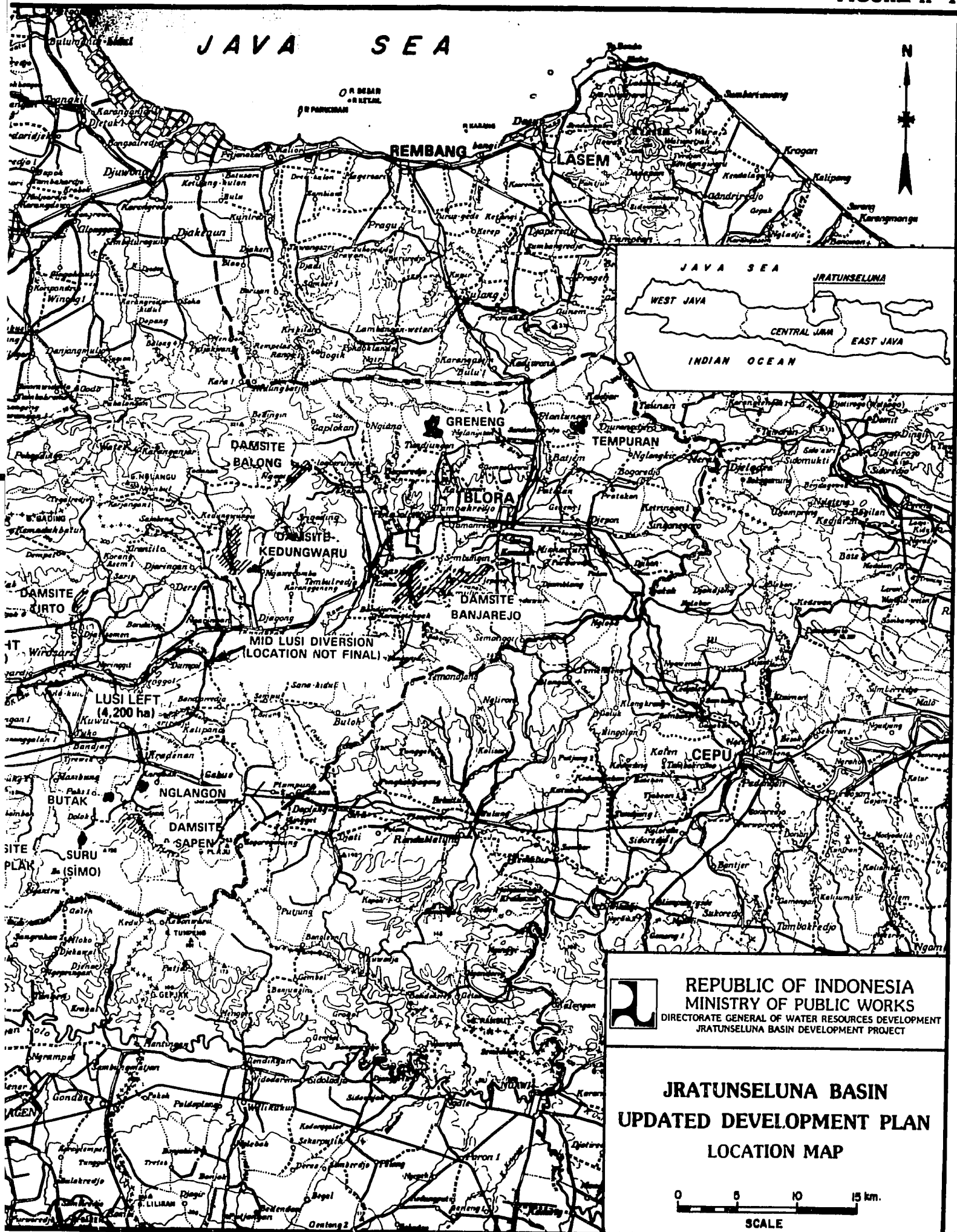
The location map of the Project Area is presented in Figure II-1.



LEGEND

- RAILROAD
- HIGHWAY
- SECONDARY ROAD
- JRATUNSELUNA BASIN PROJECT BOUNDARY
- RESERVOIRS :**
- EXISTING
- UNDER STUDY
- IRRIGATION SERVICE AREAS**
- EXISTING
- PROPOSED

FIGURE II - 1



REPUBLIC OF INDONESIA
 MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 JRATUNSELUNA BASIN DEVELOPMENT PROJECT

**JRATUNSELUNA BASIN
 UPDATED DEVELOPMENT PLAN
 LOCATION MAP**

0 5 10 15 km.
 SCALE

PART III - THE PEOPLE

The contract for the Tuntang Development Plan stipulated that PRC/ECI would provide foreign experts of various specialties and that the Ministry would provide counterpart specialists for the Consultant expatriate staff. The names and work periods of the different counterpart staff are listed in Table III-1. A list of the administrative personnel who worked on the Project is presented in Table III-2.

During the course of planning work for the Tuntang and the related rivers development plan, several meetings were held at Semarang and Jakarta, in which the Consultant briefed the Ministry, U.S. AID and other related agencies on the progress of work, the problems and proposed solutions and other technical matters related to the Project. Those officials of the Ministry of Public Works and U.S. AID who participated in those meetings and whose guidance helped in the preparation of the development plan are listed hereunder.

Ir. Suyono Sosrodarsono	Director General, Water Resources Development.
Ir. Mardjono Notodihardjo	Specialist Water Resources Development, Ministry of Public Works.
Ir. Sarbini Ronodibroto	Director, Planning and Programming.
Ir. Mashudi	Deputy Director, Planning and Programming.
Ir. Martopo	Project Manager, Jratunseluna
Ir. Bambang Soedjono	Deputy Project Manager, Jratunseluna
Mr. Maryono Bony M.E.	Chief Planning and Design Jratunseluna and Project Engineer.
Ir. Yusuf Gayo	Chief Planning and Design, Jratunseluna.
Mr. M. Takrim	Chief Operations, Jratunseluna.
Mr. Jamil Asghar	Advisor Jratunseluna Basin Project.
Mr. Abraham Grayson	Chief Engineer, U.S. AID.
Mr. Jack LeMair	Project Officer, U.S. AID.

The specialties of the PRC/ECI team to work on this Project covered the entire spectrum of expertise normally required for the successful completion of a planning project including optimization studies and computer application. The names and specialties of all PRC/ECI personnel and the time each participated in one way or another in the conduct of this work are listed in Table III-3. The dates of arrival and departure from Indonesia of each expatriate member of PRC/ECI staff are also given.

There were 3 (three) professionals from the Ministry staff who visited Pakistan for a period of eight days to see different types of water resources development works, namely, dams, barrages, diversion structures and canals in that country. The names and positions of the professionals who participated in the overseas visit to Pakistan are listed in Table III-4.

TABLE III-1

TUNTANG RIVER BASIN DEVELOPMENT PLANAssignment of Counterparts and Technical Personnel

<u>NAME</u>	<u>EXPERTISE (POSITION)</u>	<u>DATE OF ASSIGNMENT</u>	<u>PERIOD OF ASSIGNMENT</u>		<u>MAN-MONTHS WORKED</u>
			<u>STARTING</u>	<u>ENDING</u>	
<u>Counterparts</u>					
1. Ir. Martopo	Project Manager/Chief of Counterpart	June 9, 1979	May 16, 1979	June 15, 1980	13.0
2. Ir. Bambang Soedjono	Deputy Project Manager/ Deputy I Chief of Counterpart	June 9, 1979	May 16, 1979	June 15, 1980	13.0
3. Mr. Maryono Bony M.E.	Deputy II Chief of Counterpart Dam/Hydropower	June 9, 1979	May 16, 1979	June 15, 1980	13.0
4. Ir. Yusuf Gayo	Deputy II Chief of Counterpart/Project Planning Engineer Watershed Management	June 9, 1979	May 16, 1979	June 15, 1980	13.0
5. Drs. Redjiono	Hydrologist/ Sedimentation	June 9, 1979	May 16, 1979	June 15, 1980	13.0
6. Ir. Sudaryanto	Engineering Geologist	June 9, 1979	May 16, 1979	June 15, 1980	13.0
7. Ir. Sudarmanto	Agricultural Scientist	June 9, 1979	June 27, 1979	July 29, 1979	1.0
8. Ir. Eman Reyman	Agro Economist/ Project Economist	June 9, 1979	June 17, 1979	July 25, 1979	1.0
9. Mr. Takrim	Environmentalist	June 9, 1979	May 16, 1979	June 15, 1980	13.0
10. Ir. Sudarsono	Irrigation Engineer	June 9, 1979	May 16, 1979	June 15, 1980	13.0
11. Ir. Wisnu Suharto	Flood Control & Drainage	June 9, 1979	May 16, 1979	Oct. 15, 1979	5.0
12. Ir. Slamet Diyanto	Hydraulic Structures	Jan. 21, 1980	Jan. 21, 1980	June 15, 1980	4.75

TABLE III-1 (Continued)

TUNTANG RIVER BASIN DEVELOPMENT PLANAssignment of Counterparts and Technical Personnel

<u>NAME</u>	<u>EXPERTISE (POSITION)</u>	<u>DATE OF ASSIGNMENT</u>	<u>PERIOD OF ASSIGNMENT</u>		<u>MAN-MONTHS WORKED</u>
			<u>STARTING</u>	<u>ENDING</u>	
<u>Assistant Counterparts</u>					
1. Ir. Soedarno	Project Planning Engineer	June 9, 1979	May 16, 1979	Dec. 31, 1979	7.5
2. Buang Sukardjono BE	Sedimentation/ Hydrologist	June 9, 1979	May 16, 1979	Mar. 31, 1980	10.5
3. Susanto B.Sc.	Engineering Geologist	June 9, 1979	May 16, 1979	Mar. 31, 1980	10.5
4. Sutardjo BE.	Engineering Geologist	June 9, 1979	May 16, 1979	Mar. 31, 1980	10.5
5. Trijono BE.	Engineering Geologist	June 9, 1979	May 16, 1979	Mar. 31, 1980	10.5
6. Ir. Tri Hardhono	Environmentalist	June 9, 1979	May 16, 1979	Jun. 15, 1980	13.0
7. Ismail DA B Sc.	Project Planning	June 9, 1979	Jan. 1, 1980	Jun. 15, 1980	5.5
8. Ir. Mohammad Ali	Dam/Power Station	June 9 1979	May 16, 1979	Oct 31, 1979	5.5
9. Djasriansyah Ah. T.	Dam/Power Station	June 9, 1979	June 15, 1979	Nov. 30, 1979	5.5
10. Ir. Moh. Alam Hakim	Dam/Power Station	June 9, 1979	June 15, 1979	Nov. 30, 1979	5.5
11. Ir. Rustiyanti	Irrigation	June 9, 1979	May 16, 1979	June 15, 1980	13.0
12. Edy Arifin BE	Flood Control/ Drainage	June 9, 1979	May 16, 1979	Nov. 30, 1979	6.5
13. Nursalim B.Sc.	Flood Control/ Drainage	June 9, 1979	May 16, 1979	Nov. 30, 1979	6.5

TABLE III-1 (Continued)

TUNTANG RIVER BASIN DEVELOPMENT PLANAssignment of Counterparts and Technical Personnel

<u>NAME</u>	<u>EXPERTISE (POSITION)</u>	<u>DATE OF ASSIGNMENT</u>	<u>PERIOD OF ASSIGNMENT</u>		<u>MAN-MONTH WORKED</u>
			<u>STARTING</u>	<u>ENDING</u>	
<u>Draftsmen</u>					
1. S.V. Barleyanto	Draftsman	June 9, 1979	May 16, 1979	June 15, 1980	13.0
2. Bambang Prayitno	Draftsman	June 9, 1979	May 16, 1979	June 15, 1980	13.0
3. Aris Mudjianto	Draftsman	June 9, 1979	May 16, 1979	June 15, 1980	13.0

TABLE III-2

TUNTANG RIVER BASIN DEVELOPMENT PLANDirect-hire Indonesian Personnel

<u>NAME</u>	<u>POSITION</u>	<u>PERIOD OF SERVICE</u>		<u>MAN/WOMAN MONTHS</u>	
		<u>DATE STARTED</u>	<u>DATE ENDED</u>	<u>PROVIDED</u>	<u>SPENT</u>
1. Mrs. Tan Ik Goen	Interpreter/Translator	June 11, 1979	June 15, 1980	13.0	12.0
2. Miss Dra. L. Murtianingsih	Secretary	May 16, 1979	June 15, 1980	13.0	13.0
3. Mrs. Sri Anon Bintarko	Clerk/Typist	June 29, 1979	June 15, 1980	12.0	11.5
4. Miss Lanny Kristanta Hardy	Clerk/Typist	July 23, 1979	June 15, 1980	11.0	9.75
5. Mr. Suhandi	Messenger	May 16, 1979	June 15, 1980	13.0	13.0
6. Mr. Warsito	Office Helper	May 16, 1979	June 15, 1980	13.0	13.0

TABLE III-3

TUNTANG RIVER BASIN DEVELOPMENT PLANAssignment of Resident and TDY Staff

<u>NAME</u>	<u>NATIONALITY</u>	<u>JOB TITLE</u>	<u>PROJECT ASSIGNMENT</u>		<u>MANMONTHS IN INDONESIA</u>	
			<u>ARRIVAL</u>	<u>DEPARTURE</u>	<u>SCHEDULED</u>	<u>ACTUAL</u>
1. Saeed A. Rana	Permanent Resident U.S.A.	Resident Manager	May 16, 1979	Jun. 15, 1980	12.0	12.0
2. Theodore C. Patterson	U.S.A.	Planning Engineer	Oct 16, 1979 Jan 8, 1980	Nov 15, 1979 Apr 11, 1980	7.8	7.8
3. Susan S. Steenrod	U.S.A.	Environmentalist	Oct 15, 1979	Dec 15, 1979	2.0	2.0
4. Anis N. Youssef	Permanent Resident U.S.A.	Hydrologist	Dec 9, 1979	Jan 30, 1980	2.0	2.0
5. Ronald S. Baskett	U.S.A.	Irrigation Agronomist	Jan 16, 1980	Feb 16, 1980	1.0	1.0
6. Robert B. Campbell	U.S.A.	Project Sponsor	Sep 17, 1979 Oct 6, 1979 Jan 20, 1980 Feb 7, 1980	Sep 24, 1979 Oct 9, 1979 Jan 21, 1980 Feb 11, 1980	0.5	0.45
7. Glenn C. Parham	U.S.A.	Dam Engineer	Feb 3, 1980	May 14, 1980	3.75	3.75
8. Max K. Kuehl	Canadian	Vice President	July 1, 1979 Feb 10, 1980 May 11, 1980	July 6, 1979 Feb 15, 1980 May 23, 1980	0.75	0.75
9. Michael A. Stevens	Canadian	Sediment Engineer	Sep 9, 1979 Feb 11, 1980	Oct 20, 1979 Mar 10, 1980	2.5	2.25
10. David J. Kerkes	U.S.A.	Material Engineer	Feb 24, 1980 Apr 13, 1980	Mar 16, 1980 Apr 26, 1980	1.25	1.25
11. Ivan F. Wymore	U.S.A.	Watershed Specialist	Feb 24, 1980	May 20, 1980	3.0	3.0
12. Jeffery P. Frey	U.S.A.	Hydrologist	June 1, 1989	Aug 18, 1979	2.5	2.5
13. Richard J. Bielefeld	U.S.A.	Geologist	Jun 12, 1979	Aug 5, 1979	2.0	2.0

TABLE III-3 (Continued)

TUNTANG RIVER BASIN DEVELOPMENT PLANAssignment of Resident and TDY Staff

<u>NAME</u>	<u>NATIONALITY</u>	<u>JOB TITLE</u>	<u>PROJECT ASSIGNMENT</u>		<u>MANMONTHS IN INDONESIA</u>	
			<u>ARRIVAL</u>	<u>DEPARTURE</u>	<u>SCHEDULED</u>	<u>ACTUAL</u>
14. Robert L. Berger	U.S.A.	Economist	Jun 17, 1980 Sep 2, 1979	Jul 14, 1979 Sep 30, 1979	2.0	2.0
15. Rudolfo C. Clarke	U.S.A.	Flood/Drainage Engineer	Jun 20, 1979	Aug 15, 1979	2.0	2.0
16. Andrew Tczap	U.S.A.	Dam/Hydropower	Jun 2, 1979 Jul 24, 1979 Sep 19, 1979	Aug 15, 1979 Nov 10, 1979	3.0	3.0
17. Louis E. Haley	U.S.A.	Agricultural Specialist	Jun 27, 1979	Jul 29, 1979	1.0	1.0
18. James E. Nemeč	U.S.A.	Irrigation Engineer	Jul 20, 1979 Oct 10, 1979	Aug 8, 1979 Oct 21, 1979	2.0	1.1
19. Jonathan E. Diebel	U.S.A.	Water Supply Engineer	Jul 1, 1979	Aug 28, 1979	2.0	2.0
20. Howard W. Dennis	U.S.A.	Environmentalist	Jul 17, 1979	Aug 13, 1979	1.0	1.0
21. Peter L. Strauss	U.S.A.	Chief Geologist	Jul 1, 1979 Jul 10, 1979	Jul 17, 1979 Jul 12, 1979	0.25	0.30
22. Herbert C. Fletcher	U.S.A.	Watershed Management	Sep 5, 1979	Nov 5, 1979	2.0	2.0

TABLE III-4

TUNTANG RIVER BASIN DEVELOPMENT PLAN

MINISTRY PERSONNEL OVERSEAS VISIT

Names of Participants

1. Ir. Bambang Soedjono
2. Drs. Soekanto Ranumihardja
3. Ir. Ferry Putuhena

Period of Visit

June 15 - June 23, 1980

Places and Works Visited

1. Tarbela Dam: Tarbela Dam is an Earth and Rockfill dam on River Indus. The main dam is about 150 m high and about 2,750 m long. The gross storage capacity of the dam is 13,700 MCM, out of which 85 percent is the live storage. The capacities of the main and the auxiliary spillways are 18,500 m³/s and 23,800 m³/s, respectively. The irrigation and diversion tunnels have internal diameter of 13.75 m.
2. Mangla Dam: Mangla Dam on River Jhelum is an Earthfill type of dam, which is 116 m high and 3,355 m long. The gross storage at the dam is 6,850 MCM out of which 85 percent is live storage. The main and the emergency spillways have discharge capacities of 25,500 m³/s and 6,000 m³/s, respectively.
3. Rasul Barrage: Rasul Barrage on River Jhelum is 980 m long and has a design discharge capacity of 24,100 m³/s. This barrage diverts irrigation supplies of up to 540 m³/s in Rasul Qadirabad Link Canal. The Rasul Qadirabad Link Canal is 46 km long and conveys Jhelum waters into Chenab River above Qadirabad Barrage.

4. Qadirabad Barrage: Qadirabad Barrage on River Chenab is 1,365 m long and has design discharge capacity of 25,500 m³/s. The barrage diverts irrigation supplies from Chenab into Qadirabad Balloki Link Canal of the order of 530 m³/s.
5. Balloki Barrage: Balloki Barrage built in 1920s was remodelled for a design discharge capacity of 6,000 m³/s during the years 1964-1965.
6. Marala Barrage: Marala Barrage on River Chenab with a design capacity of about 30,000 m³/s has canals drawing over 700 m³/s irrigation supplies.
7. Irrigation Research Institutes: The Irrigation Research Institutes at Lahore and Nandipur conduct advanced hydraulic research for the design of Water Resources Development Projects and have been responsible for carrying out model testing for major Indus Basin Replacement Works.

PART IV - THE REPORTS

As stated in Part I, it was stipulated in the contract that certain reports would be written as part of the obligations of the Consultant. PRC/ECI complied with this requirement and issued the reports as listed in Figure I-4. The purpose of the reports and the dates when issued, are stated in the following.

1. Interim Report

The Terms of Reference for consulting engineering services for the Tuntang River Basin Development Plan provided that the Consultant would submit to DGWRD an interim report at the end of the twelfth week of the study. That report would provide details of the work plan for the study, summarize the main findings, present the various possible development components and the recommended overall development packages. Three sites for storage of water for the multiple use of irrigated agriculture, municipal and industrial water supply, flood control and hydropower generation were proposed the two rivers. It was reported that any viable development plan should maximize the benefits which would accrue from those multiple usages. To ensure the accrual of the maximum benefits, the optimization of the storage capacities of the proposed reservoirs dams and appurtenant structures taking cognizance of all the constraints and restraints was done and alternative proposals for the plan presented.

The report was submitted on August 14, 1979 and a request was made to the DGWRD to arrange a review meeting so that the alternative packages and their components would be discussed and the consultant could receive the directives from the Ministry as to which development packages should be selected and the depth to which each component should be studied.

The review meeting was held on September 24, 1979, the minutes of which were submitted by PRC/ECI with letter No. 1241/G/27 - 257/79 dated September 28, 1979.

2. Tuntang/Jragung Rivers Basins Integrated Development Plan - Executive Summary

The major decision taken in September 24 meeting in the review of the Interim Report was that the formulation of the development plan should be based on the following special considerations.

- a. Large projects should not be considered for the Tuntang or the Jragung Basin during the near-term (10-20 years); however, development of irrigation and municipal water supply within the basins should begin in the near future for which small-size, short-term projects should be considered.
- b. Hydropower development in the basins is of low priority, however, the existing power generation at the Upper Tuntang System should not be reduced significantly.

In view of the special considerations stated above it would be appropriate to identify small-size, low-cost development projects which would be technically and economically feasible if analyzed individually and could be considered for early implementation. Preferably, the small-size development projects should have the potential to become part of an overall development plan for the two basins.

Four individual elements were identified in the Tuntang/Jragung basins, three of which were found compatible with a total development plan for the integrated use of water resources of the two basins. The elements are: 1) Raising of Rawa Pening, 2) Gunung Wulan Dam, 3) Tuntang-Jragung Transbasin Diversion and 4) Glapan Barrage.

As an overall development plan, the following combinations of the above elements was proposed.

- Raise Rawa Pening to live storage capacity of $125 \times 10^6 \text{ m}^3$.
- Build Glapan Barrage to have live storage capacity of $87 \times 10^6 \text{ m}^3$.

- Build Gunung Wulan Dam to have live storage capacity of $190 \times 10^6 \text{ m}^3$.
- Construct Transbasin Diversion Works to have a discharge capacity of $18 \text{ m}^3/\text{s}$.

The overall plan would cost US \$ 179.61 million and have an internal rate of return of 14.5 percent. The combination would provide perennial irrigation water to 35,000 hectares of agricultural land and supply 2,000 l/s of M & I water to the city of Semarang.

The Executive Summary was submitted on November 30, 1979.

3. Tuntang/Jragung Integrated Development Plan - Special Report I - Municipal and Industrial Water Supply

The municipal and industrial water supply in Semarang has historically been less than the demand. In recent years this has been due mainly to limited resources of raw water, but also been aided by a shortage of treatment, transmission and distribution facilities. The water shortage has forced a large percentage of the population to use canals, shallow wells, streams and drainage ditches not only for bathing and cleaning, but in many cases, for their cooking needs and drinking water also. The use of these water source within a densely populated area such as the city of Semarang causes health problems due to pollution of the water. This shortage has likely curtailed industrial growth in the city as well.

In recent years, the demand for municipal and industrial water in Semarang has increased, and is expected to increase substantially in the future as well. This increase in demand will be heightened by annexations to the city accomplished in 1976 and intentions to develop Semarang as an industrial center with an international harbor.

This report projected water demands for the city of Semarang to the year 2000. This was done by making population projections to the year 2000 based upon acquired population data to 1978 and analysis of anticipated

growth. The analysis of anticipated growth was based substantially upon historic growth data, development plans set by the Regional Government of Semarang, projections made by the Central Java Government Census and Statistical Section, and a knowledge of efforts by the Indonesian government to reduce birth rates on the island of Java.

Following development of the projected demands for the city of Semarang, potential water supplies to meet the demands were analyzed. This report concentrated mainly on potential supplies from the Tuntang and Jragung River Basins, although all water sources were analyzed to some extent.

This report also analyzed projected demands and supplies for other water users within the service area or basins of the Tuntang and Jragung Rivers. By taking into account those demands, together with the demands of the city of Semarang, the total potential water requirements for municipal, industrial and rural water users within the Tuntang and Jragung River Basins was developed. The information from this report was used in the basin model for optimization of water resources of the Jratunseluna Basin.

4. Tuntang/Jragung Integrated Development Plan - Special Report II - Geology

This report described the general geologic conditions within the Tuntang and Jragung subbasins and presented site specific geologic conditions existing at each of the potential developments considered during the study for preparation of the development plan. Special emphasis was given to investigating geologic conditions at the features which formed the recommended development scheme.

The scope of work for this report was limited to: assembling, reviewing and evaluating existing data; field inspection; preparation of reconnaissance level surface geologic maps; preliminary assessment of foundations;

and establishment of a recommended scope of further investigations. No subsurface investigations, sampling, or laboratory testing was performed during this study due to time and budget constraints.

5. Tuntang/Jragung Integrated Development Plan - Special Report III -
Drainage and Flood Control

This report presented the results of preliminary field investigations and office studies undertaken to determine the engineering feasibility of providing a plan for flood control and drainage for the lower reaches of the Jragung and Tuntang Rivers. The flood control and drainage study was conducted in conjunction with concurrent studies of the water resources development of the two rivers for multipurpose use. Several potential storage reservoirs are included in the development plan. Also, several alternative channel improvement plans were investigated with the primary purpose of providing a high degree of flood protection to the area. A further purpose of this report was to provide a basis for a more detailed study for the future development of a flood control program for the Jragung and Tuntang River systems.

This report described various preliminary alternative plans for flood control and drainage on the Jragung and Tuntang River systems based on conditions that would prevail if dams are constructed in the upper reaches of the two rivers and on conditions that the dams would not be constructed. The study was conducted at pre-feasibility level utilizing data developed by the Proyek Jratunseluna staff and their Consultants, the Netherlands Development Engineering Company (NEDECO). The basis for design and cost estimates for the various alternative plans is presented in sufficient detail to aid in the logical selection of the most feasible plan and to enable the undertaking of more comprehensive and detailed studies of the selected plan in the future if required. Successful development and operation of a selected plan for flood mitigation will have a significant beneficial effect on the rural and agricultural areas within the area of the eastern sector of the Plain of East Semarang.

All three Special Reports I, II and III were submitted on November 30, 1979.

6. Tuntang and Related Rivers Basins Development Plan - Status Report

The Status Report presented the results of study carried out through the month of March 1980 to evaluate the surface water resources of the Jratunseluna Basin which were evaluated in a master plan for the basin prepared in the year 1973. It was stated in the report that essential components of the development plan had been identified and the process of optimization to establish sizes of the individual components and fix their order of priority for implementation was progressing. For that purposes, a basin model had been formulated to simulate the field characteristics and the development needs and multiple reservoir operation of that model had been programmed on the computer. It was reported that the simulation study was essentially complete and alternative schemes of works for the development plan were proposed. A review of the Interim Report was suggested, based on which the final report on the Updated Development Plan would be prepared.

This report was submitted on April 5, 1980.

7. Jratunseluna Basin - Updated Development Plan

The Main Report on the Updated Development Plan presents 1) a synopsis of all previous reports prepared by different agencies for the Development Plan, 2) results of investigations in the fields of Hydrology, Geology, Sedimentation, Materials and Sociology, 3) development potential in the basin, 4) results of investigations of individual project elements, 5) the methodology used in formulation of the development plan and details of the Updated Jratunseluna Basin Development Plan.

Three different alternatives for the plan for three conditions of Rawa Pening 1) raised to live storage capacity of $125 \times 10^6 \text{ m}^3$,

2) raised to live storage capacity of $175 \times 10^6 \text{ m}^3$ and 3) as existing live storage capacity of $43 \times 10^6 \text{ m}^3$ were presented. Also an interim development plan for converting rainfed areas to wet-season irrigation was proposed.

This Main Report is the document which summarizes all study done under the contract for Tuntang and the related basins development plan. Also included in the report is a conceptual plan and recommendations for soil and water conservation in the Jratunseluna Basin. A draft of the report was discussed in a meeting with the Jratunseluna Basin Project authorities at June 2, 1980.

An Executive Summary of the Main Report was issued as a separate document.

Both the Main Report and the Executive Summary alongwith the following appendices was issued on June 15, 1980.

- Appendix A - Hydrology
- Appendix B - Agriculture and Irrigation
- Appendix C - Dams and Hydropower
- Appendix D - Project Planning
- Appendix E - Economics
- Appendix F - Soil and Water Conservation
- Appendix G - Social and Environmental Assessment
- Appendix H - Sedimentation Studies.

8. Monthly Progress Reports

The monthly progress reports were required to be submitted on the 10th working day of each calendar month reported. The reports were required to include:

- a. Personnel arrivals, departures, and end-of-month strength broken down into U.S., third-country nationals and Indonesian categories (separately

- for direct-hire and counterpart);
- b. Major conferences, submissions, approvals, decisions and events;
 - c. Major problem areas, current or foreseen, together with recommendations for their solution; and
 - d. Progress accomplished versus progress scheduled (curve or bar chart form), with narrative comment regarding any significant slippage).

The schedule of preparation of the monthly progress reports was invariably met during the period of the Contract. Before printing the reports in final form the drafts were always shown to the authorities of the Jratunseluna Basin Project for their approval.

PART V - THE EXPENDITURES

U.S. DOLLAR COSTS

The U.S. Dollar costs were estimated to be \$ 299,365 for the period May 16, 1979 through November 30, 1979. With Amendment No. 1, the dollar cost estimate rose to \$ 496,545 and the contract period was extended to June 15, 1980.

Actual costs billed through the extended period of the Contract were U.S. \$ 494,637.20.-

The above given figures include a total amount of U.S. \$ 47,265 for the fixed fee costs.

The original estimated costs including Amendment No. 1 are given in Table V-1. The monthly invoices for all dollar costs and the fixed fee costs are listed in Table V-2.

The amount of U.S. \$ 23,197 provided in the Contract for the contingency item was spent in the following manner:

Additional manmonth)	
Testing)	\$ 6,907.26
)	

INDONESIAN RUPIAH COSTS

The estimated Rupiah costs for the Contract period including Amendment No. 1 were Rp. 67,591,630.

Actual Rupiah costs for the total contract period (including Amendment No. 1) were Rp. 59,368,034.- leaving a balance of Rp. 8,223,596.- The summary of these costs alongwith the original budget costs and the increases or decreases therefrom are given in Table V-3.

SUMMARY OF TOTAL COSTS

The total Dollar costs during the total period of 13 months of the Project were \$ 494,637.20.- which is 99.6 percent of the estimated costs. The corresponding total Rupiah costs amounted to Rp. 59,368,034 which were 12.2 percent less than the estimated Rupiah costs.

TABLE V-1

TUNTANG RIVER BASIN DEVELOPMENT PLAN
SUMMARY OF BUDGET AND EXPENDITURES FOR
ORIGINAL CONTRACT AND AMENDMENT NO. 1
TO THE CONTRACT

Budget Item	Total Cost (U.S. \$)			
	Original Contract	Amendment I	Total Budget	Actual Expenditure
1. Resident Staff				
Base Salaries	14,300	8,800	23,100	24,904.00
2. Overseas Differential	3,575	2,200	5,775	6,046.70
3. Overhead Residential Staff (Provisional Rate (102%) Base Salaries)	14,586	8,976	23,562	25,402.08
4. a. ECI Denver, TDY and Specialist Salaries	63,941	46,154	110,095	113,781.96
b. Outside Consultant	-	7,000	7,000	7,816.67
5. Overhead ECI Denver, TDY and Specialists (Provisional Rate 98% Base Salaries)	62,662	45,231	107,893	142,227.44
6. Overhead Contingency	6,675	4,550	11,225	11,225.00
7. Overseas Allowance (TDY)	13,105	10,408	23,513	22,155.01
8. Fixed Fee	26,825	20,440	47,265	47,265.00
9. Travel	44,000	24,000	68,000	52,347.82
10. Per Diem	1,760	960	2,720	2,200.00
11. Transportation	3,000	2,000	5,000	1,682.48
12. Miscellaneous Expenses (Other Direct U.S. \$ Costs)	13,600	18,600	32,200	26,835.15
13. Purchase of Sediment Sampling Equipment	6,000	-	6,000	3,840.63
14. Contingencies	5,000	18,197	23,197	6,907.26
Total Dollar Costs U.S.	279,029	217,516	496,545	494,637.20

TABLE V-2

TUNTANG RIVER BASIN DEVELOPMENT PLAN
INVOICE NUMBERS WITH AMOUNTS OF EXPENDITURES IN U.S. DOLLARS
AND MONTHLY FEE INSTALLMENTS DURING CONTRACT AND AMENDMENT PERIOD
BETWEEN ECI AND MINISTRY OF PUBLIC WORKS

Due Month	Invoice		Monthly Cumulative Total Invoice Expenditures
	Monthly Invoice Numbers	U.S. \$ Amount Due	
1979: May 15 -			
July 31	C-1241-1-4244	85,305.44	85,305.44
August	C-1241-2-4263	42,765.61	128,071.05
September	C-1241-3-4294	36,010.01	164,081.06
October	C-1241-4-4324	46,463.14	210,544.20
November	C-1241-5-4339	27,636.63	238,180.83
December	C-1241-6-4354	13,433.90	251,614.73
1980: January	C-1241-7-4372	28,422.46	280,037.19
February	C-1241-8-4389	38,034.78	318,071.97
March	C-1241-9-4406	53,293.28	371,365.25
April	C-1241-10-4424	31,918.30	403,283.55
May	C-1241-11-4438	24,015.91	427,299.46
June	C-1241-12-4464	47,161.48	474,460.94

TABLE V-3

TUNTANG RIVER BASIN DEVELOPMENT PLAN

SUMMARY OF RUPIAH BUDGET COSTS
ORIGINAL CONTRACT AND AMENDMENT I

<u>Contract Cost in Rupiah</u>	<u>Original</u>	<u>Extended</u>	<u>Total</u>	<u>Actual</u>	<u>Difference</u>
Per Diem	4,350,000	3,350,000	7,700,000	5,904,000	1,796,000
Other Direct Costs	16,750,000	21,500,000	38,250,000	36,052,971	2,197,029
Housing	6,800,000	6,100,000	12,900,000	9,591,753	3,308,247
Administrative Personnel	3,794,755	3,237,500	7,032,255	7,366,185	- 333,930
Contingency	-	1,709,375	1,709,375	453,125	1,256,250
Total Cost	31,694,755	35,896,875	67,591,630	59,368,034	8,223,596

PART VI - THE EQUIPMENT

An amount of U.S. \$ 6,000 was provided in the contract for purchase of sediment sampling equipment for the Jratunseluna Basin Project. The items of equipment purchased and their costs are listed hereunder.

1. Product Mfg. Co	\$ 1,529.19
2. Teledyne Gurley	1,993.60
3. Teledyne Gurley	317.84
	<hr/>
	\$ 3,840.63

PART VII - THE COMMENTS

There was no serious problem in administering the contract throughout the period of 13 months during which PRC/ECI carried out studies for the Jratunseluna Basin Updated Development Plan. We would suggest that for the implementation of the development plan, immediate actions should be initiated to carry out mapping and other investigations proposed in the plan.

We are pleased with the manner in which our transportation needs were handled. During the 13 months of the Contract period there was hardly an occasion when a member of the Consultant's team was unable to carry out his work because of a lack of transportation. This is an important consideration, especially for a Consultant who may be on the job site for only a short period of time. However, we may suggest that the operation of the vehicles assigned to the Consultant should be assigned to the administration of the Consultant.

We are also grateful for prompt handling of our Rupiah advances as they became due, as well as for the efficient auditing of our reimbursable accounts. It is important for a Consultant to know that he can rely on funds being made available as planned as well as on prompt processing of periodic accounts.

We wish to report that the relations between the Consultant and the Client, and the Consultant and the Counterpart team were cordial and with the absence of friction. Counterpart technicians to the consultants were well qualified and were a tremendous assistance to the Consultant. In future, we expect these counterpart technicians to exercise initiative in the application of on-the-job training which they have received while working with the Consultant.

We wish to suggest that for all future jobs, Ministry should

designate committees who would be charged with the responsibility of reviewing various reports submitted by the Consultant. In the absence of such a body, sometimes unavoidable delays occur in getting the reports approved for final printing and issue.

We were most fortunate in having a local administrative staff who were both qualified and dedicated to their work. These personnel worked extremely hard all the time and willingly worked overtime any time it was necessary to meet a deadline for a report. Without this dedication and devotion to work it would have been difficult for the Consultant to complete the large volume of reports and documents which were submitted at the conclusion of the Contract.

We were also fortunate in having a team of outstanding draftsmen who prepared excellent design drawings with sufficient details for construction. These draftsmen are to be commended for their dedicated work.

PART VIII - REFERENCES

The following publications were referred to, in studies for the Jratunseluna Basin Development Plan.

NEDECO. Jratunseluna Basin Development Plan, Main Report, Conclusions & Recommendations. November 1973.

NEDECO. Jratunseluna Basin Development Project, Feasibility Study, Water Resources Development, Jragung, Dolok and Penggaron Basin, Vol. 1 : Report. December 1971.

NEDECO. Jragung Dam Flood Control and Irrigation Project, Feasibility Study. August 1973.

PRC/ECI. Jragung Dam Multipurpose Irrigation Flood Control and Industrial Water Supply Project, Upgraded Feasibility Report. December 1976.

PRC/ECI. Jragung Dam Final Design Report. April 1979.

NEDECO. Jratunseluna Basin Development Plan Central Java, Glapan Dam, Irrigation, Flood Control and Hydropower Project. July 1975.

NEDECO. Jratunseluna Basin Development Plan, Central Java, Ngrambat Dam. June 1975.

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BURNS AND MCDONNELLS/TRANS-ASIA. Water Supply Master Plan for the city of Semarang. November 1976.

SMEC. The Improvement and Development of the Serang River and Irrigation Project, Central Java, Definite Scheme Report. February 1979.

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SMEC. The Improvement and Development of the Serang River and Irrigation Project, Central Java, Juana Valley Irrigation Project, Feasibility Study, Technical Report. February 1980.

NEDECO. Consequences of the Postponement of the Jragung Dam. July 1979.

PRC/ECI. Tuntang/Jragung Rivers Basins Integrated Development Plan, Interim Report. August 1979.